Mullaghclogher Wind Farm

Environmental Statement

Volume 2 - Main Report

  

power for good

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Introduction & Proposed Development

1. Introduction & Proposed Development

Background

1.1 This Environmental Statement (ES) has been prepared by Renewable Energy Systems Limited (RES) to accompany a planning application that has been made to the Department for Infrastructure (DFI) for permission to construct, operate and decommission a wind farm known as Mullaghclogher Wind Farm, hereinafter referred to as 'the Proposed Development'. The purpose of the ES is to inform DFI in the assessment of the likely significant environmental effects resulting from the Proposed Development and to establish the need for mitigation measures to reduce such effects.

1.2 The application site is located in the townlands of Carrickayne, Legnahappoge, Glengarrow, Stroanback and Doorat, 4KM North East of Plumbridge, Northern Ireland. The application site is shown in **Figure 1.1: Site Location** and **Figure 1.2: Planning Application Boundary.**

1.3 This chapter is supported by:

- Figures 1.1 to 1.20
- Technical Appendices 1.1 to 1.6

The Applicant

1.4 The application for planning permission is made by RES ('the Applicant').

1.5 RES is the world's largest independent renewable energy company, working across 24 countries and active in wind, solar, energy storage, green hydrogen, transmission and distribution. As an industry innovator for over 40 years, RES has delivered more than 27GW of renewable energy projects across the globe and supports an operational asset portfolio exceeding 41GW worldwide for a large client base. RES has developed 29 onshore wind farms in Northern Ireland totalling in excess of 500MW and operates over 150MW of wind capacity across Northern Ireland including the Craiggore and Evishagaran Wind Farms in Co. Derry/Londonderry, constructed in 2022, and Murley Mountain Wind Farm, Co. Tyrone more recently completed in 2024.

EIA Process

Scope of the ES

1.6 The Environmental Impact Assessment (EIA) has assessed the environmental impacts associated with the construction, operation and decommissioning the Proposed Development, comprising 11 three bladed wind turbines, each up to 180m maximum tip height; associated external electricity transformers; underground cabling; access tracks; turning heads; crane hardstandings; control building and substation compound, battery energy storage containers, mast, off-site areas of widening to the public road and all ancillary works. During construction and commissioning there would be a number of temporary works including a construction compound with car parking; temporary parts of crane hardstandings; welfare facilities. The purpose of the development is for the generation of electricity.

1.7 RES has undertaken informal scoping with DFI regarding the Proposed Development and a letter of Intention to Submit an ES was lodged, which is included in **Technical Appendix 1.1**. An Intention to Submit response from DFI is included in **Technical Appendix 1.2**. along with the responses received from consultees. Informal consultation was also undertaken by individual chapter authors. Responses from consultees have been considered in the individual chapters of this ES.

1.8 An EIA has been undertaken in accordance with the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017, (the "EIA Regulations"), to identify and assess the likely environmental effects of the Proposed Development and establish an appropriate range of mitigation measures in order to reduce adverse impacts where possible. This ES contains the findings of the EIA.

1.9 The Proposed Development will represent a 'Schedule 2' development, as defined under the "EIA Regulations". Development that is listed in Schedule 2 requires an EIA if it is likely to have an impact on the environment by virtue of factors such as its size, nature or location. Therefore, any potential effects of the construction, operation and decommissioning of the Proposed Development deemed to have significant environmental effects are subject to an EIA.

1.10 The scale of the Proposed Development means that there is the potential for significant environmental effects to arise. Consequently, it was deemed appropriate to undertake an EIA.

1.11 EIA is a process by which information about the environmental impacts of a project is collected, evaluated and taken into account in its design and the decision as to whether it should be granted planning permission. The applicant presents the information on the project and its likely environmental impacts in an ES. This enables decision-makers to consider these impacts when determining the related planning application. The EIA process has a number of key characteristics:

- It is systematic, comprising a sequence of tasks defined both by regulation and by practice;
- It is analytical, requiring the application of specialist skills from the environmental sciences;
- It is impartial, its objective being to inform the decision-maker rather than to promote the project;
- It is consultative, with provision being made for obtaining information and feedback from statutory agencies and key stakeholders; and
- It is iterative, allowing opportunities for environmental concerns to be addressed during the planning and design of a project.

1.12 This final point is particularly important with respect to the design of the Proposed Development where a number of design iterations have taken place in response to environmental factors identified during the EIA process. This is described in **Chapter 3: Design Evolution & Alternatives**.

1.13 The EIA for the Proposed Development has been carried out in accordance with the latest regulations, guidance and advice on good practice, comprising:

- Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017;
- Environmental Impact Assessment: A guide to procedures (Department for Communities and Local Government, amended reprint 2001); and
- Guidelines for Environmental Impact Assessment (Institute of Environmental Management and Assessment, 2004).

1.14 Individual technical assessments have been undertaken in accordance with a variety of legislation, guidance, and best practice. Relevant details are contained within the Legislation and Policy Framework section where applicable to each technical chapter.

The Assessment Method

1.15 Appropriate methodologies have been used to assess the effects relating to each of the environmental topics that have been investigated as part of the EIA. These methodologies are based on recognised good practice and guidelines specific to each subject area, details of which are provided within each individual technical section.

1.16 The design team employed an iterative approach to the design of the Proposed Development where the design evolved throughout the EIA process as different constraints and potentially adverse impacts were identified and evaluated. This method is considered best practice as mitigation measures can concurrently be integrated into the design throughout the EIA process. This approach allowed the design team to alleviate or remove potentially adverse impacts and incorporate measures into the design to enhance positive impacts. The final evaluation of significance assesses the residual impacts assuming all mitigation measures are applied.

1.17 Each technical chapter assesses the impacts that could arise as a result of the Proposed Development. Impacts are assessed as being either adverse, beneficial, permanent, temporary or reversible. Significance is determined by assessing the magnitude and sensitivity of each likely impact.

1.18 The ES complies with current planning policy and will be submitted in conjunction with a planning application. This report is a formal ES as required by DFI under the Planning (EIA) Regulations (Northern Ireland) 2017. The ES is designed to provide information for the purpose of assessing the likely impact upon the environment.

Structure of the Environmental Statement

1.19 Schedule 4 of the “EIA Regulations” states that the following must be included within the ES:

- A description of the development (description of the physical characteristics (site, design and size of the development), land-use requirements, production processes) and an estimate of expected residues and emissions resulting from the operation of the proposed development.
- An outline of the alternatives studied by the applicant and explanation of why the particular option was chosen.

- A description of the aspects of the environment likely to be significantly affected by the development (including population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage and landscape) and the inter-relationship between the above aspects.
- A description of the likely significant effects of the development on the environment (to include direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, beneficial and adverse effects of the development).
- A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.
- The data required to identify and assess the main effects that the development is likely to have on the environment.
- An indication of any difficulties (technical deficiencies or lack of know-how) encountered.
- A non-technical summary of the information contained within the ES.

1.20 This ES has been prepared in accordance with the "EIA Regulations" described above. The ES comprises the following volumes:

- **Volume 1**: Non-technical Summary (NTS) of the ES
- **Volume 2**: Main Text
- **Volume 3**: Figures (the illustrations that accompany the ES)
- **Volume 4**: Technical Appendices (technical information relating to the environmental topics such as detailed methodologies, baseline data information and data analysis).

1.21 **Volume 2** is organised as follows:

- **Chapter 1**: Introduction & Proposed Development
- **Chapter 2**: Planning Policy
- **Chapter 3**: Design Evolution & Alternatives
- **Chapter 4:** Landscape & Visual
- **Chapter 5:** Archaeology & Cultural Heritage
- **Chapter 6**: Vegetation & Peatland
- **Chapter 7**: Terrestrial Fauna
- **Chapter 8:** Ornithology
- **Chapter 9:** Fisheries
- **Chapter 10:** Geology & Water Environment
- **Chapter 11**: Acoustic Assessment
- **Chapter 12:** Traffic & Transport
- **Chapter 13:** Shadow Flicker
- **Chapter 14:** Socioeconomics
- **Chapter 15:** Schedule of Mitigation

1.22 Biodiversity is covered under Chapters 6, 7, 8, 9 and 10; Human Health is covered under Chapters 11 & 13 and Climate Change is covered within Chapter 14. A schedule of mitigation is described in Chapter 15.

1.23 Chapters 1, 3, 11, 12, 13 and 15 have been authored by RES using their in-house professionally qualified expertise in respect of these topics. The Environmental Statement has been compiled by RES, primarily by Ellen Cross (Development Project Manager).

1.24 In general, for each environmental topic, the following format has been adopted with regard to the presentation of information:

- Introduction
- Scope of Assessment
- Legislation and Policy Framework
- Consultation
- Assessment Methodology
- Baseline Assessment
- Assessment of residual impacts
- Design Evolution and Mitigation Measures
- Residual Impacts
- Cumulative Impacts
- Summary and Conclusions
- References.

1.25 A number of individual disciplines have adopted variations from this format as a result of specific assessment methodologies and appropriate reporting structure.

Planning Application

1.26 In July 2023, the Department for Infrastructure confirmed that the planning application should be submitted to the DFI, in accordance with Section 26 of the Planning Act (Northern Ireland) 2011, regarding the Department's jurisdiction in relation to developments of regional significance (Appendix 1.2).

The Proposed Development

1.27 The Proposed Development comprises up to 11 three-bladed horizontal axis wind turbines, each up to 180 m maximum tip height; associated external electricity transformers; underground cabling; access tracks; turning heads; crane hardstandings; control building and substation compound, battery energy storage containers, off-site areas of widening to the public road and all ancillary works. During construction and commissioning there would be a number of temporary works including a construction compound with car parking; temporary parts of crane hardstandings; welfare facilities. The purpose of the development is for the generation of electricity.

1.28 The Planning Application Boundary (red line boundary) is shown on **Figure 1.2**. This boundary contains the main wind farm site, including positions of the turbines and associated infrastructure, with 50 m micrositing. The Planning Application Boundary lies fully within Land under the Applicant's Control (blue line boundary), as shown in **Figure 1.2.** The measures contained in the Outline Habitat Management Plan (**Technical Appendix 6.2)** are contained within the blue line boundary.

1.29 A detailed plan of the Proposed Development showing the position of the turbines and other infrastructure is shown on **Figure 1.3: Infrastructure Layout**.

1.30 This chapter provides a description of the physical characteristics of the Proposed Development for the purpose of identifying and assessing the main environmental impacts of the proposal.

1.31 In this chapter in order to differentiate between land take and infrastructure that will be present for the wind farm lifetime, and land take and infrastructure which is only required for short term works during the construction period, the term 'permanent' is used to describe the former and 'temporary' used to describe the latter. However, it should be noted that the Proposed Development would have a temporary operational lifetime of approximately 35 years from the date of commissioning, after which the above ground infrastructure would be removed, and the land remediated. Therefore, the effects are largely long-term temporary as opposed to permanent.

1.32 Planning permission is being sought for the Proposed Development comprising the following:

- Up to 11 three-bladed horizontal axis wind turbines of up to 180 m tip-height
- Associated external electricity transformers
- Upgrades to an existing site entrance
- New access tracks
- Turning heads
- Control buildings and substation compound
- Battery energy storage containers and associated infrastructure
- Off-site areas of widening to the public road and all ancillary works
- Turbine foundations
- Hardstanding areas at each turbine location for use by cranes erecting and maintaining the turbines
- Electricity transformers
- Approximately 9.4km of new access track
- On-site electrical, control and communications network of underground (buried) cables
- Temporary construction compound
- Permanent and temporary drainage works
- Associated ancillary works

Flexibility

1.33 Although the design process and evolution seek to combine environmental and economic requirements, the Applicant would nevertheless wish some flexibility, where necessary, in micrositing the exact positions of the turbines and routes of on-site access tracks and associated infrastructure (50 m deviation in plan from the indicative design). Any repositioning would not encroach into environmentally constrained areas. Therefore, 50 m flexibility in turbine positioning would help mitigate any potential environmental effects: e.g. avoidance of unfavourable ground conditions or archaeological features not apparent from current records. See **Figure 1.3: Infrastructure Layout** for details.

Land Take

1.34 The turbines need to be spaced a suitable distance apart (taking into account the prevailing wind direction), so as not to interfere aerodynamically with one another (creating array losses). The actual land developed is limited to the substation, wind turbine towers, transformers, permanent crane hardstandings, battery energy storage hardstanding and the access tracks, which account collectively for approximately 6.7% of the total area within the Planning Application Boundary, as detailed in Table 1.1.

Table 1.1 – Summary of Temporary and Permanent Hardstanding in the Proposed Development

Wind Farm Element	Temporary hardstanding[1] in m^2	Permanent Hardstanding[2] in m^2
Turbines and transformer pads	0	2483.8
Crane pads and laydown areas	630	1925
New on-site access tracks (including junctions and turning heads)	2221.4	65911
Control building & substation compound (including hardstand)	0	4590
Energy storage hardstanding (replacing temporary construction compound)	0	4000
Total hardstanding in m^2	2851.4	78909.8
Total hardstanding in ha	0.29	7.89
Total hardstanding as % of total area within the Planning Application Boundary (Main site) (117.9 ha).	0.2%	6.7%
Total hardstanding as % of total area within the Land Under Applicant Control (Main site).	0.04%	1.07%

1.35 Thus, in summary, the Proposed Development would require approximately 7.89 ha of hardstanding lasting throughout the life of the project. An estimated further 0.29 ha would be occupied by hardstanding on a temporary basis.

Habitat Management

1.36 An Outline Habitat Management Plan (oHMP) has been developed to enhance peatland habitats on site. Please see **Chapter 6: Vegetation & Peatland**, for further details.

Wind Turbines & Foundations

1.37 The wind turbine industry is evolving at a remarkable rate. Designs continue to improve technically and economically. The most suitable turbine model for a particular location can change with time and therefore a final choice of machine for the Proposed Development has not yet been made. The most suitable machine will be selected before construction, with a maximum tip height of up to 180 m.

1.38 Most of the dominant wind turbine manufacturers are now producing turbines that are classed as suitable for the wind regimes typical of Northern Ireland and many are also producing turbines that meet the up to 180 m tip height specification being suggested for the Proposed Development. Exact tower and blade dimensions vary marginally between manufacturers. A diagram of a typical 180 m tip height turbine is given in **Figure 1.4.**

[1] Temporary hardstanding: this refers to ground which will be occupied by hardstanding / built structures during the construction of the Development. However, once the Development has been constructed this land will be reinstated and available for grazing.

[2] Permanent hardstanding: this refers to ground which will be occupied by hardstanding / built structures throughout the lifetime of the Development.

1.39 Exact megawatt capacities also vary between manufacturers. For economic assessment purposes, a suitable candidate turbine currently available in the marketplace of 6.0 MW (with an overall tip height of up to 180) has been assumed.

1.40 Turbines begin generating automatically at a wind speed of around 3 to 4 metres per second (m/s) and have a shut-down wind speed of about 25 m/s. If requested, it is proposed to install lighting on turbine(s) in a pattern that is acceptable to the Civil Aviation Authority (CAA) and Ministry of Defence (MoD) for aviation visibility purposes. Infrared lighting allows military aircraft with night vision capability to detect and avoid wind farms. Proposals for turbine lighting are included in **Technical Appendix 1.6**.

1.41 Each turbine would have a transformer and switchgear. The transformer's function is to raise the generation voltage from approximately 690 volts to the higher distribution level that is required to transport the electricity from the turbines to the grid connection point substation on the site. Depending on the turbine supplier, the transformer and switchgear may be located inside or outside each turbine.

1.42 The wind turbines would be erected on reinforced concrete foundations. It is anticipated that the foundations would be of gravity base design, but there may be the requirement to use piled foundations where ground conditions dictate. Final base designs will be determined after a full geotechnical evaluation of each turbine location. **Figure 1.15** provides an illustration of a typical gravity base wind turbine foundation design.

1.43 The turbine foundation formation level is approximately 16-25 m diameter in area and 2.5-4 m below ground level. The walls of the excavation will be battered to approximately 1:2, yielding a maximum ground level excavation area of approximately 41 m diameter.

1.44 The excavation area around each turbine is significant in terms of both its scale and duration of the works and as such requires consideration. Ancillary excavation works and material storage around other parts of development, such as those for cable trenching, would have a negligible impact on environmental receptors due to the very minor scale of the excavation, or duration of the works, and are not considered further in the ES.

1.45 Following completion of the turbine installation, the permanent hardstanding would be approximately 2150.8m^2 at each turbine site, which includes the concrete plinth to which the steel tower is attached and a maintenance track/path around the base of the turbine. The external transformer (if required) would take an additional 28 m^2 of land at each turbine. The completed foundation is covered with soil approximately 1.5m deep, leaving only the concrete plinth exposed at ground level, to which the steel tower is attached. Movement of livestock around the tower would be unrestricted.

1.46 Proposals for turbine lighting are detailed in **Technical Appendix 1.6**.

Battery Energy Storage System (BESS)

What is Energy Storage?

1.47 Battery Energy Storage is a means of storing electrical energy just like a rechargeable battery, mobile phone or electric car. These are means by which power can be stored and released. The Proposed Development includes 20 no. energy storage containers which is of a larger scale, but the basic principle is the same.

1.48 According to SONI statistics, the electricity demand in Northern Ireland, day to day, for instance during 2018 the lowest demand ranged from as low as 437MW to as high as 1648 MW. Therefore, power generation and grid must deal with large transitions between lows and highs, not only over the course of a day or week but second by second. One of the basic roles of energy storage is to act as a power reserve, when electricity generation drops below demand. Its importance then is linked to its ability to ensure a constant supply of electrical energy to our homes and business. That improves efficiency and reduces prices for consumers.

1.49 Energy storage can absorb energy at times of high generation and low demand, and release energy at times of peak demand. Customers offering Energy Storage Services (ESS) therefore have the potential of deferring network reinforcement and accommodating the connection of further demand or generation which would otherwise be constrained by thermal capacity. ESS can also play in the System Services market helping to balance demand and generation.

The Need for Energy Storage – Why is it Important?

1.50 The Proposed Development is intended to be used to provide cost effective flexible services to the electricity network, such as adding electricity to, or removing electricity from the system, when this is useful to the operation of the system. SONI, the System Operator in charge of ensuring stable secure power for the Ireland's homes and businesses, procures such services from grid connected energy systems and the flexibility they provide is critical to achieving national decarbonisation targets and a stable supply of electricity at least cost to consumers.

1.51 Energy provision in Northern Ireland is undergoing a transition from one designed primarily around a number of large thermal power stations such as Kilroot, Ballylumford and Coolkeeragh to one which now includes a number of renewable generators such as wind farms. Renewable generation is now supplying over 40% of the total annual electrical requirement in Northern Ireland. With the Minister of the Economy announcing in 2021 that the Renewable Energy target for Northern Ireland will be 70% by 2030, which has been further increased to 80% by 2030 in the Climate Bill amendment of 2022 this transition will be even more important.

1.52 There are, however, technical constraints on the transmission network which are limiting the amount of renewable energy which can be delivered from these renewable generators to the main demand centres in the east of the province.

1.53 Battery energy Storage is an innovative solution, which is being deployed across the world, to facilitate the shift from traditional thermal generation to low/zero carbon generation. The energy storage containers will help match generation produced from intermittent renewable generation with the peaks and troughs in electricity demand.

1.54 The need for battery energy storage systems (BESS) has been identified by SONI under their DS3 programme. The delivery of the DS3 programme is required to allow Northern Ireland to meet its renewable energy targets.

1.55 The BESS in the Proposed Development provides an opportunity to support innovative technology, contribute towards renewable energy targets, ensure a secure electricity supply to its population and play its part in reducing electricity costs for consumers.

1.56 In particular, the Proposed Development will deliver frequency response service to enable the necessary balancing of the emerging low carbon electricity system. The frequency at which the electricity system operates is an indication of the balance between supply and demand and a failure to maintain this frequency within strict boundaries would lead to catastrophic system failure and blackouts. Normally, the system runs at a frequency of 50Hz. If there is not enough supply to meet demand the frequency drops below 50Hz. If there is too much supply for the current demand, the frequency rises above 50Hz. The Proposed Development will be able to respond within a fraction of a second to frequency deviations away from 50Hz (by increasing supply or demand as appropriate) to help keep the system in balance.

1.57 The BESS element of the Proposed Development could also provide distribution, reinforcement and deferral services. These enable existing electrical network assets such as substations and overhead lines to have their capacity increased without the need for building new infrastructure. All of these uses of the Proposed Development involve charging the battery system with electricity, storing electricity for a period, or discharging electricity. The Proposed Development will make a valuable contribution to Ireland's secure, low carbon and affordable electricity system.

1.58 One or more of the battery storage containers are connected to a power conversion system (PCS) and transformer unit, these may be separate pieces of equipment or one combined PCS and transformer. The PCSs are inverters which convert the direct current (DC) from the batteries to alternating current (AC) when the batteries are exporting electricity into the grid. The system works in reverse when the batteries are being charged or importing electricity from the grid. Power transformers will step up the PCS AC voltage from a low voltage to a higher voltage as required by the electricity grid connection.

1.59 The batteries will operate on average for up to 24 hours per day to support the grid network, times of operation will depend on the grid parameters and requirements. There shall be no emissions from the site with the exception of noise from cooling fans. All noise associated with the energy storage has been assessed in **Chapter 11: Noise** of the ES with the full technical details supplied in **Technical Appendix 11.1.**

1.60 More information about the proposed BESS at Mullaghclogher Wind Farm is included in **Technical Appendix 1.3**.

1.61 The BESS will comprise 20 permanent containers housing energy storage devices, associated inverters and ancillary equipment. Permanent fencing will enclose the containers. The BESS compound is illustrated in **Figure 1.8: Energy Storage Compound Plan & Elevation** and **Figure 1.9: Energy Storage Container Elevation.**

1.62 The BESS compound, measuring 4,000m^2 in area, will be constructed on the area used for the temporary construction compound area.

Crane Hard Standings

1.63 During the erection of the turbines, crane hardstanding areas would be required adjacent to each turbine base. **Figure 1.16** shows the general hardstanding arrangement at each turbine. Typically, these consist of one main permanent area of 1925m^2 adjacent to the turbine position, where the main turbine erection crane will be located. The other areas, totalling 630m^2, will be temporary and used during the assembly of the main crane jib. The hardstanding will be constructed using the same method as the excavated access tracks. This involves the topsoil being replaced with suitable structural fill to finished level.

1.64 After construction operations are complete, the temporary crane pad areas, shown on **Figure 1.16**, will be reinstated. There will be a requirement to use cranes on occasion during the operational phase of the Proposed Development, so the main crane hardstanding (1925m^2) will be retained to ease maintenance activities. This approach complies with current best practice guidance[3] which recommends crane hardstandings are left uncovered for the lifetime of the Proposed Development.

Site Tracks

1.65 The Proposed Development would result in the construction of approximately 9.4 km of new track. The running width of the track would be 4.5m on straight sections, with 0.25m wide shoulders on each side, totalling 5m. The permanent land take area for the new track would be approximately 65,911 m^2.

1.66 The on-site access track layout has been designed to minimise environmental disturbance by avoiding sensitive habitats where possible; and keeping the length of track commensurate with the minimum required for operational safety. The track route also takes cognisance of the various identified environmental constraints. Typical access track designs are shown in **Figure 1.11**.

1.67 14 new watercourse crossings will be required as part of the track layout. These crossings would be designed to ensure that fish movements are not restricted (where recommended in Chapter 9: Fisheries) in addition to ensuring the crossing size is adequate for potential flood flows. An example of the watercourse crossing design is shown in **Figure 1.19**.

Electrical Connection

1.68 Assuming the use of the currently available models, each wind turbine would generate electricity at low voltage and would have an ancillary transformer located either within or outside the base of the tower to step up the voltage to the required on-site distribution voltage. Each turbine would be connected to any adjacent turbines by underground cables.

1.69 The wind farm substation is proposed to be located on the central part of the site as shown in **Figure 1.3: Infrastructure Layout**. All power and control cabling on the wind farm will be buried underground in trenches located, where possible, along the route of site access tracks. These trenches will be partially backfilled with topsoil. The vegetation soil tuft will

[3] SNH, Scottish Renewables, SEPA and the Forestry Commission Scotland (2010) "*Good Practice during Wind Farm Construction*"

be stripped and laid beside the trench and used to reinstate the trench to the original ground level immediately after the cables have been installed.

1.70 The connection of wind farms to the electrical grid typically follows a separate consenting process and it is normally the responsibility of the network operator to progress the relevant consent, where required. The Best Practice Guidance to PPS 18 states that whilst the routing of such lines by Northern Ireland Electricity (NIE) is usually dealt with separately to the application for the wind farm, developers will generally be expected to provide details of indicative routes and method of connection.

1.71 RES considers connection to the grid system via a combination of overhead line and underground cables following the public road to the proposed North Sperrin Scheme is the most likely option available. Although not a part of the planning application for the Proposed Development, proposed grid connection route is illustrated and the environmental effects have been assessed and these are presented in **Technical Appendix 1.4**.

Control Building & Substation Compound

1.72 The Control Buildings & Substation Compound will comprise of a High Voltage Air Insulated Substation (AIS) compound with various electrical plant and up to two control buildings as per **Figure 1.7**. The electrical plant within the substation compound will include:

- NIE 110kV grid connection plant comprising of structures supporting circuit breakers, disconnectors, post insulators, current transformers, voltage transformers, surge arrestors and cable sealing ends. The equipment, to be installed in the NIE section of the compound, will be used by SONI and NIE for the electrical control and protection of the site and for measuring relevant electrical quantities associated with the wind farm site.
- Grid Transformer which will transform the medium distribution voltage (33kV) used within the wind farm to a higher transmission voltage (110kV) used for the grid connection circuit to export the electrical power from the site.
- Neutral Earthing Resistor which will control electricity current arising from earth faults to safe levels.
- Lightning Protection Columns required to protect the equipment in the substation compound from lightning strikes.
- Pre-Insertion Resistor, which may be installed to meet grid compliance requirements for power quality (studies during detailed design phase will identify if it is required)
- Harmonic Filter and Resistor, which may be installed to meet grid compliance requirements for power quality (studies during detailed design phase will identify if they are required).
- Capacitor Banks and associated Capacitor Circuit Breakers and Capacitor Switches, which may be installed to meet grid compliance requirements for power quality (studies during detailed design phase will identify if they are required).
- Reactor and associated Reactor CB which may be installed to meet grid compliance requirements for power quality (studies during detailed design phase will identify if it is required)

1.73 The total area taken up by the control building and associated infrastructure is expected to be 4,590m^2. This is to include the building, rear compound, all associated welfare, access and parking (**Figure 1.5**).

1.74 The wind farm control building (shown in **Figures 1.5 and 1.6)** will be designed and constructed to the standard required by NIE for the accommodation of NIE substation equipment and wind farm equipment. Where possible, local building materials and finishes will be used to ensure that the appearance is in keeping with other buildings in the area.

1.75 The control building will accommodate metering equipment, switchgear, the central computer system and electrical control panels. A spare parts store room, and welfare facilities will also be located in the control building. The building will be attended by maintenance personnel on a regular basis.

1.76 Following an assessment of foul treatment options through a review of Pollution Prevention Guidelines 4, it was determined that both the toilet, wash hand basin and sink should drain to a small package treatment plant located adjacent to the control building, which would follow the Controlled Activities Regulations (CAR) guidelines and be constructed and located in accordance with the relevant Building Standards and agreed with the Council.

1.77 A permanent external environmental waste storage area will be provided with a minimum of 6 m clearance from the buildings. The area will consist of a concrete plinth surrounded with a security fence and double gate.

Description of Access

1.78 The site entrance for the Proposed Development is located off the Carrickayne road. The site entrance is shown in **Figure 1.10: Site Entrance.**

1.79 The proposed access route for the delivery of large turbine components, known as abnormal indivisible loads (AILs), is shown in **Figure 12.1: Turbine Delivery Route**. **Technical Appendix 12.1** shows a swept path analysis of all points along the turbine delivery route that require either overrun or oversail beyond the road edge.

1.80 At the end of the construction period and in consultation with DFI Roads, any reinstatement required to any street furniture which may be removed on a temporary basis will be undertaken. In the unlikely event that a replacement blade is required during the operational phase of the wind farm, any works will be undertaken following consultation with DFI Roads.

1.81 The proposed routes for construction traffic are shown on **Figure 12.2: HGV Routes**.

1.82 A full assessment is included in **Chapter 12: Traffic and Transport**.

Typical Construction Activities

1.83 Prior to commencement of construction, detailed method statements will be prepared to address best practice working methods. This is known as the Construction Method Statement (CMS). As a minimum, the following best practice construction methods will be adhered to:

- Where possible and in order to minimise impacts of earthworks, excavations will be kept to a minimum with granular material being reused where appropriate
- Consideration will be given to weather conditions when stripping soil. For example, during periods of heavy rain (>25 mm in 24 hours), significant snow event (>75 mm lying) or an extended period of freezing conditions (ground penetration >100 mm), soil stripping works will be reviewed to take in account any adverse weather conditions and where deemed applicable, works will cease until site conditions prevail that are compatible with this activity
- Vegetated turves shall be stripped and stockpiled separately prior to excavation of topsoil/peat in all work areas
- Vegetated turves will be reused as quickly as possible
- Excavations will be monitored for changing soil types to prevent cross mixing of soils in stockpiles
- Topsoil shall be stripped and stored carefully for use in reinstatement works, which shall be carried out as soon as possible after sections of work are complete. Topsoil will be stripped prior to excavation of subsoil in all work areas
- Any remaining subsoil will be excavated down to a suitable bearing stratum and set-aside for later use in landscaping, backfilling around structures and verge reinstatement
- Reinstatement will be ongoing as the works are constructed to minimise the amount of time in which any material will be stockpiled
- Where required, all stockpiled material will be sited in areas with shallow peat depths, negligible peat slide risk and avoiding all 50 m watercourse buffer zones, ecological and cultural heritage constraints
- All stockpiles shall be shaped to promote run-off. Detailed SUDS drainage and silt control methods shall be designed for each stockpile
- Additionally, a “toolbox talk” will be provided by the site management team to highlight possible events causing slope instability and provide guidance on best practice when operating in areas of peat and/or increased slopes. In addition, a workforce engagement event shall be performed at least once for the project and shall be organised by the project team and be attended by RES and project contractor’s workforce. The event will set and communicate the required safety culture and working practices for the project.

Access Tracks

1.84 In areas of peat with a depth greater than 1.0 m consideration has been given to the use of floating tracks. The feasibility of a floating road construction is dependent upon a number of factors, namely: the geomorphology of the peat; topography; length of road section; wind farm layout; number of vehicle movements for each option; restoration requirements; peat re-use considerations. All parameters noted above will be assessed at detailed design stage post consent and the best practice road construction type will be inferred from the various design constraints.

1.85 The access track itself will be constructed of inert material of suitable grade to withstand the expected traffic loading. Road construction techniques and roadside ditches will be designed to minimise the effect on natural hydrology as much as possible.

1.86 The depths of the ditches will be kept to the minimum required for free drainage of the road. Individual drain lengths will be minimised to avoid significant disruption of natural drainage patterns and avoid accumulation of large volumes of water within an individual drain.

1.87 Drains will not directly flow into watercourses, but into a buffer zone. Buffer zones are used to allow filtration of suspended solids in the water and reduction of runoff velocities. This reduces the flashiness of response, encourages deposition of sediments and allows pollutants to be filtered out.

Construction of Temporary Compound and Battery Energy Storage System

1.88 A temporary construction compound will be located on the site, as illustrated in **Figure 1.3: Infrastructure Layout.** Details of the temporary compound layout are included in **Figure 1.12: Temporary Construction Compound Layout Plan.** The compound will include the following:

- Temporary portable cabins for office accommodation, monitoring of incoming vehicles and welfare facilities
- Self-contained toilets with provision for waste storage and removal
- Containerised storage areas for tools, small plant and parts
- An area for site vehicle parking and storage of larger material items
- A standing and turning area for vehicles making deliveries to the site
- A bunded area for storing fuels, oils and greases.

1.89 The temporary construction compound measures 4,000m^2. On completion of the construction work these facilities will be removed and the area will be used for an energy storage compound.

1.90 The location of the temporary compound has been selected to avoid environmental constraints and for reasons of security, practicality and to obtain suitable ground conditions. The proposed compound area will be constructed by top soil excavation in a similar manner to the access tracks, laying stone over a geotextile membrane.

1.91 During construction, temporary fencing will be erected as required, around the construction compound. This is illustrated in **Figure 1.12 and Figure 1.13.**

BESS

1.92 The construction phase of the BESS will be aligned and incorporated into the general construction of the wind farm. The BESS area will be constructed at the later part of the overall construction programme as the containers and their compound will be located within an area which will be used as the temporary construction compound for the wind farm.

1.93 The lithium ion batteries will be manufactured off site and will be delivered to site as fully sealed modules. The batteries will be tested to all the required standards including the UL9540A standard (**see Technical Appendix 1.3**).

1.94 The lithium ion batteries will be enclosed in steel ISO shipping containers, designed and manufactured to a bespoke design for lithium-ion batteries. The enclosures will be mounted on concrete foundations with dc cables connecting the batteries to the power conversion systems (changes the electricity from dc to ac) then ac cables connecting the power conversion systems to the substation.

1.95 The BESS compound area would be constructed by laying stone over a geotextile membrane. During the construction phase temporary drainage measures will be installed to control sediment run-off in line with the SUDS measures outlined in **Technical Appendix 10** of the ES.

1.96 The BESS will comprise 20 permanent containers housing energy storage devices, associated inverters and ancillary equipment. Permanent fencing will enclose the containers. These are illustrated in **Figure 1.8: Energy Storage Compound Plan & Elevation** and **Figure 1.9: Typical Energy Storage Container Elevation.**

Sustainable Drainage System

1.97 The drainage measures and Sustainable Drainage System (SuDS) designs have been directed by recommendations in **Chapter 10: Geology & Water Environment**

1.98 The runoff drainage system will be designed to mimic natural conditions to mitigate against increased flashiness in water courses and reduced groundwater recharge. The SuDS will protect the status of water courses and ground waters. A proposed SuDS Design Statement is included within the Water Framework Directive Assessment in **Technical Appendix 10.1.**

1.99 Construction will be carried out according to Department of Agriculture, Environment & Rural Affairs (DAERA) and Construction Industry Research and Information Association (CIRIA) guidance for site works. Pollution control measures during the construction phase will be included in the CMS & Construction Environmental Management Plan (CEMP), which will be agreed with the Planning Authority before starting construction work on site.

1.100 Mitigation measures to minimise the hydrological effect of constructing the access tracks have been proposed in **Chapter 10: Geology & Water Environment** of this ES.

Crane Hardstanding Construction

1.101 **Figure 1.16** shows the crane hardstanding layout configuration in plan. The hardstanding would be constructed using the same method as the excavated access tracks. This involves the topsoil and subsoil being replaced with suitable stone, ensuring an adequate bearing capacity has been achieved to carry the anticipated loads. The final position of the hardstanding would be decided at detailed design stage and prior to construction and shall be based on a number of considerations, including; size of crane required, depth of excavation required, hydrological/ecological features in the vicinity, local topography (it is preferable to position the crane hardstanding on the same level, or higher level to the turbine foundation level since this eases lifting operations).

Turbine Foundation Construction

1.102 The turbine towers are fixed to a concrete foundation. The foundation proposed in **Figure 1.15** comprises a gravity base design. Each foundation typically consists of a tapered octagonal block of concrete, and formation will be approximately 3.5 m below ground level. The volume of concrete used to make each foundation is approximately 500 m^3, which is reinforced by approximately 60 tonnes of steel bar. The sub formation depth of the foundation varies for each turbine location according to the depth to suitable sub formation level.

1.103 The foundation is typically poured in two parts, with a suitable construction joint between them. This will be detailed in the CMS. Following the pouring and curing of the concrete, the foundation is backfilled with material which is initially excavated and meeting the density requirements, leaving only the tower plinth, typically 4.5 m – 5.5 m diameter, sitting at or close to ground level. Surplus excavated material will be stored in appropriate areas identified in the Peat Management Plan (PMP), produced as part of CEMP/CMS prior to construction. The proposed plan will calculate generated excavated material and identify space for the excess volume of material. An Outline Peat Management Plan is provided in **Technical Appendix 10.4**.

1.104 The exact quantities of concrete, reinforcement, depth and dimensions will vary on the final choice of turbine model. In the detailed pre-construction design of each foundation, geotechnical tests are carried out to determine the strength of the subsoil layers beneath the turbines and the soil behaviour under loading over time. This information is used to confirm a final design and incorporates factors for safety.

1.105 An earthing mat or electrode consisting of up to three interconnected concentric rings of bare stranded copper conductor is laid around the foundation of each tower and transformer, approximately 0.5 m below the finished ground level. In addition, earthing rods padded by bentonite (a water retaining clay mineral) are required at set locations around the foundation, and are positioned vertically below the earth mat. The number of rods and length is dependent upon the electrical resistivity of the soil, which is confirmed during the site investigation, prior to construction.

1.106 Sulphate resistant cement, or higher cement content, within the concrete will be used if the site is identified to have waters with potentially low pH. This is so that they do not have a corrosive effect on turbine bases.

Wind Turbine Erection

1.107 Wind turbine towers, nacelles and turbine blades will be transported to the site as abnormal loads as described in Section 1.78. The tower sections and other turbine components will be stored at each turbine hardstanding until lifted into position.

1.108 The components would be lifted by adequately sized cranes and constructed in a modular fashion. Assembly, in general requires only fixing of bolts, torquing of nuts and electrical and hydraulic connections.

Cabling, Substation and Control Building

1.109 The location of the substation and control building is shown in **Figure 1.3: Infrastructure Layout**. Layout and elevation drawings for these buildings are presented in **Figures 1.5 - 1.7**. All cabling between the turbines and the substation on the site will be connected using underground trenched cables. Where excavated, the top layer of soil will be removed and used to reinstate the excavation following the installation of the cables. Where cables are being laid in areas of peat, the various different layers will be separated and replaced appropriately. Cabling would generally run parallel to the adjacent site tracks. **Figure 1.17** presents a typical underground cable cross-section. In addition and in an effort to ensure that the cable trench does not act as a preferential drain, impermeable bunds will be installed perpendicular to the cable direction at suitable intervals (taking into account local ground conditions and topography).

Re-instatement

1.110 A programme of site reinstatement and enhancement would be put in place to minimise the visual and ecological impacts on the land, in accordance with the Outline Habitat Management Plan (**Technical Appendix 6.2**).

1.111 Reinstatement would be implemented upon completion of construction. This would relate to temporary areas of the crane hardstandings, cable trenches and track shoulders where appropriate. There remains a potential to use cranes during the operational phase of the Proposed Development, therefore the main crane hardstanding will remain uncovered.

1.112 It is essential that the access track width is retained during the operation of the Proposed Development to allow occasional access if required. Therefore, no works to reduce the track width, post turbine erection, are proposed.

Construction Programme

It is anticipated that the construction would take approximately 18 months. The indicative construction programme shown in **Diagram 1.1** shows the anticipated scheduling of construction activities. Construction of tracks and foundations would be progressive, minimising the number of simultaneously active locations and ensuring that traffic density is kept low. Turbine erection would span approximately nine weeks toward the end of the work programme.

Diagram 1.1 – Indicative Construction Programme

TASK	CONSTRUCTION MONTH																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Mobilisation & setup construction compound	■	■																
Site entrance and tracks		■	■	■	■	■	■	■	■	■	■							
Crane hardstandings				■	■	■	■	■	■	■	■	■						
Turbine foundations							■	■	■	■	■	■						
Control building & substation							■	■	■	■	■	■						
Cable installation									■	■	■	■	■					
Turbine deliveries												■	■	■	■			
Battery, storage containers, PCSs and transformer delivery												■	■	■	■	■	■	■
Turbine erection & commissioning													■	■	■	■	■	■
Operational take over																	■	■

Hours of Work

1.113 Construction work will take place between the hours of 0700-1900 Monday to Friday and 0700 – 1300 on Saturdays. Outside these hours, work at the Site shall be limited to turbine erection, testing/commissioning works and emergency works. Deliveries may occur outside these times to minimise disruption to local residents.

Construction Traffic and Plant

1.114 In addition to staff transport movements, construction traffic will consist of heavy goods vehicles (HGVs) and abnormal load deliveries.

1.115 As outlined in **Chapter 12: Traffic and Transport**, taking into account forecast vehicle numbers from construction activities (4,635 trips) and forecast staff vehicle numbers (12,200 private car, minibus or land rover trips), the total number of two-way vehicle movements generated during the construction period would therefore be 16,835 journeys. Approximately 156 abnormal load deliveries would be generated for the turbine erection stage which would typically result in three deliveries per day. The final number will be determined in the development of the Traffic Management Plan (TMP) which will be written in consultation with Department for Infrastructure (DfI), post-consent.

1.116 Turbine components will be supervised during their transportation using appropriate steerable hydraulic and modular trailer equipment where required. Axle loads would be appropriate to the roads and access tracks to be used. The transportation of turbine components would be conducted in agreement with the relevant roads authorities and local police. RES will notify the police of the movement of abnormal length (e.g. turbine blade delivery) and any abnormal weight (e.g. crane) vehicles and obtain authorisation from DfI prior to any abnormal vehicle movements.

1.117 Vehicle escorts will be used where necessary and the appropriate permits obtained for the transportation of abnormal loads, to ensure that other traffic is aware of the presence of large, slow moving vehicles. Where long vehicles have to use the wrong side of the carriageway, or have potential to block the movement of any vehicles travelling in the opposite direction, a lead warning vehicle will be used and escort vehicles will drive ahead to hold oncoming traffic. Vehicles will also be marked as long/abnormal loads. For return journeys, the extendible trailers used for wind turbine component delivery will be retracted to ensure they are no longer than that of a normal HGV.

Construction Method Statement

1.118 A Construction Method Statement (CMS) will be prepared once planning consent has been gained. This will describe the detailed methods of construction and working practices and work to reinstate the site following completion of construction activities.

Construction and Environmental Management Plan (CEMP)

1.119 The CEMP, which forms part of the wider CMS, details the environmental management controls that would be implemented by RES and its contractors during the construction of the Proposed Development to ensure that potential significant adverse effects on the environment are, wherever practicable, prevented, reduced and where possible offset. This will be submitted to the planning authority for agreement prior to any construction works taking place.

1.120 The purpose of the CEMP is to:

- Provide a mechanism for ensuring that measures to prevent, reduce and where possible offset potentially adverse environmental impacts identified in the ES are implemented;
- Ensure that good construction practices are adopted and maintained throughout the construction of the Proposed Development;
- Provide a framework for mitigating unexpected impacts during construction;
- Provide a mechanism for ensuring compliance with environmental legislation and statutory consents;
- Provide a framework against which to monitor and audit environmental performance.

1.121 The CEMP will, as a minimum, include details of the following:

- Pollution prevention measures
- Peat slide, erosion and compaction management
- Control of contamination/pollution prevention
- Drainage management
- Control of noise and vibration
- Control of dust and other emissions to air.

1.122 At Site Induction the principal contractor would ensure that all employees, sub-contractors, suppliers and other visitors to the site are made aware of the content of the CEMP and its applicability to them. Accordingly, environmental specific induction training would be prepared and presented to all categories of personnel working on and visiting the site.

1.123 As a minimum, the following information would be provided to all inductees:

- Identification of specific environmental risks associated with the work to be undertaken on site by the inductee
- Summary of the main environmental aspects of concern at the site as identified in the CEMP.
- Environmental Incident and Emergency Response Procedures (including specific Environmental Communication Plan requirements).

1.124 A conveniently sized copy of an Environmental Risk Map or equivalent would be provided to all inductees showing all of the sensitive areas, exclusion zones and designated washout areas. The map would be updated and reissued as required. Any updates to the map would be communicated to all inductees through a tool box talk given by specialist environmental personnel. Regular tool box talks would be provided during construction to provide ongoing reinforcement and awareness of environmental issues.

1.125 An Outline CEMP (OCEMP) has been included as **Technical Appendix 1.5**. The final CEMP will be agreed with the relevant statutory consultees prior to construction commencing.

Pollution Prevention, Water Quality Monitoring and Emergency Response Plan

1.126 The CEMP will detail a number of measures to deal with pollution prevention, including RES' policies and procedures such as 'Environmental Requirements of Contractors', 'Water Quality Monitoring Procedure' and 'Procedure in the Event of a Contaminant Spill'.

1.127 Contractors and sub-contractors would be required to follow all pertinent Pollution Prevention Guidance. The following pollution control measures will be incorporated into the CEMP:

- Equipment shall be provided to contain and clean up any spills in order to minimise the risk of pollutants entering watercourses, waterbodies or flush areas
- Trenching or excavation activities in open land shall be restricted during periods of intense rainfall and temporary landscaping shall be provided as required to reduce the risk of oil or chemical spills to the natural drainage system
- Sulphate-resistant concrete[4] shall be used for the construction of turbine bases to withstand sulphate attack and limit the resultant alkaline leaching into groundwater
- All refuelling will be undertaken at designated refuelling points. There will be no refuelling within catchments contributing to water supply points
- Equipment, materials and chemicals shall not be stored within or near a watercourse. At storage sites, fuels, lubricants and chemicals shall be contained within an area bunded to 110%. All filling points shall be within the bund or have secondary containment. Associated pipework shall be located above ground and protected from accidental damage
- Any on-site concrete wash-out shall occur in allocated bunded areas
- Drip trays shall be placed under machinery left standing for prolonged periods
- All solid and liquid waste materials shall be properly disposed of at appropriate off site facilities
- Routine maintenance of vehicles shall be undertaken outwith the site
- There shall be no unapproved discharge of foul or contaminated drainage from the Proposed Development either to groundwater or any surface waters, whether direct or via soakaway
- Sanitary facilities shall be provided and methods of disposal of all waste shall be approved by regulatory bodies

[4] BS EN206:1 : 2000 Concrete Part 1: Specification, performance, production and conformity and BS 8500 – 1 : 2006 Concrete – Complementary British Standard to BS EN 206 – 1 Part 1

- A programme of surface water quality monitoring would be undertaken during the construction phase to provide assurances as to the absence of water quality impacts
- RES has a policy that no wind turbines, auxiliary and electrical equipment would contain askarels or Polychlorinated biphenyls (PCBs).

1.128 In the unlikely event of an environmental pollution incident, there will be an emergency response procedure to address any accidental pollution incident. For example, a procedure requiring the use of spill kits to contain the material and procedures to ensure that NIEA is notified on their Pollution Hotline number (0800 807060) within 30 minutes of an incident (unless unsafe to do so), will be applied.

General Drainage Design

1.129 As set out in **Chapter 10: Geology & Water Environment**, buffers to watercourses have taken account of and infrastructure designed in accordance with best practice guidance.

1.130 The potential impact of preferential routing of drainage and associated erosion and sediment wash-off within the sub-catchments draining the site would be mitigated through the following measures which would be incorporated into the SuDS Design:

- Maintaining existing overland flow routes and channels. Existing natural flow paths lateral to access roads will be maintained through the use of piped crossings under road alignments at natural depressions and at regular intermediate intervals. The spacing of cross drains will be specified at detailed design stage;
- Avoiding transporting rainfall runoff in long linear drainage swales by providing regular channel “breakouts”, whereby water is encouraged to flow overland, thus maintaining existing natural hydrological patterns;
- Reducing surface water flow rates and volumes by attenuating runoff from tracks and hard standings “at source” by providing check-dams in swales, whereby the flow velocity and rate of discharge is artificially reduced to mimic natural properties;
- Providing settlement ponds at turbine hard standing areas and other main surface water discharge locations, where runoff from significant new impermeable areas is treated and attenuated before being released overland; and
- All swales, crossings and other hydraulic features will be engineered to ensure that dimensions are suitable to convey predicted flows and so prevent build-up of surface water and / or flooding.

Runoff and Sediment Control Measures

1.131 The following measures would be used to mitigate any potential impacts on the water quality of the sub-catchments through peat erosion, stream acidification and metals leaching during construction. These are incorporated into the OCEMP:

- Appropriate sediment control measures (silt fences, attenuation ponds, etc.) would be used in the vicinity of watercourses, springs or drains where natural features (e.g. hollows) do not provide adequate protection
- Sediment control measures (e.g. check dams, silt fences etc.) would be employed within the existing artificial drainage network during construction. These would be regularly checked and maintained during construction and for an appropriate period following completion
- Watercourses would be monitored throughout the construction period by the ECoW to identify any enhanced scouring of the catchment surface. If sediment from disturbed peat is excessively mobilised through the minor channels network these would be mitigated by temporary sediment control measures (e.g. geotextiles/straw/bales/brash)
- The extent of all excavations would be kept to a minimum and during construction activities surface water flows shall be captured through a series of cut-off drains to prevent water entering excavations or eroding exposed surfaces. If dewatering of excavations is required, pumped discharges would be passed through attenuation ponds and silt fences to capture sediments before release to the surrounding land
- Where there is a permanent relocation of peat, the ground would be reinstated with vegetation as soon as practicable
- Where practicable, vegetation over the width of the cable trenches would be lifted as turfs and replaced after trenching operations to reduce disturbance
- The movement of construction traffic would be controlled to minimise soil compaction and disturbance. Vehicle movements outside the defined tracks and hardstandings would be avoided
- Trenching or excavation activities in open land would be restricted during periods of intense rainfall and temporary landscaping would be provided, as required, to reduce the risk of sediment transport to the natural drainage system
- Construction of the track and cable crossings will cease during periods of heavy rain (>25mm in 24 hours), significant snow event (>75mm lying) or extended period of freezing conditions (ground penetration>100mm). If necessary, upstream of the crossing would be dammed and water pumped around the construction zone. The construction period would be minimised as far as practicable.

Peat Slide, Erosion and Compaction Management

1.132 Management of the risk of peat slides and storage is now recognised in literature, and a range of measures have now become standard engineering practice for construction of roads over peat.

1.133 These measures would be adopted, as appropriate, on site, ensuring that:

- Minimise the effects of construction on natural drainage by ensures natural drainage pathways are maintained or diverted such that there is no significant alteration of the hydrological regime of the site; drainage plans should avoid creating drainage/infiltration areas or settlement ponds towards the tops of slopes (where they may act to both load the slope and elevate pore pressures).

- Maintain drainage pathways through tracks to avoid ponding of water upslope.
- Monitor the top line of excavated peat deposits for deformation post-excavation.
- Monitor the effectiveness of cross-track drainage to ensure it water remains free-flowing and that no blockages have occurred.

2. Prior to the construction, setting out the centre-line of the proposed track should include a walk over performed by the site manager or general foreman, along with the suitably qualified Geotechnical Engineer, and appropriate Clerk of Works. This should be carried out to check that the ground conditions/drainage paths are as expected, and "fine-tuning/micrositing" of the alignment if required.

- Weather policy should be agreed and implemented during works, e.g. identifying 'stop' rules (i.e. weather dependent criteria) for cessation of track construction or trafficking (e.g. allowing tracks to thaw following periods of hard frost).
- Allow peat to undergo primary consolidation by adopting rates of road construction appropriate to weather conditions.

2.1 Areas of deep peat and areas at high risk of a peat slide were avoided during the design phase where practicable.

2.2 In consideration of the above and the level of peat disturbance anticipated, particularly where infrastructure is planned on steeper topography, it is considered that the risk from peat slide and instability is insignificant. Should a detailed ground investigation provide further evidence of deep peat, consideration will be given to the production of a Peat Stability Risk Assessment.

Traffic Management Plan

2.3 As detailed in **Chapter 12: Traffic & Transport** a Traffic Management Plan (TMP) would be developed to ensure road safety for all users during transit of development loads. The TMP would outline measures for managing the convoy and would set out procedures for liaising with the emergency services to ensure that police, fire and ambulance vehicles are not impeded by the loads. The TMP would be developed in consultation with DfI, the police and the local community and agreed before deliveries to the Proposed Development commence.

Potential Construction and Decommissioning Phase Environmental Impacts

Operation and Management

Life of the project

2.4 The expected operational life of the wind farm is 35 years from the date of commissioning. At the end of this period, a decision is made whether to refurbish, remove or replace turbines. If refurbishment or replacement were to be chosen, relevant planning applications will be made. Alternatively, if a decision is taken to decommission the Proposed

Development, this would entail the removal of all of the turbine components, transformers, the substation and associated buildings. Specific sections of the access tracks may remain on-site to ensure the continued benefit of improved access for the landowners. The concrete foundations will normally remain in place to avoid the unnecessary intrusion to the ground. The exposed concrete plinth may be removed to a specified depth, but the entire foundation will be graded over with topsoil and replanted appropriately to restore the land to its original conditions.

Maintenance Programme

2.5 Wind turbines and wind farms are designed to operate largely unattended. Each turbine at the Proposed Development would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut the turbine down should the need arise. Sometimes the turbines would re-start automatically (if the shut-down had been for high winds, or if the grid voltage had fluctuated out of range), but other shut-downs (e.g. generator over temperature) would require investigation and manual restart.

2.6 The Proposed Development itself would have a sophisticated overall Supervisory Control and Data Acquisition system (SCADA) that would continually interrogate each of the turbines and the high voltage (HV) connection. If a fault were to develop which required an operator to intervene then the SCADA system would make contact with duty staff via a mobile messaging system. The supervisory control system can be interrogated remotely. The SCADA system would have a feature to allow a remote operator to shut down one or all of the wind turbines. This is monitored 24 hours a day, 7 days a week.

2.7 An operator would be employed to operate and maintain the turbines, largely through remote routine interrogation of the SCADA system. The operator would also look after the day-to-day logistical supervision of the Proposed Development and would be on-site intermittently.

2.8 Routine maintenance of the turbines would be undertaken approximately twice yearly to ensure the turbines are maintained to Industry Standard. This would not involve any large vehicles or machinery.

2.9 If a fault should occur, the operator would diagnose the cause. If the repair warranted the Proposed Development being disconnected from the grid then the operator would make contact with NIE. However, this is a highly unlikely occurrence as most fault repairs can be rectified without reference to the network utility. If the fault was in the electrical system then the faulty part or the entire Proposed Development would be automatically disconnected until the fault is rectified.

2.10 Signs would be placed on the Proposed Development giving details of emergency contacts. This information would also be made available to the local emergency services and NIE.

Decommissioning

2.11 One of the main advantages of wind power generation over other forms of energy production is the ease of decommissioning and the simple removal of components from the site. The residual impact on the site is limited to the continued presence of the foundations and access tracks. All above ground structures can be removed from the site.

2.12 If the Proposed Development obtains planning approval it is expected that a planning condition would be set to provide for the decommissioning and restoration of the site in accordance with a scheme agreed in writing with Department for Infrastructure (DfI), which would consider the long term restoration of the site at the end of the lifetime of the Proposed Development.

2.13 The Proposed Development will be decommissioned in accordance with best practice at that time and/or in compliance with any planning conditions. Current best practice includes the removal of all above ground structures (e.g. turbines, substation etc); the removal of certain underground structures where required (e.g. cables); and reinstatement of disturbed areas all of which will be subject to any necessary consents. Consideration will be given to the retention of wind farm access tracks if they utilise pre-existing farm infrastructure or are not located on sensitive habitats if such continued use could lead to the long term degradation of these habitats.

Decommissioning Battery Energy Storage System

2.14 At the end of life, the battery enclosures, power conversion systems, substation, foundations, and cables will be removed from site and appropriately disposed of and recycled where possible.

2.15 The battery modules will be removed from the site fully intact (they are sealed units) and sent for recycling. As part of the battery supply agreement the manufacturer shall have an obligation to take the battery enclosures back to their factory for onward recycling at an approved facility. The battery enclosures, PCS's and cables will be recycled more locally at an authorised metal recycling centre.

List of Figures and Technical Appendices

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Technical Appendices

2

Planning Policy

2 Policy

Introduction

2.1. This chapter has been prepared by Savills on behalf of the applicant, RES Ltd. It demonstrates how legislation and energy and planning policy considerations have been addressed in the Proposed Development.

2.2. It opens by summarising the legislative and energy policy context within which the project has been conceived. This is not an exhaustive overview of all relevant policies and plans relevant to this subject area, and given the legislative basis and statutory nature of the net zero targets (discussed further below), only the most salient and up-to-date policies are discussed.

2.3. At the outset, it is the applicant's view that the contribution the Proposed Development can make to greenhouse gas (GHG) reduction and renewable energy generation targets should be accorded 'significant weight' in the planning balance. This position is supported by Planning Policy Statement (PPS) 18 and other wind farm decisions, including Corlacky Hill Wind Farm (PAC Reference: 2018/C009), where the Commissioner concluded that the environmental, social and economic benefits of that scheme *"strongly reinforce the case for granting approval"*.

2.4. The significant progression in Northern Ireland's renewable energy and GHG reduction targets since publication of PPS18 and the decision to grant Corlacky Hill Wind Farm, add further substance to the applicant's position that these matters ought to be given 'significant weight' in the planning balance.

2.5. The chapter then assesses the project's compliance with operational planning policy on a policy by policy basis. In this regard, it is important to note that the following planning policy narrative was written in November 2024 i.e. before the Department for Infrastructure's (DfI) binding Direction to Derry City & Strabane District Council to proceed to adopt its draft Local Development Plan (LDP) Plan Strategy came into operation. As per the transitional arrangements set out in the Strategic Planning Policy Statement (SPPS) for Northern Ireland therefore, this chapter focuses on the SPPS and other relevant Planning Policy Statements (PPS), as opposed to the emerging LDP Plan Strategy.

2.6. The applicant understands that the District Council is targeting formal adoption of its LDP Plan Strategy in April/May 2025, following which the existing Area Plans and the suite of PPSs will no longer apply. Having considered the current planning policy situation, it is the applicant's intention to prepare a revised chapter that assesses the Proposed Development against the LDP Plan Strategy following its formal adoption.

The Legislative Framework

Climate Change Act 2008 (as amended)

2.7. The Climate Change Act 2008 became law on 26 November 2008 and introduced a legally-binding target for the UK to reduce GHG emissions by at least 80% by 2050, relative to 1990 levels.

2.8. The UK Government amended the Climate Change Act 2008 in June 2019 to increase the GHG reduction targets for the UK, reflecting the recommendations set out in the Committee on Climate Change (CCC) Report from May 2019 entitled 'Net Zero - The UK's contribution to stopping global warming'.

2.9. The Climate Change Act 2008 (2050 Target Amendment) Order 2019 amended the 2008 Act by passing into law the target for UK GHG emissions to be at least 100% lower than the 1990 baseline by 2050 (i.e. net zero by 2050), an increase on the previous target for an 80% reduction by the same date.

Energy Act 2023

2.10. The Energy Act 2023 received Royal Assent on 26 October 2023 and extends to Northern Ireland (with some exceptions). Originally introduced as the Energy Security Bill in 2022, it seeks to reduce the UK's dependence on volatile fossil fuel markets, by improving domestic energy production and make the UK more self-sufficient when it come to the energy it uses.

2.11. Following the introduction of the Act into law, the then Energy Security Secretary Claire Coutinho commented that *"The Energy Act is the largest piece of energy legislation in a generation. It will boost investment in clean energy technologies and support thousands of skilled jobs across the country"*.

Climate Change Act (Northern Ireland) 2022

2.12. The Climate Change Act (Northern Ireland) 2022 sets legally binding targets for net zero carbon emissions by 2050, aligning Northern Ireland with UK-wide and international climate commitments. It also sets out interim targets, including an at least 48% reduction in net emissions by 2030. The 2040 target is for emissions to be in line with the target for the year 2050.

2.13. The 2022 Act also sets sectoral targets. In relation to renewable energy, the Department for the Economy must ensure that at least 80% of electricity consumption is from renewable sources by 2030.

International Climate Change and Energy Policy Context

2.14. Energy legislation and policy in the UK is driven by international co-operation to cut GHG emissions, as a means of combating climate change. This includes the 'Paris Agreement', established through the 21st session of the Conference of

Parties (‘COP21’). Ratified in the UK on 17 November 2016, the Paris Agreement sets out the ambition of holding the increase of global average temperature to *“well below 2°C”* and pursuing efforts to limit temperature increase to 1.5°C. This ambition has been consistently reaffirmed, most recently at COP29 in Baku in December 2024.

2.15. For more than a decade the UN Gap Reports have compared where GHG emissions are heading, against where they need to be, and highlights ways to close the gap. The latest Gap Report, ‘No more hot air … please!’, was published on 24 October 2024.

2.16. The 2024 Gap Report notes in the Foreword that GHG emissions reached a new high in 2023. This context coupled with the promises made to date put us *“on track for best-case global warming of 2.6 degrees this century and necessitating future costly and large-scale removal of carbon dioxide from the atmosphere to bring down the overshoot.”* It is outlined that the *“increased deployment of solar photovoltaic technologies and wind energy could deliver 27 per cent of the total emission reduction potential in 2030 and 38 per cent in 2035.”*

UK Climate Change and Energy Policy Context

Prime Minister’s National Statement at COP29

2.17. On 12 November 2024, at COP29 in Baku, the UK Prime Minister announced the UK’s 2035 Nationally Determined Contribution (NDC) under the Paris Agreement. This commits the UK to reducing economy-wide GHG emissions by at least 81% by 2035, compared to 1990 levels, excluding emissions from international aviation and shipping.

2.18. The 2035 NDC is based on advice from the independent CCC. It is a progression on the UK’s previous NDC pledge to reduce emissions by at least 68% by 2030. It was informed by the outcomes of the Global Stocktake from COP28 and is aligned with limiting global warming to 1.5°C. It is also aligned with the level of ambition in Carbon Budget 6 (2033-37) on the pathway to net zero by 2050.

2.19. The headline target will be followed by submission of the detail underpinning the NDC – known as Information to facilitate Clarity, Transparency and Understanding (ICTU) – to the United Nations Framework Convention on Climate Change ahead of the February 2025 deadline.

Climate Change Committee (CCC) - Progress in Reducing Emissions – 2024 Progress Report to Parliament

2.20. The 2024 Progress Report to the UK Parliament was published in July 2024 and considers the global picture with regards to emissions reductions and adaptation to climate change. It discusses the UK’s role in a global context before discussing a range of sectors such as transport, building, manufacturing, electricity supply, fuel supply, aviation and shipping etc. Each sector is looked at in terms of emission trends and drivers, indicators of progress, next steps and major risks.

2.21. In the Executive Summary, it is outlined that the UK has *"a successful track record of emissions reductions"*. However, *"despite some progress, the previous Government signalled a slowing of pace and reversed or delayed key policies"*. The new Government needs to *"act fast"* to ensure the UK remains on track to meet its current commitments.

2.22. The report sets out that the cost of key low-carbon technologies is continuing to fall, creating an opportunity for the UK to boost investment, reclaim global climate leadership and enhance energy security by accelerating take-up. British-based renewable energy is the cheapest and fastest way to reduce vulnerability to volatile global fossil fuel markets. The faster we get off fossil fuels, the more secure we become.

2.23. There is overarching support for the roll out of clean energy technology and due to the targets needing to be met, the Report states *"annual offshore wind installations must increase by at least three times, <u>onshore wind installations will need to double</u> and solar installations must increase by five times."* (emphasis added)

Northern Ireland Climate Change and Energy Policy Context

Northern Ireland Executive Programme for Government

2.24. In September 2024, the Executive agreed a Draft Programme for Government 2024-2027 'Our Plan: Doing What Matters Most' (dPfG) and published it for public consultation. While the dPfG is not an energy policy specific publication, it does set out important statements about how the Executive intends to address various matters relating to the climate emergency, nature crisis and renewable energy, amongst other matters.

2.25. Issues relating to climate change and net zero are encompassed in the dPfG's three missions, including one entitled 'Planet' and described as:-

"Harnessing the potential of a green growth economy while ensuring we provide an equitable transition to a sustainable and affordable society as we take responsibility for decarbonising our economy and society".

2.26. The dPfG outlines a series of cross-cutting priorities to help deliver the three stated missions, including *inter alia*:-

- **Growing a Globally Competitive and Sustainable Economy**

  This priority identifies four key challenges: productivity, good jobs, decarbonisation, and regional balance. In terms of decarbonisation, *"we will seek to achieve self-sufficiency in our own clean and affordable energy"*. Northern Ireland has the natural resources, including wind, to *"break the link with global energy prices, and not only supply our own consumers' energy needs, but also to become a net exporter of renewables.*

This will unlock carbon emissions reduction and economic growth here"; and

- **Protecting Lough Neagh and the Environment**

  Under this priority, tackling climate change and paying attention to the natural environment are seen as critical for wellbeing and prosperity, and helping to unlock new opportunities. The proposed actions include publication of Northern Ireland's first EIP, setting carbon budgets, and developing the first CAP (all discussed further in the following paragraphs).

Environmental Improvement Plan for Northern Ireland

2.27. Northern Ireland's first Environmental Improvement Plan (EIP) was published in September 2024. It forms part of the wider Green Growth agenda and, for the most part, is intended to be a high-level document that will sit alongside both new and existing strategies. The EIP therefore *"aims to focus on ambitious outcomes for the big environmental issues facing us that will make a difference to the lives and well-being of current and future generations."*

2.28. The key strategic drivers underpinning the EIP are as follows *inter alia*:-

A. **Sustainability** – The EIP aims to link each set of proposed actions and targets to the relevant UN Sustainable Development Goals (SDGs);

B. **Global Climate & Biodiversity Action** – The EIP commits to providing a *"coherent response to the global challenges of climate change and biodiversity loss",* consistent with the 'Paris Agreement' (COP21) and the 'Glasgow Climate Pact' (COP26), and notes the opportunity to tackle both challenges simultaneously;

C. **Green Growth Strategy** – The EIP is one of the main strategies underpinning Green Growth, which *"requires tackling climate change holistically, considering it in the context of jobs, the economy and the environment"*. The EIP will be complimentary to a Green Growth Strategy; and

D. **Northern Ireland Climate Action Plan (CAP) 2023-27** – Preparation of the first CAP is a requirement of the NI Climate Change Act. It will set out the approach to *"meeting the carbon budget for 2023 to 2027 through a set of proposals and policies for emissions reductions. It will also establish a pathway towards the interim targets for 2030 and 2040 and the overall net zero by 2050 target"*. A draft CAP requires Executive agreement and will be published for consultation as soon as possible.

2.29. Figure 3 sets out six Strategic Environmental Outcomes (SEOs) for the EIP:

1. Excellent air, water and land quality;
2. Healthy and accessible environment and landscapes everyone can connect with and enjoy;
3. Thriving, resilient and connected nature and wildlife;
4. Sustainable production and consumption on land and at sea;
5. Zero waste and highly developed circular economy; and

6. Net zero greenhouse gas emissions and improved climate resilience and adaptability.

2.30. Under SEO 3, in protecting nature on land, the future vision is that Northern Ireland will be Nature Positive by 2030. This will be achieved by *inter alia* protecting, managing, restoring, extending and connecting natural ecosystems and the species that rely on them; halting and reversing biodiversity loss; and, increasing woodland cover to improve the carbon sink.

2.31. Under SEO 6, the EIP advises, *"there is broad acceptance of the desirability of shifting towards a low-carbon economy and ensuring society can respond and adapt to the impacts of climate change"*. A series of actions and targets are set out, including *inter alia*:

- Agree, and set in legislation, the first three carbon budgets;
- Make new legislation by December 2024 to ensure that GHG emissions reduction targets for 2030 and 2040 are in line with the 2050 net zero target;
- Complete the third Northern Ireland Climate Change Adaptation Programme (NICCAP3) setting out actions for climate change adaptation; and;
- Publish a Nature-Based Solutions Plan to enhance ecological and climate resilience.

CCC – Advice Report: The Path to a Net Zero Northern Ireland & Adapting to Climate Change: Progress in Northern Ireland

2.32. Published in March 2023, the CCC's Advice Report provides guidance on Northern Ireland's 2030 and 2040 interim targets and first three carbon budgets. The advised targets and carbon budgets are consistent with the decarbonisation required for Northern Ireland to meet its legislated 2050 net zero target.

2.33. The Advice Report assesses various pathways to net zero and this includes some speculative options, such as deployment of direct air capture of CO_2, to reach the target by 2050. Using the pathway option based on direct air capture, the CCC advises that:

A. The first, second and third carbon budgets be set at levels that have average annual reductions of 33%, 48% and 62%, on 1990 levels, respectively; and

B. The 2030 and 2040 interim targets be set at reductions of 48% and 77%, on 1990 levels, respectively.

2.34. In terms of progress to date, the CCC's second report was published in April 2023. The key messages are summarised in the Executive Report as follows *inter alia:*

A. *"Planning for climate change in Northern Ireland remains at an early stage"*. While most of the identified critical policy and planning milestones are not in place, there are opportunities to address this, with several key policies currently in development;

B. *"Despite the critical importance of adapting to climate change, there is only* *limited evidence of delivery, and data gaps in key areas are unacceptably large".* The absence of relevant data is a key barrier to assessing all aspects relevant to delivery and implementation of adaptation policy – this needs to be addressed with urgency; and

C. The third NICCAP must go much further than its predecessor, increasing its scope to include the full range of sectors and policy areas which require adaptation while closing critical data gaps.

Energy Strategy for Northern Ireland – The Path to Net Zero Energy

2.35. The Energy Strategy for Northern Ireland – The Path to Net Zero Energy (the Energy Strategy) was published in December 2021. It outlines a roadmap to 2030 aiming to deliver a 56% reduction in energy-related emissions, on the pathway to deliver the 2050 vision of net zero carbon and affordable energy. The Energy Strategy sets three main targets to drive these changes:

A. delivering energy savings of 25% from buildings and industry by 2030;

B. doubling the size of the low carbon and renewable energy economy to a turnover of more than £2 billion by 2030; and

C. meeting at least 70% of electricity consumption[1] from a diverse mix of renewable sources by 2030.

2.36. Such provisions are in alignment with the Republic of Ireland's aim of 70% renewable electricity by 2030 as set out within the Region's Renewable Electricity Support Scheme (RESS). The Energy Strategy recognises that meeting the 70% electricity consumption target likely means doubling renewable energy capacity in order to meet new demands from heating our homes and powering our vehicles.

Draft Green Growth Strategy for Northern Ireland

2.37. Published for consultation in October 2021, one of the key commitments of the draft Green Growth Strategy is to develop Northern Ireland's first Climate Action Plan. The Climate Action Plan will set out how we intend to achieve the carbon budget for the Climate Action Plan period and the overall emissions reduction targets as stated in the NI Climate Change Act.

2.38. The Green Growth Strategy Consultation Report was published in January 2023. To date however, a final Green Growth Strategy has yet to be published. In response to a plenary question in October 2024, the Agriculture Minister informed the Northern Ireland Assembly that *"we hope to bring the final document to the Executive very soon"*.

Summary

2.39. The rationale for the Proposed Development is clear. Making a sustainable, renewable

[1] The NI Climate Change Act increases this target to 80% within the same timeframe

energy contribution of the scale proposed (indicatively 66 MegaWatts (MW) from 11 turbines and a battery energy storage compound) will assist in the achievement of NI strategic energy targets and objectives, consistent with a wide range of international, UK and regional level priorities.

2.40. Based on an estimated annual electricity production of almost 280 GigaWatt hours (GWh), the proposed wind farm could provide electricity equivalent to the needs of over 80,000 homes annually, or almost 10% of the total current housing stock across Northern Ireland. Additionally, the proposed wind farm could reduce CO_2 emissions by 118,000 tonnes each year.

2.41. As discussed further in Chapter 14, the Proposed Development will offer job creation and economic activity to the regional economy providing significant benefits to and investment in Northern Ireland.

2.42. The Proposed Development is estimated to involve a capital spend of approximately £101 million in nominal prices. Of this total, £35 million would be realised within the regional economy. The 18 month projected construction phase is estimated to create or sustain 290 total (direct, indirect and induced) job years of employment, £8.1 million of wages, and £20.3 million of Gross Value Added (GVA) to the Northern Irish economy.

2.43. The estimated total (direct, indirect, and induced) annual benefits realised in Northern Ireland during the operational phase includes 9 jobs, £280,000 of wages, and £840,000 in GVA. The Applicant is seeking permission to operate the Proposed Development for 35 years.

2.44. Both the construction and operational phases will generate increased tax and business rates revenue. Tax revenues over the construction phase are estimated to be £7.9 million, with an additional £70,000 expected in labour taxes for each year of operation. Additionally, annual business rates for the proposed wind farm are estimated at almost £800,000.

Planning Policy

The Development Plan

2.45. The Proposed Development is located within the Derry City & Strabane District Council boundary. The District Council is currently preparing a new Local Development Plan (LDP) for the Borough up to 2032. In the interim, the current Area Plans are the Derry Area Plan 2011 and the Strabane Area Plan 1986 – 2001. The latter Plan covers Mullaghclogher and the surrounding area.

Strabane Area Plan 1986-2001

2.46. Despite its vintage status, the Strabane Area Plan 1986-2001 operates as the adopted local development plan for the area. This Plan is silent on the issue of renewable energy and is therefore of limited relevance to the Proposed Development.

2.47. The District Strategy Map confirms that the Site is located within the Sperrin Area of Outstanding Natural Beauty (AONB).

Derry & Strabane Local Development Plan (LDP) Draft Plan Strategy 2032

2.48. When adopted, the LDP will replace *inter alia* the Strabane Area Plan 1986-2001 in its entirety. The LDP will be produced in two stages - the first stage is the Plan Strategy followed by the Local Policies Plan. The latter is required to be 'consistent' with the adopted LDP Plan Strategy.

2.49. The District Council has previously consulted on its Draft Plan Strategy (DPS) and the Planning Appeals Commission (PAC) completed its Report into the Independent Examination in May 2024. The DfI Strategic Planning Team is now considering the content of the PAC's Report prior to issuing a binding Plan Strategy Direction to the District Council.

2.50. At the time of writing (November 2024), it is considered that the DPS should not be given significant weight as it has not formally been adopted by the District Council. The Strategic Planning Policy Statement (SPPS) for Northern Ireland from September 2015 (discussed further below) sets out transitional arrangements for situations where a new Plan Strategy is not yet in place to ensure that there is continuity in planning policy for taking decisions whilst Councils bring forward locally tailored policies and proposals. SPPS Paragraph 1.10 states that these transitional arrangements will operate until such time as a *"Plan Strategy for the whole of the Council area <u>has been adopted</u>"* (emphasis added).

2.51. In this case, the District Council has yet to formally adopt its Plan Strategy. As matters currently stand, the transitional arrangements set out in SPPS apply.

Prematurity

2.52. The SPPS at paragraph 5.73 states that where a new LDP is under preparation it may be appropriate in some circumstances to refuse planning permission on the grounds of prematurity. The SPPS states that this may be appropriate in the case of proposals where to grant permission would prejudice the outcome of the plan process by predetermining decisions about the scale, location or phasing of new development which ought to be taken in the LDP context.

2.53. These circumstances do not arise in this case for three key reasons. Firstly, as discussed below, the Regional Development Strategy 2035 (RDS) clearly sees renewable energy, and onshore wind in particular, as forming a vital component of Northern Ireland's response to address the challenges of climate change and energy security in the period up to 2035. There is no question therefore that making a decision on the Proposed Development now would in any way prejudice a wider debate about the future role of onshore wind in Northern Ireland's energy mix that may emerge through the LDP.

2.54. Secondly, it is not considered that the scale or location of the Proposed Development would be prejudicial to adoption of the LDP. Wind farm decisions within AONB locations continue to be taken within the policy context provided by SPPS and the subject specific PPS and the transitional arrangements set out in SPPS provide a robust basis on which to determine the application.

2.55. Finally, but importantly, paragraph 6.221 of the SPPS states that *"moratoria on applications for renewable energy development whilst LDPs are being prepared or updated are not appropriate"*.

Regional Development Strategy 2035 (RDS)

2.56. The RDS was published in March 2012 and provides an overarching strategic planning framework to facilitate and guide the public and private sectors in Northern Ireland. The RDS has a statutory basis and was prepared under the Strategic Planning (Northern Ireland) Order 1999. It states that the Order requires Departments to *"have regard to the regional development strategy"* in exercising any functions in relation to development (paragraph 1.7). The RDS confirms in paragraph 1.4 that it will *"influence the distribution of development throughout the Region"*, while paragraph 1.8 confirms that it is *"material to decisions on individual planning applications and appeals"*.

2.57. For the purposes of this application, two of the eight aims of the RDS are considered especially relevant:-

- Protect and enhance the environment for its own sake; and
- Take actions to reduce our carbon footprint and facilitate adaptation to climate change.

2.58. Regional Guidance (RG) 4, 5, 9 and 11 are considered particularly relevant given the nature of the Proposed Development:-

- RG4 states that tourism can make a step change in the economy and emphasises the quality of our natural assets;
- RG5 seeks to *"deliver a sustainable and secure energy supply"* for Northern Ireland. Paragraph 3.8 notes the need for a robust and sustainable energy infrastructure, noting the need for a *"significant increase in all types of renewable electricity installations"* to meet the region's needs (emphasis added);
- RG9 seeks to *"reduce our carbon footprint and facilitate mitigation and adaptation to climate change whilst improving air quality"*. Paragraph 3.23 notes that fossil fuels represent over 90% of Northern Ireland's power generation while paragraph 3.24 recognises that climate change is increasingly seen as *"one of the most serious problems facing the world"*. The RDS states that a key part of the mitigation to addressing this problem is to increase the use of renewable energy and that these developments must be appropriately sited to minimise their environmental impact; and
- RG11 seeks to *"conserve, protect and, where possible, enhance our built*

heritage and our natural environment". The commentary accompanying RG11 notes that the natural and built heritage is one of Northern Ireland's most important assets and there is a responsibility to protect and enhance these assets for future generations. Specific objectives are set out to protect archaeological sites/monuments, historic buildings/landscapes, priority species, designated habitats, landscape character, scenic quality, and protected landscapes, the latter especially relevant in this case because of the AONB location of the Proposed Development.

2.59. In the commentary on Regionally Significant Economic Infrastructure, the RDS identifies in paragraph 4.4 those strategic projects which are considered to contribute to economic infrastructure development. Proposals that contribute to the achievement of renewable energy and climate change targets are identified as *'strategic projects'*. The later commentary under this sub-heading in paragraph 4.15 notes that the development of Northern Ireland's renewable energy sources is *'vital to increase its energy security, help combat climate change and achieve renewable energy targets'* (emphasis added). It continues and notes that this is likely to mean an increase in the number of wind farms both onshore and offshore, reiterated in paragraph 4.16 which states that additional renewable energy is expected to come *'primarily'* from onshore wind.

2.60. Delivering a new installation for the generation of renewable energy is consistent with meeting strategic energy targets and in line with the RDS expectation that this will mean an increase in the number of onshore wind farms. Overall, it is considered that this ES provides sufficient information on each of the interests of acknowledged planning importance identified in the RDS to conclude that the benefits of the scheme outweigh the mitigated environmental impacts.

Planning Policy Statements (PPS)

Strategic Planning Policy Statement for Northern Ireland (SPPS)

2.61. In addition to the above commentary on transitional arrangements for decision making and LDP prematurity matters, the SPPS sets out a number of other statements that are relevant to the determination of this application.

2.62. The SPPS was published in September 2015 as a statement of policy on important planning matters. Its provisions apply to the whole of Northern Ireland and are material to all decisions on individual planning applications. In regard to renewable energy, in his accompanying written statement dated 28 September 2015, the Environment Minister made the following comments:-

"Having taken into account all the comments received on the draft SPPS and following additional engagement with the Committee and others in relation to this particular policy area (i.e. renewables)*, the SPPS has been revised and improved.*

There is a greater acknowledgement of the contribution the renewable energy *industry makes towards achieving sustainable development, as a provider of jobs and investment across the region, and an acknowledgement of wider government policy support for the use of renewable energy sources. This includes reference to DETI's Strategic Energy Framework.*

Furthermore, the SPPS seeks to more closely reflect PPS 18 by making it clearer that development that generates energy from renewable resources will be permitted where the proposal and any associated buildings and infrastructure, will not result in unacceptable adverse impacts on interests of acknowledged importance.

In relation to how the wider environmental, economic and social benefits are to be assessed the SPPS clarifies that planning authorities will give such considerations 'appropriate' weight in determining whether planning permission should be granted.

It is also considered appropriate that a cautious approach in designated landscapes, as per the current best practice guidance, is reflected in strategic policy and therefore this approach has been carried forward in the SPPS."

2.63. The retained suite of PPS and the remaining provisions of the Planning Strategy for Rural Northern Ireland (PSRNI) will be cancelled when all eleven Councils across Northern Ireland have adopted a new LDP Plan Strategy.

2.64. Insofar as they are relevant to the Proposed Development, the policy provisions of the following are retained:-

- PPS 2: Natural Heritage;
- PPS 3: Access, Movement and related Parking & PPS 3 (Clarification): Access, Movement and Parking;
- PPS 6: Planning, Archaeology and The Built Heritage;
- PPS 15 Revised: Planning and Flood Risk;
- PPS 16: Tourism;
- PPS 18: Renewable Energy; and
- PPS 21: Sustainable Development in the Countryside

2.65. Mitigating and adapting to climate change is seen in the SPPS as a *'central challenge'*, including the need to reduce emissions of GHGs that contribute to climate change (paragraph 3.10). Specific reference is also made in paragraph 3.10 to the Executive's *'key pledge'* to continue to work towards a reduction in greenhouse gas emissions by at least 35% on 1990 levels by 2025.

2.66. SPPS contains a section dedicated to Renewable Energy. Paragraph 6.218 states that the overall aim is to:-

"…facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and to realise the benefits of renewable

energy without compromising other assets of acknowledged importance".

2.67. Within AONB's, paragraph 6.223 states that a *'cautious approach'* will apply when considering applications for renewable energy. The same paragraph states that *'it may be difficult to accommodate'* such proposals within these areas without detriment to the region's cultural and natural heritage assets. Importantly, these statements do not introduce a presumption against wind energy development in AONBs, rather that each application must be treated on its own merits having regard to the particular characteristics of the AONB (or other designation in question) as well the characteristics of the development in question.

2.68. Paragraph 6.225 confirms that the wider environmental, social and economic benefits of renewable energy proposals are material considerations to be given *'appropriate weight'* by decision makers. In PPS18 (discussed below), Policy RE1 states that these benefits are to be given *'significant weight'* in determining applications. SPPS advises in paragraph 1.12 that:-

"Any conflict between the SPPS and any policy retained under the transitional arrangements must be resolved in the favour of the provisions of the SPPS. For example, where the SPPS introduces a change of policy direction and/or provides a policy clarification that would be in conflict with the retained policy the SPPS should be accorded greater weight in the assessment of individual planning applications. However, where the SPPS is silent or less prescriptive on a particular planning policy matter than retained policies this should not be judged to lessen the weight to be afforded to the retained policy". (emphasis added)

2.69. In each case, it is for the decision maker to determine what level of weight it is 'appropriate' to give to the environmental, social and economic benefits of the proposed development. This may ultimately be 'significant weight' but it is for the decision maker to form a judgement on this matter given the facts associated with each case. In this instance, it is the Applicant's view that it would be appropriate to give 'significant weight' to these benefits given the compelling need for further renewable energy development and the conclusions of this ES in relation to the impact (in EIA terms) of the Proposed Development.

2.70. SPPS states in paragraph 6.230 that not all visual impacts will give rise to negative effects. In this respect, wind farms are highly visible by their nature but this should not preclude them as acceptable features in the landscape.

2.71. The other main provisions of PPS18 and its associated Best Practice Guidance are carried through into the SPPS, including:-

- The direction to take particular care when considering the potential impact of all renewable proposals on the landscape (paragraph 6.222);
- The presumption in favour of renewables proposals where there will be no unacceptable adverse effect on the planning considerations set out in PPS18 (paragraph 6.224);
- Stating that renewable energy development on active peatland will not be permitted unless there are imperative reasons of overriding public interest (paragraph 6.226);

- Specifying that, for wind farm development, a separation distance of 10 times rotor diameter to occupied property, with a minimum distance of not less than 500m, will generally apply (paragraph 6.227);
- Confirming that consideration of renewables projects will take account of their contribution to meeting wider environmental benefits, such as reductions in GHG emissions and contributions towards renewable energy targets (paragraph 6.228);
- Confirmation that factors to be considered on a case by case basis in planning decisions will depend on the scale of the development and its local context (paragraph 6.229);
- The requirement, where a project is likely to result in unavoidable damage, for an indication of how such damage will be minimised, mitigated and compensated for (paragraph 6.231);
- The requirement to provide details of future decommissioning and site restoration (paragraph 6.233); and
- The direction to take account of the supplementary planning guidance 'Wind Energy Development in Northern Ireland's Landscapes' and all other practice notes in assessing wind energy proposals (paragraph 6.234).

2.72. This chapter considers the retained policy framework having regard to the SPPS and its associated transitional arrangements.

Revised Regional Strategic Planning Policy - Renewable and Low Carbon Energy

2.73. Between April and June 2023, the Department for Infrastructure consulted on revisions to the policies on renewable and low carbon energy in the SPPS. The changes intend to align planning policies with the NI Climate Change Act and the Energy Strategy.

2.74. The updated SPPS would require Councils to identify *"appropriate areas"* for renewable energy development, including for onshore wind farms, in their LDPs. In drawing up LDPs, Councils would have to take "full account" of the Executive's renewable electricity target.

2.75. In those areas identified as *"appropriate"* for renewable energy development, a presumption in favour of granting planning permission to new proposals would then apply. There would also be a presumption in favour of granting planning permission to repower existing onshore wind farms, unless their impacts are unacceptable and cannot be mitigated.

Planning Policy Statement 2 – Natural Heritage

2.76. PPS2 is retained policy for the purposes of the SPPS transition arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.77. SPPS policy on natural heritage is set out on pages 80 to 85. It consolidates and restates policy set out in PPS2. The Environment Minister did not identify any conflicts or clarifications in his written statement launching the SPPS.

2.78. PPS2 was published in July 2013 and sets out policies for the conservation, protection and enhancement of natural heritage. There are six policies:-

- Policy NH1 – European and Ramsar Sites – International;
- Policy NH2 – Species Protected by Law;
- Policy NH3 – Sites of Nature Conservation Importance – National;
- Policy NH4 – Sites of National Conservation Importance – Local;
- Policy NH5 – Habitats, Species or Features of Natural Heritage Importance; and
- Policy NH6 – Areas of Outstanding Natural Beauty.

2.79. In taking decisions, paragraph 3.3 requires that *"appropriate weight is attached to designated sites of international, national and local importance; priority and protected species; and to biodiversity and geological interests within the wider environment"*. Section 5.0 advises that the provisions of Policies NH1-NH6 *"will prevail unless there is other overriding policy or material considerations that outweigh them and justify a contrary decision"*.

Policy NH1 – European and Ramsar Sites - International

2.80. This policy states that planning permission will only be granted for a development proposal that, either individually or in combination with existing and/or proposed plans or projects, is not likely to have a significant effect on *inter alia* Special Protection Areas (SPA) and Special Areas of Conservation (SAC).

2.81. Chapter 6 advises that there is potential for construction and decommissioning works to impact on the Owenkillew River SAC and the River Faughan and Tributaries SAC, due to increased sediment loading and waterborne pollution, as the Proposed Development is within the upper reaches of the river catchments of both designations. After mitigation however, Chapter 6 finds no residual significant impacts on either SAC designation.

2.82. Chapter 8 confirms that there are no sites designated for ornithological interest in the vicinity of the Site.

2.83. The Foyle and Tributaries SAC is hydrologically connected to the Site. Following assessment however, and provided the mitigation measures are implemented as specified, Chapter 9 finds that the Proposed Development will have a neutral impact on fish stocks and aquatic ecology.

NH2 – Species Protected by Law

2.84. This policy seeks to protect both European and National protected species, with planning permission likely to be withheld unless it can be demonstrated there will be no impact or that any impact can be adequately mitigated against or compensated for.

2.85. Detailed surveys and assessments of all relevant protected species have been undertaken and are contained within Chapters 7, 8 and 9 in relation to terrestrial fauna, birds and fish and aquatic ecology respectively.

2.86. Collectively, these assessments conclude that, provided the recommended mitigation is implemented as specified, there will be no significant effects on protected species as a consequence of the construction, operation or decommissioning of the Proposed Development.

2.87. A comprehensive suite of measures, including ongoing monitoring, are proposed in the aforementioned chapters to safeguard protected species from harm during all stages of the Proposed Development. Such measures can be secured through suitably worded planning conditions.

2.88. Mitigation for the herpetofauna found on site (common lizard), badgers and bats is proposed. For lizards this involves both installation of drift fencing and mowing/hand clearance during the construction phase. For badgers it involves the closure of a single outlier sett (under licence) during construction. A 25m buffer has been applied to all other identified setts. Chapter 7 observes that the majority of setts near to areas of infrastructure are close to existing tracks therefore any disturbance impact is predicted to be ameliorated by this fact.

2.89. As a precaution, a Bat Monitoring Mitigation Plan is recommended. Based on current knowledge, this should ensure that the Proposed Development will not have a significant impact on the local bat population.

2.90. There is no recorded usage of the area by otter or marsh fritillary butterfly, therefore no impacts to these species are likely.

2.91. Published research indicates that the principal adverse effects of wind farms on breeding birds are likely to be due to disturbance displacement during construction and that wind farm operation is unlikely to have a significant effect on local bird communities. Therefore assuming full implementation of the mitigation measures (and in particular the measures relating to construction), Chapter 8 concludes that the Proposed Development is unlikely to have any significant adverse effects on bird populations at the local, regional or national scale.

2.92. The Site lies principally within the Upper Burn Dennet River catchment with a small proportion draining to the Glenelly River via the Eden River tributary. Both river systems are locally important for recreational angling for Atlantic salmon, brown trout and sea trout.

2.93. Generally, the streams within the Site boundary are of low fisheries value in terms of usable salmonid habitat due mainly to their diminutive size, lack of significant flow and absence of fish. However, the streams draining the site to the Upper Burn Dennet River, such as Stroanbrack Tributary 1 and the main Upper Burn Dennet River itself, are of greater significance due to the presence good quality fish nursery habitat and fair to good abundance of brown trout. Most of the streams draining the site are of Moderate to High water quality with good physical habitat supporting sensitive invertebrate species.

2.94. Provided the mitigation measures set out in Chapter 9 are implemented as specified, the Proposed Development will have a neutral effect of fish stocks and aquatic biology.

2.95. Assessments of cumulative impacts have also been undertaken and no significant impacts have been identified.

NH3 - Sites of Nature Conservation Importance – National

2.96. This policy advises that planning permission will be forthcoming for a proposal that is not likely to have an adverse effect on the integrity, including the value of the site to the habitat network, or special interest of *inter alia* Areas of Special Scientific Interest (ASSI).

2.97. Potential impacts on ASSIs and their qualifying features of interest are discussed in Chapters 6-10. The collective conclusion is that either i) such sites are not hydrologically or ecologically connected to the Site, or ii) following mitigation, there will be no residual significant effects.

Policy NH4 – Sites of National Conservation Importance – Local

2.98. This policy seeks to safeguard significant adverse impacts on locally designated nature conservation sites.

2.99. There is a single Local Wildlife Site (Mullaghcarbatagh) within 500m of the Site boundary, which is designated on account of it supporting blanket bog habitat. Chapter 7 predicts no adverse impacts on this local level designation.

Policy NH5 – Habitats, Species or Features of Natural Heritage Importance

2.100. This policy indicates that a development proposal which is likely to result in an unacceptable adverse impact on, or damage to, habitats, species or features may only be permitted where the benefits of the Proposed Development outweigh the value of the habitat, species or feature. In such cases, appropriate mitigation and/or compensatory measures will be required.

2.101. This policy applies to priority habitats; priority species; active peatland; ancient and long-established woodland; features of earth science conservation importance; features of the landscape which are of major importance for wild flora and fauna; rare or threatened native species; wetlands (includes river corridors); and other natural heritage features worthy of protection.

2.102. As set out in Chapter 3, informed by extensive site survey work and assessment, mitigation by design has been the principle method of avoiding or minimising potential environmental impacts. This ES is therefore based on a wind farm design that already includes a number of important mitigation measures.

2.103. The proposed wind farm infrastructure avoids habitats and species of conservation interest where possible, and where this was not possible, mitigation and/or enhancement measures have been incorporated to balance any detrimental impact.

2.104. The principal habitats on site are extensive areas of semi-improved grassland, acid grassland, marshy grassland, blanket bog, wet and dry heath. Overall, the grassland habitats are of lower conservation value, while the blanket bog/wet and dry heath and are of moderate/high value.

2.105. The Proposed Development will result in permanent and temporary habitat loss of 11.38ha, largely comprising degraded blanket bog, wet (dwarf shrub) heath, acid grassland, and rush pasture (with both the species-rich and species-poor variant present on site) although small areas of other habitats will also be lost, such as marshy grassland, poor acid grassland and semi-natural woodland.

2.106. The loss of circa 9.84ha of NI Priority Habitats (i.e., degraded blanket bog, wet heath/heathy acid grassland and purple moor grass rush pasture (PMGRP)) is a permanent and direct effect of medium to high magnitude on receptors of high value and sensitivity.

2.107. The extent of habitat loss has been used to inform the prescriptions detailed in the Outline Habitat Management Plan, including a commitment to restablish loss for NI Priority Habitats (blanket bog, wet/dry dwarf shrub heath and PMGRP). A Habitat Management Area is proposed compensate for the loss of habitats during the 35-year lifetime of the Proposed Development (including the remediation of blocks of grassland back to blanket bog/heath). After mitigation, it is assessed that there would be no significant residual adverse effects on NI Priority Habitats (wet heathland/ blanket bog). Indeed, the measures proposed as part of the Proposed Development would deliver a net beneficial effect during operation by enhancing currently degraded blanket bog/wet heath and marshy grassland habitats.

<u>Policy NH6 – Areas of Outstanding Natural Beauty</u>

2.108. Policy NH6 sets out planning policy in relation to development proposals within AONB designations. In this respect, planning permission for new development in an AONB will only be granted where it is of an appropriate design, size and scale for the locality. Additional criteria also require to be met, including *inter alia*:

a) the siting and scale of the proposal is sympathetic to the special character of the AONB in general and of the particular locality; and

b) it respects or conserves features (including buildings and other man-made features) of importance to the character, appearance or heritage of the landscape.

2.109. The Site falls wholly within the Sperrin AONB and Chapter 4 assesses the likely impact of the Proposed Development on the designation. Consistent with the SPPS' cautious approach to protected landscapes (paragraph 6.223) and PPS18 Best Practice Guide (BPG) (paragraph 1.3.23) (discussed further below), every effort has been made during the iterative design process to minimise the impact of the Proposed Development and to aid integration into the local landscape.

2.110. In this respect, the Proposed Development has been located and designed to minimise its effect on the AONB as a whole. This has been achieved by locating it away from the core area (including the Glenelly Valley and South Sperrin range of uplands) which contains the majority of visitor attractions and key landscape features.

2.111. The majority of the AONB, even at close range, would experience limited visibility of the Proposed Development and no significant effects. Chapter 4 therefore concludes that the Proposed Development would not affect the overall integrity of the AONB designation.

2.112. There are no other wind farms in proximity to the Proposed Development and its incremental cumulative effect on the landscape character of the LVIA Study Area as a whole is deemed to be of low magnitude and not significant.

2.113. It is also noted that wind farms are not an uncommon feature in approaches to the AONB and there is already a repeating pattern of wind farms and single turbines across other parts of the LVIA Study Area and around the edges of the AONB designation.

2.114. The assessed impact of the Proposed Development on the Sperrin AONB is not therefore deemed to be unacceptably adverse for the purposes PPS2 - Policy NH6 or for the SPPS or PPS18 - Policy RE1 (discussed below).

Planning Policy Statement 3 – Access, Movement and Parking

PPS3 is retained policy for the purposes of the SPPS transitionary arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.115. SPPS policy on transportation is set out on pages 106 to 110. It consolidates and restates policy set out in PPS3 and PPS13. The Environment Minister did not identify any conflicts or clarifications in his written statement launching the SPPS. The principal focus of this section is, therefore, on PPS3.

2.116. PPS3 sets out planning policies for vehicular and pedestrian access, transport assessment, protection of transport routes, and parking. It advises that the potential impact a development may have on the efficiency of the public road network or on road safety are important material considerations.

2.117. Policy AMP2 Access to Public Roads states:-

'Planning permission will only be granted for a development proposal involving direct access, or the intensification of the use of an existing access, onto a public road where such access will not prejudice road safety or significantly inconvenience the flow of traffic.'

2.118. Chapter 12 assesses the impact of the Proposed Development on the receiving road network and considers the potential impacts on traffic and transport associated with its construction, operation and decommissioning. The main traffic impacts are associated with the increase in HGV vehicle movements along the proposed delivery route and surrounding tertiary road network during the construction stage of the project.

2.119. It is concluded that there will be no significant impacts on the road network, subject to appropriate mitigation. This includes i) provision of a pre-construction Traffic Management Plan for approval and, ii) temporary off-site works (road widening and/or vegetation removal) to facilitate delivery of the turbine components, which will then be reinstated. These measures can be secured by planning conditions.

Planning Policy Statement 6 – Planning, Archaeology and The Built Heritage

2.120. PPS6 is retained policy for the purposes of the SPPS transition arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.121. SPPS policy on archaeology and built heritage is set out on pages 37 to 44. It consolidates and restates policy set out in PPS6. The Environment Minister did not identify any conflicts or clarifications in his written statement launching the SPPS. The principal focus of this section is, therefore, on PPS6.

2.122. PPS6 sets out planning policies for the protection and conservation of archaeological remains and built heritage features. There are 15 policies in total covering:-

- Archaeological Sites and Monuments (Policies BH1-BH4);
- World Heritage Sites (Policy BH5);
- Historic Parks, Gardens and Demesnes (Policy BH6);
- Listed Buildings (Policies BH7-BH11);
- Conservation Areas (Policies BH12-BN14); and
- Non-listed Vernacular Buildings (Policy BH15)

2.123. Amongst other considerations, the proposed site layout has been designed to i) avoid direct impacts on all known archaeological remains within the Site boundary and, ii) minimise the visibility of the turbines as much as possible while also ensuring a viable scheme.

2.124. It is possible that further, as yet unknown, remains may be present that could be directly impacted during the construction phase. To mitigate this, Chapter 5 proposes that a programme of pre-construction archaeological investigation be secured by planning condition. This would reduce any residual significance of effect from minor adverse to slight adverse (not significant in EIA terms).

2.125. Turning to potential indirect (setting) impacts, a 10km Study Area was agreed with consultees. The Cultural Heritage Baseline Assessment (CHBA) (Appendix 5.1) identifies several assets (13 Scheduled Monuments (SM) and two Listed buildings) for more detailed assessment. During operation, it was found that in most cases the degree of effect resulting from the Proposed Development would be no more than slight and in no instance would the significance of effect be greater than minor adverse (not significant).

2.126. The cumulative effects of the Proposed Development in combination with Owenreagh Wind Farm and its extension and Eglish Wind Farm have also been considered. The conclusion is that there would be no significant cumulative indirect effects.

Planning Policy Statement 15 (Revised) – Planning and Flood Risk

2.127. PPS15 is retained policy for the purposes of the SPPS transition arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.128. SPPS policy on flood risk is set out on pages 61 to 68. It consolidates and restates policy set out in PPS15. The Environment Minister did not identify any conflicts or clarifications in his written statement launching the SPPS. The principal focus of this section is, therefore, on PPS15.

2.129. The main objectives of PPS15 are to *inter alia* manage flood risks to new development and elsewhere, and encourage the use of sustainable drainage.

2.130. Aspects of the design, construction and operation of the Proposed Development that may potentially impact on the receiving water environment have been identified and the pathways for impacts assessed in Chapter 10, supported by various technical appendices. This has determined the mitigation methods required to prevent any significant adverse impacts.

2.131. Mitigation integrated into the design and proposed during the construction phase includes the avoidance of water features where possible based on baseline constraints mapping; design of site elements to minimise impacts on the water environment; implementation of a comprehensive surface water management plan comprising the use of SuDS; silt management in order to prevent pathways for pollution; and construction phase pollution prevention procedures in accordance with NIEA requirements and guidance.

2.132. With such measures in place, Table 4.2 of the Flood Risk & Drainage Assessment (Appendix 10.2) concludes that the Proposed Development complies with the aims and objectives of Policies FLD1-FLD4 of PPS15 (with Policy FLD5 not applicable).

Planning Policy Statement 16 - Tourism

2.133. PPS16 is retained policy for the purposes of the SPPS transition arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.134. SPPS policy on tourism is set out on pages 97 to 100. It consolidates and restates policy set out in PPS16. The Environment Minister did not identify any conflicts or clarifications in his written statement launching the SPPS. The principal focus of this section is, therefore, on PPS16.

2.135. PPS16 seeks to facilitate economic growth and social well-being through tourism in ways which are sustainable and compatible with environmental welfare and the conservation of important environmental assets. It embodies the commitment to sustainable development and to the conservation of biodiversity.

2.136. Policy TSM8 sets out criteria to safeguard tourism assets. It indicates that planning permission will not be granted for development that would in itself, or in combination with existing and approved development in the locality, have an adverse impact on a tourism asset such as to significantly compromise its tourism value.

2.137. Paragraph 1.3.80 of PPS18 BPG advises:-

"It is not considered that wind energy developments are necessarily incompatible with tourism and leisure interests, but it is acknowledged that care does need to be taken to ensure that insensitively sited wind energy developments do not impact negatively on tourism potential." (emphasis added)

2.138. In relation to the Sperrin Mountains LCA designation, Chapter 4 concludes that access to and enjoyment of tourist and visitor amenities would not be affected by the Proposed Development. Additionally, it would have both limited and indirect effects on the physical landscape or visual character of the Glenelly Valley, the majority of scenic driving routes, footpaths and the cycle network within the AONB, and visitor sites such as the Ulster American Folk Park, An Cregan and Gortin Glen.

2.139. Having regard to the conclusions of Chapter 4 in respect of landscape and visual matters, insofar as these considerations contribute to the area's tourism assets and on the basis that the proposal would not deter visitors from utilising the tourism assets in the area, it is concluded that the Proposed Development complies with Policy TSM8 of PPS16.

Planning Policy Statement 18 – Renewable Energy

2.140. PPS18 is retained policy for the purposes of the SPPS transitionary arrangements. There is considered to be conflict with the equivalent provisions in the SPPS, only insofar as the SPPS changes the direction to attach 'significant' weight to the benefits associated with renewable energy projects and provides the decision maker with discretion in deciding the 'appropriate' amount of weight to be attached to the benefits. Therefore, until the Council adopts its Plan Strategy, in terms of the 'weighting direction' the provisions of the SPPS apply, with less weight being attached to the retained policy. In all other respects, it is anticipated that no less weight will be attached to the retained policy in PPS18 Policy RE1.

2.141. The aim of PPS18 is outlined in Section 3 which is to *"facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and to realise the benefits of renewable energy"*.

2.142. This aim is to be achieved whilst ensuring that the region's built and natural heritage benefit from *"adequate protection"*. This statement recognises that some degree of adverse impact is permissible in the planning balance and this is reflected in the detailed wording of Policy RE1 which states that renewable energy proposals will be permitted provided they do not give rise to *"unacceptable"* adverse impacts on identified features. The policy criteria on the wind energy specific section of Policy RE1 also includes reference to acceptability. This is an important issue to consider when determining wind farm applications which PPS18 notes in paragraph 4.14 are likely to have the greatest visual and landscape effects of all renewable technologies.

2.143. Within this context, Policy RE1 sets out a sets out a presumption in favour of renewable energy development provided it will not result in unacceptable adverse impact on five stated criteria (see table below).

2.144. The policy specifically adopts a mitigation/compensation led approach and emphasises the 'significant' weight to be attached to the wider environmental, economic and social benefits of renewable energy projects. In regard to the former:-

'Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures, such as a habitat management plan or the creation of a new habitat.'

2.145. The Applicant's proposed mitigation measures are drawn together into Chapter 15, which should be read in conjunction with the OCEMP (Appendix 1.5)and the OHMP (Appendix 6.2).

2.146. In general, the RE1 criteria require assessments of discrete topics, a number of which also cross cut other policy documents referred to above in order to fully address them. Each of these criteria have been addressed within this ES in one or more of the chapters. Each criterion within Policy RE1 is provided in the table below as well as reference to where this has been addressed within the ES.

Criteria	**ES Assessment Location and/or Comment**
Renewable Energy *"…will not result in an unacceptable adverse impact on:*	
public safety, human health, or residential amenity;	Chapter 3: Design Evolution; Chapter 11: Noise, Chapter 12: Traffic & Transport; and, Chapter 13 Shadow Flicker
visual amenity and landscape character;	Chapter 4: LVIA
biodiversity, nature conservation or built heritage interests;	Chapter 5: Archaeology & Cultural Heritage; Chapter 6: Vegetation; Chapter 7: Terrestrial Fauna; Chapter 8: Ornithology; and, Chapter 9: Fisheries and Aquatic Ecology
local natural resources, such as air quality or water quality;	Chapter 10: Geology & Water Environment
public access to the countryside"	The Site is privately owned and there is no formal public access
Wind Energy Development	
"…demonstrate all of the following:	Chapter 4: LVIA

that the development will not have an unacceptable impact on visual amenity or landscape character through: the number, scale, size and siting of turbines;	
that the development has taken into consideration the cumulative impact of existing wind turbines, those which have permissions and those that are currently the subject of valid but undetermined applications;	Chapter 4: LVIA, Chapter 8: Ornithology, Chapter 9: Fisheries and Aquatic Ecology, Chapter 12: Traffic and Transport
that the development will not create a significant risk of landslide or bog burst;	Peat & Landslide Hazard Risk Assessment (Appendix 10.3)
that no part of the development will give rise to unacceptable electromagnetic interference to communications installations; radar or air traffic control systems; emergency services communications; or other telecommunication systems;	Pre application consultation with telecommunications link operators and aviation consultees has raised no concerns (see Table 3.1)
that no part of the development will have an unacceptable impact on roads, rail or aviation safety;	Chapter 12: Traffic & Transport Pre application consultation with aviation consultees has raised no concerns (see Table 3.1) Given the height of the proposed turbines, an obstacle warning lighting scheme is required and CAA has been consulted on this (see Appendix 1.6)
that the development will not cause significant harm to the safety or amenity of any sensitive receptors (including future occupants of committed developments) arising from noise; shadow flicker; ice throw; and reflected light; and	Chapter 3: Design Evolution; Chapter 11: Noise; and Chapter 13: Shadow Flicker
that above-ground redundant plant (including turbines), buildings and associated infrastructure shall be removed and the site restored to an agreed standard appropriate to its location"	The Proposed Development would have an operational life of 35 years An outline decommissioning and site restoration proposal is included in the OCEMP (Appendix 1.5)
"Any development on active peatland will not be permitted unless there are imperative reasons of overriding public interest"	Chapter 6: Vegetation and Chapter 10: Geology & Water Environment
"For wind farm development a separation distance of 10 times rotor diameter to	The Proposed Development has been designed to adhere to these requirements,

occupied property, with a minimum distance not less than 500m, will generally apply."	and there are no occupied properties within the minimum 500m set back distance.

2.147. Overall the Proposed Development is considered to meet the requirements of Policy RE1.

PPS18 Best Practice Guidance (BPG)

2.148. PPS18 BPG is to continue to be treated as a material consideration during the transitionary period (or after) as per paragraph 1.14 of the SPPS.

2.149. It provides background information on a variety of renewable energy technologies and is intended to be read in conjunction with PPS18.

2.150. Section 1 is specific to wind energy. Paragraph 1.3.4 of the guidance document states that *"each planning application will be considered on its own merits, and the argument that granting permission might lead to another application will not be sufficient grounds for refusal."*

2.151. Paragraph 1.3.18 notes that some landscapes will be able to accommodate wind farms more easily than others but that *"there are no landscapes into which a wind farm will not introduce a new and distinctive feature"*. The same paragraph goes on to state that given the commitment to addressing climate change and the need for more renewable energy (a large proportion of which is expected to come from wind farms) *"it is important for society at large to accept them as a feature of many areas of the Region for the foreseeable future"*.

2.152. Paragraph 1.3.19 clarifies that this does not mean that areas valued for their landscape or nature conservation interests will be sacrificed, but that "*careful consideration"* will be required to locate development to reduce impacts. Within AONBs, the BPG states in paragraph 1.3.23 that a *"cautious approach"* is necessary which reflects the commentary in SPPS. Paragraph 1.3.21 of the BPG advises that wind farms are highly visible by their nature and it will not necessarily be the case that the extent of visual impact will give rise to negative effects. As Policy RE1 of PPS18 notes, it is the 'acceptability' of identified impacts that is the key test, when a range of factors are considered, of which landscape and visual will be one.

2.153. The BPG also notes that groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes and this principle can be applied to the Proposed Development's position within its landscape and visual context.

2.154. The BPG further details the issues relevant to planning applications for onshore wind energy. These include nature conservation, landscape and visual impact, hydrology and geology, archaeology and built heritage, noise, aviation, and health and safety issues (e.g. public access, shadow flicker and ice throw).

2.155. The policy assessment above in relation to PPS18 has had regard to the guidance contained within the BPG.

Supplementary Planning Guidance (SPG) - Wind Energy Development in Northern Ireland's Landscapes

2.156. This SPG is to continue to be treated as a material consideration during the transitionary period (or after) as per paragraph 1.14 of the SPPS.

2.157. It sets out the background to Northern Ireland's landscapes, describes the approach and general principles that should be applied to potential wind energy developments, and provides guidance related to specific sensitivity of each of the 130 Landscape Character Areas (LCAs) in Northern Ireland to wind energy development.

2.158. The Preamble to the SPG notes that *"it is intended to provide <u>broad, strategic guidance</u> in relation to the landscape and visual impacts of wind energy"* (emphasis added). It notes that *"every development proposal is unique and there remains a need for detailed consideration of the landscape and visual impacts of individual planning applications on a case by case basis…"*. Noting these comments, it is considered that while the SPG offers useful supplementary guidance, this is at a strategic level only and more weight should therefore be given to the Applicant's more detailed and site specific analysis, as set out in Chapter 4 of this ES.

2.159. Chapter 4 finds that while the Proposed Development would have a direct and significant physical effect on Landscape Character Area 29 (LCA), within which it is located, the magnitude of change would be medium because the Proposed Development is located on an outward-facing slope and is not visible from the majority of the core part of the AONB, including the Glenelly Valley and South Sperrin range of uplands. Further, the Site has no formal recreational amenity functions, which the SPG notes would increase landscape and visual sensitivity. It is also positioned within a LVIA Study Area where existing and consented wind farms and single turbines are already a defining feature of landscape character.

Planning Policy Statement 21 – Sustainable Development in the Countryside

2.160. PPS21 is retained policy for the purposes of the SPPS transitionary arrangements. Although referred to in the Environment Minister's statement launching the SPPS, as far as renewable energy proposals are concerned there is considered to be no conflict with the equivalent provisions in the SPPS. Therefore until the Council adopts its Plan Strategy, the renewable energy related provisions of PPS21 will apply, together with the SPPS, with no less weight attached to the retained policy.

2.161. The aim of PPS21 is to manage development in the countryside in a manner consistent with achieving the strategic objectives of the RDS, which also strikes a balance between the need to protect the countryside from unnecessary or inappropriate development, while supporting rural communities.

2.162. Policy CTY1 lists a range of types of development, which in principle are considered to be acceptable in the countryside and that will contribute to the aims of sustainable development. This includes *inter alia "renewable energy projects in* *accordance with PPS 18".*

2.163. As it has been concluded that the Proposed Development complies with Policy RE1 of PPS18, it follows that it is considered to be compliant with Policy CTY1 of PPS21.

Overall Policy Compliance

2.164. The established approach to decision making advocated in policy is to balance the wider environmental, economic and social benefits of a project against the environmental impacts, attaching significant weight to the former.

2.165. The SPPS changes this approach insofar as the PPS18 direction to attach significant weight to the benefits is replaced by a discretion for the decision maker to determine the appropriate weight to be attached to the benefits. In weighing the acceptability of the proposals in the planning balance, the following must be considered:-

- The Proposed Development will make a positive contribution towards NI strategic renewable energy targets and objectives;
- Based on an estimated annual electricity production of almost 280 GigaWatt hours (GWh), it could provide electricity equivalent to the needs of over 80,000 homes annually, or almost 10% of the total current housing stock across Northern Ireland;
- It could also reduce CO_2 emissions by 118,000 tonnes each year, when compared against equivalent generation from non-renewable sources;
- It offers job creation and economic activity to the regional economy providing significant benefits to and investment in Northern Ireland;
- It is estimated to involve a capital spend of approximately £101m in nominal prices. Of this total, £35m would be realised within the regional economy;
- The 18 month projected construction phase is estimated to create or sustain 290 total (direct, indirect and induced) job years of employment, £8.1 million of wages, and £20.3 million of GVA to the Northern Irish economy;
- The estimated total (direct, indirect, and induced) annual benefits realised in Northern Ireland during the operational phase includes 9 jobs, £280,000 of wages, and £840,000 in GVA; and
- Annual business rates during operation are estimated at almost £800,000.

2.166. It is acknowledged that the Site falls wholly within the Sperrin AONB designation. Consistent with policy, every effort has been made during the iterative design process to minimise the impact of the Proposed Development and to aid its integration into the local landscape.

2.167. In this respect, the Proposed Development has been located and designed to minimise its effect on the AONB as a whole. This has been achieved by locating it away from the core area (including the Glenelly Valley and South Sperrin range of uplands) which contains the majority of visitor attractions and key landscape features.

2.168. The majority of the AONB, even at close range, would experience limited visibility of the Proposed Development and no significant effects. It is therefore concluded that the Proposed Development would not affect the overall integrity of the AONB designation.

2.169. With the discretion to attach significant weight to the wider environmental, economic and social benefits arising from the Proposed Development, it is considered to comply with relevant planning policy because there are no unacceptable adverse effects which are not outweighed by the wider environmental, economic and social benefits.

References

Department for Regional Development (NI) (DRD) Regional Development Strategy 2035 (March 2012)

Department of the Environment (NI) (DoE) A Strategic Planning Policy Statement for Northern Ireland Planning for Sustainable Development (SPPS)

Department of the Environment (NI) (DoE) Best Practice Guidance to Planning Policy Statement 18: Renewable Energy (BPG, PPS18), (August 2009)

Department of the Environment (NI) (DoE) Planning Policy Statement 2: Natural Heritage (PPS2), (July 2013)

Department of the Environment (NI) (DoE) Planning Policy Statement 3: Access, Movement and Parking (PPS3), (February 2005)

Department of the Environment (NI) (DoE) Planning Policy Statement 6: Planning, Archaeology and The Built Heritage (PPS6), (March 1999)

Department of the Environment (NI) (DoE) Planning Policy Statement 10: Planning & Telecommunications (PPS10), (April 2002)

Department of the Environment (NI) (DoE) Planning Policy Statement 15: Planning and Flood Risk (PPS15), (September 2014)

Department of the Environment (NI) (DoE) Planning Policy Statement 16: Tourism (PPS16), (June 2013)

Department of the Environment (NI) (DoE) Planning Policy Statement 18: Renewable Energy (PPS18), (August 2009)

Department of the Environment (NI) (DoE) Planning Policy Statement 21: Sustainable Development in the Countryside (PPS21), (June 2010)

Department of the Environment (NI) (DoE) Supplementary Planning Guidance: Wind Energy Development in Northern Ireland's Landscapes (SPG), (August 2010)

Joint Ministerial Statement – Development Plans and Implementation of the Regional Development Strategy (January 2005)

3

Design Evolution & Alternatives

3. Design Evolution and Alternatives

Introduction

In this chapter a description is given of the site selection process, consideration of alternatives, and design strategies that were adopted in arriving at the Proposed Development described in Chapter 2: Proposed Development. Firstly, the general design principles adopted by RES are outlined and potential key issues which may affect the design are identified. Thereafter, a description is given of how the turbine layout and infrastructure design evolved in response to constraints identified through the EIA process.

Figures 3.1 – 3.3 are referenced in the text where relevant.

Current land use and site context

The location of the Proposed Development is shown in Figure 1.1: Site Location. The Planning Application Boundary (red line) and Land Under Applicant Control (blue line) are shown on Figure 1.2: Planning Application Boundary. The Land Under Applicant Control surrounding the main site shown on Figure 1.2 formed the initial preliminary site boundary, which was reduced down through the design process, and is hereinafter referred to as 'the Site'.

The Site is located in the townlands of Carrickayne, Legnahappoge, Glengarrow, Stroanback and Doorat, 4km North East of Plumbridge, Northern Ireland. The site is located in the central western part of the Sperrin Area of Outstanding Natural Beauty (AONB) on upland grazing land.

The Site is currently used for rough grazing of sheep and cattle.

Key Issues and Constraints

Site Selection

The design of a wind farm is optimised in order to produce a layout that maximises the use of the land available for wind power generation balanced against the overall environmental impact of the development. The optimal layout of a wind farm depends on a range of technical, economic and environmental criteria. There following are site specific factors determining the viability of a wind farm:

- Wind Speeds/Energy Yields: Sufficiently high wind speeds to ensure energy production from the wind turbines that would yield an adequate return on investment;
- Planning: A site which complies with planning policy and in particular, avoids unacceptable effects on areas designated by statutory agencies; maintains appropriate

distances from dwellings to avoid unduly impacting local amenity and; avoids impeding or interfering with major electromagnetic transmission and airport communication systems;

- Area of Site: A site must have sufficient area to accommodate the number of wind turbines required for economic viability;
- Access: Adequate vehicular access to a site using existing roads wherever possible to minimise the amount of civil works, particularly during the construction phase;
- Local Terrain and Topography: Terrain and topography affect wind flow across a site and need to be considered in relation to turbine performance, specification and life-span;
- Ground Conditions: A site must have suitable ground conditions for the construction of wind turbine foundations, erection of the machines and the provision of access tracks and cables.

Design Principles

There are additional factors which also influence the scale and viability of a wind farm including:

- Turbines must be separated by specific distances both perpendicular to, and in line with, the prevailing wind direction to minimise turbulent interaction between the wind turbines (i.e. wake effect). This needs to be considered to balance turbine performance with energy extraction, and to protect the life-span of the turbines. Spacing requirements vary between turbine manufacturers and are also subject to wind conditions;
- Wind turbines have to be located at a distance sufficiently far from occupied residential property to ensure adherence to relevant noise criteria and to ensure that shadow flicker impacts are minimised;
- The implications of locating turbines near environmentally sensitive features and areas (ecology, archaeology, hydrology etc.) need to be carefully considered; and
- Landscape and visual design considerations, including potential cumulative effects, need to be taken into account.

The apportioning of weight to each element is a site-dependent consideration and results in bespoke design approaches and strategies for each site.

For the Proposed Development, the upland nature of the Site creates a number of sensitivities that need to be carefully addressed through appropriate design of the wind farm. The following sections identify potential issues and outline how these have been addressed through appropriate design.

The basis of the design process is the evaluation of the various constraints that have been identified through the environmental surveying that was undertaken at the Site. The constraints identified through these surveys, along with other technical constraints and appropriate buffers are presented in **Figure 3.2**: Combined Constraints and Infrastructure and are discussed in the layout evolution sections of this chapter.

Potentially significant effects

Following consultation and baseline characterisation of the Site, the following key environmental issues have been identified:

- Landscape and visual, including relationships with neighbouring wind farms
- Archaeology and cultural heritage
- Peatland and vegetation
- Fauna, including ornithology and fisheries
- Geology and the water environment
- Noise and shadow flicker
- Traffic and transport.

The issues listed above will be considered through design with the aim of designing out significant effects. Where it is not possible to mitigate by design, the issues are considered further as part of this Environmental Impact Assessment (EIA).

Consultation

Prior to and during the production of this Environmental Statement (ES), RES and the Consultant project team have consulted with various stakeholders and where appropriate incorporated the outcome of this into the various chapters of this ES.

Throughout the EIA process, continual scoping has occurred to ensure that the ES fully, but concisely, addresses all potentially significant issues.

Details of consultation undertaken in the preparation of each of the technical chapters of this ES (chapters 4 to 13) are presented in the relevant chapter.

Public Consultation

RES is committed to finding effective and appropriate ways of consulting with all its stakeholders, including local residents and community organisations, and believes that the views of local people are an integral part of the development process. RES began the engagement process with the local community in August 2023 to facilitate a constructive consultation process which helped RES to understand and address any concerns as the project developed.

A public exhibition was held in the local area on 5th and 6th September 2023 which included detailed maps and information about the proposals, including: a map of the proposed layout; photomontages representing how the proposed layout would appear from a range of viewpoints, and; Zone of Theoretical Visibility (ZTV) drawings. (A ZTV is a map-based diagram of where and how many wind turbines, or wind farms, would theoretically be visible from all parts of a given area.) RES also held an online exhibition on 7th September 2023 staff were available for telephone/video conference meetings to answer questions and feedback was encouraged.

A Pre-Application Community Consultation (PACC) Report has been produced and is available for viewing at the locations listed in the Preface.

Alternatives

RES considers a range of potential options when selecting and designing wind farm sites. The following sections outline the broad design alternatives that have been considered in terms of the EIA Regulations.

Do-Nothing Alternative

The “do-nothing” scenario is a hypothetical alternative considered as a basis for comparing the potential significant effects of a development proposal. In the case of the Proposed Development the “do-nothing” scenario would be to have the Site continue to be managed for sheep grazing by the landowners. It is likely that current land management activities, including artificial drainage and grazing, would continue and are likely to cause further degradation to the habitats on the Site in the future.

Alternative Sites

RES has a robust site selection methodology, using a Geographical Information System (GIS) to aid identification of potential wind farm sites.

The Proposed Development Site meets the criteria listed in section 3.6 of this chapter. The GIS model was used to identify potential constraints which could restrict development, or would need to be addressed in the design process.

Alternative Layout Designs

There have been several iterations of the turbine and infrastructure layouts. From the outset the following design principles have been employed when making design decisions:

- Mitigation by design should be the principle method of reducing potential environmental impacts
- Utilisation of existing infrastructure should be implemented whenever possible to avoid unnecessary development
- All site infrastructure should be designed as efficiently as possible to reduce the overall extent of development whilst maximising the renewable energy generation potential.

A key tool in the design process is the combined constraints drawing which integrates all potential constraints that need to be considered in the design process. The finalised combined constraints map is shown as Figure 3.2.

The combined constraints drawing is iteratively updated as new information from surveys, site visits and consultation is received. The following surveys informed the combined constraints drawing and design evolution process:

- Breeding and wintering bird survey
- Ornithological vantage point survey
- Phase 1 habitat survey and National Vegetation Classification (NVC) Phase 2 survey
- Terrestrial fauna surveys
- Fisheries survey
- Peat probing, peat management plan and peat slide risk assessment
- Hydrology assessment
- Archaeology and cultural heritage surveys
- Landscape field survey
- Transport and traffic reconnaissance trip
- Technical and engineering site walkovers.

The final site layout for the Proposed Development (Figure 1.3: Infrastructure Layout) reflects the need to optimise the energy yield whilst paying due regard to environmental and technical sensitivities. Wind farm design is an iterative process and is influenced by potential environmental effects identified throughout the EIA process: policy recommendations; environmental, technical, engineering and landscape design considerations; and as a result of feedback from consultees.

The Design Evolution section of this chapter describes the evolution of the turbine and infrastructure layouts.

Turbine tip height

A landscape consultant was involved throughout the design process to provide advice regarding turbine height, as well as site suitability, scale of the development and cumulative effects. A full Landscape and Visual Impact Assessment (LVIA) of the Proposed Wind Farm Development in included in Chapter 4.

Zone of Theoretical Visibility (ZTV) diagrams were initially prepared to compare the difference in theoretical visibility for various layouts assessed ranging from 11T to 13T 180m tip height machines. A ZTV is a map-based diagram of where and how many wind turbines, or wind farms, would theoretically be visible from all parts of the Study Area. Comparative wirelines were prepared from twenty provisional viewpoint (PVP) locations in key parts of the Study Area (PVPs 1 – 19 as detailed in Technical Appendix 4, Table 4.4.1) to compare and assess the appearance of the turbines within their context. The comparative wirelines or ZTV are not reproduced in the LVIA.

Design Evolution

Turbine Layout

There were four principle iterations of the turbine layout, shown in Figure 3.1: Turbine Layout Evolution, which were developed at the following three stages in the project process:

- Initial feasibility/screening stage, when turbines were located based on preliminary constraints only, with baseline environmental surveys underway but not yet completed.
- EIA baseline data stage, when layouts were developed in response to baseline survey information and resulting constraint information.
- Further environmental assessment and refinement, when further, more detailed assessment was carried out on specific issues highlighted and refinements were made to the layout as a result.

Initial Feasibility Stage

At the beginning of the development process an initial layout was produced to show the maximum potential extent of the development within the space available and in accordance with the design principles and preliminary environmental information, prior to baseline surveys being completed. The layouts were informed by the following constraints:

- Preliminary ecological constraints
- Preliminary watercourse buffers
- Slope
- Separation from housing
- Tip height + 10% to public roads, in accordance with the Best Practice Guidance to PPS 18[1].

This identified that the Site could potentially accommodate 14 turbines, to be further refined throughout the EIA process. **This is layout 1 in Figure 3.1.**

EIA Baseline Data Stage

Combined Constraints

Detailed environmental and technical surveys were completed to characterise the baseline environmental conditions on the Site and associated study areas, as described in more detail in chapters 4 to 13 of this ES. Any constraints to development, or avoidance areas, resulting from the baseline surveys were used to build up the combined constraints drawing.

[1] Best Practice Guidance to Planning Policy Statement 18: Renewable Energy, DOE Planning & Environmental Policy Group, August 2009.

Key constraints informing the layout are listed in the following sections. Further details on baseline surveys and mitigation by design are included in each technical chapter (Chapters 4 to 13).

The final Combined Constraints are shown in Figure 3.2 (Combined Constraints and Infrastructure).

Water Environment and Fisheries

Following the baseline survey the hydrology consultant recommended watercourse buffers of 50 m and 10 m depending on the sensitivity of the watercourse, which were agreed as appropriate by the fisheries consultant.

Terrestrial Fauna

A 25 m buffer was applied to a badger setts identified through the baseline surveys. Note that these are not marked on Figure 3.3 as their location is confidential.

Bat buffers of 50 m were added to major watercourses, as advised by the ecological consultant. This achieves a 50 m buffer between the blade tip and the watercourse feature, in line with Bat Conservation Trust guidance. This is based on an assumed blade length of up to 74m, hub height of up to 105m and maximum feature height of 5 m.

S. pratensis was thinly recorded within areas of rush pasture throughout the extent of the site, and no devils- bit scabious was recorded. Therefore, the site is deemed to have negligible breeding potential for marsh fritillary butterfly.

Vegetation and Peat Stability Assessments

Areas of potentially active peat and species rich grassland were mapped as initial avoidance areas, as recommended by the vegetation and peatland consultant.

Following baseline peat probing and peat slide risk assessment, areas of deeper peat were avoided to limit excavation and spoil generation. Areas identified as medium and high peat instability were identified and avoided.

Public Roads and Overhead Electricity Lines

Buffers were applied to nearby public roads in line with the Best Practice Guidance to PPS18 which recommends a setback distance of at least tip height plus 10% between turbines and roads.

Landscape & Visual

Zone of Theoretical Visibility (ZTV) visualisations were prepared in order to indicate where all, or part of, the Proposed Wind Farm Development is likely to be visible from. The ZTV is first used to assist the identification of areas with theoretical visibility and the location of viewpoints as part of the baseline landscape and visual assessment. It is then used to aid the assessment of visual effects because the turbines would be the most visible element of the Proposed Wind Farm Development, particularly during the operational period. As described in earlier sections they are also useful in considering the height and geometry of the turbine model selected.

At an early stage of the EIA process a provisional list of viewpoints was created, from which provisional wirelines were generated, which were used to identify any potential landscape and visual issues with the turbine layout, as well as from the effects of the wind farm as a whole.

The presence of outlying turbines was addressed in the iterative design process and efforts were made to minimise instances where turbines were located at some distance or at noticeably different heights from the grouping of turbines in order to create a compact layout that minimised the geographical extent and variable height within the Proposed Development whilst also maintaining an evenly spaced layout where turbine heights instances of stacking where also minimised.

Multidisciplinary Site Walkover

A multidisciplinary site walk-over was arranged by RES, involving development, ecology, engineering, and construction to collaboratively review and refine the layout, discuss interrelationships and mitigation, resolve potential conflicts and agree actions for further assessment.

Layout 2 on Figure 3.1 Turbine Layout Evolution represents the result of this stage.

Further assessment and refinement stage

The turbine layout was reviewed and refined in response to further assessment actions identified by consultant review and from the multidisciplinary site visit, including the following:

- Noise assessment, based on the background noise survey
- Shadow flicker assessment
- Archaeological assessment
- Further ecological assessment
- Further peat stability assessment
- Engineering considerations

Peat stability

Following the baseline stage, a second phase of peat probing was carried out the layout, and an outline peat slide risk assessment and peat management plan were prepared. As a result of recommendations in the outline peat slide risk assessment the locations of T4, and T5 were adjusted to occupy shallower peat, T2 and T8 were rotated to have a residual orientation which was more suitable in areas of more shallow peat, and T3 & T7 was recommended for removal from the development.

Refinements were also made to infrastructure, which are detailed later in this chapter.

Archaeology and Cultural Heritage

In consultation with the Archaeology and Cultural Heritage consultant the layout of Proposed Development has been designed to avoid significant effects on archaeological heritage assets in conjunction to appropriate mitigation.

Chapter 5: Archaeology & Cultural Heritage of the ES considers in detail the impact of the Proposed Development on the setting of a number of assets.

Noise and Shadow Flicker Assessments

Layout 3 was further reviewed following assessments for noise and shadow flicker on nearby receptors. As a result, T7 **(Layout 3, Figure 3.1)** was recommended for removal, in order to increase the separation distance to houses, reduce noise and shadow flicker impacts. Full details of the noise and shadow flicker assessments are given in Chapters 11 and 13 respectively. Both chapters conclude that with appropriate mitigation there would be no significant effects on surrounding properties.

Multidisciplinary Site Walkover

A follow up multidisciplinary site walk-over was arranged by RES, involving development, engineering, and construction to collaboratively review and refine the layout, discuss interrelationships and mitigation, resolve potential conflicts and agree actions for further assessment. Following this walkover, it was noted that T10 **(Layout 2, Figure 3.1)** was located within a proximity to a watercourse and would have required a second major water crossing to enable access to it. T10 was recommended for removal. Layout 4 in Figure 3.1 shows the resulting and final layout.

Final Turbine Layout

The final turbine layout is shown in Layout 4 of Figure 3.1 and consists of 11 turbines of up to 180m tip height. The layout was optimised after each iteration of the design, in order to maximise wind potential, and avoid the development of 'clusters' of turbines throughout the area under applicant control. The turbine numbers were then reallocated accordingly. The final layout, including turbines and infrastructure along with the combined constraints is shown in **Figure 3.2.**

A 50 m micrositing radius was applied to each of the turbines. The extent of this micrositing area was then reduced such that the micrositing avoids any of the combined constraints. The final micrositing areas are included in Figure 1.3: Infrastructure Layout.

Infrastructure Design Evolution

The infrastructure design has evolved through the EIA process as illustrated in **Figure 3.3: Infrastructure Design Evolution, Designs 1 to 4.** Design 4 is the final design, which forms Figure 1.3 Infrastructure Layout.

Engineering considerations

The following general principles were taken into consideration when designing the supporting infrastructure:

- Maximise use of existing infrastructure to reduce land take
- Avoidance of environmental and technical constraints (as shown in Figure 3.2)
- Design of the track layout to follow natural contours as far as possible, in order to avoid unnecessary amounts of excavation and reduce adverse hydrological impacts
- Minimisation of the overall length of access track
- Minimisation of the number of watercourse crossings, as far as possible
- Avoidance of steep slope areas to minimise earthworks
- Incorporation of measures to improve the visual appearance of the scheme, including reinstatement of some elements of temporary infrastructure following the construction period, reinstatement of road widening areas, and consultation with the landscape consultant on the position of the control room and substation building and energy storage area.

As well as the turbine positions, the layout of infrastructure was also a key consideration in the collaborative site walkovers described earlier in this chapter.

Key adjustments in response to constraints made through the design evolution are summarised in the following sections.

Vegetation and Peatland

Following the advice of the vegetation and peatland specialist a number of refinements were made to the track layout in order to minimise impacts to blanket bog habitats, including the following:

- Re-alignment of track to T2 to avoid peat habitat
- Re- alignment of track to T4 & T5 to avoid peat habitat
- Track moved further south-east from T3 to T8 to avoid peat habitat
- Track redesign, between T6, T7 (Design 1, Figure 3.3) to reduce the amount of earthworks required and excavation of peat habitat

In line with recommendations in Chapter 6: Vegetation and Peatland and Technical **Appendix 10.5**: Peat Management Plan, consideration was given to the use of floated track in areas of where peat depths exceeded 1 m, particularly within areas of Northern Ireland Priority Habitat. As well as reducing impacts on surrounding habitat the use of floated reduces quantities of excavated peat. with the final proposal shown on **Design 4 of Figure 3.2.** which is also included in Figure 1.3: Infrastructure Layout.

Water Environment

The location and nature of watercourse crossings were reviewed with the hydrology and fisheries consultants. Following the mitigation detailed in Chapter 9: Fisheries and Chapter 10: Geology & Water Environment,

A number of refinements were made to avoid and reduce potential effects as far as possible, including the following:

- Realignment of site entrance to avoid hydrological features
- Removal of track (subsequent to the removal of T10) to access T10 (See Figure 3.3, Design 2) due to proximity to hydrological feature
- Location of substation, temporary construction compound and BESS relocated to avoid hydrological features and peat habitat

Site Entrance Location

The site entrance is located to the South of the Carrickayne road. There has been 2 different iterations of the site entrance location, however this has always been accessed via the Carrickayne road. Local movement to the site entrance such as can be seen in Design 1, to Design 2 in Figure 3.3 Infrastructure Design Evolution; this was due to the proximity of the site entrance to hydrological features. The site entrance was moved West to avoid the need to construct watercourse crossings and unnecessary associated construction or excavation works.

Temporary Construction Compound

In all 4 of the iterations of the infrastructure design evolution (Figure 3.3) the Temporary construction compound has relocated slightly. However, through the course of the design evolution the location of the temporary construction compound was moved further South to a flatter area of ground, that was not subject to any areas of deep peat and had minimal proximity watercourses within the total development area, in order to reduce excavation and spoil generation, whilst remaining outside environmental constraints.

Control Building and Substation and Battery Energy Storage

The control building has relocated throughout the design of the proposed wind farm. However, through the course of the design evolution the location of the control building, substation and battery energy storage compound was moved to a flatter area of ground, that was not subject to any areas of deep peat, and had minimal proximity watercourses within the total development area, in order to reduce excavation and spoil generation, whilst remaining outside environmental constraints.

Final Infrastructure Layout

The final infrastructure layout is shown in Design 4 of Figure 3.3. Once finalised, the Planning Application Boundary was drawn, ensuring sufficient space within the boundary for all features.

The final Infrastructure Layout and combined constraints is shown in Figure 3.2.

Other Design Considerations

TV interference

Wind turbines can potentially interfere with communication systems that use electromagnetic waves as the transmission medium (e.g. television, radio or microwave links). Wind turbines therefore may cause interference to television reception in the proximity of a wind farm, primarily for receptors in the '*shadow*' of the turbines with aerials pointing through the wind farm, causing loss of picture detail, loss of colour or loss of audio. Microwave links can also be affected by the reflection, scattering, diffracting and blocking of the electromagnetic signal caused by wind turbines.

If the Proposed Wind Farm Development is consented, RES would agree a scheme of assessment and mitigation with the planning authority to be implemented in the case of complaints associated with television reception. Should interference to reception occur as a result of the Proposed Wind Farm Development, a range of viable mitigation measures can be considered, with the most suitable method chosen on a case by case basis. Any necessary work would be undertaken in a timely manner following receipt of a valid complaint, and would be funded by the wind farm operator.

Electromagnetic Interference

RES has consulted with all organisations operating microwave links which could be affected by the Proposed Development and these are listed in **Table 3.1**.

Atkins Global, BT, Joint Radio Company, and Northern Ireland Water have all been consulted with in regard to the Proposed Development, none of these organisations have raised any concerns.

As no anticipated detrimental impact upon any aviation stakeholder has been identified it is considered that there will be no additional impact created when considered cumulatively with other existing, consented or proposed wind farms.

Aviation

Wind turbines can potentially interfere with aviation operators by either physically affecting the safeguarding of an aerodrome by the close proximity of the turbines or through interference with the Air Traffic Control (ATC) radars that direct aircraft in flight. RES has consulted with all relevant organisations which could be affected by the Proposed Wind Farm Development and these are listed in table 3.1.

The Defence Infrastructure Organisation (DIO) consultation response stated that the Ministry of Defence (MOD) had no concerns to the Proposed Development, but have added that a suitable lighting scheme be implemented, as the area of the proposed development falls within a low flying area

As no anticipated detrimental impact upon any aviation stakeholder has been identified it is considered that there will be no additional impact created when considered cumulatively with other existing, consented or proposed wind farms.

Table 3.1: EMI and Aviation Consultation Summary

Consultee	Date of Consultation	Nature and Purpose of Consultation
Atkins Global	27th September 2022	Check for EMI impact – no response
Atkins Global	30th September 2022	Check for EMI impact – no response
BT	29th September 2023	Check for EMI impact – no concerns
Joint Radio Company	28th August 2023	Check for EMI impact- no concerns
Northern Ireland Water	31st December 2022	Check for EMI impact – no concerns
Civil Aviation Authority	6th November 2023	Check for aviation impact - Proposed obstacle lighting scheme for Mullaghclogher Wind Farm - provision of a variation of measures to install an appropriate lighting scheme
Defence Infrastructure Organisation	7th March 2024	Check for aviation impact - Proposed obstacle lighting scheme for Mullaghclogher Wind Farm

Ice Throw

Under certain climatic conditions, ice can build up on turbine blades which may be thrown from the blades during blade rotation or fall when blades are stationary.

The International Energy Association (IEA) has recommended an empirical formula to calculate the maximum distance that ice may be thrown from an operating turbine based on turbine geometry. For the proposed turbine envelope this ice throw risk distance has been calculated and used in the wind farm design to locate turbines away from public roads and therefore the potential for ice throw to affect members of the public is considered to be low.

Summary

The final layout of the Proposed Development reflects the need to minimise potential effects on environmental sensitivities whilst optimising the energy yield. Wind farm design is an iterative process and the design has been influenced by potential environmental effects identified through the EIA process. The proposed layout has evolved in response to policy recommendations, environmental, technical, engineering and landscape design considerations and as a result of feedback from key consultees.

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4

Landscape & Visual

4 Landscape and Visual Impact Assessment

Executive Summary

4.1 This chapter is a Landscape and Visual Impact Assessment (LVIA) of the proposed Mullaghclogher Wind Farm (hereinafter referred to as 'the Proposed Development'). An LVIA is a formal part of the Environmental Impact Assessment (EIA) process and the methodology used to prepare this chapter is defined by the requirements of the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017 (hereinafter referred to as the 'EIA Regulations') and best practice guidance publications relating both to the LVIA process in general and in specific relation to wind farm developments (refer to Volume 4 Technical Appendix 4.1 for further details).

4.2 The Proposed Development comprises 11 three-bladed turbines each up to 180 m maximum blade tip height. It would be located in the townlands of Carrickayne, Legnahappoge, Glengarrow, Stroanbrack and Doorat, approximately 4 km to the north east of Plumbridge, Northern Ireland. The site is located in the central western part of the Sperrin Area of Outstanding Natural Beauty (AONB) on upland grazing land. The Study Area for this LVIA covers an area that extends to a 30 km radius from the Proposed Development and is further described from paragraph 4.78. Ancillary works associated with the turbines are also considered briefly in this Chapter. A detailed description of these elements is contained in Chapter 1.

The Purpose of this Chapter

4.3 The aims of an LVIA are to:

- Present an objective analysis of the landscape and visual character of a defined area (i.e. the baseline conditions within the Study Area) in so far as they relate to the Proposed Development;
- Identify the potential effects of the Proposed Development on these baseline conditions including direct, indirect, permanent, temporary and cumulative effects;
- Clearly distinguish between landscape effects and visual effects which although closely related are also distinct from each other. The former relates to the effects on the physical landscape as a resource in its own right. The latter relates to the effects on specific views and general visual amenity as experienced by people (hereinafter referred to as visual receptors);

- Propose appropriate mitigation measures to address likely significant effects, where possible, and to assess any residual effects that would remain following the implementation of these measures;
- Present all information clearly and objectively with a well-reasoned methodology that is in accordance with best practice guidance and in a manner that will inform the decision-making process.

Statement of Authority

4.4 This LVIA has been prepared by Shanti McAllister Landscape Planning & Design Limited (hereinafter referred to as SMc Ltd) on behalf of the applicant, RES Limited (hereinafter referred to as RES). Shanti McAllister is an independent consultant and Chartered Landscape Architect with over 20 years' experience of preparing LVIAs for major development proposals including many wind farms in Northern Ireland.

4.5 All information presented in this LVIA has been prepared in accordance with a methodology that is derived from a suite of best practice guidance (see Technical Appendix 4.1). A summary of the LVIA process and the key elements of this methodology are provided from paragraph 4.33 and are described in full detail in Technical Appendix 4.2. The identification and objective analysis of the landscape and visual effects of the Proposed Development is made using professional expertise and impartial judgement. The conclusions of the LVIA are based on whether or not the Proposed Development is likely to result in significant effects on the landscape and visual elements of the Study Area. The appropriate weight to be attached to these effects, when weighed against the other effects analysed in the ES, is the responsibility of the relevant planning authority, which in this case is the Strategic Planning Division (SPD) of the Department for Infrastructure (DFI).

Feasibility Appraisal and Design Iterations

4.6 The nature of the Proposed Development has evolved through an iterative design process that has been informed by a careful analysis of the constraints and opportunities presented by the site location and the characteristics of the Proposed Development itself. This process is further detailed from paragraph 4.26 of the LVIA and in Chapter 3: Design Evolution and Alternatives. The final choice of turbine model for the Proposed Development will be selected before construction, with a maximum tip height of 180 m. In this assessment turbine hub heights of up to 105 m and rotor diameters of up to 150 m have been assumed for the purpose of preparing visualisations (see Volume 2 Figures 4.5 onwards) but the application as a whole relates to the overall height above ground level only (180 m).

Establishing Baseline Conditions and Analysing Effects

4.7 The Baseline Assessment considers statutory landscape designations covering the Study Area which are contained within current planning policy. The primary policy guidance on the assessment of landscape and visual effects of wind farm development is the Strategic Planning Policy Statement for Northern Ireland (SPPS) which should be read in conjunction with Planning Policy Statement 18: Renewable Energy (PPS 18) and its accompanying Best Practice and Supplementary Planning Guidance (BPG and SPG). In addition, there are a number of guidance documents and extant Development Plans, which contain some relevant statutory planning designations. These are analysed in the Baseline Assessment where applicable.

4.8 It is noted that changes in planning policy and updates to Development Plans are expected to take place over the coming months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become superseded by emerging Local Development Plans. These must be primarily informed by the SPPS. The Proposed Development is located within Derry City and Strabane District Council Area where there is currently no adopted Local Development Plan. In such instances the SPPS is clear that a transition period will operate until the adoption of a Plan Strategy and, until the adoption of such, the planning authority (in this case DfI) will apply existing regional policies and those contained in the SPPS.

4.9 The Baseline Assessment also considers non-statutory landscape classifications and the information gleaned through driving and walking surveys of the Study Area to amplify and enhance the understanding of its landscape and visual character.

4.10 Nineteen viewpoints have been shortlisted for detailed analysis in this LVIA via a viewpoint selection process which identified parts of the Study Area and key groups of visual receptors that may be potentially affected by the Proposed Development. A detailed description of this selection process and a full list of Provisional Viewpoint Locations (PVPs) are provided in Technical Appendix 4.4. Detailed descriptions of the final Viewpoints are an integral part of the Visual Impact Assessment section of this LVIA chapter. Viewpoint locations are indicated on all map-based Figures (Figures 4.1 – 4.8). Visualisations to accompany the detailed written analysis of these Viewpoints are provided in Figures 4.10 – 4.27.

Overall Significance of Landscape and Visual Effects

4.11 In terms of both landscape and visual effects the Proposed Development conforms to the general principles laid out in the policy and best practice guidance which are broadly promotive of renewable energy developments as a means of mitigating against the effects of climate change. The BPG states that, given their importance, is it important for society at large to accept wind farms as a feature of the Region for the foreseeable future and that, whilst some locations may be highly visible, this does not necessarily render them unacceptable. The BPG also notes that groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes and this principle can be applied to the Proposed Development's position within its landscape and visual context. The Proposed Development also conforms to the majority of the landscape and visual character issues that the SPG notes should be considered for wind energy developments within the North West region. Furthermore, its visibility from key parts of the Study Area, including the majority of the AONB and its core area is particularly limited.

4.12 Whilst the Proposed Development would have a direct and significant physical effect on the part of the Study Area and LCA 29 within which it is located, the magnitude of change would be medium because the Proposed Development is located on an outward-facing slope, is not visible from the majority of the core part of the AONB, including the Glenelly Valley and South Sperrin range of uplands. The site of the Proposed Development has no formal recreational amenity functions, which the SPG notes would increase landscape and visual sensitivity. It is also positioned within a Study Area where existing and consented wind farms and single turbines are already a defining feature of landscape character.

4.13 The Proposed Development may have indirect effects on the landscape character of some other parts of the Study Area which are in proximity to it, or which contain viewpoints used in this LVIA. However, there are unlikely to be any discernible effects on their physical landscape character resulting from the Proposed Development due to the physical distance between them. In relation to these other LCAs sensitivity is generally high due to their location within the AONB. However, the magnitude of effects resulting from the Proposed Development would be low to negligible and in no instances are the physical effects on landscape character deemed to be significant.

4.14 It would have a significant visual effect on only three of the 19 Viewpoints which were chosen to represent typical views within the Study Area. All are located within approximately 5 km and from locations where the Proposed Development would be both prominent and visible in its entirety or near-entirety from rural roads and areas of settlement. These viewpoints are also all located to the north and north-west on uplands adjacent to the site of the Proposed Development. Conversely, from viewpoints located at similar distances to the south of the Proposed Development are found to experience no significant effects despite being located within and around the scenic Glenelly Valley, which forms a key part of the AONB core. From these locations there would be acute angles of view and higher levels of vegetation cover from the valley areas which would screen views. Views from more elevated locations tend to be screened by the summit of Mullaghclogher and the proposed turbines are located on the north and west-facing side slopes and are therefore also substantially screened from view. From other parts of the AONB, the Proposed Development may become more visible in its entirety but are lessened in magnitude and significance because views available from these locations are not solely focused on the site of the Proposed Development. Rather, these views frequently encompass much wider panoramas where the site and the Proposed Development comprise a small part.

4.15 In recognition of its location within the Sperrin AONB and the Sperrin Mountains LCA the layout and position of the Development has been designed to minimise its effect on the AONB as a whole and this has been achieved by locating it away from the core area containing the majority of visitor attractions and key landscape features. It is noted that the BPG recognises that wind farms may be expected to be relatively prominent within distances of approximately 5 km but that clear visibility does not automatically equate to the development being unacceptable (see paragraph 4.62 onwards). It is also noted that the majority of the AONB, even at close range would experience limited visibility of the Proposed Development and no significant effects. Furthermore, from the majority of the Study Area, including the AONB, the Proposed Development would have no little to any visibility and would result in no significant visual effects. Therefore, the Proposed Development would not affect the overall integrity of the AONB.

4.16 Although the effect on the physical character of the site and immediate surrounding landscape would be significant because there are currently no other such features in close proximity, the Proposed Development would be physically separate from both the Owenreagh and Sperrin Foothills clusters of wind farms which defines the western-most end of LCA 29 and the Sperrin Foothills LCA to the north west. It would therefore have limited magnitude of cumulative effect on landscape character when considered in combination with these wind farms. Although it would incrementally increase the physical presence of wind turbines in this part of LCA 29 it is not of such a scale that it would cause the landscape character to become more defined by wind farms than by other landscape attributes. There are no other wind farms in proximity to the Proposed Development and its incremental cumulative effect on the landscape character of the Study Area as a whole is therefore deemed to be of low magnitude and not significant. It is also noted that wind farms are not an uncommon feature in approaches to the AONB and there is already a repeating pattern of wind farms and single turbines across other parts of the Study Area and around the edges of the AONB.

4.17 The Proposed Development would have no significant incremental cumulative visual effect on any of the 19 Viewpoints considered in this LVIA because it is largely perceived as a standalone development with no visual relationship of any great magnitude with other wind farms in the cumulative baseline.

4.18 The Proposed Development would have no significant effects on landscape character and limited visibility across the wider Study Area as a whole. This is expressed by only four of the 19 representative viewpoints experiencing significant visual effects, and none experiencing significant cumulative visual effects. Therefore, the LVIA concludes that the Proposed Development is acceptable in landscape and visual terms.

Description of the Proposed Development

4.19 The Proposed Development comprises 11 three-bladed turbines each with overall maximum height to blade tip of up to 180 m. The turbines are located on the north and west-facing side slopes of Mullaghclogher mountain which is near the western end of the main Sperrin Mountain range. This stretches for approximately 40 – 50 km from Carntogher in the north east to Owenreagh, which is located a further 10 km to the west. The current land use on this site is rough upland grazing, like most areas of the central Sperrins, but there is also a coniferous forestry plantation at Bradkeel on the south western side of the mountain. There are several streams and drystone walls dividing the upland parts of the site but there is no public access beyond the peripheral lower slopes where any minor roads, access tracks and houses tend to be located.

4.20 The summit of Mullaghclogher is 572 m AOD with a secondary outcrop named Mullaghcarbatagh at 517 m. The turbine layout wraps around the mid and upper slopes on the northern and north western sides of the hill in a double staggered row and broadly reflects the underlying contours. Turbine 6 is the highest turbine in the layout (486 m AOD) and is located approximately 1.36 km from the main summit and 400 m from the secondary outcrop. Turbines T4, T5 and T7 are positioned around T6 at 386 – 435 m AOD. The remaining turbines are positioned on the lower north-facing slopes at 245 –357 m AOD. There is approximately 3 km between the western and eastern-most turbines (T1 – T11) and approximately 1.7 km from the uppermost turbine (T6) to the lowest turbine (T1).

4.21 Ancillary works associated with the turbines include external electricity transformers; underground cabling; access tracks; turning heads; crane hardstandings; control building and substation compound; energy storage containers; off-site areas of widening to public roads; other ancillary works. A detailed description of these elements is contained in Chapter 1.

4.22 During construction and commissioning, over an anticipated 18-month period, there would be a number of temporary works including a construction compound with car parking, temporary storage areas, welfare facilities and crane hardstandings. Construction traffic would utilise the existing road network, entering the site from the Carrickayne Road located to the north. The site entrance is located off the Carrickayne road, to the north west of the Proposed Development. The visual effects of construction traffic and work on site will be short term and experienced only in close range views, primarily by residents and drivers on the Carrickayne Road. The potential effects of this are considered in the analysis of effects on Viewpoints 3 and 4, Category A Viewpoints described from paragraph 4.141).

4.23 During the operational phase of the Proposed Development, anticipated to be 35 years, the landscape and visual effects would primarily relate to the presence of the turbines themselves as described and analysed in this LVIA. Day-to-day site activity would be minimal and there would be no further discernible changes to the landscape or visual character of the site resulting from site maintenance activities.

4.24 In addition to the turbines, there will be a sub-station and control building and energy storage compound located in the north-western section of the site, south west of the site entrance. The battery storage compound would contain 20 battery containers with heights of 2.9 m and widths of 6.1m, five power conversions units of similar heights and an auxiliary transformer. These would be evenly spaced in a grid layout. The compound would be surfaced in crushed rock or asphalt and surrounded by a 2.5 m high weld mesh fence. The overall height of the proposed compounds would be small in relation to the scale of the proposed turbines.

4.25 Following decommissioning of the wind farm all above-ground structures would be dismantled and removed from site (unless further consent is given to extend the operational life of the wind farm or replace the turbines) in accordance with a decommissioning and restoration plan which will be agreed with the local planning authority prior to decommissioning.

Feasibility Appraisal, Design Evolution and Iteration

4.26 The nature of the Proposed Development has evolved through an iterative design process that has been informed by a careful analysis of the constraints and opportunities presented by the site and its characteristics. This process is further detailed in Chapter 3: Design Evolution and Alternatives. The turbine layout that is presented in the EIA is the result of this iterative design process.

4.27 A Zone of Theoretical Visibility diagram (ZTV) was initially prepared as part of internal project discussions to illustrate the potential hub-height visibility of a 12-turbine scheme as part of this process. It showed that there would be theoretical hub height visibility across 41.37% of the 30 km Study Area. Whilst the reduction in the number of proposed turbines is the result of other site constraints rather than any attempt to mitigate overall visual effects by a reduction in the number of turbines, it has further reduced theoretical visibility by 10.64% and the final 11-turbine layout would only be visible to hub height across 30.73% of the 30 km Study Area, which is a substantial reduction.

Consultation

4.28 Consultation and discussion between RES and the Department for Infrastructure (DfI) has taken place through the submission of a Proposal of Application Notice (PAN) and a notification of intention to submit an Environmental Statement, copies of which are provided in Volume 4 Appendix 1.1. A copy of the responses from DfI is provided in Appendix 1.2. The Department are obliged to consult with other statutory consultees who would have an interest in the likely landscape and visual effects of the Proposed Development, and it is understood that they consulted directly with the Department of Agriculture, Environment and Rural Affairs: Northern Ireland Environment Agency (NIEA) although no scoping response relating to landscape and visual issues has been received to date.

4.29 An in-person public exhibition was held over two days in September 2023, as well as an online exhibition, to present and discuss the Proposed Development with interested parties from the local and wider community. A 30 km blade tip ZTV diagram was overlaid with the AONB boundary, locations of other wind farms within the Study Area and Provisional and final Viewpoint locations to illustrate the theoretical visibility of the Proposed Development within a 30 km Study Area. Wirelines and photomontages of six viewpoints were presented to illustrate how the Proposed Development would appear from some of the key locations/ key visual receptors in the surrounding area (Viewpoint 1, 3, 4, 7, 8 and 16), refer to Technical Appendix 4).

4.30 A number of concerns were raised during the consultation process:

- The scale of the size of the turbines is not portrayed accurately on the visualisations;
- The proposal will visually affect the landscape and man-made structures would spoil the scenery and natural beauty of the Sperrin AONB;
- Photographs that were on display were not taken from key locations e.g. Aughabrack Rd, Lisnarragh- where the turbines would have the greatest impact;
- Turbines T4, T6 and T& would be visible from the Glenelly Valley which currently has 'no wind farms on view' and there was a suggestion that turbines visible on the skyline should be removed.

4.31 The comments and concerns raised are considered in the detailed analysis of landscape and visual effects in this chapter. In particular, the selection and analysis of viewpoints in this LVIA includes representative close-range and medium-range views in the Sperrin Mountains and Foothills to north and west of the Proposed Development and views from the Glenelly Valley, Plumbridge and the surrounding areas where most potentially sensitive residential receptors are located. Provisional wirelines were prepared to ensure that the nature of views from these locations was adequately considered and represented in the final selection of Viewpoints (Technical Appendix 4.4, Table 4.4.1).

Summary of the Methodology for this Landscape and Visual Impact Assessment

Best Practice Guidance

4.32 An LVIA is a formal assessment, which is carried out as part of the EIA, a process defined by the EIA Regulations. In accordance with these Regulations the LVIA takes an objective approach to the identification of the baseline conditions within an appropriate 'Study Area'. In this instance the Study Area extends to a 30 km radius from the Proposed Development.

4.33 The LVIA methodology used by the author for wind farm projects has been developed in accordance with the EIA Regulations and the suite of available best practice guidance on the preparation of LVIAs in both general terms and specifically in relation to wind energy development. The latter, published by Nature Scotland and the Landscape Institute, has been adapted by the author to suit the Northern Ireland context. A full list of this best practice guidance is provided in Technical Appendix 4.1 and a detailed description of the Methodology is provided in Technical Appendix 4.2. This LVIA must be read in conjunction with these Technical Appendices in order to be properly understood.

4.34 The criteria used to identify and analyse both the nature of landscape and visual receptors (their 'Sensitivity'), the nature of landscape and visual effects ('Magnitude') and the Signficance of these effects are all key LVIA terms which are defined in detail in the Methodology. They are also summarised in this section of the chapter for ease of reference.

The LVIA Process

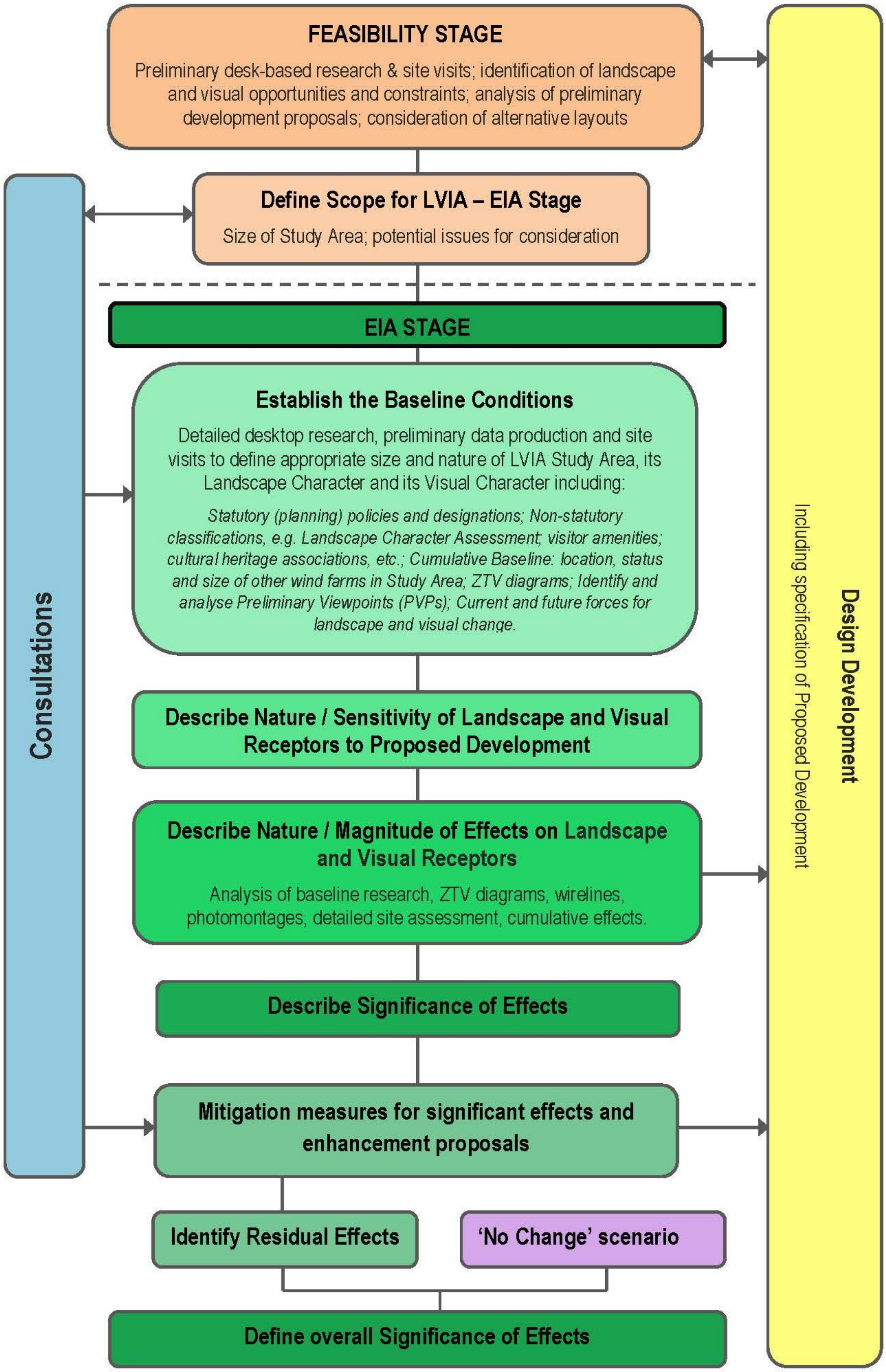
4.35 The LVIA begins with an assessment of baseline conditions combining existing desktop information, such as maps and documents, with site surveys of the Study Area carried out by an experienced Chartered Landscape Architect. A review of relevant planning policy is carried out in order to identify any elements or parts of the Study Area which are recognised for their landscape or visual qualities and any locations that may have been identified by the SPG as being more or less suitable for wind energy development. The baseline assessment also evaluates likely levels of acceptable change for various parts of the Study Area in accordance with current definitions of landscape and visual sensitivity.

4.36 Potential landscape and visual effects on the baseline conditions are then assessed as separate but linked issues. However, it is noted that all policy guidance and publications providing information on the baseline character of the Study Area deal with landscape and visual elements in combination. To avoid repetition and present an accurate reflection of this baseline information it has been necessary for the LVIA analysis of these publications to reflect this approach. The assessment of both landscape and visual effects require a combination of quantitative and qualitative evaluation. The magnitude of landscape effects is derived from the extent to which physical changes resulting from the Proposed Development would cause changes in landscape character. Visual effects relate to changes in the composition of views and people's perception of/responses to these physical changes.

4.37 For both landscape and visual effects the Significance of effect is derived from the assessment of Landscape Value, Sensitivity and Magnitude of change and also by using objective professional judgement in relation to site circumstances. It is important to recognise that the landscape is constantly evolving and that opinions on the beneficial or adverse effects of wind farms are highly subjective. Therefore, in order to ensure that the LVIA presents information objectively, a judgement is made on the significance of effects but no judgement is made on whether these effects are beneficial or adverse.

Plate 4.1 presented on next page…

Plate 4.1: The LVIA Process



Key LVIA Terminology and Assessment Criteria

4.38 The following terms and assessment criteria form the basis for the LVIA and are summarised below for ease of reference. They are fully described in Technical Appendix 4.2.

The Nature of Landscape and Visual Receptors

4.39 The baseline assessment element of the LVIA gathers information on the 'nature' of landscape and visual receptors which is then correlated with the nature of the Proposed Development and its anticipated 'effects' on these receptors in order to draw conclusions on the 'significance' of these effects.

4.40 This LVIA uses the term 'Landscape Sensitivity' to refer to the overall nature of landscape receptors (refer to the landscape attributes described in Technical Appendix 4.2, paragraph 4.18) and their susceptibility to the changes caused specifically by the Proposed Development.

4.41 The consideration of key landscape attributes enables a considered judgement to be made on the level of sensitivity to be apportioned to each defined LCA within the Study Area specifically related to the Proposed Development. The following criteria outline the general principles that are used to inform and guide the assessment of Landscape Sensitivity:

- ***High Landscape Sensitivity:*** A landscape where the majority of attributes are unlikely to withstand change without causing a change to overall landscape character to the extent that it would be difficult or impossible to restore. The frequency and sensitivity of landscape receptors may be high but not exclusively so;
- ***Medium Landscape Sensitivity:*** A landscape with a combination of attributes that is capable of absorbing some degree of change without affecting overall landscape character. There are unlikely to be large numbers of sensitive landscape receptors;
- ***Low Landscape Sensitivity:*** A landscape where the majority of attributes are robust and/ or tolerant of change to the extent that change or development would have little or no effect on overall landscape character. It is likely to be easily restored and the frequency and sensitivity of landscape receptors may be low but not exclusively so.

4.42 Visual effects relate to changes in the composition of views and people's responses to these changes. The nature of visual receptors is determined through the analysis of ZTV diagrams, site assessment and viewpoints representing both typically occurring views within the Study Area and views from specific locations or those likely to be experienced by specific visual receptors (for example, visitors to a specific site). 'Visual Sensitivity' refers to the overall nature of views and viewers (visual receptors) and their likely sensitivity to the changes in views that would be caused specifically by the Proposed Development. The following criteria outline the general principles that are used to inform and guide the assessment of visual sensitivity:

- ***High Visual Sensitivity***: may typically include residents of properties where the main view is orientated towards the Proposed Development, or people undertaking recreation where the landscape within which the Proposed Development is seen is the primary reason for attraction (for example, walkers, cyclist and drivers on scenic routes). Receptors are more likely to be located within a designated landscape and could be attracted to visit more frequently, or stay for longer, by virtue of the view;
- ***Medium Visual Sensitivity***: may typically involve people undertaking active recreational pursuits where the wider landscape within which the Proposed Development is not seen as the primary reason for attraction (e.g. golf, water sports, theme and adventure parks, historic sites, parks and gardens). Receptors are less likely to be located within a designated landscape and could be attracted to visit more frequently or stay for longer by virtue of the facilities and features of the particular attraction rather than by the value of the view;
- ***Low Visual Sensitivity***: may typically include vehicular travellers; outdoor workers (e.g. farm and forestry workers); people in indoor workplaces and community facilities; and residents within larger settlements. Receptors are unlikely to be within a designated landscape and are most likely to be present at a given viewpoint by virtue of some other need or necessity unrelated to the appreciation of the landscape or visual value.

The Nature of Landscape and Visual Effects

4.43 This LVIA uses the term 'Magnitude' to cover assessment of the degree of change that would result from the introduction of the Proposed Development into the baseline landscape and visual context.

4.44 The nature of landscape effects is dependent on the degree of change that would result from the introduction of the Proposed Development in terms of size or scale, geographical extent, duration and reversibility of the proposed change and whether the effects would be experienced directly or indirectly (refer to Technical Appendix 4.2 paragraph 4.28 for further detail). The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of landscape effects:

- ***High Landscape Magnitude***: The Proposed Development would be immediately apparent and would result in substantial loss or major alteration to key elements of landscape character to the extent that there is a fundamental and permanent, or long-term, change to landscape character. The change may occur over an extensive area;

- ***Medium Landscape Magnitude***: The Proposed Development would be apparent and would result in loss or alteration to key elements of landscape character to the extent that there is a partial long-term change to landscape character. The change may occur over a limited area;
- ***Low Landscape Magnitude***: The Proposed Development would result in minor loss or alteration to key elements of landscape character to the extent that there may be some slight perception of change to landscape character. The change may be temporary and occur over a limited area;
- ***Negligible Landscape Magnitude***: The Proposed Development would result in such a minor loss or alteration to key elements of landscape character that there would be no fundamental change.

4.45 The nature of visual effects is dependent on factors including, for example, the prominence of the Proposed Development in the view; the number of turbines that would be visible and the geographical extent of turbines in relation to the extent of the view; the angle and relative elevation of the viewpoint in relation to the Proposed Development; and the context within which the Proposed Development will be seen. The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of visual effects:

- ***High Visual Magnitude***: The Proposed Development would be a dominant and immediately apparent feature that would affect and change the overall character of the view and to which other features would become subordinate;
- ***Medium Visual Magnitude***: The Proposed Development would form a visible and recognisable new element within the overall view and would be readily noticed without changing the overall nature of the view;
- ***Low Visual Magnitude***: The Proposed Development would form a component of the wider view that might be missed by the casual observer. Awareness of the Proposed Development would not have a marked effect on the overall quality of the view;
- ***Negligible Visual Magnitude***: The Proposed Development would be barely perceptible, or imperceptible, and would have no marked effect on the overall quality of the view.

The Significance of Landscape and Visual Effects

4.46 The EIA Regulations require the LVIA to identify and assess the acceptability of significant effects. Best practice guidance recognises that the significance of effects is not absolute and is related specifically to the Proposed Development. It is also dependent on the relationship between sensitivity and magnitude.

4.47 This LVIA uses the following criteria to inform and guide the assessment of the Significance of Landscape Effects:

- ***Significant Landscape Effects:*** Effects that would occur when the majority of landscape attributes are deemed to be highly sensitive and the magnitude of change would alter landscape character to the extent that it would become defined, or considerably influenced, by the presence of the Proposed Development;
- ***No Significant Landscape Effects (Not Significant)***: Effects would not be significant when the majority of landscape attributes are not deemed to be highly sensitive and where the Proposed Development would have little, or no, effect on existing landscape character. This would also occur where the Proposed Development can be integrated into the existing Study Area without the loss of key landscape attributes. Where the magnitude of effect is higher but the number and sensitivity of landscape attributes decreases, so landscape character would become less defined by the Proposed Development and more so by other landscape attributes.

4.48 This LVIA uses the following criteria to inform and guide the assessment of the Significance of Visual Effects:

- ***Significant Visual Effects***: Effects that would occur when the majority of visual receptors are deemed to be highly sensitive and the magnitude of change would alter visual character to the extent that it would become defined, or considerably influenced, by the presence of the Proposed Development;
- ***No Significant Visual Effects (Not Significant)***: Such effects would occur when the majority of visual receptors are not deemed to be highly sensitive and where the Proposed Development would have little or no effect on existing views. The Proposed Development would be likely to constitute a minor component of the wider view, which might be missed by the casual observer, and awareness of the Proposed Development would not have a marked effect on the overall quality of the view. Where the Proposed Development is easily noticeable but the number and sensitivity of visual receptors decreases, so overall visual character would remain less defined by the Proposed Development and more so by other elements of the existing view.

Cumulative Landscape and Visual Effects

4.49 The purpose of the cumulative impact assessment is to measure the incremental effect of the Proposed Development on the Cumulative Baseline rather than to assess the combined effects of all, or some, of the Cumulative Baseline with the Proposed Development[1]. The magnitude of cumulative change is dependent on a number of factors, including the presence of other wind farms and the degree to which these

[1] Scottish Natural Heritage (March 2012), 'Assessing the Cumulative Impacts of Onshore Wind Energy Development s' paragraphs 7 and 55, paraphrased from the GLVIA para 7.12

already influence landscape and visual character and the distance between the Proposed Development and other wind farms (see Technical Appendix 4.2, paragraphs 4.60 and 4.65 for further detail).

4.50 There are existing and consented wind farms as well as single turbines in other parts of the 30 km Study Area and these are considered to form part of its baseline character which informs the assessment of landscape and visual effects, particularly the analysis of effects on viewpoints for this LVIA. Proposed wind farms are also considered but may be afforded less weight when assessing the incremental effects of the Proposed Development because their status is less certain. The additional cumulative effects of the Proposed Development when considered with other wind farms in the cumulative baseline are assessed from paragraph 4.187.

4.51 Cumulative landscape effects relate to the incremental degree of change to the existing landscape character or physical fabric of the Study Area that would result from the introduction of the Proposed Development over and above that of the Cumulative Baseline. The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of Cumulative Landscape Effects:

- ***High Cumulative Landscape Magnitude***: The introduction of the Proposed Development to the Cumulative Baseline would result in substantial incremental loss of, or major alteration to, key elements of landscape character to the extent that there would be a fundamental and permanent, or long-term, change to landscape character. The change may occur over an extensive area;
- ***Medium Cumulative Landscape Magnitude***: The introduction of the Proposed Development to the Cumulative Baseline would result in the incremental loss of, or alteration to, key elements of landscape character to the extent that there would be a partial long-term change to landscape character. The change may occur over a limited area;
- ***Low Cumulative Landscape Magnitude***: The introduction of the Proposed Development to the Cumulative Baseline would result in minor incremental loss of, or alteration to, key elements of landscape character to the extent that there may be some slight perception of change to landscape character. The change may be temporary and occur over a limited area;
- ***Negligible Cumulative Landscape Magnitude***: The introduction of the Proposed Development to the Cumulative Baseline would result in such a minor incremental loss of, or alteration to, key elements of landscape character that there would be no fundamental change to landscape character.

4.52 The significance of cumulative landscape effects is dependent on landscape sensitivity, the magnitude of cumulative change, and the relationship between these two factors. The following criteria outline the general principles that are used to inform and guide the assessment of the significance of cumulative landscape effects:

- ***Significant Cumulative Landscape Effects***: Effects that would occur when the majority of landscape attributes are deemed to be highly sensitive and the incremental effects of the Proposed Development would alter landscape character to the extent that it would become defined or considerably influenced by the presence of wind farms, taking account of cumulative baseline conditions;
- ***No Significant Cumulative Landscape Effects (Not Significant):*** Such effects would occur when the majority of landscape attributes are not deemed to be highly sensitive and where the Proposed Development would have little or no incremental effect on the existing landscape character. Where the Proposed Development can be integrated into the existing cumulative baseline, without the loss of key landscape attributes, cumulative landscape effects would also be deemed as Not Significant. This level of significance would also occur where the Proposed Development may have a greater magnitude of effect but its incremental effects would not cause the landscape character to become more defined by wind farms than it currently is, or to become more defined by wind farms than by other landscape attributes

4.53 Cumulative visual effects relate to the degree to which wind energy developments feature in particular views or sequences of views, and the resulting effects of this upon visual receptors. This LVIA considers simultaneous and sequential cumulative visual effects that may arise within the Study Area and in relation to the selected viewpoints. The LVIA principally considers the degree to which the Proposed Development would contribute to wind energy development becoming a significant or defining characteristic of visual character. The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of cumulative visual effects:

- ***High Cumulative Visual Magnitude***: The Proposed Development would increase the scale of wind turbines in the landscape to a level at which the view would become dominated by wind farms;
- ***Medium Cumulative Visual Magnitude***: The Proposed Development would result in a noticeable increase in turbines but this increase would not result in wind farms being the dominant feature of the view;
- ***Low Cumulative Visual Magnitude***: The Proposed Development would be visible but would constitute a component of the view that might be easily missed by the casual observer and/ or would not contribute to the overall prominence of wind farms within the view;

- ***Negligible Cumulative Visual Magnitude***: The Proposed Development would be barely perceptible, or imperceptible, and/ or would have no effect on the perception of wind turbines within the view.

4.54 The following general principles are used to inform and guide the assessment of the Significance of Cumulative Visual Effects:

- ***Significant Cumulative Visual Effects***: Effects that would occur when the majority of visual receptors are deemed to be highly sensitive and the addition of the Proposed Development to the cumulative baseline would result in the view becoming defined, or considerably influenced, by wind turbines;
- ***No Significant Cumulative Visual Effects (Not Significant)***: Such effects would occur when the majority of visual receptors are not deemed to be highly sensitive and where the Proposed Development would have little or no incremental effect on existing views. The Proposed Development is likely to constitute a barely perceptible, or imperceptible, component of the wider view, which might be missed by the casual observer. Awareness of the Proposed Development would not have a marked effect on the overall quality of the view. Where the Proposed Development may be a noticeable addition to views containing wind farms in the cumulative baseline but it would not cause the overall visual character of the view to become defined by wind turbines rather than by other elements of the existing view the overall effects would also be deemed to be Not Significant.

Baseline Assessment

Legislation and Planning Policy

4.55 The primary policy guidance on the assessment of landscape and visual effects of wind farm development is the Strategic Planning Policy Statement for Northern Ireland (SPPS) which should be read in conjunction with Planning Policy Statement 18 (PPS 18), its Supplementary Planning Guidance (SPG) and Best Practice Guidance (BPG)[2]. Further changes in planning policy and updates to development plans are expected to take place over the next few months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become entirely superseded by the SPPS and emerging Local Development Plans.

[2] Department of the Environment Northern Ireland (September 2015) 'Strategic Planning Policy Statement for Northern Ireland (SPPS): Planning for Sustainable Development' , (2013) ; 'Planning Policy Statement 18: Renewable Energy' and (August 2010) 'Wind Energy Development in Northern Ireland's Landscapes, Supplementary Planning Guidance to Accompany Planning Policy Statement 18 'Renewable Energy'; (2009) 'Best Practice Guidance to Planning Policy Statement 18: Renewable Energy'

Strategic Planning Policy Statement for Northern Ireland (SPPS): Planning for Sustainable Development

4.56 The SPPS sets out strategic subject policies, including for renewable energy, and is intended to provide core principles to underpin the delivery of the new two-tier planning system where local councils have primary responsibility for the implementation of development control. However, for the transitional period whilst Local Development Plans are being prepared, the existing suite of Planning Policy Statements, supplementary and best practice guidance and relevant provisions within the *'Planning Strategy for Rural Northern Ireland'* will remain in place.

4.57 The aim of the SPPS is to facilitate sustainable development based on three overarching principles: supporting rural regeneration; promoting economic growth; and promoting environmental sustainability. The latter principle includes for the protection of landscape character as well as a reduction in greenhouse gas emissions. The mitigation and adaptation to the effects of climate change is a key principle in the SPPS which notes that the promotion of renewable energy systems is one of the means by which the planning system will achieve this principle.

4.58 'Subject Polices' for Renewable Energy are covered in paragraphs 6.214 - 6.234 of the SPPS but the SPG is also noted as remaining in place. The SPPS retains the European Landscape Convention's definition of 'landscape' to mean "*an area, as perceived by people, whose character is the result of the action and interaction of natural and / or human factors*"[3]. The SPPS also recognises that Northern Ireland has significant renewable energy resources and that the renewable energy industry makes an important contribution to sustainable development and investment in the region. Renewable energy also reduces our dependence on imported fossil fuels and benefits our overall health, well-being and quality of life. "*The aim of the SPPS in relation to renewable energy is to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and to realise the benefits of renewable energy without compromising other environmental assets of acknowledged importance.*" (SPPS paragraph 6.218).

4.59 The strategic regional objectives of the SPPS are to ensure that environmental, landscape and visual amenity impacts are adequately addressed, and that natural and cultural heritage features are adequately protected. However, the SPPS also expects that the emerging Local Development Plans will support a diverse range of renewable energy developments whilst taking account of both local circumstances and the wider recognised benefits of renewable energy. Whilst the SPPS advises that a cautious approach should be applied to proposals within designated landscapes which are of significant value, and their wider settings where it may be difficult to accommodate renewable energy developments without detriment to the regions

[3] Definition of landscape used in the European Landscape Convention (2000, Article 1.a) Council of Europe and 'Northern Ireland's Landscape Charter' (January 2014) NIEA

cultural and natural heritage assets, it also notes that *"It will not necessarily be the case that the extent of visual impact or visibility of wind farm development will give rise to negative effects; wind farm developments are by their nature highly visible yet this in itself should not preclude them as acceptable features in the landscape. The ability of the landscape to absorb development depends on careful siting, the skill of the designer, and the inherent characteristics of the landscape such as landform, ridges, hills, valleys, and vegetation.*" (SPPS paragraphs 6.230 - 231).

Planning Policy Statement 2: Natural Heritage

4.60 Policy NH6 of PPS 2 states that permission will only be granted for new development in AONBs where it is of an appropriate design, size and scale for the locality and meets three criteria including; siting that is sympathetic to the special character of the AONB in general and also the particular locality; it respects or conserves features of importance to this character and; it respects vernacular styles and materials. PPS 2 also notes that "*the quality, character and heritage value of the landscape of an AONB lies in their tranquillity, cultural associations, distinctiveness, conservation interest, visual appeal and amenity value*" (PPS 2, paragraph 5.15). It refers to LCAs and AONB Management Plans for further information. It is noted that a Management Plan has never been developed for the Sperrin AONB but that funding has recently been obtained by the Sperrins Partnership Board to develop both a 10 year Management Plan and a 5-year Action Plan at some point in the near future (refer to paragraph 4.88 for further details). In the meantime, detail of the appropriateness of the proposed design, scale and size of the Proposed Development in relation to landscape character as described by the SPG is analysed from paragraph 4.97.

Planning Policy Statement 18: Renewable Energy

4.61 The aim of PPS 18, which is broadly aligned with that of the SPPS, is "*to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and realise the benefits of renewable energy*" (PPS 18, section 3.1). Policy RE1 states that proposals must demonstrate that they "*would not have an unacceptable impact on visual amenity or landscape character through: the number, scale, size and siting of turbines; that the Proposed Development has taken into consideration the cumulative impact of existing turbines, those which have permissions and those that are currently the subject of valid but undetermined applications*". It is noted that the more recently published EIA Regulations do not require consideration of proposed wind farms due to the unknown nature of their status.

Best Practice Guidance to accompany PPS 18

4.62 The BPG provides technical information and potential considerations in relation to planning applications for wind energy projects. It refers to the SPG for guidance on the landscape and visual analysis process and advice on the indicative type of development that may be appropriate but it is not prescriptive. The BPG notes that "*There are no landscapes into which a wind farm will not introduce a new and distinctive feature. Given the Government's commitment to addressing the important issue of climate change and the contribution expected from renewable energy developments, particularly wind farms, it is important for society at large to accept them as a feature of the Region for the foreseeable future.*" However, it also notes that the locations of developments should be carefully considered in order to reduce their impact and aid integration into the local landscape even though they may be highly visible. (BPG section 1.3.18 - 19).

4.63 The BPG reiterates the SPPS in its recognition that visibility doesn't necessarily equate with levels of acceptability and notes that there are three considerations when considering the capacity of a landscape to accommodate wind farm development (BPG 1.3.21):

- The degree of impact the Proposed Development will have on the existing character of the landscape;
- The sensitivity of the character of the landscape, and;
- The extent to which this impact can be modified and reduced by design.

4.64 The BPG also refers to the inherent characteristics of a landscape, such as landform and vegetation, the careful siting and skilful design of developments all playing an important role in the ability of a landscape to absorb development. Turbine layouts must also be appropriate to the local landform and landscape characteristics; groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes whereas rows of turbines may be more appropriate where there are formal field boundaries within flatter agricultural landscapes. Wind farms should not appear visually confusing in relation to the character of the landscape and should ideally be separate from surrounding features to create a simple image (sections 1.3.22 & 1.3.26).

4.65 In relation to visual impact the BPG notes that wind farms in an open landscape setting are likely to be prominent features at distances below 2 km, and relatively prominent at up to 5 km. Between 5 – 15 km they are more likely to be seen as part of the wider landscape and prominent only in clear visibility. Beyond 15 km they are only likely to be seen in clear visibility and as a minor element in the landscape (section 1.3.25).

4.66 It is noted that Nature Scotland's best practice guidance in relation to the siting and design of wind farms has been updated since the BPG was published and no longer refers to specific distances in relation to visual prominence (see Technical Appendix 4.1, paragraph 4.3). Their research has found that other factors such as weather conditions, time of day/year, angle of view, and composition of other elements in the view, all contribute to the assessment of visual effects and visual prominence, and this is also considered in the assessment of visual effects.

Supplementary Planning Guidance to accompany PPS 18

4.67 The SPG is intended to provide broad strategic guidance on appropriate locations for wind energy development based on the definition of Landscape Character Areas (LCAs) within the Northern Ireland Landscape Character Assessment (NILCA). It advises that the detailed assessment of the nature of a wind farm's effects on landscape character should be dealt with on a case-by-case basis via an LVIA. The SPG itself is non-prescriptive with regards to turbine heights and groupings. Its assessment of landscape sensitivity is intended to provide broad guidance but not to exclude development. Rather it places an onus on developers to demonstrate, via the EIA process, that wind farms can be developed without unacceptable effects on LCAs as a whole.

4.68 The SPG recommends a 20-30 km radius Study Area for medium or large commercial height turbines, which has informed the selection of a 30 km Study Area for this Development. The SPG includes recommendations that are specific to the potential effects of wind energy developments on the character of individual LCAs. The SPG as it relates to the Proposed Development is analysed starting at paragraph 4.97.

4.69 The assessment of Landscape Value and Sensitivity for some LCAs is altered from the SPG where detailed site survey in relation to this LVIA has revealed variations in particular areas. This is in accordance with the SPG, which states that, "*It should be noted that within many LCAs there is considerable variation in sensitivity levels across the area, reflecting the fact that the LCAs are broad character or identity areas. The overall sensitivity level is therefore the level that prevails over most of the LCAs geographic area. Localised areas of higher or lower sensitivity may also exist and these are generally identified in the sensitivity descriptions within each LCAs assessment sheet. The overall sensitivity level of a LCA is indicative of the relative overall sensitivity level of each LCA. A high sensitivity level does not necessarily mean that there is likely to be no capacity for wind energy development within the LCA and conversely a low sensitivity level does not mean that there are no constraints to development*" (SPG section 2.3).

Emerging Council Policy

4.70 Changes in planning policy and updates to Development Plans are expected to take place over the coming months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become superseded by emerging Local Development Plans, which will be primarily informed by the SPPS. The SPPS (at paragraph 1.10) sets out transitional arrangements where this is the case to ensure continuity of planning policy and decision making and notes that decisions should be taken in line with the SPPS and relevant PPSs until such time as a plan strategy for the whole council area has been adopted.

4.71 The site falls within Derry City and Strabane District Council area (hereafter referred to as DCSDC) who have not yet adopted their Local Development Plan. It is understood that an Independent Examination (IE) of the Draft Plan Strategy is currently or imminently due to take place. The documents which will be reviewed by the IE include the main Draft Plan Strategy, Preferred Options Paper and a series of Evidence Base Papers covering a range of topics including a review of Landscape Character, the natural environment, renewable energy, and climate change. If the IE concludes that the documents are sound DCSDC will carry out any appropriate amendments and move towards adoption of the Plan Strategy, followed by a similar process for the Local Policies Plan. However, the SPPS notes that decisions should continue to be taken in line with the SPPS and relevant PPSs until such time as a Plan Strategy for the whole Council area has been adopted and the timescale for this is, as yet, unknown. Therefore, for the purpose of this ES it is considered that the Draft Plan Strategy is at too early a stage to be afforded weight.

Analysis of the Proposed Developments Effects on Planning Policy

4.72 The Development is located within the Sperrin AONB, which is an environmental asset of acknowledged importance. Apart from Registered Parks at Baronscourt, Gortin and Learmount which are located at distances of at least 8 – 10 km from the Proposed Development, the AONB is the only statutory landscape designation that would be affected by the Proposed Development. The Development's location is not contrary to the relevant planning policies described in the preceding paragraphs because they do not preclude such Development from designated areas. However, they do require developments to be appropriately located in relation to the AONB, the key characteristics of which are usually described within an AONB Management Plan. This is a non-statutory document providing information on the special qualities of the AONB and the aims and objectives for its long-term management. No such plan exists for the Sperrins and therefore the special qualities of the AONB have been extrapolated from other policy and non-statutory documents.

4.73 The SPPS, which is the overarching policy document, recognises that renewable energy is a beneficial type of development provided it is appropriately located. The SPPS also reiterates the European Landscape Convention's definition of landscape as being a result of both natural and human factors. The SPPS is supportive of renewable energy developments as a means of mitigating against the effects of climate change but advises that a cautious approach should be taken to taken to siting renewable energy developments in designated landscapes where such developments would result in detrimental effects on the value of these landscapes. In this respect it is necessary to consider policy principles set out in Planning Policy Statement 2 (PPS 2) relating to AONBs and more detailed advice set out by the SPG in relation to specific Landscape Character Areas (LCAs) and to the Northern Ireland Regional Landscape Character Assessment (NIRLCA).

4.74 PPS 2, Policy NH6 notes that the special qualities of AONB's in general include tranquillity cultural associations, distinctiveness, conservation interest, visual appeal, and amenity value. PPS 2 states that permission will only be granted in AONBs where the Development would be sympathetic to the character of the AONB in general and also of the particular locality. PPS 2 defers to the descriptions of LCAs (and AONB Management Plans) for further information on these elements.

4.75 It is noted that, of the 15 LCAs which fall either partially or wholly within the AONB boundary, most are assessed by the SPG as being of much the same sensitivity to wind energy development as LCA 29 within which the Development would be located. All 15 are deemed by the SPG to have High or High – Medium sensitivity to wind energy developments. Eight of these LCAs fall wholly or mostly within the boundary but only five are likely to experience any landscape effects resulting from the Proposed Development. These 5 are all deemed by the SPG to have broadly high sensitivity to wind energy development except Binevenagh LCA which is deemed to have high – medium sensitivity. It is noted that the Binevenagh LCA bridges two AONBs, the Sperrins and Binevenagh and contains a number of wind farms and clusters in locations that are specifically referred to in the SPG as being particularly sensitive. LCA 30 Sperrin Foothills, which form parts of the AONB, also contains several wind farms in locations which identified by the SPG as being particularly highly sensitive but have nevertheless been subject to planning consents. Furthermore, it is noted that there are a total of 130 LCAs covering Northern Ireland and only two are deemed by the SPG have medium to low sensitivity to wind energy development. Despite this document being intended the support PPS 18, which is broadly promotive of wind energy development, the majority of LCAs in the country are deemed to be of either Medium, Medium/High or High sensitivity.

4.76 PPS 18 and its Best Practice Guidance (BPG) are generally promotive of wind energy development in appropriate locations and note that the capacity of a landscape to accommodate such development is dependent on the existing character of the landscape. The BPG further states that, given their importance, is it important for society at large to accept wind farms as a feature of the Region for the foreseeable future. The BPG notes that some locations may be highly visible but that this is not necessarily unacceptable. The latter judgement depends on the degree of effect and sensitivity of the receiving landscape. Of relevance to this Development the BPG also notes that groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes such as the proposed site. Beyond 5 km they are likely to be visible as part of the wider landscape and prominent only in clear visibility, becoming less prominent with distance.

4.77 The site has visual appeal and value by virtue of its location within the Sperrin AONB. However, the Development would have minimal visibility across the Study Area in general and notably from most parts of the AONB because it occupies a north-facing site towards the western end of the central spine of mountains and is therefore largely screened by rising topography to the south. The SPGs guidance on landscape character considerations for wind energy development in LCA 29 Sperrin Mountains is considered in further detail starting at paragraph 4.101.

Baseline Landscape Character Assessment and Analysis of Effects

The Site and the Study Area

4.78 The Study Area for this LVIA extends to a radius of 30 km from the centre of the Proposed Development (A map-based analysis of the Study Area is provided in Figure 4.1 and the extent of the Study Area is indicated on all map-based figures in Section 4, Volume 3 of the ES). Key features of the Study Area are listed below:

- The Study Area is divided from the north west to south east between Counties Derry and Tyrone, with the Proposed Development and the larger portion of the Sperrin AONB falling within the latter. The far west of the Study Area extends slightly into Co. Donegal;
- The Proposed Development is in the central western part of the AONB and the majority of the AONB is located within the Study Area, filling the central and eastern side and occupying approximately half of the 30 km Study Area;
- Areas beyond the AONB cover the northern side of the Study Area beyond approximately 12 km from the Proposed Development and include the A6 road corridor, the north-facing side of the Sperrin Foothills and the lowlands around the North Antrim coast in proximity to Derry city. To the west, beyond approximately 15 km are the towns of Lifford, Strabane, Sion Mills and Newtownstewart positioned within the agricultural lowlands of the Foyle and Derg river valleys. To the south Omagh city also sits within an agricultural landscape bounded to the south, east and west by a series of uplands;
- The majority of the Study Area is formed by a series of uplands divided by several valleys formed around river corridors. Primary and secondary roads with small towns and villages tend to be in these lowland areas. Larger settlements are located on the peripheries of the Study Area and include the cities of Omagh and Derry, and the larger towns of Lifford and Strabane;
- Rural dwellings and farmsteads are scattered throughout the Study Area within valleys and side slopes of upland areas but tend not to be located on higher ground. Land uses on upland areas tend to be either open moorland and rough grazing land with some large areas of forestry, typically on side slopes rather than clothing summits;
- There are a number of quarry sites, primarily in the south eastern part of the Study Area and a series of large coniferous forestry plantations and clusters of existing and consented wind farms located throughout upland parts of the Study Area (cumulative wind farms are further described from paragraph 4.187);

- The Sperrin Mountains and outlying hills form an extensive bowl-shaped formation which combine to form the AONB. This latter series of uplands encircle and physically enclose the Glenelly Valley which forms the heart of the AONB. The Sperrin Mountains are the principal mountain range in the north west of the country. The various hills within the range include outlying hills Bessy Bell in the west and Slieve Gallion in the east; the central spine of mountains, which run through the centre of the Study Area from the west to the north, is distinctively crescent-shaped. The highest peaks are Mount Sawel and Mullaghneany (678 m and 627 m respectively). Many of the other mountains in this range exceed 500 m, including Mullaghclogher which is 572 m; and Benbradagh and Carntogher in the north (just outwith the north eastern side of this Study Area);
- The Sperrins merge with the Binevenagh range of uplands beyond the north eastern edge of the Study Area. These separate the north Derry coastal area from the agricultural farmland in the Bann Valley. The Loughermore Hills physically enclose the northern side of the Study Area. Slieve Gallion, the Slievemore and Lough Bradan upland areas physically enclose the southern side of the Study Area;
- The North Sperrin Hills and Roe Valley is located in the north eastern part of the Study Area where the lower foothills of the Sperrins are interspersed with valleys which become progressively shallow and less steep towards the coast;
- In the north east the uplands around Glenshane and Carntogher are dissected by the A6 road corridor linking Belfast and the eastern side of the Province to the city of Derry and industrial development around its periphery in the north west.

4.79 The proposed site is located on upland grazing land on the north and west-facing side slopes of Mullaghclogher mountain which is near the central western end of the main Sperrin Mountain range and which has a summit height of 572 m AOD. It would be located in the townlands of Carrickayne, Legnahappoge, Glengarrow, Stroanbrack and Doorat, approximately 4 km to the north east of Plumbridge. The location of the proposed turbines in relation to the underlying topography and land uses on the site is described from paragraph 4.19.

4.80 Plumbridge is a small town located on the secondary road network at the western end of the Glenelly Valley and is a stopping point for visitors to the AONB travelling along the Central Sperrins Scenic Drive. To the south west is the similar-sized town, Gortin which is also a hub for visitors because it is close to Gortin Glen Forest Park. There are clusters of houses forming smaller settlements located along various parts of the secondary road network between Gortin, Plumbridge and Draperstown, which is larger town located at the other end of the Glenelly Valley on the eastern edge of the Study Area.

4.81 There are no statutory designations of relevance to the LVIA within or immediately adjacent to the site other than the AONB. Part of the Central Sperrins Scenic Drive runs along the B48 to the west of the site which allows public vehicular access and enjoyment of this part of the Sperrin AONB. The nearest footpath is the Ulster Way/ International Appalachian Trail which traverses the length of the Glenelly Valley and crosses Barnes Gap, which is located approximately 5.6 km from the Proposed Development (see Viewpoint 11, described from paragraph 4.158).

Landscape Designations

4.82 The European Landscape Convention (2000) requires member states to recognise that all landscapes can have value, and that the perception of value may vary from person-to-person. Statutory designations are one of the criteria used to assess the significance of effects on landscape character and visual amenity in an objective manner. Whilst it is recognised that all landscapes have some subjective importance, particularly for those who live and work in them, or use them for leisure purposes, designation gives an indication of a landscape's 'value to society'. Landscapes are designated by statute, and policies for their protection, use, and management are included in Development Plans, usually following a consultation process (which seeks to reach a consensus opinion, thereby reducing subjectivity). The national, regional and local designations that have been identified as being relevant to the landscape and visual character of this Study Area are described in the following paragraphs and illustrated in Figure 4.1.

4.83 Statutory landscape designations are contained within the current planning policy and guidance which cover the Study Area. The primary designated landscape within the Study Area is the Sperrin AONBs and policy guidance in relation to this designation is contained within the SPPS, PPS 18 and SPG which are described in the preceding paragraphs. The nature of the AONBs and the effects of the Proposed Development on these are analysed below. Other statutorily designated landscapes within the Study Area are analysed in subsequent paragraphs. As noted previously the draft Local Development Plan Strategy is at too early a stage for its proposed policies to be afforded weight.

Sperrin Area of Outstanding Natural Beauty

4.84 AONBs are the principal landscape conservation designation in Northern Ireland. The designation gives statutory recognition to the high scenic quality and distinctive landscape character of an area and the need to ensure that sensitive conservation measures take place to preserve these qualities alongside measures to allow public access and enjoyment of the area. The needs of local communities, including their social and economic well-being, is a key management objective for all AONBs, although development deemed to be detrimental to environmental quality is not permitted by the SPPS and supporting PPSs. The landscape around AONBs also performs an important function by providing context, particularly in views to and from the AONB and from key approach routes. This is a key consideration in relation to the landscape and visual effects of the Proposed Development.

4.85 Sperrin is the largest AONB in Northern Ireland, covering 118,206 hectares, and was one of first to be designated in 1968. In 2008 it was re-designated to increase its boundary slightly in most directions to encompass areas around its previous boundary which share similar scenic qualities. The majority of the AONB falls within this Study Area.

4.86 Overall, the landscape character of the AONB comprises broad rounded mountains and high plateaus dissected by narrow glens and lowland moorland. The landscape is often relatively remote and sparsely populated with little access via roads or footpaths, but the fringes and valleys between upland areas are less remote and more strongly characterised by human influence as evidenced by areas of forestry, primary and secondary road corridors, agricultural land and small towns and villages.

4.87 Its landscape characteristics, including their potential sensitivity to the Development, and the potential nature, or Magnitude of effects, on this AONB are described below. The sensitivity, magnitude, and significance of visual effects on receptors located within the AONB are described and analysed in the assessment of Visual Effects. All representative viewpoints considered as part of the visual assessment are located either within or on the periphery of the AONB. The AONB boundary is shown on all map-based figures that accompany the LVIA (Figures 4.1 – 4.8).

4.88 There is currently no published Management Plan for the Sperrin AONB, the like of which does exist for other AONBs in Northern Ireland. Therefore, specific information on the Sperrin AONB has been gleaned from a number of other sources including: the NIEA website, which contains a brief and general summary; the Northern Ireland Landscape Character Assessment series, which provides fairly detailed information on landscape and visual character of the various parts of the AONB; and the Supplementary Planning Guidance to PPS 18 (SPG) which provides further analysis of this character specifically in relation to wind energy developments.

4.89 However, reference was also found online to reporting on a project called the 'Sperrins Partnership' by the Leisure and Development Committee of Causeway Coast and Glens Borough Council in September 2023[4] where the allocation of funding and joint initiatives between four District Councils to support the development of a Management Plan for the Sperrins and the appointment of a Project Officer to oversee this work was discussed. It is understood from the minutes of this meeting that a final draft Management Plan will be submitted to NIEA by the end of November 2024, with a draft Action Plan to follow by the end of January 2025.

4.90 The primary means of access for visitors to this AONB is by road. There are four scenic driving routes on parts of the secondary and tertiary road network in this AONB

[4] https://www.causewaycoastandglens.gov.uk/uploads/general/230919_LD_Item_7_-_Sperrins_Partnership_Project.pdf

which allow visitors to appreciate many parts of the AONB and its various amenity sites and visitor attractions. The majority of these tend to be in lower lying rather than upland parts of the AONB which are generally less accessible. The Central Sperrin Scenic Drive is a 90-mile-long route which passes near the Development. The National Cycle Network also covers small parts of the tertiary road network between Plumbridge and towns in the west of the Study Area, and around Gortin and Davagh Forest in the southern part of the AONB. The Ulster Way is primarily located in the north eastern part of the AONB around Benbradagh and across the centre of the AONB in the Glenelly Valley. There are very few footpaths providing access to the highest summits in the heart of the AONB. Scenic drives, cycle routes and footpaths have been taken cognisance of in the viewpoint selection process. The majority of Provisional Viewpoints (PVPs) were identified within the Sperrins AONB (Technical Appendix 4.4 and Figure 4.4) and all viewpoints which have been selected for more detailed analysis in this LVIA are either located within or on the periphery of the AONB. However, the Zone of Theoretical Visibility diagrams (ZTVs, Figures 4.5 – 4.8) indicate very limited visibility of the Proposed Development in the AONB as a whole and several of the viewpoints serve to illustrate this lack of visibility even at relatively close range.

4.91 The descriptions of the fifteen LCAs that are located within the Study Area and AONB boundary provide the most detailed information on landscape and visual characteristics of the various parts of the AONB. The Proposed Development is located just west of the centre of LCA 29 Sperrin Mountains which forms the core part of the AONB. This is analysed in detail starting at paragraph 4.97. Parts of LCAs 26, 28, 30 and 36 also fall within AONB and the ZTV for the Proposed Development and a summary of their Value and Sensitivity to the Proposed Development is included in Technical Appendix 4.3. Other LCAs which cover other parts of the AONB were found to contain few to no views of the Development. They have not been analysed further for this reason. The location of all LCAs is shown on Figure 4.3.

4.92 It is recognised that the proposal is within the AONB and that the site has merit in terms of its contribution to the AONB's landscape and visual character. The layout and position of the Proposed Development has therefore been designed to minimise its effect on the AONB as a whole. This has been achieved by locating the turbines on parts of the site where the surrounding landform will provide substantial levels of screening from the AONB's core area because this contains the majority of visitor attractions and key landscape features such as the highest summits centred on Sawel Mountain and the Glenelly Valley, and attractions such as Gortin Glen, the Ulster American Folk Park, An Creagan Visitor Centre and Beaghmore Stone Circle[5]. It is also in a location that is neither prominent nor highly visible from the majority of the AONB nor from other parts of the Study Area with good views to the AONB's core.

[5] https://exploreomaghsperrins.com ; https://discovernorthernireland.com/explore/the-sperrins/

4.93 The proposed site is used primarily as grazing land and there is an area of forestry immediately to the south, which is a land use that the NILCA identifies as the most detrimental force of landscape change in this LCA. Elsewhere in the AONB quarrying is also identified as a detrimental activity. The nearest quarry is visible to the south-west of the B48 approximately 5 km from the Development. There is also a single turbine prominently located on the skyline above this quarry and visibility of the Owenreagh cluster of wind farms beyond this.

4.94 There is a pattern of clustering wind farm developments on upland areas around the periphery of the AONB and along the uplands which continue northwards into the Binevenagh AONB. The Proposed Development would be visually distinct and physically separate from any established clusters of turbines and would also be located more closely to the core of the AONB than other wind farms. However, the position of the proposed turbines on slopes which face the outer edges of the AONB rather that the centre means that it would also be visually and physically distinct from the majority of the AONB, including the central part. Neither is it in proximity to any visitor amenity facilities that are likely to attract the most sensitive receptors – the main tourist attractions tend to be located within the core of the AONB and look inwards rather than outwards into the surrounding countryside. The Proposed Development would also be less detrimental to the overall landscape character of the AONB than forestry or quarrying because it will not have permanent presence. Whilst forestry and quarry both leave permanent marks on the landscape, wind farms are considered to be long term temporary rather than permanent developments which will ultimately be removed, and the sites reinstated back to their previous uses. There are four scenic driving routes which offer a series of visual experiences and links to points of interest throughout the landscape in and around the edges of the AONB. All these routes feature views towards existing and consented clusters of wind farms in other parts of the Study Area but, whilst part of the Central Sperrins Scenic Drive passes close to the west of the Proposed Development, the ZTV diagrams indicate that it would not be clearly visible from many points along this drive.

Other Statutorily Designated Landscapes in the Study Area

Register of Historic Parks, Gardens and Demesnes

4.95 The Register identifies sites that are considered to be of exceptional importance within Northern Ireland, which have historic significance, and which may also contribute to local landscape character. It is maintained by NIEA Built Heritage. Inclusion on the Register affords sites protection through the SPPS and Planning Policy Statement 6 (PPS6)[6] which requires NIEA to make comment on the protection of such sites as part of the planning consultation process. The SPPS states that permission would not be granted for development that would harm the overall character of site's

[6] Department of the Environment (March 1999) 'Planning Policy Statement 6: Planning, Archaeology and the Built Environment'

integrity, overall quality or setting and its contribution to local landscape character should be maintained where possible.

4.96 There are several registered sites located within the Study Area particularly on the edge of settlements. Baronscourt and Gortin are the nearest locations and there are other sites at Park and Strabane. However, none are likely to have views of the Proposed Development due to screening factors such as surrounding built development, high levels of tree cover and flat topography in low lying areas. For these reasons, Registered Parks, Gardens and Demesnes are not considered to experience potential effects resulting from the Proposed Development and are not considered further in this LVIA.

Non-Statutory Landscape Classifications

The Northern Ireland Landscape Character Assessment

4.97 The NILCA classifies the landscape of Northern Ireland into six broad regions and 130 smaller areas of distinct and separate character termed Landscape Character Areas (LCAs). The SPG provides further broad guidance on these regions and LCAs including the overall sensitivity of LCAs specifically in relation to wind energy developments. The descriptions of landscape and visual character in this LVIA are based on the SPG which itself reiterates information contained within the NILCA. They are also inextricably linked to the description of the key characteristics of the Sperrin AONB and some elements of the subsequent LCAs have already been analysed in the preceding sections.

4.98 The SPG accompanying PPS 18 provides further broad guidance on the LCAs that are defined in the NILCA, including their overall sensitivity, specifically in relation to wind energy developments. Broad landscape and visual character issues to be considered in relation to wind farm development in the North West are provided in section 3.3.2 of the SPG:

- Effects on certain skylines, separation distances and thresholds of wind energy developments on specific ridge lines, all of which are located in excess of 20 km from the Proposed Development and from which the Proposed Development is likely to be significantly intervisible with and are therefore not considered to be of relevance to this LVIA. It is also noted that the term threshold is not quantified in the SPG or in any related policy or guidance documents as far as we are aware;
- Effects on the wild character of some landscapes, and effects on the landscape character, scenic value and setting of the Sperrins of any development in the Sperrin Foothills and Carrickmore Hills LCAs. The Proposed Development is not located within either of these LCAs but it is adjacent to the southern side of the Sperrin Foothills and would be visible from some parts of this LCA. The visual effects of this are considered in the analysis of Viewpoints 5, 16 and 17 which are in this part of the Study Area.

- The Proposed Development is also located within the Sperrin LCA which could be described as wild, although this author notes that true wildness is not an accurate description of the open moorland within the Sperrins which has been formed and maintained by agricultural practices/ human influence over centuries. Furthermore, the ZTV indicates limited visibility within the Sperrin LCA as whole or the wider AONB. Potential landscape effects on the setting and scenic value of the Sperrins are analysed from paragraph 4.84. Visual effects are analysed from paragraph 4.123;
- Effects on transport corridors and important tourist routes including the A5, A505 and A6 which are located within this Study Area, approximately 15 km from the Proposed Development. Visibility of the Proposed Development from these distances is limited and, in most cases, restricted by topography. Viewpoint 14 has been selected to represent they typical nature of views from the A5 and A505. No viable viewpoints were identified along the A6;
- Visual effects on the Erne Lakelands and cumulative effects with trans-boundary development in Co. Donegal are issues that are not deemed to be of relevance to this LVIA because both issues fall well outwith the geographical coverage of this Study Area.

4.99 General and area-specific principles for the layout, siting and design of wind farms are provided in section 3 of the SPG. Of relevance to the Proposed Development are:

- Adequate and appropriate spacing depends on landscape character, including pattern and rhythm, and the degree of intervisibility between wind farms. It is necessary to maintain areas of undeveloped landscape between wind farms to prevent a landscape becoming dominated by them, although the SPG also recognises that clustering wind farms together may also be an appropriate means of creating coherent groups of turbines. The Proposed Development maintains adequate separation distances between the nearest wind farms to it which are at Owenreagh approximately 7.6 km to the west and Bessy Bell approximately 17.6 km to the south west;
- Small turbine groupings are likely to fit best in small scale and more intricate landscapes. Landscapes with a strong horizontal form are more likely to accommodate larger groupings, such as that of the Proposed Development. The turbines wrap around the mid and upper slopes on the northern and north western sides of the hill in a double staggered row and broadly reflects the underlying contours. The elevation of the site in relation to the higher uplands which surround it mean that the turbines will often be concealed from views or seen within the wider landscape context;
- The turbine layout is simple and coherent and would not be directly comparable to any other wind farms near it which is reflective of the principles in the SPG;

- The SPG notes that the central part of upland areas will often be the least visible from adjoining lowland landscapes but in this case the central part of the uplands are the most sensitive because they form the heart of the Sperrin AONB. The bowl-shaped nature of the topography in the AONB means that locations around the edge of these uplands are likely to be less prominent because the rising topography will screen them from the central parts of the AONB. The SPG also advises that less prominent side slopes are often better to minimise the prominence of turbines and the Proposed Development has been located in accordance with this principle. This is apparent, for example, in Viewpoint 16 where the position of the Proposed Development on an 'outward-facing' side slope can be appreciated (see Figure 4.25);
- Sites characterised by heather moorland and bog are described as having a wilder character but sites containing forestry and improved grassland are regarded as being of less sensitivity. The Proposed Development is located adjacent to an area of forestry and land use on site is currently rough grazing. Proximity to scale indicators such as lines of forestry is noted as having the potential to increase apparent turbine heights but this is unlikely to be the case here and this is apparent from many of the shortlisted viewpoints. Also, in relation to Viewpoint 6 (Figure 4.15) the screening effects of this forestry from close range viewpoints located to the south of the Proposed Development can be appreciated;
- Commercial forestry also introduces a man-made influence on landscapes that may otherwise seem natural, thereby reducing sensitivity. There are large expanses of coniferous forestry across many parts of the uplands in the Study Area. The landscape within the Study Area is also influenced by other man-made elements including quarries, television aerials, roads, and clusters of existing and consented wind farms;
- Sites should relate well to the broad grain of the topography and not distract from or obscure important character distinctions such as the transition between uplands and lowlands. The Proposed Development is a relatively neat and compact layout that reflects the character of the hill on which it is located, and which is also positioned on the outward-facing side slopes of a hill located at near the western edge of the Sperrin LCA.
- Siting should respect landscape settings and skylines, particularly those around distinctive landform features, settlements, historic landmarks, and areas designated for scenic quality. The Proposed Development would be clearly visible from some parts of the secondary road network around the settlements of Plumbridge and Gortin but would occupy a relatively small proportion and lower elevation than the wider expanse of mountains which define the setting of these parts of the Study Area. It would not be clearly

visible from Plumbridge itself, as illustrated by Viewpoints 7 and 10 (Figures 4.16 and 4.19);

- Prominent and highly visible skylines, for example at the edge of upland areas, as well as significant effects on key views from important viewpoints and popular scenic routes should be avoided. The Proposed Development is located at the edge of an upland area but not on a prominent or highly visible skyline. Key viewpoints and scenic routes were analysed as part of the Viewpoint selection process (Technical Appendix 4.4) and viewpoints located on some scenic driving routes in the AONB and along the A505 have been selected as viewpoints;
- Landscapes that do not form distinctive backdrops tend to be less sensitive. There are a number of summits and uplands within the Study Area which all have very distinctive profiles and which combine with each other to form a distinctive crescent-shaped profile of uplands that extends across much of the Study Area to provide a backdrop to the lowland parts of the Study Area and the settlements located within it (see Figure 4.1). The Development's position on the outward rather than inward-facing side slope of a hill towards the western end of the Sperrin LCA means that it does not make a prominent contribution to the overall Sperrin range or to the function of this expansive sequence of uplands as a distinctive backdrop to the Glenelly Valley in particular.
- Other principles of the SPG to which the Proposed Development conforms include: forming a coherent group of turbines with relatively consistent heights and spacings; minimising the overlapping of turbines; few instances where only the blades of turbines would be visible and would create a distracting image below upland edges; utilising a site that has a network of existing tracks and access points and is characterised by human influence and land uses.

4.100 There are twenty-four Landscape Character Areas (LCAs) within the Study Area. They are illustrated on Figure 4.3. The Proposed Development is located within LCA 29 Sperrin Mountains and would therefore have a direct physical effect on small part of this area, which is described in detail below. The Proposed Development may also have a potential indirect effect on the setting of parts of a further 4 LCAs which are in close proximity to it, or which contain viewpoints used in this LVIA. These LCAs are listed in Appendix 4.3. There are 19 LCAs within the Study Area which have not been assessed in detail because, following the Baseline Assessment and site surveys, they are unlikely to be significantly affected by the Development. LCAs on the periphery of the Study Area and the ZTV, and those which do not contain viewpoints have not been subject to a detailed assessment. These LCAs are also listed in Appendix 4.3. The ZTVs are illustrated in Figures 4.5 – 4.8.

Landscape Character Area 29: Sperrin Mountains

4.101 The SPG's assessment of the Sperrin Mountains LCA, within which the Proposed Development is located, briefly summaries its landscape characteristics, defines its overall sensitivity to wind energy and its capacity to accommodate certain turbines groups and heights.

The SPG's description of Key Landscape and Visual Characteristics and Values

4.102 The SPG describes the Sperrin Mountains LCA as dramatic east-west spine of mountains running across the North West of Northern Ireland. The ridges have a broad rounded profile whilst the summits often have rocky pointed profiles averaging 500m in height and rising to 678m at Sawel Mountain which is the highest summit, and which is located approximate 8.6 km to the north east of the Development. The lower slopes are often softened and broken up by mounds and terraces formed by glacial deposits with deep branching gullies and streams in the lower valley areas between the mountains. The LCA is generally open and exposed with some areas of coniferous forestry. Summits have extensive areas of bog and heather moorland and stone walls which follow historic townland boundaries. The lower valleys often retain a historic agricultural field pattern divided by earth banks, hedgerows, and stone walls with a patchwork of broadleaved woodland.

4.103 The SPG notes man-made influences in this LCA as being localised and including a wind farm at Owenreagh, conifer plantations prevalent in the eastern section and at Banagher Forest forming dark geometric blocks on slopes and a number of quarries. It is also noted that there are other areas of forestry directly to the south of the Proposed Development and around the lower slopes of Owenreagh to the west and large areas of forestry in adjoining LCAs within the AONB. There are also clusters of wind farms located in several of the LCAs surrounding the Sperrin LCA which combine to form the AONB and its setting (see Figures 4.1 and 4.4).

4.104 Whilst there are many prominent ridge lines in this LCA the skyline in the western[7] part of the LCA is described as being generally lower and more broken with the main skyline features including Knockavoe and Owenreagh Hill as well as other smaller individual hills. To the east the ridge broadens and increases in height. It is noted that Knockavoe and Owenreagh are in fact located in the western section of the LCA and it is assumed therefore that the increase in ridge height is located to the east of these hills and towards the middle and eastern side of the LCA where they conjoin with the adjacent uplands of Binevenagh and Glenshane. This LCA forms the wider setting for surrounding towns including Strabane to the west, Dungiven to the north east and Draperstown to the south east. The LCA is also described as iconic feature in south and westward views from the A6 road corridor and views east from the A5 near Strabane but there would be limited visibility of the Proposed Development from these locations.

[7] It is believed that page 119 of the SPG mistakenly refers to Owenreagh being in the east and an increase in height in the west.

4.105 The Proposed Development site is located approximately 8.6 km from the highest parts of the LCA at its nearest point and also approximately 1.46 km from the summit of Mullaghclogher mountain. The summit, although meeting the SPG's description of being open and exposed with some coniferous forestry, is lower than the series of neighbouring summits (Sawel Mountain is at 678 m AOD, Dart Mountain is 619 m and Mullaghclogha is 635 m AOD). Owenreagh, which terminates the western end of this spine of hills, is 400 m AOD. The turbines in the Proposed Development would be located at heights ranging from 245 m – 486 m AOD.

The SPG's description of Landscape Value of LCA 29: Outstanding

4.106 The SPG describes this LCA as a stunning mountain landscape of very high scenic quality which forms the heart of the Sperrin AONB and which represents wildness more strongly than any other part of Northern Ireland apart from the Mourne Mountains. The scenic quality is noted as being a key attraction for tourists and walkers although much of the LCA is also described as being remote and inaccessible. However, despite the lack of formal footpaths over the higher upland areas there are some waymarked trails available via tourist publications and marked in some locations within the LCA. The Glenelly Valley and Sperrin Foothills LCAs which lie adjacent to the Sperrin Mountains are easily accessible by road and there are small towns and villages located around its boundaries so, although the SPG describes the landscape character as wild, there are no parts of the LCA that are located any great distance from areas of settlement or that are not influenced by human land uses. Visitor attractions and cultural heritage sites tend to be located in and around the network of tertiary roads.

4.107 The physical condition of the landscape does not match its scenic quality. The historic field pattern on lower slopes has become derelict and overgrown with rushes and scrub in areas where poor soils have resulted in an abandonment of agricultural practices. Coniferous plantations throughout various parts of the LCA, including one directly to the south of the Proposed Development, are also visually detractive man-made features.

4.108 A more detailed consideration of the proposed site in relation to the overall description of this LCA has concluded that it is in relatively good physical condition and is managed primarily for rough grazing with shelter belts of coniferous forestry and farm access tracks. It is located at the north eastern edge of this LCA but does not conform to the SPGs description of this side of the LCA increasing in ridge height. The site itself is a distinct and lower rounded hill backed by higher ground. There are rural properties along many parts of the tertiary road network around the base of the hill and it has a closer physical relationship to the adjoining Roe Valley LCA than the main Sperrin mountain range. It is in relatively close proximity to Banagher Forest and forms part of the setting for this amenity landscape but it does not contain any visitor amenity facilities itself.

The SPG's description of Landscape Sensitivity to the Proposed Development

4.109 The SPG states that overall sensitivity to wind energy development in the Sperrin Mountains LCA is high because it lies at the heart of the Sperrins and whilst "*the scale and landform of at least parts of the area are in theory well-suited to wind energy development*" there are a number of factors that the SPG notes as making it, in practice, unsuitable, including:

- The sheer visual prominence of the Sperrin Mountains over a wide area of Northern Ireland;
- Its value as an iconic landscape of immense appeal for tourism and recreation;
- Its core landscapes being highly sensitivity to any wind energy development;
- Its strong wild character;
- Its many natural and cultural features which are highly vulnerable to wind energy development.

4.110 The Proposed Development is not, however, located to meet these criteria and the site is therefore deemed to meet the SPG's initial statement of being well-suited to wind energy development for the following reasons:

- It is not visually prominent either as part of the Sperrin Mountain LCA, the Sperrin AONB as a whole or across other parts of Northern Ireland. This is clearly illustrated by the ZTV diagrams and supported by detailed site assessment. The ZTV indicates theoretical blade tip visibility of the Proposed Development in approximately 35.36% of the total area covered by the AONB;
- The site is a small part near the western end of the LCA with no formal public access. Access and enjoyment of other tourist and visitor amenities within the LCA would not be affected by the Proposed Development and it would have both limited and indirect effects on the physical landscape or visual character of the Glenelly Valley, the majority of scenic driving routes, footpaths and the cycle network within the AONB, and visitor sites such as the Ulster American Folk Park, An Cregan and Gortin Glen;
- The Proposed Development is located on an outward-facing slope near the western end of this LCA rather than facing inwards toward the core area and would have limited effects on the landscape character in the core;
- The Proposed Development would have a negligible effect on the majority of natural and cultural features within this LCA.

The SPG's description of Key Location, Siting, Layout and Design Considerations

4.111 The Proposed Development meets the locational criteria of the SPG, specifically:

- The turbines are sited on the side slopes of a hill where they would be seen either against a backdrop of land or in the context of a wider expanse of higher uplands. This also avoids significant effects on the physical landscape character of skylines within and this LCA and the wider AONB;

- Significant effects on key views within the LCA are avoided. The SPG notes that these include locations from where the mountains and valleys which characterise the LCA can be obtained, and this is most likely to occur from elevated locations within and surrounding this LCA, including from locations along the Glenelly Valley, the A5 and A6 from where the Proposed Development would have very limited visibility;
- The Proposed Development has a small compact and coherent turbine layout which reflects the underlying topography of the hill on which it is located. It has a secondary and subservient position within the wider range of uplands within the LCA;
- The SPG notes the presence of a cluster of existing and consented wind farms at Owenreagh Hill at the western end of this LCA and on Bessy Bell Hill and in County Donegal to the south and west of this LCA at distances of 15 km – 25km. Since the publication of the SPG there have been a number of other wind farms constructed and consented throughout the Study Area. Clusters of wind farms are a commonly occurring characteristic around the peripheries of the Sperrin AONB. All the ranges of hills in the Study Area also contain clusters of existing and consented wind farms and single turbines. Whilst there are sufficient separation distances between these clusters to ensure they are not the dominant characteristic they do form part of baseline landscape character throughout the Study Area. This development reflects both policy and the general advice provided in the SPG that elevated upland landscapes can better accommodate turbines and the broader the upland the greater the capacity.

4.112 It is noted that the general principles contained within the SPG are broadly supportive of wind energy development and the Proposed Development is also located in accordance with the majority of the landscape and visual character issues that the SPG notes should be considered for wind energy developments within the North West region. There are a number of LCAs which combine to form the AONB and these are assessed by the SPG as being of much the same sensitivity to wind energy development as LCA 29 within which the Proposed Development would be located, but which also contain existing or consented wind farms. For example, the Sperrin Foothills cluster of wind farms is located in LCA 30 which the SPG describes as being of high sensitivity because it provides the foreground to some of the most important views of the Sperrins, contains a cluster of wind farms in a location specifically refers to as highly sensitive but which has subsequently received consent for several wind farms, all of which are operational. In relation to LCA 26 Bessy Bell and Gortin the SPG regards sensitivity to be increased by the area's popularity for outdoor recreation (a factor that does not apply to the Proposed Development) but decreased by the presence of the existing Bessy Bell wind farm. In the same respect, sensitivity of the Proposed Development site is not increased by recreational amenity but may be regarded as being reduced by the presence of single turbines and the existing and consented cluster of wind farms at Owenreagh.

4.113 There are 19 LCAs within the Study Area which have not been assessed in detail because, following the Baseline Assessment and site survey, it is concluded that they are unlikely to be significantly affected by the Proposed Development. In particular, LCAs and SCAs on the periphery of the Study Area and the ZTV, and those which do not contain viewpoints have not been subject to a detailed assessment. These LCAs are also listed in Appendix 4.3 and illustrated in Figure 4.2. The ZTVs are illustrated in Figures 4.5 – 4.8.

Other Non-Statutory Landscape and Visual Classifications

4.114 A review of other relevant non-statutory landscape and visual classifications has also been carried out as part of this LVIA. These classifications identify landscapes or elements within the landscape which have no statutory protection but that are nevertheless recognised as having value by virtue of being marketed as visual attractions or identified in non-statutory documentation within the public realm. These classifications are illustrated on Figure 4.1. Information is drawn from a number of websites[8] providing relevant descriptive information which is used in conjunction with Ordnance Survey maps to plot the locations of visitor attractions including the Ulster Way, National Cycle Network, and scenic drives in the Study Area and to aid the selection of viewpoints (Figure 4.4).

Rights of Way, Cycle Routes, and Scenic Drives

4.115 The Ulster Way is a 1000 km long circular walking route which covers the most scenic parts of Ulster. It is divided into 'Quality Sections', which provide largely off-road way-marked access for walkers in highly scenic areas, and 'Link Sections', which are mainly along roads and are not generally way-marked. A largely 'Quality' section of the Ulster Way tracks along the uplands which sweep in a broad crescent-shaped arc from the summit of Binevenagh at the northern edge of the Study Area, along the series of summits and plateaus to the summit of Benbradagh, which is located in the north east of the Study Area. The route then joins the tertiary road network into Dungiven and crosses the A6 road corridor and largely follows the secondary and tertiary road network into the heart of the Sperrins AONB through the Glenelly Valley in the centre of the Study Area. There is an alternative off-road route through Glenshane and Moyladamlaght Forests in the east of the Study Area and another off-road section through Gortin forest to the south west.

4.116 At its nearest point the Proposed Development is located approximately 6 km to the north of the Ulster Way at Barnes Gap and Craignamaddy Circuit which also forms part of the International Appalachian Trail. There would be no visibility of the

[8] www.walkni.com; www.visitcausewaycoastandglens.com; www.causewaycoastandglens.gov.uk; www.cycleni.com; www.sustrans.org.uk

Proposed Development from much of the road section which overlooks the Glenelly Valley due to the screening effects of higher summits between. There would also be very limited, if any, visibility of the Proposed Development from most other parts of the Ulster Way. Overall, the Proposed Development is not deemed to have a significant effect on the appreciation of views or the physical character of most parts of the landscape through which the Ulster Way passes.

4.117 The National Cycle Network provides cyclists with marked scenic routes across the province. Within this Study Area there are routes linking the Sperrin Foothills to the Roe Valley; around the Glenelly Valley in the central and south western parts of the Sperrin AONB; and along the western side of the Study Area linking Omagh to Derry. Similarly to the Ulster Way there would be limited, if any, visibility of the Proposed Development from most other parts of the cycle network and the Proposed Development is not deemed to have a significant effect on the appreciation of views or the physical character of most parts of the landscape through which the cycle network passes.

4.118 There are several scenic driving routes which are signposted on roads within the Study Area, of which three are in the Sperrin AONB and which are intended to provide visitors with marked routes from which to experience a range of sites of interest, visitor attractions and the scenic qualities of the Sperrins. The East, North and Central Sperrins scenic driving routes were considered in the selection of PVPs. The ZTV and preliminary site surveys indicate very little visibility from the Central or East routes, but several Viewpoints have been selected along parts of the Central route. Information on the routes and points of interest can be access via the website www.discovertyroneandsperrins.com.

Summary of Landscape Effects

4.119 The Proposed Development is located within LCA Sperrin Mountains, much of which is of outstanding value due to its location within the Antrim Coast and Glens AONB. The Proposed Development would be located in the south western side of the LCA on a lower, north to north west-facing slope and would have no discernible physical effect on the majority of the LCA or its key characteristics. There are several busy secondary road corridors, areas of forestry, quarries and a number of single turbines located in proximity to the Proposed Development and a repeating pattern of wind farm clusters surrounding the AONB which are all established manmade elements of the landscape character.

4.120 Whilst the Proposed Development would have a direct and significant physical effect on the part of the Study Area and LCA 29 within which it is located, the magnitude of change would be medium because the Proposed Development is located on an outward-facing slope, is not visible from the majority of the core part of the AONB, including the Glenelly Valley and South Sperrin range of uplands. The site of the Proposed Development has no recreational amenity functions, which the SPG notes would increase landscape and visual sensitivity. It is also positioned within a Study

Area where existing and consented wind farms and single turbines are already a defining feature of landscape character. There is also an area of forestry immediately to the south of the Proposed Development which is noted by the SPG as being a visually detractive feature and, in relation to its description of other LCAs where forestry occurs, the SPG note that its presence serves to lessen the sensitivity of parts of this LCA where it occurs. For these reasons the physical landscape character of LCA 29 is deemed to be sufficiently robust and capable of absorbing some degree of change without affecting its overall landscape character and the overall effects on the character of LCA 29 are not deemed to be significant.

4.121 The Proposed Development may have indirect effects on the landscape character of some other parts of the Study Area amounting to small areas within four other LCAs which are in proximity to it, or which contain viewpoints used in this LVIA. However, there are unlikely to be any discernible effects on their physical landscape character resulting from the Proposed Development. These LCAs are listed in Appendix 4.3 Table 4.3.1 and illustrated in Figure 4.2. Visual effects from locations within these LCAs are analysed in relation to visual rather than physical landscape character effects.

4.122 In relation to these other LCAs the magnitude of effects resulting from the Proposed Development would range from medium to negligible. Sensitivity would range from high to negligible depending on whether the LCAs would be located in relatively close proximity to the Proposed Development or at a greater distance and to what extent existing and consented wind farms define the physical landscape character of these LCAs and their settings (see Technical Appendix 4.3 table 4.3.1). However, in no instances are the physical effects on landscape character deemed to be significant.

Baseline Visual Character Assessment and Analysis of Effects

Visual Character of the Study Area

4.123 The visual characteristics of the Study Area are intertwined with the landscape characteristics described by the various policy and guidance documents and other publications which provide baseline information about the Study Area. Therefore, many visual characteristics have already been referred to in the previous section of this LVIA and are not repeated. However, they are summarised in relation to their visual as opposed to physical expressions.

4.124 The Proposed Development is in the central western part of the AONB and the majority of the AONB is located within the Study Area, filling the central and eastern side, and occupying approximately half of the 30 km Study Area.

4.125 Areas beyond the AONB cover the northern side of the Study Area beyond approximately 12 km from the Proposed Development and are both physically and visually separated from the central Sperrins by the north-facing side of the Sperrin Foothills.

4.126 To the west, beyond approximately 15 km are the towns of Lifford, Strabane, Sion Mills and Newtownstewart positioned within the agricultural lowlands of the Foyle and Derg river valleys which have a more complex topography and denser vegetation along road and river corridors and field boundaries, and hence relatively high levels of natural screening. They are also separated from the AONB by the western most summits around Owenreagh and Bessy Bell which provide the setting for these lowlands and visually screen any views from this part of the Study Area into other parts of the AONB. The far west of the Study Area extends slightly into Co. Donegal from which there may be views from elevated areas into the central part of the Study Area, including the Proposed Development, but at distances in excess of 20 km where the Proposed Development would be perceived as a very small element within expansive views across much of the western part of Northern Ireland.

4.127 To the south Omagh city also sits within an agricultural landscape bounded to the south, east and west by a series of uplands, and to the north by the outward facing uplands which enclose the core of the AONB, and which would prevent any clear views in the direction of the Proposed Development.

The Zone of Theoretical Visibility

4.128 ZTV diagrams have been produced at radii of 15 km and 30 km to illustrate visibility for both the maximum hub-height and blade-tip dimensions being considered for the Proposed Development (Figures 4.5 and 4.6) although the hub-height diagrams are for illustrative purposes only because the application is based on overall tip height only. Blade tip visibility ZTVs illustrate any parts of the Study Area where at least one blade tip would be theoretically visible without taking account of screening provided by contour variations within 50 m intervals or land cover elements such as trees and hedgerows. These show the highest potential levels of theoretical visibility but not necessarily the most realistic because blade tips are counted even where they protrude only a small amount above a skyline and, in practice, may not be easily discernible. This type of visibility will also change as the turbines rotate. Hub height ZTV diagrams are more realistic because they represent more constant levels of visibility by illustrating theoretical visibility of all points of the turbines to the hub/ nacelle, and therefore include the upper parts of the turbine blades as a minimum. Reverse ZTVs are included (Figure 4.7) to clearly illustrate areas where there would be no theoretical blade tip visibility.

4.129 The ZTV diagrams are the starting point for the baseline visual assessment and were initially used to assist the selection of PVPs. They illustrate the theoretical visibility and non-visibility of the Proposed Development as a standalone wind farm, unrelated to any others in the Study Area. The 30 km ZTVs clearly illustrate the manner in which the central part of the AONB is encircled and contained by uplands serves to effectively contain the majority of visibility of the Proposed Development within the central part of the Study Area and prevent visibility from the majority of the AONB to the south and east and the landscape along the northern and western edges of the

AONB. Some longer-range visibility (beyond approximately 15 km) of the Proposed Development is indicated from elevated landscapes in the northern and western parts of the Study Area but in practice this would be substantially reduced by distance from the Proposed Development and levels of intervening screening from vegetation, etc.

4.130 Within a 15 km radius from the Proposed Development 44.12% the Study Area is likely to have some theoretical hub height visibility of the Proposed Development but only a small proportion (9.64 %) would be of the Proposed Development in its entirety or near entirety (i.e. 9- 11 turbines, refer to Figure 4.5, page 1 of 2). This ZTV diagram illustrates that over half of hub-height visibility within 15 km is likely to be of 1 – 5 turbines. Visibility of a greater proportion of the proposed turbines would only occur from the northern side of the Study Area and would become more sporadic at greater distances.

4.131 There is relatively limited visibility indicated within the AONB as a whole. The 15 km ZTVs indicate that there would be virtually no theoretical visibility of the Proposed Development within a 15 km radius to the east, which is the part of the Study Area which forms the central part of the AONB, and very limited visibility to the south, which is also within the AONB. Within a 15 km radius from the Proposed Development overall visibility would increase to 52.57 % if blade tip calculations are used and visibility of 9 - 11 turbines would form 18.28 of this visibility but the majority of visibility would still be of a lesser number of blade tips (refer to Figure 4.5, page 2 of 2).

4.132 Within a 30 km radius from the Proposed Development hub height visibility would reduce to 30.73 % of the Study Area with only 4.96 % representing visibility of 9 - 11 turbines (refer to Figure 4.6, page 1 of 2). Visibility in all directions would become patchier beyond 15 km. Within a 30 km radius from the Proposed Development overall visibility would be 38.88 % if blade tip height visibility calculations are used with 11.5 % of this being visibility of 9 - 11 turbines (refer to Figure 4.6, page 2 of 2).

4.133 Figure 4.6 page 1 of 2 indicates that theoretical hub height visibility of the Proposed Development would occur across just 27.7 % of the AONB. Figure 4.7 page 2 of 2 indicates that theoretical blade tip height visibility would occur across just 35.36 % of the AONB. The majority of the AONB would experience no theoretical visibility of the Proposed Development, and many of the areas indicated as experiencing theoretical visibility would not be publicly accessible, would be located within areas of forestry or would also be in excess of 20 km where the Proposed Development is unlikely to be an easily discernible feature of views. Therefore, the Proposed Development would not affect the overall integrity of the AONB.

4.134 The reverse ZTVs (Figure 4.7) clearly illustrate the same points made above. It is noted that all the ZTV diagrams illustrate theoretical visibility and that levels of visibility would be further reduced in reality by topographical variations and land cover elements. Detailed site assessment indicates that tree and hedgerow cover along parts of the road network, including parts that are in close proximity to the Proposed Development and in the agricultural landscapes around river corridors to the west, and the coastal lowlands to the north would often prevent clear views in the direction of the Proposed Development. The acute angle of views from the Glenelly Valley that runs through the centre of the AONB is bounded by the main spine of mountains in the central Sperrins which also screen views in the direction of the Proposed Development and the uplands which bound the outer edges of the AONB have a similar screening effect on the wider Study Area.

Table 4.1 - Zone of Theoretical Visibility of the Proposed Development

ZTV Diagram	No. of turbines theoretically visible	% of Study Area with visibility	
15 km hub height Figure 4.5 (page 1/ 2)	**1 - 2**	**15.72 %**	**Total % of 15 km Study Area with theoretical hub height visibility = 44.12 %**
	3 - 5	**10.17 %**	
	6 - 8	**8.59 %**	
	9 - 11	**9.64 %**	
	0 turbines	**55.88 %**	
15 km blade tip Figure 4.5 (page 2/2)	**1 - 2**	**12.09 %**	**Total % of 15 km Study Area with theoretical blade tip visibility = 52.57 %**
	3 - 5	**8.36 %**	
	6 - 8	**13.84 %**	
	9 - 11	**18.28 %**	
Reverse blade tip Figure 4.7 (page 1/2)	**0 turbines**	**47.43 %**	
30 km hub height Figure 4.6 (page 1/ 2)	**1 - 2**	**13.29 %**	**Total % of 30 km Study Area with theoretical hub height visibility = 30.73 % Percentage of total AONB with visibility = 27.70 %**
	3 - 5	**6.98 %**	
	6 - 8	**5.50 %**	
	9 - 11	**4.96 %**	
	0 turbines	**69.27 %**	
30 km blade tip Figure 4.6	**1 - 2**	**11.58 %**	
	3 - 5	**7.37 %**	

ZTV Diagram	No. of turbines theoretically visible	% of Study Area with visibility	
(page 2/2)	6 - 8	8.58 %	Total % of 30 km Study Area with theoretical blade tip visibility = 38.88 %
	9 - 11	11.35 %	
Reverse blade tip Figure 4.7 (page 2/2)	0 turbines	61.12 %	Percentage of total AONB with visibility = 35.36 %

Viewpoint Selection Process

4.135 The Baseline Assessment identified parts of the Study Area most likely to contain key visual receptors, the potential sensitivity of either the location and / or the visual receptors likely to be present and those areas likely to experience visibility of the Proposed Development due to the theoretical levels of visibility indicated by the ZTV diagrams. This resulted in the selection of PVPs including:

- Locations within the Sperrin AONB because it is statutorily designated as nationally recognised high-quality landscapes and will attract visitors by virtue of this designation and contain various visitor amenity sites and attractions. Visual receptors present at these locations are likely to be highly sensitive;
- Residential properties and the rural road network in close proximity to the Proposed Development where viewers may either be static or obtain views for prolonged periods of time and where the Proposed Development may form a key element in these views;
- Areas of settlement where viewers may also be static and obtain views for long periods of time and where the landscape in proximity to the Proposed Development is likely to form a key element within the landscape setting for these settlements;
- Locations from public rights of way, scenic drives and cycling routes where viewers are likely to be present for the primary purpose of appreciating scenic views. Such locations include: the Ulster Way, International Appalachian Trail and other footpaths which cross the Study Area from north east to south west; the National Cycle Network; and four scenic driving routes which cover various parts of the Sperrin AONB and its setting;

- The primary and secondary road network taking visitors to, from and across the AONB, some of which are classified as scenic driving routes, and others which provide access to some of the key visitor attractions within the AONB.

4.136 These locations guided the selection of Provisional Viewpoints (PVPs). The initial desk-based selection of PVPs, including the selection criteria used, is described in Technical Appendix 4.4 and illustrated on Figure 4.3. Sixty-three PVP locations were identified and analysed through the production of a preliminary ZTV diagram. Draft wirelines for all these locations were prepared and checked by site visits to confirm the nature of receptors and potential visibility of the Proposed Development. These draft wirelines were used as working documents and are not reproduced in this LVIA but they were used to form a detailed understanding of the nature of visibility throughout the Study Area and to inform the selection or non-selection of PVPs as shortlisted viewpoints.

Final Viewpoint Selection

4.137 Following the initial assessment described above 19 Viewpoints were shortlisted for detailed analysis in the LVIA. They include a proportionate number of locations which are intended to be representative of typically occurring views within the Study Area, views experienced by key visual receptors, and also views from specific locations that merit inclusion in the LVIA by virtue of their contribution to the key landscape and visual qualities of the Study Area. The majority are located within approximately 10 km of the Proposed Development and all except one (Viewpoint 17) are located within to AONB (Viewpoint 17 being located just beyond the northern edge). There were very few viable viewpoints located beyond this distance or within the large proportion of the AONB. The locations of the final shortlisted viewpoints reflect the topography, land cover in the Study Area and the location on the Proposed Development in relation to the baseline landscape character, i.e. the ZTV. PVPs were not usually shortlisted if they were found to provide no actual view of the Proposed Development despite visibility being indicated by the ZTV. The reasons for this absence of visibility usually arose from differences between theoretical and actual visibility which is explained in Technical Appendix 4.2 (ES Volume 2). Other PVPs were not shortlisted if a more typical view was demonstrated elsewhere, where no safe stopping place was available to take photographs or where the viewpoint location would not be easily accessible to the public.

4.138 A detailed description of the methodology for viewpoint selection is included in Technical Appendix 4.2 starting at paragraph 4.23. A summary analysis of all PVP locations and the rationale for the selection of shortlisted viewpoints is provided in Technical Appendix 4.4, Table 4.4.1. The location of viewpoints is indicated on all map-based figures which accompany this LVIA chapter (Figures 4.1 - 4.8). Wirelines and photomontages of each viewpoint are also presented in Figures 4.10 - 4.27. These are intended to assist in the understanding of, but not to replace, the detailed written description of effects which are contained in subsequent paragraphs of this chapter. It is important to recognise the limitations of visualisations and this is further described in Technical Appendix 4.2 from paragraph 4.41. They should not be relied upon as the primary means to determine visual effects and it is expected that all locations will be visited by the decision-maker and any interested third parties to be fully understood.

4.139 In the analysis of visual effects cognisance is also taken of the SPPS and PPS 18: BPG. These policy and guidance documents note that whilst wind farms are, by their nature, highly visible and are likely to be relatively prominent at distances of up to 5 km, this does not necessarily preclude them from being acceptable features. The choice of viewpoints is intended to represent the way the Proposed Development is experienced when travelling around the Study Area and not just from locations in close proximity where it may naturally be expected to be clearly visible. To this end, a series of viewpoints have been selected to represent longer range views within and around the AONB in recognition of its potential sensitivity. These locations tend to illustrate the visibility of the Proposed Development in the context of wider views across the AONB and the Study Area and the way the Proposed Development would affect these views.

4.140 For ease of analysis the shortlisted viewpoints have been categorised as follows so that the different types of views, receptors, and specific areas they represent can be accurately described and understood without unnecessary repetition:

A. Locations representing close and medium-range views in the Sperrin Mountains and Foothills to north and west of the Proposed Development;
B. Locations representing views from the Glenelly Valley, Plumbridge and environs;
C. Locations representing views from the southern part of the Sperrins around Bessy Bell and Gortin;
D. Views representing longer range views of the Development from south-facing parts of uplands containing the northern edge of the AONB;
E. Locations representing views of the Development from the eastern edge of the Sperrin AONB;

Category A: Locations representing close and medium-range views in the Sperrin Mountains and Foothills to north and west of the Proposed Development

Description of Existing Views

4.141 Category A includes Viewpoints 1 – 5. They are illustrated in Figures 4.10 – 4.14 and have been selected to represent the range of typically occurring views from settlements, rural properties, and the secondary and tertiary road network within a radius of approximately 5 – 8 km where the Proposed Development may be expected to be either prominent or clearly visible. Views of this nature occur primarily to the north and west of the Proposed Development on the lower lying side slopes and upland areas located between the higher summits of the main Sperrin range to the east and the Owenreagh hills to the west. This Category includes the B48 road corridor at its nearest point to the west of the Proposed Development where it forms part of the Central Sperrins Scenic Drive.

4.142 A number of other PVP locations have not been shortlisted but would experience similar types of views. These include p2, p19, p41 – p44, p46 and p52. The reasons these have not been shortlisted in favour of the above viewpoints is provided in Appendix 4.4 but these locations offer similar views to those represented by Viewpoints 1 – 5 which is indicative of the representative nature of the latter. Whilst some are located on parts of the road network where traffic is too fast-moving to allow receptors to pause and appreciate views, the existence of a scenic driving route means that receptors on some roads in this part of the Study Area are still regarded as being highly sensitive because they are likely to be present primarily for the scenic quality of the area.

4.143 Viewpoint 1 is located approximately 3.1 km from the Proposed Development slightly to the west of the B48 on the lower slopes of Balix Hill and Crockour which physically and visually contain views in the opposite direction to those illustrated in Figure 4.10. These hills form the east-facing side of the Owenreagh outcrop of hills at the central western side of the AONB and enclose the opposite side of the Central Sperrins Scenic Drive to Mullaghclogher. Views from this part of the scenic drive are, therefore, not typically wide in extent and tend to be channelled in a north – south direction along the road corridor rather that in the direction of the Proposed Development, which would be located to the west. Slightly more extensive views can be obtained from locations such as Viewpoint 1, which are slightly elevated and overlook the scenic route. Land uses are typical of the AONB as a whole, consisting of pastoral fields and areas of coniferous forestry on lower slopes and rougher open moorland on the upper slopes. There is scattered rural settlement throughout the landscape in proximity to this viewpoint although not in high concentration. To the south east there are more open views towards the hills around Gortin. On the hills directly behind this viewpoint there is a quarry and associated single turbine which is prominently located on the upper side of the excavated hillside, and which is an identifiable feature in views from the wider landscape to the south and east.

4.144 Viewpoint 2 is located approximately 7.8 km to the west of the Proposed Development on the upper slopes of Owenreagh Hill in proximity to the site entrance for the cluster of wind farms here (a total of 16 operational and 6 consented turbines). The foreground is characterised by rough grazing and open moorland dissected by a relatively remote and quiet network of tertiary roads. This is an elevated location from where extensive views along the north-facing slopes and summits of the main Sperrin Mountain range can be appreciated and also the south-facing side of the Sperrin Foothills. These are characterised by similar land cover elements and there are also numerous small coniferous plantations visible on the lower slopes of in front and to the north of Mullaghclogher. There are a number of existing and consented wind farms visible along various parts of the skyline including the Sperrin Foothills cluster, which is clearly visible to the far north west (37 operational turbines located beyond the angle of view illustrated in Figure 4.11), and Loughermore cluster, which is the largest collection of turbines in Northern Ireland (53 operational turbines and a further 7 consented). There is also partial blade tip visibility of the existing Evishagaran wind farm, which is part of the Carntogher cluster, but this is only likely to be discernible in very clear weather conditions.

4.145 Viewpoints 3 and 4 are both located on the tertiary road network to the east of the B48 scenic drive and between 1.32 km and 1.47 km to the north of the Proposed Development. There are rural properties located at low density throughout this part of the Study Area and a small settlement clustered around the B48 between Aghabrack and Ballynamallaght which includes a church, community centre, some shops and a GAA pitch. These viewpoints have been selected to represent views from receptors in and around these areas of settlement which are contained to the south by the rising side slopes of Mullaghclogher.

4.146 Viewpoint 5 is located 4.89 km to the north west of the Proposed Development, also on the tertiary road network but in a slightly more elevated position than Viewpoints 3 and 4. From this location there are more extensive views encompassing the highly scenic pastoral landscape around Lough Ash and across other parts of the Sperrin uplands.

Sensitivity of Visual Receptors: ranging from High to Low

4.147 Visual receptors present at all viewpoints would comprise a combination of normal road users and outdoor workers who are regarded as being of low sensitivity. However, there would also be road users who are travelling along or in proximity to the Central Sperrins Scenic Drive and residents of rural properties who are regarded as being highly sensitive.

Magnitude of Visual Effect: High to Low

4.148 From Viewpoint 1 the Proposed Development would be visible on the north-west facing side slopes of Mullaghclogher. Six of the turbines (T1 – T6) would be largely on the skyline, which the lower parts of the some of the bases either visible in front or behind the skyline. Only the upper parts of the other turbines would be visible because the lower parts would be screened by intervening landform. Turbines 4 and 6 would be most prominently located on the highest part of the site near the apparent summit. This location is at a slightly higher elevation than the Scenic Drive and, whilst the Proposed Development would be prominent by virtue of its proximity, there are also views which are uninterrupted by its presence, including longer range views to the north and south. However, aside from a small single turbine to the south west, there are currently no vertical man-made features of this scale visible from this location and the Proposed Development is deemed to have a high magnitude of effect for this reason.

4.149 From Viewpoint 2 the Proposed Development would be partially visible but not prominent. The upper parts of the hubs and rotors of turbines 5, 6 and 4 would be largely visible above the skyline on the right-hand side of the view with the turbine bases positioned behind the intervening hillside. The upper parts of the four turbines on the lefthand side of the Proposed Development (T8 – 11) would appear entirely against a backdrop of rising ground and would appear far less visually prominent. Only the blade tips of the other turbines would be visible, mostly against a backdrop of rising ground as well and not easily discernible. The Proposed Development would form an additional vertical element of a scale which is already apparent across several other areas of this view with large areas of the landscape being devoid of turbines but featuring other human influences in between. The turbines located in closest proximity to this Viewpoint – Owenreagh cluster – would be far more prominent, and the clusters of wind farms located at a greater distance from this location would comprise of a greater number of turbines. None affect the appreciation of the overall scale and landscape pattern formed by the Sperrin Mountains and Foothills and the magnitude of effect resulting from the Proposed Development is deemed to be low.

4.150 The Proposed Development would become a dominant feature on the rising side slopes of Mullaghclogher which form the focus of foreground views from Viewpoints 3 and 4. In other directions the topography is flatter and views tend to be focussed on rough grazing land in the foreground, with the hills beyond being a less prominent element. The arrangement of hills does serve to channel views into the wider landscape northwards towards the Sperrin Foothills and south westwards towards Owenreagh Hill but these are less prominent elements of the view than the foreground to the east. From these locations, all turbines in the Proposed Development would be clearly visible either wholly or the upper parts of the hubs and rotors would be seen. The Proposed Development would have a high magnitude of visual effect.

4.151 From Viewpoint 5 the turbines would be visible to a similar extent as the latter viewpoints but within the context of a more extensive view encompassing the highly scenic pastoral landscape around Lough Ash and views across other parts of the Sperrin uplands. The Proposed Development would appear largely against a rising backdrop of side slopes and only the upper parts of some of the turbines would protrude above the skyline. For this reason the magnitude of visual effect would be medium.

Significance of Visual Effect: Significant at Viewpoints 1, 3 and 4; Not Significant from Viewpoints 2 and 5

4.152 The Proposed Development would have a significant effect on viewpoints 1, 3 and 4. From these locations, it would be a prominent feature visible at relatively close range, many visual receptors would be of high or medium sensitivity, and the overall magnitude of effect would be high. From Viewpoints 3 and 4 views would also be relatively narrow in their extent, meaning there is less awareness of the wider landscape and views tend to be constrained by foreground topography, which is low-lying and physically surrounded by higher ground, at least in some direction, with only glimpsed or partial views in to the wider AONB. The Proposed Development assumes greater visual prominence because it occupies a greater proportion of the available view. Viewpoints 2 and 5 are located in more elevated position where this is not the case and, from these locations the Proposed Development would also appear largely against a backdrop of rising ground rather that above the skyline, which reduces its visual prominence. There would be no significant visual effects on views represented by these locations.

Category B: representing views from the Glenelly Valley, Plumbridge and environs

Description of Existing Views

4.153 Category B includes Viewpoints 6 – 11 which are illustrated in Figures 4.15 – 4.20 and have been selected to represent typical views from the western end of the Glenelly Valley which forms the central part of the AONB. A number of provisional viewpoints located more centrally in the heart of the Sperrins were not shortlisted because they would experience no views of the Proposed Development. It would be entirely screened by the main Sperrin Mountain range when viewed from this part of the Study Area (see Figure 4.3 and PVPs 6, 7, 9, 20, 36 – 39 and 45 described in Appendix 4, Table 4.4.1).

4.154 Viewpoint 6 is located on the tertiary road network approximately 2.35 km to the south of the Proposed Development on the elevated side slopes of Eden Hill. From this location the main focus of views, and the area of highest visual value, is the pastoral landscape on the outskirts of Plumbridge along the Glenelly River corridor to the south west which are channelled between the Owenreagh and Craignamaddy uplands. The view from this location is backed by rising moorland which is also visible to the right of the central view illustrated in Figure 4.15. Beyond this the south-facing slopes of the uplands surrounding Mullaghclogher summit are covered by Bradkeel Forest.

4.155 Viewpoint 7 is located 4.08 km to the south west on the upper part of Fairview Road near Plumbridge. The foreground landscape is also characterised by pastoral fields, hedgerows and trees which is typical of the lower slopes of Glenelly Valley. The focus of views from this part of the Study Area is the opposite (south) side of the Glenelly Valley which would be visible to the far righthand side of the view illustrated in Figure 4.16. The hills which form the north side of the valley are partially visible beyond the foreground but are not visually prominent.

4.156 Viewpoint 8 is located on a side road near the B48 on the southern edge of Plumbridge village. The foreground landscape is similarly pastoral to that described for Viewpoints 6 and 7 but is visible to a greater extent. The uplands beyond are less prominent but do serve to visually contain views. Traffic is fast-moving on this part of the secondary road network and road corridors are more frequently contained by roadside planting such as that evident on the lefthand side of the view illustrated by Figure 4.17. Therefore, views into the surrounding landscape are frequently screened. Viewpoint 9 is quite similar but is located slightly further from the Proposed Development – 6.29 km. There are fewer built structures evident in the existing view which currently has a pastoral character overall.

4.157 Viewpoint 10 is located on the river crossing in the centre of Plumbridge village and is taken from one of the few locations in the village likely to experience any views of the Proposed Development. However, these views are substantially screened by vegetation along the river corridor and in the summer months, when trees are in full leaf, views will be entirely screened.

4.158 Viewpoint 11 is located near the western end of the Corramore Road which is a quiet tertiary running along the mid slopes to the south of the Glenelly Valley between Mount Hamilton/ Sperrin village and this location, which is in proximity to Barnes Gap and the start of the Craignamaddy Circuit walk. There are residential properties and farmsteads positioned at low density along the entire length of Corramore Road which are positioned to take advantage of its highly scenic aspect overlooking Glenelly Valley. There are extensive panoramic views across the valley towards the main section of the Sperrin Mountains, the western portion of which is illustrated in Figure 4.20. However, although views from this location include partial views of the Proposed Development, they are limited by the side slopes of Mullaghbolig and Craignamaddy hills to the east and west respectively. Views from the rest of the road corridor the views are far more extensive but would not feature views of the Proposed Development (refer to PVPs p9 and p36 – 39 in Appendix 4.4). Craignamaddy Circuit forms part of the International Appalachian Trail and Ulster Way and is likely to attract visitors by virtue of being highly scenic.

Sensitivity of Visual Receptors: ranging from Low to High

4.159 Visual receptors in this category include general road users on the secondary and tertiary road network and outdoor workers who are both groups deemed to be of relatively low sensitivity. There are some residential properties in proximity to Viewpoints 6, 7 and 10 but views from these properties are likely to be screened vegetation. There are likely to be some walkers/ tourists in proximity to Viewpoint 11 who are of high sensitivity, but the Proposed Development is not prominent from this location.

Magnitude of Visual Effect: primarily Low except Viewpoint 9 which is Medium

4.160 None of the shortlisted viewpoints in this category illustrate clear, uninterrupted views of the Proposed Development. In all instances the majority of the turbines would be screened either by intervening topography, vegetation, or both. From Viewpoint 6 only two of the proposed turbines would be visible in any substantial way. The remainder would be entirely screened by topography and forestry and the overall magnitude of effect would be low. The same is true from Viewpoint 7 where only one of the proposed turbines would be clearly visible but not a prominent element of views which tend to be focussed south westwards. The remainder of the turbines at this location are screened by a combination of topography and land cover features. In Viewpoints 8 and 9 the Proposed Development would slightly more visible – the rotors and upper parts of the towers of three turbines and a further 3 blade tips would be visible but less prominent elements due to the wider extent of the views available from these locations. They would appear in part of the view which is already characterised by other manmade elements, most notably forestry, roads with fast-moving traffic and agricultural land. The magnitude of effect from Viewpoint 8 would be low but, from Viewpoint 9, it is deemed to be medium because the existing view is more tranquil in nature and there are fewer vertical built structures evident in the current view. Therefore, the Proposed Development would introduce a relatively new visual element that would be readily noticed. The Proposed Development would be barely noticeable from Viewpoint 10 because it is almost entirely screened by trees along the river corridor. It is noted that, during the summer months, the screening effect of these trees would be greater still.

4.161 There are highly scenic views available from the entire length of the road on which Viewpoint 11 is located but visibility of the Proposed Development is only possible in proximity to Viewpoint 11 and there is only partial visibility of two of the proposed turbines at this point. The turbines would be visible as a small element of a very extensive and scenic view, and they would not be prominent elements. The remainder of the proposed Development would be screened/ located beyond the uplands illustrated in Figure 4.20. The overall magnitude of effect is deemed to be low.

Significance of Visual Effect: Not Significant

4.162 Visual receptors would range from low to medium sensitivity at Viewpoints 6, 7 and 10. Viewpoints 8, 9 and 11 would also be experienced by some visual receptors of higher sensitivity but, the overall magnitude of effect would range from medium to low. Therefore, there would be no significance of visual effect on this category of viewpoints.

Category C: Locations representing views from the southern part of the Sperrins around Bessy Bell and Gortin

Description of Existing Views

4.163 Category C includes Viewpoints 12 -15 which are illustrated in Figures 4.21 – 4.24. It been selected to represent typical views from the south western part of the AONB around Gortin Glen and Bessy Bell because this area is regarded as one of the gateways into the Sperrins from the west.

4.164 Site survey revealed a relatively complex lowland landscape with variations in topography and substantial shelter belts of trees, areas of woodland and agricultural filed boundaries which all serve to restrict clear views into the wider landscape. This is evidenced by the lack of clear views from either PVP p33 or p35 which were visited but not shortlisted. PVP p34 provides a similar view to the shortlisted Viewpoint 15 but from a less well-used part of the road network and has not been shortlisted for this reason (see Appendix 4, Table 4.4.1 for further description of these PVPs).

4.165 All the Viewpoints in this category are characterised by agricultural lowlands backed by the extensive profile of uplands and summits which make up the central Sperrin mountain range with the exception of Viewpoint 14. From this location there are limited views in the direction of the Proposed Development but extensive panoramic views across Fairy Water Valley towards the Lough Bradan uplands to the south west. The latter are located beyond the Study Area and beyond the field of view illustrated in Figure 4.23 which illustrates the nature of views in the direction of the Proposed Development.

4.166 The lowland landscape in the south and west includes the majority of larger towns and villages and connecting road corridors which are located within this Study Area and for this reason there is a higher proportion of built development than more remote/ less settled parts of the AONB. This development includes agricultural buildings, clusters of rural settlement, a busier network of roads and several operational single turbines associated with both the agricultural functions of the landscape and also some small quarrying operations. In proximity to Category C Viewpoints are the city of Omagh, Newtownstewart and Gortin village which are interconnected by the busy A5, A505 and B46 road corridors. Further north along the A5 are the towns of Sion Mills, Strabane and Lifford. The Owenreagh and Sperrin Foothills clusters of wind farms would be visible on other parts of the skyline from Viewpoints 12, 13 and 15. There is an established cluster of wind farms on Bessy Bell, located approximately 4 km to the south of Newtownstewart, which would be visible from Viewpoint 15 and larger clusters located round the edges of this Study Area at Lismullyduff, Lough Bradan and Slievemore which would be visible from Viewpoint 14 (refer to Figure 4.4).

4.167 All viewpoints in this Category are either located on, or in proximity to a scenic driving route, public footpath or the National Cycle Network. Viewpoint 13 is located at a waymarked viewing area with a small carpark and picnic facilities and provides a vantage point for visitors to the Gortin Glen area to stop and appreciate the surrounding landscape of the south western Sperrins.

Sensitivity of Visual Receptors: ranging from Low to High

4.168 There are a relatively large number of visitor attractions and outdoor amenities located in this part of the AONB including registered parks in Gortin and on the outskirts of Newtownstewart (Baronscourt), various footpaths, cycle routes and the south Sperrins Scenic Driving Route. Therefore, there are likely to be a relatively high proportion of sensitive visual receptors located in this part of the Study Area. Visual receptors represented by Viewpoints 12, 14 and 15 will range from high to low sensitivity and include local road users, residents, outdoor workers and walkers, cyclists and travellers on nearby scenic driving routes. Visual receptors at Viewpoint 13 are deemed to be highly sensitive in the majority because this is a designated viewing area in proximity to Gortin Glen Forest Park.

Magnitude of Visual Effect: ranging from Low to Negligible

4.169 Viewpoints 12 and 13 are both located approximately 11 km to the south of the nearest turbine in the Proposed Development. Viewpoint 14 is located 18.9 km to the south east and Viewpoint 15 is located 15.8 km to the south west. In all instances the majority of the turbines would be positioned beyond and below the skyline and only the upper towers and hubs of some of the turbines would be visible.

4.170 From Viewpoint 12, six of the turbines would be visible to this extent, the blade tip of a further turbine would be visible on the eastern side of the Proposed Development, and the remainder would not be visible. From a distance of 11 km, and in comparison with the extensive views available from this location, the Proposed Development would form a relatively minor element of the view and would be seen in the context of a view which already contains several single turbines and two clusters of wind farms visible on other parts of the skyline. Whilst it would be closer to this Viewpoint than either Owenreagh or the Sperrin Foothills wind farm clusters, it be visually subordinate to the existing turbine in the foreground of this view and the magnitude of effect on Viewpoint 12 is deemed to be low.

4.171 The Proposed Development would be less visible from Viewpoint 13 – only three of the proposed turbines would be clearly visible but visual receptors are deemed to be highly sensitive and the overall magnitude of effect from this viewpoint is also deemed to be low.

4.172 There would be a negligible magnitude of effect on Viewpoints 14 and 15. There would be no visibility of the Proposed Development from Viewpoint 14 because the two blade tips that are shown to be theoretically visible in the wireline would, in practice be screened by foreground vegetation. The available view from Viewpoint 15 is of such a wide extent and at a substantial distance from the Proposed Development, which would be difficult to discern with the naked eye.

Significance of Visual Effect: Not Significant

4.173 Visual receptors would range from high to medium sensitivity at Viewpoints 12 and 10, high at Viewpoint 13 and medium to low at Viewpoint 14 but the overall magnitude of effect would be either low or negligible. Therefore, there would be no significance of visual effect on this category of viewpoints.

Category D: Locations representing longer range views of the Development from south-facing parts of uplands containing the northern edge of the AONB

Description of Existing Views

4.174 Category D includes Viewpoints 16 and 17 which are illustrated in Figures 4.25 – 4.26. They have been selected to represent medium to longer range views of the Proposed Development from the northern part of the Study Area where the 'outward facing' slopes of the main Sperrin Mountain range form the setting for the Sperrin Foothills and the landscape around the A6 road corridor between Dungiven and Derry. A relatively large number of PVPs were identified and assessed as part of the baseline assessment of the Proposed Development but very few viable viewpoints were identified. This is clearly illustrated on Figure 4.3 by the number of PVPs which were not shortlisted due to an absence of views, and a smaller number which were not shortlisted for reason of having limited views (PVPs p21 and p55).

4.175 Viewpoint 16 is located approximately 7.2 km to the north of the Proposed Development near the B49 road corridor between Dunamanagh and Claudy. It is positioned on the lower slopes of Eglish Hill which has an existing wind farm on it, although it would not be visible from this particular location due to the acute angle of view and the screening effects of the hill's profile. The foreground is characterised by a series of low rounded hills which are characteristic of the Sperrin Foothills area. These are covered by agricultural land uses and landcover elements including pastoral fields, farmsteads and barns, rural residential properties, hedgerows, shelter belts of broadleaved trees and some small areas of mixed and coniferous woodland. This landscape is visually contained by the broad undulating profile of the central Sperrin Mountain range beyond and views area extensive from the east to the west.

4.176 Viewpoint 17 is located approximately 11.8 km to the north west of the Proposed Development, also in proximity to the secondary road network – this time the B48 between Dunamanagh and New Buildings. The overall character of the landscape is similar to that described for Viewpoint 16 but it is more heavily influenced by the foreground landscape. The main Sperrin Mountains still form a backdrop but are less prominent than the foreground foothills. The existing wind farm at Eglish would be clearly visible at relatively close range and appear far more visually prominent than the Proposed Development. There would be glimpsed views of the Owenreagh cluster further to the south west.

Sensitivity of Visual Receptors: ranging from Low to High

4.177 There would be a wide range of visual receptors represented by Category D Viewpoints including residents of rural properties who are deemed to be of high sensitivity and may, in many instances, have views orientated in the direction of the Proposed Development. Viewpoint 17 is located near the National Cycle Network but there are no specific landscape designations or classifications in proximity of Viewpoint 16 aside from its location within the AONB boundary. Visual receptors would have heighted sensitivity by virtue of this but would mostly comprise of outdoor workers and travellers in vehicles on the secondary and tertiary road network who are deemed to be of low sensitivity.

Magnitude of Visual Effect: ranging from Medium to Low

4.178 The Proposed Development would be visible in its entirety from both viewpoint locations with the highest positioned turbines T4 – 6 visible above the skyline but the others positioned either wholly or partially in front of a backdrop of rising ground – the side slopes of Mullaghclogher. From Viewpoint 16, whilst the turbines are likely to be clearly visible, their position against this rising backdrop would minimise their prominence and the overall magnitude of visual effect would be medium. From Viewpoint 17, the main focus of views would be the foreground landscape and a lesser number of turbines would be visible from a greater distance. Therefore, the Proposed Development would be visible but not visually prominent and the magnitude of visual effect is deemed to be low.

Significance of Visual Effect: Not Significant

4.179 The majority of visual receptors in this category are not deemed to be highly sensitive and the overall magnitude of effects would be medium to low. Furthermore, there are many locations in this part of the Study Area from where the Proposed Development would not be visible at all and, for these reasons, there would be no significant visual effects.

Category E: Locations representing views of the Development from the eastern edge of the Sperrin AONB

Description of Existing Views

4.180 Category E includes Viewpoints 18 and 19 which are illustrated as wirelines in Figure 4.27[9]. They have been included to properly represent the nature of views from as many parts of the Sperrin AONB as possible but they illustrate the limited visibility of the Proposed Development from this part of the AONB. Viewpoint 18 is located approximately 25.4 km to the south east of the Proposed Development at a marked viewing area on Slieve Gallion which is prominent summit on the south eastern edge of the AONB. There are relatively extensive views across upland grazing land and areas of forestry between Draperstown and Gortin/ Newtownstewart and the A505 road corridor. There are extensive areas of forestry and gravel extraction operations within this landscape as well as several operational wind farms and single turbines.

4.181 Viewpoint 19 is located approximately 22.81 km to the north east of the Proposed Development near the summit of Benbradagh. There is a parking area and part of the Ulster Way accessible from this location. There are also nearly 360 degree panoramic views available in proximity to this location, including across the crescent-

[9] Refer to Technical Appendix 4.2, paragraph 4.33 iii: SNH guidance advises that photomontages may not be required where the Proposed Development is unlikely to be a perceptible feature in the view or located beyond 20 km.

shaped arc of hills within the Sperrins stretching from the Glenshane Pass into the heart of the AONB, westwards across the Loughermore Hills towards the Sperrin Foothills and, in clear weather conditions, as far as hills surrounding Lough Foyle and Co. Donegal, and also northwards along the spine of uplands stretching from Benbradagh to Binevenagh on the north Antrim coast. These hills form the Binevenagh AONB. There are a large number of wind farms and clusters of wind farms visible in many directions and at varying distances including the Carntogher cluster immediately to the east of this location and the large Loughermore cluster which is prominently located to the north west.

Sensitivity of Visual Receptors: ranging from High to Low

4.182 Visual receptors in proximity to Viewpoint 18 would include tourists visiting the viewing area and travelling along the East Sperrins Scenic Drive and they would be of high sensitivity because of their likely presence for the purpose of scenic enjoyment. There would also be some residential properties in proximity to this viewpoint and residents would also be deemed to be highly sensitive. However, outdoor workers including farm and quarry/ extractive industry workers and general road users are deemed to be of low sensitivity. Visual receptors in proximity to Viewpoint 19 would mostly be highly sensitive because they would comprise largely of walkers and visitors travelling to this location for the primary purpose of appreciating the panoramic views that can be obtained from this vantage point near the summit of Benbradagh.

Magnitude of Visual Effect: Negligible

4.183 The blade tip of one of the turbines in the Proposed Development would be theoretically visible from Viewpoint 18 but, at a distance of 25.4 km it would not, in practice, be discernible and the magnitude of visual effect would be negligible. The Proposed Development would appear as a small group of turbines on the skyline approximately 22.8 km from Viewpoint 19. There are already several other larger and established clusters of turbines on other parts of the skyline which are more visually prominent. The Proposed Development would not appear in close proximity to any of these and would maintain substantial undeveloped areas of skyline in between. It is unlikely to be easily discernible at such a distance and the magnitude of effect is also deemed to be negligible.

Significance of Visual Effect: Not Significant

4.184 Although many visual receptors present at these viewpoints are highly sensitive the Proposed Development would not be easy to discern, and the magnitude of effects is deemed to be negligible. Therefore there would be no significant effects on Category E viewpoints.

Table 4.2: Summary of Visual Effects on Viewpoints

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of visual effect	Significance of visual effect
Category A: Locations representing close and medium-range views in the Sperrin Mountains and Foothills to north and west of the Proposed Development						
1	Balix Upper to west of site	3.10 km to T1	Prominent	High - Low	High	Significant
2	Glenmornan Road, Owenreagh	7.83 km to T1	Visible	Medium - Low	Low	Not Significant
3	Stroanbrack Road near B47 and Aghabrack GAA	1.32 km to T1	Prominent	High - Medium	High	Significant
4	Craig to north of site	1.47 km to T10	Prominent	High - Medium	High	Significant
5	Lough Ash	4.89 km to T1	Prominent	High - Medium	Medium	Not Significant
Category B: Locations representing views from the Glenelly Valley, Plumbridge and environs						
6	Bradkeel Road upper to south of site	2.36 km to T4	Visible	Medium - Low	Low	Not Significant
7	Fairview Road, Plumbridge	4.06 km to T4	Visible	Medium - Low	Low	Not Significant
8	Slievebeg Road near B48 to south of Plumbridge	5.30 km to T4	Visible	High - Low	Low	Not Significant
9	B48 between Plumbridge and Gortin	6.29 km to T4	Visible	High - Low	Medium	Not Significant
10	Plumbridge at river in village centre	4.73 km to T2	Visible	Medium - Low	Low	Not Significant
11	Barnes Gap	6.53 km to T6	Visible	High - Low	Low	Not Significant
Category C: Locations representing views from the southern part of the Sperrins around Bessy Bell and Gortin						

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of visual effect	Significance of visual effect
12	Eskaradooey/ Robber's Table footpath to south west	11.06 km to T4	Visible	High - Low	Low	Not Significant
13	Viewing area on Lenamore Road, Gortin	11.06 km to T6	Visible	High	Low	Not Significant
14	Fingrean Road near A505	18.90 km to T6	Barely Visible	Medium - Low	Negligible	Not Significant
15	Gortnagranagh Road, Bessy Bell	15.87 km to T2	Visible	High-Low	Negligible	Not Significant
Category D: Views representing longer range views of the Development from south-facing parts of uplands containing the northern edge of the AONB						
16	South-facing side of Eglish hill	7.20 km to T1	Prominent	High-Low	Medium	Not Significant
17	Near Carrickatane	11.81 km to T1	Visible	High-Low	Low	Not Significant
Category E: Locations representing views of the Development from the eastern edge of the Sperrin AONB (wireline-only figures)						
18	Crockandun viewing area near Slieve Gallion	25.40 km to T11	Barely Visible	High - Low	Negligible	Not Significant
19	Benbradagh	22.81 km to T10	Barely Visible	High	Negligible	Not Significant

4.185 Of the 19 Viewpoints which have been selected to represent typical views within the Study Area, four would experience significant visual effects resulting from the Proposed Development. These are Viewpoints 1, 3 and 4 in Category A. All are located within approximately 5 km and from locations where the Proposed Development would be both prominent and visible in its entirety or near-entirety from rural roads and areas of settlement. These viewpoints are also all located to the north and north-west on uplands adjacent to the site of the Proposed Development. Conversely, from viewpoints located at similar distances to the south of the Proposed Development are found to experience no significant effects despite being located within and around the scenic Glenelly Valley, which forms a key part of the AONB core. From these locations there would be acute angles of view and higher levels of vegetation cover from the valley areas which would screen views. Views from more elevated locations tend to be screened by the summit of Mullaghclogher and the proposed turbines are located on the north and west-facing side slopes and are therefore also substantially screened from view. From other parts of the AONB, the Proposed Development may become more visible in its entirety but are lessened in magnitude and significance because views available from these locations are not solely focused on the site of the Proposed Development. Rather, these views frequently encompass much wider panoramas where the site and the Proposed Development comprise a small part.

4.186 It is noted that the BPG recognises that wind farms may be expected to be relatively prominent within distances of approximately 5 km but that clear visibility does not automatically equate to the development being unacceptable (see paragraph 4.62 onwards). It is also noted that the majority of the AONB, even at close range would experience limited visibility of the Proposed Development and no significant effects. Furthermore, from the majority of the Study Area, including the AONB, the Proposed Development would have no little to any visibility and would result in no significant visual effects.

The Cumulative Baseline and Analysis of Effects

4.187 The Cumulative Baseline refers to all existing, consented and proposed wind farms within the 30 km Study Area. There are a total of 29 wind farms considered to be part of the Cumulative Baseline for this LVIA. In many instances other wind farms in the cumulative baseline are located in visually and / or physically distinct clusters. This often reflects landscapes, ground conditions and wind speeds that are favourable for wind energy development. It also reflects a general principle, which is implemented by planning consents, to consolidate and group new and established developments together as a means to achieve sustainable development and mitigate potential adverse cumulative effects on scenic landscapes which would otherwise result from a sporadic approach to siting new developments. The following clusters of wind farms are identified in this LVIA and reference is made to these clusters rather than individual wind farms where appropriate. Details of which wind farms are located within clusters are provided in Technical Appendix 4.5 Table 4.5.1 and are not repeated here. The locations of these clusters are indicated on Figure 4.4:

- Owenreagh Cluster comprising 2 existing wind farms and 1 consented and a total of 22 turbines located in closest proximity to the Proposed Development approximately 9 km to the west. The Owenreagh hills form the western most end of the main Sperrin Mountain range which the Proposed Development is also located on;

- Bessy Bell Cluster is located approximately 18 km to the south west of the Proposed Development just beyond the AONB boundary. It comprises the two operational phases of Bessy Bell wind farm which has a total of 16 turbines and a 4-turbine consented extension;
- Loughermore Cluster comprising 5 existing wind farms and one consented and a total of 60 turbines located on the Loughermore Hills approximately 15 – 20 km to the north east of the Proposed Development;
- Sperrin Foothills Cluster comprising 5 existing wind farms with a total of 37 turbines and focused around the Slievekirk outcrop of uplands located approximately 10 – 15 km to the north of the Proposed Development;
- Carntogher Cluster comprising 1 existing wind farm located within this Study Area but also a further existing and consented wind farm located slightly beyond the Study Area boundary but forming a relatively contiguous cluster overall. This cluster has a total of 44 turbines and is located approximately 25 km from the Proposed Development at the north eastern edge of the AONB;
- Slieve Gallion Cluster comprising 2 existing wind farms and 1 proposed with a total of 13 turbines (of which 9 are operational). It is located near the eastern end of the AONB approximately 25 - 30 km from the Proposed Development;
- Lough Bradan Cluster comprising 8 existing wind farms, 3 of located just within the south western boundary of the Study Area. A further 5 existing wind farms, 2 consented and one proposed wind farm are located beyond the 30 km Study Area but they form a relatively large and contiguous cluster and a total of 99 turbines;
- Slievemore Cluster comprising 9 existing wind farms, of which 3 are located approximately 20 – 30 km to the south of the Proposed Development and which equate to 15 turbines. A further 6 existing and one proposed wind farm are located beyond 30 km. The cluster as a whole comprises 60 existing turbines and a further 3 proposed turbines.

4.188 There are currently a total of 209 existing and consented turbines in the Study Area. Full details of all wind farms included in the Cumulative Baseline are provided in Technical Appendix 4.5 and a summary below. This has been used in conjunction with the cumulative ZTV diagrams and Viewpoints to analyse cumulative landscape and visual effects. There are single turbines evident across the Study Area which are visible in the baseline photographs used for the photomontages and the location of these are highlighted on these Figures where relevant to the existing character of the view in question.

4.189 There is already a wide range of dimensions evident in the wind turbines which form the cumulative baseline. Twenty-two wind farms in the cumulative baseline are existing and account for a total of 184 turbines of varying sizes:

- Overall tip heights ranging from 58.5 m (Bessy Bell I) to 140 m (Evishagaran);
- Rotor diameters ranging from 39 m (Bessy Bell I) to 100 m (Evishagaran);
- Hub heights ranging from 39 m (Bessy Bell I) to 90 m (Evishagaran).

4.190 A further 4 wind farms are consented which accounts for a total of 25 turbines also of varying sizes:

- Overall tip heights ranging from 107 m (Craignagapple) to 126 m (Ballyhanedin). There are also wind farms located slightly beyond the Study Area which form contiguous clusters within some wind farms within the Study Area and the highest consented tip height is Corlacky Hill which is 149.9 m. It is noted that both Corlacky and Craignagapple are also located within the AONB;
- Rotor diameters ranging from 80 m (Craignagapple) to 90 m (Barr Cregg);
- Hub heights ranging from 67 m (Craignagapple) to 82 m (Ballyhanedin).

4.191 A further 3 wind farms are proposed (i.e. in-planning) and these account for 16 turbines of varying sizes as listed below. The sizes of consented and proposed turbines when compared to those of existing wind farms is indicative of a general upward trend in turbine dimensions.

- Overall tip heights ranging from 126.5 m (Beltonanean Road) to 150 m (Magheramore);
- Rotor diameters ranging from 103 m (Beltonanean Road) to 112 m (Magheramore);
- Hub heights ranging from 75 m (Beltonanean Road) to 94 m (Magheramore).

Table 4.3: Summary of Cumulative Baseline

Wind Farm (see Technical Appendix 4.5 for full details)	No. of turbines	Approx. distance from Development (km between nearest turbines)
Existing Wind Farms, 22 no.	**Total no. of turbines = 184**	
Altahullion Phase I	**20**	**17.46 km to north east**
Altahullion Phase II	**9**	**17.63 km to north east**
Bessy Bell I & II	**16**	**17.73 km to south west**
Carrickatane	**9**	**12.80 km to north west**
Clondermot	**1**	**18.49 km to north west**
Creagh	**3**	**22.85 km to south east**

Wind Farm (see Technical Appendix 4.5 for full details)	No. of turbines	Approx. distance from Development (km between nearest turbines)
Cregganconroe	5	24.97 km to south east
Crockandun	6	26.31 km to south east
Crockdun	5	20.40 km to south east
Curryfree	6	13.81 km to north west
Eglish	6	8.18 km to north
Evishagaran	14	24.93 km to north east
Glenconway	8	19.91 km to north east
Glenconway II	12	17.42 km to north east
Inishative	5	29.27 km to south east
Monnaboy	4	18.74 km to north
Owenreagh	10	7.54 km to west
Owenreagh Extension	6	7.08 km to west
Pigeon Top	9	28.52 km to south west
Pollnallaght aka Cornavarrow	14	27.84 km to south west
Slieveglass	3	29.03 km to south west
Slieve Kirk	12	10.93 km to north
Slieve Kirk Extension	4	12.66 km to north
Consented Wind Farms, 4 no.	Total no. of turbines = 25	
Barr Cregg	7	14.20 km to north
Ballyhanedin	8	12.30 km to north east
Bessy Bell II Extension	4	17.5 km to south west
Craignagapple	6	6.95 km to west
Proposed Wind Farms, 3 no.	Total no. of turbines = 16	
Beltonanean Road	6	22.15 km to south east
Cullion	4	26.90 km to south east
Magheramore	6	17.11 km to north east

Wind Farm (see Technical Appendix 4.5 for full details)	No. of turbines	Approx. distance from Development (km between nearest turbines)
Total no. of turbines in Study Area	**228**	

Cumulative Landscape Effects

4.192 Most of the wind farms in the Study Area are located in physically distinct clusters around the edges of the AONB and the landscape that forms the setting to it. They are a recurring and defining feature of Study Area and on approaches towards the AONB from all directions. The positioning of wind farms on upland plateau and edges overlooking more populated rural landscapes is also a common and repeated pattern across Northern Ireland. The core part of the AONB which is physically defined by the bowl-shaped configuration of higher summits enclosing lower ground in the centre does not currently feature any wind farms and the Proposed Development would maintain this character. Although it would be located more closely to the core part of the AONB that other wind farms in the cumulative baseline it would not be clearly visible from it.

4.193 The cluster of wind farms in closest proximity to the Proposed Development are referred to in this LVIA as the Owenreagh cluster which includes two operation phases of Owenreagh wind farm and a further consented wind farm at Craignagapple located approximately 6.95 km to the west at its nearest point. This cluster is apparent in some of the viewpoints analysed in LVIA but it is physically detached by the B48 road corridor which runs through Butterlope Glen to the immediate west of the Proposed Development and by the lower range of hills formed by Balix Hill, Crockrour and Craigatuke which are located between Craignagapple and the west side of the B48. There are few other wind farms which appear within the same field of view as the Proposed wind farm and none which would have any substantial magnitude of effect on landscape character.

4.194 In addition to commercial wind farms there are existing and, most likely, consented single turbines located throughout the Study Area, some of which appear in the baseline photographs which have been used to create the photomontages in these figures. The approach of clustering wind farms together as a means of achieving sustainable development and mitigating potential adverse cumulative effects is not reflected in the siting of single turbines which are proliferate across the lowland pastoral landscapes and lower slopes of upland areas throughout the Study Area. Single turbines are a characteristic feature of the rural landscape in the wider Study Area. It is therefore noted that wind turbines are not a new or unusual feature element of landscape character across the Study Area as a whole.

4.195 The SPG's recommendation for LCA 29 is that it is, in theory, well-suited to wind energy development by virtue of its scale and landform but the majority of the LCA is highly sensitive due to its immense appeal for tourism and recreation, its strong wild character with vulnerable natural and cultural heritage features, and the visual prominence of the Sperrin Mountains over a wide area of Northern Ireland. However, whilst the Proposed Development does encroach further into the core part of the AONB, it is not visible from it due to its location on the outward facing side slopes of Mullaghclogher as opposed the inward-facing slopes and summits which physically contain the core area. There are no known cultural heritage features near the Proposed Development or features from where it would be significantly apparent. Neither does the site of the Proposed Development have any know tourism or amenity features. The Proposed Development would not be clearly visible from the nearest tourist amenities or attractions within or overlooking the Glenelly Valley and the town of Plumbridge despite being located 5 km to the south west. It would be immediately apparent within a small part of the LCA but would have no direct physical or visual effect on the majority of this LCA including the core area.

4.196 Although the effect on the physical character of the site and immediate surrounding landscape would be significant because there are currently no other such features in close proximity, the Proposed Development would be physically separate from both the Owenreagh and Sperrin Foothills clusters of wind farms which defines the western-most end of LCA 29 and the Sperrin Foothills LCA to the north west. It would therefore have limited magnitude of cumulative effect on landscape character when considered in combination with these wind farms. Although it would incrementally increase the physical presence of wind turbines in this part of LCA 29 it is not of such a scale that it would cause the landscape character to become more defined by wind farms than by other landscape attributes. There are no other wind farms in proximity to the Proposed Development and its incremental cumulative effect on the landscape character of the Study Area as a whole is therefore deemed to be of low magnitude and not significant.

Cumulative Visual Effects

4.197 Existing wind farms form the majority of the cumulative baseline that is considered in this LVIA. There are 22 existing wind farms in the Study Area and these are described as an integral part of the baseline views in the assessment of Viewpoints starting at paragraph 4.135. There are a further 4 consented wind farms located between approximately 6.95 km and 17.5 km from the Proposed Development. Whilst they would, in some instances, appear in different parts of views obtained from representative Viewpoints they would generally not be easily discernible. The Proposed Development would have no significant cumulative effects in conjunction with these wind farms or vice versa. Technical Appendix 5 Table 4.5.1, in conjunction with the wirelines in Figures 4.10 – 4.27 illustrate this.

4.198 Two cumulative ZTV diagrams (Figure 4.8) have been produced at 30 km radii using theoretical blade tip visibility calculations to consider the greatest possible levels of visibility (refer to the LVIA methodology in Technical Appendix 4.2 for further details). The first illustrates the combined effect of other existing and consented wind farms within the Study Area and the incremental effect of the Proposed Development on this cumulative baseline (Figure 4.8 page 1 of 2). This ZTV clearly illustrates the conclusion that has already been made in relation to cumulative landscape effects, i.e. that clusters of wind farms are already a characteristic feature throughout the Study Area. Theoretical visibility of existing and consented wind farms occurs across 91.41 % of the Study Area and the Proposed Development would increase this theoretical visibility by only 1.70%. This theoretical increase would be experienced in parts of the Study Area where site survey has suggested that actual visibility would be extremely limited, in particular along north-facing side slopes of the Glenelly Valley which the ZTV indicates would experience visibility, but which preliminary wirelines indicate would have none (PVPs 9 and 36 – 39). When compared to the blade tip ZTVs of the Proposed Development as a standalone feature (Figures 4.5 and 4.6) it is apparent that this part of the Study Area may experience theoretical visibility of 1 – 2 turbines but that this limited amount of visibility would only be achieved from farmland and not publicly accessible locations like the road network or footpaths.

4.199 The second cumulative ZTV diagram (Figure 4.8 page 2 of 2) illustrates the theoretical visibility of proposed wind farms and the incremental effect of the Proposed Development on the level of visibility of proposed wind farms across the Study Area. There are three proposed wind farms in the Study Area, all located in the eastern part of the AONB largely outwith the ZTV for the Proposed Development and none are clearly intervisible with the Proposed Development. When considered alongside these wind farms the Proposed Development would increase overall theoretical visibility of proposed wind farms by 16.5 % (and be visible across 30.88 % of the Study Area). Other proposed wind farms in the Cumulative Baseline would be theoretically visible across 49.65 % of the whole Study Area and the combined visibility of all proposed wind farms, including the Proposed Development would result in overall visibility of proposed wind farms in 66.15 % of the Study Area. However, Table 4.5.1 in Technical Appendix 4.5 shows that very few representative viewpoints would experience views of these wind farms (Viewpoint 2, 16 and 19) and these views would never be experienced in close succession with views of the Proposed Development. It is also noted that The EIA Regulations do not require account to be taken of proposed wind farms and they are afforded less weight in the assessment of cumulative visual effects.

Table 4.4: The Proposed Development's Cumulative Zone of Theoretical Visibility

<table>
<tr><th>Cumulative ZTV Diagram
(30 km radius, blade tip)</th><th>No. of turbines theoretically visible</th><th colspan="3">% of Study Area with visibility</th></tr>
<tr><td rowspan="4">Existing and Consented Wind Farms
Figure 4.8
(page 1 of 2)</td><td>Visibility of existing and consented wind farms where there is no visibility of the Proposed Development</td><td>53.73 %</td><td rowspan="2">Total % of 30 km Study Area where existing and consented wind farms are theoretically visible
= 91.41 %</td><td></td></tr>
<tr><td>Visibility of the Proposed Development together with other wind farms</td><td>37.18 %</td><td rowspan="2">Total % of 30 km Study Area where the Proposed Development is theoretically visible
= 38.88 %</td></tr>
<tr><td>Additional visibility of the Proposed Development</td><td>1.70 %</td><td></td></tr>
<tr><td>0 turbines visible</td><td>6.89 %</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Proposed Wind Farms
Figure 4.8
(page 2 of 2)</td><td>Visibility of proposed wind farms where there is no visibility of the Proposed Development</td><td>27.27 %</td><td rowspan="2">Total % of 30 km Study Area where other proposed wind farms are theoretically visible
= 49.65 %</td><td></td></tr>
<tr><td>Visibility of the Proposed Development together with other proposed wind farms</td><td>22.38 %</td><td>Total % of 30 km Study Area where the Proposed Development is theoretically visible
= 38.88 %</td></tr>
</table>

Cumulative ZTV Diagram (30 km radius, blade tip)	No. of turbines theoretically visible	% of Study Area with visibility		
	Additional visibility of the Proposed Development	16.50 %		
	0 turbines visible	33.85 %		

4.200 In general, the SPG notes that separation distances ranging from 6 km for smaller sites in landscapes with some enclosure to 12 km for larger sites in open exposed landscapes are desirable to prevent the landscape becoming dominated by wind farms and to reduce intervisibility[10]. Separation distances between the established Owenreagh and Sperrin Foothills clusters range from approximately 7 - 8 km and, whilst these are partially intervisible from some locations this is not common or typical and there are also large areas of undeveloped land between these wind farms.

4.201 The Proposed Development would have no significant incremental cumulative visual effect on any of the 19 Viewpoints considered in this LVIA because it is largely perceived as a standalone development with no visual relationship of any great magnitude with other wind farms in the cumulative baseline.

Information Gaps

4.202 There are no known gaps in the information that has been used in this LVIA with the exception of the exact positions and dimensions of single turbines. These are included in the baseline photos used to prepare the photomontages, but it has not been possible to include them in the wirelines for this reason. Their presence, in so far as they relate to landscape and visual effects, is referred to in the written chapter where relevant.

Future Baseline – The ‘No Change’ Scenario

4.203 Under the “no change” scenario, were the Proposed Development not to be constructed, it is anticipated that the site would be continued to be used in much the same manner as it currently is, and the immediate surroundings would continue to be influenced by human activity including forestry, extensive grazing, rural settlement, and transport. Human activity is constantly changing the landscape and it is important that the implications of these changes are considered and understood

[10] Section 3.2 of the SPG

so that the intrinsic qualities of the landscape may be retained and enhanced where possible rather than destroyed or compromised. The key trends are identified in the NILCA, SCA and RLCA and are also implied by the baseline character of the Study Area at present:

- There are existing wind farms within and surrounding the Study Area and it is likely that more wind farms will be developed within the Study Area and across Northern Ireland to meet climate change commitments. Some of these are likely to be intervisible with the Proposed Development and they will continue to influence the overall landscape and visual character of the Study Area. The dimensions of wind turbines will continue to increase in order to maximise efficiency and productivity. It is also likely that the current trend of developing cleaner renewable energy sources will continue and become more environmentally acceptable given the predicted effects of climate change and the necessity to tackle these effects;
- Climate change is likely to have the biggest implications on the landscape and its users in the future. Broadly, climate change will be characterised by a general increase in unpredictable weather conditions which will inevitably impact upon all areas of life. River levels are likely to rise and there will be an associated loss of buildings in the flood plain and changes to land uses, including farming practices which characterised the majority of the landscape within the Study Area at present. There will be a loss of habitats associated with the erosion of river banks, lough shores and coastlines which support unique combinations of plants and animals. Flooding will become more frequent and cause damage to the interiors and structures of buildings which will, in turn affect both the appearance and presence of vernacular buildings which are currently an integral part of the physical landscape character;
- Demographic change is creating the need for a large number of additional dwellings in the countryside which creates pressures on infrastructure. In particular the rural landscape at the edge of existing settlements will continue to experience pressure for built development and ribbon development along road corridors that link these settlements together, such as the secondary and tertiary road networks in this Study Area. In the open countryside the presence of derelict buildings signifies a loss of traditional built vernacular and a loss of biodiversity and vegetation associated with a decline in the management of rural field boundaries and farmland;
- Continued expansion and upgrading of the road network is likely to occur alongside built development. Improvements to existing secondary roads are also likely (e.g. straightening, widening and increased signage) will have cumulative negative impacts on local landscape character by eroding local

patterns and causing the loss of roadside trees, hedgerows, stonewalls and bridges;

- There is an ongoing trend towards the amalgamation of small farms with the associated loss of traditional buildings and vernacular features, loss of hedgerows and trees to create larger fields. This is having a detrimental impact on the general quality and condition of the rural landscape character. There is also a trend, however, for farmers to diversify into more traditional farming techniques, husbandry of traditional breeds, and the provision of tourist attractions and accommodation. This often has positive landscape impacts. Current forestry grant schemes encourage farmers to plant more broadleaved trees for amenity and wildlife benefits and in the future, this should strengthen the character of farmed landscapes. However, converting fields to coniferous plantations or selling it for housing development will continue to be a detrimental force, particularly if wetter weather renders areas of rough grazing land unviable for livestock. The development of renewable energy projects such as wind and solar farms will continue to allow landowners the means to manage and use land for farming in conjunction with energy generation;
- Commercial forestry on a large scale is detrimental to landscape character as it conceals the intricate pattern of the landscape and often occupies visually prominent positions in upland areas. Peat cutting alters the undulating topography and creates abrupt and artificial changes in level. This activity, particularly as it has become mechanised, also destroys natural vegetation and habitats. Where land becomes too wet to farm forestry is likely to become an attractive alternative. This may provide the opportunity to continue the current shift from coniferous plantations to broadleaved forestry which will in turn have a potentially positive impact on landscape character, visual amenity and ecological function;
- Agriculture is one of Northern Ireland's major industries. Pasture is likely to remain the dominant agricultural land-use, but warmer temperatures will also enable spring cereal crops to be grown as well as an increase in the use of pesticides. This has the potential to alter the appearance of agricultural parts of the Study Area in the future.

Mitigation and Enhancement Proposals

Mitigation Proposals

4.204 Mitigation proposals in specific response to landscape and visual effects include:

- The exterior surfaces of the turbines will be painted in a recessive, non-reflective light grey colour to minimise their visual prominence against the sky in most weather conditions;

- Ancillary facilities, such as the control building, substation, and energy storage compounds, have been designed in a manner that is sensitive to the immediate landscape character with regards to location, scale, colour, and choice of materials.

Enhancement Proposals

4.205 Habitat management will be enforced across the site, including areas of heath planting, using seeds collected from heath mowing.

Residual Effects

4.206 Potential landscape and visual effects were addressed throughout the iterative design development. This resulted in the Proposed Development as it is now proposed and therefore potentially significant effects have been minimised prior to the LVIA being carried out as part of the EIA. Beyond this, the proposed mitigation measures will help to minimise the effect of certain aspects of the Proposed Development. However, there would be no resulting change in the overall significance of effects. Therefore, the residual effects are the same as those already identified.

Overall Significance of Landscape and Visual Effects

4.207 In terms of both landscape and visual effects the Proposed Development conforms to the general principles laid out in the policy and best practice guidance which are broadly promotive of renewable energy developments as a means of mitigating against the effects of climate change. The BPG states that, given their importance, is it important for society at large to accept wind farms as a feature of the Region for the foreseeable future and that, whilst some locations may be highly visible, this does not necessarily render them unacceptable. The BPG also notes that groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes and this principle can be applied to the Proposed Development's position within its landscape and visual context. The Proposed Development also conforms to the majority of the landscape and visual character issues that the SPG notes should be considered for wind energy developments within the North West region. Furthermore, its visibility from key parts of the Study Area, including the majority of the AONB and its core area is particularly limited.

4.208 The Proposed Development would have significant landscape effects on a small part of LCA 29 Sperrin Mountains but, overall, the significance of effect on this LCA would be low. It would have a significant visual effect on only four of the 19 Viewpoints which were chosen to represent typical views within the Study Area. In recognition of its location within the Sperrin AONB and the Sperrin Mountains LCA the layout and position of the Development has been designed to minimise its effect on the AONB as a whole and this has been achieved by locating it away from the core area containing the majority of visitor attractions and key landscape features. The proposed site is used primarily for grazing.

4.209 Whilst the Proposed Development would have a direct and significant physical effect on the part of the Study Area and LCA 29 within which it is located, the magnitude of change would be medium because the Proposed Development is located on an outward-facing slope, is not visible from the majority of the core part of the AONB, including the Glenelly Valley and South Sperrin range of uplands. The site of the Proposed Development has no recreational amenity functions, which the SPG notes would increase landscape and visual sensitivity. It is also positioned within a Study Area where existing and consented wind farms and single turbines are already a defining feature of landscape character. There is also an area of forestry immediately to the south of the Proposed Development which is noted by the SPG as being a visually detractive feature and, in relation to its description of other LCAs where forestry occurs, the SPG note that its presence serves to lessen the sensitivity of parts of this LCA where it occurs. For these reasons the physical landscape character of LCA 29 is deemed to be sufficiently robust and capable of absorbing some degree of change without affecting its overall landscape character and the overall effects on the character of LCA 29 are not deemed to be significant.

4.210 The Proposed Development may have indirect effects on the landscape character of some other parts of the Study Area which are in proximity to it, or which contain viewpoints used in this LVIA. However, there are unlikely to be any discernible effects on their physical landscape character resulting from the Proposed Development due to the physical distance between them. In relation to these other LCAs sensitivity is generally high due to their location within the AONB. However, the magnitude of effects resulting from the Proposed Development would be low to negligible and in no instances are the physical effects on landscape character deemed to be significant. Visual effects from locations within these LCAs are analysed in relation to visual rather than physical landscape character effects.

4.211 Of the 19 Viewpoints which have been selected to represent typical views within the Study Area three would experience significant visual effects resulting from the Proposed Development. These are Viewpoints 1, 3 and 4 in Category A. All are located within approximately 5 km and from locations where the Proposed Development would be both prominent and visible in its entirety or near-entirety from rural roads and areas of settlement. These viewpoints are also all located to the north and north-west on uplands to the site of the Proposed Development. Conversely, from viewpoints located at similar distances to the south of the Proposed Development are found to experience no significant effects despite being located within and around the scenic Glenelly Valley, which forms a key part of the AONB core. From these locations there would be acute angles of view and higher levels of vegetation cover from the valley areas which would screen views. Views from more elevated locations tend to be screened by the summit of Mullaghclogher and the proposed turbines are located on the north and west-facing side slopes and are therefore also substantially screened from view. From other parts of the AONB, the Proposed Development may become more visible in its entirety but are lessened in magnitude and significance because views available from these locations are not solely focused on the site of the Proposed Development. Rather, these views frequently encompass much wider panoramas where the site and the Proposed Development comprise a small part.

4.212 It is noted that the BPG recognises that wind farms may be expected to be relatively prominent within distances of approximately 5 km but that clear visibility does not automatically equate to the development being unacceptable. It is also noted that the majority of the AONB, even at close range would experience limited visibility of the Proposed Development and no significant effects. Furthermore, from the majority of the Study Area, including the AONB, the Proposed Development would have no little to any visibility and would result in no significant visual effects. Therefore, the Proposed Development would not affect the overall integrity of the AONB.

4.213 Although the effect on the physical character of the site and immediate surrounding landscape would be significant because there are currently no other such features in close proximity, the Proposed Development would be physically separate from both the Owenreagh and Sperrin Foothills clusters of wind farms which defines the western-most end of LCA 29 and the Sperrin Foothills LCA to the north west. It would therefore have limited magnitude of cumulative effect on landscape character when considered in combination with these wind farms. Although it would incrementally increase the physical presence of wind turbines in this part of LCA 29 it is not of such a scale that it would cause the landscape character to become more defined by wind farms than by other landscape attributes. There are no other wind farms in proximity to the Proposed Development and its incremental cumulative effect on the landscape character of the Study Area as a whole is therefore deemed to be of low magnitude and not significant. It is also noted that wind farms are not an uncommon feature in approaches to the AONB and there is already a repeating pattern of wind farms and single turbines across other parts of the Study Area and around the edges of the AONB.

4.214 The Proposed Development would have no significant incremental cumulative visual effect on any of the 19 Viewpoints considered in this LVIA because it is largely perceived as a standalone development with no visual relationship of any great magnitude with other wind farms in the cumulative baseline.

4.215 The Proposed Development would have no significant effects on landscape character and limited visibility across the wider Study Area as a whole. This is expressed by only four of the 19 representative viewpoints experiencing significant visual effects, and none experiencing significant cumulative visual effects. Therefore, the LVIA concludes that the Proposed Development is acceptable in landscape and visual terms.

List of Appendices

- Technical Appendix 4.1: LVIA Plates, Tables and Figures, Glossary and References
- Technical Appendix 4.2 LVIA Methodology
- Technical Appendix 4.3 Landscape Character Areas
- Technical Appendix 4.4 Viewpoint Selection
- Technical Appendix 4.5 Cumulative Baseline

Summary List of Figures

- Refer to Technical Appendix 4.1 for detailed list of figures
- Figures 4.1 – 4.4: Baseline Assessment Figures including landscape designations and classifications; landscape character; viewpoint selection; and cumulative baseline
- Figures 4.5 – 4.8: Zone of Theoretical Visibility Diagrams
- Figures 4.10 – 4.27: Viewpoint Visualisations

5

Archaeology & Cultural Heritage

5 Archaeology and Cultural Heritage

Introduction

5.1.1 This chapter of the ES assesses the likely significant effects the Proposed Development would have on the historic environment, and incorporates an assessment of baseline conditions and potential effects provided by the Cultural Heritage Baseline Appraisal, which is included in Appendix 5.1, and which should be read in conjunction with this chapter. A number of heritage visualisations of the Proposed Development have also been produced to inform the assessment provided in the baseline assessment and in this chapter, and these are provided in Appendix 5.2.

5.1.2 The historic environment includes a wide range of different types of features and structures, from ancient buried archaeological remains up to late 20th century industrial and military structures. Historic environment resources, or heritage assets, can be broadly divided into the following categories:

Archaeology

- Scheduled Ancient Monuments (SAMs) (statutory); and
- Archaeological remains and artefacts (non-statutory).

Built Heritage

- Conservation Areas (statutory);
- Listed Buildings (statutory);
- Registered Parks and Gardens
- Non-designated built heritage assets (non-statutory).
- Registered Historic Battlefields, Shipwrecks, World Heritage Sites and Locally Listed Buildings are not considered within this Chapter because there are no such designations within, or adjacent to the Site.

5.1.3 The chapter describes the assessment methodology; the baseline conditions currently existing at the Site and in the surrounding area; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed; and the cumulative effects associated with the Proposed Development in combination with; Owenreagh windfarm and its extension and Eglish windfarm.

Legislation, Policy and Guidance

Legislation

Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995

5.1.4 The Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995 protects the fabric of Scheduled Monuments, but does not afford statutory protection to their settings. Relevant policies relating to the protection of the setting of scheduled monuments are contained within national and local development plans and are set out below.

5.1.5 The Planning (Northern Ireland) Order 1991 sets out provisions relevant to the protection of listed buildings and conservation areas and their setting. The following sections are relevant to the Site.

5.1.6 Section 45 states that:

> *"In considering whether to grant planning permission for development which affects a listed building or its setting, and in considering whether to grant listed building consent for any works, the Department shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses"*

Regional Planning Policy

Introduction and Overview

5.1.7 In March 1999 the Planning Service (an agency within the Department of the Environment for Northern Ireland) published Planning Policy Statement 6 (PPS 6), 'Planning, Archaeology and the Built Heritage'.

5.1.8 Planning Policy Statements set out the policies of the DoE on particular aspects of land use planning and apply to the whole of Northern Ireland. Their contents will be taken into account in preparing development plans and are a material consideration in determining individual planning applications and appeals.

5.1.9 PPS 6 sets out the DoE's planning policies for the protection and conservation of archaeological remains and built heritage.

5.1.10 Section 3 of PPS 6 relates to archaeological sites and monuments and provides guidance for property owners, developers, their professional advisors and others on the preservation and investigation of archaeological remains.

5.1.11 The Department's relevant policies on this topic are set out below:

BH1 - The preservation of archaeological remains of regional importance and their setting

> *The department will operate a presumption in favour of the physical preservation in situ of archaeological remains of regional importance and their settings. These comprise monuments in state care, scheduled monuments and other important sites and monuments which would merit scheduling. Development which would adversely affect such sites of regional importance, or the integrity of their settings will not be permitted unless there are exceptional circumstances.*

BH2 - The protection of archaeological remains of local importance and their settings.

Development proposals which would adversely affect archaeological sites or monuments which are of local importance or their settings will only be permitted where the department considers the importance of the proposed development or other material considerations outweigh the value of the remains in question.

BH3 – Archaeological Assessment and Evaluation

Where the impact of a development proposal on important archaeological remains is unclear, or the relative importance of such remains is uncertain, the department will normally require developers to provide further information in the form of an archaeological assessment or an archaeological evaluation. Where such information is requested but not made available the department will normally refuse planning permission.

BH4 – Archaeological Mitigation

Where it is decided to grant planning permission for development which will affect sites known to contain archaeological remains, the department will impose conditions to ensure that appropriate measures are taken for the identification and mitigation of the archaeological impacts of the development, including where appropriate the completion of a licensed excavation and recording of remains before development commences.

BH6 – The Protection of Parks, Gardens and Demesnes of Special Historic Interest

The department will not normally permit development which would lead to the loss of, or cause harm to, the character, principal components or setting of parks, gardens and demesnes of special historic interest. Where planning permission is granted this will normally be conditional on the recording of any features of interest which will be lost before development commences.

BH11 – Development Affecting the Setting of a Listed Building

The department will not normally permit development which would adversely affect the setting of a listed building. Development proposals will normally only be considered appropriate where all the following criteria are met:

- *The detailed design respects the listed building in terms of scale, height, massing and alignment;*
- *The works proposed make use of traditional or sympathetic building materials and techniques which respect those found on the building; and*
- *The nature of the use proposed respects the character of the setting of the building.*

5.1.12 PPS 6 also includes policy statements on Northern Ireland's World Heritage Sites. However, this topic is not relevant to the scope of this particular assessment.

5.1.13 Planning policy relating to renewable energy is set out in PPS 18: Renewable Energy. The relevant policies are presented below.

RE 1: Renewable Energy Development

Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on:

[…]

(c) Biodiversity, nature conservation or built heritage interests;

[…]

Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures, such as a habitat management plan or the creation of a new habitat. This matter will need to be agreed before planning permission is granted.

The wider environmental, economic and social benefits of all proposals for renewable energy projects are material considerations that will be given significant weight in determining whether planning permission should be granted.

The publication best practice guidance to planning policy statement 18 'renewable energy' will be taken into account in assessing proposals.

Strategic Planning Policy Statement for Northern Ireland (SPPS)Introduction and General Overview

5.1.14 The SPPS is a statement of the Department's policy on important planning matters that should be addressed across Northern Ireland (SPPS paragraph 1.3). Paragraph 1.5 of the SPPS notes that the provisions within the SPPS apply to the whole of Northern Ireland and must be taken into account in the preparation of Local Development Plans, and are also a material consideration in all planning applications and appeals.

5.1.15 All local councils in Northern Ireland are in the process of developing new local plans which conform with the SPPS. Once these are all completed and adopted, they, together with the SPPS, will replace the Planning Policy Statements, which will be cancelled (SPPS paragraph 1.9).

5.1.16 Paragraphs 1.10 to 1.12 of the SPPS set out that until the adoption of the new local plans by the eleven local councils in Northern Ireland, the existing adopted local plans and Planning Policy Statements will continue to apply alongside the SPPS. However, where a policy within an existing local plan or PPS conflicts with that set out in the SPPS, the policy in the SPPS Should be accorded greater weight in the decision making process (SPPS paragraph 1.12).

5.1.17 SPPS policy in relation to archaeology and built heritage is set out in paragraphs 6.1 to 6.30 of the SPPS. It sets out the aim of the SPPS in relation to archaeology and built heritage in paragraph 6.3:

5.1.18 "The planning system has a key role in the stewardship of our archaeological and built heritage. The aim of the SPPS in relation to Archaeology and Built Heritage is to manage change in positive ways so as to safeguard that which society regards as significant whilst facilitating development that will contribute to the ongoing preservation, conservation and enhancement of these assets."

5.1.19 Paragraph 6.4 sets out the regional strategic objectives for archaeology and built heritage as to:

- *secure the protection, conservation and, where possible, the enhancement of our built and archaeological heritage;*

- *promote sustainable development and environmental stewardship with regard to our built and archaeological heritage; and*
- *deliver economic and community benefit through conservation that facilitates productive use of built heritage assets and opportunities for investment, whilst safeguarding their historic or architectural integrity.*

5.1.20 The SPPS goes on to set out policy in relation to the determination of planning applications in relation to different types of archaeological and built heritage assets in paragraphs 6.6 through 6.25. Key elements of the policies set out in this section are reproduced below for ease of reference:

World Heritage Sites

6.6 Development that would adversely affect the Outstanding Universal Value of a World Heritage Site (WHS) or the integrity of its setting must not be permitted unless there are overriding exceptional circumstances.

Archaeology

6.8 Archaeological remains of regional importance include monuments in State Care, scheduled monuments and Areas of Significant Archaeological Interest (ASAIs). Such sites (or constituent parts of them) benefit from statutory protection. Development which would adversely affect such sites or the integrity of their settings must only be permitted in exceptional circumstances. The scheduling programme is an ongoing process and there are archaeological remains of regional importance yet to be scheduled. In order to make sure that the most up to date information is taken into account when determining applications, this policy approach should also apply to such sites which, whilst not scheduled presently, would otherwise merit such statutory protection.

6.9 Development proposals which would adversely affect archaeological remains of local importance or their settings should only be permitted where the planning authority considers that the need for the proposed development or other material considerations outweigh the value of the remains and/or their settings.

6.10 Planning authorities should seek all necessary information from applicants in making well informed planning judgements, particularly where the impact of a development proposal on archaeological remains is unclear, or the relative significance of such remains is uncertain. Should an applicant fail to provide a suitable assessment or evaluation on request, the planning authority should adopt a precautionary approach and refuse planning permission.

6.11 Where a planning authority is minded to grant planning permission for development which will affect sites known or likely to contain archaeological remains, it should ensure that appropriate measures are taken for the identification and mitigation of the archaeological impacts of the development. Where appropriate, this may involve the preservation of remains in situ, or a licensed excavation, recording examination and archiving of the archaeology by way of planning conditions.

Listed Buildings

6.12 Listed Buildings of special architectural or historic interest are key elements of our built heritage and are often important for their intrinsic value and for their contribution to the character and quality of settlements and the countryside. It is *important therefore that development proposals impacting upon such buildings and their settings are assessed, paying due regard to these considerations, as well as the rarity of the type of structure and any features of special architectural or historic interest which it possesses.*

6.13 Development involving a change of use and / or works of extension / alteration may be permitted, particularly where this will secure the ongoing viability and upkeep of the building. It is important that such development respects the essential character and architectural or historic interest of the building and its setting, and that features of special interest remain intact and unimpaired. Proposals should be based on a clear understanding of the importance of the building/place/heritage asset, and should support the best viable use that is compatible with the fabric, setting and character of the building. Applicants should justify their proposals, and show why alteration or demolition of a listed building is desirable or necessary.

Historic Parks, Gardens and Demesnes

6.16 Planning permission should not be granted for development that would lead to the loss of, or cause harm to, the overall character, principal components or setting of Historic Parks, Gardens and Demesnes.

Conservation Areas

6.18 In managing development within a designated Conservation Area the guiding principle is to afford special regard to the desirability of enhancing its character or appearance where an opportunity to do so exists, or to preserve its character or appearance where an opportunity to enhance does not arise. Accordingly, there will be a general presumption against the grant of planning permission for development or conservation area consent for demolition of unlisted buildings, where proposals would conflict with this principle. This general presumption should only be relaxed in exceptional circumstances where it is considered to be outweighed by other material considerations grounded in the public interest. In the interests of protecting the setting of designated Conservation Areas, new development in proximity needs to be carefully managed so as to ensure it respects its overall character and appearance. Important views in and out of the Conservation Area should be retained.

Areas of Townscape Character (ATC)

6.21 In managing development within ATCs designated through the LDPs process, the council should only permit new development where this will maintain or enhance the overall character of the area and respect its built form.

Non-Designated Heritage Assets

6.24 The effect of an application on the significance of a non-designated heritage asset such as an unlisted vernacular building, or historic building of local importance should be taken into account in determining the application. In weighing applications that affect directly or indirectly non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset. Councils may wish to bring forward bespoke local policies for such buildings.

Enabling Development

6.25 Enabling Development is a development proposal that is contrary to established planning policy and in its own right would not be permitted. Such a proposal may however be allowed where it will secure the long term future of a significant place and will not materially harm its heritage value or setting. Enabling development typically seeks to subsidise the cost of maintenance, major repair, conversion to the optimum viable use of a significant place where this is greater than its value to its owner or market value.

5.1.21 The SPPS also provides policy in relation to renewable energy developments in paragraphs 6.214 through 6.234. Paragraph 6.224 makes specific reference to how effects of renewable energy developments to the historic environment should be weighed (emphasis added for clarity):

6.224 Development that generates energy from renewable resources will be permitted where the proposal and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on the following planning considerations:

- *public safety, human health, or residential amenity;*
- *visual amenity and landscape character;*
- *biodiversity, nature conservation or built heritage interests;*
- *local natural resources, such as air quality, water quality or quantity; and,*
- *public access to the countryside.*

Local Planning Policy

5.1.22 Local planning policy is provided by the Derry City and Strabane District Council Local Development Plan to 2032. The Local Development Plan 2032 contains the following policy relating to archaeology and cultural heritage:

GDP 8 Development Principles: Preserving and Enhancing the Historic Environment

Development affecting the historic environment should:

i. *promote sustainable development and environmental stewardship with regard to our historic environment;*

ii. *secure the preservation, conservation and where possible, the enhancement of buildings and areas of cultural, historic or archaeological interest including conservation areas, historic parks, gardens, areas of archaeological interest and listed buildings and their settings;*

iii. *promote the enhancement of the historic environment through the use of high standards of design and careful choice of sustainable materials for all development;*

iv. *promote economic and community development through the sympathetic and appropriate reuse of existing buildings, especially those which make a contribution to the special character of their locality;*

v. *promote design that ensures a safe and secure environment; vi maximise opportunities for the use of sustainable construction techniques such as the reuse of building materials, sustainable drainage systems, renewable energy* *generation, water and energy efficiency, recycling and reuse to minimise waste in new developments;*

vi. incorporate high quality design which results in usable, durable and adaptable places which reflect local distinctiveness.

vii. promote improvements in accessibility of the historic environment for all people regardless of age, gender, religious belief, political opinion or ethnicity.

Policy HE1 Archaeology and Upstanding Remains

Archaeological Remains of Regional Importance

Planning permission will not be permitted where a development proposal would adversely affect archaeological remains of Regional importance such as Monuments in State Care, Scheduled Monuments, and Areas of Significant Archaeological Interest (ASAI). Development which would adversely affect such sites or the integrity of their settings must only be permitted in exceptional circumstances.

Archaeological Remains of Local Importance

Planning permission will not be granted for a development proposal which would adversely affect archaeological remains of local importance or their settings. Planning permission will only be granted where Council considers that the need for the proposed development or other material considerations outweigh the value of the remains and or their setting.

Policy HE2 Archaeological Assessment, Evaluation and Mitigation

Planning Permission will not be granted where the impact of a development on important archaeological remains are unclear, or the relative importance of the remains is uncertain. The Council will require developers to provide further information in the form of an archaeological assessment or an archaeological evaluation. Where such information is requested but not provided, a precautionary approach will be adopted and Planning Permission will be refused; Where Planning Permission is granted for development which will affect sites known or likely to contain archaeological remains, the Council will impose conditions to ensure preservation in situ, and archiving of the archaeology before development commences.

Policy HE4 Listed Buildings and their Settings

Change of use of a Listed Building

Planning Permission will be granted, in consultation with the relevant statutory authority, where the change of use secures its upkeep and survival, and the character and architectural or historic interest of the building would be preserved or enhanced. Proposals for a change of use should incorporate details of all intended alterations to the building and its curtilage to demonstrate their effect on its appearance, character and setting.

[…]

Demolition of Listed Building

There will be a presumption in favour of retaining Listed Buildings. The Council, in consultation with the relevant statutory authority, will not permit the total demolition or any significant part of a listed building unless there are exceptional reasons why the *building cannot be retained in its original or a reasonably modified form. Where, exceptionally, Listed Building Consent is granted for demolition, this will normally be conditional on prior agreement for the redevelopment of the site and appropriate arrangements for recording before its demolition.*

Development Affecting the Setting of a Listed Building

Planning Permission will only be granted, for a development proposal which would not adversely affect the setting of a listed building. Development proposals will normally only be considered appropriate where all the following criteria is met:

- *The detailed design respects the listed building in terms of scale, height, massing and alignment.*
- *The works proposed make use of traditional or sympathetic building materials and techniques which respect those found on the building; and*
- *The nature of the use proposed respects the character of the setting of the building.*

Policy HE5 Conservation Areas

1) *New development within or affecting the setting of a Conservation Area Planning Permission will be granted for a proposal that enhances the character or appearance where the opportunity to do so exists or to preserve its character or appearance where an opportunity to enhance does not arise. Any proposal for new development in or adjacent to a Conservation Area should:*
    - *be sympathetic to the characteristic built form of the area;*
    - *respect the characteristics of adjoining buildings in the area by way of its scale, form materials and detailing;*
    - *not result in environmental problems such as noise, nuisance or disturbance;*
    - *protect important views within, into and out of an area;*
    - *protect trees and other landscape features contributing to the character or appearance of the area;*
    - *protect the Conservation Area public realm – including street furniture, light fixtures and traditional paving surfaces and patterns;*
    - *conform with the guidance set out in the Conservation Area design guides; and*
    - *only consider the demolition of an unlisted building where Council deems that the building makes no material contribution to the character or appearance of the areas and subject to appropriate arrangements for the redevelopment of the site.*
2) *Demolition in a Conservation Area*

The Council will normally only permit the demolition of an unlisted building in a Conservation Area where the building makes no material contribution to the character or appearance of the area. Where Conservation Area consent for demolition is granted, this *will normally be conditional on prior agreement for the redevelopment of the site and appropriate arrangements for recording the building before its demolition.*

Policy HE6 Area of Townscapes/ Village Character (ATCs/AVTs)

Demolition in an Area of Townscape or Village Character

The Council will operate a presumption in favour of retaining any building which makes a positive contribution to the character of an Area of Townscape Character (ATC) and its setting. The Council will normally only permit the demolition of an unlisted building within an ATC where the building makes no material contribution to the distinctive character of the area. Where permission for demolition is granted, this will normally be conditional on prior agreement for the redevelopment of the site.

New Development in an Area of Townscape or Village Character

The Council will permit development proposals in an Area of Townscape Character where the development maintains or enhances its overall character and respects the built form of the area. The Council will require that any trees, archaeological or other landscape features which contribute to the distinctive character of the area are protected and integrated in a suitable manner into the design and layout of the development.

HE7 Historic Parks, Gardens, Demesnes and their Setting

The Council will not normally permit development which would lead to the loss of, or cause harm to, the character, principal components or setting of parks, gardens and demesnes of special historic interest. Where Planning Permission is granted, this will normally be conditional on the recording of any features of interest which will be lost before development commences.

RED1 Renewable and Low Carbon Energy Development – General Criteria

All Renewable and Low Carbon Energy Developments

In the first instance, proposals for renewable energy must accord with the relevant LDP landscape designations (Refer also to Chapter 21 Natural Environment):

- Wind Energy Capacity Area (WECA)

- Special Countryside Area (SCA)

- Area of High Landscape Importance (AHLI)

- Area of Outstanding Natural Beauty (AONB)

Subsequent to meeting the above, development proposals that generate energy from renewable resources will be permitted where the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on:

[…]

c) biodiversity, natural and / or historic assets;

[…]

Where any project is likely to result in unavoidable damage to the site / area during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory *measures, such as a habitat management plan or the creation of a new habitat. This matter will need to be agreed before planning permission is granted.*

[…]

The potential for significant adverse impacts from renewable and low carbon energy development proposals on designated sites across the District, including Special Countryside Areas (SCA), Areas of High Landscape Importance (AHLIs) and Areas of Outstanding Natural Beauty (AONB) will be a priority consideration. The impact of proposals on designated natural and historic environment assets will also be a priority consideration.

[…]

Wind Energy Development

Proposals for wind energy development, including proposals for repowering of existing developments, will also be required to meet all of the following criteria:

1) the development will not have an unacceptable impact on visual amenity or landscape character through: the number, scale, size and siting of turbines;

[…]

Consultation

5.1.23 Consultations were held with the Department for Communities (DoC) in order to agree the scope of the assessment work, and also the key elements of the historic environment that would require consideration. Further guidance was provided by the Historic Environment Division's Development and Archaeology: Guidance on Archaeological Works in the Planning Process document. The liaison comprised:

- Email correspondence to agree the area around the Site that should be examined for potential indirect impacts; agreed to be 10km.

Assessment Methodology

Scope of Study

For the Assessment of Archaeological Potential

5.1.24 The archaeological potential of the Site was assessed by reviewing available relevant evidence, both from within the Site, and also from the surrounding area. This was used to assess the potential the Site has to contain buried archaeological remains. The evidence was drawn from the following resources:

- Data from the Historic Environment Record of Northern Ireland (HERoNI);
- The results of previous archaeological investigations (if available and relevant);
- Consultation of the schedule of ancient monuments and lists of listed buildings and other designated heritage assets held by the Historic Environment Division of the Department for Communities of Northern Ireland;
- Local studies and record office research;
- Satellite imagery (if available and relevant);
- A site walk over (where possible and appropriate); and
- Review of historic mapping.

5.1.25 In addition, information about the topography and geology of the Site was also collated and considered alongside the archaeological evidence.

5.1.26 These records and resources were examined in relation to the Site, and a suitable buffer zone (the study area) around the Site. This ensured that the baseline information used to inform the assessment of potential for the Site included sufficient information with which to understand the context of the evidence discussed. The extent of the study area needed to inform the assessment depends on the quantity and quality of the evidence available, as well as the size of the Proposed Development among other factors.

5.1.27 The standard extent of the study area is usually 1km from the Site boundary. However, this may be varied depending on the nature of the evidence available; for example in some urban settings there may be a high quantity of evidence in the immediate vicinity of the Site, meaning that the extent of the study area can be reduced and more focussed on the and the immediately surrounding area.

5.1.28 On this occasion, a 1km search radius from the Site boundary was considered appropriate for the study area.

For the Assessment of Effects on the Setting of Heritage Assets

5.1.29 This assessment also considered the potential effects of the Proposed Development within the Site on the significance of heritage assets, through effects to their settings. This included any heritage assets within the Site, and those in the surrounding area, whose setting could be affected.

5.1.30 This assessment will also consider the potential effects of development within the Site on the significance of heritage assets, through effects to their settings. This will include any heritage assets within the Site, and those in the surrounding area, whose setting may be affected. The heritage assets which require assessment have been selected with reference to the Northern Ireland Sites and Monuments Record and the Northern Ireland Buildings Record, as well as information held by the LPA on conservation areas and heritage assets.

5.1.31 A basic search radius of 10km from the Site boundary was used to establish which heritage assets required assessment for impacts. This is normally sufficient to ensure all assets which require consideration are properly assessed, as beyond this distance the residential development is rarely discernible to the degree that it would affect the heritage value of a view.

5.1.32 Designated heritage assets of the high significance, comprising listed buildings and registered parks and gardens graded A and B+, scheduled ancient monuments, world heritage sites and conservation areas within the whole 10km search radius are assessed for potential impacts from the proposed development. This is because such assets tend to either be prominent or have heightened sensitivity to change before their significance is affected.

5.1.33 Other designated heritage assets, such as grade B listed buildings and registered parks and gardens and conservation areas are assessed for impacts within a 10km search radius from the Site boundary. This is because assets at this level of designation tend to have a lower sensitivity to change than higher graded assets.

Methodology for the Assessment of Archaeological Potential

5.1.34 The available evidence was reviewed and used to determine what potential the Site has to contain buried archaeological remains. Regard was had to the reliability of the evidence reviewed, any limitations inherent in the methods used to generate that evidence, and to the relevance of the evidence in informing the assessment of archaeological potential of the Site. The assessment considered the available archaeological evidence by historical period.

5.1.35 It is not necessary to describe all available evidence for each period exhaustively; the assessment of potential is focussed on the evidence which helps to clarify the archaeological potential of the Site.

5.1.36 The historical periods referred to in this assessment are set out below:

Prehistoric period

Mesolithic	8,000 BC to 4,000 BC
Neolithic	4,000 BC to 2,500 BC
Bronze Age	2,500 BC to 500 BC
Iron Age	500 BC to AD 400

Historic period

Early medieval	AD 400 to AD 1100
Medieval	AD 1100 to AD 1600
Post-Medieval	AD 1600 to AD 1901
Modern	AD 1901 to present

5.1.37 The potential for the Site to contain buried remains was categorised as either known, moderate, general, low, limited, no potential or unknown potential, based on the criteria set out below.

- **Known potential**: where a site is known to have archaeological remains, for example from evidence provided by archaeological investigations.
- **Moderate potential**: where the available evidence suggests there is a strong possibility for a site to contain archaeological remains, but it is not conclusive or certain. For example, an adjacent field to that being assessed has been subject to archaeological field investigations and is known to have evidence of occupation remains. But there is no clear evidence in the results of the investigations that these remains continue into the site being assessed.
- **General potential**: where the available evidence suggests that archaeological remains may be present in the Site, but the evidence is not clear enough to determine whether the Site is likely or unlikely to contain associated buried remains. For example there may be a general potential for archaeology, evidenced by residual finds in nearby investigations and other evidence in the wider area, but no clear evidence close to the Site, which would help to determine whether their presence within the Site is likely or unlikely.
- **Low potential**: where the available evidence suggests that the presence of archaeological remains within a site is unlikely, but this is not certain or conclusive.
- **No potential**: where a site is known to have no archaeological remains, for example due to past mineral extraction, or when previous archaeological works demonstrate that no remains are present.
- **Unknown potential**: where there is insufficient information to provide any assessment of the archaeological potential of a site.

5.1.38 The assessments of potential set out above can refer to the potential across the whole of the Site, or to only part of it. For example, potential for evidence from a particular period may be focussed in a specific part of the Site, or there may be evidence of past localised mineral extraction.

Methodology for Assessment of the Setting of Heritage Assets

5.1.39 This assessment will consider the potential effects of development within the Site on the significance of heritage assets, through effects to their settings. This will include any heritage assets within the Site, and those in the surrounding area, whose setting may be affected. Heritage assets and potential impacts will be assessed using best practice, including that set out in the Historic Environment Division's Guidance on Setting and the Historic Environment (2018 HED). This defines setting as:

> *The term 'setting' applies to the physical space that is part of – and contributes to – the significance and distinctive character of a heritage asset, and through which the asset may be seen, experienced, understood and enjoyed.*

5.1.40 In order to assess potential effects on the setting of heritage assets, it is necessary to define the integrity of the setting, due to the wording of policies provided in the SPPS, which restricts developments which would adversely affect either the physical remains of scheduled archaeological monuments and other assets, or the integrity of their setting, unless there are exceptional circumstances.

5.1.41 In this context, and given how the term setting is defined, the term integrity must refer to the ability of physical space in which the heritage asset is located to:

- Form part of the physical remains of the asset
- Contribute to its significance and distinctive character; and
- To be a means through which it can be seen, experienced, understood and enjoyed.

5.1.42 If the physical space is able to do these three things, it must follow that the integrity of the setting has been preserved. This is distinct from change, as the setting may change but may still be able to contribute to the physical remains, its significance and distinctive character and provide appreciation despite a change to the setting.

5.1.43 The guidance goes on to set out a three-stage process for the assessment of the setting of heritage assets, and of development impacts to the significance of heritage assets through changes to their setting:

Stage 1: identify the heritage assets that might be affected.
Stage 2: define the setting by establishing how the surroundings contribute to the significance of the heritage assets in the ways they are understood, appreciated and experienced.
Stage 3: assess how any change would impact upon that setting.

5.1.44 As part of stage 1, set out above, the heritage assets which require assessment have been selected with reference to the heritage data for the Site and surrounding area provided by the HED and held by the Northern Ireland Environment Agency. A search radius of 10km from the Site boundary was used to establish which heritage assets required assessment for impacts, which is usually sufficient to ensure all assets which require consideration are properly assessed.

5.1.45 Not all designated heritage assets within this radius will require full assessment for impacts; where a designated heritage asset has been excluded, a clear justification will be provided, for example if the asset is sufficiently far, and well screened from the Site. Also, not all assets will require the same level of assessment; more complex and/or significant assets which may be subject to a higher level of impact will require more detailed consideration than those of less significance, or which are not highly affected by the proposed development.

Photography

5.1.46 Photographs taken to illustrate the scale of a heritage asset from a particular viewpoint have been taken with a Canon EOS 6D camera with a 24-105mm lens. The camera has a 20.2 megapixel full-frame CMOS sensor.

5.1.47 Research[1] has found that images taken with a focal length of between 70mm and 80mm provide the most realistic representation of landscape features in terms of their scale within the photograph, with shorter focal lengths (i.e. 50mm or 60mm) found to exaggerate the distance of the object (Hunter 2012). While this chapter does not consider landscape impacts, it does consider views of heritage assets within their setting, including distant key

[1] Hunter, P. (2012). *The Effect of Focal Length on Perception of Scale and Depth in Landscape Photographs - Implications for visualisation standards for wind energy developments*. Stirling: University of Stirling.

views, in which similar considerations to those studied by Hunter's research apply (for instance, one of the receptors considered in the 2012 study was Urquhart Castle, a scheduled monument in Scotland).

5.1.48 Therefore, photographs of heritage assets within this assessment, such as a church tower seen from a specific viewpoint, will be taken at focal lengths of between 70mm to 80mm, to provide an accurate representation of the scale of the heritage asset within any view presented. Lower focal lengths (which provide a more wide-angle view) may be used in certain circumstances, for example in urban contexts or for general site or location photographs, to provide better context for a view, or understanding of the setting of a heritage asset, if appropriate. The focal length of the image will be provided with all photographs.

5.1.49 Care has also been taken to ensure that the images presented are of a good quality. Photographs are taken in clear weather wherever possible. Finally, photographs within the body of this assessment are provided for illustrative purposes only and are not sized within the assessment for viewing to scale as is done in Landscape and Visual Impact Assessment (LVIA). If it is necessary to provide such a scaled view, it will be clearly labelled with specific viewing instructions.

Methodology for Assessment of Significance of Heritage Assets

5.1.50 Ultimately the assessment of the significance of archaeological remains and other heritage assets is a matter of professional judgement, having regard to the available evidence, including research priorities, guidance, as well as any designation the asset may have. The assessment will be made with reference to the Historic Environment Division's Criteria for the Scheduling of Historic Monuments and the Listing of Buildings of Special Architectural or Historic Interest, with associated procedures (DfC 2019a), and research priorities set out in the relevant regional and local archaeological research frameworks, as appropriate.

5.1.51 The levels of significance used in this assessment are defined in table 5.1, below.

Importance / value	Description
Very High	- World Heritage Sites
High	- Scheduled Monuments and archaeological sites of demonstrable schedulable quality & importance; - Protected Wreck Sites - Listed buildings graded A and B+ - Designated registered parks and gardens - Registered Historic Landscapes of high interest - Conservation Areas
Medium	- Local Authority designated sites and their settings; - Listed buildings graded B; - Undesignated sites of demonstrable regional importance
Low	- Sites with specific and substantial importance to local interest groups; - Sites whose importance is limited by poor preservation and poor survival of contextual associations.
No importance	- Sites with no surviving archaeological or historical component.

Assessment of Impacts

5.1.52 Assessments of the degree of adverse effects on the significance of heritage assets are based on the extent to which the proposed development would affect the nature, extent and level of significance of the asset.

5.1.53 The degree of effect will vary in severity, depending on the extent, nature and level of effect to the significance of the heritage asset. Understanding the degree of effect is important to determine whether a potential effect is acceptable or not, as well as whether mitigation measures should be implemented, and what form them should take.

5.1.54 In order to inform this process, a spectrum of effects is provided in Table 2, below, along with brief descriptions of the terms used. Where this assessment determines that an adverse effect would result from the implementation of the proposed development, the level of effect will be assigned based on the terms used in table 5.2.

5.1.55 By nature, this process is not quantitative but relies on professional judgement. However, this judgment is informed by accepted, observable facts, such as spatial relationships and designations, the extent of any physical impacts, and the extent of changes to the surroundings of heritage assets.

Table 5.2 – Criteria for determining the degree of harm on the significance of heritage assets

Level of impact	Description
Major Adverse	Substantial harm to, or total loss of, the significance of a heritage asset. Harm to a heritage asset through effects to its setting, such that the significance of the asset would be totally lost or substantially reduced (e.g. the significance of a designated heritage asset would be reduced to such a degree that its designation would be questionable; the significance of an undesignated heritage asset would be reduced to such a degree that its categorisation as a heritage asset would be questionable).
Moderate Adverse	Less than substantial, but still moderate harm to a heritage asset. An adverse effect that would materially affected and/or considerably devalue the significance of a heritage asset, but not one that would totally or substantially remove it.
Minor Adverse	Less than substantial, but low level of harm to the significance of a heritage asset. This could include the removal of fabric that forms part of the heritage asset, but that is not integral to its significance (e.g. the demolition of later extensions/additions of little intrinsic value). Low level of harm to the heritage asset's significance through effects to its setting.
Negligible	A change to a heritage asset or its setting that involves no loss of significance or harm.
No Impact	No change to a heritage asset or its setting.

Assessment of Heritage Benefits

5.1.56 In addition to adverse effects, a development may also have beneficial effects on the significance of a heritage asset. For example, a development may involve the repair and restoration of the fabric of a historic building which is at risk.

5.1.57 Furthermore, there are often instances where the effects of a development on the significance of a heritage asset are multifaceted, with both adverse and beneficial effects. In these instances it is necessary to come to an overall understanding of the impact of a proposed development, which considers both positive and negative effects. To inform such a judgment, it is not sufficient to understand that an effect is beneficial, it is also necessary to understand the scale of the benefit in order to understand how a harmful effect compares to a beneficial one.

5.1.58 Therefore, where a beneficial effect to a heritage asset is identified it will be categorised as either major, moderate or low, mirroring the degrees of adverse effects set out in table 2, above. Where a benefit is categorised, this will be justified within the assessment. The categorisation of a benefit will follow the broad criteria set out below in table 5.3.

Table 5.3 – Criteria for determining the degree of heritage benefits

Level of effect	Description
Major benefit	Benefits that enhance key elements of a heritage asset's significance to a substantive degree. This would include effects such as substantial repairs or restoration of original fabric of a listed building which is at risk, or works that allow a central part of an asset's special interest to be appreciated or understood where this was not previously possible.
Moderate benefit	Benefits that provide a moderate enhancement to important elements of a heritage asset's significance. Examples would be realising the research value of remains of archaeological interest through archaeological investigation, modest repairs and restoration of key parts of the fabric of a heritage asset, and works that better reveal key elements of the significance of a listed building, either by removing unsympathetic extensions or by sympathetically modifying the building's setting.
Minor benefit	Benefits that either provide minor enhancements to important elements of a heritage asset's significance, or which benefit more peripheral elements of the asset's significance. Examples would include removing unsympathetic elements from the setting of a heritage asset which allow for generally enhanced appreciation of the asset's significance, or minor repairs and restoration of a historic building's fabric.
Slight benefit	Benefits that provide a minor benefit to peripheral elements of the asset's significance. Examples would include limited improvements to the setting of a heritage asset which allow for a small enhancement in appreciation of the asset's significance.

5.1.59 It is important to note that the descriptions and categories above are for guidance, and that assessments of benefits must ultimately be based on professional judgment which is informed by a thorough understanding of the heritage asset's significance, and of the effects of the proposed development.

Assessment of the significance of effects

5.1.60 The assessment of the overall impact of the proposed wind farm on the significance of heritage assets is evaluated by taking into account both the heritage significance of the heritage asset in question, and the magnitude of the predicted effect on that significance. As is set out in policy in relation to the determination of renewable energy developments with regard to effects to heritage assets (SPPS paragraph 6.224 and PPS 18 policy RE1), it is important to understand whether a development would result in an unacceptable adverse impact on the significance of built heritage interests.

5.1.61 To understand whether an effect to a heritage asset is unacceptable, it is necessary to understand the degree of effect a development would have on the significance of a heritage asset, as well as of the level of importance of the heritage asset in question. Due to the higher protection provided to heritage assets of higher importance, the significance of an adverse effect to the planning balance will vary depending on the importance of the asset in question (as defined in table 5.1, above), as well as the level of adverse or beneficial effect identified (as defined in tables 5.2 and 5.3).

5.1.62 Table 5.4, below, uses these factors to provide a framework for the identification of the significance of effect of an identified effect on the significance of a heritage asset, which would result from the proposed development.

Table 5.4 – Criteria for determining the significance of effect

Degree of adverse and of beneficial effects (tables 2 and 3)	Level of importance (table 1)			
	Very High	High	Medium	Low
Major Adverse	Very Large Adverse	Large Adverse	Moderate/Large Adverse	Moderate/Minor Adverse
Moderate Adverse	Large Adverse	Moderate/Large Adverse	Moderate/Minor Adverse	Minor Adverse
Minor Adverse	Moderate/Large Adverse	Moderate/Minor Adverse	Minor Adverse	Slight Adverse
Negligible/No impact	Neutral	Neutral	Neutral	Neutral
Minor beneficial	Moderate/Large Beneficial	Moderate/Minor Beneficial	Minor Beneficial	Slight Beneficial
Moderate beneficial	Large Beneficial	Moderate/Large Beneficial	Moderate/Minor Beneficial	Minor Beneficial
Major beneficial	Very Large Beneficial	Large Beneficial	Moderate/Large Beneficial	Moderate/Minor Beneficial

5.1.63 Where the significance of effect is assessed as being Moderate or higher, this is considered to be a significant effect as referred to in the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017.

Baseline Assessment

Introduction

5.1.64 This chapter is informed by a Cultural Heritage Baseline Assessment (CHBA), which considered the potential effects the Proposed Development would have on the historic environment. It considered both indirect effects which would result from changes to the setting of heritage assets in the wider area, as well as potential direct physical impacts on buried archaeological remains. The CHBA is provided as an appendix to this chapter, in Appendix 5.1.

5.1.65 The assessment of potential indirect effects provided in the CHBA comprised a comprehensive assessment of the potential indirect impacts the proposed development could have on the significance of designated heritage assets in the wider area due to changes to their settings. The baseline assessment comprised a staged assessment process, consisting of a detailed consideration of a detailed consideration of 92 designated built and archaeological heritage assets and 7 non-designated heritage assets in the wider area around the Site, followed by the detailed assessment of 15 designated heritage assets and 5 non-designated heritage assets, which are provided in Appendix 1 of the CHBA (see Appendix 5.1).

5.1.66 This process has found that in most cases, the degree of effect which would result from the proposed development would be no more than slight, and in no instance would the proposed development result in a significance of effect higher than minor adverse. The assessment of indirect effects was informed by a site visit and walkover, visualisations of proposed development within the LVIA (see Chapter 4), as well as additional visualisations produced to inform the assessment of heritage impacts which is provided in Appendix 5.2. The LVIA visualisations are referenced by Viewpoint (VP) number. Likewise, the visualisations produced for heritage assessment are referenced by heritage viewpoint (HVP) number.

5.1.67 The assessment of designated heritage assets provided in the CHBA highlighted several assets that required more detailed assessment due either to their proximity to the proposed development, their sensitivity, or the complexity of the issues surrounding their assessment which meant that they would benefit from fuller assessment. A total of fifteen such assets were identified, as follows:

- TYR 011:018 – Giants Grave Scheduled Monument
- TYR 006:006 – Court Tomb: The White Rocks Scheduled Monument
- TYR 006:030 – Two Stone Circles and Stone Alignment Scheduled Monument
- TYR 006:004 – Cashel Scheduled Monument
- TYR 006:047 – Field Walls and Cairns Scheduled Monument
- TYR 006:044– Stone Circle, Cairns and Alignments Scheduled Monument
- TYR 006:045 – Stone Circle, Cairns and Alignments Scheduled Monument
- TYR 006:046 – Field Walls, Cairns and Standing Stones Scheduled Monument
- TYR 026:005 – Stone Circle and Alignment Scheduled Monument
- TYR 011:016 – Castledamph Circle: Two Stone Circles, Cairns with Cists and Two Alignments Scheduled Monument
- TYR 011:015 – Bronze Age Ceremonial Landscape Scheduled Monument
- TYR 006:022 – Two Stone Circles and Possible Alignment Scheduled Monument
- TYR 011:004 – Castledamph Rath Scheduled Monument
- HB10/09/006 – St Marys Roman Catholic Church, Grade B1
- HB10/05/019 – 141 Glenelly Road, Grade B2

5.1.68 The CHBA recommended that the fifteen designated heritage assets should be assessed within the EIA. Therefore, these assets are described in detail below, together with the effects the Proposed Development would have on their significance. The potential for indirect effects to the remaining heritage assets in the wider study, which could result from the Proposed Development, was considered in detail in the CHBA. It was concluded that the Proposed Development would have no more than a slight effect on the remaining heritage assets in the wider area, which would not comprise significant environmental effects. As such, it is not necessary to consider these effects in detail within this chapter. However, the CHBA is provided in Appendix 5.1, where detailed assessments of all the remaining heritage assets can be found if needed.

5.1.69 The CHBA also considered the potential for the Proposed Development to result in direct physical impacts to buried archaeological remains. A summary of the potential for buried archaeological remains within the Site is provided below, and the potential effects of the proposed development are also considered below.

Cultural Heritage Baseline

TYR 011:018 - Giant's Grave scheduled monument

5.1.70 This Giant's Grave tomb is located 1.9km to the southwest of the nearest proposed turbine location and 1.7km southwest of the Site boundary. The monument comprises the well-preserved remains of a wedge tomb, with a surrounding stone circle (see plate 5.1, below).

5.1.71 The wedge tomb consists of a gallery covered by a single capstone, a cobbled interior, a pair of jams projecting to the southwest, with a large sill stone across the entrance forming a possible antechamber, or second chamber. The surrounding stone circle measured 16.2m in diameter with partly cobbled interior. The entrance to the tomb is at the south-western end, facing towards the southwest (see Plate 5.1, overleaf).

5.1.72 The tomb is of high significance, and earlier archaeological investigations have found that it contained additional associated artefactual and environmental evidence of high research value, including charcoal, bone, a flint chip and a barbed and tanged arrowhead. Although no pottery was recovered during the excavations wedge tombs were predominantly constructed between 2500 and 1800 BC and is by far the most numerous type of megalithic tomb (O'Sullivan and Downy, 2010). However, it was suggested by McConkey in 1987 that this monument may be a hybrid tomb, based on the presence of the stone circle which surrounds it (McConkey, 1987). The monument is legible from the immediate vicinity, and its orientation is readily appreciated at present, with an information board in a prominent position to the southwest of the tomb. Aligned southwest / northeast with the entrance at the southwest implies that the key part of experiencing the asset in the past, with views to the southwest being the most significant and are aligned with the past experience of the monument. The placement of the information board at the southwest now encourages the monument to be experienced facing the northeast.

Plate 5.1 Giant's Grave TYR 011:018 Entrance (35mm)

TYR 006:006 – Court Tomb 'The White Rocks' scheduled monument

5.1.73 This court tomb is located approximately 1.8km to the west of the nearest proposed turbine location and 790m west of the development.

5.1.74 It is situated in an area of rough ground on a terrace, on the east facing slope of the Inver Burn Valley with fine views of the surrounding area. The tomb consists of a large trapezoidal, denuded, long cairn of kerb stones aligned east to west. The cairn measures 24m long by 12m wide at the west tapering to approximately 9m in width at the east. The gallery measures 4.5m long and 2.6m wide at the west tapering to 1.1m at the east, if this was originally divided into two there is no visible evidence (Lynch 1966). Two entrance jams set transversely to the direction of the gallery at a height of 0.75m and provide access through a 0.5m wide gap out to the court which is 5m deep and approximately 6.8m at its widest. The court is defined at its northern edge by a peristyle of flat slabs set on edge which decrease in height to the west.

5.1.75 The monument is legible, and its orientation is readily appreciated at present. The tomb is of high significance and will preserve additional archaeological evidence of high research value.

5.1.76 Almost 30% of the court tombs recorded in Ireland are located within Northern Ireland and these were in use between 3600BC and 2400BC (O'Sullivan and Downey, 2019). The court entrance faces west, and the tomb seems to be aligned to the summit of Balix Hill to the west of the monument, making views to the west significant for appreciating the past experience of the tomb (Lynch, 1966). This view is key to appreciating the archaeological and historical interest of the tomb, and provides an appreciation of its relationship to the surrounding historic topography (see plate 5.2, below). The monument is orientated east to west, and the court opening preceding the burial chamber is at the eastern end. The immediately surrounding area also provides a good appreciation of the tomb's archaeological interest, although this is not readily discernible from the wider area.

Plate 5.2 Looking east towards Court Tomb TYR 006:006 facing the Site (24mm)

TYR 006:030 - Two Stone Circles and Stone Alignment scheduled monument

5.1.77 The two stone circles and stone alignment scheduled monument is located in the northwest of the Site, but the nearest proposed turbine would be located 710m to the southeast. The stone circles are situated in a field of heather and rough grazing on a west facing hill. The monument comprises two large stone circles, an alignment of stones in between (see plate 5.3, overleaf).

5.1.78 The two stone circles and stone alignment are of high significance, as is evidenced by their designation. It has high archaeological interest, and the monument will contain considerable associated artefactual and environmental evidence of high research value.

5.1.79 The monument is relatively well preserved and some of the stones are visible from the immediate vicinity. It is located on the west facing slope of the valley of the Inver Burn watercourse, with rising topography to the east, and seems to have been sited to provide commanding views across the valley. The setting of the monument comprises the experience provided by the immediately surrounding area, although its archaeological interest is not readily discernible from a distance, for example in views from the Longland Road to the west. There are no information boards in the surrounding area, so it is difficult actively appreciate the historical interest.

Plate 5.3 **Monument TYR 006:030 facing east to towards the proposed development (50mm)**

TYR 006:004 - Cashel scheduled monument

5.1.80 The Cashel scheduled monument located on a natural terrace to the west of side of the Inver Burn Valley, with extensive views across the Inver Burn Valley to the east.

Plate 5.4 **Cashel TYR 006:004 (70mm)**

5.1.81 The cashel is located approximately 1.7km to the northwest of the nearest turbine location and 670m northwest of the Site.

5.1.82 The remains of this cashel consist of a stone bank with many large boulders, plus a later field wall, which is much disturbed. There is a good original wall face along the interior at southwest and west but there is no original entrance. There are structural remains defining a further four small structures (See plate 5.4).

5.1.83 The cashel is of high significance and has a high level of archaeological interest, with good preservation, and the monument will contain additional associated artefactual and environmental evidence of high research value. The monument is legible and visible from the immediate vicinity and Aghabrack road located to the west (see plate 5.5, below). Views of the cashel provide appreciation of the preservation and archaeological interest of the monument, with the presence of earth and stone elements of the original construction provides appreciation for the architectural interest of the monument.

Plate 5.5 Looking east across the Cashel TYR 006:004 toward development (47mm)

TYR 006:047 - Prehistoric Landscape scheduled monument

5.1.84 This prehistoric landscape is located 2.35km to the north of the nearest proposed turbine location and 950m north of the Site boundary (see plate 5.6, overleaf).

5.1.85 It is situated in an area of heather and open undeveloped grassland, with good views towards the south, across the Burn Dennet River. The monument comprises the well-preserved remains of three small cairns and an unbroken field wall. The wall is aligned north /south for 80m and consists of linear scraw-covered or turf bank feature to a maximum height of 0.6m high. The three small cairns are located to the west of the wall, between 2 to 3m in diameter with a maximum height of 0.5m, based on their appearance they are more likely to be field clearance and not burial cairns.

5.1.86 The prehistoric landscape is of high significance, and will contain additional associated artefactual and environmental evidence of high research value. The site visit confirmed that the monument is not readily discernible from the immediate vicinity, and there is no meaningful experience of the cairns or field wall from the wider area. However, at close quarters the good preservation of the remains can be appreciated as is the orientation of the field wall, aligned south / north, which would have been a key part of experiencing the asset in the past as well as the present (based on information from HERoNI record TYR 006:047). Due to the above ground undeveloped land, it is difficult to see the cairns and field wall from the wider area.

Plate 5.6 Prehistoric Landscape TYR 006:047 looking south to the Site (47mm)

TYR006:044 - Prehistoric Landscape scheduled monument

5.1.87 This prehistoric landscape is located 1.85km to the north of the nearest proposed turbine location and 950m northeast of the Site boundary. The monument comprises the well-preserved remains of a possible stone circle, two cairns and the two stone alignment. The possible stone circle consisted of 6 standing stones visible above the bog surrounding one of the cairns, the second cairn is located 10m to the northwest. The landscape is located on the south-facing slope of a hill, overlooking the Burn Dennet River.

5.1.88 The prehistoric landscape is of high significance and will contain additional associated artefactual and environmental evidence of high research value. The monument is legible from the immediate vicinity, however there is no meaningful experience of the stone circle, cairns or stone alignment from the wider area, and public access to the monument was not possible during the site visit. Due to the above ground undeveloped land, it is difficult to see the cairns, stone circle and alignment from the wider area.

TYR 006:045 - Prehistoric Landscape scheduled monument

5.1.89 This prehistoric landscape is located 1.85km to the north of the nearest proposed turbine location and 950m northeast of the Site boundary. The monument comprises the well-preserved remains of twelve cairns and two upright slabs recorded as an alignment. Four are grouped closely together 80m south are a further four cairns and 35m west of this group is three further cairns. Running southeast is a potential linear cairn as a stony bank and a further alignment of two upright slabs 90m to the southeast The possible stone circle consisted of 6 standing stones visible above the bog surrounding one of the cairns, the second cairn is located 10m to the northwest. The landscape is located on the south-facing slope of a hill, overlooking the Burn Dennet River.

5.1.90 The prehistoric landscape is of high significance, and will contain additional associated artefactual and environmental evidence of high research value. The monument is legible from the immediate vicinity, however there is no meaningful experience of the cairns and the stone alignment from the wider area, and public access to the monument was not possible during the site visit.

5.1.91 However, at close quarters the remains can be perceived, including the orientation of the linear cairn, aligned south / north, which would have been a key part of experiencing the asset in the past as well as the present (based on information from HERoNI record TYR 006:045). Due to the above ground vegetation on the land, it is difficult to see the cairns and standing stones from the wider area and therefore appreciate the archaeological and architectural interest of the monument.

TYR 006:046 - Field Walls, Cairns and Standing Stones scheduled monument

5.1.92 This monument is located 1.4km to the northwest of the nearest proposed turbine location and 1.1km north of the Site boundary. It is situated in bog land on a southwest facing slope of Tornoge Hill with clear views of the surrounding area. The monument comprises the well-preserved remains of thirteen cairns, a field wall and a standing stone.

5.1.93 The cairns range in diameter of between 2 and 5m at a maximum height of 1m, the northern cairns are better built and spaced equally suggesting they are more likely to be burial cairns not field clearance. The field wall is visible as a low linear rise aligned northeast / southwest for 40m at the south of the monument (see plate 5.7, overleaf), finally, the standing stone is 1.2m high and located at the southeast of the scheduled area. The monument is located on the south-facing slope of a hill, overlooking the Burn Dennet River.

5.1.94 The monument is of high significance, and will contain additional associated artefactual and environmental evidence of high research value. The monument is legible from the immediate vicinity, however there is no meaningful experience of it from the wider area, and public access to the monument was not possible during the site visit.

5.1.95 However, at close quarters the remains can be perceived, including the orientation of the field wall, aligned southwest / northeast (based on information from HERoNI record TYR 006:046). Due to the ground conditions on the monument, it is difficult to see the cairns and standing stones from the wider area and therefore appreciate the archaeological and architectural interest of the monument. There are also no information boards in the surrounding area so it is difficult actively appreciate the historical interest of the monument.

Plate 5.7 Prehistoric Landscape TYR 006:046 Field Wall (47mm)

TYR 026:005 – Stone Circles and Alignment scheduled monument

5.1.96 This monument is located 3.4km to the southeast of the nearest proposed turbine location and 2.4km south of the Site boundary.

Plate 5.8 Monument TYR 026:005 looking northwest, some stones are just visible through the vegetation (50mm)

5.1.97 It is situated in improved grassland near the top of a hill sloping to the west, with good views in all directions. The monument comprises a stone circle facing west and made of 27 small closely set stones with a diameter of 8m and a maximum height of 0.62m. The monument also comprises a possible stone alignment of three low stones with an average height of 0.23m and aligned west for 3.5m at the top of the hill, wearing away towards the west.

5.1.98 The monument is of high significance, and will contain additional associated artefactual and environmental evidence of high research value. The monument is legible from the immediate vicinity, however there is no meaningful experience of it from the wider area due to the overgrown landscape (see plate 5.8). At close quarters the monument has moderate levels of preservation of the remains but due to the overgrown nature of the landscape it is difficult to appreciate the architectural and archaeological interest and the lack of information boards in the surrounding area makes it difficult to actively appreciate the historical interest.

TYR 011:016 – Megalithic Complex scheduled monument

5.1.99 This monument is located 3.4km to the south of the nearest proposed turbine location and 2.4km south of the Site boundary. It is situated in improved grassland on a south facing slope, with good views in all directions. The monument comprises the previously excavated remains of a double stone circle surrounding a central cairn with a cist, double tangential alignment, a second cairn and two further double stone circles. The central cairn measured 13m in diameter with the tallest stone at 1.1m.

5.1.100 The monument is of high significance, and will contain additional associated artefactual and environmental evidence of high research value. The monument is legible from the immediate vicinity, however there is no meaningful experience of it from the wider area, and public access to the monument was not possible during the site visit so it is difficult to appreciate the architectural and archaeological interest and the lack of information boards in the surrounding area makes it difficult to actively appreciate the historical interest.

TYR 011:015 – Bronze Age Ceremonial Landscape scheduled monument

5.1.101 This ceremonial landscape is located 3km to the southwest of the nearest proposed turbine location and 1.7km south of the Site boundary. It is situated on a wide, flat summit of a spur of land rising to the north with excellent views of the surrounding hills, Castledamph valley to the east with the best views towards Mullaghcairn to the southeast. The monument consists of at least three stone circles, one containing a disturbed cist grave and another a standing stone with a stone alignment in the east.

5.1.102 The monument is of high significance, and will contain additional associated artefactual and environmental evidence of high research value. The monument is legible from the immediate vicinity, however there is no meaningful experience of it from the wider area, and public access to the monument was not possible during the site visit, so it is difficult to appreciate the architectural and archaeological interest and the lack of information boards in the surrounding area makes it difficult to actively appreciate the historical interest.

TYR 006:022 – Stone Circle scheduled monument

5.1.103 This stone circle is located 1.2km to the northwest of the nearest proposed turbine location and 170m north of the Site boundary. It is situated on a flat terrace overlooking the Inver Burn Valley with fine views all around. The monument comprises two circles within 30m of each other, the first is approximately 9.5m in diameter and consists of eleven stones most of which are low set with a single stone in the centre standing 0.5m high. The second circle is positioned slightly downslope from the first on a second terrace, measuring approximately 13m in diameter, consisting of thirteen stones in a low set position with a the tallest at a height of 0.85m.

5.1.104 The stone circle is of high significance, and will contain additional associated artefactual and environmental evidence of high research value. The monument is legible from the immediate vicinity but public access to the monument was not possible during the site visit, and the architectural and archaeological interest of the monument was not readily discernible from the wider area (see plate 5.9, below).

Plate 5.9 Looking towards Stone Circle TYR 006:022 from Longland Road (50mm)

TYR 011:004 - Rath scheduled monument

5.1.105 This rath is located 3.4km to the south of the nearest proposed turbine location and 3km south of the Site boundary (see plate 5.10, overleaf).

5.1.106 The rath is of high significance, and will contain additional associated artefactual and environmental evidence of high research value. The monument is legible from the immediate vicinity, however there is no meaningful experience of the rath from the wider area due to the presence of intervening vegetation and the lack of public access. There are no information boards in the surrounding area making it difficult to actively appreciate the historical interest.

5.1.107 The rath is located on the south-facing valley, overlooking the Glenelly River, which is a clearly strategic location for this feature. The entrance was located at the south end of the rath (based on information from HERoNI record TYR 011:004), suggesting that the key association of the monument was with the river valley to the south.

Plate 5.10 Rath TYR 011:004 looking to northwest towards the Site (70mm)

HB 10/09/006 – St. Marys Roman Catholic Church, Grade B1

5.1.108 St. Marys Roman Catholic Church is constructed in a cruciform plan, the nave aligned north / south and double height transepts at east and the west, located 2.3km northwest of the nearest proposed turbine location. The main frontage of the church faces south, with a lean-to porch. The church has high architectural and historic interest and is of high significance (Table 5.1).

5.1.109 The list description notes that the church is situated on an elevated location with views to the surrounding area. The church was constructed in 1897 and then remodelled in 1940, with a graveyard to the east, all of which is surrounded by mature trees. The church is located within a churchyard which comprises its immediate setting (see plate 5.11, overleaf). Some views of the church are afforded from the wider area, for example from the Tornage Road to the north (see plate 5.12, overleaf).

5.1.110 The immediate setting provides the best experience of the church's architectural interest, and the group value it has with the nearby graveyard. The wider area provides a more limited experience of the church's special interest but provides a rural setting which is sympathetic to its historic function.

Plate 5.11 **St. Mary's Roman Catholic Church (24mm)**

Plate 5.12 **Looking south from Tornage Road towards St. Mary's Church (70mm)**

HB 10/05/019 – 141 Glenelly Road, Grade B2

5.1.111 141 Glenelly Road is a two-storey three-bay house with well-proportioned and detailed outbuildings, located approximately 5.5km to the southeast of the nearest proposed turbine location. The main frontage of the house faces north, towards an offshoot of Glenelly River. The house has high architectural interest and is only of local historical interest, but it still is of high significance (Table 1).

5.1.112 The list description notes that the house is situated on the south side of Glenelly Road, Plumbridge. The house is surrounded by mature trees and rural fields, with a grassed over lawn to the north, two outbuildings are located to the rear of the house, all constructed in the early 19th century. The immediate setting provides the best experience of the farmhouses' architectural interest, and the group value it has with the nearby outbuildings. The wider area provides a more limited experience of the farmhouse's special interest but provides a rural setting which is sympathetic to its historic function. Public access to the monument was not possible during the site visit. There are no information boards in the surrounding area making it difficult to actively appreciate the historical interest.

Archaeological Heritage Assets

5.1.113 The CHBA provided a detailed desk-based assessment of the archaeological potential of the Site. The CHBA:

- Assessed the potential for the Site to contain buried archaeological remains from each period based on available evidence;
- Assessed impacts the Proposed Development would have on the identified buried archaeological remains;
- Assessed the significance of any identified impacts; and
- Set out any appropriate mitigation measures which could be deployed to reduce the significance of the effect.

5.1.114 The resources reviewed to inform the assessment of potential comprise the following:

- The Northern Ireland Sites and Monuments Record (NISMR);
- Historic Environment Record of Northern Ireland (HERoNI);
- Historic mapping available from record offices and the Northern Ireland Historic Map Viewer;
- The results of previous archaeological investigations where relevant from the HERoNI and from the online database of Irish Excavation Reports (if available); and
- A site walk over.

5.1.115 The assessment of archaeological heritage assets provided in the CHBA highlighted several assets that required more detailed assessment due either to their proximity to the proposed development, their sensitivity, or the complexity of the issues surrounding their assessment which meant that they would benefit from fuller assessment. A total of five such assets were identified, as follows:

- TYR 011:006 – Beacon, Undesignated monument
- TYR 011:032 – Cairn, Undesignated monument
- TYR 011:033 – Cairn, Undesignated monument
- TYR 011:014 – Megalithic Tomb, Undesignated monument
- TYR 006:052 – Booley House, Undesignated monument

5.1.116 The CHBA concluded that the Site has a known potential for prehistoric remains associated with ceremonial and symbolic activity (recorded under NISMR TYR 011:032, TYR 011:033, TYR 011:006 and TYR 006:052) and a general potential for the presence of yet unknown prehistoric remains. There is also a low potential for remains associated with the Early Christian / Medieval period. Finally, there is a known potential for the Post-Medieval / Modern period and a low potential for the presence of yet unknown Post-Medieval / Modern period associated with agricultural processes.

5.1.117 The presence of the prehistoric remains within the Site are only of low interest as defined in Table 5.1, as such they make meaningful contribution to local research objectives. As such there is no evidence of well-preserved prehistoric remains of high significance within the Site and it is considered that any unknown remains present within the Site are likely to also be of low interest.

TYR 011:006 – Beacon Undesignated Monument

5.1.118 This is located within the southwestern extent of the Site on an area of rough ground in the northwest of the craggy summit of Mullaghcarbatagh mountain with panoramic views, 120m northwest of the nearest turbine (see plate 5.15, overleaf). This is a modern upright beacon that first appeared on the Tyrone County Series 1st edition Map, is roughly circular, around 12m in diameter with a flat topped to a height of 1.5m high. The original cairn was flattened, and the larger stones were used to construct this modern beacon, however there is no evidence of structurally set stones among the small, flat angular stones visible during the site visit.

Plate 5.15 Beacon TYR 011:006 looking north near the centre of the Site (24mm)

5.1.119 The beacon is situated in a prominent location in the landscape suggesting it was significant to the local area in the past. This would explain why the cairn was modified into a beacon during the Post-Medieval period. Due to the modification in the Post-Medieval period it is unlikely that any associated artefactual and environmental evidence of high research value would remain. The monument is legible from the immediate vicinity, as well as across the wider area of the Site. Due to the low grassland surrounding the monument it is possible to see the beacon from the wider area.

TYR 011:032 - Cairn, Undesignated monument

5.1.120 This cairn is located 30m west of the Site and 410m southwest of the closest proposed turbine (see plate 5.13, below). Located on the second summit of Mullaghcarbatagh Mountain, roughly circular in plan, measuring 3.5m in diameter and 1.75m high. The stones have been chosen to create a stable structure, likely gathered from the immediate vicinity but none of them appear to be structural with no evidence of cists or chambers within the site. The cairn itself is composed entirely of stone with no sign of soil or sod in construction, however this could be because of weathering of the cairn.

Plate 5.13 Looking southwest towards TYR 011:032 located in the east of the Site (24mm)

5.1.121 The cairn is situated in a prominent location in the landscape suggesting the cairn would have been significant in the past. The cairn may contain additional associated artefactual and environmental evidence of research value. The monument is legible from the immediate vicinity, as well as across the wider area of the Site. Due to the low grassland surrounding the monument it is possible to see the cairn from the wider area.

TYR 011:033 - Cairn, Undesignated Monument

5.1.122 This cairn is located 20m south of the Site, on a secondary out crop to the west of TYR 011:032, 405m southeast of the closest turbine. It consists of loose cairn of stones, piled together rather than placed suggesting that it is a field clearance cairn. It is roughly circular on plan measuring 1.5m in diameter and at its tallest is 0.75m high.

5.1.123 The cairn is situated in a prominent location in the landscape suggesting the cairn would have been significant in the past. The Cairn may contain additional associated artefactual and environmental evidence of high research value. The monument is not legible from the immediate or wider vicinity.

TYR 011:014 – Megalithic Tomb, Undesignated monument

5.1.124 Located 555m west of the Site is a Megalithic Tomb TYR 011:014 located 870m west of the closest proposed turbine (see plate 5.14, below). This Megalithic tomb was destroyed by the landowner during some routine drainage works but it was recorded as comprising of two thin slabs set on their edge, the tomb measured 2.5m long by 0.35m wide to a max depth of 0.5m. while the monument was intact it was constantly flooded due to its proximity to a nearby stream. Any associated artefacts and / or ecofacts will most likely have been removed during the demolition and drainage works.

Plate 5.14 Megalithic Tomb TYR 011:014 located in the Site (24mm)

TYR 006:052 – Booley House Undesignated Monument

5.1.125 Located in the 215m northwest of the Site and 785m northwest of the nearest turbine is the potential remains of a booley house foundation TYR 006:052 of unknown date. Set on a high northwest facing hillslope with excellent views in all directions, except in the southwest where it is blocked by rising ground. This consists of a small circle of stones, one or two courses high and 4m in diameter, set against the remains of an old lane or boundary. Due to the low grassland surrounding the monument it is possible to see the booley house from the wider area.

Assessment of Development Effects

Construction Phase Effects

Assessment of Direct Physical Effects to buried Archaeological Remains

5.1.126 The proposed development comprises a wind farm, with up to 11 turbines measuring to a maximum of up to 180m in height, to be placed across the Site, together with a BESS and associated access an infrastructure. These turbines will be set on foundations, and will be accessed using a modest track, which will make use of existing routes where possible. There will also be additional construction phase impacts during the erection of the turbines, to stabilise them, and transport the turbine parts to the Site and put them into place, any compound which is constructed. The development would be sparsely distributed throughout the Site, with a low below ground impact relative to the area.

5.1.127 These activities have the potential to result in the localised removal of any archaeological remains which may be present where any impact is planned. There is potential for localised impacts to result to as yet unknown buried archaeological remains (A6), which could result in a **moderate** effect if located in areas of construction but a **minor** effect within the rest of the Site (see Table 5.4).

5.1.128 Any potential prehistoric remains within the Site are likely to be of low interest as defined in Table 5.1, and they could make meaningful contribution to local research objectives. At this time there is no evidence of well-preserved prehistoric remains of high significance within the Site and it is considered that any unknown remains present within the Site are likely to also be of low interest.

5.1.129 The construction phase of the Proposed Development would be short lived, and the effect of this on the setting of cultural heritage assets in the wider area would be temporary. Furthermore, any effects in terms of the prominence and visibility of the turbines would be less than is the case during the operational phase. As such, the indirect construction phase effects of the Proposed Development do not need detailed assessment, and are adequately covered by the assessment of operation phase effects below.

Summary of Construction Phase Effects

5.1.130 The construction phase effects of the Proposed Development on the cultural heritage baseline, as assessed above, are summarised in Table 5.5, below.

Table 5.5 – Construction phase effects of Proposed Development on heritage assets

Ref.	NHLE/LPA reference if applicable	Description	Level of Importance (Table 5.1)	Degree of Effect (Tables 5.2 and 5.3)	Significance of Effect (Table 5.4)
SM1	TYR 011:018	Giants Grave Scheduled Monument	High	Minor Adverse	Minor Adverse
SM2	TYR 006:006	Court Tomb: The White Rocks Scheduled Monument	High	Minor Adverse	Minor Adverse
SM3	TYR 006:030	Two Stone Circles and Stone Alignment Scheduled Monument	High	Negligible	Neutral
SM4	TYR 006:004	Cashel Scheduled Monument	High	Negligible	Neutral

Ref.	NHLE/LPA reference if applicable	Description	Level of Importance (Table 5.1)	Degree of Effect (Tables 5.2 and 5.3)	Significance of Effect (Table 5.4)
SM5	TYR 006:047	Field Walls and Cairns Scheduled Monument	High	Negligible	Neutral
SM6	TYR 006:044	Stone Circle, Cairns and Alignments Scheduled Monument	High	Negligible	Neutral
SM7	TYR 006:045	Stone Circle, Cairns and Alignments Scheduled Monument	High	Negligible	Neutral
SM8	TYR 006:046	Field Walls, Cairns and Standing Stones Scheduled Monument	High	Negligible	Neutral
SM9	TYR 026:005	Stone Circle and Alignment Scheduled Monument	High	Negligible	Neutral
SM10	TYR 011:016	Castledamph Circle: Two Stone Circles, Cairns with Cists and Two Alignments Scheduled Monument	High	Negligible	Neutral
SM11	TYR 011:015	Bronze Age Ceremonial Landscape Scheduled Monument	High	Negligible	Neutral
SM12	TYR 006:022	Two Stone Circles and Possible Alignment Scheduled Monument	High	Negligible	Neutral
SM13	TYR 011:004	Castledamph Rath Scheduled Monument	High	Negligible	Neutral

Ref.	NHLE/LPA reference if applicable	Description	Level of Importance (Table 5.1)	Degree of Effect (Tables 5.2 and 5.3)	Significance of Effect (Table 5.4)
LB1	HB10/09/006	St Marys Roman Catholic Church, Grade B1	Medium	Negligible	Neutral
LB2	HB10/05/019	141 Glenelly Road, Grade B2	Medium	Negligible	Neutral
A1	TYR 011:032	Cairn, Undesignated Monument	Low	Moderate Adverse	Minor Adverse
A2	TYR 011:033	Cairn, Undesignated Monument	Low	Moderate Adverse	Minor Adverse
A3	TYR 011:014	Megalithic Tomb Undesignated Monument	No Importance	Negligible	No Impact
A4	TYR 011:006	Beacon Undesignated Monument	Low	Moderate Adverse	Minor Adverse
A5	TYR 006:052	Booley House Undesignated Monument	Low	Moderate Adverse	Minor Adverse
A6	-	As yet undiscovered buried archaeological remains within Site.	Low	Moderate adverse if present within areas of construction. Minor adverse across the rest of the Site	Minor Adverse

Operational Phase

Assessment of Indirect Effects due to Changes to Setting of Heritage Assets

TYR 011:018 - Giant's Grave scheduled monument

5.1.131 The proposed wind turbines would potentially be visible in the distance of views from the northeast of the monument. However, the closest historic point of view (HPV) 9 suggests that none of the proposed wind turbines would be visible from the monument so the proposed development would not affect the core elements of the significance of the monument and would only have a slight effect on the setting, which would not meaningfully affect appreciation of the monument's significance and archaeological interest, or the integrity of its setting.

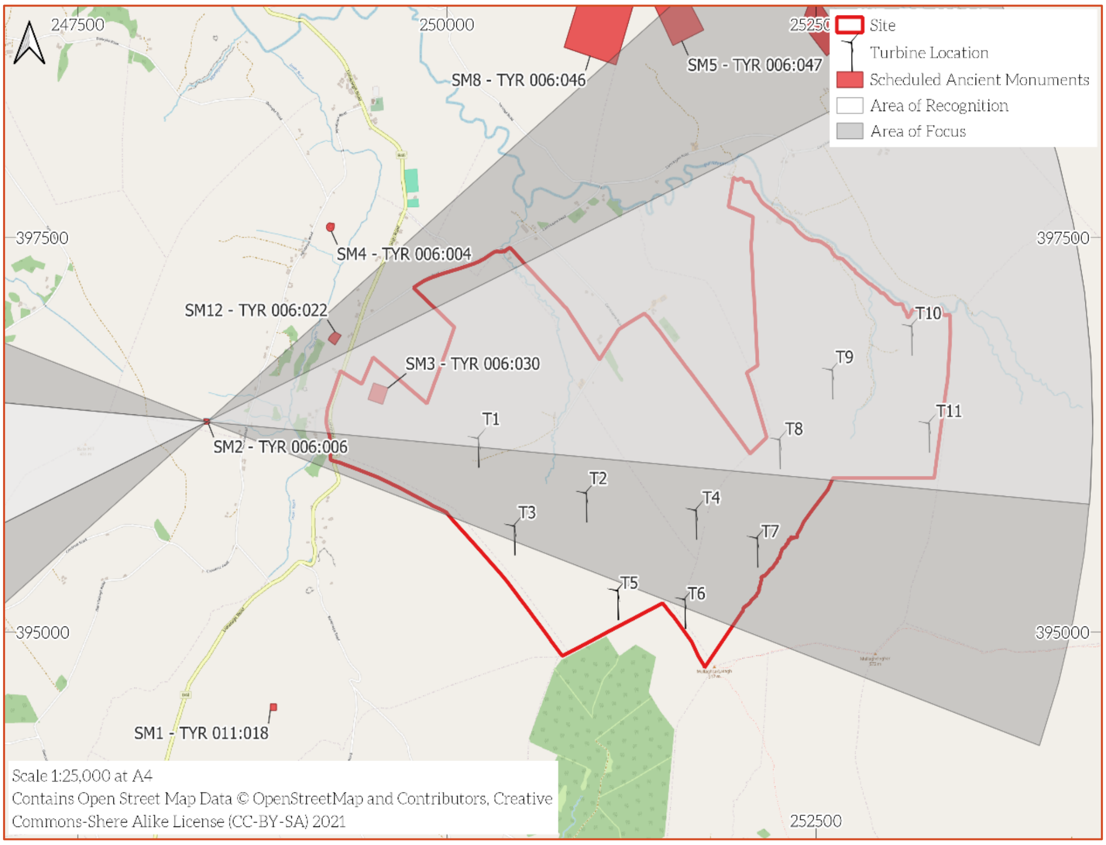
5.1.132 On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of effect (Table 5.4). This is not considered to be a significant effect.

TYR 006:006 – Court Tomb 'The White Rocks' scheduled monument

5.1.133 The site visit confirmed that all the proposed turbines would be visible in views from the tomb towards the east. The impact of this will be assessed with reference to Visual Acuity. Visual Acuity is the measure of the ability of the human eye to distinguish shapes and details of objects at a given distance. Research has found that the field of view of the human eye consists of two elements: the recognition zone and the area of focus. The average human's recognition zone, where an object is readily recognised in a view, is 30° wide. By contrast, the area of focus, which forms a wider view of the surrounding context, has been calculated at 60° (Marieb, E.N. and Hoehn, K. 2019 and Leat, Yakobchuk-Stanger and Irving, 2020). The human eye has the capacity to see objects up to three miles away on a clear day, however the recognition of objects decreases over this distance due to the curvature of the earth, the brightness and size of an object, the person's line of sight and the person's overall eyesight (Marieb, E.N. and Hoehn, K. 2019).

5.1.134 The alignment of the tomb was mapped, together with the recognition zone and area of focus, and shown in plate 5.15. This model suggests the proposed turbines 1, 8-11 are present within the human recognition zone and all but turbine 5 present within the area of focus. Based on the visual acuity and field of view, when focussing on the tomb facing east, there will be a separation between the monument and the Site due to the distance between the two locations (Alphan, 2021).

Plate 5.15 Views from Court Tomb 'The White Rocks' TYR 006:006



5.1.135 As mentioned above some of the proposed turbines are present within the human recognition zone all of the proposed turbines are located outside the central area of recognition which means that although they are visible in the distance, the distance between the Site and the tomb as well as the intervening topography would provide some separation from the turbines, which would ensure that appreciation of the archaeological interest of the monument would not be unduly affected.

5.1.136 On this basis the overall assessment of the level of impact of the proposed development on the significance of the Tomb (Table 5.2) is considered to be **minor adverse**. Due to the high significance of the tomb, this has the potential to result in either a **moderate adverse**, or a **minor adverse** significance of effect. Due to the distance between the proposed turbines and the tomb, and the lack of other impacts, it is considered that the significance of effect would be **minor adverse** as defined in Table 5.4 of this assessment.

TYR 006:030 – Two Stone Circles and Stone Alignment scheduled monument

5.1.137 The proposed turbines 4 and 6 and the blades of turbines 1 to 3 and 5 will be visible in the backdrop of views of the monument to the northeast, east and southeast, however these would be partially screened by intervening vegetation and would not meaningfully affect appreciation of the monument's significance. Furthermore, the proposed development would not affect views from the monument across the valley to the west.

5.1.138 The upper sweep of turbines 7 to 9 may be visible in the distant backdrop in views from Longland Road, however these would be partially screened by intervening vegetation and topographical changes and would not meaningfully affect appreciation of the monument's significance (see HVP 8).

5.1.139 The proposed development would not affect the core elements of the significance of the monument, and would only have a slight effect on the setting, which would not meaningfully affect appreciation of the monument's significance and archaeological interest, or the integrity of its setting.

5.1.140 On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of effect (Table 5.4).

5.1.141 This is not considered to be a significant effect.

TYR 006:004 – Cashel scheduled monument

5.1.142 Six of the proposed turbines and the blades of a further five turbines would be visible in the distance behind the cashel when seen from Aghabrack Road to the west, and so the proposed development would change the backdrop of the cashel (see HVP 6). The turbines would not affect the immediate setting of the cashel, nor affect appreciation of its archaeological and architectural interest. Intervening vegetation in the vicinity would also provide some partial screening. Therefore, while the turbines may be noticeable in the wider area, they would not affect how the setting contributes to the significance of the cashel.

5.1.143 Therefore, the proposed development would not affect any of the key elements of the significance of the cashel and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the cashel's significance or archaeological interest. It therefore follows that the integrity of the setting of the monument would not be affected. On this basis the overall assessment of the degree of impact of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of effect (Table 5.4), due to the high significance of the monument.

5.1.144 This is not considered to be a significant effect.

TYR 006:047 - Prehistoric Landscape scheduled monument

5.1.145 The proposed wind turbines would be visible in the distance to the south of the monument, and so would change the setting of the prehistoric landscape. However, the features in the landscape are not readily experienced visually, and no significant alignment or orientation forms a clear part of its setting or significance, although the placement of the features seems to have been placed to provide commanding views across the topography to the south. However, the turbines would not affect the legibility of the surrounding topography, nor of the prehistoric landscape's strategic location within it. The turbines would be noticeable but would not meaningfully distract from the appreciation of the monument, which is limited in visual terms in any case.

5.1.146 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the prehistoric landscape, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the prehistoric landscape's significance or archaeological interest. As such, it is not considered that the proposed development would affect the integrity of its setting. On this basis the overall assessment of the degree of impact of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of effect (Table 5.4), due to the high significance of the monument.

5.1.147 This is not considered to be a significant effect.

TYR 006:044 - Prehistoric Landscape scheduled monument

5.1.148 The proposed wind turbines would be visible in the distance to the south of the monument, and so would change the setting of the prehistoric landscape. However, the features in the landscape are not readily experienced visually, and no significant alignment or orientation forms a clear part of its setting or significance, although the placement of the features seems to have been placed to provide commanding views across the topography to the south. However, the turbines would not affect the legibility of the surrounding topography, nor of the prehistoric landscape's strategic location within it. The turbines would be noticeable but would not meaningfully distract from the appreciation of the monument, which is limited in visual terms in any case.

5.1.149 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the prehistoric landscape, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the prehistoric landscape's significance or archaeological interest. On this basis the overall assessment of the degree of impact of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of impact (Table 5.4), due to the high significance of the monument.

5.1.150 This is not considered to be a significant effect.

TYR 006:045 - Prehistoric Landscape scheduled monument

5.1.151 The proposed turbines would be visible in the distance to the south of the scheduled landscape. The turbines would not affect the legibility of the surrounding topography, nor of the prehistoric landscape's strategic location within it. The turbines would be noticeable, but would not meaningfully distract from the appreciation of the monument, which is limited in visual terms in any case.

5.1.152 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the prehistoric landscape, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the prehistoric landscape's significance or archaeological interest. On this basis the overall assessment of the degree of impact of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of impact (Table 5.4), due to the high significance of the monument.

5.1.153 This is not considered to be a significant effect.

TYR 006:046 – Field Walls, Cairns and Standing Stones scheduled monument

5.1.154 The proposed wind turbines would be visible in the distance to the south of the monument, and so would change the setting of the monument. However, the turbines would not affect the legibility of the surrounding topography, nor of the monument's strategic location within it. The turbines would be noticeable, but would not meaningfully distract from the appreciation of the monument, which is limited in visual terms in any case.

5.1.155 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the monument, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the prehistoric landscape's significance or archaeological interest. On this basis the overall assessment of the degree of impact of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of effect (Table 5.4), due to the high significance of the monument.

5.1.156 This is not considered to be a significant effect.

TYR 026:005 – Stone Circles and Alignment scheduled monument

5.1.157 The blades of proposed wind turbines 4 and 6 are likely to be visible in the distance to the north of the monument, and so would change the backdrop of views from the monument to the north. However, the turbines would not interfere with the view along the alignment of the monument, nor affect appreciation of the archaeological and architectural interest provided by the immediate setting. Also, the proposed turbines would be located at a considerable distance, such that they would not be readily discernible from the setting of the monument.

5.1.158 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the monument, and would not adversely affect its setting, or appreciation of the monument's significance or archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **negligible**, comprising a small change to the setting of the monument, but one which does not result in any harm or loss. This would result in a **neutral** significance of effect (Table 5.4), due to the high significance of the monument.

5.1.159 This is not considered to be a significant effect.

TYR 011:016 – Megalithic Complex scheduled monument

5.1.160 The blades of proposed wind turbines 4 and 6 are likely to be visible in the distance looking north from the monument, affecting the backdrop of the monument when facing north. However, the turbines would not interfere with the views out of the monument, nor affect appreciation of the archaeological and architectural interest provided by the immediate setting. Also, the proposed turbines would be located at a considerable distance, such that they would not be readily discernible from the setting of the monument.

5.1.161 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the monument, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the monument's significance or archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of effect (Table 5.4), due to the high significance of the monument.

5.1.162 This is not considered to be a significant effect.

TYR 011:015 – Bronze Age Ceremonial Landscape scheduled monument

5.1.163 Proposed wind turbine 4, the blades of proposed wind turbines 2 and 6 and the upper sweep of turbines 1, 3 and 5 would be visible in the distance to the north of the monument, causing a change to the setting of the ceremonial landscape. However, the turbines would not interfere with the views from the monument, nor affect appreciation of the archaeological and architectural interest provided by the immediate setting. Also, the proposed turbines would be located at a considerable distance with an ancient woodland in between the monument and the proposed development so the turbines would not be readily discernible from the setting of the landscape.

5.1.164 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the Bronze Age ceremonial landscape, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the Bronze Age ceremonial landscape's significance or archaeological interest. On this basis the overall assessment of the degree of impact of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of impact (Table 5.4), due to the high significance of the monument.

5.1.165 This is not considered to be a significant effect.

TYR 006:022 – Stone Circle scheduled monument

5.1.166 Within the initial research of the proposed development, HVP 7 suggested that all of the proposed turbines would be visible from the stone circle. This was confirmed during the site visit, looking from Longland Road towards the Site there are clear panoramic views of the surrounding area.

5.1.167 Proposed wind turbines 1, 2 and 4 to 6, the blades of proposed wind turbines 3, 7 and 8 and the upper sweep of turbines 9 to 11 would be visible to the east of the monument, and so would change the views out of the monument facing east. The turbines would interfere with the view out of the monument, but would not affect appreciation of the archaeological and architectural interest provided by the immediate setting. Also, the proposed turbines would be located at a considerable distance, such that they would not be readily discernible from the setting of the stone circles.

5.1.168 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the stone circle, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the monument's significance or archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of effect (Table 5.4), due to the high significance of the monument.

5.1.169 This is not considered to be a significant effect.

TYR 011:004 - Rath scheduled monument

5.1.170 The blades of the proposed wind turbines 4 and 6 would be visible in the distance in views to the northwest of the monument, and so would change the views to the north of the Rath. However, the turbines would not interfere with the legibility of the relationship of the rath with the river valley, nor affect appreciation of the archaeological and architectural interest provided by the immediate setting. The proposed turbines are also located at a considerable distance, such that they would not be readily discernible from the setting of the monument.

5.1.171 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the rath, and would only have a slight effect on its setting, which would not meaningfully affect appreciation of the rath's significance or archaeological interest. On this basis the overall assessment of the degree of impact of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of impact (Table 5.4), due to the high significance of the monument.

5.1.172 This is not considered to be a significant effect.

HB 10/09/006 - St. Marys Roman Catholic Church, Grade B1

5.1.173 The turbines would not affect the experience in the immediate setting of the church, and only the upper sweep of a couple of the turbines could potentially be visible in the distance in winter views. The turbines would also be visible in longer views of the church from the north. However, the turbines would be distant in the view, and would not dominate the church. Finally, the proposed development would not affect the appreciation of the church's wider rural setting. Therefore, the proposed development may be noticeable, but would not detract from the contribution the setting makes to the significance of the church.

5.1.174 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the church, and would only have a slight effect on its setting, which would not meaningfully affect appreciation its significance or heritage interest. On this basis the overall assessment of the degree of impact of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of effect (Table 5.4), due to the high significance of the building.

5.1.175 This is not considered to be a significant effect.

HB 10/05/019 - 141 Glenelly Road, Grade B2

5.1.176 The turbines would not affect the key views from the house towards the sea to the east. The tips of a couple of the turbines would be potentially visible in the distant backdrop of views of the house from Magherabrack Road. However, several buildings and areas of vegetation are present in the intervening landscape, such that they are unlikely to be discernible. Finally, the proposed development would not affect the appreciation of the house provided by the wider rural setting. Therefore, the proposed development may be noticeable, but would not detract from the contribution the setting makes to the significance of the house.

5.1.177 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the house, and would only have a slight effect on its setting, which would not meaningfully affect appreciation its significance or heritage interest. On this basis the overall assessment of the degree of impact of the proposed development (Table 5.2) is considered to be **negligible**, with a **neutral** significance of effect (Table 5.4), due to the high significance of the building.

5.1.178 This is not considered to be a significant effect.

TYR 011:032 Cairn, Undesignated monument

5.1.179 The proposed wind turbines would be located within the wider setting of the undesignated monument and therefore would change the setting of the cairn. The turbines would also interfere with the views from the cairn and have an effect on the appreciation of the archaeological and architectural interest provided by the immediate setting.

5.1.180 It is therefore considered that the proposed development affect key elements of the significance of the cairn and would only have a large effect on its setting, which would affect appreciation of the cairn's significance and archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **moderate adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the close proximity of the turbines to the undesignated monument.

5.1.181 This is not considered to be a significant effect.

TYR 011:033 Cairn, Undesignated monument

5.1.182 The proposed wind turbines would be located within the wider setting of the undesignated monument and therefore would change the setting of the cairn. The turbines would also interfere with the views from the cairn and have an effect on the appreciation of the archaeological and architectural interest provided by the immediate setting.

5.1.183 It is therefore considered that the proposed development affect key elements of the significance of the cairn and would only have a major effect on its setting, which would affect appreciation of the cairn's significance and archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **moderate adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the high proximity of the turbines to the undesignated monument.

5.1.184 This is not considered to be a significant effect.

TYR 011:014 – Megalithic Tomb Undesignated monument

5.1.185 The proposed wind turbines would be potentially visible in the distance in views to the northeast of the monument, and so would change the views to the northeast of the Tomb. However, the turbines would not interfere affect appreciation of the archaeological interest provided by the immediate setting, as the monument has been destroyed.

5.1.186 It is therefore considered that the proposed development would not affect any of the key elements of the significance of the tomb, and would only have no effect on its setting, which would not meaningfully affect appreciation of the tomb's significance or archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **negligible**, with a **no impact** on the significance (Table 5.4), due to the high significance of the monument.

5.1.187 This is not considered to be a significant effect.

TYR 011:006 - Beacon Undesignated Monument

5.1.188 The proposed wind turbines would be located within the wider setting of the undesignated monument and therefore would change the setting of the beacon. The turbines would also interfere with the views from the beacon and have an effect on the appreciation of the archaeological and architectural interest provided by the immediate setting.

5.1.189 It is therefore considered that the proposed development affect key elements of the significance of the beacon, and would only have a major effect on its setting, which would affect appreciation of the beacon's significance and archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **moderate adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the close proximity of the turbines to the undesignated monument.

5.1.190 This is not considered to be a significant effect.

TYR 006:052 - Booley House Undesignated Monument

5.1.191 The proposed wind turbines would be located within the wider setting of the undesignated monument and therefore would change the setting of the structure. The turbines would also interfere with the views from the monument and have an effect on the appreciation of the archaeological and architectural interest provided by the immediate setting.

5.1.192 It is therefore considered that the proposed development affect key elements of the significance of the monument, and would only have a major effect on its setting, which would affect appreciation of the booley house's significance and archaeological interest. On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **moderate adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the close proximity of the turbines to the undesignated monument.

5.1.193 This is not considered to be a significant effect.

Summary of Operational Phase Effects

5.1.194 The construction phase effects of the Proposed Development on the cultural heritage baseline, as assessed above, are summarised in Table 5.6, overleaf.

Table 5.6 – Operational phase effects of Proposed Development on heritage assets

Ref.	NHLE/LPA reference if applicable	Description	Level of Importance (Table 5.1)	Degree of Effect (Tables 5.2 and 5.3)	Significance of Effect (Table 5.4)
SM1	TYR 011:018	Giants Grave Scheduled Monument	High	Negligible	Neutral
SM2	TYR 006:006	Court Tomb: The White Rocks Scheduled Monument	High	Minor Adverse	Minor Adverse
SM3	TYR 006:030	Two Stone Circles and Stone Alignment Scheduled Monument	High	Negligible	Neutral

Ref.	NHLE/LPA reference if applicable	Description	Level of Importance (Table 5.1)	Degree of Effect (Tables 5.2 and 5.3)	Significance of Effect (Table 5.4)
SM4	TYR 006:004	Cashel Scheduled Monument	High	Negligible	Neutral
SM5	TYR 006:047	Field Walls and Cairns Scheduled Monument	High	Negligible	Neutral
SM6	TYR 006:044	Stone Circle, Cairns and Alignments Scheduled Monument	High	Negligible	Neutral
SM7	TYR 006:045	Stone Circle, Cairns and Alignments Scheduled Monument	High	Negligible	Neutral
SM8	TYR 006:046	Field Walls, Cairns and Standing Stones Scheduled Monument	High	Negligible	Neutral
SM9	TYR 026:005	Stone Circle and Alignment Scheduled Monument	High	Negligible	Neutral
SM10	TYR 011:016	Castledamph Circle: Two Stone Circles, Cairns with Cists and Two Alignments Scheduled Monument	High	Negligible	Neutral
SM11	TYR 011:015	Bronze Age Ceremonial Landscape Scheduled Monument	High	Negligible	Neutral
SM12	TYR 006:022	Two Stone Circles and Possible Alignment Scheduled Monument	High	Negligible	Neutral
SM13	TYR 011:004	Castledamph Rath Scheduled Monument	High	Negligible	Neutral
LB1	HB10/09/006	St Marys Roman Catholic Church, Grade B1	Medium	Negligible	Neutral

Ref.	NHLE/LPA reference if applicable	Description	Level of Importance (Table 5.1)	Degree of Effect (Tables 5.2 and 5.3)	Significance of Effect (Table 5.4)
LB2	HB10/05/019	141 Glenelly Road, Grade B2	Medium	Negligible	Neutral
A1	TYR 011:032	Cairn, Undesignated Monument	Low	Moderate Adverse	Minor Adverse
A2	TYR 011:033	Cairn, Undesignated Monument	Low	Moderate Adverse	Minor Adverse
A3	TYR 011:014	Megalithic Tomb Undesignated Monument	No Importance	Negligible	No Impact
A4	TYR 011:006	Beacon Undesignated Monument	Low	Moderate Adverse	Minor Adverse
A5	TYR 006:052	Booley House Undesignated Monument	Low	Moderate Adverse	Minor Adverse
A6	-	As yet undiscovered buried archaeological remains within Site.	Low	Minor adverse if present	Minor Adverse

Design Evolution and Mitigation Measures

Mitigation Responses to Direct Physical Effects

5.1.195 As has been noted above, the Proposed Development has been designed to avoid all recorded archaeological heritage assets whose location is confirmed, and so no known buried archaeological remains would be impacted by the Proposed Development.

5.1.196 It is possible that additional, as yet unknown remains may be present within the planned areas of impact, which could be impacted (potential cultural heritage receptors A1 - A6). Depending on the extent of the impact and the nature of the buried remains the significance of this impact has the potential to be minor to Moderate adverse (Table 5.4).

5.1.197 In response, a programme of archaeological works can be implemented ahead of the development to detect and record any remains prior to any impact. The recording of archaeological remains serves to realise the research value of those remains, and enhance understanding and appreciation of the more significant remains in the wider area which would not be affected. While this benefit does not undo or fully outweigh the loss of any remains, it would serve to partially compensate for the loss, and would reduce any residual significance of effect to minor adverse to slight adverse. As such, such a programme of archaeological works would ensure that no significant effects would arise as a result of direct physical effects to buried archaeological remains.

5.1.198 Such a programme of archaeological works could be secured as a condition to planning consent and implemented ahead of development.

Mitigation Measures in Response to Indirect Effects

5.1.199 Given the scale of the proposed turbines, there is little scope for additional mitigation beyond the embedded mitigation undertaken by the design process, which sought to minimise the visibility of the turbines as much as possible, while also seeking to ensure the scheme remains viable.

Residual Effects

5.1.200 The mitigation measures set out above would serve to reduce the significance of effect which would result from direct physical impacts of the proposed development.

5.1.201 The residual effects of the Proposed Development are set out in Table 5.7, below.

Table 5.7 – Summary of effects of Proposed Development following mitigation measures

Ref.	Level of Importance (Table 5.1)	Degree of Effect (Tables 5.2 and 5.3)	Significance of Effect (Table 5.4)	Mitigation measures	Residual Significance of Effect (Table 5.4)
SM1	High	Negligible	Neutral	None possible	Neutral
SM2	High	Minor Adverse	Minor Adverse	None possible	Minor Adverse
SM3	High	Negligible	Neutral	None possible	Neutral
SM4	High	Negligible	Neutral	None possible	Neutral
SM5	High	Negligible	Neutral	None possible	Neutral
SM6	High	Negligible	Neutral	None possible	Neutral
SM7	High	Negligible	Neutral	None possible	Neutral
SM8	High	Negligible	Neutral	None possible	Neutral
SM9	High	Negligible	Neutral	None possible	Neutral
SM10	High	Negligible	Neutral	None possible	Neutral
SM11	High	Negligible	Neutral	None possible	Neutral
SM12	High	Negligible	Neutral	None possible	Neutral
SM13	High	Negligible	Neutral	None possible	Neutral
LB1	Medium	Negligible	Neutral	None possible	Neutral
LB2	Medium	Negligible	Neutral	None possible	Neutral
A1	Low	Negligible	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	Minor Adverse

Ref.	Level of Importance (Table 5.1)	Degree of Effect (Tables 5.2 and 5.3)	Significance of Effect (Table 5.4)	Mitigation measures	Residual Significance of Effect (Table 5.4)
A2	Low	Moderate Adverse	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	Minor Adverse
A3	No Importance	Negligible	No Impact	None possible	No Impact
A4	Low	Moderate Adverse	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	Minor Adverse
A5	Low	Moderate Adverse	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets.	Minor Adverse
A6	Low	Minor adverse if present	Minor Adverse	Programme of archaeological works	Slight Adverse

Cumulative Effects

Baseline

5.1.202 This application has collated existing and proposed developments that could result in cumulative effects within a 30km radius from the Site. This comprises the Cumulative Baseline. This baseline has been used to assess whether there is potential for cumulative effects to result to the identified cultural heritage receptors as a result of the combined effects of the Proposed Development and one or more developments recorded in the Cumulative Baseline).

Potential direct physical cumulative effects during construction

5.1.203 There are no proposed developments which would result in any additional physical impacts to the identified or potential buried archaeological remains within the Site. As such, the Proposed Development would not result in any cumulative effects to buried archaeological remains.

5.1.204 The Proposed Development has been designed to avoid all recorded archaeological heritage assets whose location is confirmed, and so no known buried archaeological remains would be impacted by the Proposed Development. There is potential for localised impacts to result to as yet unknown buried archaeological remains (A6), which could result in a **minor effect**. In response a programme of archaeological works is proposed, which would record any remains prior to construction, and would realise the research value of the remains.

Potential indirect cumulative effects during construction

5.1.205 The Cumulative Baseline was reviewed in relation to the heritage assets in the wider area which would be subject to indirect effects as a result of the Proposed Development, to determine whether any cumulative effects would result.

Potential direct physical cumulative effects during operation

5.1.206 There are no proposed developments which would result in any additional physical impacts to the identified or potential buried archaeological remains within the Site. As such, the Proposed Development would not result in any cumulative effects to buried archaeological remains.

Potential indirect cumulative effects during operation

5.1.207 The Cumulative Baseline was reviewed in relation to the heritage assets in the wider area which would be subject to indirect effects as a result of the Proposed Development, to determine whether any cumulative effects would result. In the case of most of the heritage assets no other wind farms were visible from the settings of the monuments during the site visit to inform the CHBA. Furthermore, no proposed, or consented schemes are planned in the vicinity of the monuments, which could affect their settings.

5.1.208 Those which require further discussion are included below.

TYR 011:018 - Giant's Grave scheduled monument

5.1.209 The Giant's Grave scheduled monument would be located between the Proposed Development and the Owenreagh windfarm and its proposed extension, which is located 5.9km west of the monument. The current and proposed turbines at Owenreagh windfarm are not located within any key views of the monument. As such, the Owenreagh windfarm and its extension, would be noticeable in the wider area around the monument, but due to the distance of the windfarm it would not materially affect it significance. As such it is likely that this would have no more than a slight effect to the setting of the monument, and the two schemes together would not result in more than a **slight effect** to the setting, as they would not affect how the setting of the monument contributes to its significance.

5.1.210 As such, the presence of this development in the wider landscape would not change the assessment of the effect of the Proposed Development on the significance of the Giant's Grave which is provided in Table 5.7.

TYR 006:006 - Court Tomb 'The White Rocks' scheduled monument

5.1.211 The Court Tomb 'The White Rocks' scheduled monument would be located between the Proposed Development and the Owenreagh windfarm and its proposed extension, which is located 3.7km west of the monument. The current and proposed turbines at Owenreagh windfarm are not located within any the key views of the tomb. As such the Owenreagh windfarm would be noticeable in the wider area around the monument but due to the distance of the windfarm it would not materially affect its significance. As such it is likely to have no more than a **slight effect** to the setting of the monument and the two schemes together would not result in more than a slight effect to the setting as they do not affect key elements of the significance of the tomb, or the experience and appreciation of its archaeological interest, which is provided by its immediate setting.

5.1.212 As such, the presence of this development in the wider landscape would not change the assessment of the effect of the Proposed Development on the significance of the Beacon which is provided in Table 5.7.

TYR 006:030 - Two Stone Circles and Stone Alignment scheduled monument

5.1.213 The Stone circles and stone alignment would be located between the Proposed Development, and the Eglish windfarm, which would be located approximately 8.4km north of the monument. The turbines at Eglish windfarm are not be located along the stone alignment, which is orientated west to east, with key views to the west. As such, the Eglish windfarm, would be noticeable in the wider area around the monument, but due to the distance of the windfarm it would not materially affect it significance. As such it is likely that this would have no more than a slight effect to the setting of the monument, and the two schemes together would not result in more than a **slight effect** to the setting, as they would not affect how the setting of the monument contributes to its significance.

5.1.214 As such, the presence of this development in the wider landscape would not change the assessment of the effect of the Proposed Development on the significance of the Beacon which is provided in Table 5.7.

TYR 011:015 - Bronze Age Ceremonial Landscape scheduled monument

5.1.215 The ceremonial landscape would be located between the Proposed Development, and the Owenreagh windfarm and its proposed extension, which is located approximately 7km northeast of the monument. The current and proposed turbines at Owenreagh windfarm are not located within any key views of the monument. As such, the Owenreagh windfarm and its extension, would be noticeable in the wider area around the monument, but due to the distance of the windfarm it would not materially affect it significance. As such it is likely that this would have no more than a slight effect to the setting of the monument, and the two schemes together would not result in more than a **slight effect** to the setting, as they would not affect how the setting of the monument contributes to its significance.

5.1.216 As such, the presence of this development in the wider landscape would not change the assessment of the effect of the Proposed Development on the significance of the Beacon which is provided in Table 5.7.

TYR 011:032 Cairn, Undesignated monument

5.1.217 The Cairn unscheduled monument would be located between the Proposed Development and the Owenreagh windfarm and its proposed extension are visible in the wider area around the monument, which is located 9.5km west of the cairn. The current and proposed turbines at Owenreagh windfarm are not located within any key views of the cairn. As such, the Owenreagh windfarm and its extension, would be noticeable in the wider area around the cairn, but due to the distance of the windfarm it would not materially affect it significance. As such it is likely that this would have no more than a slight effect to the setting of the cairn, and the two schemes together would not result in more than a **minor effect** to the setting, as they would not affect how the setting of the monument contributes to its significance.

5.1.218 As such, the presence of this development in the wider landscape would not change the assessment of the effect of the Proposed Development on the significance of the Beacon which is provided in Table 5.7.

TYR 011:033 Cairn, Undesignated monument

5.1.219 The Cairn unscheduled monument is located between the Proposed Development and the Owenreagh windfarm and its proposed extension are visible in the wider area around the monument, which is located 9.5km west of the cairn. The current and proposed turbines at Owenreagh windfarm are not located within any key views of the cairn. As such, the Owenreagh windfarm and its extension, would be noticeable in the wider area around the cairn, but due to the distance of the windfarm it would not materially affect it significance. As such it is likely that this would have no more than a slight effect to the setting of the cairn, and the two schemes together would not result in more than a **minor effect** to the setting, as they would not affect how the setting of the monument contributes to its significance.

5.1.220 As such, the presence of this development in the wider landscape would not change the assessment of the effect of the Proposed Development on the significance of the Beacon which is provided in Table 5.7.

TYR 011:006 - Beacon Undesignated Monument

5.1.221 The Beacon unscheduled monument would be located within the Proposed Development and the Owenreagh windfarm and its proposed extension are visible in the wider area around the monument, which is located 9.5km west of the Beacon. The current and proposed turbines at Owenreagh windfarm are not located within any key views of the Beacon. As such, the Owenreagh windfarm and its extension, would be noticeable in the wider area around the Beacon, but due to the distance of the windfarm it would not materially affect it significance. As such it is likely that this would have no more than a slight effect to the setting of the Beacon, and the two schemes together would not result in more than a **minor effect** to the setting, as they would not affect how the setting of the monument contributes to its significance.

5.1.222 On this basis the overall assessment of the degree of effect of the proposed development (Table 5.2) is considered to be **moderate adverse**, with a **minor adverse** significance of effect (Table 5.4), due to the beacon's presence within the proposed development to the undesignated monument.

5.1.223 As such, the presence of this development in the wider landscape would not change the assessment of the effect of the Proposed Development on the significance of the Beacon which is provided in Table 5.7.

Summary and Conclusions

Summary

5.1.224 This chapter has assessed the potential effects that the Proposed Development would have on the historic environment. It has considered potential direct physical impacts, indirect effects resulting from changes to the setting of heritage assets in the wider area, and the potential cumulative effects due to the presence of other extant or proposed developments.

Baseline conditions

5.1.225 The assessment provided in this chapter was informed by a comprehensive assessment of the potential indirect impacts the Proposed Development could have on the significance of designated heritage assets in the wider area due to changes to their settings, which was provided by the CHBA provided in Appendix 5.1.

5.1.226 The assessment of designated heritage assets provided in the CHBA highlighted a number of assets that required more detailed assessment due either to their proximity to the proposed development, their sensitivity, or the complexity of the issues surrounding their assessment which meant that they would benefit from fuller assessment.

5.1.227 A total of fifteen such assets were identified, as follows:

- SM1 - TYR 011:018 – Giants Grave Scheduled Monument
- SM2 -TYR 006:006 – Court Tomb: The White Rocks Scheduled Monument
- SM3 - TYR 006:030 – Two Stone Circles and Stone Alignment Scheduled Monument
- SM4 - TYR 006:004 – Cashel Scheduled Monument
- SM5 - TYR 006:047 – Field Walls and Cairns Scheduled Monument
- SM6 - TYR 006:044– Stone Circle, Cairns and Alignments Scheduled Monument
- SM7 - TYR 006:045 – Stone Circle, Cairns and Alignments Scheduled Monument
- SM8 - TYR 006:046 – Field Walls, Cairns and Standing Stones Scheduled Monument
- SM9 - TYR 026:005 – Stone Circle and Alignment Scheduled Monument
- SM10 - TYR 011:016 – Castledamph Circle: Two Stone Circles, Cairns with Cists and Two Alignments Scheduled Monument
- SM11 - TYR 011:015 – Bronze Age Ceremonial Landscape Scheduled Monument
- SM12 - TYR 006:022 – Two Stone Circles and Possible Alignment Scheduled Monument
- SM13 - TYR 011:004 – Castledamph Rath Scheduled Monument
- LB1 - HB10/09/006 – St Marys Roman Catholic Church, Grade B1
- LB2 - HB10/05/019 – 141 Glenelly Road, Grade B2

5.1.228 This assessment of archaeological heritage assets provided in the CHBA highlighted several assets that required more detailed assessment due either to their proximity to the proposed development, their sensitivity, or the complexity of the issues surrounding their assessment which meant that they would benefit from fuller assessment. A total of five such assets were identified, as follows:

- TYR 011:014 – Megalithic Tomb, Undesignated monument
- TYR 011:032 – Cairn, Undesignated monument
- TYR 011:033 – Cairn, Undesignated monument
- TYR 011:006 – Beacon, Undesignated monument

- TYR 006:052 – Booley House, Undesignated monument

5.1.229 The CHBA recommended that all of these cultural heritage assets should be considered in detail in the EIA, and as a consequence these were considered in detail by this chapter.This process has found that in most cases, the degree of effect which would result from the proposed development would be no more than **slight adverse**, and in no instance would the proposed development result in a significance of effect higher than **minor adverse**.

5.1.230 The potential for indirect effects to the remaining heritage assets in the wider study area, which could result from the Proposed Development, was considered in detail in the CHBA. It was concluded that the Proposed Development would have no more than a slight adverse effect on the remaining heritage assets in the wider area, which would not comprise significant environmental effects. As such, it is not necessary to consider these effects in detail within this chapter. However, the CHBA is provided in Appendix 5.1, where detailed assessments of all the remaining heritage assets can be found if needed.

5.1.231 In all cases, the effects are medium term and reversible, and in no instance would the proposed development directly affect a key aspect of the significance of any of these assets.

5.1.232 The potential for buried archaeological remains to be present within the Site was assessed by review of the available evidence undertaken within the CHBA, which confirmed that the Site has a known potential to contain one beacon (TYR 011:006). Therefore, there is a low potential for prehistoric remains associated with ceremonial and symbolic activity due to likely disturbance caused by the adaptation of TYR 011:006 into a beacon and a moderate potential for the presence of yet unknown prehistoric remains. There is also a low potential for remains associated with the Early Christian / Medieval period. Finally, there is a known potential for the Post-Medieval / Modern period and a low potential for the presence of yet unknown Post-Medieval / Modern period associated with agricultural processes.

5.1.233 The Proposed Development has been designed to avoid all recorded archaeological heritage assets whose location is confirmed, and so no known buried archaeological remains would be impacted by the Proposed Development. There is potential for localised impacts to result to as yet unknown buried archaeological remains (A6), which could result in a minor effect. In response a programme of archaeological works is proposed, which would record any remains prior to construction, and would realise the research value of the remains. With the benefit of such a programme works, the significance of any effects to buried archaeological remains would be at most **slight adverse.**

Effects of the Proposed Development on the historic environment

5.1.234 During construction, after a programme of archaeological works the proposed development would result in a significance of effect of **slight adverse** on the below ground remains within the Site. The construction phase of the Proposed Development would be short lived, taking less than one year, and the effect of this on the setting of cultural heritage assets in the wider area would be temporary. Furthermore, any effects in terms of the prominence and visibility of the turbines would be less than is the case during the operational phase. As such, the indirect construction phase effects of the Proposed Development do not need detailed assessment, and are adequately covered by the assessment of operation phase below.

5.1.235 During operation, it was found that in most cases the degree of effect would result from the proposed development would be no more than slight and that in no instance would the proposed development result in a significance of effect higher than **minor adverse**.

5.1.236 The potential for cumulative effects has been considered for each of the heritage assets assessed by this chapter. The assessment of potential cumulative effects has been made with reference to the cumulative baseline provided in Chapter 4 of the ES, together with information provided in the heritage viewpoints and LVIA.

5.1.237 The potential for cumulative effects was considered in detail, and it was found that the developments within the cumulative baseline are sufficiently far and well screened, that they would not affect the impact assessments within this chapter. As a result, it is concluded that during the construction and operation, the Proposed development and the presence of the developments within the cumulative baseline would not result in a materially higher level of effect to the identified heritage assets than what would result from the Proposed Development on its own.

Mitigation measures

5.1.238 The residual effects on the historic environment which would result from the Proposed Development are summarised in Table 5.8, below.

Table 5.8 – Summary of effects of Proposed Development on the historic environment

Ref.	Level of Importance (Table 5.1)	Significance of Effect (Table 5.4)	Embedded Mitigation	Additional Mitigation	Significance of Residual Effect (Table 5.4)
Construction and Operation					
SM1	High	Neutral	None possible	None possible	Neutral
SM2	High	Minor Adverse	None possible	None possible	Minor Adverse
SM3	High	Neutral	None possible	None possible	Neutral
SM4	High	Neutral	None possible	None possible	Neutral
SM5	High	Neutral	None possible	None possible	Neutral
SM6	High	Neutral	None possible	None possible	Neutral
SM7	High	Neutral	None possible	None possible	Neutral
SM8	High	Neutral	None possible	None possible	Neutral
SM9	High	Neutral	None possible	None possible	Neutral
SM10	High	Neutral	None possible	None possible	Neutral

Ref.	Level of Importance (Table 5.1)	Significance of Effect (Table 5.4)	Embedded Mitigation	Additional Mitigation	Significance of Residual Effect (Table 5.4)
SM11	High	Neutral	None possible	None possible	Neutral
SM12	High	Neutral	None possible	None possible	Neutral
SM13	High	Neutral	None possible	None possible	Neutral
LB1	Medium	Neutral	None possible	None possible	Neutral
LB2	Medium	Neutral	None possible	None possible	Neutral
A1	Low	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	None possible	Minor Adverse
A2	Low	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	None possible	Minor Adverse
A3	No Importance	No Impact	None possible	None possible	No Impact
A4	Low	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	None possible	Minor Adverse
A5	Low	Minor Adverse	Proposed Development designed to	None possible	Minor Adverse

Ref.	Level of Importance (Table 5.1)	Significance of Effect (Table 5.4)	Embedded Mitigation	Additional Mitigation	Significance of Residual Effect (Table 5.4)
			avoid all recorded archaeological heritage assets whose location is confirmed.		
A6	Low	Major adverse if present within areas of construction. Minor Adverse across the rest of the Site	Programme of archaeological works	No further mitigation necessary	Slight Adverse
Cumulative Effects – Construction and Operation					
SM1	High	Neutral	None possible	None possible	Neutral
SM2	High	Minor Adverse	None possible	None possible	Minor Adverse
SM3	High	Neutral	None possible	None possible	Neutral
SM4	High	Neutral	None possible	None possible	Neutral
SM5	High	Neutral	None possible	None possible	Neutral
SM6	High	Neutral	None possible	None possible	Neutral
SM7	High	Neutral	None possible	None possible	Neutral
SM8	High	Neutral	None possible	None possible	Neutral
SM9	High	Neutral	None possible	None possible	Neutral
SM10	High	Neutral	None possible	None possible	Neutral
SM11	High	Neutral	None possible	None possible	Neutral
SM12	High	Neutral	None possible	None possible	Neutral

Ref.	Level of Importance (Table 5.1)	Significance of Effect (Table 5.4)	Embedded Mitigation	Additional Mitigation	Significance of Residual Effect (Table 5.4)
SM13	High	Neutral	None possible	None possible	Neutral
LB1	Medium	Neutral	None possible	None possible	Neutral
LB2	Medium	Neutral	None possible	None possible	Neutral
A1	Low	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	None possible	Minor Adverse
A2	Low	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	None possible	Minor Adverse
A3	No Importance	No Impact	None possible	None possible	No Impact
A4	Low	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	None possible	Minor Adverse
A5	Low	Minor Adverse	Proposed Development designed to avoid all recorded archaeological heritage assets whose location is confirmed.	None possible	Minor Adverse

Ref.	Level of Importance (Table 5.1)	Significance of Effect (Table 5.4)	Embedded Mitigation	Additional Mitigation	Significance of Residual Effect (Table 5.4)
A6	Low	Minor Adverse	Programme of archaeological works	No further mitigation necessary	Slight Adverse
SM1	High	Minor Adverse	None possible	None possible	Minor Adverse
SM2	High	Minor Adverse	None possible	None possible	Minor Adverse
SM3	High	Neutral	None possible	None possible	Neutral
SM4	High	Neutral	None possible	None possible	Neutral

Conclusion

5.1.239 In conclusion, the potential effects of the proposed development on the setting of heritage assets have been minimised by the design of the proposed development, and any archaeological impacts could be mitigated by a programme of archaeological works secured via planning condition. It would therefore be possible to implement the proposed development in accordance with the requirements set out in policies BH2 - 4 of PPS 6, paragraph 6.224 of the SPPS and policy HE1 in the LDP 2035.

References

General

The Northern Ireland Sites and Monuments Record (NISMR);

Historic Environment Record of Northern Ireland (HERoNI);

Northern Ireland Historic Map Viewer;

Online database of Irish Excavation Reports (if available); and

Bibliographic

Alphan, H. (2021). Modelling potential visibility of wind turbines: A geospatial approach for planning and impact mitigation. *Renewable and Sustainable Energy Reviews*, 152, p.111675. doi:https://doi.org/10.1016/j.rser.2021.111675.

CIfA. 2017. Standard and Guidance for Historic Environment Desk-Based Assessment

Department for Communities 2018. Guidance on Setting and the Historic Environment

Department for Communities 2019. Register of Parks, Gardens and Demesne of Special Historic Interest in Northern Ireland

Department for Communities 2019a. Criteria for the Scheduling of Historic Monuments and the Listing of Buildings of Special Architectural or Historic Interest, with associated procedures

Geological Survey of Northern Ireland. (2017). *Geological Survey of Northern Ireland GeoIndex (GSNI).* [Online] bgs.ac.uk available at: https://mapapps2.bgs.ac.uk/GSNI_Geoindex/home.html

ICOMOS 2011. Guidance on Heritage Impact Assessments for Cultural World Heritage Properties

Halpin, E. (2019). Growing Evidence for Portal Tomb Cairns? *Archaeology Ireland*, [online] 33(3), pp.43–47. Available at: https://www.jstor.org/stable/10.2307/26844493 [Accessed 12 May 2023].

Hunter, P. 2012. The Effect of Focal Length on Perception of Scale and Depth in Landscape Photographs.

Landgage Heritage Limited. 2023. Mullaghclogher Wind Farm, Aughabrack, Plumbridge, Northern Ireland: Cultural Heritage Baseline Appraisal.

Landscape Institute. 2019. Visual Representation of Development Proposals. Technical Guidance Note 06/19

Leat, S.J., Yakobchuk-Stanger, C. and Irving, E.L. (2020). Differential visual acuity – A new approach to measuring visual acuity. *Journal of Optometry*, 13(1), pp.41–49. doi:https://doi.org/10.1016/j.optom.2019.04.002.

Lynch, F. (1966). The Court Cairn at Balix Lower, Co. Tyrone. *Ulster Journal of Archaeology*, [online] 29(3), pp.39–42. Available at: http://www.jstor.com/stable/20627429 [Accessed 12 May 2023].

Marieb, E.N. and Hoehn, K. (2019). *Human anatomy & physiology*. 11th ed. Hoboken, New Jersey: Pearson Education, Inc.

McConkey, R (1987). *unpublished masters thesis*. 57

O'Sullivan, M. and Downey, L. (2010). WEDGE TOMBS. Archaeology Ireland, [online] 24(4), pp.36–39. Available at: https://www.jstor.org/stable/40961793 [Accessed 12 May. 2023].

O'Sullivan, M. and Downey, L. (2012). PASSAGE TOMBS and MEGALITHIC ART. *Archaeology Ireland*, [online] 26(1), pp.36–40. Available at: https://www.jstor.org/stable/41483607.

Palmer, J.F. (2022). Deconstructing viewshed analysis makes it possible to construct a useful visual impact map for wind projects. *Landscape and Urban Planning*, 225, p.104423. doi:https://doi.org/10.1016/j.landurbplan.2022.104423.

Proudfoot, B. (1970). Irish Raths and Cashels: Some Notes on Chronology, Origins and Survivals. *Ulster Journal of Archaeology*, [online] 33(3), pp.37–48. Available at: https://www.jstor.org/stable/20567665 [Accessed 12 May 2023].

List of Figures and Appendices

Figures

Appendices

6

Vegetation & Peatland

6. Vegetation & Peatland

Introduction

6.1 This chapter constitutes the vegetation and peatland ecology and nature conservation assessment for the Environmental Impact Assessment of a proposed wind farm at Mullaghclogher, Carrickayne, Legnahappoge, Glengarrow, Stroanack and Doorat, situated approximately 4 km to the north-east of Plumbridge, Northern Ireland, hereinafter referred to as 'the Proposed Development'. The site occupies part of the extensive northern and north-eastern slopes beneath two peaks, Mullaghcarbatagh (IGR 251813394789) and Mullaghclogher (IGR 252898394859) mountains, which rise to 517 m ASL and 572 m ASL respectively. The initial studies within the site "Blue Line1," which encloses an area that is approximately 3 km in length and is approximately 4.2 km in width (at its longest and widest points) during July and August 2022, identified extensive areas of valued habitat types, as outlined in Figure 6.2: JNCC Phase 1 Habitat Map. This early study described the habitats within an area of approximately 630 ha. Further, more detailed, National Vegetation Classification (NVC) surveys were completed from May to September 2023 and were primarily located with the planning application boundary (Red Line) which has an area of approximately 118ha.

6.2 The present proposal is for the construction of eleven three-bladed horizontal axis turbines, each up to 180 m maximum tip height together with associated external electricity transformers, underground cabling, access tracks, turning heads, crane hardstandings, control building and substation compound, battery energy storage containers, off-site areas of widening to the public road and all ancillary works. During construction and commissioning there would be a number of temporary works including a construction compound with car parking, temporary parts of crane hardstandings and facilities.

6.3 This study addresses the potential impacts of the proposal to erect thirteen turbines and associated access tracks and infrastructure on the habitats and species in this reduced study area, as shown in **Figure 6.3: NVC Phase 2 Habitat Map**.

6.4 Blackstaff Ecology Ltd was commissioned by RES UK and Ireland Ltd to undertake an Ecological Impact Assessment (EcIA) for the proposed wind farm. The ecological surveys used to describe the baseline conditions on site and to inform the EcIA were carried out during 2022 and 2023. Full details of the proposed development can be found in **Chapter 1: Introduction and The Proposed Development**.

6.5 The chapter is supported by:

- Appendix 6.1: Chapter 6 Annexes
- Habitat Descriptions & Quadrat Data
- (outline) Habitat Management Plan

[1] The Blue Line used in the chapter refers to the Land Under Applicant Control.

- Figure 6.1: Designated Sites (within 15km)
- Figure 6.2: JNCC Phase 1 Habitat Map
- Figure 6.3: NVC Phase 2 Habitat Map
- Figure 6.4: NVC Quadrat Locations
- Figure 6.5: Habitat Management Areas (with ditch blocking)

Statement of Authority

6.6 Initial vegetation surveys and habitat assessments were carried out by Karl Hamilton, with badger, otter and viviparous lizard surveys carried out by Jazmin Creaney and Catriona Porter. Jazmin, Michelle Duggan and Catriona also assisted with active peat assessments. Quadrat surveys in support of the habitat survey were carried out by Karl Hamilton. Bat detector deployments and bat data analysis were completed by Philip Leathem, who also produced the figures to accompany the impact assessment.

6.7 All surveys were planned and designed by Cormac Loughran, a Chartered Environmentalist (CEnv) and full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM). Cormac has worked professionally as a Consultant Ecologist for over 17 years. He holds an MSc (Distinction) in Environmental Management from the University of Ulster and has extensive experience in a broad range of flora and fauna surveys. He has undertaken and/or coordinated a wide range of ecological surveys and associated impact assessments for over 30 renewable energy projects. Cormac is also an experienced field naturalist and, prior to his consultancy work, he worked as a ranger on a number of important nature reserves. As a result, he also has considerable habitat management experience across a broad range of habitats including broadleaved woodland, wetland, grassland and wet and dry heathland.

6.8 Karl Hamilton co-authored this chapter. Karl has a BSc (Hons) in Environmental Biology from the Queen's University of Belfast, after which he took up the post of Senior Reserve Warden and Biodiversity Officer for the Wildfowl Wetlands Trust within Northern Ireland. This role included hands-on management of a variety of terrestrial and aquatic habitats, surveying and monitoring of flora and fauna, managing volunteers and work placements, and surveying. In 2010 Karl commenced his career in ecological consultancy as a freelance ecologist, engaging in contract and sub-contract work throughout Northern Ireland and the Republic of Ireland, undertaking primarily Preliminary Ecological Assessments, Protected Species Surveys, Invasive Species Surveys and Ecological Impact Assessments. In 2020 Karl joined Blackstaff Ecology as Senior Ecologist and specialises in ornithological, botanical and habitat surveys. Karl also regularly provides training courses in these and other ecological subjects for environmental NGOs, statutory organisations and other ecologists. To date Karl has completed habitat surveys and active peat assessments on a dozen wind farm developments.

6.9 This report has been reviewed Dr Brian Sutton, who was awarded a PhD in Environmental Science by the University of Ulster. Prior to working at Blackstaff Ecology, he worked as a member of the Habitat Survey Team of the Environment and Heritage Service (now NIEA) for 2 years. During this time, he carried out habitat surveys of, principally, designated sites or candidate designated sites across Northern Ireland. In so doing he gained experience of most of the habitat types that are present in the Province. Following this, he worked as a consultant ecologist for AECOM Ltd for 15 years, carrying out habitat and faunal surveys for a wide range of governmental and private clients. Projects undertaken were at a range of scales, from small private developments to major infrastructure projects. He has been a Principal Ecologist with Blackstaff Ecology for the past eight years.

6.10 Catriona has an MSc in Animal Behaviour and Welfare (Distinction) from Queen's University, Belfast. She has several years of experience within the nature conservation sector through extensive volunteering including organisations such as UK Overseas Territories Conservation Forum, Ulster Wildlife and the RSPB. Catriona has just over 2yrs of experience within the ecological consultancy sector, beginning in April 2021 with Allen & Mellon Environmental. Since joining Blackstaff she has been involved in projects in the north and south of Ireland and has gained varied experience in survey techniques and the associated ecological reports. She is a Qualifying CIEEM member and holds a BTO T-permit under which she has ringed approximately one hundred and ten birds / twenty-one species.

6.11 Jazmin has a BSc in Zoology and is a qualifying member of CIEEM. She has undertaken further courses including Animal Conservation, GIS and Environmental Management. She has a range of experience in conducting field surveys both locally, with organisations including BTO, The National Trust and TetraTech, and abroad, through her time monitoring elephant behaviour and habitat damage in South Africa. Since joining Blackstaff Ecology in 2021, Jazmin has been involved in projects throughout NI and the ROI and has gained significant ecological experience. She has completed four active peat assessment surveys.

6.12 Michelle has a BSc (Hons) in Field Biology and wildlife tourism (1st class) from the Institute of Technology Tralee and an MSc in Ecological Management and Conservation Biology from Queen's University, Belfast. Michelle is also a Qualifying member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and holds a BTO ringing T- permit. She has gained professional and voluntary experience within the ecology and nature conservation sector working with organisations such as, The National Trust, Mourne Heritage Trust, RSPB NI and the Belfast Hills Partnership. Michelle also undertook an environmental internship within Astellas Pharma Co Ltd, Co. Kerry, completing a Preliminary Ecological Appraisal to facilitate future management of a site. Since joining Blackstaff in May 2021, Michelle has been involved in projects both Northern Ireland and RoI.

Legislation & Planning Policy

International Treaties, Conventions & Directives

Bonn Convention of the Conservation of Migratory Species of Wild Animals (June 1979)

6.13 The Convention requires the protection of the endangered migratory species listed and encourages separate international agreements covering particular species. An agreement covering the conservation of bats in Europe came into force in January 1994. It deals with the need to protect bats and their feeding and roosting areas.

Bern Convention on the Conservation of European Wildlife and Natural Habitats (September 1979)

6.14 The Convention carries obligations to conserve wild plants, birds and other animals, with emphasis on endangered and vulnerable species and their habitats. The provisions of the Convention underlie the EC Habitats Directive as well as the UK's wildlife legislation.

UN Biodiversity Convention (The Rio Convention) (June 1992)

6.15 The Convention provides a framework for international action to protect species and habitats. The UK's overall goal under the Convention is to conserve and enhance biological diversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms.

Convention on Biological Diversity (93/626/EEC) (CBD)

6.16 The Convention requires contracting parties, in accordance with its conditions and capabilities, to develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes. It also requires contracting parties to integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectorial and cross sectorial plans, programmes and policies.

EC Council Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) (The Habitats Directive)

6.17 Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the EU Habitats Directive) is transposed into law in Northern Ireland by the Conservation (Natural Habitats, etc.) Regulations 1995 (as amended) - the Habitats Regulations.

6.18 The Habitats Directive covers habitats and non-avian species of fauna of nature conservation importance for which the European Commission (EC) has responsibility in view of their global range, population and/or distribution. Habitats are listed and detailed on Annex I of the Directive.

6.19 To conserve habitats listed on Annex I of the Directive, and species, listed and described on Annex II, a European network of Special Areas of Conservation (SAC) has been established.

6.20 As the Habitats Directive encapsulates a presumption in favour of maintaining Annex I habitats in good conservation status wherever they occur, prior assessment is required to determine whether any areas of habitat within a development site meets the criteria for recognition as Annex I habitat types.

6.21 The Directive also requires appropriate assessment of any plan or project not directly connected with or necessary to the management of a Natura 2000 site, but likely to have significant effects upon a Natura 2000 site, either individually or in combination with other plans or projects.

Annex 1 Habitats

6.22 Blanket Bog (H7130) is listed in Annex 1 of the EU Habitats Directive as a habitat of European interest. Blanket bog occurs extensively over the site, occasionally in mosaics with other habitat types. The significant presence of extensive *E. vaginatum*, with patchy and/or localised *Sphagnum* suggests that active peat is at least locally present.

6.23 The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats listed in Annex 1 at a favourable conservation status, introducing robust protection for those habitats of European importance.

Domestic Legislation

6.24 The proposed development has been reviewed in relation to local planning policy specific to geology and the water environment. A detailed planning policy and legislation review is included within **Chapter 2: Planning Policy**.

Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended)

6.25 The Regulations give effect to requirements relating to the designation of protected sites under the Birds Directive and Habitats Directive. The Regulations provide for the protection and management of European Sites and place obligations on all competent authorities to have regard to the requirements of the Directives. The Regulations also provide for the protection of species of European importance.

Environment (Northern Ireland) Order 2002

6.26 The Order provides for the designation, management and protection of Areas of Special Scientific Interest (ASSIs). ASSIs may be designated for important geology and land forms as well as for wildlife and habitats. The legislation repeals Part VI of the Nature Conservation and Amenity (Northern Ireland) Order 1985.

Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (as amended)

6.27 The Order provides for the establishment of National Nature Reserves (NNRs), Nature Reserves (NRs) and Marine Nature Reserves (MNRs). It also provides for the designation and formulation of proposals for National Parks and Areas of Outstanding Natural Beauty (AONBs).

The Wildlife (Northern Ireland) Order 1985 (as amended)

6.28 The Order prohibits the intentional killing, taking or injuring of certain wild birds or wild animals; or the intentional destruction, uprooting or picking of certain wild plants. It also allows for the establishment of Wildlife Refuges (akin to Nature Reserves) for the special protection of certain species of rare plants or animals.

The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009

6.29 The Regulations implement Directive 2004/35/EC and require those carrying out certain activities to prevent, limit and remediate significant environmental damage to protected species, natural habitats, ASSIs, surface water, ground water and land. Operators of activities such as discharges to water sources and water impounding are liable for any significant environmental damage, regardless of whether they intended to cause the damage or were negligent.

Wildlife and Natural Environment Act (Northern Ireland) 2011

6.30 The Act makes provision about biodiversity; amends the Wildlife (Northern Ireland) Order 1985 and Part 4 of the Environment (Northern Ireland) Order 2002; abolishes game licences and game dealers' licences; prohibits hare coursing events and amends the Game Preservation Act (Northern Ireland) 1928.

Planning Policy

Regional Development Strategy (RDS) 2035: Building a Better Future

6.31 The Strategy takes account of European and national policies which would have an influence on the future development of Northern Ireland. The Strategic Planning (Northern Ireland) Order 1999 requires Northern Ireland Departments to have regard to the Regional Development Strategy in exercising any functions in relation to development. There are two types of Strategic Guidance: Regional Guidance (RG) and Spatial Framework Guidance (SFG). RG applies to everywhere in the region and is presented under the three sustainable development themes of Economy, Society and Environment.

6.32 RG 9-RG 12 (Environment) have been adjusted to meet obligations under the Habitats Regulations. Of relevance to the Development is RG 11: Conserve, protect and, where possible, enhance our built heritage and our natural environment. This Strategy Guidance refers to the need to:

'Sustain and enhance biodiversity in line with the objective of the Northern Ireland Biodiversity Strategy to halt the loss of indigenous species and habitats. By protecting existing, or creating new, ecological or wildlife corridors particularly in our cities and towns we can provide valuable help to arrest the decline in biodiversity.'

and

'Identify, establish, protect and manage ecological networks. Ecological networks, including the protection of priority species, are needed to maintain environmental processes and help to conserve and enhance biodiversity. A well-established ecological network, including designated sites, should provide the habitats needed for ecosystems and species populations to survive in an increasingly human dominated landscape. Such networks could also be of amenity value if linked to the green infrastructure provided by walking and cycle routes to heritage and other recreational interest.'

Strategic Planning Policy Statement for Northern Ireland (SPPS) (September 2015)

6.33 In addition to reiterating the statement made in PPS18 (below) the SPPS States:

'Active peatland is of particular importance to Northern Ireland for its biodiversity, water and carbon storage qualities.'

and

'Renewable energy reduces our dependence on imported fossil fuels and brings diversity and security of supply to our energy infrastructure. It also helps Northern Ireland achieve its targets for reducing carbon emissions and reduces environmental damage such as that caused by acid rain.'

Planning Policy Statement 18: Policy RE1

6.34 Policy RE1 States:

'The wider environmental, economic and social benefits of all proposals for renewable energy projects are material considerations that will be given significant weight in determining whether planning permission should be granted'.

'Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on:

(a) public safety, human health, or residential amenity;

(b) visual amenity and landscape character;

(c) biodiversity, nature conservation or built heritage interests;

(d) local natural resources, such as air quality or water quality; and

(e) public access to the countryside.

Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures, such as a habitat management plan or the creation of a new habitat. This matter will need to be agreed before planning permission is granted.

Any development on active peatland will not be permitted unless there are imperative reasons of overriding public interest.'

Planning Policy Statement 2 - Policy NH5 (2013)

6.35 Policy NH 5 - Habitats, Species or Features of Natural Heritage Importance, states:

'Planning permission will only be granted for a development proposal which is not likely to result in the unacceptable adverse impact on, or damage to known:

- priority habitats;
- priority species;
- active peatland;
- ancient and long-established woodland;
- features of earth science conservation importance;
- features of the landscape which are of major importance for wild flora and fauna;
- rare or threatened native species;
- wetlands (includes river corridors); or
- other natural heritage features worthy of protection.

A development proposal which is likely to result in an unacceptable adverse impact on, or damage to, habitats, species or features may only be permitted where the benefits of the proposed development outweigh the value of the habitat, species or feature. In such cases, appropriate mitigation and/or compensatory measures will be required.

PPS 21 Sustainable Development in the Countryside

6.36 PPS 21 aims to:

'Manage development in the countryside in a manner consistent with achieving the strategic objectives of the Regional Development Strategy for Northern Ireland 2025." Objectives include to "Conserve the landscape and natural resources of the rural area and to protect it from excessive, inappropriate or obtrusive development and from the actual or potential effects of pollution," and to "Promote high standards in the design, siting and landscaping of development in the countryside.'

Derry Area Plan 2011 and Strabane Area Plan 1986 – 2001

6.37 The proposed development is located within the Derry City and Strabane District Council (DCSDC) boundary. DCSDC are currently preparing a new Local Development Plan (LDP) for the Borough up to 2032. In the interim, the current area plans for the same area are the Derry Area Plan 2011 and the Strabane Area Plan 1986 – 2001. The latter Plan, which would cover Mullaghclogher and the surrounding area, is not currently available online.

Derry City and Strabane District Council Local Development Plan 2032 Draft Plan Strategy – Natural Environment

6.38 The Draft Local Development Plan 2032, although not yet adopted, outlines planning policy pertinent to the natural environment.

6.39 NE1 sets out policy to protect nature conservation sites and is an amalgamation of Planning Policies NH1, NH3 and NH5 within PPS2; it also aligns with the SPPS.

6.40 NE2 sets out policy to conserve protected species and their habitats and aligns with PPS2 and the SPPS.

6.41 NE3 sets out policy to protect biodiversity or features of natural heritage importance, and broadly aligns with PPS and the SPPS except that the recognition of and wording in relation to ancient / long-established woodland has been strengthened.

6.42 NE4 strengthens the commitment of the LDP to protect the character, views and access to main rivers and open water bodies, in relation to development proposals. It also further protects the tidal sections of main rivers.

6.43 NE5 strengthens existing policy relating to development within or affecting the setting of the Sperrin AONB from detrimental development and the requirement for enhanced design within its boundaries.

6.44 NE6 is a new policy which aims to protect the remote wilderness parts of the upland AONB landscape from all forms of future development, with a number of exceptional exemptions, in line with similar policies proposed by the adjoining AONB Councils.

6.45 NE7 strengthens policy to ensure that developments do not impede the inter-connectedness of areas of high landscape importance which include key coastal, river valley and key settlement settings and their associated nature conservation assets.

6.46 NE8 relates to development within local landscape policy areas (LLPAs) and aims to identify a series of further LLPAs.

6.47 As the draft Plan is only at consultation stage it holds no material weight in decision making.

Northern Ireland Biodiversity Strategy

6.48 An updated Northern Ireland Biodiversity Strategy is currently being drafted. In the interim period, the current strategy which was published by the DoE entitled 'Valuing Nature – A Biodiversity Strategy for Northern Ireland to 2020' (01 July 2015) is in effect; it describes 20 targets arising from the 2010 Convention on Biological Diversity

(CBD) which was held in Noyoga, Japan during October 2010. A key decision at the Convention was the adoption of a new ten-year strategic plan to guide international and national effort to save biodiversity. The strategic plan, or the Aichi Target, adopted by the meeting is the overarching, internationally agreed, framework on biodiversity. The 20 Aichi Targets form the basis for the Implementation Plan for the NI Biodiversity Strategy. The CBD fully adopted the ecosystem services approach that stresses the need to look at maintaining the functionality of ecosystems as key to protecting biodiversity and delivering benefits for humanity.

Draft Northern Ireland Environment Strategy

6.49 This strategy is intended to set out Northern Ireland's environmental priorities over the next few decades and will form part of the Green Growth agenda (the Green Growth Strategy will provide more detail on actions in respect of climate change and greenhouse gas emissions).

Draft Green Growth Strategy for Northern Ireland

6.50 The Green Growth Strategy aims to balance climate, environment and the economy within the Province. Its sets out the long-term vision and provides a framework for tackling the climate crisis.

Northern Ireland Peatland Strategy 2021-2040

6.51 The Northern Ireland Peatland Strategy identifies the ecosystem services provided by healthy peatlands including climate regulation and adaptation, specialised biodiversity, good water quality, flood alleviation and a historical archive. Peatland habitats also provide a unique landscape for recreation and education.

6.52 The Northern Ireland Peatland Partnership consists of members from many sectors and aims to provide oversight and ensure delivery of the Strategic Objectives and Actions contained within the Strategy.

Sustainable Development Strategy for Northern Ireland

6.53 The Strategy sets out the Government agenda for ensuring that sustainable practice becomes an integral part of development policy in Northern Ireland. The following six principles of the strategy continue to echo those developed from the previous strategy, and are as follows;

- Living within Environmental Limits;
- Ensuring a Strong, Healthy, Just and Equal Society;
- Achieving a Sustainable Economy;
- Promoting Good Governance;
- Using Sound Science Responsibly;
- Promoting Opportunity and Innovation.

6.54 The strategic objective most relevant to this development is: Ensuring reliable, affordable and sustainable energy provision and reducing our carbon footprint.

UK and Northern Ireland Biodiversity and Habitat Action Plans

6.55 The UK Biodiversity Action Plan (UKBAP) and equivalent Northern Ireland Habitat Action Plan, as well the internal NIEA Guidance Document, have been consulted regarding what constitutes 'active' blanket bog.

6.56 The UKBAP indicates that 'active' peatlands include the EU Habitats Directive priority habitat 'active' blanket bog, the definition of 'active' being given as 'still supporting a significant area of vegetation that is normally peat forming'. The UKBAP indicates that the principal vegetation (NVC) types covered and so defined as Blanket bog are M1, M2, M3, M15, M17, M18, M19, M20 and M25, together with their intermediates.

6.57 The Northern Ireland Habitat Action Plan (NIHAP) provides a similar definition of the habitat type, The NI HAP notes the EC Habitats Directive definition of what constitutes 'active' bog, and notes the following in respect of relevant NVC types: -

> *'Within Northern Ireland, blanket bog encompasses a range of plant communities that are similar to those identified in the National Vegetation Classification (NVC) of Great Britain (Rodwell, 1991). NVC descriptions and codes are given to associations of plants that are characteristic of particular environmental and management conditions. Plant communities that are typical of natural blanket bogs include the bog pool communities M1 to M3, M17 Scirpus cespitosus - Eriophorum vaginatum blanket mire, M18 Erica tetralix - Sphagnum papillosum raised and blanket mire and M19 Calluna vulgaris - Eriophorum vaginatum. Several additional NVC communities are characteristic of the extensive areas of blanket bog which have been subject to some disturbance such as drainage or peat cutting. These include M15 Scirpus cespitosus - Erica tetralix wet heath, M20 Eriophorum vaginatum blanket and raised mire, M25 Molinia caerulea - Potentilla erecta mire, together with their intermediates. Other wetland plant communities, such as flush M10 Carex dioica - Pinguicula vulgaris mire and poor-fen M6 Carex echinata-Sphagnum recurvum/auriculatum mire, are often closely associated with blanket bog. For the purposes of this plan, these are treated as an integral part of the blanket bog habitat.'*

6.58 The UKBAP, NIHAP and European Commission (2007) Interpretation Manual of European Union Habitats has been utilised in the current report to determine whether peatlands are 'active' and hence require consideration in policy and impact assessment terms.

Guidance on Species/Habitats of Conservation Concern

Red Data Book

6.59 Vascular plant species that are rare and/or threatened on an all-Ireland or European scale have been identified as Red Data Book (RDB) species (Curtis & McGough, 1988).

Northern Ireland Species of Conservation Concern

6.60 NIEA has produced a list of Northern Ireland Priority Species (NIPS) and Species of Conservation Concern (SOCC), which includes Biodiversity Action Plan species, not all of which are Red Data Book species. Rarity is also a criterion for inclusion in the list. NIEA is also in the process of identifying vascular plant species that are of conservation concern as the NI response to the adoption by the UK of the Global Strategy for Plant Conservation (Palmer, 1994). The proposed list will be comprehensive and include species that are near-threatened as well as those protected by the Wildlife Order or listed as NIPS and SOCC. This process of evaluation of the current list of species of conservation concern is on-going.

Local Biodiversity Action Plans (LBAPs)

6.61 Local Authorities have been able to employ Biodiversity Officers, with financial aid from NIEA, since 2004. Their duties include raising awareness of biodiversity issues within local areas, and the development of LBAPs as a means of conserving and enhancing biodiversity at a local scale.

NIEA Internal Guidance Note on Active Peatland

6.62 The Northern Ireland Environment Agency (NIEA) provides internal guidance to their personnel indicating the site conditions, and which NVC types, may indicate that blanket bog is 'active'. In terms of NVC communities, the Guidance states: -

'The list below indicates the NVC classifications that could be active. In these habitats, the full details of quadrats surveyed will be needed to aid identification of active peatland. They should be provided within the environmental statement (ES).

NVC classifications which are likely to be found in active peatland:

- M1 *Sphagnum auriculatum* bog pool community
- M2 Sphagnum cuspidatum/recurvum bog pool communities
- M3 Eriophorum angustifolium bog pool community
- M17 Scirpus cespitosus - Eriophorum vaginatum blanket bog
- M18 Erica tetralix- Sphagnum papillosum raised and blanket mire
- M19 Calluna vulgaris-Eriophorum vaginatum blanket mire
- M20 Eriophorum vaginatum blanket mire
- M25 Molinia caerulea-Potentilla erecta mire'

6.63 Other criteria from the Guidance, including site-specific characteristics which could indicate the presence of 'active' peat include:

- *Sphagnum* is present
- If the surface is spongy underfoot
- Deep peat is present (>0.5m)
- Intact peat is present, or the hydrology is still intact
- *E. vaginatum/angustifolium* is present in significant quantities with some *Sphagnum*
- The typical range of blanket bog and raised bog species is present as indicated within the interpretation manual
- There is a hummock and pool topography

6.64 Consideration of this Guidance is essential in the design and layout of wind energy projects to ensure compliance with Planning Policy.

Scope of Assessment

Ecological Impact Assessment

6.65 The assessment is based mainly on a study area within the scheme Red Line boundary surrounding the proposed Development and associated infrastructure. This study area is considerably smaller than the area enclosed by the LUAC (Blue Line). The entire area within the Red Line was surveyed to establish the main habitat types present, and the results are presented as **Figure 6.2:** JNCC Phase 1 Habitat Map. The reduced survey area described in the present report considers the results of this earlier survey and avoids considerable areas of habitats of conservation value identified at that time. Surveys for bats were extended to 200m outside the Planning Application Boundary, as required by NIEA guidance. Sites designated for their nature conservation features within a radius of 15km of the site boundary (**Figure 6.1**) were also considered to assess potential remote effects on valuable ecological site-based receptors.

6.66 The aim of EcIA is therefore to describe and assess potential significant effects upon ecological receptors within the application site and zone of ecological influence within the wider environment, as applicable. This is achieved by informed decision-making in accordance with published methodologies and after collecting a range of primary survey data across the site of the proposed development. Identification and evaluation of likely significance of effects associated with the Development during construction, operation and decommissioning phases permit recommendation of appropriate mitigation measures to avoid and/or reduce the predicted adverse effects of the proposed development on the recorded ecological receptors identified as part of the baseline survey.

6.67 The baseline survey, characterisation of the environment and the likely significance of effects of the Development on ornithology, fisheries (aquatic ecology) and the water environment are reported upon in **Chapter 8: Ornithology, Chapter 9: Fisheries** and **Chapter 10: Geology and Water Environment**.

Consultation

6.68 Consultation was undertaken with the statutory and non-statutory organisations listed below regarding the proposed scope of the EcIA, the location of any statutory and non-statutory designated nature conservation sites that have the potential to be impacted by the Development, and identification of potential ecological receptors.

- Centre for Environmental Data and Recording (CEDaR);
- DAERA Natural Environment map viewer;
- National Biodiversity Network (NBN) Atlas for Northern Ireland; and
- NI Bat Group.

6.69 Biological records were obtained from CEDaR, the NI Bat Group and NBN Atlas NI.

6.70 NIEA normally requires the identification of the ecological baseline of the area that will be affected by the scheme, the identification of areas which are likely to be of high conservation value and of ecological receptors vulnerable to significant impact from the proposed scheme. NIEA requires that the EIA should cover both habitats and species of flora and fauna, especially protected species, and that it should cover both the site and its surroundings, in all seasons.

6.71 The developer is required to consider the potential impact of the scheme on designated sites. Where there is a potential for impacts on a European protected site (SPA, SAC) the developer will be responsible for informing a HRA as mandated by Article 6 of EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ("the Habitats Directive").

6.72 The consultation and desk study identified those ecological receptors most likely to be impacted by the proposed wind farm. Ecological receptors identified included Northern Ireland and European priority habitats. The ecological surveys and EcIA therefore concentrate on the potential effects of the Development on these ecological receptors.

Assessment Methodology

Baseline Characterisation of the Study Area

6.73 The study methodology includes both desktop and field survey methods in order to assess potential impacts on the receptors of ecological and nature conservation interest.

6.74 Sites designated at international, national and local level for their conservation value within a potential impact zone were considered. The nearest designated sites to the study area were identified, to assess the potential for remote effects of the scheme on valued habitats and species outside the immediate area.

6.75 Features of conservation interest and importance were recorded and their locations were one of the key criteria that affect the wind farm layout. The location of the wind farm infrastructure avoids habitats and species of conservation interest where possible, and where this is not possible, mitigation and/or enhancement measures have been incorporated into the design to offset any adverse impact.

6.76 The habitats within the entire area enclosed by the original Planning Application Boundary were described in the NVC Phase 2 habitat survey of the site. Habitats were surveyed within the whole Planning Application Boundary. As a consequence of the extensive nature of the Blue Line site (approximately 630ha), the preliminary examination of the site used a largely “broad brush” approach, which identified spatially extensive habitat types as well as many smaller features of ecological significance. This preliminary assessment enabled the identification of substantial areas of ecologically significant habitat, and the reduction in the area that would be required for the appropriate implementation of the scheme.

6.77 Detailed surveys were undertaken to establish the baseline conditions for the various habitats and for the species groups that are likely to occur within the proposed scheme area. The purpose of an ecological survey is to identify 'valued ecological receptors', those species and habitats that are especially valued for their ecological function, their contribution to biodiversity or are protected by specific legislation. The following specialist surveys were undertaken:

- JNCC Phase 1 habitat survey
- NVC Phase 2 habitat survey

6.78 A detailed Phase I habitat survey was carried out by Karl Hamilton in April 2023, in order to more clearly define the limits of habitat types within the newly defined development area. In addition to this, 84 no. (2m x 2m) botanical quadrats were also recorded when assessing habitat type and condition.

Phase 1 Habitat Survey

6.79 The aim of Phase 1 survey is to provide, relatively rapidly, a record of the semi-natural vegetation and wildlife habitat over large areas of countryside. The purpose of the survey is to identify those habitats of conservation interest that might impose a constraint on the placement of the infrastructure of a proposed wind farm. Habitats of the proposed development site are described according to the JNCC Phase 1 Habitat (JNCC 2010) classification. Notes were made of the main plant species, and other species that are indicative of the condition and management of the habitat.

6.80 It is noted that habitat types may frequently merge, grade from one to another, or form complex mosaics. Frequently encountered habitat mosaics in Ireland include various mixtures of grassland/pasture types, heathlands and blanket bogs. Mosaics and transitional, modified and degraded habitats may be difficult to assign to any one Phase 1 Habitat category yet may have very different sensitivities and implications for project planning and assessment.

6.81 The 2023 surveys were carried out along walked transects that attempted to include the variations in habitat types that were present across this extensive site. Features that indicated the potential for active peat formation were noted and, in particular, the extent and type of moss cover were noted, with an emphasis on the prevalence or absence of *Sphagnum* species. The presence of *Succisa pratensis,* the food plant of the marsh fritillary butterfly, which is fully protected under the Wildlife (Northern Ireland) Order, 1985, was noted where encountered.

6.82 The area covered by the Phase 1 Habitat survey is illustrated in **Figure 6.2**.

National Vegetation Classification (NVC) Survey

6.83 The NVC is a system of classifying natural plant communities in Britain according to the species they contain and provides a standardised methodology for detailed environmental assessments. The methodology is repeatable and incorporates the use of quadrat sampling within which the types and relative abundance of plant species is recorded. From these results, plant community types can be classified.

6.84 The survey method employed at Mullaghclogher was based on the NVC survey methodology described by Rodwell (Volumes 1 to 5, 1991 to 2000), which provides for the detailed classification and map-based survey of a wide range of plant communities found in Britain. The NVC describes communities in Britain, while often relatively depauperate communities in Northern Ireland have developed as a result of isolation from potential colonisers and under a generally more oceanic climate. Consequently, NVC types, while widely applicable to vegetation communities present in Northern Ireland, may vary significantly from those described for Britain in species composition and frequency.

6.85 Plant species were identified and recorded using the keys and nomenclature of Stace (2019) for higher plants and Atherton *et al*. (2010) for bryophytes (mosses and liverworts).

6.86 NVC survey requires the placement by eye of 2m x 2m squares to include either locally typical vegetation or to record the local variation in community type. All herbaceous and bryophyte species present within the square were recorded and their percentage cover noted. This approach allows subsequent analysis using the MAVIS program. Sward height and evidence of grazing pressure were recorded and, where appropriate, peat depth was measured. Irish Grid References were recorded for all quadrats sampled.

6.87 The NVC survey in the vicinity of proposed turbine locations was undertaken by Karl Hamilton on 11.05.23, 30.05.23, 01.06.23, 12.07.23 and 28.09.23. In total, 84 quadrats were described from the eleven proposed turbine locations. The GPS location of each quadrat was recorded and the results mapped using geo-referenced OSNI maps. All quadrat data is provided in **Appendix 6.1: Ecology Annexes.**

6.88 NVC plant communities were mapped on a 1:10,000 OS map. A hand-held GPS was used to record the location of target notes accurately. A digital camera was used to take representative photographs of each quadrat location for future reference.

Analysis of the NVC community and sub-communities that were present were made using the relevant NVC Volumes (Rodwell 1991a to 2000). For the sake of clarity this report uses a combination of common and scientific species names, although the latter are only used by Rodwell (1991a to 2000). The most important references for this work are Rodwell Volume 2 (1991) and Volume 3 (1992).

6.89 NVC survey results were used to identify valued vegetation communities and provided input into the assessment of active blanket peat within the study area. These were included in a constraints mapping exercise, along with other environmental constraints, to evolve the final layout design and layout of the wind farm. This process is described in **Chapter 3: Design Evolution and Alternatives**.

Blanket Bog Condition Assessments

6.90 Peatland habitats within the site were assessed to determine whether there were any areas of 'active' blanket bog present. The criteria used included the following:

- criteria provided in the NIEA Guidance note (2012);
- the presence and condition of NVC communities;
- the eco-hydrological conditions found in each part of the site, particularly the presence and condition of artificial drainage;
- past and present land management practices which have the potential to damage the habitat, including peat cutting, burning, vegetation topping, sheep grazing, etc.

Ecological Impact Assessment

6.91 The assessment of the impact of a scheme on a species or habitat must consider the conservation value of the species or habitat. This assessment of the potential impact of the Development on the conservation interest of the construction area and associated access routes adopts the Guidelines for Ecological Impact Assessment in the UK (CIEEM 2018[2]).

6.92 The objective of the EIA process, in relation to the natural environment, is to undertake sufficient assessment to identify and quantify any significant impacts on the natural environment likely to arise from turbine construction, operation and eventual decommissioning. Following identification of the final infrastructure layout, the baseline ecological (or biodiversity) conditions in the Site are described, based on information provided by consultees, background sources of information and the results of dedicated surveys carried out for the scheme.

6.93 As a means of achieving this objective, ecological constraints on development of the scheme at international, national, regional and local levels are identified and assessed. This includes the main ecological features that should be avoided or that could affect the design of the scheme or delay progress.

[2] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2 (updated April 2022). Chartered Institute of Ecology and Environmental Management, Winchester.

Sensitivity Criteria

6.94 Potential significant impacts are assessed according to the ecological value of a site, which is derived from the criteria outlined below. The sensitivity (importance) of a receiving habitat is defined by its position in a hierarchy of site importance and conservation value. This hierarchy extends, highest to lowest, from International, National, Regional, Local, to negligible importance. This range of values is expressed in the protection afforded a site by international and national legislation, and in planning policy at a more local level (**Table 6.1**).

6.95 The biodiversity value of a site, is measured by such factors as:

- animal or plant species, subspecies or varieties that are rare or uncommon, either internationally, nationally or more locally;
- endemic species or locally distinct sub-populations of a species;
- ecosystems and their component parts, which provide the habitats required by the above species, populations and/or assemblages;
- habitat diversity, connectivity and/or synergistic associations (e.g., networks of hedges and areas of species-poor pasture that might provide important feeding habitat for rare species);
- notably large populations of animals or concentrations of animals considered uncommon or threatened in a wider context;
- plant communities (and their associated animals) that are typical of valued natural/semi-natural vegetation types, including examples of naturally species-poor communities;
- species on the edge of their range, particularly where their distribution is changing because of global trends and climate change;
- species-rich assemblages of plants or animals; and
- typical faunal assemblages that are characteristic of homogeneous habitats.

6.96 The secondary value of a site can be as part of a corridor or a series of stepping stones that facilitate the migration, dispersal and genetic exchange of wild species, or as a buffer zone that protects a valued site from adverse or beneficial environmental impacts.

Magnitude of Effect

6.97 This relates to the magnitude of the impacts on the features during the construction, operation and decommissioning phases. The magnitude of ecological impacts is assessed by considering the change in the ecology of a site that will arise because of the direct and indirect effects of a development on that ecology. Factors to be considered when considering the magnitude of an impact are outlined in **Table 6.2**. The criteria for determining the magnitude of impact are listed in **Table 6.3**. Both direct and indirect impacts, and the duration of these impacts are examined.

Significance Criteria

6.98 This relates to the significance of impacts on species and habitats of conservation importance, based on their presence as determined by survey. Factors to be considered when assessing the ecological significance of impacts are outlined in **Table 6.4**. Taking the factors in **Table 6.4** into account the significance of an impact may be broadly categorised according to **Table 6.5**.

Table 6.1: Criteria for assessing ecological sensitivity/importance at a geographic scale

Value/Importance	Criteria
Internationally important sites (very high conservation value)	World Heritage Sites identified under the Convention for the Protection of World Cultural & Natural Heritage, 1972. Biosphere Reserves identified under the UNESCO Man & Biosphere Programme. Wetlands of International Importance designated as Ramsar Sites under the terms of the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention) formulated at Ramsar, Iran, in 1971. Special Protection Areas (SPAs) designated in accordance with the 1979 European Communities Directive on the Conservation of Wild Birds (79/409/EEC): The Birds Directive. This Directive requires member states to take measures to protect birds, particularly rare or endangered species as listed in Annex I of the Directive, and regularly occurring migratory birds. Special Areas of Conservation (SACs and cSACs) designated in accordance with the 1992 European Commission Habitats Directive 92/43/EEC (1992): The Habitats Directive. This Directive requires member states to establish a network of sites that will make a significant contribution to conserving habitat types and species identified in Annexes I and II. Other sites maintaining habitats and/or species listed under the Birds and/or Habitats Directives (see above). Sites hosting significant populations of species annexed under the Bonn Convention. Sites hosting significant populations annexed under the Bern Convention. Biogenetic Reserves (UNESCO Man and the Biosphere Programme).
Nationally important sites (high conservation value)	Areas of Special Scientific Interest are the principal national designation for sites of nature conservation interest. They are notified under Section 28 of the Environment (NI) Order 2002 and are chosen by virtue of any of their flora, fauna, geological, or physiographic features to represent the best national and regional example of natural habitat, physical landscape features or sites of importance for rare or protected species. National Nature Reserves (NNRs) and Marine Nature Reserves (MNRs) are designated under the Environment Order. Sites maintaining UK Red Data Book species that are listed as being either of unfavourable conservation status in Europe, of uncertain conservation status or of global conservation concern. Sites maintaining species listed in Schedules 1, 5 and 8 of The Wildlife (NI) Order 1985, as amended.
Regionally important sites (medium conservation value)	Sites that reach criteria for Local Nature Reserve but do not meet ASSI selection criteria. Sites of Local Importance for Nature Conservation (SLNCIs) are recognised by Planning Service and are intended to complement the network of nationally and regionally important sites. SLNCIs receive special consideration in relation to local planning issues. Sites supporting viable areas or populations of priority habitats/species identified in the UK Biodiversity Action Plan or smaller areas of such habitat that contribute to the maintenance of such habitat networks and /or species populations.

Value/Importance	Criteria
	Sites maintaining habitats or species identified in Regional Biodiversity Action Plans based on national rarity or local distribution. Other sites of significant biodiversity importance (e.g., sites relevant to Local Biodiversity Action Plans).
Local (lower conservation value)	Sites not in the above categories but with some biodiversity interest. Examples of lands of lower ecological value include; intensive agricultural lands and coniferous forestry.
Negligible conservation value	Sites with little or no local biodiversity interest.

Table 6.2: Factors to be considered when assessing magnitude of ecological impacts

Parameter	Description
Extent	The area over which an impact occurs.
Duration	The period required for a feature to recover or be replaced following an impact. Duration of an activity may have a shorter duration than the impact of the activity.
Reversibility	A permanent impact is one from which recovery is unlikely within a reasonable timescale. A temporary impact is reversible either through natural recovery or because of mitigation.
Timing and frequency	In some cases, an impact may only occur if it occurs during a critical season or part of a species' life cycle and may be avoided by careful scheduling of work activities. Frequency of an activity may also affect the magnitude of its impact by reinforcement of the impact.
	The period required for a feature to recover or be replaced following an impact. Duration of an activity may have a shorter duration than the impact of the activity.
	A permanent impact is one from which recovery is unlikely within a reasonable timescale. A temporary impact is reversible either through natural recovery or because of mitigation.

Table 6.3: Criteria for assessing magnitude of ecological impact

Significance	Description
Severe adverse	The development fails to satisfy the subject environmental objective and results in major fundamental deterioration of the environment at national and international levels of importance. Proposed development activities will result in a major alteration to the baseline ecological conditions, resulting in fundamental change and major environmental deterioration. Large adverse impacts are attributed to any significant adverse impact on habitat and species (or other valued ecological receptors) identified as being of international significance. Highly significant impact, warrants refusal of planning permission.
Major adverse	The proposal (either on its own or in-combination with other proposals) may adversely affect the site, in terms of coherence of its ecological structure and function, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest.
Moderate adverse	The site's integrity will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If it cannot be clearly illustrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as a major adverse.
Minor adverse	Neither of the above applies, but some minor adverse impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).

Significance	Description
Negligible	Very minor alteration to one or more characteristics, features or elements.
Neutral	No observable impact in either direction.

Table 6.4: Factors to be considered when assessing ecological significance of impacts

Factor	Defining criteria
Site integrity	Extent to which site/ecosystem processes will be removed or changed. Effect on the nature, extent, structure and function of component habitats. Effect on the average population size and viability of component species, size and viability of component species.
Conservation status	Habitats: conservation status is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area. Species conservation status is determined by the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area. Conservation status may be evaluated for any defined study area at any defined level of ecological value. The extent of the area used in the assessment will relate to the geographical level at which the feature is considered important.
Probability of expected outcome	Known or likely trends and variations in population size/habitat extent. Likely level of ecological resilience.

Table 6.5: Significance of impacts

Significance	Description
Severe adverse	The proposal (either on its own or with other proposals) is likely to adversely affect the integrity of a European or nationally designated site, in terms of coherence of its ecological structure and function, across its whole area, that enables it to sustain the population levels of species of interest, or is likely to adversely affect the numbers, distribution or viability of a species or population of conservation concern. A major change in a site or feature of local importance may also enter this category.
Major adverse	The integrity of a European or nationally designated site will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If, in the light of full information, it cannot be clearly illustrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as very large adverse.
Moderate adverse	The proposal may adversely affect the integrity of a locally important conservation site, or may have some adverse effect on the numbers, distribution or viability of a species or population of conservation concern.
Minor adverse	None of the above applies, but some minor negative impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Neutral	No observable impact in either direction.
Minor beneficial	The development partly satisfies the subject environmental objective and partly contributes to the environmental context. Proposed development activities will result in minor improvements to baseline ecological conditions and should result in minor environmental gains. Slight beneficial impacts can be attributed to benefits to any valued ecological receptors. Environmental gains which can easily be achieved through standard practices.

Significance	Description
Moderate beneficial	The development satisfies the subject environmental objective and contributes to the environmental context. Proposed development activities will result in recognisable improvements to baseline ecological conditions and will result in notable environmental gains. Moderate beneficial impacts can be attributed to benefits to any valued ecological receptors where improvements are expected to be significant. Environmental gains which require detailed design consideration – potentially employed to offset slight/moderate adverse impacts elsewhere.
Major beneficial	The development satisfies the subject environmental objective and results in a major contribution to the environmental context. Proposed development activities will result in quantifiable improvements to baseline ecological conditions and will result in significant environmental gains. Large beneficial impacts are only attributed to substantial benefits to valued ecological receptors identified as being of National or International importance and where such benefits will result in the consolidation and/or expansion of areas of habitats or ensure the security and/or expansion of viable populations of species. Environmental gains which require very detailed design consideration – potentially employed to eliminate and offset potential significant adverse impacts elsewhere.

6.99 Cumulative impacts may also arise. Other projects that have been included in the cumulative impact assessment are:

- Wind farm projects which have received planning consent; and
- Other development projects with valid planning permissions, and for which formal EIA is a requirement or for which non-statutory EIA has been undertaken. Other projects should be included as appropriate, subject to consultation with DAERA Planning and other statutory bodies. The cumulative impacts of different projects are assessed against the significance criteria outlined in **Table 6.6**.

Table 6.6: Criteria for assessing the significance of cumulative effects

Significance	Effects
Severe	Effects that the decision-maker must consider as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issue.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

Baseline Conditions

Consultation and Desk Study Results

6.100 The results of the desk study detail designated nature conservation sites and/or ecological records of protected species or species of natural heritage importance within 2 km of the Planning Application Boundary.

Plants of additional conservation interest

6.101 The food plant (devil's-bit scabious *Succisa pratensis)* of the marsh fritillary butterfly *Euphydryas aurinia* is present locally at a low density as an occasional component of the rush pasture on site. The insect is fully protected in Great Britain and Northern Ireland under the Bern Convention (Annexe II) and EC Habitats and Species Directive (Annex II). The Wildlife (Northern Ireland) Order 1985 Schedule 5 protects the species at all times and Schedule 7 makes it an offence to sell live or dead specimens.

6.102 No examples of bog myrtle *Myrica gale* (food plant for the larvae of the argent and sable moth *Rheumaptera hastata*, a UK priority species) were found on the site.

Site Overview

6.103 The site is situated across the extensive northern and north-eastern slopes of Mullaghcarbatagh Mountain and part of the north-western slope of adjacent Mullaghclogher Mountain in the north Sperrins; the peak of Mullaghcarbatagh (517 m) is situated to the immediate south of the blue line boundary and the peak of Mullaghclogher (572 m) is situated a short distance to the south-east of the blue line boundary. Adjacent slopes of the two mountains meet in a shallow valley created by the Glengarrow River which flows across part of the site to the north, where it merges with the Burn dennett River along the north-eastern part of the Preliminary Site Boundary (hereafter referred to as 'the Site').

6.104 The majority of the site consists of upland slopes which descend into improved and semi-improved agricultural fields along parts of the northern site boundary. The majority of the site consists of blanket mire of varying quality and condition which periodically grades into mosaics with rush pasture and acid grassland.

6.105 Although the majority of the site is located in an upland, it is sub-divided into a series of large 'fields' by barbed wire fencing. Some degree of agricultural improvement is evident even in the southern-most, higher parts of the site. Improved areas in the northern portion of the site often coincide with the localised presence of smaller field systems and their associated boundaries in close proximity to parts of the Carrickayne Road and along parts of the Burn dennett River.

6.106 Blanket mire habitat is found extensively across the site, forming frequent mosaics with wet heath, rush pasture and acid grassland which vary according to variations in peat depth, slope, aspect, local topography and a combination of both past and current grazing pressure. Grazing is dominantly by sheep, although cattle were also observed on lower ground in the northern part of the site, above Carrickayne Road. Grazing pressure differs markedly across the site according to vegetation type and elevation, with higher ground in the southern portion of the site being subjected to relatively low intensity grazing whereas lower-lying areas consisting of a greater proportion of rush-pasture and acid grassland within the habitat mosaics are often more heavily grazed, with a tight sward and associated poor species diversity.

6.107 Grazing pressure is one of the main factors impacting negatively on the favourable condition of areas of NI Priority Habitat within the site, with a reversion from more typical upland heath and mire communities to grass-dominated communities in those areas subjected to the most sustained high levels of grazing pressure.

6.108 Sloping ground across the site, but particularly at mid-elevation and lower elevation parts of the site, often supports expanses of marshy grassland consisting of species-poor rush-pastures where *Juncus effusus, Molinia caerulea* and/or *Holcus lanatus* are the dominant species *Juncus acutiflorus* can be abundant locally but not in its species-rich form, and is often present in a mosaic with other species-poor types of rush-pasture; The species-rich form of rush-pasture which conforms to the NI Priority Habitat purple moor-grass and rush pasture is not present within the development site.

6.109 Two small coniferous forestry blocks are present near the northern blue line boundary adjacent to the Carrickayne Road, each consisting of a monoculture of Sitka Spruce *Picea sitchensis*.

6.110 The following account will provide brief descriptions of the occurrence and distribution of Phase I habitat types, followed by a more detailed differentiation of habitats, based on NVC Phase II quadrat data, across the site as a whole. A further section describes the Phase II NVC survey of, specifically, proposed turbine locations.

Phase I Habitat Types

6.111 The broad habitat types differentiated by Phase I methodology are described below.

A1 Coniferous woodland

6.112 Two small blocks of coniferous forestry are present at the northern limit of the blue line boundary adjacent to Carrickayne Road, each consisting of planted rows of *Picea sitchensis*.

A3 Scattered trees

6.113 Scattered trees are located mainly in lowland parts of the site i.e., those areas with improved or semi-improved agricultural fields where scattered trees indicate the line of a former hedgerow which has since been removed. Occasional trees are also present in close proximity to occupied and derelict dwellings along the Carrickayne Road, along the banks of a small stream flowing between two branches of the Carrickayne Road, and along the steep banks of the Burn dennett River which forms part of the north-eastern blue line boundary. A small cluster of trees is also present a short distance to the south of Turbine T1.

B1 Acid grassland

6.114 Three main types of acid grassland are present within the application area. The most widespread type is dominated by *Deschampsia flexuosa* with lesser quantities of *Galium saxatile* and is typically found in areas of shallower peat, in a mosaic with other habitat types such as wet heath e.g. to the east of T3, mesotrophic grassland, rush pasture and, to a lesser extent, blanket mire.

6.115 The second type is dominated by *Festuca ovina* usually with variable quantities of *Juncus squarrosus* which is thinly spread across the site, usually on shallow peat, and usually in a mosaic with either mesotrophic grassland or wet heath e.g. to the south-east of T3.

6.116 The third type, dominated by *Anthoxanthum odoratum*, is thinly scattered across areas of shallow peat in a mosaic with mesotrophic grassland, rush-pasture or wet heath e.g., in a mosaic with wet heath a short distance to the south of T1.

B2 Neutral grassland

6.117 Neutral grassland within the application area is dominated by *Holcus lanatus*, usually in a mosaic with marshy grassland; an area of neutral grassland dominated by *Holcus* is present at and around T1. This habitat is rather species-poor, with the sward generally supporting either few forbs, bryophytes and/or graminoids other than *Holcus*, or having forbs, bryophytes and graminoids other than a few grass species entirely absent. Heavy grazing within such areas results in the sward becoming a dense lawn of a few hardy, fast-growing grass and forb species. Common associates include *Trifolium repens* and *Ranunculus repens*.

B4 Improved grassland

6.118 Within the application area, improved fields are largely restricted to along parts of the northern site boundary, in close proximity to the Carrickayne Road; a single improved field is also present to the immediate south of T10. These areas consist of closely-grazed fields which have been re-seeded and fertiliser applied to yield a rich green sward where *Lolium perenne* is dominant.

B5 Marshy grassland

6.119 Three main types of marshy grassland are present within the application area – those dominated by *Juncus acutiflorus*; those dominated by *Juncus effusus*; and those dominated by *Molinia caerulea*. All three types are often species-poor. Marshy grassland is most prevalent on parts of the north-western slope of Mullaghcarbatagh.

6.120 The type dominated by *Juncus acutiflorus* is found scattered thinly across the site in a mosaic with neutral grassland between T3 and T5; at and around T8; and around the margins of improved grassland a short distance to the south of T10. It also occurs in a mosaic with the type dominated by *Juncus effusus* on sloping ground along the banks of the Glengarrow River e.g. between T8 and T9. The sward dominated by *J. acutiflorus* is the species-poor variant of M23a.

6.121 Species-poor marshy grassland dominated by *Juncus effusus* is scattered across the site, usually in linear or fan-shaped swathes on sloping ground such as between T1 and T2; to the immediate west of T3; and to the immediate south of T9. It also occurs in a mosaic with neutral grassland a short distance to the north-west of T5; in a mosaic with the type dominated by *Juncus acutiflorus* on sloping ground along the banks of the Glengarrow River e.g., between T8 and T9; and in a mosaic with improved grassland along parts of the northern site boundary e.g. along parts of the Carrickayne Road.

6.122 Species-poor marshy grassland dominated by *Molinia caerulea* is present within a small area of cut-over mire close to the site entrance along Carrickayne Road. This habitat also occurs intermittently in a mosaic with wet modified bog over sloping ground on the north-west and south-east facing slopes of Mullaghcarbatagh e.g., at and around T1 and T3; and in a mosaic with wet heath e.g. to the west of T4 and to the west of T11.

D1 Dry dwarf shrub heath

6.123 Localised areas of this habitat, typified by co-dominance of *Calluna vulgaris* and *Vaccinium myrtillus*, are present near the summit of Mullaghcarbatagh e.g. between T4 and T5, and at T6. A small area of similar habitat where *Sphagnum capillifolium* is abundant within the sward is present at the infrastructure junction between T10 and T11.

D2 Wet dwarf shrub heath

6.124 This habitat is present primarily at and around the summit of Mullaghcarbatagh, between and around T4, T5 and T6; in scattered patches between and around T8, T9, T10 and T11 and, to a much lesser extent, its north-western slope e.g. a narrow band between T1 and T2. The presence of this habitat represents areas of peat which are not sufficiently deep to support wet modified bog, but which may support vegetation which mirrors that which is typical of wet modified bog e.g., dominated by *Calluna vulgaris* and/or *Eriophorum vaginatum*.

6.125 Wet dwarf shrub heath is also present in a mosaic with marshy grassland to the east of T3; to the west and south-west of T4; and at T11 and in a broad expanse to its west and south-west. A mosaic with acid grassland is also present as several narrow bands to the east and south-east of T3, where a complex mosaic with both wet modified bog and acid grassland is also present.

E1.7 Wet modified bog

6.126 This habitat is present as extensive parcels across the site, particularly the eastern half of the site which encompasses the north-eastern slope of Mullaghcarbatagh and part of the north-western slope of Mullaghclogher were occasional variations in peat depth result in the formation of a mosaic between wet heath and wet modified bog, the latter being greater in overall extent. Notably, peat depth decreases with increasing altitude within the valley of the Glengarrow River so that wet heath is associated with the summits of Mullaghcarbatagh and Mullaghclogher, whereas wet modified bog dominates on the lower valley slopes.

6.127 Wet modified bog is less extensive on the north-western slope of Mullaghcarbatagh owing to greater influence of grazing and a previous fire event in this area; it is the prevalent habitat type only along the western site boundary between T4 northwards to the site entrance at Carrickayne Road, where it enters into a mosaic with marshy grassland at and around T1. To the east, the same north-western slope is marked by the presence of habitat mosaics which include a mosaic with marshy grassland at and to the north of T3; and a mosaic with wet heath and acid grassland to the south-east of T3.

6.128 Sward composition is dominated by *Calluna vulgaris* and/or *Eriophorum vaginatum* with common associates including *Eriophorum angustifolium*, *Erica tetralix*, *Narthecium ossifragum*, *Vaccinium myrtillus* and the bryophytes *Sphagnum capillifolium*, *Hypnum jutlandicum*, *Rhytidiadelphis squarrosus*, *R. loreus*, and *Hylocomium splendens*.

E1.8 Dry modified bog

6.129 This habitat type, marked by an absence of peat-forming *Sphagna* within the sward and the concurrent dominance of *Calluna vulgaris* and/or *Eriophorum vaginatum* within the sward, which in combination strongly indicate a drying-out of surface peat layers due to the effects of artificial drainage channels, overgrazing and/or previous fire events.

6.130 Pockets of dry modified bog are present to the east of T5; as narrow west-east oriented bands to the north of T7; and to the north-west and south-west of T9.

G2 Running water

6.131 A number of small upland streams traverse the site including three which flow across the section of proposed access track between the Carrickayne Road and T1, all in a north-easterly direction. Another upland stream is present to the east of T2, flowing northwards.

6.132 The Glengarrow River, in the valley between the adjoining slopes of Mullaghcarbatagh and Mullaghclogher, flows northwards and crosses the proposed infrastructure route to the east of T9 which leads to a bifurcating spur allowing access to T10 and T11. This river then flows into the Burn dennett River a short distance to the north, which delineates the north-eastern blue line boundary.

6.133 The larger watercourses (the Glengarrow and Burn dennett rivers) each have a relatively shallow channel overall, with localised deep pools. The channel is typically shallow and rocky in the upper reaches but mud-based and deeper, to 1.5m depth, in lower-lying areas.

6.134 Numerous other, more minor streams and drainage ditches are present across the site, often flowing into one of the above-mentioned larger streams.

Phase II NVC Habitat Surveys

6.135 The NVC communities identified during the survey are listed below:

- H12 *Calluna vulgaris-Vaccinium myrtillus* heath;
- H21 *Calluna vulgaris-Vaccinium myrtillus-Sphagnum capillifolium* heath;
- M17 *Scirpus cespitosus-Eriophorum vaginatum* blanket mire;

- M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire;
- M20 *Eriophorum vaginatum* blanket and raised mire;
- M23a *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus effusus* sub-community;
- M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus acutiflorus* sub-community;
- M25 *Molinia caerulea-Potentilla erecta* mire;
- MG7 *Lolium perenne* leys and associated grasslands;
- MG10 *Holcus lanatus-Juncus effusus* rush-pasture;
- U2 *Deschampsia flexuosa* grassland; and
- U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland;

6.136 More detailed descriptions of the habitats can be found in **Appendix 6.1: Ecology Annexes.** The proposed route and associated turbine locations has been sub-divided into a series of eight Compartments to enable better understanding of the distributions of various habitat types along the infrastructure route as well as at each turbine location (as detailed in **Figure 6.3**).

Designated Nature Conservation Sites

Internationally Designated Nature Conservation Sites

6.137 Four Special Areas of Conservations (SACs) are situated within 15 km of the centre of the Site:

UK0030233: Owenkillew River SAC

6.138 This site has been designated for its physical diversity and the naturalness of the bank and channel of the Owenkillew River, including the richness and naturalness of its plant and animal communities. Beds of stream water-crowfoot *Ranunculus pencillatus* ssp. *pencillatus* occur throughout its middle and lower levels, typically in association with intermediate water-starwort *Callitriche hamulata* and large-leaved pondweeds such as broad-leaved pondweed *Potamogeton natans* and shining pondweed *P. lucens*.

6.139 This site is also designated for its several woodlands which, in combination, represent one of the best examples of old sessile oakwood in Northern Ireland. These woodlands contain a number of associated physical features including waterfalls, gorges, cliffs and scattered boulder scree which contribute to the diversity of the woodland communities. The woodland canopy is generally dominated by sessile oak *Quercus petraea* with frequent downy birch *Betula pubescens*. The shrub layer consists of rowan *Sorbus aucuparia* and holly *Ilex aquifolium*, with hazel *Corylus avellana* locally frequent and occasional goat willow *Salix capraea*. The ground flora is dominated in places by grasses including wavy hair-grass *Deschampsia flexuosa*, calcifuge mosses such as *Rhytidiadelphis loreus*, bilberry *Vaccinium myrtillus*, great wood-rush *Luzula sylvatica* and bluebell *Hyacinthoides non-scripta*.

6.140 Owenkillew River SAC is situated 7.8 km to the south-west of the Site.

6.141 Annex I habitats for which the site has been designated are:

- 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; and
- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles.

6.142 Annex I habitat that is present as a qualifying feature but is not a primary reason for designation:

- 91D0 Bog woodland.

6.143 Annex II species that is a primary reason for designation:

- 1029 Freshwater pearl mussel *Margaritifera margaritifera*.

6.144 Annex II species that is present as a qualifying feature but is not a primary reason for designation:

- 1106 Atlantic salmon *Salmo salar*; and
- 1355 Otter *Lutra lutra*.

UK0030320: River Foyle and Tributaries SAC

6.145 This site has been designated for its physical diversity and the naturalness of the riverbank and channel, including the richness and naturalness of its plant and animal communities. Beds of stream water-crowfoot *Ranunculus pencillatus* ssp. *pencillatus* occur throughout the lower levels, typically in association with pondweeds *Potamogeton* spp., water-milfoils *Myriophyllum* spp. and water-starworts *Callitriche* spp.

6.146 The River Foyle and Tributaries SAC is situated 13.3 km to the south-west of the Site.

6.147 The Annex I habitat for which the site has been designated is:

- 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation.

6.148 Annex II species that is a primary reason for designation:

- 1106 Atlantic salmon *Salmo salar*. The river has the largest population of Atlantic salmon in Northern Ireland.

6.149 Annex II species which is present as a qualifying feature but is not a primary reason for designation:

- 1355 Otter *Lutra lutra*.

UK0030361: River Faughan and Tributaries SAC

6.150 This site has been designated on account of supporting an internationally important population of Atlantic salmon *Salmo salar*. The river and its tributaries are also notable for the physical diversity and naturalness of their banks and channels, particularly in the upper reaches, and the richness and diversity of its plant and animal communities; these include several areas of old oak woodland along the riverbanks.

6.151 The River Faughan and Tributaries SAC is situated 3.3km to the north-north-east of the Site.

6.152 The Annex I habitats which is present as a qualifying feature but is not a primary reason for designation is:

- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles.

6.153 Annex II species that is a primary reason for designation:

- 1106 Atlantic salmon *Salmo salar*.

6.154 Annex II species that is present as a qualifying feature but is not a primary reason for designation:

- 1355 Otter *Lutra lutra*.

UK0030360: River Roe and Tributaries SAC

6.155 This site has been designated on account of supporting an internationally important population of Atlantic salmon *Salmo salar*. The river and its tributaries are also notable for the physical diversity and naturalness of their banks and channels, particularly in the upper reaches, and the richness and diversity of its plant and animal communities; these include submerged plant communities and several areas of upland oak woodland along the riverbanks.

6.156 The River Roe and Tributaries SAC is situated 10.9 km to the north-east of the Site.

6.157 Annex I habitats which are present as a qualifying feature but are not a primary reason for designation include:

- 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; and
- 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles.

6.158 Annex II species that is a primary reason for designation:

- 1106 Atlantic salmon *Salmo salar*.

6.159 Annex II species which is present as a qualifying feature but is not a primary reason for designation:

- 1355 Otter *Lutra lutra*.

Nationally Designated Nature Conservation Sites

6.160 There are two Areas of Special Scientific Interest (ASSIs) is situated within 7.5 km of the Site:

ASSI296: River Faughan and Tributaries

6.161 The River Faughan and its tributaries have been designated on account of their physical features and associated flora and fauna; the latter include Atlantic salmon *Salmo salar* which is present in internationally important numbers, Dipper *Cinclus cinclus*, Kingfisher *Alcedo atthis* and Otter *Lutra lutra*. The site also supports blocks of sessile oakwood. It is situated 3.3 km to the north-north-east of the Site.

ASSI195: Silverbrook Wood

6.162 The wood is designated for its woodland flora and fauna. Despite its moderate extent, Silverbrook Wood includes a number of woodland plant communities, ranging from strongly acidic to flushed and base-rich. As a result of this variation, the area has one of the richest woodland plant assemblages in Northern Ireland and supports a number of notable woodland plants and animals.

6.163 There are a further three ASSIs within the study area which are designated for their earth science interests rather that for nature conservation and therefore, these are not considered further.

Local Wildlife Sites

6.164 The NIEA Natural Environment Map Viewer (which maps Local Wildlife Sites, which are equivalent in conservation interest to SLNCIs) was reviewed and found a single site within 500 m of the scheme red line:

- Mullaghcarbatagh Local Wildlife Site – designated on account of supporting blanket bog habitat, this encompasses part of the Site and lands to the immediate north-east and south-west.

Biodiversity Action Plan (BAP) Habitat Action Plan habitats

6.165 NIEA requires reference to be made to any potential impacts of the scheme on habitats that are the subject of Northern Ireland Habitat Action Plans (HAPs). There are significant areas of blanket bog and heath habitats within the site Red Line, but these are mostly outside that part of the site that will be affected by construction or operation of the proposed wind farm.

Blanket bog

6.166 Blanket bog habitats are distributed patchily across the site and are often present in mosaics with marshy grassland, wet heath and acid grassland. Blanket bog within such habitat mosaics is unlikely to support active peat as indicator species such as *Sphagnum capillifolium, S. papillosum, Eriophorum angustifolium* and *E. vaginatum* are rather scattered and patchy in their occurrence within such mosaics.

6.167 Turbines T2, T5, T7 and T10 are situated on blanket bog, which is potentially active, meaning that the abovementioned indicator species are present however adverse habitat management such as over-grazing, previous fire events and/or the cutting of artificial drainage ditches have affected the composition of the vegetation present and/or ability of the peat to retain water.

6.168 T1 and T3 are both situated within mosaics of wet modified bog and marshy grassland.

Purple moor-grass and rush pastures

6.169 Although *Molinia* is an occasional constituent of the sward within many areas of blanket bog and upland heath because of a previous fire event, it becomes dominant only within a small area near the proposed site entrance at Carrickayne Road, in an area of former cutover bog. No examples of the *Molinia* rush-pasture NVC community M24, which falls within the remit of this NI Priority Habitat, are present within the Preliminary Site Boundary.

6.170 *Juncus* rushes are a frequent feature across the site in areas of flushed peat, but do not form pure stands of the species-rich NVC sub-community M23a which falls within the remit of this NI Priority Habitat. Examples of M23a in a mosaic with MG10 rush-pasture are present mid-way between the proposed locations of T3 and T7; at and around T9; and a short distance to the south of T12. Examples of M23a in a mosaic with the species-poor NVC sub-community M23b occur a short distance to the north-east of the proposed location of T1; a short distance to the south-west of T7; and a short distance to the south of T10.

Rivers

6.171 Rivers and minor streams that drain parts of the site such as the Glengarrow River and Burn dennett River are examples of the NI priority habitat Rivers, as they represent headwaters which feed into the River Foyle and Tributaries SAC and ASSI. The rivers and streams on the site have a natural aspect but, because of their youthful stage do not support significant vegetation communities. Further information on the rivers and streams on the site can be found in **Chapter 10: Geology and Water Environment**.

Upland Heathland

6.172 Examples of H12 which fall within the umbrella of this NI Priority Habitat are present a short distance to the north-east of T4 and also at and around the proposed location of T6. A small band of vegetation conforming to the NVC community H21 is present near the eastern site boundary, at and around the junction between T10 and T11.

Existing Ecological Records (NIPS)

6.173 The desk study found historical records of a number of Northern Ireland Priority Species (NIPS), BAP, and/or Red-or Amber-listed species of conservation concern (as defined by CEDaR). Plant species are listed below and those relating to animal taxa are detailed within **Chapter 7**.

Plants

6.174 There are three records of Stiff Sedge Carex *bigelowii* on the CEDaR database from Mullaghclogher Mountain, the most recent of which is from 2005. This species is listed within Schedule 8 of the Wildlife (NI) Order 1985 (as amended) and is a NI Priority Species. Two records of Dwarf Willow *Salix herbacea* also exist for Mullaghclogher Mountain, the most recent being from 2005; this is also a NI Priority Species.

Assessment of Impacts

General

6.175 Having defined the ecological baseline characteristics of the study area, it is necessary to describe the potential resultant scheme-related changes to the baseline and to assess the impact on valued ecological resources (CIEEM 2018)[3]. The process of identifying impacts refers to aspects of ecological structure and function on which a resource feature depends. Examples of aspects of ecological structure and function to consider when predicting impacts include (CIEEM 2018):

- Available resources (Territory: hunting/foraging grounds; shelter and roost sites; breeding sites; corridors for migration and dispersal; stop-over sites);
- Stochastic processes (Flooding, drought, wind blow and storm damage, disease, eutrophication, erosion, deposition and other geomorphological processes, fire and climate change);
- Ecological processes (Population dynamics: population cycles; survival rates and strategies; reproduction rates and strategies; competition; predation; seasonal behaviour; dispersal and genetic exchange; elimination of wastes. Vegetation dynamics: colonisation; succession; competition; and nutrient-cycling);
- Human influences (Animal husbandry, cutting, burning, mowing, draining, irrigation, culling, hunting, excavations, maintenance dredging, earth shaping, ploughing, seeding, planting, cropping, fertilising, pollution and contamination, use of pesticides and herbicides, introduction of exotics, weeds and genetically modified organisms and disturbance from public access and recreation, pets and transport);
- Ecological relationships (Food webs, predator-prey relationships, herbivore-plant relationships, herbivore-carnivore relationships, adaptation and dynamism);
- Ecosystem properties (Fragility and stability, carrying capacity and limiting factors, productivity, community dynamics; connectivity; source/sink; numbers in a population or meta-population, minimum viable populations; sex and age ratios; patchiness and degree of fragmentation);
- Ecological role or function (decomposer, primary producer, herbivore, parasite, predator, keystone species).

6.176 Impacts on ecosystem structure and function are assessed by reference to the following parameters:

- Positive or negative impacts, with international, national and local policies increasingly pressing for projects to deliver positive biodiversity outcomes
- Magnitude, or size of an impact, which in the case of habitat may be coincident with extent
- Extent over which an impact is felt
- Duration of time over which the impact is expected to last prior to recovery or replacement of the resource or feature
- Reversibility, or whether an impact is permanent or temporary

[3] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2 (updated April 2022). Chartered Institute of Ecology and Environmental Management, Winchester.

- Timing and frequency of an activity, which may have different impacts depending on, for example, the season during which it is carried out.

6.177 EIA legislation requires the enumeration of significant negative or positive impacts of an activity on ecological features. An ecologically significant impact is here defined as an impact on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area (CIEEM 2018). The significance of an impact depends on the importance of a receptor as defined in **Table 6.1** and on the magnitude of the impact on that receptor as defined in **Table 6.2**. Receptor impacts may be averaged against each other to assess the significance of the impact of the scheme on the site's natural environment, but in some cases a single receptor, for example an internationally important species or habitat, may be of sufficiently critical importance that the magnitude of impact on that single receptor defines the significance of the impact on the site. The following narrative assesses the significance of the impact of the Development.

Construction Phase

6.178 Activities that may be associated with construction of the Development and that may generate impacts on the natural environment near the proposed scheme include:

- Disturbance of designation features/designated sites;
- Disturbance to protected species;
- Construction of hard surfaces for access roads, turbine bases and construction platforms;
- Construction on new ground, leading to habitat and population constriction and/or fragmentation;
- Storage of materials and plant, and construction of site compounds;
- Environmental incidents and accidents (e.g., spillages, noise and emissions;
- Excavation works;
- Removal and redistribution of topsoil and subsoil;
- Provision of temporary access routes;
- Disruption or modification of drainage;
- Vegetation clearance; and
- Implementation of landscape design and habitat management.

6.179 The significance of the potential effects of the proposed scheme on valued ecological receptors during the construction phase has been assessed and outlined in the following sections.

Permanent loss of habitats due to land-take

6.180 The footprint of wind farm infrastructure will involve permanent land-take, due to construction of around 9.84ha, consisting of new access track (including turning heads), the substation and control building, 11 crane pads and turbine bases (see **Chapter 1: Introduction & Proposed Development**).

6.181 The design of the wind farm layout has evolved in part by taking into account the location of NI Priority Habitats and the NIEA, Natural Heritage, Development Management Team Advice Note – Active Peatland and PPS18.

6.182 The location of all 11 turbines, and the route of the access tracks have been chosen, as far as is possible, to minimise impacts to habitats of conservation significance.

6.183 There is likely to be a limited effect on active blanket bog. Turbines T2, T5, T7, T9, T10 and T11 are situated on blanket bog, which is potentially active, meaning that the abovementioned indicator species are present however adverse habitat management such as over-grazing, previous fire events and/or the cutting of artificial drainage ditches have affected the composition of the vegetation present and/or ability of the peat to retain water.

6.184 **Table 6.11** lists the NVC communities and habitat condition at each turbine location.

Table 6.11: NVC community and habitat condition at each turbine location

Turbine	NVC	Habitat condition
T1	Wet Heath	Vegetation resembling that of M19 blanket mire within which *Calluna vulgaris* and *Eriophorum vaginatum* are co-dominant, but occur on shallow peat (circa 15cm).
	MG10	Extensive area of species-poor rush-pasture dominated by *Holcus lanatus* and *Juncus effusus*, indicating some agricultural improvement.
T2	M19	Extensive area of blanket mire which has been subjected to artificial drainage and a previous fire event, the latter resulting in the presence of an even age-class of *Calluna vulgaris*. *Sphagnum capillifolium* cover is high but peat is not active at this location.
T3	M23a Acid Grassland Mosaic	The dominant habitat type at the location of T3, present in a mosaic with MG10 and M25 owing to varied topography and former heavy grazing pressure.
	M19 U2 Mosaic	Blanket mire is present in a mosaic with U2, the latter comprising *c*.15% of the sward.
T4	M20 H12 Mosaic	Peat depth variable at this location (from *c*.30cm to >1m) , with M20 on deeper peat and H12 on areas of shallow peat. Emergent boulders present within H12.
T5	M19	Extensive area of blanket mire with its north-western margin traversing the turbine location. Grazing pressure low, therefore sward dense.
	Wet Heath	M19 transitions into wet heath to the north-west of the turbine location due to decreasing peat depth; visually contiguous with M19 as *Calluna vulgaris* and *Eriophorum vaginatum* still co-dominant within sward.
	M20 Wet Heath Mosaic	Wet heath grades into M20 to the south-west where *Eriophorum vaginatum* occurs at greater frequency within the sward presumably due to a localised increase in sheep grazing pressure and an increase in peat depth.
T6	H12	Higher ground at this turbine location supports very thin peat where *Calluna vulgaris* and *Vaccinium myrtillus* are co-dominant. The dominance of *V. myrtillus* decreases with altitude to the north-west.
	Wet heath	To the north-west of the turbine location a slight increase in peat depth and decrease in altitude result in *Calluna vulgaris* and *Eriophorum vaginatum* becoming co-dominant, the sward resembling M19 on shallow peat.
T7	M19	An extensive swathe of M19 reaches its southern limit at this location, being traversed by relatively few artificial drainage channels.
	M23b/M20 Mosaic	M19 mire to the north transitions into a mosaic of species-poor rush-pasture and M20 blanket mire with increasing altitude.
T8	M19	An extensive swathe of blanket mire extends into the western portion of the turbine location and forms a relatively minor component of the turbine footprint.
	M23a	A band of the species-poor variant of M23a traverses this location from north-east to south-west.
	M23a MG10 Mosaic	This open and species-poor sward is subjected to moderate levels of grazing by sheep. Some previous nutrient enrichment likely.

T9	M19	An extensive area of species-poor blanket mire encompasses this turbine location; grazing pressure is low resulting in a relatively tall sward where only a single forb is present.
T10	H21 M20 Mosaic	Variable peat depths result in a mosaic of M20 blanket mire and H21 heath which is subjected to moderate to heavy grazing pressure.
	M23a MG10 Mosaic	A field at the southern edge of the turbine location supports a species-poor mosaic which likely indicates previous nutrient enrichment.
	M19	Deeper peat (>1m) at the eastern portion of the turbine location creates a transition from H21/M20 into blanket mire where *Calluna vulgaris* and *Eriophorum vaginatum* are co-dominant.
	Wet Heath	Vegetation resembling M19 blanket mire on shallow peat (c.25cm) where *Calluna vulgaris* and *Eriophorum vaginatum* are co-dominant, present at the northern end of the turbine location.
T11	M20	In complex mosaic with M19 blanket mire, with M20 representing areas of higher grazing pressure from sheep.
	M19	In complex mosaic with M20 blanket mire, with M19 representing areas of reduced grazing pressure. Peat-forming Sphagna scarce to absent, therefore peat assessed as being inactive.
	M23b	A band of species-poor rush-pasture sward traverses the end of track infrastructure associated with T11.

6.185 The site at Mullaghclogher is a complicated mosaic of habitats due to topography, drainage and grazing. Therefore, estimating the exact loss of habitat types and hence the overall loss of NI Priority Habitat has been estimated in the table below. These mosaics either represent a NI Priority Habitat or contain substantial areas of these habitats. They have been included as a precautionary basis even when in a mosaic with species poor habitats of lower conservation value.

Table 6.12: Habitat loss calculations by habitat type (M^2)[4]

Habitat Type	Total Permanent Loss (m^2)	Total Temporary Loss (m^2)
H12 Heath	5916	373
H21 Heath	1031	0
H21 M20 Mosaic	2152	191
M19 Blanket Mire	38125	4669
M19 M20 Mosaic	1048	0
M19 M25 Mosaic	768	0
M19 U2 Mosaic	546	0
M20 Blanket Mire	9022	735
M20 H12 Mosaic	3123	792
M20 M23a M23b Mosaic	1185	0
M20 M25 Mosaic	4100	2239
M20 Unclassified Acid Grassland Mosaic	968	0
M20 Unclassified Wet Heath Mosaic	1955	15
M23a	2016	294
M23a Acid Grassland Mosaic	3345	868
M23a M23b Mosaic	1631	0
M23a MG10 Mosaic	3195	434

[4] Calculated using a continuous 0.5m buffer around all construction structures and an 5m wide track (5m for running surface and 0.5m either side for shoulders/drainage.

M23b	487	84
M23b MG10 Mosaic	5002	1958
M25	481	0
MG10	6204	641
MG7	607	470
Unclassified Wet Heath	4482	1781
Unclassified Wet Heath U4 Mosaic	671	0
Wet Heath U2 Mosaic	368	0
Total	**98429**	**15545**

6.186 The loss of approximately 9.84 ha of degraded blanket bog, wet heath/heathy acid grassland and PMGRP habitats is a permanent and direct effect of medium to high magnitude on receptors of high value and sensitivity. The loss of these NI priority habitats is assessed to be an adverse effect of **moderate magnitude** on receptors of high value. Since land take (and hence habitat loss) will be long term, this means that the effect is of **moderate adverse significance** and further mitigation is required.

6.187 In addition, there will be a temporary loss of 1.55ha due to the need for spoil storage during construction. However, these areas will be restored to their original levels post-construction and impacts should be only minor adverse, of limited duration and reversibility.

Operational Phase

6.188 Characteristics of wind farms that may generate impacts on the natural environment in the vicinity of the proposed scheme include:

- Replacement of former semi-natural habitats by turbines and associated infrastructure;
- Use of a swept volume of air space by turbine rotors;
- Vehicular use of access routes; and
- Improved access to remote sites.

6.189 Many of the impacts on biological receptors noted for the construction phase are also relevant during the operational phase. However, effective land take is reduced following the construction phase, as temporary site compounds and vehicle and plant running surfaces are returned to their former vegetation cover, and disturbance pressures arising from human presence along the route are significantly reduced. However, some changes are likely to be long term; as restoration of vegetation cover is not always a simple case of removing the construction materials/structures.

6.190 Impacts on valued ecological receptors are outlined below.

Habitats

6.191 No adverse effects on vegetation communities and habitats are anticipated during the operation of the Development. Significant positive effects, through habitat restoration and enhancement, i.e., the reinstatement of heathland and blanket bog are anticipated through implementation of the outline HMP (Habitat Management Plan) in **Appendix 6.2.**

Decommissioning Phase

6.192 Impacts associated with decommissioning a wind farm bear many similarities to those arising during construction. Many of the work processes are similar and plant and vehicle movements are likely to be at a similar scale. It is assumed that decommissioning will require the removal of all above ground structures; the removal of all underground structures to one metre below ground level; and reinstatement of disturbed areas.

Habitats

6.193 Two types of activities have the potential to disrupt and damage vegetation communities and peatland habitats during decommissioning. These are:

- Removal of above-ground infrastructure; and
- Laydown of waste demolition materials or spillages or leaks of fuels from decommissioning plant.

6.194 The types of decommissioning effects are as follows:

- Disruption/damage to peatland vegetation, compaction/rutting of the peat surface and disruption of peat hydrology that supports peatland (especially blanket bog) vegetation
- Contamination of the peat surface and peatland vegetation with demolition waste materials or spilled/leaked fuels.

Table 6.14: Significant Effects upon Valued Ecological Receptors (Prior to Mitigation)

Impact	Nature of Effect	Magnitude	Significance
Construction			
Designated Sites	Statutory sites: River Faughan & Tributaries SAC/ASSI; Owenkillew River SAC/ASSI. There is potential for works to have effects on the designated sites as the proposed works are within the upper reaches of the river catchments of both ASSI/SAC's.	Moderate	Moderate Adverse
Watercourses	Access tracks will cross a number of unnamed minor streams; there is a potential for ingress of silt and construction materials into streams at crossing points.	Moderate	Moderate Adverse
Loss of NI Priority Habitats	Degraded blanket bog/Wet heath/PMGRP Land-take associated with construction of access tracks and turbines and associated infrastructure.	Moderate	Moderate Adverse
Operational			
Designated Sites / Watercourses	Statutory sites:	Neutral	Neutral

Impact	Nature of Effect	Magnitude	Significance
	Water pollution or increased sediment loading are extremely unlikely during the operational phase		
NI Priority Habitats	Habitat restoration and enhancement to be conducted in accordance with methods defined in the outline HMP	Neutral	Neutral
Decommissioning			
Designated Sites / Watercourses	Statutory sites: River Faughan & Tributaries SAC/ASSI; Owenkillew River SAC/ASSI. There is potential for waterborne pollution and increased sediment loading during the decommissioning phase in the absence of mitigation	Moderate	Moderate Adverse
NI Priority Habitats	Removal of turbines and associated infrastructure will permit reinstatement of impacted areas of this habitat types.	Moderate	Moderate Adverse

Design Evolution & Mitigation

6.195 The purpose of what is broadly classed as mitigation is to maintain the conservation value of a development site as far as is possible, and to exploit opportunities to enhance the site's conservation value wherever possible. This can be achieved by (CIEEM 2018):

- avoiding negative ecological impacts - especially those that could be significant;
- reducing negative impacts that cannot be avoided; and
- compensating for any remaining significant negative ecological impacts.

6.196 The aims of mitigation can be best achieved by choosing locations that allow sites or features of conservation value to be avoided; **Chapter 3: Design Evolution & Alternatives** provides a full description of the design evolution process which includes details on avoidance measures.

6.197 The Red Line boundary of lands available to the developer encloses an area of approximately 118ha. The development site comprises numerous enclosed 'fields', while the access road to the public road network crosses a small wooded embankment. A number of fields support pockets of both 'species-poor' and 'species-rich' variants of rush pasture. Lands within the Red Line, but outside the development site, support extensive areas of wet/dry heath and blanket bog, as well as a number of smaller features of conservation interest such as streams and flushes. The present scheme therefore avoids using those areas that support the most extensive and most intact areas of habitat of conservation value.

6.198 Avoidance and impact reduction techniques relate to reducing the footprint of the development and any ancillary works as far as is practicable. Measures required to address ecological concerns described in this ES during the construction phase will be implemented by an Ecological Clerk of Works (ECoW) as detailed in the outline Construction Environmental Management Plan (oCEMP) in **Technical Appendix 1.5** and will be incorporated within a Construction & Method Statement (CDMS), which will be submitted to and agreed with the Department at the pre-construction stage. Avoidance and impact reduction measures include:

- No turbine rotors are within 50m from the edge flight-lines such as streams and shelterbelts), which is the minimum stand-off distance from blade tip to the nearest habitat feature likely to be used by bats, (Natural England 2014).
- Consideration will be given to the provenance of fill materials for roads, in terms of the similarity of their physicochemical properties (particularly pH) to the present substrate.
- The contractor will prepare a CEMP and a construction method statement (CMS) prior to construction activities, to provide a method statement for working practices that will include measures, among others, to prevent adverse impacts on rivers and other watercourses. Please also refer to the SUDS design Statement in Appendix 9.1 Surface Water Management Plan.
- A “no access” buffer will be implemented along sensitive watercourses to prevent damage to banks and to prevent disturbance of riparian habitats, apart from the narrow corridor required during construction.
- Access of all machinery and personnel will be limited to the working area corridor.
- Site compounds and stores will be sited away from any features of conservation interest, including watercourses. Any of these features in close proximity to the works or to compounds will be fenced to prevent damage by plant or stored materials.
- Dust suppression filters and appropriate wetting of running and work surfaces will be used to prevent masking of vegetation outside construction corridors, where appropriate.
- Appropriate speed limits will be imposed to reduce the potential for dust production.
- Excavations left unattended overnight should be ramped in at least one location to allow mammals to avoid becoming trapped.
- It is also recommended that, to minimise the risk of suspended sediment entrainment in surface water run-off, the site drainage system should only be carried out during periods of low rainfall and therefore minimum run-off rates.

6.199 Of particular importance for the maintenance of habitats and associated fauna is the institution of good management practices that prevent the discharge of silt and pollutants into the local drainage system. Containment measures will include:

- Where works near or in watercourses are unavoidable, working practices will include standard methods designed to minimise sedimentation and pollution, and measures will be put in place before the works begin to ensure containment of any released sediments. These may include silt containment booms or sediment barriers, as appropriate. Land stripping will be done in stages to minimise the potential for concentrated, long-lasting pulses of silt to discharge into watercourses. All filtration systems will be monitored frequently, and they will be replaced before they become ineffective.
- Material storage compounds will be located remote from any watercourse. Surface water run-off high in suspended solids should be contained and treated prior to discharge to any watercourse. All storage tanks should be bunded and should be sited remotely from any watercourse. Works should incorporate the relevant

Pollution Prevention Guidelines. Additionally, a Pollution Incident Response Plan should be put in place as part of the Construction Management Plan.

- Water should be pumped from turbine bases during construction either to areas of ground capable of absorbing the water or to settlement ponds prior to discharge. Any discharged water must be free of cementitious products.
- All tracks and drains will be maintained and monitored to ensure that surface water flow is directed as designed, and that ponding and blockages are prevented.

6.200 Avoiding or mitigating impacts arising from construction-initiated alterations of drainage patterns and infiltration regimes is of importance for preventing damage to both aquatic and terrestrial habitats. It must be appreciated that hydrological characteristics of peatland and the habitats that they support are inextricably linked, and that changes in hydrological regime will lead to changes in these habitats. The areas of blanket bog have been avoided by sensitive siting during the design process. The site hydrological regime is considered in detail in **Chapter 10: Geology & the Water Environment** and measures outlined there will be carried out in order to maintain the limited areas of conservation interest on the Site.

6.201 Sympathetic management of the wind farm habitats during the operational phase will provide the greatest opportunity for enhancing the conservation value of the Site and should be regarded as compensatory mitigation for the permanent land take required for the new turbines and infrastructure.

6.202 The landowner will incorporate compensation and enhancement into the habitat management plan for the site. This will include the restriction of grazing the habitat management area (shown in **Figure 6.5**) for the lifetime of the Development

Habitat Specific Mitigation

6.203 Mitigation measures are required during both the construction and decommissioning phases of the Development. These consist of both generic, standard, good construction working practices and controls described in the CMS, together with site specific and activity specific measures. Only the latter, the specific mitigation measures, are described here.

6.204 Adverse effects during the construction phase that were assessed to be potentially significant and require mitigation are:

- Land take (9.84ha), resulting in loss of degraded blanket bog/wet heath/PMGRP/ash woodland (the former, despite being degraded are still considered to be an NI priority habitats).
- Excavation of turbine bases and cable trenches, potentially severing hydrological routing and causing dewatering of areas of soils.

6.205 The prime mitigation to reduce to an absolute minimum any disturbance or damage to vegetation, over and above the strict controls provided in the CMS, is habitat restoration and enhancement and vigorous supervision by the ECoW of all activities and at all stages of the Development.

6.206 Habitat restoration and enhancement is described in the Outline Habitat Management Plan (OHMP) in **Appendix 6.2** to provide compensation for the loss of areas of PMGRP/wet heath/degraded blanket bog.

6.207 Quantification of anticipated areas enhanced via habitat management measures indicate that approximately 241.4ha of habitat management areas will be restored or managed for the benefit of biodiversity. The overall area enhanced is a combination of two extensive areas of degraded heathland and degraded blanket bog habitats – one consisting of two land parcels at the north-western corner of the site covering an area of *c*.31.9ha, and a larger and more extensive area encompassing *c*.209.5ha in the eastern third of the site along the western margin of the Glengarrow River.

6.208 In addition, the restored and enhanced habitats will also be protected from drainage, cutting and burning, and reduced grazing throughout the 35-year lifetime of the Development.

6.209 As detailed in the outline HMP, the landowners have agreed to fully implement the land management prescriptions to restore and enhance the habitats on siteshould the Development be constructed.

General principles for reinstatement of habitats

6.210 Turves of heathland vegetation and associated topsoil from construction activity represent a valuable resource that can be used in the restoration of bare areas. Turves must be cut so that they capture the root systems of mineral soil as this will ensure any viable seeds are present. Turves can be laid in blocks or in a patchwork and over time heathland will develop within gaps and will provide a mosaic of structure.

6.211 During construction the areas of bog/heath/heathy acid grassland will be lifted and stored for reuse using large-scale turfing equipment, using a technique known as "macro-turfing", moving large, thick turves. This method has many advantages over traditional turfing, virtually eliminating problems of frost and drought damage, and because the turves are thick, most burrowing invertebrates and deep-rooted plants survive. At both locations the vegetated turves will be lifted to a depth of approximately 25-40cm, (i.e., total depth of topsoil at each location).

6.212 Under the supervision of an Ecological Clerk of Works the original soil layering will be maintains and the mixing of topsoil and subsoil layers will not be permitted to occur. For peat soils, the acrotelm and catotelm will be handled and stored separately and reinstated with the acrotelmic layer on top. For peat and mineral soils, it is especially important to keep the layer of surface soil and stripped turves of vegetation on the top of the reinstatement, the right way up.

6.213 Turves will not be stacked but placed beside each other. As described above turves will be cut to an appropriate depth to maintain plant root systems and provisions for keeping soil moist must be considered in the event of dry spells of weather where vegetation may succumb to drought or the soil may be susceptible to wind erosion.

Maintaining the seed bank and existing vegetation on the surface provides the best possible start for effective restoration.

6.214 Turves will be watered during times of drought or more frequently if deemed necessary by the ECoW in order to protect the health and integrity of newly translocated turves.

Compensation of the loss of NI Priority Habitats

6.215 Under the "*Biodiversity Net Gain Good practice principles for development*" and to achieve net gain locally to the Development while also contributing towards nature conservation priorities at local, regional and national levels management measures will be implemented to both enhance existing and also create/enhance new habitat across *c*.276.3ha of suitable lands. An outline HMP (Habitat Management Plan) is presented in **Appendix 6.2**

6.216 Existing habitats (likely derived from former heath/bog) will be managed in order to restore these habitats to the more species-rich habitats from which they are ultimately derived.

6.217 The main management techniques that will be employed is the blocking of all drains within the two proposed habitat management areas. In addition heathland will be re-created in selected areas of current semi-improved grassland, areas of over-mature Heather will be mown to diversify the sward structure in selected areas and current areas of species-poor blanket bog and wet heath within the Habitat Management Areas will be over-seeded using Heather seed in selected areas. After 5 years the sward will be assessed and compared with the preconstruction baseline for the area, to determine the success of the abovementioned habitat restoration measures.

6.218 The current land-use within the two proposed Habitat Management Areas consists primarily of sheep grazing. Given the historical land-uses, the complete moratorium on livestock grazing is proposed for the first 12-24 months (from the commencement of construction). Thereafter, sheep grazing will be re-established across the entirety of the LUAC at a reduced stocking rate of 0.075 livestock units per hectare.

Residual Impacts

6.219 Residual effects relating to land management that is designed to provide ecological benefits through the establishment of grazing measures which are appropriate within peatland and associated habitats (See **Appendix 6.2:** containing the outline Habitat Management Plan) will result in more diverse and ecologically valuable habitat than the present degraded habitats that cover the majority of the site. Continuity of effective, appropriate management should result in the area becoming more biodiverse over time. With improved land management, it is anticipated that in the long term there will be at least a neutral residual impact on fauna of conservation concern. For habitats, a beneficial impact is likely if site management results in more diverse habitats of greater conservation value

6.220 **Table 6.16** provides details of the residual impacts.

Table 6.16: Summary of Residual Impacts after Mitigation and Enhancement

Impact	Ecological Impact Significance without Mitigation	Mitigation & Enhancement	Ecological Impact Significance with Mitigation
Construction			
Designated Sites / Watercourses	Moderate adverse	Avoidance during infrastructure design and SuDS drainage management (Appendix 9.1). No in-stream works will be required.	Neutral
NI Priority Habitats	Moderate adverse	NI Priority Habitat restoration and enhancement according to the outline HMP.	Beneficial
Operational			
Designated Sites / Watercourses	Major Adverse	Application of the SuDS drainage management and CMS as detailed in Appendix 9.1	Neutral
NI Priority Habitats	Moderate	NI Priority Habitat restoration and enhancement according to the outline HMP.	Beneficial
Decommissioning			
Designated Sites / Watercourses	Moderate adverse	SuDS and standard Pollution Prevent Guidelines will be adhered to during decommissioning.	Neutral
NI Priority Habitats	Moderate adverse	NI Priority Habitat restoration and enhancement according to the outline HMP.	Beneficial

Cumulative Impacts

6.221 When considered in the context of the overwhelming dominance of the impact of agricultural land-use change as the primary driver controlling the extent and quality of habitats in Northern Ireland, as well as natural variation (in species populations) over time, it is credible to assume that in only very exceptional circumstances will direct effects in aggregation between wind farm sites have any potential to be cumulatively of concern let alone significant (in EIA terms). It is not unreasonable to assume that any such aggregate effects that may be of significance are likely to be readily apparent to those considering individual applications who can inform consideration of specific detailed measures to avoid unacceptable effects[5].

6.222 The potential for a cumulative impact between proposed and operational wind farms arises principally if species from the same population are using more than one of the sites. The likelihood of this can be assessed through an analysis of the species assemblage and by examining the likely range and territory size of those species.

6.223 The area over which a cumulative impact may be felt should also be considered, and in the present case, wind farms within a radius of 15km have been identified. There are 11 windfarms (existing, in-construction or proposed), with a combined total of 91 turbines. These are;

[5] Review of Guidance on the Assessment of Cumulative Impacts of Onshore Windfarms, Phase 1 Report, ENTEC, September 2008

- Owenreagh & Owenreagh Ext.
- Craignagapple
- Eglish
- Slieve Kirk and Slieve Kirk Ext.
- Carrickatane
- Ballyhanedin
- Lisnaharney
- Curryfree
- Barr Cregg.

6.224 The following sections assess the potential cumulative impacts, as a result of the Development with other proposed and operational wind farms, where relevant.

Habitats

6.225 In the uplands there is some concern over the potential effects of the access track network required by wind farm developments on the hydrology of peatlands which are important both because they are generated by and support highly valued specialised vegetation, and as natural carbon stores.

6.226 The Development will result in a loss of low and moderate quality habitats, which are of local conservation value. Restricted areas of habitat of higher conservation value have been avoided and their interest maintained. In the case of Mullaghclogher, this additional loss of habitats is considered to be not significant because the degraded blanket bog, wet heath/grassland habitats are of local conservation value and is widespread both locally and throughout the region. It is therefore within the ability of the resource to absorb this loss. Those habitats that are of greater value have been avoided and there will be **no significant impact** on them.

Trans-boundary effects

6.227 Potential trans-boundary effects of the Development on designated sites and on mobile species (i.e., bats) were assessed. The effects are considered to be the same as those described in the relevant sections (i.e., cumulative effects). Trans-boundary effects are therefore not considered to be significant. Potential trans-boundary effects of the Development on Annex 1 migratory bird species are assessed in **Chapter 8: Ornithology**.

Conclusions

6.228 There is no regular usage of the area by otter, smooth newt or marsh fritillary butterfly, therefore no impacts to these species are likely. Mitigation for the herpetofauna found on site (i.e., common lizard) and badgers is proposed. This involves the provision of habitat management, as well as drift fencing and mowing/hand clearance during the construction phase. All badger setts have been buffered by the required 25m from any infrastructure.

6.229 The proposed outline HMP will ensure compensation for areas of NI Priority Habitat lost under the footprint of the Development and should also result in enhancement of the local site ecology.

6.230 The mitigation measures specified in **Table 6.16** will be adhered to, ensuring that any potential impacts to bats will be negligible. In conclusion and based on current knowledge this would appear to be a site posing little risk to bats or bat populations, with the satisfactory implementation of the recommended BMMP (including curtailment and increased cut-in speeds (as required).

6.231 Therefore, the potential effects of the Development on ecological receptors have been assessed and it is concluded that with the implementation of appropriate mitigation measures the effects would be reduced to a **beneficial effect** on the ecological integrity of the site and the wider area.

6.232 An assessment of cumulative impacts on the habitats and fauna of the area was also undertaken, and it was concluded that this is **not a significant impact**.

References

6.233 References have been inserted as footnotes within the body of the document.

Abbreviations

AONB	Area of Outstanding Natural Beauty
ARGUK	Amphibian and Reptile Groups of the UK
ASSI	Area of Special Scientific Interest
BESS	Battery Energy Storage Site
BSBI	Botanical Society of the British Isles
CEDaR	Centre for Environmental Data and Recording
CIEEM	Chartered Institute of Ecology and Environmental Management
CNCC	Council for Nature Conservation and the Countryside
EC	European Commission
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
HRA	Habitat Regulations Assessment
HSI	Habitat Suitability Index
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee

LHP	Larval Host Plant
LUAC	Land Under Applicant Control
MNR	Marine Nature Reserve
NBN	National Biodiversity Network
NIBG	Northern Ireland Bat Group
NIEA	Northern Ireland Environment Agency
NIPS	Northern Ireland Priority Species
NNR	National Nature Reserve
NR	Nature Reserve
PPS	Planning Policy Statement
SAC	Special Area of Conservation
SLNCI	Sites of Local Nature Conservation Importance
SPA	Special Protected Area
UW	Ulster Wildlife

7

Terrestrial Fauna

7. Terrestrial Fauna

Introduction

7.1 This chapter constitutes the terrestrial fauna assessment for the Environmental Impact Assessment of a proposed wind farm at Mullaghclogher, situated approximately 4 km to the north-east of Plumbridge, Northern Ireland, hereinafter referred to as 'the Proposed Development'. The site occupies part of the extensive northern and north-eastern slopes beneath two peaks, Mullaghcarbatagh (IGR 251813 394789) and Mullaghclogher (IGR 252898 394859) mountains, which rise to 517 m ASL and 572 m ASL respectively. This study addresses the potential impacts on terrestrial fauna of the proposal to erect the turbines and associated access tracks and infrastructure, as described in Chapter 1: Introduction & Proposed Development, hereinafter referred to as 'the Proposed Development'.

7.2 Blackstaff Ecology Ltd was commissioned by RES Ltd to undertake an Ecological Impact Assessment (EcIA) for the proposed wind farm. Surveys for bats commenced during 2022; while the badger, otter and common lizard surveys were carried out in during 2023.

7.3 The chapter is supported by:

- Appendix 7.1 – Mullaghclogher Bat Report
- Appendix 7.2 - Badger & Otter Survey Report (Confidential)
- Appendix 7.3 – Common Lizard Survey Report
- Figure 7.1 - Automated Static Bat Detector Locations
- Figure 7.2 – Badger & Otter Survey Results (Confidential)
- Figure 7.3 – Common Lizard Survey Results

Statement of Authority

7.4 The badger, otter and viviparous lizard surveys were carried out by Karl Hamilton, Catriona Porter and Jazmin Creaney. While the bat detector deployments and bat data analysis were completed by Philip Leathem, who also produced the figures to accompany the impact assessment. The BRP surveys were also carried out by Jazmin and Catriona. An initial site appraisal for bats was carried out by Cormac Loughran, with input into the layout design. The chapter was reviewed and impact assessment were also completed by Cormac Loughran and reviewed by Dr Brian Sutton.

7.5 The author of this chapter is (and all surveys were planned by) Cormac Loughran, a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). Cormac has worked professionally as a Consultant Ecologist for over 18 years. He holds an MSc (Distinction) in Environmental Management from the University of Ulster and has extensive experience in a broad range of flora & fauna surveys. He has undertaken and/or coordinated a wide range of ecological surveys and associated impact assessments for over 25 renewable energy projects. Cormac is also an experienced field naturalist and prior to his consultancy work, he worked as a ranger on a number of important nature reserves. As a result, he also has considerable experience of surveying and recording of Irish mammal and herpetofauna and has held numerous licences for same.

7.6 This report has been reviewed Dr Brian Sutton, who was awarded a PhD in Environmental Science by the University of Ulster. Prior to working at Blackstaff Ecology, he worked as a member of the Habitat Survey Team of the Environment and Heritage Service (now NIEA) for 2 years. During this time, he carried out habitat surveys of, principally, designated sites or candidate designated sites across Northern Ireland. In so doing he gained experience of most of the habitat types that are present in the Province. Following this, he worked as a consultant ecologist for AECOM Ltd for 15 years, carrying out habitat and faunal surveys for a wide range of governmental and private clients. Projects undertaken were at a range of scales, from small private developments to major infrastructure projects.

7.7 Karl Hamilton co-authored this chapter. Karl has a BSc (Hons) in Environmental Biology from the Queen's University of Belfast, after which he took up the post of Senior Reserve Warden and Biodiversity Officer for the Wildfowl Wetlands Trust within Northern Ireland. This role included hands-on management of a variety of terrestrial and aquatic habitats, surveying and monitoring of flora & fauna, managing volunteers and work placements, and surveying. In 2010 Karl commenced his career in ecological consultancy as a freelance ecologist, engaging in contract and sub-contract work throughout Northern Ireland and the Republic of Ireland, undertaking primarily Preliminary Ecological Assessments, Protected Species Surveys, Invasive Species Surveys and Ecological Impact Assessments. In 2020 Karl joined Blackstaff Ecology as Senior Ecologist and specialises in ornithological, botanical and habitat surveys. Karl also regularly provides training courses in these and other ecological subjects for environmental NGOs, statutory organisations and other ecologists. To date Karl has completed badger and otter surveys on a dozen wind farm developments.

7.8 Catriona has an MSc in Animal Behaviour and Welfare (Distinction) from Queen's University, Belfast. She has several years of experience within the nature conservation sector through extensive volunteering including organisations such as UK Overseas Territories Conservation Forum, Ulster Wildlife and the RSPB. Catriona has 8 months experience within the ecological consultancy sector, beginning in April 2021 where she assisted with carcass trials on a windfarm with Allen & Mellon Environmental. Since joining Blackstaff in May 2021 she has been involved in projects in Northern Ireland and the ROI and has gained experience in both survey techniques and ecological report writing specific to bats. Catriona has conducted approximately one dozen bat roost potential (BRP) surveys, thirty emergence / re-entry surveys, two endoscope surveys and seventy-six carcass searches for single wind-turbines (SWTs), plus the associated reports.

7.9 Jazmin has a BSc in Zoology and is a qualifying member of CIEEM. She has undertaken further courses including Animal Conservation, GIS and Environmental Management. She has a range of experience in conducting field surveys both locally, with organisations including BTO, The National Trust and TetraTech, and abroad, through her time monitoring elephant behaviour and habitat damage in South Africa. Since joining Blackstaff Ecology in 2021, Jazmin has been involved in projects throughout NI and the ROI and has gained significant ecological experience. To date she has conducted 24 walkover surveys for Badgers, 20 lizard surveys and 8 habitat surveys for HMP management.

7.10 Philip Leathem is a GIS/Ecological Technician who has worked in the environmental sector for the past 9 years. Philip's role as a technician includes the maintenance, monitoring and deployment of a suite of automated bat detector units (SM2 Bat+, SMZC's and Anabat Express') which are used during static (bat) monitoring. In addition to the above role, Philip is also a GIS Technician and has considerable experience in the production of Figures for Environmental Statements.

Legislation & Planning Policy

International Treaties, Conventions & Directives

Bonn Convention of the Conservation of Migratory Species of Wild Animals (June 1979)

7.11 The Convention requires the protection of the endangered migratory species listed and encourages separate international agreements covering particular species. An agreement covering the conservation of bats in Europe came into force in January 1994. It deals with the need to protect bats and their feeding and roosting areas.

Bern Convention on the Conservation of European Wildlife and Natural Habitats (September 1979)

7.12 The Convention carries obligations to conserve wild plants, birds and other animals, with emphasis on endangered and vulnerable species and their habitats. The provisions of the Convention underlie the EC Habitats Directive as well as the UK's wildlife legislation.

UN Biodiversity Convention (The Rio Convention) (June 1992)

7.13 The Convention provides a framework for international action to protect species and habitats. The UK's overall goal under the Convention is to conserve and enhance biological diversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms.

Convention on Biological Diversity (93/626/EEC) (CBD)

7.14 The Convention requires contracting parties, in accordance with its conditions and capabilities, to develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes. It also requires contracting parties to integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectorial and cross sectorial plans, programmes and policies.

EC Council Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) (The Habitats Directive)

7.15 Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the EU Habitats Directive) is transposed into law in Northern Ireland by the Conservation (Natural Habitats, etc.) Regulations 1995 (as amended), the Habitats Regulations.

7.16 The Habitats Directive covers habitats and non-avian species of fauna of nature conservation importance and in danger of disappearance, for which the European Commission (EC) has responsibility in view of the proportion of their global range. Habitats are listed and detailed on Annex I of the Directive.

7.17 To conserve these habitats, listed on Annex I of the directive, and species, listed and described on Annex II, a European network of Special Areas of Conservation (SAC) is being established.

7.18 As the Habitats Directive encapsulates a presumption in favour of maintaining Annex I habitats in good conservation status wherever they occur, prior assessment is therefore required to determine whether any areas of habitat within a development site meets the criteria for recognition as Annex I habitat types.

7.19 The Directive also requires appropriate assessment of any plan or project not directly connected with or necessary to the management of a Natura 2000 site, but likely to have significant effects upon a Natura 2000 site, either individually or in combination with other plans or projects.

Domestic Legislation

Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended)

7.20 The Regulations give effect to requirements relating to the designation of protected sites under the Birds Directive and Habitats Directive. The Regulations provide for the protection and management of European Sites and place obligations on all competent authorities to have regard to the requirements of the Habitats Directive. The Regulations also provide for the protection of species of European importance.

Environment (Northern Ireland) Order 2002

7.21 The Order provides for the designation, management and protection of Areas of Special Scientific Interest (ASSIs). ASSIs may be designated for important geology and land forms as well as for wildlife and habitats. The legislation repeals Part VI of the Nature Conservation and Amenity (Northern Ireland) Order 1985.

Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (as amended)

7.22 The Order provides for the establishment of National Nature Reserves (NNRs), Nature Reserves (NRs) and Marine Nature Reserves (MNRs). It also provides for the designation and formulation of proposals for National Parks and Areas of Outstanding Natural Beauty (AONBs).

The Wildlife (Northern Ireland) Order 1985 (as amended)

7.23 The Order prohibits the intentional killing, taking or injuring of certain wild birds or wild animals; or the intentional destruction, uprooting or picking of certain wild plants. It also allows for the establishment of Wildlife Refuges (akin to Nature Reserves) for the special protection of certain species of rare plants or animals.

The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009

7.24 The Regulations implement Directive 2004/35/EC and require those carrying out certain activities to prevent, limit and remediate significant environmental damage to protected species, natural habitats, ASSIs, surface water, ground water and land. Operators of activities such as discharges to water sources and water impounding are liable for any significant environmental damage, regardless of whether they intended to cause the damage or were negligent.

Wildlife and Natural Environment Act (Northern Ireland) 2011

7.25 The Act makes provision about biodiversity; amends the Wildlife (Northern Ireland) Order 1985 and Part 4 of the Environment (Northern Ireland) Order 2002; abolishes game licences and game dealers' licences; prohibits hare coursing events and amends the Game Preservation Act (Northern Ireland) 1928.

Planning Policy

Regional Development Strategy (RDS) 2035: Building a Better Future

7.26 The Strategy takes account of European and national policies which would have an influence on the future development of Northern Ireland. The Strategic Planning (Northern Ireland) Order 1999 requires Northern Ireland Departments to have regard to the Regional Development Strategy in exercising any functions in relation to development. There are two types of Strategic Guidance: Regional Guidance (RG) and Spatial Framework Guidance (SFG). RG applies to everywhere in the region and is presented under the three sustainable development themes of Economy, Society and Environment.

7.27 RG 9-RG 12 (Environment) have been adjusted to meet obligations under the Habitats Regulations. Of relevance to the Proposed Development is RG 11: Conserve, protect and, where possible, enhance our built heritage and our natural environment. This Strategy Guidance refers to the need to:

'Sustain and enhance biodiversity in line with the objective of the Northern Ireland Biodiversity Strategy to halt the loss of indigenous species and habitats. By protecting existing, or creating new, ecological or wildlife corridors particularly in our cities and towns we can provide valuable help to arrest the decline in biodiversity.'

and

'Identify, establish, protect and manage ecological networks. Ecological networks, including the protection of priority species, are needed to maintain environmental processes and help to conserve and enhance biodiversity. A well-established ecological network, including designated sites, should provide the habitats needed for ecosystems and species populations to survive in an increasingly human dominated landscape. Such networks could also be of amenity value if linked to the green infrastructure provided by walking and cycle routes to heritage and other recreational interest.'

Strategic Planning Policy Statement for Northern Ireland (SPPS)

7.28 In addition to reiterating the statement made in PPS18 (below) the SPPS States:

'Active peatland is of particular importance to Northern Ireland for its biodiversity, water and carbon storage qualities.'

and

'Renewable energy reduces our dependence on imported fossil fuels and brings diversity and security of supply to our energy infrastructure. It also helps Northern Ireland achieve its targets for reducing carbon emissions and reduces environmental damage such as that caused by acid rain.'

Planning Policy Statement 18: Policy RE1

7.29 Policy RE1 States:

'The wider environmental, economic and social benefits of all proposals for renewable energy projects are material considerations that will be given significant weight in determining whether planning permission should be granted'.

'Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on:

(a) public safety, human health, or residential amenity;

(b) visual amenity and landscape character;

(c) biodiversity, nature conservation or built heritage interests;

(d) local natural resources, such as air quality or water quality; and

(e) public access to the countryside.

Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures, such as a habitat management plan or the creation of a new habitat. This matter will need to be agreed before planning permission is granted.

Any development on active peatland will not be permitted unless there are imperative reasons of overriding public interest.'

Planning Policy Statement 2 - Policy NH5

7.30 Policy NH 5 - Habitats, Species or Features of Natural Heritage Importance, states:

'Planning permission will only be granted for a development proposal which is not likely to result in the unacceptable adverse impact on, or damage to known:

- priority habitats;
- priority species;
- active peatland;
- ancient and long-established woodland;
- features of earth science conservation importance;
- features of the landscape which are of major importance for wild flora and fauna;
- rare or threatened native species;
- wetlands (includes river corridors); or
- other natural heritage features worthy of protection.

A development proposal which is likely to result in an unacceptable adverse impact on, or damage to, habitats, species or features may only be permitted where the benefits of the proposed development outweigh the value of the habitat, species or feature. In such cases, appropriate mitigation and/or compensatory measures will be required.

PPS 21 Sustainable Development in the Countryside

7.31 PPS 21 aims to:

'Manage development in the countryside in a manner consistent with achieving the strategic objectives of the Regional Development Strategy for Northern Ireland 2025." Objectives include to "Conserve the landscape and natural resources of the rural area and to protect it from excessive, inappropriate or obtrusive development and from the actual or potential effects of pollution," and to "Promote high standards in the design, siting and landscaping of development in the countryside.'

Northern Ireland Biodiversity Strategy

7.32 A strategy that has been published by the DoE entitled, Valuing Nature – A Biodiversity Strategy for Northern Ireland to 2020 (01 July 2015) describes 20 targets arising from the 2010 Convention on Biological Diversity (CBD) which was held in Noyoga, Japan during October 2010. A key decision at the Convention was the adoption of a new ten-year strategic plan to guide international and national effort to save biodiversity. The strategic plan, or the Aichi Target, adopted by the meeting is the overarching, internationally agreed, framework on biodiversity. The 20 Aichi Targets form the basis for the Implementation Plan for the NI Biodiversity Strategy. The CBD fully adopted the ecosystem services approach that stresses the need to look at maintaining the functionality of ecosystems as key to protecting biodiversity and delivering benefits for humanity.

Sustainable Development Strategy for Northern Ireland

7.33 The Strategy sets out the Government agenda for ensuring that sustainable practice becomes an integral part of development policy in Northern Ireland. The following six principles of the strategy continue to echo those developed from the previous strategy, and are as follows;

- Living within Environmental Limits;
- Ensuring a Strong, Healthy, Just and Equal Society;
- Achieving a Sustainable Economy;
- Promoting Good Governance;
- Using Sound Science Responsibly;
- Promoting Opportunity and Innovation.

7.34 The strategic objective most relevant to the Proposed Development is: Ensuring reliable, affordable and sustainable energy provision and reducing our carbon footprint.

Guidance on Species/Habitats of Conservation Concern

Red Data Book

7.35 Vascular plant species that are rare and/or threatened on an all-Ireland or European scale have been identified as Red Data Book (RDB) species (Curtis & McGough, 1988).

Northern Ireland Species of Conservation Concern

7.36 NIEA has produced a list of Northern Ireland Priority Species (NIPS) and Species of Conservation Concern (SOCC), which includes Biodiversity Action Plan species, not all of which are Red Data Book species. Rarity is also a criterion for inclusion in the list. NIEA is also in the process of identifying vascular plant species that are of conservation concern as the NI response to the adoption by the UK of the Global Strategy for Plant Conservation (Palmer, 1994). The proposed list will be comprehensive and include species that are near-threatened as well as those protected by the Wildlife Order or listed as NIPS and SOCC. This process of evaluation of the current list of species of conservation concern is on-going.

Local Biodiversity Action Plans (LBAPs)

7.37 Local Authorities have been able to employ Biodiversity Officers, with financial aid from NIEA, since 2004. Their duties include raising awareness of biodiversity issues within local areas, and the development of LBAPs as a means of conserving and enhancing biodiversity at a local scale.

Scope of Assessment

Ecological Impact Assessment

7.38 The Study Area described in the present report takes into account the results of the habitat survey and avoids considerable areas of habitats of conservation value identified at that time. Surveys for bats were extended to 200m plus the rotor radius of potential turbine locations, as required by NIEA guidance. Sites designated for their nature conservation features within a radius of 2 km of the Study Area (**Figure 6.1**) were also considered to assess potential remote effects on valuable ecological site-based receptors. Specific study areas for other species are detailed in paragraph 7.47.

7.39 The aim of EcIA is therefore to describe and assess potential significant effects upon ecological receptors (in this case terrestrial fauna) within the planning application boundary and zone of ecological influence within the wider environment, as applicable. This is achieved by informed decision-making in accordance with published methodologies and after collecting a range of primary survey data across the site of the Proposed Development. Identification and evaluation of likely significance of effects associated with the Proposed Development during construction, operation and decommissioning phases permit recommendation of appropriate mitigation measures to avoid and/or reduce the predicted adverse effects of the Proposed Development on the recorded ecological receptors identified as part of the baseline survey.

7.40 The baseline survey, characterisation of the environment and the likely significance of effects of the Proposed Development on habitats, ornithology, fisheries (aquatic ecology) and the water environment are reported upon in **Chapter 6: Vegetation & Peatland, Chapter 8: Ornithology, Chapter 9: Fisheries** and **Chapter 10: Geology & Water Environment**.

Desktop Review

7.41 Consultation was undertaken with the statutory and non-statutory organisations listed below regarding the proposed scope of the EcIA; the location of any statutory and non-statutory designated nature conservation sites that have the potential to be impacted by the Proposed Development; identification of potential ecological receptors; the existence of any ecological records within 2 km of the Preliminary Study Area.

- Centre for Environmental Data & Recording (CEDaR);
- DAERA Natural Environment map viewer;
- Northern Ireland Bat Group;
- National Biodiversity Network (NBN).

7.42 CEDaR, the NI Bat Group and NBN provided biological records.

7.43 NIEA requires the identification of the ecological baseline of the area that will be affected by the scheme and the identification of areas which are likely to be of high conservation value or particularly vulnerable to impact from the proposed scheme. NIEA requires that the EIA should cover both the site and its surroundings, in all seasons.

7.44 The developer will be required to consider the potential impact of the scheme on designated sites. Where there is a potential for impacts on a European protected site (SPA, SAC) the developer will be responsible for informing an HRA as mandated by Article 6 of EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ("the Habitats Directive").

7.45 The consultation and desk study identified those ecological receptors most likely to be impacted by the proposed wind farm. Ecological receptors identified included; Northern Ireland or European priority and protected species. The ecological surveys and EcIA therefore concentrate on the potential effects of the Proposed Development on these ecological receptors.

Assessment Methodology

Baseline Characterisation of the Study Area

7.46 The study methodology includes both desktop and field survey methods in order to assess the potential impact on the local ecological and nature conservation interest. Features of conservation interest and importance were recorded and their locations are one of the key criteria that affect the wind farm layout. The location of the wind farm infrastructure avoids species of conservation interest where possible, and where this is not possible, mitigation and/or enhancement measures have been incorporated into the design to balance any detrimental impact.

7.47 Signs of mobile species were assessed outside the site to determine their point of origin. The study area was thus extended to take account of the potential for species to use the vicinity of the Proposed Development as part of wider territories or foraging areas. Watercourses within the site, and some tributaries outside the site, were surveyed for signs of otter. Specific study areas for each species are as follows;

- Bats (200m plus rotor radius around proposed turbine locations);

- Otter & badger (planning application boundary + 30m buffer for Otter, and 25m for Badger);
- Common lizard (site);
- Marsh fritillary (site).

7.48 Sites designated at international, national and local level for their conservation value within a potential impact zone were considered. The nearest designated sites to the study area were identified, to assess the potential for remote effects of the scheme on valued habitats and species outside the immediate area.

7.49 The Fauna section of the EIA considers information gathered from the following sources:

- Consultations, with statutory and non-statutory stakeholders
- Desk study, including review of published/unpublished sources/literature
- A walkover survey of the entire study area and any other areas likely to be affected
- Specialist surveys, as detailed in paragraph 7.50 below
- Assessment of the data acquired
- Consideration of ecological interests in the scheme design and identification of mitigation to be incorporated into the design
- Impact assessment
- Proposed additional mitigation measures to address any likely significant adverse impacts

7.50 The data collection methodology adopted involved both a desktop search and field survey. The relevant statutory and non-statutory bodies were contacted to obtain ecological data for the study area. Records of species of conservation concern in the study area were formally requested from the Centre for Environmental Data and Recording (CEDaR). Detailed surveys were undertaken to establish the baseline conditions of the various habitats and for the species groups that are likely to occur around the proposed scheme. The purpose of an ecological survey is to identify 'valued ecological receptors', those species and habitats that are especially valued in some way for their ecological function, their contribution to biodiversity or are protected by specific legislation. The following specialist surveys were undertaken:

- Bat (Chiroptera spp) survey
- Otter (*Lutra lutra*) survey
- Badger (*Meles meles*) survey
- Common Lizard (*Zootoca vivipara*) survey
- Marsh Fritillary (*Euphydryas aurinia*) habitat survey

Bat Survey Methodology

7.51 NIEA recommends different types of guidance for bat surveys, depending on the type of proposal. In the case of the proposed development this includes the SNH guidance (Jan 2021) entitled '*Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*'. Therefore, this guidance was used when arriving at the appropriate level of survey effort (for both automated and manual surveys) at the windfarm.

7.52 A desk study was undertaken in order to plan survey work and provide context for this assessment. The desk study included a review all the available information on bats relevant to the proposed wind farm and considered the various factors that influence risk to the species at a site. This included:

- The use of bespoke UAV aerial imagery (a ground truthing site visit), topographical maps and habitat survey maps (from a previous Preliminary Ecology Assessment) of the proposed site to identify features of potential value to bats.
- The collation of relevant bat information within 10 km of the proposed wind energy site, including species and roost records and the proximity of national and internationally designated sites for bats.
- Particular efforts were made to identify locations with the potential to house significant roosts, such as barns and other buildings.
- The location of other wind energy developments, including the number of turbines and their size, within the surrounding 10km in order to inform an assessment of cumulative pressure.

7.53 Collins (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition) was also considered during survey design and the subsequent survey effort.

7.54 It was noted that:

- Habitat quality is poor for bats on the site due to the presence of largely low-quality foraging habitat for bats (blanket bog and upland heath) across the majority of the site. There are some areas of moderate quality foraging habitat, namely the rivers and stream valleys proximal to the proposed turbine locations.
- The site has an exposed aspect;
- The site is not proximal to sites designated for bats; and,
- No buildings or other structures known to support bats are extant on the site[1].

7.55 Based upon this information, and upon the factors noted in the aforementioned SNH Guidance, the site was deemed to be of 'low quality' for bats and the following survey standard was implemented in accordance with SNH Guidelines.

[1] within 200m plus rotor radius of the proposed turbine locations.

- Survey Area of up to 200m plus the rotor radius from the proposed turbine locations;
- Ten consecutive nights of static monitoring per turbine location during each season (spring/summer/autumn) using broadband passive recorders.

7.56 The site occupies a broad valley with generally shallow to moderate slopes, although steeper slopes are present on the higher ground along the southern valley side. The study area comprises a range of habitats, namely heath, bog, acid flush, grassland and running water. The wider landscape is similar to the site with extensive areas of open moorland and sheep grazed pasture, while a conifer plantation exists to the north-east.

7.57 A detailed survey of potential roosting features within 200m of the application site boundary was carried out during 2023. The habitat survey did not identify any buildings or structures with potential roosting features. Few trees are present in proximity turbines however no mature trees suitable for use by roosting bats are extant within the application boundary. The majority are isolated and deemed unsuitable for roosting bats.

7.58 Overall, the site is identified as being of Low-risk due to the presence of largely low-quality foraging habitat (and limited opportunity for roosting) for bats; with even the areas normally described as moderate quality foraging habitat (i.e., rivers and streams) located in an isolated upland context with no trees (or sheltered areas) and limited invertebrate prey.

Automated Bat Activity Surveys

7.59 Automated passive monitoring was also undertaken during spring (15 Apr – 15 Jun), summer (15 Jun – 15 Aug) and autumn (15 Aug – 15 Oct) 2022 (**Appendix 7.1** and **Figure 7.1: Static monitoring locations**). Several (calibrated) broadband ultrasonic bat detectors (SM2BAT+ and Anabat Express) were placed to record for a minimum of ten nights at numerous locations across the site on a seasonal basis, including a number of potential turbine locations. Each static detector was programmed to automatically operate during set time periods to record bat activity between dusk and dawn each night.

7.60 The SNH 2021 guidance states that;

> *''Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites up to a maximum of 40 detectors for the largest developments''.*

7.61 At Mullaghclogher, 11 proposed turbines were monitored, which yielded over 300 nights of recording time (May to September inclusive). This was done in order to allow for alterations to the proposed turbine layout (which often occur during the assessment process) and to allow for equipment failure or damage.

7.62 Detectors were placed with the microphone directed at a 90° angle towards the area to be monitored (e.g., the proposed turbine location). Whenever possible microphones were placed on a fence post or pole. This helps to prevent recording extraneous noises and places the microphone closer to or within the flight path of the bats; this tends to provide higher quality recordings.

7.63 AnalookW and Kaleidoscope Pro UK was used to undertake analysis of data collected during automated passive monitoring. Bat activity was measured using the number of files containing a bat call or bat call sequence irrespective of length, for a complete night of recording. Passive monitoring enables determination of species composition and temporal activity patterns between different times of year and different times of night at a fixed-point location. Bat activity indices (for all survey types) are provided in the survey results, included in **Appendix 7.1**.

Otter Survey

7.64 An otter survey was conducted, extending to 30m around the planning application boundary on the 14, 18, 21 and 29 September 2023, using the methodology described in the NIEA survey requirements (NIEA 2017[2]). The survey area was thoroughly searched for both direct and indirect evidence of otters. Such evidence included: prey remains, spraints, footprints, slides and dens. The locations of any features were noted using a handheld GPS. Where excavations were discovered, the survey detailed; the direction of tunnelling; and the degree of use at the time of the survey. Where trails were found, these were followed to the edge of the recording area.

Badger Survey

7.65 A badger survey was conducted at the site on 14, 18, 21 and 29 September 2023. The search area on these dates comprised 25 m surrounding the planning application boundary as well as the banks of the water course that runs through the northern section of the site.

7.66 The survey followed the methodology described in Harris *et al* (1989[3]) and with reference to the NIEA survey requirements (NIEA 2017[4]). The survey area was thoroughly searched for both direct and indirect evidence of badger activity. Such evidence included: badger hairs; mammal pathways of suitable dimension; gaps of suitable dimension in fences or hedgerows; snuffle holes indicating foraging activity; tracks; latrines; and excavations of suitable dimensions to host badgers. The locations of any features were noted using a handheld GPS. Where excavations were discovered, the survey detailed;

- The number of entrances present;
- The shape of tunnel entrances;
- The width of the tunnel entrance at its widest point (visible);
- The direction of tunnelling; and

[2] https://www.daera-ni.gov.uk/sites/default/files/publications/daera/otter-survey-specifications.pdf
[3] Harris, S., Creswell. P., and Jefferies, D.J., 1989. Surveying badgers. Mammal Society, London.
[4] https://www.daera-ni.gov.uk/sites/default/files/publications/daera/bat-survey-specifications.pdf

- The degree of use at the time of the survey, i.e., active or inactive.

Viviparous Lizard Survey

7.67 On assessing the habitats present on the application site it was considered that there is a high likelihood of viviparous lizards being present. Therefore, in order to ensure that the proposed development complies with legislation and planning policy, a survey for this species was carried out. The work was carried out during April 2023 and aimed to establish whether lizards are present within the construction corridor and surrounding area.

7.68 The methodology includes both visual searches and the use of artificial refugia. Surveys were carried out during the following optimal periods;

- Early spring - middle hours of the day (c.11am-3pm);
- Late spring – mid morning (c.9-11am) and late afternoon (c.4-6pm), and/or;
- Summer – short periods in morning (c.7-9am) and evening (6-8pm); hot weather can produce totally negative results;
- Autumn similar to spring timings.

7.69 During the visual searches a transect was walked slowly, scanning sunny sides of vegetation while keeping the sun behind you or to your side. Particular attention was paid to vegetation interfaces (i.e., habitat edges, where bracken meets heather or grassland) as these are often places where reptiles bask (as they seldom venture far from dense cover for protection).

7.70 The walked transects also made use of natural basking spots, however artificial refugia in the form of 30 number rubber backed carpet tiles (500 x 500 mm) were also placed around most of the proposed turbine locations (see **Figure 7.3** and Volume 4: **Appendix 7.3**). The transect also took account of suitable habitat within or adjacent to the construction corridor. The following was applied to the emplacement of refugia;

- Choose sunny locations away from public view and livestock;
- Press refugia down close to the ground;
- Use deep cover or edge of dense vegetation;
- Do not deploy on bare ground/sparse cover;
- Lift and replace refugia carefully taking care not to squash retreating animals.

7.71 Surveys were carried out during suitable weather conditions (as above), and focussed during June and September 2023. The surveys were 2-3 hours in duration and three visits were made (with the first visit at least a week after the refugia were laid).

Marsh Fritillary Habitat Assessment

7.72 A devil's-bit scabious *Succisa pratensis* survey was undertaken as part of both the JNCC Phase 1 & NVC Phase 2 habitat surveys (2022 and 2023) in accordance NIEA recommendations (arising out of their consultation response) to establish the presence/abundance within the Site of devil's-bit scabious, which is main food plant of the marsh fritillary butterfly.

7.73 The presence of *S. pratensis* (the LHP of *Euphydryas aurinia*) was confirmed within the site.

7.74 Over the whole site *S. pratensis* was thinly recorded within areas of rush pasture across the wider site. In view of the limited extent of suitable habitat and the distance from any known breeding colonies, the site is considered to have negligible potential for breeding marsh fritillary butterfly. The size and extent of these patches were too small to map at any meaningful scale.

7.75 The presence of marsh fritillary larval webs was not confirmed on any of these plants. This butterfly exists in a series of linked meta-populations, forming numerous temporary sub-populations, which frequently die out and recolonise. Where unable to do this, populations do not seem to be able to persist in habitat fragments.

7.76 In addition to this marsh fritillary is typically found in either dry calcicolous grassland or damp neutral or acidophilous grassland and mires. A common factor in many occupied sites is the presence of low-intensity cattle grazing which creates the preferred sward for the butterfly. The sheep grazing across much of the site has created poor sward conditions and the absence of suitable habitat which is highly unlikely to favour marsh fritillary; therefore, this species has been removed from any further assessment and is not considered further.

Argent & Sable Habitat Assessment

7.77 A bog myrtle *Myrica gale* survey was undertaken as part of the Phase 1 habitat survey during 2023 in accordance NIEA recommendations to establish the presence/abundance within the Site of bog myrtle, which is main food plant of the argent & sable moth. No plants of this species were recorded, and therefore this species has been removed from any further assessment and is not considered further.

Ecological Impact Assessment

7.78 The assessment of the impact of a scheme on a species or habitat must consider the conservation value of the species or habitat. This assessment of the potential impact of the Proposed Development on the conservation interest of the construction area and associated access routes adopts the Guidelines for Ecological Impact Assessment in the UK (CIEEM 2022).

7.79 The objective of the EIA process, in relation to the natural environment, is to undertake sufficient assessment to identify and quantify any significant impacts on the natural environment likely to arise from turbine construction, operation and eventual decommissioning. Following identification of the final infrastructure layout, the baseline ecological (or biodiversity) conditions in the site are described, based on information provided by consultees, background sources of information and the results of dedicated surveys carried out for the scheme.

7.80 As a means of achieving this objective, ecological constraints on development of the scheme at international, national, regional and local levels are identified and assessed. This includes the main ecological features that should be avoided or that could affect the design of the scheme or delay progress.

Sensitivity Criteria

7.81 Potential significant impacts are assessed according to the ecological value of a site, which is derived from the criteria outlined below. The sensitivity (importance) of a receiving habitat is defined by its position in a hierarchy of site importance and conservation value. This hierarchy extends, highest to lowest, from International, National, Regional, Local, to negligible importance. This range of values is expressed in the protection afforded a site by international and national legislation, and in planning policy at a more local level (**Table 7.1**).

7.82 The biodiversity value of a site, is measured by such factors as:

- animal or plant species, subspecies or varieties that are rare or uncommon, either internationally, nationally or more locally;
- endemic species or locally distinct sub-populations of a species;
- ecosystems and their component parts, which provide the habitats required by the above species, populations and/or assemblages;
- habitat diversity, connectivity and/or synergistic associations (e.g. networks of hedges and areas of species-poor pasture that might provide important feeding habitat for rare species);
- notably large populations of animals or concentrations of animals considered uncommon or threatened in a wider context;
- plant communities (and their associated animals) that are typical of valued natural/semi-natural vegetation types, including examples of naturally species-poor communities;
- species on the edge of their range, particularly where their distribution is changing because of global trends and climate change;
- species-rich assemblages of plants or animals; and
- typical faunal assemblages that are characteristic of homogeneous habitats.

7.83 The secondary value of a site can be as part of a corridor or a series of stepping stones that facilitate the migration, dispersal and genetic exchange of wild species, or as a buffer zone that protects a valued site from adverse or beneficial environmental impacts.

Magnitude of Effect

7.84 This relates to the magnitude of the impacts on the features during the construction, operation and decommissioning phases. The magnitude of ecological impacts is assessed by considering the change in the ecology of a site that will arise because of the direct and indirect effects of a development on that ecology. Factors to be considered when considering the magnitude of an impact are outlined in **Table 7.2**. The criteria for determining the magnitude of impact are listed in **Table 7.3**. Both direct and indirect impacts, and the duration of these impacts are examined.

Significance Criteria

7.85 This relates to the significance of impacts on species and habitats of conservation importance, based on their presence as determined by survey. Factors to be considered when assessing the ecological significance of impacts are outlined in **Table 7.4**. Taking the factors in **Table 7.4** into account the significance of an impact may be broadly categorised according to **Table 7.5**.

Table 7.1: Criteria for assessing ecological sensitivity/importance at a geographic scale

Value/Importance	Criteria
Internationally important sites (very high conservation value)	World Heritage Sites identified under the Convention for the Protection of World Cultural & Natural Heritage, 1972. Biosphere Reserves identified under the UNESCO Man & Biosphere Programme. Wetlands of International Importance designated as Ramsar Sites under the terms of the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention) formulated at Ramsar, Iran, in 1971. Special Protection Areas (SPAs) designated in accordance with the 1979 European Communities Directive on the Conservation of Wild Birds (79/409/EEC): The Birds Directive. This Directive requires member states to take measures to protect birds, particularly rare or endangered species as listed in Annex I of the Directive, and regularly occurring migratory birds. Special Areas of Conservation (SACs and cSACs) designated in accordance with the 1992 European Commission Habitats Directive 92/43/EEC (1992): The Habitats Directive. This Directive requires member states to establish a network of sites that will make a significant contribution to conserving habitat types and species identified in Annexes I and II. Other sites maintaining habitats and/or species listed under the Birds and/or Habitats Directives (see above). Sites hosting significant populations of species annexed under the Bonn Convention. Sites hosting significant populations annexed under the Bern Convention. Biogenetic Reserves (UNESCO Man and the Biosphere Programme).
Nationally important sites (high conservation value)	Areas of Special Scientific Interest are the principal national designation for sites of nature conservation interest. They are notified under Section 28 of the Environment (NI) Order 2002 and are chosen by virtue of any of their flora, fauna, geological, or physiographic features to represent the best national and regional example of natural habitat, physical landscape features or sites of importance for rare or protected species. National Nature Reserves (NNRs) and Marine Nature Reserves (MNRs) are designated under the Environment Order. Sites maintaining UK Red Data Book species that are listed as being either of unfavourable conservation status in Europe, of uncertain conservation status or of global conservation concern. Sites maintaining species listed in Schedules 1, 5 and 8 of The Wildlife (NI) Order 1985, as amended.
Regionally important sites (medium conservation value)	Sites that reach criteria for Local Nature Reserve but do not meet ASSI selection criteria. Sites of Local Importance for Nature Conservation (SLNCIs) are recognised by Planning Service and are intended to complement the network of nationally

Value/Importance	Criteria
	and regionally important sites. SLNCIs receive special consideration in relation to local planning issues. Sites supporting viable areas or populations of priority habitats/species identified in the UK Biodiversity Action Plan or smaller areas of such habitat that contribute to the maintenance of such habitat networks and /or species populations. Sites maintaining habitats or species identified in Regional Biodiversity Action Plans based on national rarity or local distribution. Other sites of significant biodiversity importance (e.g. sites relevant to Local Biodiversity Action Plans).
Local (lower conservation value)	Sites not in the above categories but with some biodiversity interest. Examples of lands of lower ecological value include; intensive agricultural lands and coniferous forestry.
Negligible conservation value	Sites with little or no local biodiversity interest.

Table 7.2: Factors to be considered when assessing magnitude of ecological impacts

Parameter	Description
Extent	The area over which an impact occurs.
Duration	The period required for a feature to recover or be replaced following an impact. Duration of an activity may have a shorter duration than the impact of the activity.
Reversibility	A permanent impact is one from which recovery is unlikely within a reasonable timescale. A temporary impact is reversible either through natural recovery or because of mitigation.
Timing and frequency	In some cases, an impact may only occur if it occurs during a critical season or part of a species' life-cycle, and may be avoided by careful scheduling of work activities. Frequency of an activity may also affect the magnitude of its impact by reinforcement of the impact.

Table 7.3: Criteria for assessing magnitude of ecological impact

Significance	Description
Severe adverse	The development fails to satisfy the subject environmental objective and results in major fundamental deterioration of the environment at national and international levels of importance. Proposed development activities will result in a major alteration to the baseline ecological conditions, resulting in fundamental change and major environmental deterioration. Large adverse impacts are attributed to any significant adverse impact on habitat and species (or other valued ecological receptors) identified as being of International significance. Highly significant impact, warrants refusal of planning permission.
Major adverse	The proposal (either on its own or in-combination with other proposals) may adversely affect the site, in terms of coherence of its ecological structure and function, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest.
Moderate adverse	The site's integrity will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If it cannot be clearly illustrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as a major adverse.

Significance	Description
Minor adverse	Neither of the above applies, but some minor adverse impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Negligible	Very minor alteration to one or more characteristics, features or elements.
Neutral	No observable impact in either direction.

Table 7.4: Factors to be considered when assessing ecological significance of impacts

Factor	Defining criteria
Site integrity	Extent to which site/ecosystem processes will be removed or changed. Effect on the nature, extent, structure and function of component habitats. Effect on the average population size and viability of component species, size and viability of component species.
Conservation status	Habitats: conservation status is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area. Species conservation status is determined by the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area. Conservation status may be evaluated for any defined study area at any defined level of ecological value. The extent of the area used in the assessment will relate to the geographical level at which the feature is considered important.
Probability of expected outcome	Known or likely trends and variations in population size/habitat extent. Likely level of ecological resilience.

Table 7.5: Significance of impacts

Significance	Description
Severe adverse	The proposal (either on its own or with other proposals) is likely to adversely affect the integrity of a European or nationally designated site, in terms of coherence of its ecological structure and function, across its whole area, that enables it to sustain the population levels of species of interest, or is likely to adversely affect the numbers, distribution or viability of a species or population of conservation concern. A major change in a site or feature of local importance may also enter this category.
Major adverse	The integrity of a European or nationally designated site will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If, in the light of full information, it cannot be clearly illustrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as very large adverse.
Moderate adverse	The proposal may adversely affect the integrity of a locally important conservation site, or may have some adverse effect on the numbers, distribution or viability of a species or population of conservation concern.
Minor adverse	None of the above applies, but some minor negative impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Neutral	No observable impact in either direction.
Minor beneficial	The development partly satisfies the subject environmental objective and partly contributes to the environmental context. Proposed development activities will result in minor improvements to baseline ecological conditions and should result in minor environmental gains.

Significance	Description
	Slight beneficial impacts can be attributed to benefits to any valued ecological receptors. Environmental gains which can easily be achieved through standard practices.
Moderate beneficial	The development satisfies the subject environmental objective and contributes to the environmental context. Proposed development activities will result in recognisable improvements to baseline ecological conditions and will result in notable environmental gains. Moderate beneficial impacts can be attributed to benefits to any valued ecological receptors where improvements are expected to be significant. Environmental gains which require detailed design consideration – potentially employed to offset slight/moderate adverse impacts elsewhere.
Major beneficial	The development satisfies the subject environmental objective and results in a major contribution to the environmental context. Proposed development activities will result in quantifiable improvements to baseline ecological conditions and will result in significant environmental gains. Large beneficial impacts are only attributed to substantial benefits to valued ecological receptors identified as being of National or International importance and where such benefits will result in the consolidation and/or expansion of areas of habitats or ensure the security and/or expansion of viable populations of species. Environmental gains which require very detailed design consideration – potentially employed to eliminate and offset potential significant adverse impacts elsewhere.

7.86 Cumulative impacts may also arise. Other projects that have been included in the cumulative impact assessment are:

- Wind farm projects which have received planning consent; and
- Other development projects with valid planning permissions, and for which formal EIA is a requirement or for which non-statutory EIA has been undertaken. The cumulative impacts of different projects are assessed against the significance criteria outlined in **Table 7.6**.

Table 7.6: Criteria for assessing the significance of cumulative effects

Significance	Effects
Severe	Effects that the decision-maker must consider as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issue.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

Baseline Conditions

Desk Study Results

7.87 The results of the desk study detail designated nature conservation sites and/or ecological records of protected species or species of natural heritage importance within 2km of the Planning Application Boundary.

Plants of additional conservation interest

7.88 The food plant (devil's-bit scabious *Succisa pratensis)* of the marsh fritillary butterfly *Euphydryas aurinia* is present locally at a low density outside the Planning Application Boundary and is sparsely present in the vicinity of any infrastructure.

7.89 No examples of bog myrtle *Myrica gale* (food plant for the larvae of the argent and sable moth *Rheumaptera hastata*, a UK priority species) were found on the site.

Site Overview

7.90 The site is situated across the extensive northern and north-eastern slopes of Mullaghcarbatagh Mountain and part of the north-western slope of adjacent Mullaghclogher Mountain in the north Sperrins; the peak of Mullaghcarbatagh (517 m) is situated to the immediate south of the blue line boundary and the peak of Mullaghclogher (572 m) is situated a short distance to the south-east of the blue line boundary. Adjacent slopes of the two mountains meet in a shallow valley created by the Glengarrow River which flows across part of the site to the north, where it merges with the Burn dennett River along the north-eastern part of the Preliminary Site Boundary (hereafter referred to as 'the Site').

Designated Nature Conservation Sites

Internationally Designated Nature Conservation Sites

7.91 Four Special Areas of Conservations (SACs) are situated within 15 km of the centre of the Site: these are detailed in paragraphs 6.137 to 6.159 of Chapter 6.

Nationally Designated Nature Conservation Sites

7.92 There are two Areas of Special Scientific Interest (ASSIs) situated within 7.5 km of the Site:

ASSI296: River Faughan and Tributaries

7.93 The River Faughan and its tributaries have been designated on account of their physical features and associated flora and fauna; the latter include Atlantic salmon *Salmo salar* which is present in internationally important numbers, Dipper *Cinclus cinclus*, Kingfisher *Alcedo atthis* and Otter *Lutra lutra*. The site also supports blocks of sessile oakwood. It is situated 3.3 km to the north-north-east of the Site.

ASSI195: Silverbrook Wood

7.94 The wood is designated for its woodland flora and fauna. Despite its moderate extent, Silverbrook Wood includes a number of woodland plant communities, ranging from strongly acidic to flushed and base-rich. As a result of this variation, the area has one of the richest woodland plant assemblages in Northern Ireland and supports a number of notable woodland plants and animals.

7.95 There are a further three ASSIs within the study area which are designated for their earth science interests rather that for nature conservation and therefore, these are not considered further.

Locally Designated Conservation Sites

7.96 The NIEA Natural Environment Map Viewer (which maps Local Wildlife Sites, which are equivalent in conservation interest to SLNCIs) was reviewed and found a single site within 500 m of the scheme red line:

- Mullaghcarbatagh Local Wildlife Site – designated on account of supporting blanket bog habitat, this encompasses part of the Site and lands to the immediate north-east and south-west.

Species Action Plan species

7.97 Several non-avian species for which NIEA has published Species Action Plans (SAPs) occur or may occur in the study area. SAP species that are known to occur or may occur at the site include; Irish hare, all bat species (the subject of an all-Ireland SAP) and otter. Occurrence of and significance of impact on these species are discussed below.

Existing Biological Records (NIPS)

Mammals

7.98 There are CEDaR records of Otter *Lutra lutra* from the Burn dennett River, the most recent being from 2002; Irish Hare *Lepus timidus hibernicus* from near Bradkeel Forest on Mullaghclogher Mountain in 1998; and a single record for Red Squirrel *Sciurus vulgaris* from Doorat which is c.4km to the north of Plumbridge in 1997.

Species Baseline

Bats

7.99 A site visit was undertaken during April 2022 to consider the potential value of habitats and landscape features within 200 m of the proposed turbine locations (i.e., the bat study area). The presence of any features that could support maternity roosts and significant hibernation and/or swarming sites (both of which may attract bats from numerous colonies from a large catchment) within 200 m plus rotor radius of the proposed turbine locations was also considered.

7.100 The landscape surrounding the site consists of several features that have potential to provide habitat for bats, notably open moorland, acid grassland, as well as several watercourses. However, overall habitat quality for bats is poor due to a combination of the exposed nature of the site, habitat types and grazing pressure from livestock which has resulted the site having very limited shelter and vegetation in order to provide suitable foraging conditions.

7.101 Thence, the overall foraging potential of the study area is considered 'poor' as it comprises mostly heavily grazed degraded blanket bog, heath and marshy grassland. However, the site is connected to the wider landscape by linear features (i.e., minor watercourses) that could be used by commuting bats. Landscape features such as watercourses can be seen on the aerial photography in Figure 7.1: Static Monitoring Locations. Habitat types are shown in Figure 6.2: JNCC Phase 1 Habitat Survey Map.

7.102 The overall potential of the wider site was of 'low' value however; the watercourses are of 'medium' value for bats. This takes into consideration the wider landscape, the habitats and landscape features identified on the site, the distance from the proposed turbines and the potential use of the site by bats for roosting, foraging and/or commuting.

Automated Passive Monitoring

7.103 Automated passive monitoring was undertaken at the site across spring, summer and autumn during 2022. Monitoring took place at 11 potential turbine locations (see **Figure 7.1 – Static Monitoring Locations**).

7.104 Across the three seasons (spring, summer & autumn), automated monitoring was carried out for 30 nights (estimated total hours = 3327 hours (based on an average of eight hours recording per night (although night length varies across the survey season)). Bat species recorded during automated passive monitoring included; common pipistrelle, soprano pipistrelle, pipistrelle spp., Nathusius pipistrelle, Leisler's bat, Myotis species. (*Myotis daubentonii*, *M. nattereri* and *M. mystacinus*) bat are the most difficult species to identify and are therefore collectively referred to as Myotis bats (Russ 1999[5] & Russ 2012[6])), as well as a few records for brown long-eared bat.

7.105 **Appendix 7.1** contains Bat Activity Indices (BAI) for the static surveys, broken down by proposed turbine location. These indices are based on the total number of files (containing a recording) of each species, divided by the total number of survey hours for that location.

Table 7.7: Description of levels of bat activity (adopted from Mathews et al., 2016)

Description	Bat Activity Index	Interval between passes
Negligible	<1	>60 minutes
Low	1 – 5	12 – 60 minutes
Moderate	5 – 12	5 – 12 minutes
High	12 – 60	1 – 5 minutes

[5] Russ, J. (1999) *The Bats of Britain and Ireland, Echolocation Calls, Sound Analysis and Species Identification*, Alana Ecology Ltd, Shropshire.
[6] Russ, J. (2012) *British Bat Calls, A Guide to Species Identification*, Pelagic Publishing, Exeter.

Near-constant	>60	<1 minute

7.106 Activity levels were negligible across 52.6% (162 out of 308 nights total) of the monitoring period. There were 86 nights of low bat activity during spring, summer and autumn.

7.107 There were 28 nights of moderate activity at turbines T1-8, 10, 12, recorded during spring, summer and autumn. There were 32 nights of high activity recorded at turbines T1, 3, 5-10, 12 recorded during the summer and autumn monitoring period.

7.108 All species most at risk from collision were recorded (Appendix 7.1 contains a detailed breakdown of activity at each turbine during each night of monitoring). Therefore, a Bat Monitoring & Mitigation Plan has been recommended.

Other Mammals

Otter

7.109 The presence of this species within the site was not confirmed during otter surveys, with two weathered mammal scats being recorded near waterbodies and a single naturally occurring rock cavity also near a waterbody which had some potential to act as a temporary resting place for Otters. However, there were no otter holts or other field signs recorded. The watercourses within the site are upland streams and drainage channels, the former of which are devoid of any significant riparian vegetation; some drainage channels are defunct and partially choked with bog vegetation.

7.110 It was not possible to survey parts of the Burn dennett River along the north-eastern site boundary as a combination of dense riverside tree cover, steep sloping banks and sheer rock faces prevented access on foot.

7.111 Otters are known from the Burn dennett River and there is therefore the potential for otters to travel along and/or across parts of the site on occasion e.g., during dispersal of young animals or when travelling between the numerous minor catchments within the wider catchment.

Badger

7.112 The results of the badger survey are presented in (confidential) **Appendix 7.2**.

Herpetofauna

Viviparous Lizard

7.113 Lizard *Lacerta vivipara* surveys commenced when the first (500x500mm artificial refugia) were placed across the site on the 11th May 2023. These were left in-situ for at least a week to allow the lizards to become acclimatised to their presence. This coincides with the NIEA Specific Requirements (in force at the time of survey) for this species, which states that "surveys should be carried out between March and October.

With the best time for surveys to be undertaken is generally April-May and in September."

7.114 **Appendix 7.3** Details the results of the lizard surveys undertaken during the 2023 survey season.

7.115 Habitat suitable for supporting common lizard is present across the site and common terrestrial invertebrates were observed, confirming ample food source.

7.116 Ten lizards were observed during the survey period. These sightings occurred in the west and centre of the application site: no lizards were found to the east, where refugia 24 – 30 were deployed. Lizard scat was observed on nine refugia – again these refugia were located in the west and centre of the site. No lizard scat was observed in the refugia deployed to the east of the site. Figure 7.3 shows the locations of these results relative to the proposed infrastructure.

7.117 It is difficult to convert survey counts into an indication of relative population size for reptiles due to the inherent challenges associated with the survey methodology, and as such it should be noted that each survey visit may only reveal a small sample of the true population. A basic estimation of the population was conducted by assessing survey results against the Key Reptile Site Survey Assessment Categories (Froglife 1999[7]). This assessment details that Low (<5), Good (5-20) and Exceptional (>20) population scores are determined by the maximum number of adults observed in one day. Ten lizards were observed in total across the site and the maximum number observed in one day was two. The lizard population across the proposed windfarm site is therefore categorised as Low.).

Assessment of Impacts

General

7.118 Having defined the ecological baseline characteristics of the study area, it is necessary to describe the potential resultant scheme-related changes to the baseline and to assess the impact on valued ecological resources (CIEEM 2018)[8]. The process of identifying impacts refers to aspects of ecological structure and function on which a resource feature depends. Examples of aspects of ecological structure and function to consider when predicting impacts include (CIEEM 2018):

- Available resources (Territory: hunting/foraging grounds; shelter and roost sites; breeding sites; corridors for migration and dispersal; stop-over sites);
- Stochastic processes (Flooding, drought, wind blow and storm damage, disease, eutrophication, erosion, deposition and other geomorphological processes, fire and climate change);

[7] Froglife (1999) Reptile Survey: An Introduction to Planning, Conducting and Interpreting Surveys for Snake and Lizard Conservation. Froglife Advice Sheet 10

[8] Chartered Institute of Ecology & Environmental Management (CIEEM) (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (September 2018)*.

- Ecological processes (Population dynamics: population cycles; survival rates and strategies; reproduction rates and strategies; competition; predation; seasonal behaviour; dispersal and genetic exchange; elimination of wastes. Vegetation dynamics: colonisation; succession; competition; and nutrient-cycling);
- Human influences (Animal husbandry, cutting, burning, mowing, draining, irrigation, culling, hunting, excavations, maintenance dredging, earth shaping, ploughing, seeding, planting, cropping, fertilising, pollution and contamination, use of pesticides and herbicides, introduction of exotics, weeds and genetically modified organisms and disturbance from public access and recreation, pets and transport);
- Ecological relationships (Food webs, predator-prey relationships, herbivore-plant relationships, herbivore-carnivore relationships, adaptation and dynamism);
- Ecosystem properties (Fragility and stability, carrying capacity and limiting factors, productivity, community dynamics; connectivity; source/sink; numbers in a population or meta-population, minimum viable populations; sex and age ratios; patchiness and degree of fragmentation);
- Ecological role or function (decomposer, primary producer, herbivore, parasite, predator, keystone species).

7.119 Impacts on ecosystem structure and function are assessed by reference to the following parameters:

- Positive or negative impacts, with international, national and local policies increasingly pressing for projects to deliver positive biodiversity outcomes
- Magnitude, or size of an impact, which in the case of habitat may be coincident with extent
- Extent over which an impact is felt
- Duration of time over which the impact is expected to last prior to recovery or replacement of the resource or feature
- Reversibility, or whether an impact is permanent or temporary
- Timing and frequency of an activity, which may have different impacts depending on, for example, the season during which it is carried out.

7.120 EIA legislation requires the enumeration of significant negative or positive impacts of an activity on ecological features. An ecologically significant impact is here defined as an impact on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area (CIEEM 2018). The significance of an impact depends on the importance of a receptor as defined in **Table 7.1** and on the magnitude of the impact on that receptor as defined in **Table 7.2**. Receptor impacts may be averaged against each other to assess the significance of the impact of the scheme on the site's natural environment, but in some cases a single receptor, for example an internationally important species or habitat, may be of sufficiently critical importance that the magnitude of impact on that single receptor defines the significance of the impact on the site. The following narrative assesses the significance of the impact of the Proposed Development.

Construction Phase

7.121 Activities that may be associated with construction of the Proposed Development and that may generate impacts on the natural environment near the proposed scheme include:

- Disturbance of designation features/designated sites;
- Disturbance to protected species;
- Construction of hard surfaces for access roads, turbine bases and construction platforms;
- Construction on new ground, leading to habitat and population constriction and/or fragmentation;
- Storage of materials and plant, and construction of site compounds;
- Environmental incidents and accidents (e.g. spillages, noise and emissions;
- Excavation works;
- Removal and redistribution of topsoil and subsoil;
- Provision of temporary access routes;
- Disruption or modification of drainage;
- Vegetation clearance; and
- Implementation of landscape design and habitat management.

7.122 The significance of the potential effects of the proposed scheme on valued ecological receptors during the construction phase has been assessed and outlined in the following sections.

Bats

7.123 Construction activities have the potential to remove foraging habitat or reduce its value, and to disrupt flight-lines. Studies in Britain indicate that most bat activity is near habitat features. Activity declines with distance from features such as treelines and woodland edge and is generally not significant at distances greater than 50 m (Natural England 2014[9]). This decline occurs both when bats are commuting and when foraging, although the decline is greater when animals are commuting. The potential impact of loss of feeding habitats may vary seasonally, with greater impact during the summer, and lower impact during migration.

7.124 Low numbers of bats were recorded foraging over the site, while the main bat foraging and commuting routes have all been avoided during the emplacement of infrastructure. A few river crossings will be required during construction, and therefore this may cause some limited disruption to foraging areas. However, most bat activity will likely continue as the main areas of better foraging along the wooded

[9] Natural England Technical Information Note TIN051 Third edition February 2014, Bats and onshore wind turbines Interim guidance.

escarpment edges will remain untouched during construction activities and key commuting routes will therefore be unaffected.

7.125 The other main potential impact on bat populations that may arise due to construction is the loss of roost sites. However, no roosts were identified on the site during survey, and the nearest potential roosting location is 450 m away from the nearest turbine. Therefore, this impact will not arise at the Proposed Development. The magnitude of construction activities on bats is likely to be **neutral**, and the significance of the impacts will be **neutral**.

Otter

7.126 Impacts of construction works on otters includes damage to holts, disturbance at holts, disruption of dispersion and foraging routes and displacement of foraging or breeding animals. Disturbance of otters is possible during the construction phase, but the shy species is likely to avoid areas of intense human activity, particularly when this involves significant noise. Potential indirect impacts include adverse effects on fish prey species (see **Chapter 9** – **Fisheries and Aquatic Ecology**). The species is largely crepuscular in its habits, and it is likely that much of its activity will take place outside normal working hours. However, the reaction of individual otters to disturbance is unpredictable, with some inquisitive animals drawn to investigate work sites, whilst others avoid them. The likely sporadic nature of any use by otters of the site, indicates that there is highly unlikely to be any significant impact on the species as a result of construction activities. Magnitude of impacts is likely to be **negligible to neutral** and of **neutral** significance.

Badger

7.127 Potential conflicts with badgers (arising from construction) include damage to setts, disturbance at setts, and removal of foraging areas and displacement of foraging or breeding animals. Construction works may present additional hazards to badgers, with a potential for entrapment within excavations, accidental injuries on construction plant or materials, diversion from traditional trails by plant and site compounds and exposure to oils and other toxic materials.

7.128 There are numerous of badger setts located within the site and thus there is the potential for such disturbance to occur. Badgers have crepuscular and nocturnal foraging habits, and it is unlikely that daytime construction activities will disturb or reduce the foraging range of the local social group. However, construction of access tracks, crane bases, foundations and erection of turbines will reduce the area available for foraging.

7.129 There is also the potential risk of displacement of sensitive animals unaccustomed to high levels of anthropogenic activities. The potential magnitude of impact (without mitigation) on badgers during the construction phase is moderate adverse magnitude and significance.

7.130 However, the location of known badger setts has been identified and taken into consideration during the emplacement of site infrastructure such that there are no sett entrances are within 25m of any infrastructure. In addition, the majority of setts near to areas of infrastructure are close to existing tracks and any disturbance impact if likely to be ameliorated by this fact. As a result of this mitigation measure, the potential impacts are of **minor adverse magnitude** and **minor significance** during construction.

Common Lizard

7.131 Construction of infrastructure will remove habitat for this species and cause disturbance leading to displacement of animals over a limited area of the site. It also has the potential to impact the habitat feature/requirements that lizards need within suitable habitat; this includes areas for basking, foraging, diurnal shelter and hibernation. The recorded use of the site by this species indicates that these impacts have the potential to be of **moderate adverse magnitude** and of **moderate adverse significance**. Therefore, mitigation is required (see paragraphs 7.191 – 7.200).

Operational Phase

7.132 Characteristics of wind farms that may generate impacts on the natural environment in the vicinity of the proposed scheme include:

- Replacement of former semi-natural habitats by turbines and associated infrastructure;
- Use of a swept volume of air space by turbine rotors;
- Vehicular use of access routes; and
- Improved access to remote sites.

7.133 Many of the impacts on biological receptors noted for the construction phase are also relevant during the operational phase. However, effective land take is reduced following the construction phase, as temporary site compounds and vehicle and plant running surfaces are returned to their former vegetation cover, and disturbance pressures arising from human presence along the route are significantly reduced.

7.134 Impacts on valued ecological receptors are outlined below.

Bats

7.135 The main potential impacts on bats during the operational phase arise from collision with rotors and from ‘barotrauma’, the often-fatal injuries that occur as a result of bats flying through air of rapidly changing atmospheric pressure in the immediate vicinity of a moving blade. The turbines have been located away from the habitat features that many species of bat use as flightlines or as a focus for foraging.

7.136 There is potential for loss of foraging area because bats may avoid a turbine site. Alternatively, there is some evidence that bats may be attracted to turbines (Kunz et al 2007[10]), possibly because insects may congregate in these locations as a response to the heat radiating from the structures (Ahlén 2003[11]). This effect is most likely to occur in calm conditions, or at low wind speeds, when collision risk for bats is likely to be at its highest.

7.137 A further possible operational impact is that ultrasound emissions from turbines may interfere with bats' echolocation capabilities. The literature addressing this effect is sparse and it is likely that impacts on Irish bat species is limited (European Commission 2010[12)]. **Table 7.9** outlines the bats likely to be at risk from wind turbines.

7.138 Seasonal variation in impacts of operational turbines on bats in Ireland is at present not fully understood. Movement of bats over long distances within a limited time period may produce a concentration of animals that are available for collision. Studies have shown that there is a peak in mortality in late summer and autumn during dispersal and migration, and that migrating species are most susceptible (Rodrigues et al 2008[13]). However, it is not known to what extent Irish bats migrate, which species, if any, are involved, whether migration is on a broad or narrow front, and whether there are discernible migration routes. It has been suggested that collisions during migration may be exacerbated because echolocation is not used in order to save energy (Keeley et al 2001[14]).

7.139 Late summer and autumn are also the period during which there may be increased activity associated with finding mates, and differentiating between migration and mating-related causality of mortality at turbines is problematic (Cryan and Barclay 2009[15]). Recent research into Leisler's bat in Ireland (Boston, 2008[16]) showed that this species does not migrate long distances between summer ranges and hibernation sites. Leisler's have been shown to hibernate within Ireland and do not appear to migrate in numbers on a broad front. This is likely to significantly reduce the collision risk for this species in the Irish context. However, in the absence of definitive data for all species, it is not possible to assess the likelihood, and hence the significance, of collision risk during putative migration periods. **Table 7.9** outlines the risk of collision fatalities affecting bat populations identified from the site.

[10] Kunz, T.K., Arnett, E.B., Erickson, W.P., Alexander, A.R.H., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W. & Tuttle, M.D. (2007) Ecological impacts of wind energy development on bats: questions, research, needs and hypotheses. – Frontiers in Ecology and the Environment 5: 315-324. R.

[11] Ahlén, I. (2003) Wind turbines and bats – a pilot study. – Report to the Swedish National Energy Administration, Dnr 5210P-2002-00473, P-nr P20272-1.R.

[12] European Commission (2010) Guidance on wind energy development in accordance with the EU nature legislation. European Commission, Brussels.

[13] Rodrigues, L., Bach, L., Duborg-Savage, M-J., Goodwin, J. & Harbusch, C. (2008) Guidelines for consideration of bats in wind farm projects. – EUROBATS Conservation Series No. 3, UNEP/EUROBATS Secretariat, Bonn.

[14] Keeley, B., Uogretz, S. & Strickland, D. (2001) Bat ecology and wind turbine considerations. –pp135-141 in Schwartz, S.S. (2001, ed) Proceeding of the National Avian-Wind Power Planning Meeting IV, Carmel, CA, May 16-17, 2000.

[15] Cryan, P.M. and Barclay, R.M.R. (2009) Causes of bat fatalities at wind turbines: hypotheses and predictions. Journal of Mammalogy, 90(6):1330–1340.

[16] Boston (2008) Molecular ecology and conservation genetics of the Leisler's bat (*Nyctalus leisleri*) in Ireland. Unpublished Ph.D Thesis.

Table 7.9: Level of potential vulnerability of populations of N. Irish bat species[17]

		Low collision risk	Medium collision risk	High collision risk
Relative abundance	Common species			Common pipistrelle Soprano pipistrelle
	Rarer species	Brown long-eared bat Daubenton's bat		Nathusius' pipistrelle Leisler's Bat
	Rarest species	Whiskered bat Natterer's bat		

7.140 In the absence of mitigation, bats flying along the site would be potentially in close proximity to the rotor swept areas during foraging and commuting activity. This could potentially result in bat fatalities. Therefore, under the precautionary principle (and without mitigation) this project has the potential to have a **moderate adverse** impact magnitude, of **major adverse** significance during the operational phase. As a result, detailed mitigation by design has been developed and implemented. In addition to the layout design, a detailed BMMP has been recommended.

7.141 With mitigation, and based on currently available data on all species of (Irish) bat species, the impact magnitude can be reduced to **neutral** significance during the operational phase of the Proposed Development.

Otter

7.142 The level of potential disturbance to otters is less during wind farm operation as compared with the construction phase, as the site reverts to minimal human presence. There is likely to be **neutral** impact magnitude and significance during the operational phase.

Badger

7.143 The use of access tracks will be mainly limited to single-vehicle journeys for maintenance and there will be minimal collision risk to badgers. There will be no additional impacts on badgers as a result of the operation of the Proposed Development. There is likely to be **neutral** impact on magnitude and significance during the operational phase.

Common Lizard

7.144 The use of access tracks will be mainly limited to single-vehicle journeys for maintenance, and there will be minimal traffic risk to lizards. The additional likely impacts on this species as a result of the operation of the Proposed Development will include species specific habitat management and enhancement measures. Overall,

[17] There is no Ireland specific section with the SNH guidance, therefore the Table 2 ('Scotland') has been adapted for use here (with Brandt's and Noctule bats removed) as this is the closest match to the bat species assemblage found locally to the Site.

the successful implementation of these measures during the operational lifetime of the wind farm is likely to be of **minor positive** magnitude and of **beneficial** significance.

Decommissioning Phase

7.145 Impacts associated with decommissioning a wind farm bear many similarities to those arising during construction. Many of the work processes are similar and plant and vehicle movements are likely to be at a similar scale. It is assumed that decommissioning will require the removal of all above ground structures; the removal of all underground structures to one metre below ground level; and reinstatement of disturbed areas.

Species of Conservation Concern

7.146 Impacts on protected mammals and reptiles during decommissioning are likely to be of a similar scale and nature to those that occurred during construction and are unlikely to be significant.

7.147 Each of these impacts is described and assessed below and the unmitigated impacts, mitigation measures and residual impacts are summarised in tabular form (**Tables 7.8 & 7.10**).

Table 7.8: Significant Effects upon Valued Ecological Receptors (Prior to Mitigation)

Impact	Nature of Effect	Magnitude	Significance
Construction			
Bats	Disturbance of European Protected Species during construction activities	Neutral	Neutral
Otter	Temporary disturbance from construction works unlikely	Negligible	Neutral
Badger	Temporary disturbance from construction works probable	Minor	Minor Adverse
Common lizard	Temporary disturbance from construction works and loss of habitat	Moderate	Moderate Adverse
Operational			
Bats	Potential collision of European Protected Species with turbine blades (or barotrauma) during the operational phase	Moderate adverse	Major Adverse
Otter	Operational effects unlikely	Negligible to Neutral	Neutral
Badger	Operational effects unlikely	Negligible to Neutral	Neutral
Common lizard	Loss of habitat for the operational lifetime of the wind farm	Negligible to Neutral	Neutral
Decommissioning			
Bats	Disturbance of European Protected Species during decommissioning activities unlikely	Neutral	Neutral
Otter	Temporary disturbance from construction works unlikely	Negligible	Neutral

Impact	Nature of Effect	Magnitude	Significance
Badger	Temporary disturbance from decommissioning works possible	Minor	Minor Adverse
Common lizard	Temporary disturbance from decommissioning works unlikely	Neutral	Negligible

Design Evolution & Mitigation

7.148 The purpose of what is broadly classed as mitigation is to maintain the conservation value of a development site as far as is possible, and to exploit opportunities to enhance the site's conservation value wherever possible. This can be achieved by (CIEEM 2022):

- avoiding negative ecological impacts - especially those that could be significant;
- reducing negative impacts that cannot be avoided; and
- compensating for any remaining significant negative ecological impacts.

7.149 The aims of mitigation can be best achieved by choosing locations that allow sites or features of conservation value to be avoided; **Chapter 3: Design Evolution & Alternatives** provides a full description of the design evolution process which includes details on avoidance measures, including buffers to potential bat habitat features and badger setts.

7.150 Avoidance and impact reduction techniques relate to reducing the footprint of the development and any ancillary works as far as is practicable. Measures required to address ecological concerns described in this ES during the construction phase will be implemented by an Ecological Clerk of Works (ECoW) as detailed in the outline Construction Environmental Management Plan (oCEMP) in **Technical Appendix 1.5** and will be incorporated within a Construction & Decommissioning Method Statement (CDMS), which will be submitted to and agreed with the Department at the pre-construction stage. Avoidance and impact reduction measures include:

- No turbine rotors are within 50m from the edge flight-lines such as streams, which is the minimum stand-off distance from blade tip to the nearest habitat feature likely to be used by bats, (Natural England 2014). These buffers are built into the layout of the Proposed Development as described in Chapter 3: Design Evolution & Alternatives.
- Consideration will be given to the provenance of fill materials for roads, in terms of the similarity of their physicochemical properties (particularly pH) to the present substrate.
- The contractor will prepare a CDMS prior to construction activities to provide a method statement for working practices that will include measures, among others, to prevent adverse impacts on rivers and other watercourses. Please also refer to the SUDS design Statement in Appendix 10.1.
- A "no access" buffer will be implemented along sensitive watercourses to prevent damage to banks and to prevent disturbance of riparian habitats, apart from the narrow corridor required during construction.

- Access of all machinery and personnel will be limited to the working area corridor.
- Site compounds and stores will be sited away from any features of conservation interest, including watercourses. Any of these features in close proximity to the works or to compounds will be fenced to prevent damage by plant or stored materials.
- Dust suppression filters and appropriate wetting of running and work surfaces will be used to prevent masking of vegetation outside construction corridors, where appropriate.
- Appropriate speed limits will be imposed to reduce the potential for dust production.
- Excavations left unattended overnight should be ramped in at least one location to allow mammals to avoid becoming trapped.
- It is also recommended that, to minimise the risk of suspended sediment entrainment in surface water run-off, the site drainage system should only be carried out during periods of low rainfall and therefore minimum run-off rates.

7.151 Of particular importance for the maintenance of habitats and associated fauna is the institution of good management practices that prevent the discharge of silt and pollutants into the local drainage system. Containment measures will include:

- Where works near or in watercourses are unavoidable, working practices will include standard methods designed to minimise sedimentation and pollution, and measures will be put in place before the works begin to ensure containment of any released sediments. These may include silt containment booms or sediment barriers, as appropriate. Land stripping will be done in stages to minimise the potential for concentrated, long-lasting pulses of silt to discharge into watercourses. All filtration systems will be monitored frequently, and they will be replaced before they become ineffective.
- Material storage compounds will be located remote from any watercourse. Surface water run-off high in suspended solids should be contained and treated prior to discharge to any watercourse. All storage tanks should be bunded and should be sited remotely from any watercourse. Works should incorporate the relevant Pollution Prevention Guidelines. Additionally, a Pollution Incident Response Plan should be put in place as part of the Construction Environmental Management Plan.
- Water should be pumped from turbine bases during construction either to areas of ground capable of absorbing the water or to settlement ponds prior to discharge. Any discharged water must be free of cementitious products.
- All tracks and drains will be maintained and monitored to ensure that surface water flow is directed as designed, and that ponding and blockages are prevented.

7.152 Further details about the proposed SuDS are included in **Technical Appendix 10.1**.

7.153 Avoiding or mitigating impacts arising from construction-initiated alterations of drainage patterns and infiltration regimes is of importance for preventing damage to both aquatic and terrestrial habitats. It must be appreciated that hydrological characteristics of peatland and the habitats that they support are inextricably linked, and that changes in hydrological regime will lead to changes in these habitats. The areas of blanket bog have been avoided by sensitive siting during the design process. The site hydrological regime is considered in detail in **Chapter 10: Geology & the Water Environment** and measures outlined there will be carried out in order to maintain the limited areas of conservation interest on the Site.

7.154 Sympathetic management of the wind farm habitats during the operational phase will provide the greatest opportunity for enhancing the conservation value of the site and should be regarded as compensatory mitigation for the permanent land take required for the new turbines and infrastructure.

7.155 The Outline Habitat Management Plan (**Appendix 6.2**) includes compensation and enhancement measures for lizard achieved by a significant reduction in grazing pressure within the habitat management area (shown in **Figure 6.5**) for the lifetime of the Proposed Development.

Species specific mitigation

Mitigation for bats

7.156 Under the precautionary principle, and due to the presence of several species of bat known for open-air foraging, i.e., considered at risk from turbine associated mortality (Leisler's bat; common and soprano pipistrelle, a BMMP will be implemented as follows.

7.157 The BMMP will include the use of "feathering". This shall involve pitching the blades to 90 degrees and/or rotating the blades parallel to the wind direction to reduce the blade rotation speeds below two revolutions per minute while idling. This will substantially reduce the risk of bats being struck by idling blades and will reduce the spatial extent of low-pressure vortices in the wake of the blades (i.e., will substantially reduce the potential for barotrauma to occur).

7.158 This BMMP will consist of post-construction monitoring in the form of casualty searches (with trained search dogs), undertaken during years 1-5 post construction.

7.159 Carcass searches will be conducted during the spring (15 Apr – 15 Jun), summer (15 Jun – 15 Aug) and autumn (15 Agu – 15 Oct). This monitoring will entail the systematic search for bat casualties within a 150m x 150m grid centred on the turbine. Searches will commence in April and be carried out as shown in Table 7.11 (adjusted accordingly depending on weather conditions; see below). They will begin no later than 1-hour post-sunrise to minimise the potential for carcass removal by predators. Three turbines will be searched during each visit, and these will be selected at random across the year.

Frequency of searches and number of turbines to be searched

7.160 It is recommended that systematic searches should be conducted within a 150m x 150m grid centred on each turbine. A minimum of 20 searches (for medium risk sites) per turbine should be conducted during spring, summer and autumn. Three turbines will be selected at random during each visit.

7.161 Searches will be conducted at 2 to 4-day intervals (based on National Bats and Wind Turbines study recommendations). Data must be obtained from the turbine operators on whether or not the target turbine was operational on the night preceding the search, with the surveying protocol being adjusted as necessary if the turbines were either non-operational or were not rotating because of a lack of wind.

7.162 To maximise the duration of monitoring during each season, whilst maintaining low carcass removal rates, it is recommended that surveying should be split into blocks as illustrated in Table 7.9 below. This schedule will be repeated for each season and across each of the five years of the programme.

Table 7.9: Summary of proposed schedule for carcasses searches (spring).

Days 1-10	Days 11-20	Days 21-30	Days 31-40	Days 41-50	Days 51-60
Initial 'sweep' then survey alternate days (d2, d4, d6, d8, d10)	No Survey	Initial 'sweep' then survey alternate days	No survey	Initial 'sweep' then survey alternate days	No survey

Bat Carcass (Mortality) Searches

7.163 Bat carcass searches will be undertaken using a specialist ECoW; and will only take place the morning after optimal conditions for bats have occurred. These are defined as;

- <5m/s ground wind speed,
- >10^{o}C of temperature (1 hour after dusk),
- no rain, and
- after a warm day of similar settled conditions (i.e. the dusk should have a peak in bat activity in the area).

7.164 Carcass searches will commence one hour after dawn to minimise the potential for carcass removal by predators.

7.165 This approach has been selected to maximise the likelihood of finding bat carcasses, which is essential in enabling predicted bat mortality to be accurately estimated. Bat carcasses (if found) will be collected to enable accurate species identification using DNA where required. A post-mortem will also be conducted in order to ascertain the cause of death.

7.166 Also, the recording of a bat activity across the application site will also take place using automated detectors at the turbine base paired with adjacent habitat features. The recording will be undertaken for 10-nights during Spring, Summer & Autumn. This will also allow for comparison with the date collected previously as part of the planning application.

Meteorological Data

7.167 Simultaneous daily collection of meteorological data including wind speed, temperature, and precipitation will be undertaken at the turbine location, alongside bat carcass searches to identify the effect on levels of bat activity at the turbine(s).

Operational curtailment

7.168 In the event that 1 dead bat is found (in any season) during carcass searches, curtailment of the turbine will be immediately implemented on a precautionary basis. This will involve increasing the cut-in speed to 5 m/s, which is recommended by Mathews et al (2016). As bats are nocturnal, the increased cut-in speed will only apply at night, measured from 30 minutes before sunset to 30 minutes after sunrise. The increased cut-in speed will only apply between the 15 Apr and the 15 Oct each year (i.e., the generally accepted bat activity season in NI). For the remainder of the year (i.e., 15 Oct to 15 Apr), the turbine manufacturer's cut-in speed will be used.

7.169 In addition, the turbine will be feathered when winds are below cut-in speed, which will involve pitching the blades to 90° and/or rotating the blades parallel to the wind. This will prevent the turbines from freewheeling or idling, and reduce the rotation rate to the minimum level required, ideally to below one revolution per minute. This will substantially reduce the risk of bats being struck by idling blades, and will reduce the spatial extent of low-pressure vortices in the wake of the blades (i.e., will substantially reduce the potential for barotrauma to occur).

7.170 Also, the recording of a bat carcass will escalate the searches to involve the use of trained scent dogs (although the search protocol and programme will remain unchanged).

Search efficiency trials

7.171 In addition to the proposed operational curtailment, the efficiency of the search dogs will be assessed based on integrated efficiency trials (Mathews et al., 2016). Use of this method will allow a correction factor for search efficiency to be factored into statistical modelling of numbers of bats which may be found dead beneath the turbine.

7.172 Carcasses will be dropped from waist height at randomly selected points within the search area under the turbine, on days when the dog teams are conducting searches and prior to searches taking place. The person placing the bats will not be involved in the search and will not reveal the exact number and location of bats that have been deployed to the dog teams until the trial is concluded.

7.173 When conducting observer efficiency trials for dog search teams, care will be taken to avoid transferring human scent to the specimen, for example by using tongs or disposable gloves. To allow human scent from footprints to dissipate, an interval of at least an hour will be left between placing the bats and conducting the searcher efficiency trial.

Scavenger removal rates

7.174 In order to determine the rate at which carcasses are removed (and therefore not be available for dogs to find), scavenger removal trials will be completed.

7.175 A carcass (of similar size and colour to a bat) will be left under the turbine each season. The carcasses will be placed out around dusk, and transference of human smell will be avoided. Carcasses will not be left under the turbine if and when searches are being carried out.

7.176 The carcasses will be monitored through the use of a motion-activated remotely operated camera for up to 10 days (battery life is affected by weather and the number of times the camera is triggered and is not entirely predictable). A second visit will be made to the site to check the cameras and change the batteries to ensure we can assess the scavenging rates over a three-week period. Assessing rates over a shorter timeframe would not enable a true test of scavenging removal rates to be made (Mathews et al., 2016). Different habitat types will be selected for the trials to ensure a robust evaluation of scavenging rates can be made.

7.177 The methods used in the Matthews (2016) study involved daily visits, rather than camera traps, to check corpses for the first seven days, but the use of camera traps will be more resource efficient and should also indicate the time at which the corpse was taken as well as the species of scavenger in most cases.

7.178 Different locations will be selected for the carcasses during each visit so that scavengers do not become familiar with feeding locations, and the cameras will be repositioned accordingly.

Estimating actual mortality rates

7.179 The number of observed bat carcasses recorded during the study will be corrected taking into account the area searched, scavenger rates and searcher efficiency results. Various researchers have proposed different approaches to data correction including Korner-Nievergelt et al. (2011), Korner-Nievergelt, et al. (2011), Bispo et al. (2012), and Lintott et al. (2016).

7.180 The most up to date formula for estimating the total number of carcasses present per turbine per season will be applied to the data collected at the end of the survey season

Remedial measures

7.181 The trigger threshold for remedial measures will be linked to 'significance' in line with the CIEEM guidelines for EcIA. Remedial measures will be triggered by an impact predicted to be of significance to bats at the Local level or greater.

7.182 For geographic context, the local level is considered to represent the site boundary plus a 15km radius. A significant effect would be triggered where the level of bat mortality is considered to reduce the ability of the bat population at the Local scale to sustain a viable and stable population, as informed by monitoring.

7.183 The requirement for and design of remedial measures will depend upon the findings and conclusions of monitoring and specific measures will be developed as appropriate to mitigate and significant impact predicted (those considered significant to bat populations at the Local scale or above). Where significant impacts are predicted, potential remedial options may include, but are not limited to, the feathering of individual turbines.

Mitigation for badgers

7.184 A 25m buffer zone around the entrances to a badger sett is usually recommended to protect the underground tunnels associated with the sett and allow badgers undisturbed access to it. However, due to the proximity of the proposed construction works associated with the development, it will not be possible to maintain this buffer in all cases.

7.185 Therefore, it is proposed to close this sett (No. 4) prior to commencement of construction work, in order to ensure that it is not used by badgers. The sett closure will be carried out by a suitably qualified ecologist who has obtained a licence from NIEA to disturb badgers. This work can only be carried out within the time constraints of the licence (July- November inclusive). As a main sett for this social group has already been identified in the wider locale, no further survey effort in this respect is required.

7.186 Sett closures involve the erection of a one-way gate over a period of 2 weeks at the entrances to the sett, which allows badgers to exit but not re-enter. The sett is monitored over the 2-week period to ensure that badgers have not breached the one-way gate. The sett can then be permanently closed at the end of the 2-week period.

7.187 To give confidence in continued badger sett absence within the construction buffer, updated pre-construction surveys should be conducted for this species specifically along proposed infrastructure locations / routes should one year elapse between the current survey dates and commencement of construction. These should follow the aforementioned methodology of Harris, Cresswell and Jeffries (1989) as adopted in the walkover surveys.

7.188 An emergency procedure will be communicated to site workers detailing what to do if badger setts are encountered. Should badgers or their setts be sighted during construction, all works (including those within a 25m buffer, or 100m for operations of high noise / vibration levels) will cease immediately. The Ecological Clerk of Works will inspect the site and define appropriate mitigation (if required). This could involve creating a BPZ (badger protection zone) and timing restrictions on works e.g., construction activities must occur only within daylight hours.

7.189 Development should not fragment key foraging habitats for badgers; due to the isolated location of the site and minimal human disturbance, it is anticipated that badgers will remain free to roam across the site following the proposed works therefore no further mitigation / compensation is required.

7.190 It should be noted that badgers are a mobile species and can excavate setts at any time. Should badger activity become apparent within the site prior to or during construction then all works should cease and NIEA should be immediately informed.

Mitigation for viviparous lizard

7.191 In the case of common lizard, it has been impossible to totally avoid impacts to this species, given the layout constraints. Therefore, the next course of action is to mitigate for any potential impacts.

7.192 The results of the common lizard surveys for the Proposed Development were assessed against the Key Reptile Site Survey Assessment Categories (HGBI 1998). This revealed that parts of the site had a good population (with ten individuals recorded). However, given the location of the records, it is also likely that much of the site is sub-optimal habitat for this species. This is likely a consequence of over-grazing.

7.193 Depending on the commencement of construction on site, the works corridor will be mowed. If possible, this work will be undertaken before the end February (to avoid a conflict with the bird breeding season). If this is not possible, then mowing will take place between August and September, when common lizards are likely to be fully active. Should the latter be required, the corridor will be subjected to an active nest survey by a suitably qualified ornithologist immediately prior to the commencement of mowing operations.

7.194 Clearance of stones, tree stumps, logs, brash, rocks or piles of similar debris will be undertaken carefully and by hand. Although this is only required in a few areas where the proposed site tracks traverse low stone walls. This work will not take place during the hibernation period for common lizard (i.e., mid-October to mid-March).

7.195 Clearance of tall vegetation will be undertaken using a strimmer or brush cutter with all cuttings raked and removed the same day. Cutting will only be undertaken in a phased way which will either include:

- Cutting vegetation to a height of no less than 30mm, clearing no more than one third of the site in anyone day or;
- Cutting vegetation over three consecutive days to a height of no less than 150mm at the first cut, 75mm at the second cut and 30mm at the third cut;

7.196 Following removal of tall vegetation using the methods outlined above, the remaining vegetation will be maintained at a height of 30mm through regular mowing or strimming to discourage common lizards from returning. Ground clearance of any remaining low vegetation (if required) and any ground works will only be undertaken following the works described above.

7.197 As an additional precaution the ECoW will be present from the commencement of clearance/construction with a watching brief to ensure that no common lizards remain within the construction corridor and remain in situ until the area is cleared to ensure no species or habitat conflicts emerge affecting damage to the local lizard population.

7.198 If any common lizards are found during excavation works, all works within the affected area will cease until the ECoW has safely removed them (under licence) from the construction corridor.

7.199 Should it prove necessary during site supervision (i.e., lizards are observed returning to the construction corridor); a protective lizard barrier fence will be installed along both sides of the construction corridor in order to prevent common lizards from entering the works area.

7.200 In total, there is >500 ha (of blanket bog; dry heath and marshy grassland) adjacent to the proposed construction corridor. These areas together provide more than sufficient suitable habitat.

Residual Impacts

7.201 Residual effects relating to land management that is designed to provide ecological benefits through the establishment of grazing measures which are appropriate within peatland and associated habitats (See **Appendix 6.2** – outline Habitat Management Plan) will result in more diverse and ecologically valuable habitat than the present degraded habitats that cover the majority of the site. Continuity of effective, appropriate management should result in the area becoming more biodiverse over time. With improved land management, it is anticipated that in the long term there will be at least a neutral residual impact on fauna of conservation concern. For habitats, a beneficial impact is likely if site management results in more diverse habitats of greater conservation value.

7.202 **Table 7.10** provides details of the residual impacts.

Table 7.10: Summary of Residual Impacts after Mitigation and Enhancement

Impact	Ecological Impact Significance without Mitigation	Mitigation & Enhancement	Ecological Impact Significance with Mitigation
Construction			
Temporary disturbance to bats	Neutral	No mitigation required	Neutral
Temporary disturbance to badgers	Moderate	A 25m buffer has been applied to all badger setts found within 25m of the construction area. A single outlier (single entrance) will have to be closed under licence. In addition, a pre-construction badger survey will be completed.	Neutral
Temporary disturbance to common lizard	Moderate	Implementation of species-specific mitigation to off-set potential significant effects including phased mowing of the vegetation within the construction corridor.	Negligible to Neutral

Impact	Ecological Impact Significance without Mitigation	Mitigation & Enhancement	Ecological Impact Significance with Mitigation
Operational			
Potential collision of bats with turbine blades	Major adverse	The proposed turbine layout was designed to ensure a minimum stand-off distance of 50 m (Natural England TIN051) to all habitat edges (shelterbelts and natural watercourses) which will be maintained through the lifetime of the Proposed Development. A Bat Monitoring & Mitigation Plan (BMMP) will be implemented under the Precautionary Principle.	Neutral
Disturbance to badgers	Neutral	None required. Habitat management will provide enhanced foraging areas across large areas of the site	Neutral
Disturbance to common lizard	Neutral	Implementation of species-specific enhancement to off-set potential significant effects includes; Management of 241.4ha of habitat which will also benefit this species.	Beneficial
Decommissioning			
Temporary disturbance to bats	Neutral	No mitigation required	Neutral
Temporary disturbance to badgers	Minor adverse	Pre-decommissioning badger survey recommended. In order to ensure no new setts have been excavated within the infrastructure footprint.	Neutral
Temporary disturbance to common lizard	Negligible	No mitigation required as no impact during the decommissioning phase is considered likely.	Neutral

Cumulative Impacts

7.203 When considered in the context of the overwhelming dominance of the impact of agricultural land-use change as the primary driver controlling the extent and quality of habitats in Northern Ireland, as well as natural variation (in species populations) over time, it is credible to assume that in only very exceptional circumstances will direct effects in aggregation between wind farm sites have any potential to be cumulatively of concern let alone significant (in EIA terms). It is not unreasonable to assume that any such aggregate effects that may be of significance are likely to be readily apparent to those considering individual applications who can inform consideration of specific detailed measures to avoid unacceptable effects[18].

7.204 The potential for a cumulative impact between proposed and operational wind farms arises principally if species from the same population are using more than one of the sites. The likelihood of this can be assessed through an analysis of the species assemblage and by examining the likely range and territory size of those species.

7.205 The potential cumulative impact of the Proposed Development in addition to (the wind farm (within 15km) was specifically considered. There are 11 windfarms

[18] Review of Guidance on the Assessment of Cumulative Impacts of Onshore Windfarms, Phase 1 Report, ENTEC, September 2008

(existing, in-construction or proposed), with a combined total of 91 turbines. These are;

- Owenreagh & Owenreagh Ext.
- Craignagapple
- Eglish
- Slieve Kirk and Slieve Kirk Ext.
- Carrickatane
- Ballyhanedin
- Lisnaharney
- Curryfree
- Barr Cregg.

7.206 The following sections assess the potential cumulative impacts, as a result of the Proposed Development with other proposed and operational wind farms, where relevant.

Bats

7.207 Outcomes which must be considered are whether the cumulative impact of wind farm developments will adversely affect the distribution of these species of European conservation concern, and whether there will be population-scale effects on any bat species. The most contentious species issue currently is the extent to which bats may be at risk of collision with turbines. There is potential for bats to forage across more than one wind farm and to be subject to at least the potential of an increased risk of collision. As yet there is no agreement on how best to address it, though specific impacts on bats have been addressed through the incorporation of precautionary stand-offs to habitat features (foraging and commuting areas), as well as the selection of windfarm sites with ‘low’ levels of bat activity.

7.208 The development therefore has the potential to increase bat mortality resulting from collision and barotrauma, and this impact is likely to be additive to similar impacts arising from the operation of other wind farms, at both local and regional scales. The absence of data relating to bat life cycles and to the intensity and spatial variation of activities during different parts of those life cycles means that there is difficulty in determining the significance of the cumulative impacts on bat species. It is likely that the significance of cumulative impacts will also vary between species, depending on inter alia local and regional abundance of different species, prey preferences, preferred flight height, preferred foraging habitat, degree of attraction to or deflection from turbines, extent of migratory behaviour, swarming characteristics and variability of behaviour in response to varying weather conditions. Bat behaviour and collision risk are likely to be highly site-specific during much of the annual cycle, but more generalised patterns, such as those relating to migration, may be superimposed on these local factors.

7.209 Whilst evidence is beginning to be revealed through a combination of academic research and on-going monitoring at wind farm sites, certainty with regard to cumulative effects is far from clear. This is because the effects of wind farms on bat populations is dependent on a wide variety of factors including; the turbine layout, the species of bats present, existing environmental conditions and the mitigation measures proposed at each wind farm (or individual turbine). Therefore, a clear understanding of the patterns of bat activity at individual wind farms (during the development of EIA's) is essential.

7.210 In the case of the Proposed Development a clear understanding of the patterns of bat activity at the site and surrounding area was used to inform the final layout and recommend mitigation, in the form of precautionary stand-off distances to habitat features, and the maintenance of said buffers for the 35-year lifetime of the wind farm). The resulting residual impact, following mitigation, is neutral.

7.211 The stand-off distances of the existing turbines were measured (in addition to the 11 turbines in the Proposed Development), in relation to habitat features such as watercourses and habitat edges (areas which are known to have higher levels of bat activity). None of the approved turbines encroached on the Natural England stand-off distance to the edge habitat features. Therefore, if precautionary stand-off distances were applied retrospectively to the windfarms described, the layouts would comply with the guidance (with the implementation of agreed mitigation at the respective sites listed above). The cumulative impact (of the 11 proposed Mullaghclogher turbines) is not considered to alter the existing predicted impacts, therefore the cumulative impact is considered to be **not significant**.

Badger

7.212 It is not anticipated that the Proposed Development will have a measurable impact on local badger social groups and the wind farm will therefore not contribute to any cumulative impacts that may be detectable from the operation of other wind farms in the local area. The cumulative impact on badgers is considered to be **not significant**.

Reptiles

7.213 The limited distribution of these species across much of the site and the habitat improvements specifically designed to favour them, indicate that the Proposed Development will not add to any adverse cumulative effects that may arise from wind farm developments generally. The cumulative impact on the site herpetofauna is therefore considered to be **not significant**.

Trans-boundary effects

7.214 Potential trans-boundary effects of the Proposed Development on designated sites and on mobile species (i.e., bats) were assessed. The effects are considered to be the same as those described in the relevant sections (i.e., cumulative effects). Trans-boundary effects are therefore not considered to be **significant**.

Conclusions

7.215 There is no regular usage of the area by smooth newt or marsh fritillary butterfly, therefore no impacts to these species are likely. Otter only use the site for commuting and no holts were noted, therefore no impact is considered likely. Mitigation for the reptiles found on site (i.e., common lizard) is proposed. This involves the provision of habitat management, as well as drift fencing (if required) and mowing/hand clearance during the construction phase. A single entrance outlier used by both fox and badger will be permanented closed. However, all badger setts have been buffered by the required 25 m from any infrastructure, including the main sett for this social group.

7.216 The proposed outline HMP will ensure compensation for areas of NI Priority Habitat lost under the footprint of the Proposed Development and should also result in enhancement of the local site ecology.

7.217 The mitigation measures specified in **Table 7.10** will be adhered to, ensuring that any potential impacts to bats will be negligible. In conclusion and based on current knowledge this would appear to be a site posing little risk to bats or bat populations, however a BMMP has been recommended as a precaution.

7.218 Therefore, the potential effects of the Proposed Development on ecological receptors have been assessed and it is concluded that with the implementation of appropriate mitigation measures the effects would be reduced to a **neutral effect or beneficial effect** that would not adversely affect the ecological integrity of the site and the wider area.

7.219 An assessment of cumulative impacts on the habitats and fauna of the area was also undertaken, and it was concluded that this is **not significant impact**.

References

7.220 References have been inserted as footnotes within the body of the document.

Abbreviations

AONB	Area of Outstanding Natural Beauty
ARGUK	Amphibian and Reptile Groups of the UK
ASSI	Area of Special Scientific Interest
BSBI	Botanical Society of the British Isles
CEDaR	Centre for Environmental Data and Recording
CIEEM	Chartered Institute of Ecology and Environmental Management

CNCC	Council for Nature Conservation and the Countryside
EC	European Commission
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
HRA	Habitat Regulations Assessment
HSI	Habitat Suitability Index
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
LHP	Larval Host Plant
LUAC	Land Under Applicant Control
MNR	Marine Nature Reserve
NBN	National Biodiversity Network
NIBG	Northern Ireland Bat Group
NIEA	Northern Ireland Environment Agency
NIPS	Northern Ireland Priority Species
NNR	National Nature Reserve
NR	Nature Reserve
PPS	Planning Policy Statement
SAC	Special Area of Conservation
SLNCI	Sites of Local Nature Conservation Importance
SPA	Special Protected Area
UW	Ulster Wildlife

8

Ornithology

8. Ornithology

Introduction

8.1 This chapter assesses potential effects of the Proposed Development on bird communities. The principal objectives of the chapter are:

- To outline the scope of the assessment;
- To describe the methodologies used in completing the assessment;
- To describe the baseline bird communities;
- To describe the potential effects on these bird communities and to assess the significance of these effects;
- To detail any mitigation or compensation measures that may be required and to describe any residual effects remaining after the implementation of these measures.

8.2 The ornithology assessment is supported by:

- Figures 8.1 - 8.10;
- Technical Appendices 8.1 - 8.17.

8.3 The Figures and Technical Appendices are referenced in the text as necessary and listed in full at the end of the chapter.

Statement of Authority of the Author

8.4 The ornithology assessment and associated survey work has been completed by David Steele:

- Professional qualifications - B.Sc. (2i Honours), Zoology, University of Aberdeen (1988);
- Professional experience – 34 years working as a professional ornithologist throughout Britain and Ireland, covering a wide range of survey methodologies including those particularly relevant to birds at on-shore wind farms such as raptor surveys and breeding wader surveys. For the last 20 years working as a freelance consultant in Northern Ireland and has completed ornithology assessments for 20 wind farm proposals and has also completed training on vantage point survey methodology and in collision risk modelling.

Legislation & Planning Policy

8.5 The ornithology assessment has been carried out with reference to the following key pieces of legislation and planning policy:

- The Wildlife (Northern Ireland) Order 1985 (as amended) which describes general protection measures for wild birds and in particular Schedule 1 to the Order which details those species that have special levels of protection;
- Annex 1 of the EC Birds Directive which details those bird species which are of particular conservation concern in Europe and which should be subject to special measures concerning their habitats in order to ensure they maintain a favorable conservation status;
- Planning Policy Statement (PPS) 2 (Natural Heritage) for Northern Ireland, in particular Policy NH2 (species protected by law), Policies NH3 and NH4 (sites of conservation importance) and Policy NH5 (species and features of natural heritage importance).

Scope of Assessment

General Effects of Wind Farms on Birds

8.6 On-shore wind farms can potentially effect birds in two main ways – by displacement of birds around the turbine array (leading to indirect habitat loss) or by creating a risk of direct mortality due to collisions with the turbines. Direct habitat loss from wind farms is usually relatively small scale compared to other sorts of developments and in most cases is unlikely to be significant for bird communities[1].

8.7 The ornithology assessment therefore focuses on assessing potential displacement effects and (where relevant) collision mortality effects of the Proposed Development. The assessment considers the potential effects on the bird communities found within the Preliminary Site Boundary (hereafter referred to as "the Site" and in defined surrounding buffer areas. Where relevant, the assessment also considers potential cumulative effects resulting from other existing, consented or proposed wind farms in the vicinity of the Proposed Development.

Bird Species Requiring Assessment

8.8 All wild birds are subject to a general level of protection through the Wildlife and Countryside Act (Wildlife Order in Northern Ireland) and the EU Birds Directive but in line with the current NatureScot (formerly SNH) guidance only some bird species should generally be of concern in relation to wind farms:

- Birds on Annex 1 of the EU Birds Directive;
- Birds on Schedule 1 to the Wildlife and Countryside Act (Wildlife Order in Northern Ireland);

[1] Percival, S. (2005): Birds and wind farms, what are the real issues? (British Birds 98 / 4)

- Regularly occurring migratory species;
- Species listed on the non-statutory lists of Birds of Conservation Concern (BOCC) for the United Kingdom and the island of Ireland.

8.9 The NatureScot guidance recommends that assessment of the effects of a wind farm on birds will normally be limited to those species included within the above categories. Additionally, NatureScot is of the view that passerine species are not significantly impacted by wind farms[2]. However, all bird species (including passerine species) need to be considered in relation to the general levels of statutory protection afforded by the Wildlife (Northern Ireland) Order[3].

Consultation

8.10 To date no ornithology consultations have been received in relation to the Proposed Development.

Assessment Methodology

Baseline Surveys

8.11 Baseline surveys were carried out in line with the current published guidance for bird survey methods to inform impact assessments for on-shore wind farms[4]. The different methodologies employed during the field surveys are described in further detail below.

Brown and Shepherd Surveys (Breeding Birds)

8.12 Surveys for breeding birds have been completed during three consecutive breeding periods as summarized in Table 8.1. In each baseline year the surveys commenced in April and finished not later than mid-July. Further details of the survey visits are provided in Technical Appendix 8.1.

8.13 All surveys were completed using the adapted four-visit Brown and Shepherd method recommended by NatureScot. This method is suitable for surveying breeding wader species (curlew, snipe and lapwing) and also red grouse. NatureScot do not generally recommend survey of moorland passerines, however, on sites where breeding waders are present only in small numbers then it is possible to include passerines in the Brown and Shepherd method and thereby provide a wider picture of the overall diversity of breeding birds within the Site and surrounding buffer area. The principal target species for the surveys were

[2] Scottish Natural Heritage (2017): Recommended bird survey methods to inform impact assessment of on-shore wind farms (SNH Guidance Note)

[3] NIEA: The Wildlife Law and You in Northern Ireland (Northern Ireland Environment Agency Biodiversity Series Booklet)

[4] SNH (2014 and 2017): Recommended bird survey methods to inform impact assessment of on-shore wind farms (Guidance Notes, May 2014 and March 2017)

therefore the breeding wader species and also red grouse however passerine species (in particular any less common species) were included where reasonably possible and particularly during the final survey year.

8.14 The surveys extended to at least a 500 m extent around the Proposed Development. All land under the Applicant's control (i.e. within the Site) was walked through, with additional coverage into adjacent areas (depending on the habitat) by appropriate periods of scanning with binoculars.

Curlews

8.15 The survey area for curlew extended to at least a 1 km extent around the Proposed Development. As there were no access permissions for much of this additional area the survey coverage was achieved by three methods: (1) by scanning the additional area with binoculars during the Brown and Shepherd survey visits (any areas under the Applicant's control were also walked through); (2) during the vantage point surveys by carefully scanning areas of potential curlew habitat and also by listening for calling or singing birds and (3) by looking for curlews from minor public roads while moving around within the wider surrounding area of the Site.

Table 8.1: Summary of Brown and Shepherd Survey Visits (Breeding Period)

Baseline Period	Dates	No. of Survey Visits Completed
Breeding Period 3	Apr to Jul 2022	4
Breeding Period 2	Apr to Jul 2021	4
Breeding Period 1	Apr to Jul 2020	4

Brown and Shepherd Surveys (Non-Breeding Birds)

8.16 Surveys for birds during the non-breeding (winter) period have been concurrent with the surveys for breeding birds and have been completed during three consecutive non-breeding periods (September to February) as summarized in Table 8.2. Further details of the survey visits are provided in Technical Appendix 8.2. The surveys were completed using the same adapted four-visit Brown and Shepherd method as employed for the breeding bird surveys and extended over the same area (to within at least a 500 m extent around the Proposed Development).

Table 8.2: Summary of Brown and Shepherd Survey Visits (Non-Breeding Period)

Baseline Period	Dates	No. of Survey Visits Completed
Non-Breeding Period 3	Sep 2022 to Mar 2023	4
Non-Breeding Period 2	Sep 2021 to Mar 2022	4
Non-Breeding Period 1	Sep 2020 to Mar 2021	4

Vantage Point Surveys

Vantage Point Survey Effort

8.17 An assessment of activity by raptors and other relatively large aerial species (e.g. migrating swans and geese) was completed from a total of five vantage points (or view points) during the baseline period, covering three consecutive breeding and non-breeding periods as summarized in Table 8.3. Further details of the individual vantage point watches are provided in Technical Appendix 8.3.

8.18 The surveys commenced during the Coronavirus lock-downs of spring 2020 and due to the various restrictions in place during that period only two vantage points were used initially. Survey from these two vantage points continued for the rest of the baseline period, giving three full years of coverage (for both breeding and non-breeding periods). With the easing of the Coronavirus restrictions a third vantage point was added at the start of the first non-breeding baseline period.

8.19 Following some changes to the infrastructure layout for the Proposed Development it was necessary to add two further vantage points and all five vantage points were then employed for one full (third and final) year of survey covering both breeding and non-breeding periods. All parts of the Site have therefore received at least one full year of vantage point survey coverage, with at least two (up to three) years of survey over the greater part of the Site. Given the relatively low sensitivity of the general area for ornithology (for example there are no designated or protected sites) then it is considered that the vantage point survey coverage is at least adequate.

Table 8.3: Summary of Vantage Point Survey Effort

Baseline Period	Dates	Vantage Point / Hours Effort				
		VP1	VP2	VP3	VP4	VP5
Non-Breeding Period 3	Sep 2022 to Feb 2023	40	36	36	36	36
Breeding Period 3	Mar to Aug 2022	36	37	36	36	36
Non-Breeding Period 2	Sep 2021 to Feb 2022	40	39.5	36.5	0	0
Breeding Period 2	Mar to Aug 2021	36	36	36	0	0
Non-Breeding Period 1	Sep 2020 to Feb 2021	43	39	30	0	0
Breeding Period 1	Mar to Aug 2020	33	33	0	0	0

Vantage Point Selection

8.20 As far as was practicably possible the vantage points were selected in line with the current NatureScot guidance however the following constraints also had to be considered:

- Vantage points needed to be reasonably and safely accessible.
- It was not possible to locate vantage points on lands without access permissions and in such instances the best possible alternative location (on land with access permissions) was selected (any variations to the vantage point guidelines are detailed in Technical Appendix 8.4).

8.21 The locations of the vantage points and the associated visibility coverage are shown in Figure 8.1. In line with the guidance (bar variations detailed in Technical Appendix 8.4) visibility is shown for a 2 km maximum extent from each vantage point and at collision risk height (lower edge of the rotor-swept disc). For the assessment of collision risk, visibility at rotor height is more important than visibility at or near the ground, however as far as practicably possible the vantage points were selected so as to also provide an adequate view at or near ground level. Additional location details for each vantage point are provided in Technical Appendix 8.4.

Vantage Point Method

8.22 The vantage point watches were completed in line with the NatureScot method statement for this type of survey[5]. The surveys therefore extended to at least a 500 m extent around the proposed turbine locations, up to a maximum 2 km extent from each vantage point (bar variations detailed in Technical Appendix 8.4). The target species were all raptor species (with priority given to the Annex-1 species). Other species (e.g. whooper swans, geese, golden plovers and gulls) were recorded as secondary species. At the discretion of the observer, notes were also kept of any significant activity by smaller aerial species.

8.23 For the non-Annex-1 raptor species (buzzard and kestrel) it was sometimes necessary to adopt a pragmatic approach to recording observations. In these instances it was possible to record activity using the 5-minute activity-period summaries (also used for secondary species) thereby allowing the observer greater focus on the Annex-1 target species.

8.24 Vantage point watches were carried out at different times of day and in a range of weather conditions but not during continuous or heavy precipitation or very strong winds. Most watches were of three hours duration but in order to make

[5] Scottish Natural Heritage (2017): Recommended bird survey methods to inform impact assessment of on-shore wind farms (Guidance Note, March 2017)

best use of time spent on the Site (particularly during shorter winter days) some shorter or longer watches were also completed.

8.25 During the non-breeding baseline period a number of vantage point watches (Table 8.4) were targeted at detecting roosting activity. These watches commenced at least 30 minutes before sunset and continued as long as reasonably possible up to a maximum 40 minutes after sunset.

Table 8.4: Summary of Sunset Vantage Point Surveys

Baseline Period	**Dates**	**Vantage Point / No. Watches Completed**				
		VP1	**VP2**	**VP3**	**VP4**	**VP5**
Non-Breeding Period 3	Sep 2022 to Feb 2023	4	2	1	2	2
Non-Breeding Period 2	Sep 2021 to Feb 2022	2	8	1	0	0
Non-Breeding Period 1	Sep 2020 to Feb 2021	0	8	2	0	0

Wider Area Checks

8.26 Checks for breeding activity by raptor species in the wider area around the Site have been carried out concurrently with the vantage point surveys and are summarized in Table 8.5. The selection of target species depended primarily on indications provided by the vantage point surveys in combination with an assessment (using professional experience) of potential raptor breeding habitat within the wider area.

8.27 Following the above criteria the principal target species for the wider area checks were hen harrier, peregrine and merlin. Current NatureScot guidance for these species indicates a wider area survey limit of 2 km extent[6]. In the first instance all three species were looked for during the vantage point surveys with additional checks of the wider surrounding area as necessary.

8.28 For hen harrier and peregrine potential breeding sites within 2 km are minimal and checks for these species were therefore confined to a small number of potential breeding locations. Potential merlin breeding sites (principally edges of commercial forestry and shelterbelts) are more widespread within the 2 km extent. Other raptor species that were possibly breeding (based on indications provided by the vantage point surveys) were also looked for within the same 2 km extent.

[6] SNH (2016) Assessing Connectivity with Special Protection Areas (Guidance Note June 2016)

8.29 The wider area checks followed appropriate methodologies for the relevant species[7]. The surveys were carried out from public roads and other areas with access permissions. To avoid disturbance, all observations were made from a safe distance and no attempt was made to approach nests. Some potential breeding sites (particularly for merlin's) were also checked during the Brown and Shepherd Surveys for breeding birds.

Table 8.5 - Summary of Wider Area Checks

Baseline Period	Dates	Survey Extent
Breeding Period 3	Mar to Aug 2022	2 km
Breeding Period 2	Mar to Aug 2021	2 km
Breeding Period 1	Mar to Aug 2020	2 km

Desk Study

8.30 A limited amount of desk study was completed, principally in relation to assessing bird habitats within the wider surrounding area (using publically available on-line mapping and imagery) and also to identify any protected areas such as Nature Reserves or Areas of Special Scientific Interest (ASSI's).

Assessing Significance of Effects

Favourable Conservation Status

8.31 The assessment of the significance of effects on bird communities primarily follows the Favourable Conservation Status (FCS) approach recommended by NatureScot[8]. This approach considers any potential effects on a species and assesses these in the context of the total national or regional population and distribution. An impact should be judged to be of concern where it would adversely affect the favourable conservation status of a species (or prevent a species from recovering to favourable conservation status) at the regional or national level. The conservation status of the bird species considered by the ornithology assessment follows the current non-statutory list of Birds of Conservation Concern published for the island of Ireland[9].

8.32 For assessing the significance of bird populations (or any expected losses at the national or regional level) the generally accepted 1% threshold level is used, therefore if a population (or loss) exceeds 1% of the national or regional population of the species then it should be considered to be significant.

[7] Gilbert, G *et al.* (1998): Bird Monitoring Methods – a manual of techniques for key UK bird species (RSPB)

[8] SNH (2018): Assessing Significance of Impacts from Onshore Wind Farms Outwith Designated Areas (Guidance, February 2018)

[9] Gilbert, G *et al.* (2021): Birds of Conservation Concern in Ireland 4: 2020-2026 (Irish Birds 43: 1 - 22)

8.33 In the assessment of effects, the probability of any given effect occurring (and the probability of any likely effects being significant) are described using the scale suggested by the Institute of Ecology and Environmental Management (IEEM)[10] – the scale is given in Appendix 8.5.

8.34 In line with the IEEM guidance, where relevant the assessment also considers possible local effects on bird communities. The assessment of the significance of local effects follows the same approach as for regional and national effects.

Cumulative Effects

8.35 Where relevant the assessment also considers possible cumulative effects on bird communities from other existing, consented or proposed wind farm developments in the vicinity. The assessment of cumulative effects on birds has been completed with reference to the current published NatureScot guidance[11].

Baseline Conditions

Breeding Birds

8.36 The status of breeding birds within the Site and surrounding buffer area is summarized in Technical Appendix 8.6 and discussed further under the relevant species headings below. The locations of breeding territories for selected bird species are shown in Figures 8.2 – 8.5. Those species associated with areas of commercial tree plantation or anthropogenic habitat features and also very mobile species (e.g. cuckoo) have not been mapped.

8.37 A total of 33 bird species were confirmed or probably breeding within the Site and surrounding 500 m buffer area. About a third of the total bird species (e.g. blackcap, the tit and thrush species and some of the finch species) were associated predominantly or exclusively with the shelterbelts and commercial tree plantation habitats and four species (swallow, pied wagtail, starling and jackdaw) were associated exclusively with anthropogenic habitat features (e.g. farmyards and abandoned buildings). The remaining species were found within the open moorland habitats of grassland, heather, bog and shrub-patches and included red grouse, snipe and a fairly typical selection of upland passerine species.

[10] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

[11] SNH (2018): Assessing the cumulative impacts of onshore wind farms on birds (Guidance, August 2018)

Red grouse

8.38 The locations of red grouse observations are shown in Figure 8.2 and details of the observations are provided in Technical Appendix 8.7. The observations indicate the presence of four red grouse territories within the Site and surrounding buffer area. Detection rates for grouse (or signs of presence such as dropping-piles) were low, which is consistent with a low density of birds. As expected for this species, the observations were associated with areas of heather vegetation and there were no observations in the areas of grassland habitat. Birds disturbed from the ground were typically observed to fly long distances (up to 1 km) before settling again. The numbers of grouse found within the Site are consistent with the typical density for this species in the uplands of Northern Ireland of about one territorial male per square kilometre within areas of suitable heather habitat[12].

Curlew

8.39 During the baseline period there were no observations of breeding curlews within the Site or surrounding buffer area. There was one observation of a curlew during a vantage point survey however the date and circumstances of the observation (a single bird flying high and directly south-west in August) would indicate a migrating bird rather than a breeding individual: curlews typically vacate their breeding territories around the middle of July. Local landowners (pers. comm.) have indicated that although curlews have historically occurred in the general vicinity of the Site (on the lower lands towards the public roads) they are no longer present in the area.

Snipe

8.40 The locations of snipe territories are shown in Figure 8.3 and details of the observations are provided in Technical Appendix 8.8. The observations indicate the presence of three snipe territories within the Site and surrounding buffer area which corresponds to an approximate density of < 0.5 territories per square kilometre. The observed low density of breeding snipe is consistent with the obvious signs of long-term habitat degradation (most notably drainage) within extensive areas of the Site.

Moorland Passerines

8.41 The locations of selected breeding moorland passerine species are shown in Figures 8.4 and 8.5 and details of the observations are provided in Technical Appendix 8.9. About a third of the passerine species were exclusively or predominantly associated with the shelterbelts and commercial tree plantation

[12] Allen and Mellon Environmental Ltd (2004): The Status of Red Grouse in Northern Ireland (Report to EHS)

habitats and four species (swallow, pied wagtail, starling and jackdaw) were associated exclusively with anthropogenic habitat features (e.g. farmyards and abandoned buildings).

8.42 The remaining species represent a fairly typical upland breeding bird assemblage for the west of Northern Ireland. Most species were present in small numbers however skylarks and meadow pipits were present in larger numbers and were very widely distributed within the Site. Other species found included grey wagtail (two pairs), dipper (one pair), cuckoo (three singling males), sand martin (one active burrow), stonechat (nine pairs) and reed bunting (seven pairs).

8.43 Wheatears occurred widely within the Site in small numbers during the spring migration period, however there were no observations to indicate breeding and it is considered that all birds observed were migrating through the area on-route to more northerly breeding latitudes and this was supported by birds showing features typical of the northern sub-species *leucorhoa* ("Greenland Wheatear").

8.44 The singing male cuckoos were very mobile within the survey area, often flying long distances between song-posts. Although breeding was not confirmed for this species the abundance of its favoured host-species (in particular meadow pipit) indicates that breeding is likely to have occurred. Dippers and grey wagtails occupied extended linear territories along streams: although nests were not located, both species were confirmed breeding.

Non-breeding Birds

8.45 Observations of birds during the non-breeding (winter) baseline period are summarized in Technical Appendix 8.10 and detailed further in Technical Appendix 8.11. A total of 36 bird species were observed during the non-breeding period excluding red grouse (which are detailed under breeding birds) and raptor species (detailed separately). The winter bird assemblage within the Site is fairly typical for an upland location in the west of Northern Ireland. Only a small number of species were found with any degree of regularity and on some winter days very few birds of any species were to be found within the Site. The most regularly occurring species (found on all surveys) were raven and hooded crow.

8.46 Wintering snipe were found on most survey visits but at very low densities. There were some observations of larger flocks of starlings and the winter thrush species however these larger flocks were not regular in occurrence within the Site. During the baseline period there were single observations of jack snipe, woodcock and snow bunting: although these species are likely to be overlooked to some extent, the observations nevertheless indicate the occurrence of only small numbers within the Site.

Golden Plovers

8.47 Golden plovers were observed on a total of eight survey dates during the non-breeding period (September to February) with one additional observation during the early breeding period (April). The maximum count (in April) was of a flock of approximately 150 birds however during the winter period numbers were typically smaller than this and on five dates fewer than ten birds were observed. The birds observed in April were of the northern race which breeds on the tundra of Iceland and northern Continental Europe. Birds were typically observed either circling high overhead (and subsequently then leaving the area) or flying directly overhead without stopping. Only a small number of birds were observed on the ground and there did not appear to be any particularly favoured or regular resting area for golden plovers within the Site. There were some additional observations of golden plovers during the winter vantage point surveys and these are detailed under the description of the baseline for those surveys.

Vantage Point Surveys

Annex-1 Species

Overview

8.48 Activity by Annex-1 species observed from the vantage points during the baseline period is summarized in Table 8.6 and discussed further under the relevant species headings below. The flight-lines for these species are shown in Figure 8.6 (hen harrier, golden eagle and whooper swan) and Figure 8.7 (peregrine). The table also includes additional observations of the Annex-1 species made during the Brown and Shepherd surveys. Details of the observations of Annex-1 species (including both the vantage point and Brown and Shepherd surveys) are provided in Technical Appendix 8.12.

Table 8.6: Summary of Observations of Annex-1 Species

Species (Code)	No. of Observations (Vantage Point Survey)	Additional Observations (Brown and Shepherd Survey)
Whooper swan (WS)	4	1
Golden eagle (EA)	2	0
Hen harrier (HH)	3	0
Peregrine (PE)	20	3
Merlin (ML)	5	4

Whopper swan

8.49 During the baseline period there were four observations of whooper swans from the vantage points and one additional observation during the Brown and Shepherd surveys. The maximum flock size observed was 13 birds. The observations indicate that small groups of swans may occasionally fly over the

Site during the migration and winter periods however there has been no indication of any regular flights or of the occurrence of larger flocks.

Golden eagle

8.50 During the baseline period there were two observations of golden eagles. Both observations were early in the baseline period: the first observation was in July of baseline year 1 and the second observation four months later in November of the same year. Both observations were of immature eagles (in at least their 2nd calendar-year) and it is possible (although not confirmed) that the observations related to the same individual. There were no subsequent observations during the following years of the baseline period. The observations indicate that immature (non-breeding) golden eagles may occur very occasionally within the Site at any time of year however they are not regularly occurring and would not necessarily be expected to occur every year.

Hen harrier

8.51 During the baseline period there were just three observations of hen harriers. All the observations were of female or immature harriers (there have been no observations of adult males) and all were during the late summer / autumn period (July to October). The observations were relatively early in the baseline period and there were no harrier observations during the final (third) baseline year. The observations indicate that hen harriers may occur very occasionally within the Site during the post-breeding (late summer) and autumn (or winter) periods however they are not regularly occurring during those periods and are not likely to occur during the breeding season.

Peregrine

8.52 During the baseline period there were 20 observations of peregrines from the vantage points and an additional three observations during the Brown and Shepherd surveys. During the baseline period peregrines were observed in almost all months (bar May and November) and the observations were reasonably evenly distributed between the breeding (March to August) and non-breeding (September to February) periods. Of those birds for which the age was determined (about half of all observations) the clear majority were immatures (birds in their first or second calendar-year) although a small number of birds were confirmed to be adults. During the final (third) baseline year there were eight observations of peregrines from the vantage points (six immatures, one adult and one not aged) and these were during the months of January, June, July (two), August and September (three). The observations indicate that peregrines occur occasionally within the Site during most of the year and there is an indication that immature (non-breeding) birds are more likely to occur than adults.

Merlin

8.53 During the baseline period there were five observations of merlins from the vantage points and an additional four observations during the Brown and Shepherd surveys. The observations were almost all during the non-breeding period and all the observations (bar one) were of birds in female-type plumage: three individuals (observed in September, November and December) were confirmed to be juvenile (first calendar-year) birds. One of the two breeding period observations was of a female-type bird observed in early April and the circumstances of this observation indicated that it more likely related to a lingering winter or passage (migrating) individual rather than a potential breeding bird.

8.54 The single observation of a male merlin was during a Brown and Shepherd survey in May of baseline year 1. The bird was perched on a fence-line within the Site and in relative close proximity to potential nest-sites (coniferous trees) however no signs or behaviours indicative of breeding were observed. The location of the observation (which is also visible from VP2) was checked subsequently during baseline year 1 and in subsequent baseline years, however no further merlin activity was observed. Merlins have a foraging range of up to 5 km around the nest-site[13] therefore it is possible that the observation in baseline year 1 related to a male from a breeding site located within the wider surrounding area.

8.55 The observations indicate that merlins occur occasionally within the Site during the non-breeding and early spring periods (September to February / early April). They may also occur (very infrequently) during the breeding season however during the baseline period there has been no indication of breeding or any other regular activity (such as foraging) by merlins within the Site during the breeding season.

Non Annex-1Raptor Species

Overview

8.56 Activity by Non Annex-1 species observed from the vantage points during the baseline period is summarized in Table 8.7 and discussed further under the relevant species headings below. The flight-lines for these species are shown in Figure 8.8 (buzzard) and Figure 8.9 (kestrel). Sparrowhawk observations are only available for baseline year 3 and flight-lines have not been mapped for this species. Details of the observations of Non Annex-1 species during the final

[13] [13] SNH (2016) Assessing Connectivity with Special Protection Areas (Guidance Note June 2016)

(third) baseline year are provided in Technical Appendix 8.13 and a summary of observations of these species from the two earlier baseline years is provided in Technical Appendix 8.14.

Table 8.7: Summary of Observations of Non Annex-1 Species

Species (Code)	**Baseline Year / No. of Observations**		
	Baseline year 3	**Baseline year 2**	**Baseline year 1**
Buzzard (BZ)	38	30	25
Kestrel (K.)	13	13	11
Sparrowhawk (SH)	5	-	-

Buzzard

8.57 During the final (third) baseline year there were 38 observations of buzzards and this species was comfortably the most regularly occurring raptor species within the vantage point survey extents. The best months for observations were April (five observations), August (seven observations), September (six observations) and October (six observations). The pattern of observations is typical for this species and is consistent with early spring activity (for example by soaring birds), a quieter summer period and then a post-breeding activity peak (boosted by the occurrence of fledged juveniles) during the late summer / early autumn period. By comparison, there was just one buzzard observation during the mid-winter period (November to January) however a small peak (four observations) was noted in February.

8.58 Most of the buzzard activity observed within the Site was related to foraging: some soaring flights were observed however no actual display flights were observed within the Site. Most of the observations were of single birds or two birds together however there were two observations of small groups of buzzards: five juveniles soaring together in August and six birds (including some juveniles) soaring together in September.

8.59 During the earlier baseline years fewer vantage points were employed however the general pattern of buzzard observations during those baseline years is broadly comparable to the final (third) baseline year.

Kestrel

8.60 During the final (third) baseline year there were 13 observations of kestrels however this species was irregular in occurrence: there were only four observations during the breeding period (March to August) and no observations during the mid-winter period (November to January). The best months for observations were September (four observations) and October (four observations): this pattern is consistent with a post-breeding activity peak (boosted by the occurrence of fledged juveniles) during the late summer / early autumn period (most of the kestrels observed during the period August to October were aged as juveniles). All of the kestrel activity observed within the Site was related to foraging.

8.61 During the earlier baseline years fewer vantage points were employed however the general pattern of kestrel observations during those years is closely comparable to the final (third) baseline year: in particular the peak in activity during the late summer / early autumn period, low activity levels during the main breeding period and negligible activity during the mid-winter period.

Other Species

Overview

8.62 Activity by other larger species observed from the vantage points during the baseline period is summarized in Table 8.8 and discussed further under the relevant species headings below. Details of the observations are provided in Technical Appendix 8.15.

Table 8.8: Summary of Observations of Other Species

Species (Code)	**No. of Observations**	**Remarks**
Unidentified geese (-)	2	Small flocks flying over in September and November
Golden plover (GP)	8	-
Great black-backed gull (GB)	6	-
Lesser black-backed gull (LB)	6	-

Geese

8.63 During the baseline period there were two observations of geese flying over the Site: a flock of 20 birds flying south in September and a flock of six birds flying south in November. On both occasions the views obtained were insufficient to identify the birds to species level but both flocks were confirmed to be “grey geese” of the genus *Anser*. The observations indicate that small groups of geese may occasionally fly over the Site during the migration and winter periods however there has been no indication of any regular flights or of the occurrence of larger flocks.

Golden plovers

8.64 During the baseline period there were eight observations of golden plovers from the vantage points (additional birds were observed during the non-breeding period Brown and Shepherd surveys). Half of the observations were in April and these were attributable to birds of the northern race (which breeds on the tundra of Iceland and northern Continental Europe) engaged on spring migration: the maximum flock size observed in April was approximately 100 birds. Smaller flocks (up to approximately 50 birds) were observed during the winter period in January (one observation), February (one observation), October (one observation) and December (one observation). All of the observations from the vantage points were of birds either circling high over the Site or flying directly over without stopping. The observations indicate that flocks of golden plovers occasionally fly over the Site during the migration and winter periods however the overall frequency of observations has been low and the maximum flock size observed has been relatively small.

Gulls

8.65 During the baseline period two gull species (great black-backed gull and lesser black-backed gull) have been observed flying over the Site however the frequency of observations of both species has been low and all observations have related to either single birds or small groups of less than ten gulls.

Wider Area Surveys

8.66 Breeding activity by raptor species and ravens within the wider surrounding area of the Proposed Development (within a 2 km extent) is summarized in Table 8.9 and discussed further under the relevant species headings below. The locations of buzzard pairs and raven nest-sites are shown in Figure 8.10 and further details of the locations are provided in Technical Appendix 8.16.

Table 8.9 – Summary of Wider Area Observations

Species (Code)	No. Pairs	No. Confirmed Nests
Hen harrier (HH)	0	-
Buzzard (BZ)	5	0
Peregrine (PE)	0	-
Kestrel (K.)	0	-
Merlin (ML)	0	-
Sparrowhawk (SH)	1	1
Raven (RN)	2	2

Hen harrier

8.67 During the baseline period there were no observations of breeding hen harriers within the wider surrounding area. An assessment of the habitats within this area indicates only marginal suitability for nesting hen harriers: in particular there is a general absence of large areas of good, undisturbed heather habitat, second rotation forestry habitat is currently very limited in extent and in much of the area there is significant disturbance from farming activities.

Buzzard

8.68 Five pairs of buzzards were located within the wider surrounding area although none was particularly close to the Proposed Development (not closer than approximately 1 km). Two pairs were associated with a wooded riverine valley, two pairs with partially-wooded farmed landscapes and one pair with commercial forestry habitat. Nests were not confirmed at any of the locations (most of which did not have access permissions) however breeding is likely to have occurred.

Peregrine

8.69 During the baseline period there were no observations of breeding peregrines within the wider surrounding area. An assessment of the habitats within this area indicates only very marginal suitability for nesting peregrines, which usually require a cliff (either natural or man-made) for nesting. The small natural cliff at Butterlope Glen was identified early in the survey period as a potential peregrine nest-site, however during the baseline period this location was occupied by a pair of ravens.

Kestrel

8.70 Although potential habitat does exist (e.g. coniferous trees and old farm buildings) during the baseline period there were no observations of breeding kestrels within the wider surrounding area (within a 2 km extent). This observation is consistent with the relatively low frequency of kestrel foraging activity within the Site during the breeding period. It is likely, however, that breeding kestrels (at least one but probably two pairs) occur within an expanded wider area around the Proposed Development (within a 5 km extent) and this is consistent with the observations of foraging adult kestrels and also the observations of recently fledged juvenile kestrels foraging within the Site during the late-summer / autumn post-breeding period.

Merlin

8.71 Although potential nesting habitat does exist (in particular the edges of pole-stage commercial forestry and shelterbelts of coniferous trees) during the baseline period there were no observations of breeding merlins within the wider surrounding area (within a 2 km extent). However it is possible that breeding merlins occur within an expanded wider area around the Proposed Development (within a 5 km extent) and this is consistent with the observation of a male merlin within the Site during baseline year 1.

Sparrowhawk

8.72 During the baseline period sparrowhawks were confirmed breeding at one location within the wider surrounding area. The breeding site (within pole-stage commercial forestry) was very typical for this species.

Raven

8.73 During the baseline period ravens were confirmed breeding at two locations (location 1 and location 2) within the wider surrounding area. Location 1 was an isolated tall conifer tree close-by an abandoned building and this nest was successful (fledged juveniles observed). Location 2 was at a small natural cliff and although breeding attempts were confirmed at this location they were not successful: the site is very close to a minor public road and is relatively accessible and human interference with the nest was considered possible.

Assessment of Effects

Breeding Birds

General Remarks

8.74 Published research[14] has indicated that the main adverse effects of wind farms for breeding birds are disturbance and displacement during construction and that wind farm operation is unlikely to have a significant effect on local breeding bird populations. The research also suggested that there are potential beneficial effects of wind farm construction for some passerine species. The potential effects of the proposed Development on breeding birds are described under the headings below. Potential adverse effects and the significance of any likely effects are summarized in Table 8.10.

Red Grouse

8.75 The baseline surveys have indicated that four red grouse territories are found within the Site and surrounding buffer area. Red grouse is a Red-listed Species of Conservation Concern in Ireland. The potential adverse effects of the Proposed Development on red grouse relate principally to displacement due to disturbance during construction however this effect would be expected to be temporary and grouse numbers would be expected to recover after construction[15]. The construction works are expected to proceed in stages across the Site therefore at

[14] Pearce-Higgins, J.W. *et al.* (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

[15] Pearce-Higgins, J.W. *et al.* (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

any one time significant parts of the Site are likely to be relatively undisturbed, allowing any temporarily displaced birds to find refuge. There are also significant areas of suitable habitat in the immediately adjacent area (within approximately 500 m to 1 km extent) which could also allow refuge for temporarily displaced birds.

Snipe

8.76 The baseline surveys have indicated that three pairs of snipe are present within the Site and surrounding buffer area. The potential adverse effects of the Proposed Development on snipe relate principally to displacement: the effect can extend up to 400 m around the turbine array resulting in a predicted average 47.5 % reduction in breeding density within a 500 m extent of the turbine array[16].

8.77 Applying the predicted reduction factor to the snipe baseline population indicates the potential displacement of one or two (1.4) pairs of snipe within a 500 m extent from the Development. Snipe is a Red-listed Species of Conservation Concern in Ireland[17]. The Northern Ireland breeding population has declined c. 78% since the 1980's up to 2013 when there were estimated to be 1,123 breeding pairs however further decline since then is likely. The displacement of one pair of snipe is likely to be significant for the local snipe breeding population but is not significant at the regional or national population level.

Moorland Passerines

8.78 The baseline surveys found 33 species of breeding passerines within the Site and surrounding buffer area however about a third of the passerine species were exclusively or predominantly associated with shelterbelts and commercial tree plantation habitats and four species were associated exclusively with anthropogenic habitat features. Most of the remaining species were present in small numbers however skylarks and meadow pipits were present in larger numbers and were very widely distributed within the Site. Several of the passerine species found are Birds of Conservation Concern in Ireland. The potential adverse effects of the Proposed Development on breeding passerines relate principally to displacement due to disturbance during construction and avoidance of the turbine array.

8.79 For two passerine species (meadow pipit and wheatear) breeding densities have been found to be reduced within a 500 m extent from turbine arrays however the reasons for this were unclear and subsequent analysis found little evidence for

[16] Pearce-Higgins, J.W. *et al.* (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

[17] Gilbert, G *et al.* (2021): Birds of Conservation Concern in Ireland 4: 2020-2026 (Irish Birds 43: 1 - 22)

consistent population declines in wheatear populations at wind farm sites[18]. The same research also suggested potential positive effects of wind farm construction on skylarks, meadow pipits and stonechats and it is suggested that vegetation disturbance during the construction of wind farms results in changes to the vegetation that are known to favour these species.

8.80 Although several of the species found during the baseline surveys are of conservation concern all these species were also found in the wider surrounding area (within a 2 km extent from the Proposed Development) and are also more widely distributed locally and at a regional level[19]. It is also noted that NatureScot take the view that passerine species are generally not adversely affected by wind farms[20].

8.81 Taking all of the above factors into consideration (and including the potential positive effects of wind farm construction that have been identified for several passerine species) it is unlikely that the Proposed Development would have a significant adverse effect on the local populations of breeding moorland passerines.

Table 8.10 – Summary of Potential Effects on Breeding Birds

Species / Species Group	Potential Effects	Significance of Effect
Red grouse	Temporary displacement of birds during construction	No permanent adverse effect
Snipe	Displacement of 1 – 2 (1.4) breeding pairs	Likely to be significant for the local snipe population but not significant at the regional or national level
Moorland passerines	Displacement of birds during construction and around the turbine array	Unlikely to be significant

Winter Birds

8.82 The potential effects of the Proposed Development on winter bird species are likely to be similar to those described for breeding birds, therefore displacement due to disturbance during construction and (for some species) potentially also due to avoidance of the turbine array. All of the species found during the winter

[18] Pearce-Higgins, J.W. *et al.* (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

[19] Balmer, D *et al.* (2013): Bird Atlas 2007-2011 (BTO Books)

[20] SNH (2006): Assessing the significance of impacts of on-shore wind farms on birds out-with designated areas (Guidance Note, July 2006)

and migration seasons are very widespread in distribution locally and regionally[21] and were observed within the Site in relatively small numbers. In general it is therefore unlikely that the Proposed Development would cause any significant adverse effects on the local populations of wintering birds. For some species (e.g. snow bunting) that are associated with anthropogenic habitat features, there may be potential beneficial effects of wind farm construction at the local population level.

Annex-1 Species

8.83 The potential effects of the proposed Development on Annex-1 species are described under the headings below. Potential adverse effects and the significance of any likely effects are summarized in Table 8.11.

Whooper swan

8.84 The baseline surveys have indicated that whooper swans are not regularly occurring within the Site and surrounding buffer area therefore it is highly unlikely that the Proposed Development would have any significant adverse effects on the regional conservation status of this species.

Golden eagle

8.85 The baseline surveys have indicated that golden eagles are not regularly occurring within the Site and surrounding buffer area however this species might occasionally wander into the survey area at any time of year – any such occurrences are expected to be infrequent and are most likely to involve immature (non-breeding) birds, which range very widely before they establish a permanent territory and there is no indication that the survey area is of any particular significance for such wandering birds. Golden eagles require remote, high cliffs for nesting and an assessment of the wider surrounding area (from mapping, aerial imagery and professional experience) indicates that there are no likely potential nest-sites within 9 – 10 km of the Proposed Development therefore it is highly unlikely that a permanent golden eagle home-range could be established in the vicinity. It is therefore highly unlikely that the Proposed Development would have any significant adverse effects on the regional conservation status of this species.

Hen Harriers

8.86 The baseline surveys have indicated that hen harriers are not regularly occurring within the Site and surrounding buffer area. An assessment of the wider surrounding area (from mapping, aerial imagery and direct observations) indicates that potential harrier breeding habitat (extensive, undisturbed deep

[21] Balmer, D *et al.* (2013): Bird Atlas 2007-2011 (BTO Books)

heather or young commercial forestry) is very limited in extent therefore it is unlikely that a population of nesting harriers could become established in the vicinity. It is therefore highly unlikely that the Proposed Development would have any significant adverse effects on the regional conservation status of this species.

Peregrines

Displacement Effects (Foraging)

8.87 The baseline surveys have indicated that peregrines occasionally forage within the Site and surrounding buffer area however the frequency of observations has been low. Published guidance indicates a core foraging range for peregrines of 2 km however foraging up to a maximum of 18 km from the nest has been recorded in Scotland[22]. It can therefore be assumed that foraging peregrines are likely to travel significantly beyond the indicated core range. Peregrines also forage over a very wide range of habitats including even urban areas and the open sea (anywhere where their principal prey of small and medium sized birds is available).

8.88 Peregrine has a favourable conservation status in the island of Ireland and the U.K. (it is not currently a species of conservation concern) and the most recent published information for the UK indicates a population of 95 territorial pairs in Northern Ireland[23]. The published research on the effects of wind farms on birds does not indicate any specific turbine avoidance distance for peregrines however it can be assumed that there is likely to be some degree of avoidance. However considering the foraging behaviour of this species then it is highly unlikely that displacement of foraging birds around the turbine array (assuming a moderate level of avoidance) would have any significant adverse effects on the local peregrine population or on the regional conservation status of the species.

Collision Risk

8.89 From the baseline observations the Collision Risk Model (Appendix 8.17) indicates a collision risk for peregrine equivalent to one bird every 27.2 years and it is highly unlikely that this number of collisions would have any significant adverse effects on the local peregrine population or on the regional conservation status of this species.

[22] SNH (2016) Assessing Connectivity with Special Protection Areas (Guidance Note June 2016); NIEA guidance given in wind farm consultation responses

[23] Eaton, M (2023): Rare breeding birds in the UK in 2021 (British Birds 116)

Direct Disturbance (Nest Sites)

8.90 During the baseline period peregrines were not found breeding within a 2 km extent from the Proposed Development. Guidance on the upper limit of disturbance for nesting peregrines indicates a distance in the range of 500 - 750 m[24] therefore it is highly unlikely that nesting peregrines would be directly disturbed by the Proposed Development.

Merlins

8.91 The baseline surveys have indicated that merlins occur occasionally within the Site and surrounding buffer area during the non-breeding period however they are not regularly occurring during the breeding period and there have been no breeding attempts (either confirmed or probable) during the baseline period. Merlin nest-sites are not permanent (the birds use old hooded crow nests and typically change location after a period of several years) and while it is therefore possible that merlins might attempt to nest in the wider surrounding area (within 2 km) at some point in the medium-term it is overall considered unlikely that nesting might occur within the disturbance distance for this species (300 - 500 m)[25]. It is therefore unlikely that the Proposed Development would have any significant adverse effects on the regional conservation status of this species.

Table 8.11 – Summary of Potential Effects on Annex-1 Species

Species / Species Group	Potential Effects	Significance of Effect
Whooper swan	Highly unlikely	-
Golden eagle	Highly unlikely	-
Hen harrier	Highly unlikely	-
Peregrine	Displacement (foraging)	Highly unlikely to be significant
Peregrine	Collision risk	Highly unlikely to have any significant adverse effects on the regional conservation status of the species
Peregrine	Direct disturbance (nests)	Highly unlikely to be significant
Merlin	Unlikely	-

Non Annex-1 Species

8.92 The potential effects of the proposed Development on Non-Annex 1 raptor species are described under the headings below. Potential adverse effects and the significance of any likely effects are summarized in Table 8.12.

[24] NatureScot Guidance – Disturbance Distances in Selected Scottish Bird Species
[25] NatureScot Guidance – Disturbance Distances in Selected Scottish Bird Species

Buzzards

Displacement Effects (Foraging)

8.93 The baseline surveys have indicated that buzzards forage regularly within the site and surrounding buffer area. They were observed throughout the year however overall activity levels were not particularly high and activity was very low during the mid-winter months. Potential adverse effects of the Proposed Development on foraging buzzards include displacement due to avoidance of the turbine array and for buzzards the effect can extend up to 500 m resulting in a predicted 41.4% reduction in flight activity within a 500 m extent of the turbine array[26] however the significance of this effect needs to be assessed in the context of other habitat that is likely to be available to the birds and also the favourable conservation status[27] and very widespread distribution of this species in Northern Ireland and in the island of Ireland as a whole[28].

8.94 Buzzards forage over a very wide range of habitats including moorland habitats (such as those found within the survey area), upland (less improved) farmland habitats, woodland and commercial forestry habitats and also intensive lowland farmland habitats including highly improved grasslands. During the baseline period buzzards were observed foraging in association with all of the above habitats within the wider area around the Proposed Development and availability of foraging habitat is unlikely to be a significant constraint for the birds. Placed in this context then it is highly unlikely that the predicted foraging displacement would have any significant adverse effects on the local buzzard population or on the regional conservation status of this species.

Collision Risk

8.95 From the baseline observations the Collision Risk Model (Appendix 8.17) indicates a collision risk for buzzard equivalent to one bird every 12.2 years. The collision risk assumes no significant reduction in flight activity due to displacement effects within the 500 m extent around the turbine array and needs to be assessed in the context of other relevant factors (notably breeding productivity, annual survival and typical life-span)and also the favourable conservation status and very widespread distribution of this species in Northern Ireland and in the island of Ireland as a whole.

8.96 The all-Ireland buzzard breeding population (including Northern Ireland) has been estimated at 3,312 pairs however the population is still expanding in size and

[26] Pearce-Higgins, J.W. *et al.* (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

[27] Gilbert, G *et al.* (2021): Birds of Conservation Concern in Ireland 4: 2020-2026 (Irish Birds 43: 1 - 22)

[28] Balmer, D. *et al.* (2013): Bird Atlas 2007-2011 (BTO Books)

range[29]. The population in the U.K. is estimated at 57,000 - 79,000 pairs of which 1,000 – 2,000 pairs are in Northern Ireland[30]. Breeding productivity in Northern Ireland has been estimated to average 1.95 young fledging per successful pair[31] and a study in the Republic of Ireland recorded an average of 2.61 young fledging per successful pair[32]. Clutch size is two or three eggs and the experience of the author is that two or three fledged young per nesting pair is typical for buzzards in Northern Ireland and nests (which are located in trees and so are relatively secure from predators) are usually successful.

8.97 The typical life-span of a buzzard is 12 years and annual survival is relatively high at around 90% for adults and 63% for juveniles[33]. Five pairs of buzzards are present within a 2 km extent of the Proposed Development and although no actual nest-sites were confirmed, breeding is considered probable and fledged juvenile buzzards were observed within the survey area. Therefore the local buzzard population is likely to be producing in the region of at least ten young birds annually, with about two-thirds of these expected to survive their first-year and any loses to the local population due to collision mortality are therefore expected to be small by comparison. For adult buzzards the typical life-span of 12 years means that any one individual is unlikely to be the victim of a collision.

8.98 Taking these various factors into account then it is unlikely that the predicted number of collisions would have a significant adverse effect on the local buzzard population and highly unlikely there would be a significant adverse effect on the regional conservation status of this species.

Kestrels

Displacement Effects (Foraging)

8.99 The baseline surveys have indicated that kestrels occasionally forage within the Site and surrounding buffer area however the overall frequency of observations has been low and in some months (most notably during the mid-winter period) there have been no observations. Potential adverse effects of the Proposed Development on foraging kestrels include displacement due to avoidance of the turbine array however the published research on the effects of wind farms on birds does not indicate any specific turbine avoidance effect for kestrels.

[29] Nagle, T. *et al.* (2014): Habitat and diet of re-colonising common buzzards *Buteo buteo* in County Cork (Irish Birds 10)
[30] Musgrove *et al.* (2013): Population Estimates of Birds in Great Britain and the United Kingdom (British Birds 106)

[31] Rooney, E and Montgomery, W.I. (2013) Diet diversity of the common buzzard *Buteo buteo* in a vole-less environment (Bird Study 60)
[32] Nagle, T. *et al.* (2014): Habitat and diet of re-colonising common buzzards *Buteo buteo* in County Cork (Irish Birds 10)
[33] BTO Birdfacts (bto.org)

8.100 It is noted that the recommended avoidance rate for kestrels for collision risk assessment is relatively low compared to other raptor species[34] and this would indicate that kestrels are less likely to avoid turbines and therefore are also less likely to be prone to displacement effects. Kestrels also have an extensive foraging range that is likely to extend up to 5 km from the nest[35] although comparative information for other raptor species indicates that the core foraging range is likely to be less[36]. Considering these factors in combination (and also the relatively low rates of occurrence of kestrels within the Site and buffer area) it is highly unlikely that the displacement of foraging birds around the turbine array would have a significant adverse effect on the local kestrel population or on the regional conservation status of this species.

Collision Risk

8.101 From the baseline observations the Collision Risk Model (Appendix 8.17) indicates a collision risk for kestrel equivalent to one bird every 8.9 years. Kestrel is a Red-listed Species of Conservation in Ireland (due to significant population declines)[37] however it nevertheless remains the most widely distributed raptor species in Britain and Ireland[38] and the breeding range of the nominate subspecies also extends across the whole of Europe. The species is closely associated with farmland throughout most of its European range and the effects of agricultural intensification are likely to be an important factor in the observed declines in Britain and Ireland and also more widely in Europe[39]. Any potential collisions need to be considered in the context of this very widespread distribution, the underlying landscape-scale effects of agricultural intensification and also other relevant factors (notably breeding productivity, annual survival and typical life-span)

8.102 The typical life-span of a kestrel is four years and annual adult survival is relatively high at 69% however only about a third of juveniles survive their first year of life[40]. Clutch size is four to five eggs and the experience of the author is that two or three fledged young per nesting pair is typical for kestrels in

34 SNH (2016): Avoidance rates for the SNH onshore wind farm Collision Risk Model (SNH Guidance Note, October 2016)

35 Personal observations

36 SNH (2016) Assessing Connectivity with Special Protection Areas (Guidance Note June 2016)

37 Gilbert, G *et al.* (2021): Birds of Conservation Concern in Ireland 4: 2020-2026 (Irish Birds 43: 1 - 22)

38 Balmer, D. *et al.* (2013): Bird Atlas 2007-2011 (BTO Books)

39 European Breeding Bird Atlas 2 (European Bird Census Council and Lynx Edicions, Barcelona)

40 BTO Birdfacts (bto.org)

Northern Ireland and nests (which are located at a variety of sites but always off the ground and so relatively secure from predators) are usually successful.

8.103 Although kestrels were not found breeding within a 2 km extent of the Proposed Development, the baseline observations indicate that one or two pairs are likely to be present within an expanded 5 km extent and fledged juvenile kestrels were observed within the survey area. Therefore the local kestrel population is likely to be producing in the region of four to six young birds annually, with about a third of these expected to survive their first-year and any loses to the local population due to collision mortality are therefore expected to be relatively small by comparison. For adult kestrels the typical life-span of four years means that any one individual is highly unlikely to be the victim of a collision.

8.104 Taking these factors into account then it is unlikely that the predicted number of collisions would have a significant adverse effect on the local kestrel population and highly unlikely that there would be a significant adverse effect on the regional conservation status of this species.

Table 8.12 - Summary of Potential Effects on Non Annex-1 Raptor Species

Species / Species Group	Potential Effects	Significance of Effect
Buzzard	Displacement (foraging)	Highly unlikely to be significant
Buzzard	Collision risk	Highly unlikely to have any significant adverse effects on the regional conservation status of the species
Kestrel	Displacement (foraging)	Highly unlikely to be significant
Kestrel	Collision risk	Highly unlikely to have any significant adverse effects on the regional conservation status of the species

Local ASSIs

8.105 Two ASSI's (Aghabrack and Butterlope Glen) are located within relatively close proximity of the Proposed Development however both sites are designated principally for their earth science interest and not for any ornithological features therefore they are not considered further within the ornithology assessment.

Cumulative Effects

Scope

Other Wind Farms

8.106 Details of other wind farms (existing, consented or proposed) within a 30 km extent of the Proposed Development have been provided by the Applicant. Within this area there are a total of 31 wind farms (22 existing, five consented and four proposed) however only four wind farms (three existing and one consented) are located within 10 km of the Proposed Development and further details of these are provided in Table 8.13. It is considered that wind farms located beyond 10 km are highly unlikely to have any significant adverse effects on local bird populations in the vicinity of the Proposed Development therefore these wind farms are not considered further in the assessment of possible cumulative effects.

Table 8.13 - Summary of Other Wind Farms within 10 km of the Proposed Development

Wind Farm	Status	No. of Turbines	Distance from the Proposed Development
Eglish	Existing	6	8.18 km to north
Owenreagh	Existing	10	7.54 km to west
Owenreagh Extension	Existing	6	7.08 km to west
Craignagapple	Consented	9	6.95 km to west

Target Species

8.107 The target species for the cumulative assessment are all bird species that are regularly occurring within the vicinity of the Proposed Development (within the Site and the relevant surrounding buffer areas) that could also be reasonably considered to be potentially sensitive to wind farm developments in one way or another (e.g. due to displacement or collision mortality). Bird species that are not regularly occurring in the vicinity (or not likely to be adversely affected) are not considered further.

Assessment

8.108 The assessment of cumulative effects is summarized in Table 8.14 and detailed further under the relevant species headings below.

Red grouse

8.109 Potential effects on red grouse relate to possible temporary displacement during wind farm construction however displaced birds are likely to find refuge within the Site and also in the immediately surrounding area (within a 500 m to 1 km extent). None of the other wind farms are located within this immediately surrounding area and it is therefore highly unlikely that displaced birds would be subject to any additional adverse effects from these wind farms.

Snipe

8.110 Potential effects on snipe relate to the possible displacement of breeding pairs within a 400 m extent around turbine locations and habitat management measures are proposed in order to mitigate for this possible effect. None of the other wind farms are located in the near vicinity (within 400 m) either of the snipe locations or of the proposed snipe habitat management area and it is therefore highly unlikely that displaced birds would be subject to any additional adverse effects from these wind farms.

Peregrine

8.111 Potential effects on peregrines relate to the possible displacement of foraging birds around turbine arrays and also collision mortality. This species has a favourable conservations status in the U.K. and Ireland and when this is considered in the context of the general foraging behaviour, very diverse habitat tolerance and low collision risk then it is highly unlikely there would be any significant additional displacement or collision mortality effects due to the other wind farms.

Buzzard

8.112 Potential effects on buzzards relate to the possible displacement of foraging birds around turbine arrays and also collision mortality. This species has a favourable conservations status in the U.K. and Ireland and when this is considered in the context of the very diverse habitat tolerance, expected good breeding productivity and annual survival for the local buzzard population then it is highly unlikely there would be any significant additional displacement or collision mortality effects due to the other wind farms.

Kestrel

8.113 Potential effects on kestrels relate to the possible displacement of foraging birds around turbine arrays and also collision mortality. The published research does not indicate any specific displacement effects for this species and turbine avoidance is lower compared to other raptor species. Observations by the author at numerous operational wind farms located throughout Northern Ireland indicate that kestrels forage freely within turbine arrays (they are not displaced around them) and on occasion will approach close to operating turbines (within several tens of metres). Considering these various factors then there are highly unlikely to be any significant additional displacement effects on this species due to the other wind farms.

8.114 Possible cumulative collision mortality effects for kestrels need to be considered in terms of the local breeding population in the vicinity of the Proposed Development (as defined by a 5 km maximum foraging range around nest locations). The locations of the other wind farms (although within 10 km of the Proposed Development they are not closer than approximately 6 km and mostly in the range of 7 – 8 km distant) indicates that although some overlap with the local kestrel population is possible in terms of the maximum foraging range this is likely to be relatively minor in extent and if the smaller core foraging range is considered then any overlap is likely to be negligible. Overall, therefore, and when the expected annual productivity and survival of the local kestrel population is also considered then it is unlikely that any additional collision mortality due to the other wind farms would have a significant adverse effect on the local kestrel population or on the regional conservation status of this species.

Table 8.14 – Summary of Possible Cumulative Effects

Species	Potential Effect(s)	Significance of Effect(s)
Red grouse	Temporary displacement of birds during construction	Highly unlikely to be any significant cumulative effect
Snipe	Displacement of breeding pairs	Highly unlikely to be any significant cumulative effect
Peregrine	Displacement (foraging)	Highly unlikely to be any significant cumulative effect
Peregrine	Collision risk	Highly unlikely to be any significant cumulative effect
Buzzard	Displacement (foraging)	Highly unlikely to be any significant cumulative effect
Buzzard	Collision risk	Highly unlikely to be any significant cumulative effect
Kestrel	Displacement (foraging)	Highly unlikely to be any significant cumulative effect
Kestrel	Collision risk	Unlikely to be any significant cumulative effect

Mitigation

8.115 Proposed mitigation measures are outlined below and summarized in Table 8.15 and it is proposed that these would be implemented in full by the Applicant. Full details of the outline Habitat Management Plan (oHMP), Ornithology Mitigation Strategy (OMS) and Ornithology Management and Monitoring Plan (OMMP) would be provided in reports prior to commencement of construction.

Habitat Management

8.116 It is proposed to implement a programme of long-term habitat management (during the life of the Proposed Development) to compensate for the potential displacement of breeding snipe. The snipe habitat management area is to be of an adequate size to compensate for the magnitude of the potential displacement and at an appropriate distance from any species-specific turbine buffers. The habitat management is to follow the Northern Ireland Environmental Farming Scheme species-specific guidance for breeding snipe.

8.117 The oHMP includes details of two Habitat Management Areas (HMA1 and HMA2) totalling 246.6 ha of land that is to be under management options that are beneficial for breeding snipe. HMA1 is 22.7 ha in extent and all of this area is >400 m from the turbine locations and so is potentially optimal for breeding snipe. HMA2 is 223.9 ha in extent and the northern portion (approximately 20 ha) is >400 m from the turbine locations and so is also potentially optimal for breeding snipe. Therefore a total of approximately 55.4 ha of habitat management land is in areas that are potentially optimal for breeding snipe (>400 m from turbines).

8.118 Published information[41] indicates a typical breeding density of approximately ten snipe pairs per 100 ha and this concurs with the observations of the author at sites in Northern Ireland where (in good quality upland habitat) territorial males can be spaced 200 – 300 m apart, with up to three observed in an area of 20 ha and an average density of one territorial male per nine hectares[42]. It is therefore anticipated that 55.4 ha of habitat will be more than adequate to compensate for the potential displacement of one or two pairs of snipe due to the Proposed Development and could potentially provide habitat for up to at least four pairs of snipe. The additional parts of HMA2, although within 400 m of the turbines and therefore sub-optimal (due to potential displacement effects) will nevertheless also be under management options that are beneficial to breeding snipe and so will provide habitat that can be used by this species, albeit potentially at lower densities than in areas further away from the turbines.

Ornithology Mitigation Strategy (OMS)

8.119 It is proposed that no development activity will take place on the Site between 1 March and 31 August in any year until an Ornithology Mitigation Strategy (OMS) has been prepared by a suitably experienced ornithologist and approved by the Planning Authority. The OMS is to include:

- Details of pre-construction bird surveys including the locations of any breeding activity by sensitive species;
- Details of mitigation measures to be implemented prior to construction works commencing including details of disturbance buffers and any associated phasing of works;
- Details of the timing of ground preparation and vegetation clearance to avoid disturbance to breeding birds;
- Details of bird surveys to be conducted during the construction phase;

[41] Cramp, S. *et al.* (1983) Birds of the Western Palearctic (Vol. 3) and del Hoyo, J. *et al.* (1996) Handbook of the Birds of the World (Vol. 3)

[42] Unpublished observations

- Details of appropriate mitigation measures to be implemented during the construction phase (e.g. species-specific buffer zones);
- Provisions for reporting after construction has commenced and at the end of each breeding season during which construction takes place.

Ornithology Management and Monitoring Plan (OMMP)

8.120 It is proposed that no development activity will take place until an Ornithology Management and Monitoring Plan (OMMP) has been prepared by a suitably experienced ornithologist and approved by the Planning Authority. The OMMP is to include:

- Details of the programme of habitat management measures for snipe to be completed prior to the first breeding season after completion of construction;
- Details of a programme of appropriate post-construction bird surveys including surveys of breeding snipe;
- Details of the provision of bird monitoring reports at the end of each year.

Table 8.15 – Proposed Mitigation Measures

Proposed Mitigation	Implementation	Reason
▪ Habitat management measures (approx.. 246.6 ha including c. 55.4 ha located >400 m from turbines)	▪ Long term during the life of the Proposed Development	▪ To compensate for the potential displacement of 1 – 2 pairs of breeding snipe
▪ Ornithology Mitigation Strategy (OMS)	▪ Prior to and during construction when this takes place during 1 March to 31 August in any year	▪ To protect breeding birds during the construction phase
▪ Ornithology Management and Monitoring Plan (OMMP)	▪ During construction and post-construction	▪ To ensure implementation of the long-term snipe habitat management measures and to monitor the long-term effects of the Proposed Development on sensitive bird species

Residual Effects

8.121 Any likely significant effects of the Proposed Development on birds and any residual effects after the implementation of the proposed mitigation measures are summarized in Table 8.14. (Potential effects that have been assessed as unlikely to be significant are not included in the table).

Table 8.14 – Summary of Likely Significant Effects and Residual Effects

Species	Effect	Proposed Mitigation	Residual Effects
Snipe	▪ Potential displacement of 1 - 2 pairs of snipe ▪ Likely to be significant for the local snipe population ▪ Not significant at the regional or national level	▪ Implementation of long term habitat management measures for snipe ▪ Implementation of Ornithology Mitigation Strategy ▪ Implementation of Ornithology Management and Monitoring Plan	▪ No residual effects

Conclusions

8.122 The findings of the ornithology assessment can be summarized as follows:

- The Site and surrounding buffer area of the Proposed Development is overall of relatively low sensitivity for birds and there are no protected or designated bird sites in the vicinity.
- Red grouse are present on the Site but with appropriate management of the construction phase then it is not expected that there would be any permanent adverse effects on this species.
- There is a potential significant adverse effect for breeding snipe (displacement of one or two pairs) however the effect would be local and is not significant at a regional or national scale.
- There are no Annex-1 raptor-species (e.g. hen harrier) either currently breeding in the near-vicinity or (based on an assessment of habitat conditions) likely to do so in at least the medium-term. For the other (non-Annex-1) raptor species occurring in the vicinity there are unlikely to be any significant adverse displacement or collision mortality effects.

- Potential cumulative effects have been considered in terms of other wind farms located within 10 km of the Proposed Development however no likely significant cumulative effects have been identified.
- Details are provided of mitigation measures including appropriate habitat management measures for breeding snipe. Assuming full implementation of the mitigation measures then it is concluded that the Proposed Development is unlikely to have any significant adverse effects on bird populations at the local, regional or national scale.

List of Appendices

- Technical Appendix 8.1 – Details of Brown and Shepherd Survey Visits (Breeding Period)
- Technical Appendix 8.2 – Details of Brown and Shepherd Survey Visits (Non-breeding Period)
- Technical Appendix 8.3 –Details of Vantage Point Watches
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9

Fisheries & Aquatic Ecology

9. Fisheries & Aquatic Ecology

Background

9.1 This chapter describes the fisheries interests of the watercourses draining the proposed Mullaghclogher Wind Farm, hereinafter referred to as 'the Development', and considers the potential effects of the construction, operation and decommissioning of the Development on these interests. The assessment consists of a desk-based assessment using available published and online information in combination with data and observations collected in the field.

9.2 The specific objectives of the chapter are to:

- describe the fisheries baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects;
- assess the residual effects remaining following the implementation of mitigation.

9.3 The assessment has been carried out by Paul Johnston Associates Ltd, an independent fisheries consultancy specialising in freshwater fisheries in Ireland. David Kelly holds a BSc (1st Class Hons) degree in Zoology, and a PhD in Freshwater Ecology & Fisheries; he is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM), a registered member of the Institute of Fisheries Management (MIFM) and a visiting Research Fellow at Queens University Belfast.

9.4 The practice has completed a wide range of assignments in the areas of environmental impact assessment, fisheries development and catchment management. This includes fisheries assessments in connection with a series of onshore wind farm developments in Northern Ireland.

9.5 **Volume 3 - Figures 9.1 to 9.7** are referenced in the text where relevant.

Legislation, Policy & Relevant Guidance

Fisheries Administration

9.6 With regard to fisheries administration and legislation, the footprint of the proposed Development lies within the Loughs Agency's geographic area of responsibility.

9.7 Under Section 11 (6) of the Foyle Fisheries Act (Northern Ireland) 1952 and the Foyle Fisheries Act 1952 (Republic of Ireland), the Foyle Fisheries Commission was given the responsibility for "the conservation, protection and improvement of the Fisheries of the Foyle Area generally". Under the North/South Co-Operation (Implementation Bodies) (Northern Ireland) Order 1999 and the British Irish Agreement Act 1999 these functions were extended to include the Carlingford Area, and the Foyle Fisheries Commission transferred its functions to the Loughs Agency.

9.8 The Loughs Agency is an agency of the Foyle, Carlingford and Irish Lights Commission (FCILC), established under the 1998 Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of Ireland.

Legislation

EU Legislation

9.9 EU and local legislation relevant to fisheries and the water environment in the area of the Development includes the following:

- EC Habitats Directive (92/43/EEC);
- EU Water Framework Directive (2000/60/EC) [incorporating standards from the Fish Directive [Consolidated] (2006/44/EC) – this Directive was repealed in 2013];
- European Eel Regulation (EC) 1100/2007.

Domestic Legislation

- Fisheries (Northern Ireland) Act 1966;
- Foyle Fisheries Act (Northern Ireland) 1952;
- North/South Co-Operation (Implementation Bodies) (Northern Ireland) Order 1999;
- Drainage (Northern Ireland) Order 1973;
- Environment (Northern Ireland) Order 2002;
- Nature Conservation and Amenity Lands (Amendment) (Northern Ireland) Order 1989;
- Water (Northern Ireland) Order 1999;
- Water Environment (Water Framework Directive) (Northern Ireland) Regulations 2003;
- Wildlife (Northern Ireland) Order 1985;
- Wildlife and Natural Environment Act (Northern Ireland) 2011.

Policy

9.10 Policy with regard to Atlantic salmon and European eel in this region is set out in the following:

- Foyle and Tributaries ASSI Citation
- Foyle and Tributaries SAC Conservation Objectives

- Owenkillew Local Management Area Action Plan and Update 2013
- Atlantic Salmon Management Strategy for Northern Ireland and the Cross-Border Foyle and Carlingford catchments to meet the objectives of NASCO resolutions and agreements, 2008-2012 (DCAL);
- North Western International River Basin District Eel Management Plan (Northern Regional Fisheries Board/Loughs Agency/DCAL).

Guidance

9.11 Specific guidance relevant to the Development includes the following:

- Guidelines for Fisheries Protection during Development Works (Foyle and Carlingford areas). Environmental Guideline Series – No. 1. (Loughs Agency, 2011);
- Engineering in the water environment: good practice guide River Crossings (SEPA 2nd Edtn 2010);
- Culvert Design and Operation Guide (C689) (Balkham et al, 2010);
- Industry Best Practice as described in the Good Practice Guidance for Pollution Prevention (https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/), including but not limited to the following;
    - GPP1: Understanding your environmental responsibilities – good environmental practices
    - GPP2: Above ground oil storage tanks;
    - GPP5: Works and maintenance in or near waters;
    - PPG6: Working at construction and demolition sites;
    - PPG7: Safe Storage – The safe operation of refuelling facilities
    - GPP8: Safe storage and disposal of used oils;
    - PPG13: Vehicle washing and cleaning;
    - PPG18: Managing fire water and major spillages;
    - GPP21 Pollution incident response planning;
    - GPP22 Dealing with spills;
    - GPP26 Safe storage – drums and intermediate bulk containers

Scope of Assessment

9.12 The fisheries assessment has involved desk study, field work, data processing and analysis and interpretation using professional judgement. The key receptors are the Upper Burn Dennet River and tributaries, and its downstream drainage to the main Burn Dennett River within the River Foyle catchment. Drains that feed several small tributaries of the Eden River occur on the southern edge of the Land Under Applicant Control, hereinafter referred to as 'the Site', and this drainage meets the main Glenelly river downstream.

9.13 Existing fisheries data and relevant conservation information on the Burn Dennett and Eden River, and the main Glenelly River, was assimilated and supplemented through a bespoke fisheries survey of the Site covering the principal watercourses draining the area.

9.14 The field study consisted of walkover surveys of the principal watercourses, assessments of physical habitat conditions, measurement of basic chemistry parameters, collection of benthic invertebrate samples for assessment of biological quality, and a fish stock survey by electrofishing.

Consultation

9.15 The principal consultee during the study was the Loughs Agency as the statutory body with authority for fisheries matters in the local waters. Consultee responses are summarised in **Table 9.1**.

9.16 Consultations were also conducted with other sub-consultants on the project, notably in relation to hydrology and drainage issues which are contained within **Chapter 10: Geology and Water Environment** of this ES.

Table 9.1: Consultee Responses

Consultee		Summary of Response	Addressed in Assessment
Loughs Agency	Fisheries	Personal communication with Mr. Seamus Cullinan, Loughs Agency area fisheries officer to discuss intended fish surveys in both sub-catchments. Seamus indicated that recent Loughs Agency juvenile salmonid surveys in summer 2022 had produced excellent results	Discussed under “WFD Fish Monitoring” and “Angling”

Assessment Methodology

Baseline Characterisation

Study Area

9.17 The study area focused on the Upper channel Burn Dennett River and associated tributary streams, which drain north and north-west from across most of the Site. A smaller portion of the southern part of the Site is drained by small field drains that are hydrologically linked to upper tributaries of the Eden River, which ultimately drains south to the main Glenelly River (**Volume 3 - Figure 9.1**).

9.18 The desk assessment includes an evaluation of fisheries in downstream reaches of the Burn Dennett, Eden and Glenelly Rivers (**Volume 3 - Figure 9.1**).

Desk Study

9.19 A desk study was carried out to assimilate baseline information relating to salmonid fisheries, ecological and water quality status (under WFD) for the study area. The following sources were consulted/used:

- Loughs Agency annual juvenile salmonid monitoring data
- Northern Ireland Environment Agency (NIEA) – Water Management Unit (WMU) (Rivers and Lakes Team) https://appsd.daera-ni.gov.uk/RiverBasinViewer/
- NIEA digital datasets https://www.daera-ni.gov.uk/articles/digital-datasets

Field Survey

General Approach

9.20 An initial walkover survey was carried out to assess the significance of the streams directly draining the Site. This was followed by more detailed surveys of the Upper Burn Dennett and associated drainage tributaries, including the Glengarrow Burn and Stroanbrack tributary, and tributary streams of the Eden River downstream of the Site (**Vol 3 Figure 9.2**).

9.21 The surveys at each site comprised assessments of stream quality (water chemistry, physical habitat and aquatic ecology), fisheries habitat and juvenile fish stocks as described below.

Stream Quality

9.22 A series of survey sites was selected on the streams draining the Site. Surveys were conducted in August and September 2022. For each site, baseline water chemistry, physical habitat and aquatic ecology were assessed.

Water Chemistry

9.23 A series of basic water quality parameters were measured at each site using portable meters to provide an outline profile of chemical quality.

9.24 Dissolved oxygen was measured with a Hanna Oxy-Check oxygen meter, conductivity with a Hanna HI86303 conductivity meter, and pH with a Hanna 8424 pH meter; temperature measurements were made with the oxygen meters.

Physical Habitat

9.25 River physical habitat (substratum type, depth, flow velocity) was assessed based on the fully quantitative method developed by DAERA Inland Fisheries Division and the AgriFood and Biosciences Institute (AFBI). In each site, surveys consisted of a 40m stream reach with 25 sampling points across five equidistant cross-sectional transects except on very narrow (<0.3m width) and overgrown streams where it was difficult to observe the riverbed; on these streams, up to 12 transects (1-3 sampling points per transect) were surveyed in each reach.

9.26 At each sampling point, flow velocity was recorded at 60% depth using a Geopacks flow meter, with water depth measured using the meter's impeller stick; substrate was visually assessed using a bathyscope with the dominant substrate type recorded according to a modified Wentworth Scale (Bain et al. 1985; Table 9.2).

Table 9.2: Substrate classification and scoring based on the Wentworth system (from Bain *et al*. 1985)

Substrate type	Size Class (mm)	Score
Sand/silt	**<2**	**1**
Gravel	**2-16**	**2**
Pebble	**17-64**	**3**
Cobble	**65-256**	**4**
Boulder	**>256**	**5**
Irregular Bedrock	**-**	**6**

9.27 The following physical characteristics were measured at each site:

- Stream width and depth at each transect (m)
- Substrate composition (visually estimated as per Bain et al., 1985);
- Percentage of deposited fine sediment (<2mm grain) on the river bed as per Clapcott et al. (2011), with the dominant fine sediment type (sand, silt, clays) determined by running the grain through the observer's fingers.

9.28 The classification system of Bain et al (1985) was used to summarise the composition of substrate in a reach based on two indices:

- Coarseness index (CI) – calculated as the mean dominant substrate score
- Heterogeneity (SD) – calculated as the standard deviation of the mean CI.

These indices show how coarse or smooth the substrate of a reach is and if it is comprised of a mixture or is dominated by a particular substrate class **(Table 9.3)**.

Table 9.3: Substrate description inferred from sample data (from Bain *et al*. 1985)

Mean substrate score (CI)	Heterogeneity (SD)	Inferred substrate description
3.2	**1.96**	**Heterogeneous, smooth and rough**
5.0	**0.00**	**Homogeneous, coarse**
1.25	**0.44**	**Nearly homogeneous, smooth**
3.25	**0.85**	**Heterogeneous, intermediate coarseness**

Mean substrate score (CI)	Heterogeneity (SD)	Inferred substrate description
5.05	**0.69**	**Heterogeneous, coarse**

Aquatic Ecology

9.29 Stream benthic communities are sensitive to a wide range of environmental stressors including nutrient enrichment and organic pollution, acidification, fine deposited and suspended sediments, and hydrocarbons/ oils. The relatively long lifespans and varying sensitivities of individual taxa mean that invertebrate communities can integrate stressor effects over longer timescales than may be indicated by physico-chemical parameters alone (Extence et al. 2013). As such, they are important for assessing both short and longer term effects.

9.30 In September 2022, baseline ecology of watercourses adjacent and downstream of the Development was assessed by sampling the benthic macroinvertebrate community in the riffle/ run habitat using a standard three-minute kick sample (hand held 1mm mesh pole net); the method is recommended by the United Kingdom Technical Advisory Group (UK-TAG) for assessing the condition of the quality element "benthic invertebrates" for WFD reporting (WFD-UKTAG, 2014).

9.31 Samples were collected from riffle/run habitats, fixed in 4% formalin for 1 week, followed by preservation in 70% ethanol prior to sorting and identification.

9.32 In the laboratory, macroinvertebrate samples were spread across a 4 x 5, 20-square grid sorting tray to facilitate identification and to estimate relative abundance. Abundant taxa were counted in a subset of five squares and scaled to whole sample estimates as recommended in Murray-Bligh (2002). Less abundant taxa were counted in all grid squares. The ecological quality baseline was summarized as the following observed metrics; total number of taxa (NTAXA), total site WHPT score, and average score per taxon (WHPT-ASPT), using the abundance weighted sensitivity scores developed by Walley and Hawkes as recommended for the WFD (WFD-UKTAG, 2014).

9.33 In order to classify a sites ecological status, expected (predicted) metric values were determined from site-specific physical and chemical data using the RIVPACS IV model implemented by the online River Invertebrate Classification Tool Version 2 (RICT2) a web application (https://www.fba.org.uk/FBA/Public/Discover-and-Learn/Projects/RICT%20Application.aspx/). This tool is maintained by the UK's environment agencies; Scottish Environment Protection Agency (SEPA), Environment Agency (EA), Natural Resources Wales (NRW) and Northern Ireland Environment Agency (NIEA). Predictions require input of the following test site data: Altitude, distance from source, discharge category, percent substrate composition, and alkalinity (or a surrogate such as electrical conductivity). Input data were obtained from 1:50,000 ordnance surveys maps and from the physical habitat surveys based on the recommended methods outlined in Murray-Bligh (2002). However, discharge category was estimated from width, depth and flow velocity measurements taken during the baseline physical habitat surveys.

9.34 Although samples from at least two seasons are recommended, site classifications can be generated from single season samples. A range of experimental models is available using the online RICT tool with the experiment selected based on relevance. For example, for summer sampled macroinvertebrates in Northern Ireland, the NI single year spring autumn prediction and classification model version 2.0 was selected. The model is hosted on Microsoft Machine Open Learning Studio and is freely available to access with a Microsoft Account. The model calculates observed ecological quality ratios for WHPT-ASPT and NTAXA to determine an unofficial ecological status classification https://www.fba.org.uk/FBA/Public/Discover-and-Learn/Projects/User%20Guides.aspx. Both metrics were then assessed in a "worst of" approach to give an overall invertebrate classification for each reach (see WFD-UKTAG, 2014

9.35 It should be noted that classifications based on single season sampling (as here) are intended only for investigations and are unsuitable for setting environmental objectives or testing compliance against them (RICT2 user guide, https://www.fba.org.uk/FBA/Public/Discover-and-Learn/Projects/User%20Guides.aspx.)

Fisheries Habitat

9.36 An outline assessment of the tributary streams draining the Site was carried out in August 2022 and consisted of walkover surveys recording general characteristics. Additional information of fish habitat classification was recorded during the fish stock survey in September 2022.

9.37 The descriptive terminology used in the survey is based on the Life Cycle Unit method (Kennedy, 1984) currently used by DAERA Inland Fisheries and the Loughs Agency (see also DANI advisory leaflet No 1). In summary, habitat type is recorded as:

- Nursery (shallow rock/cobble riffle areas for juvenile fish - fry/parr);
- Holding (deeper pools/runs for adult fish);
- Spawning (shallow gravel areas for fish spawning);

- Unclassified (unsuitable for fish – shallow bedrock areas or heavily modified sections of channel).

Juvenile Fish Stocks

9.38 Monitoring of fish stocks by the Loughs Agency tends not to include sampling sites in the upper reaches of tributaries in most river systems. Therefore, this part of the fisheries assessment considered the principal streams draining the Site with the data supplemented by Loughs Agency annual monitoring data of juvenile salmonid stocks for the lower Eden River and Burn Dennett River.

9.39 A juvenile fish stock survey of the Eden River, Upper Burn Dennett, and associated tributaries within and draining the Site, was carried out by electrofishing at selected locations in September 2022.

9.40 Electrofishing was carried out according to a semi-quantitative methodology described by Crozier and Kennedy (1994). The procedure involves two operators fishing continuously in an upstream direction for five minutes at each sampling location, using an E-Fish 500W single anode electrofishing backpack (EF-500B-SYS). The system operates on 24V input and delivers a pulsed DC output of 10 to 500W at a variable frequency of 10 to 100Hz. Output voltage and frequency are adjusted according to the electrical conductivity at the survey site.

9.41 All fish were caught using a dip net and retained for general inspection and length measurement before being returned to the water live. Any additional Age 0 salmonids observed but not captured were also recorded. This method is consistent with Loughs Agency monitoring procedures.

9.42 The semi-quantitative electrofishing method has been calibrated separately for trout and salmon based on extensive studies in river reaches of known juvenile salmonid density. This has resulted in the development of an abundance classification system (Abundance Index) for salmon with five categories: Absent, Poor, Fair, Good, Excellent (Table 9.4a). The Abundance Index for trout has six classifications: Absent, Poor, Poor/Fair, Moderate, Good, Excellent (**Table 9.4b).**

Table 9.4: Semi-quantitative abundance categories for age 0 salmon (a) and trout (b), as developed by Crozier and Kennedy (1994); Kennedy (*unpublished data*)

(a) Salmon

Fry (0+) nos.	Density (No/100m2)	Abundance/ quality category
0	0	Absent
1 - 4	0.1 - 41.0	Poor

Fry (0+) nos.	Density (No/100m2)	Abundance/ quality category
5 - 14	41.1 - 69.0	Fair
15 - 24	69.1 - 114.6	Good
25+	114.6+	Excellent

(b)Trout

Fry (0+) nos.	Density (No/100m2)	Abundance/ quality category
0	0	Absent
0 - 1	0.1 - 7.0	Poor
2 - 3	7.1 - 16.5	Fair
4 - 8	17 - 31	Moderate
9 - 17	32 - 59.9	Good
18+	60+	Excellent

Assessment of Effects

9.43 The assessment of effects was derived from methodologies outlined by:

- the Design Manual for Roads and Bridges specifically with regard to Road Drainage and the Water Environment, Volume 11, Section 3, Part 10 LA113 (DMRB, 2019);
- Guidelines for Ecological Impact Assessment in the UK and Ireland (2018).

9.44 The significance of the potential effects of the Development has been classified by professional consideration of the sensitivity of the receptor and the magnitude of the potential effect.

Sensitivity Criteria

9.45 Using the information assembled through the baseline assessment, the Fisheries Significance/Sensitivity of each watercourse was graded according to the generic methodology for environmental sensitivity outlined in the Design Manual for Roads and Bridges (2019). Table 9.5 details the framework applied in determining the sensitivity and this evaluation was used as the basis for the assessment of effects and the specification of any necessary mitigation requirements with regard to fisheries and the aquatic environment.

Table 9.5: Estimating the Sensitivity/Importance of Receptors (adopted from Table 3.70, DMRB, 2019)

Sensitivity	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on a regional or national scale	WFD Class 'High'. Site protected/designated under EC or UK habitat legislation (SAC, ASSI, salmonid water)/Species protected by EC legislation. Watercourse containing salmon and supporting a nationally important fishery or river ecosystem.
High	Attribute has a high quality and rarity on a local scale	WFD Class 'Good'. Species protected under EC or UK habitat legislation. Watercourse containing salmon or trout and supporting a locally important fishery or river ecosystem.
Medium	Attribute has medium quality and rarity on a local scale	WFD Class 'Moderate'. Watercourse containing trout and upstream of locally important fishery or river ecosystem.
Low	Attribute has low quality and rarity on a local scale	WFD Class 'Poor'. Watercourse without salmon or trout but upstream of locally important fishery or river ecosystem.
Negligible	Attribute has very low quality and rarity on a local scale	WFD Class 'Poor'/unspecified.

Magnitude of Effect

9.46 The magnitude of effect was assessed according to the criteria set out in Table 9.6 and includes a consideration of the timescale of the effect (short, medium or long term).

Table 9.6: Estimating the Magnitude of Impact on Receptors (adopted from Table 3.71, DMRB, 2019).

Magnitude	Criteria	Type and Scale of Effect
Major	Results in loss of attribute and/or quality and integrity of the attribute	Loss or extensive change to a fishery. Loss or extensive change to a designated Nature Conservation Site. Major alteration to fish population levels in catchment as a whole, through fish mortality, habitat destruction or barrier to migration. Duration: long-term (>5 years).
Moderate	Results in effect on integrity of attribute, or loss of part of attribute	Partial loss in productivity of a fishery. Appreciable alteration to fish population levels in specific sub-catchment or zone. Duration: medium-term (1-5 years).

Magnitude	Criteria	Type and Scale of Effect
Minor	Results in some measurable change in attribute's quality or vulnerability	Minor loss in productivity of a fishery. Minor alteration to fish population levels in specific sub-catchment or zone. Duration: short-term (up to 1 year).
Negligible / No impact	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	Unlikely to affect the integrity of the water environment. No measurable alteration to fish population levels.

Significance Criteria

9.47 The correlation of magnitude against the sensitivity of the receptor determines a qualitative expression for the significance of the effect on the basis of a standard matrix shown in Table 9.7. The greater the sensitivity or value of a receptor or resource, and the greater the magnitude of the impact, the more significant the effect.

Table 9.7: Estimating the Significance of Potential Effects (adopted from Table 3.8.1, DMRB, 2019b)

Sensitivity	Magnitude of Effect			
	Major	Moderate	Minor	Negligible
Very High	Very Large	Large/Very Large	Moderate/Large	Neutral
High	Large/Very Large	Moderate/Large	Slight/Moderate	Neutral
Medium	Large	Moderate	Slight	Neutral
Low	Slight/Moderate	Slight	Neutral	Neutral

9.48 The five significance categories with typical effects are shown in Table 9.8. Effects evaluated as being Moderate, Large or Very Large are considered to be significant for the purpose of the EIA in line with the EIA Regulations and will require mitigation. Those effects assessed as Slight or Neutral are not considered to be significant in terms of the EIA.

Table 9.8: Descriptors of the Significance of Effect Categories (adopted from Table 3.7, DMRB, 2019b).

Significance category	Descriptors of effects
Very large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.

Significance category	**Descriptors of effects**
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Baseline Conditions

Outline

9.49 This element of the assessment consisted of:

- Desk studies to collate baseline information on fisheries, conservation designations, and ecological status of waterbodies hydrologically connected to the Site; and
- Field surveys focused on the streams draining the Site to assess baseline physical habitat conditions, biological quality, salmonid habitat, and fish distribution. Field survey work was therefore carried out both within the Site Boundary and in the immediate downstream reaches of the drainage streams connecting to the Burn Dennett and Eden Rivers.

Catchment Status

Designated Sites

River Foyle and Tributaries SAC/ ASSI

9.50 There are no designations relating to Fisheries and Aquatic Ecology with respect to SACs or ASSIs within the Site boundary or immediate drainage streams. However, the Foyle and Tributaries SAC/ ASSI is hydrologically connected to Site drainage.

9.51 The Foyle and Tributaries SAC/ ASSI is located over 18km downstream of the Eden River Site drainage and over 25km downstream of the Burn Dennett River Site drainage (**Figure 9.1**).

9.52 Within the Foyle and Tributaries SAC/ ASSI, the following aspects are relevant to fisheries and aquatic species:

- SAC - The river habitat is a key selection feature with a global assessment grade of “B” (International Importance), due to the presence of dynamic flow habitat types, largely natural channel and substrates, and extensive beds of water crowfoot *Ranunculus* in stretches including the Strule. Annex II listed Atlantic salmon is a primary selection feature with a global assessment grade of "B" (International Importance) (NIEA, 2015b). Annex II listed European Otter, *Lutra lutra*, is also a qualifying feature with a global assessment grade of "C" (National Interest), but is not the primary reason for the designation. Sea Lamprey, River Lamprey and Brook Lamprey and Freshwater Pearl Mussel are included as selection features of interest (global assessment grade D) but are not qualifying features for the designation (NIEA, 2015a).

- ASSI – The River Foyle and Tributaries was designated an ASSI in 2003 under Article 28 of the Environment (Northern Ireland) Order 2002, with the designated area corresponding to that of the SAC. The ASSI designation is largely on account of the river's naturalness of channel and bank, and because of the presence of Atlantic salmon (see below) and European otter.

EU Water Framework Directive

Local River Catchments

9.53 The Development is located in two sub-catchments of the River Foyle; the Burn Dennett River and the Eden River (Glenelly River sub-catchment). The Upper Burn Dennett River is formed by a series of tributary streams that rise largely within the central and eastern part of the Site, including the Glengarrow Burn and the Stroanbrack tributary. A section of the main channel Upper Burn Dennett River runs just within the north-eastern boundary of the Site and is sourced at c. 635m elevation by several smaller streams that drain from Mullaclogher Mountain that lies to the east of the Site boundary (**Vol 3 Figure 9.2**).

9.54 Two small tributaries of the Eden River rise via small drains at the southern edge of the Site boundary and flow south-west to south before meeting several additional tributaries over 1.5km downstream that form the main channel Eden River (**Figure 9.2**). The Eden River meets the main Glenelly River at c. 3.8km downstream of the Site boundary.

9.55 Land use in the upper reaches of the Site drainage streams is predominantly rough grazing for sheep and limited cattle grazing.

Ecological Status & Water quality

9.56 The Water (Amendment) (Northern Ireland) (EU Exit) Regulations 2019 ensured that the Water Framework Directive (WFD) continues to operate in Northern Ireland after January 1st 2021. To achieve the ecological objectives of the WFD, River Basin Management Plans (RBMPs) have been implemented through a series of Local

Management Areas (LMAs) during the 2010 to 2015 planning cycle, now extended into the subsequent 2016 to 2021 second cycle, and with a draft plan now published for the third cycle from 2021 to 2027 (https://www.daera-ni.gov.uk/consultations/consultation-draft-3rd-cycle-river-basin-management-plan-2021-2027).

9.57 The Development is bisected by two LMAs consistent with the two different river catchment drainages; the Burn Dennett and Foyle LMA includes the river waterbody defined as the Burn Dennett River (Ballynamallaght; GBNI1NW010101071) whereas the Owenkillew LMA includes the river waterbody defined as the Glenelly River (GBNI1NW010104040), which captures drainage from the Eden River and tributaries.

9.58 Ecological and water quality monitoring to inform waterbody status is conducted by the NIEA Water Management Unit to comply with statutory monitoring for WFD compliance. The monitoring station that informs the Burn Dennett River (Ballymallaght) status is located c. 1.4km downstream of the Site boundary at Essbeg Bridge (station 10019). The monitoring station on the Glenelly River is located at Corick Bridge (F10078) over 6km downstream of the confluence of the Eden River with the Glenelly River. The latest available ecological assessment for these waterbodies (2021) is summarised in Table 9.9 which indicates the overall classification and status with regard to each of the principal parameters monitored.

Table 9.9: Classification of individual quality elements contributing to overall WFD status of relevant water bodies in Burn Dennett and Foyle and Owenkillew LMAs, 2021 (Source: NIEA data request)

Parameter	Burn Dennett River (Ref 1071)	Glenelly River (Ref 4040
Benthic Invertebrates	**Good or better**	**Poor**
Macrophytes	**High**	**High**
Phytobenthos	**High**	**High**
Fish	**-**	**Poor**
Dissolved oxygen	**High**	**High**
pH	**High**	**High**
Soluble Reactive Phosphorus	**High**	**Good**
Ammonia	**High**	**High**
Hydrological regime	**High**	**High**
Morphological conditions	**Moderate**	**-**

Parameter	Burn Dennett River (Ref 1071)	Glenelly River (Ref 4040
Overall Status	**GOOD**	**POOR**

9.59 For the current planning cycle 2021 to 2027, NIEA has published a draft RMBP that includes the North Western International RBD. This document sets out the latest assessment of pressures and impacts on the water environment, describe the progress DAERA NIEA made towards achieving objectives for 2015 and mid-cycle 2018, and explains the significant water management issues that still need to be addressed.

9.60 For the Burn Dennett river waterbody immediately draining the Site, most indicators were classified at High, with the overall ecological status indicated as Good. However, for the Glenelly waterbody immediately downstream of the Eden River confluence, several indicators such as invertebrates and fish, were classified as Poor and these contributed to the overall ecological status assessment of POOR. It should be noted that these classifications are broadly applicable to a waterbody but may fail to reflect the status of individual tributaries that occur distantly upstream of monitoring sites. It is for this reason that additional baseline data is used here to inform on baseline status within the Site (see 9.122 Aquatic Ecology).

EC Fish Directive

9.61 The EC Freshwater Fish Directive (Consolidated) 2006/44/EC (FWFD) set physical and chemical water quality objectives for salmonid waters and cyprinid waters, specifically with regard to dissolved oxygen, ammonia, pH and total zinc.

9.62 Only the main stem channel of the Burn Dennett River to its upper source within and along the north-eastern boundary of the Site, was designated as "salmonid" under the Surface Waters (Fish Life Classification) Regulations (Northern Ireland) 1997, which implements the EC Freshwater Fish Directive. The main channel Glenelly River at the confluence with the Eden River is also designated a "salmonid" water.

9.63 The Fish Directive was repealed by the Water Framework Directive at the end of 2013, and the ecological status defined in the WFD sets the same protection to waterbodies designated for fish under the original directive. Areas designated under the Fish Directive have become areas designated for the protection of economically significant aquatic species under WFD and placed on a Register of Protected Areas.

Significant Freshwater Species

9.64 This section outlines the current status of Annexe II freshwater species and other species of conservation interest in the Burn Dennett and Eden River/ Glenelly catchments.

Atlantic salmon

9.65 As an anadromous species, Atlantic salmon use both the freshwater and marine for the completion of the life cycle. The relevant conservation designations for Atlantic salmon give the species national and international significance. Atlantic salmon is listed in Annexes IIa and Va of the EC Habitat and Species Directive (Directive 92/43/EEC), Appendix III of the Bern Convention, and has a IUCN status of threatened in the Irish Red List No 5 (King et al, 2011). The species was added to the UK Biodiversity Action Plan (BAP) list in 2007 as a priority species for conservation action.

9.66 Adult salmon mature at two to four years of age with spawning occurring between November and December usually the upper reaches of suitable tributaries. Juvenile fish remain in freshwater for one or two years to attain sufficient size before becoming smolts, when they migrate to sea during April and May. The marine phase represents a period of rapid growth associated with greater food availability. Many salmon will return to freshwater in the following year as one sea-winter fish (grilse) but a proportion may remain at sea for another year to return as two sea-winter fish.

9.67 The North Atlantic Salmon Conservation Organisation (NASCO) has endorsed a precautionary approach to the conservation, management and exploitation of the salmon resource and the environments in which it lives; Northern Ireland, through the UK and EU, is a Party to NASCO.

9.68 Atlantic salmon stocks in general are in serious decline with some stocks threatened with extinction. Atlantic salmon in the Foyle system (designated as an SAC and ASSI largely on the basis of salmon), are of international importance and represent one of the largest populations in Europe with genetically distinct sub-populations found in individual sub-catchments. The Loughs Agency is responsible for monitoring and conserving Atlantic salmon stocks in this jurisdiction.

9.69 Within the Foyle system, counts of returning adult fish on the River Finn indicate a failure to meet the conservation limit over the five-year period to 2014 (Niven et. al. 2015). Low returns of adult fish to the Finn and failure to achieve Conservation Limits underpinned the introduction of suspensions to existing commercial netting in the

Foyle and its estuary, and mandatory catch and release for rod caught fish in the Finn and Foyle rivers, under The Foyle Area (Control of Fishing) Regulations 2010.

Lamprey

9.70 There are three species of lamprey in Northern Ireland:

- Brook lamprey (*Lampetra planeri*)
- River lamprey (Lampetra fluviatilis)
- Sea lamprey (Petromyzon marinus)

9.71 Sea and River lampreys are parasitic and migrate between the freshwater and marine environments, returning to freshwater to breed. In contrast, Brook lamprey are resident freshwater throughout their life cycle and are non-parasitic. Brook lamprey are widely distributed in Northern Ireland but River and Sea lamprey have a more limited distribution (Goodwin et al, 2009).

9.72 All three species are designated under Annex II of the EU Habitats Directive (Directive 92/43/EEC). None of the three species is listed as a site selection feature of the River Foyle and Tributaries SAC but River/Brook lamprey are known to be present.

9.73 The Loughs Agency carried out baseline surveys in 2013 to record the abundance and distribution of juvenile lamprey in the Foyle and tributaries SAC; unidentified lamprey and river/ brook lamprey were mapped as present in the vicinity of the Eden River confluence with the Glenelly and in the lower Burn Dennett River. Overall for the SAC, it was found that River/Brook lamprey and Sea lamprey populations were at Favourable conservation status (Niven & McCauley, 2013).

Eel

9.74 The European eel stock has been in rapid decline throughout its range since around 1980. This has led to the passing of the European Eel Regulation (EC) 1100/2007 which aims to return the European eel stock to more sustainable levels of adult abundance and juvenile eel recruitment. Member States are required to implement Eel Management Plans in each eel river basin, in this case the North Western International River Basin District.

9.75 The European eel is not listed under Annexe II but has recently been added to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species in the category of Critically Endangered (King et al, 2011).

9.76 Detailed distributional data for eel in the Burn Dennett and Glenelly/ Owenkillew catchments is lacking although the species is present within both catchments (Loughs Agency 2010; Loughs Agency 2011).

Brown trout

9.77 Brown trout are a priority species for conservation action in Northern Ireland, as required under the Wildlife and Natural Environment Act (Northern Ireland) 2011. Brown trout are widely distributed in the Owenkillew, Glenelly and Burn Dennett catchments. A significant proportion of the Owenkillew and Glenelly stock migrate to sea to become sea trout and return to freshwater to spawn. This anadromous behaviour demonstrates the phenotypic population divergence within brown trout and gives rise to many common names i.e. river, lake or slob trout. It should be noted that it is the same species i.e Salmo trutta.

9.78 Within the Burn Dennett catchment, the Altnaghree Burn is a major spawning tributary for Sea trout and had been the subject of concerted sampling by the Loughs Agency for pre-spawning adult fish in autumn (Loughs Agency, 2016).

Salmon & Trout Stock Data

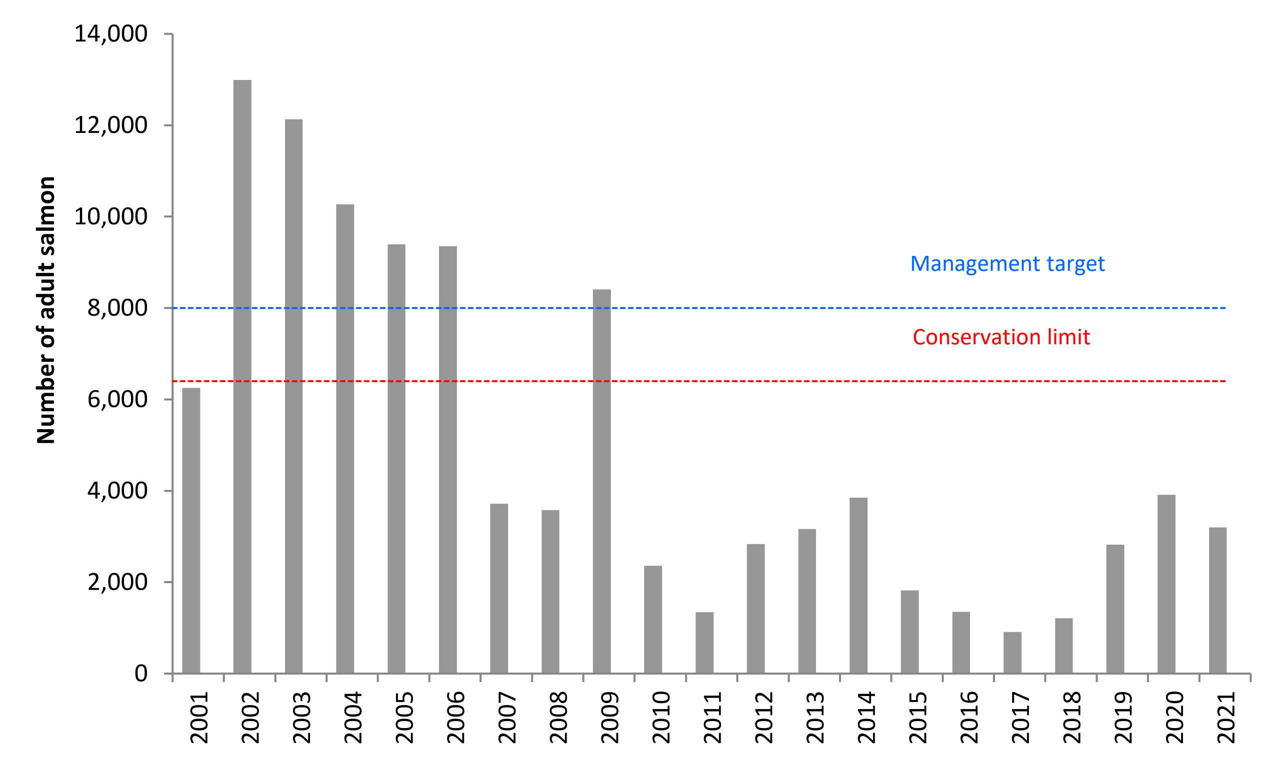
9.79 A key factor in assessing the status of salmon stocks is determination of Conservation Limits for individual river systems. The Conservation Limit for Atlantic salmon is defined by NASCO as: the spawning stock level that produces long term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship. In simpler terms the Conservation Limit for a river is the number of spawning salmon required to ensure that salmon are reproducing in sufficient quantities to produce the next generation of fish.

9.80 A “real time” management regime is operated by the Loughs Agency so that failure to meet management targets, e.g. insufficient number of returning adults through fish counters, can lead to the immediate closure of recreational fisheries, or targeted size restrictions. Management targets and spawning targets are determined for each river catchment with egg deposition levels set according to the area and quality grading of each section of nursery habitat. A percentage of the number of returning adults is deducted from the management target allowing for losses through angling, poaching and predation; the remaining figure is referred to as the conservation limit/spawning target.

9.81 The Owenkillew/ Glenelly is part of the Mourne/ Strule river system within the River Foyle catchment. A management target of 8000 adult Atlantic salmon has been set for the Mourne with a conservation limit/spawning target of 6400 adult fish (Niven & Clarkin 2018).

9.82 The numbers of adult fish returning to the Mourne each year since 2001 is shown in Chart 1. Although the river exceeded the Conservation Limit and Management Target in several years between 2002 and 2009, in the last 12 years to 2021, it failed to meet either target. Overall, the stock status for the Mourne sub-catchment is unsatisfactory.

Chart 1. Numbers of salmon ascending River Mourne fish counter, 2001-21 (Source: Loughs Agency)



Juvenile Fish Stocks

9.83 Fry distribution and abundance are an indication of the distribution and level of spawning by adult fish. Trends in abundance of juvenile salmon and trout are monitored by the Loughs Agency through annual or rotational semi-quantitative electrofishing surveys according to a methodology developed by Crozier & Kennedy (1994).

9.84 The semi-quantitative electrofishing method has been calibrated separately for trout and salmon based on extensive studies in river reaches of known juvenile salmonid density. This has resulted in the development of an abundance classification system (Abundance Index) for salmon with five categories: Absent, Poor, Fair, Good, Excellent (Crozier and Kennedy, 1994). The Abundance Index for trout has six classifications:

Absent, Poor, Poor/Fair, Moderate, Good, Excellent (Kennedy, unpublished; see Table 9.4).

9.85 Charts 2a and b to 4a and b show the average abundance of Atlantic salmon and Brown trout fry across Loughs Agency survey sites on the Glenelly, Eden Burn, and Burn Dennet rivers over the period 2016-2021 with index levels indicated. Note that for the Eden Burn, data are presented for the single monitoring site. Note also that data were unavailable for some of these years and species.

9.86 In the Glenelly, salmon fry were generally more abundant than trout although there was a decline between a high in 2016, when most sites were classed at Excellent abundance. Brown trout abundance across sites in the Glenelly catchment was generally Fair to Moderate. These data reflect the importance of this river system for salmon spawning and nursery rearing for fish in their first year of life cycle, a key stage in maintaining the stocks at a sustainable level. Moreover, the variable data for the Glenelly demonstrates that recruitment patterns can change rapidly, demonstrating the fragility of these populations to environmental stressors.

9.87 For the single monitoring site on the Eden River, which occurs over 3km downstream of the Site boundary, and immediately upstream of the confluence with the Glenelly River, salmon fry abundance patterns generally followed that for the average indicated for the overall Glenelly catchment. Trout fry occurred at up to Excellent abundance in 2019 but was lower in 2020 and 2021.

9.88 For the Burn Dennett catchment, trout were generally more abundant than salmon, ranging generally Good to Excellent, and most likely demonstrating the importance of this system for Brown trout/ Sea trout spawning and rearing. However, salmon fry abundance was generally Fair to almost Good for most years between 2018 and 2021, which demonstrates that a reasonable level of spawning and recruitment takes place. Nonetheless, as compared to levels of abundance between 2005 and 2012 (see Loughs Agency, 2014), salmon abundance has dropped considerably in the Burn Dennett.

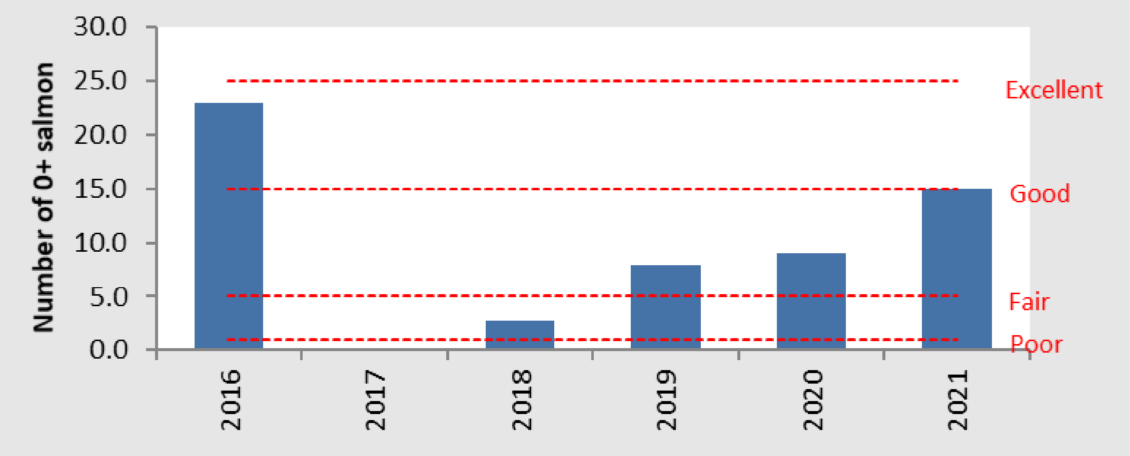


Chart 2a. Average abundance of Age 0 Atlantic salmon across sites in the Glenelly catchment, 2016-2021 (Source: Loughs Agency). NB data were unavailable for 2017.

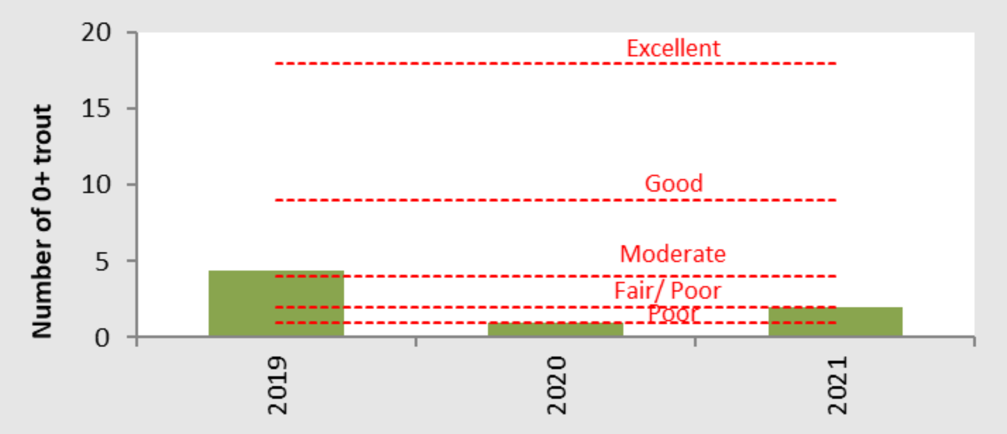


Chart 2b. Average abundance of Age 0 Brown trout across sites in the Glenelly catchment, 2019-2021 (Source: Loughs Agency).

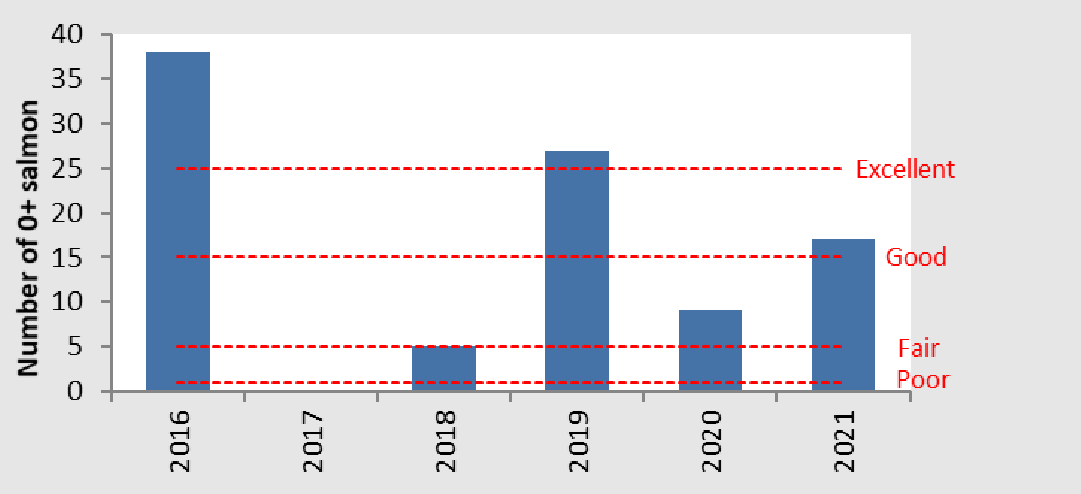


Chart 3a. Abundance of Age 0 Atlantic salmon at the single monitoring site on the Eden Burn, 2016-2021 (Source: Loughs Agency). NB data were unavailable for 2017.

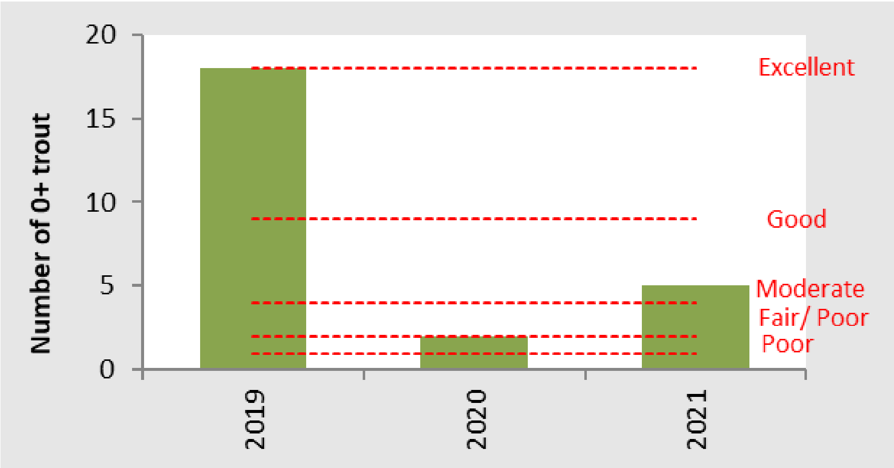


Chart 3b. Abundance of Age 0 Brown trout at the single monitoring site on the Eden Burn, 2016-2021 (Source: Loughs Agency). NB data were unavailable for 2017.

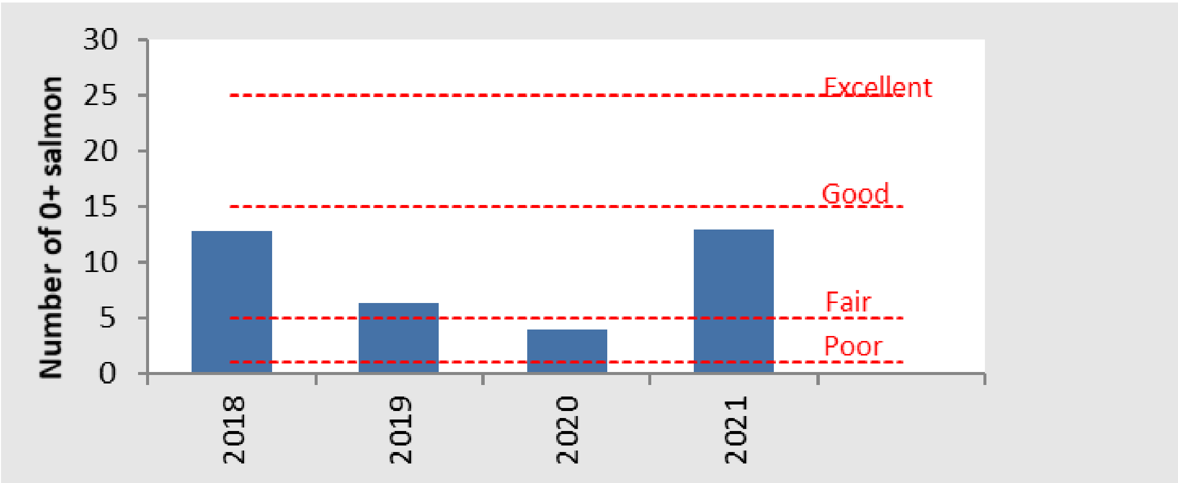


Chart 4a. Average abundance of Age 0 Atlantic salmon across sites in the Burn Dennett catchment, 2018-2021 (Source: Loughs Agency).

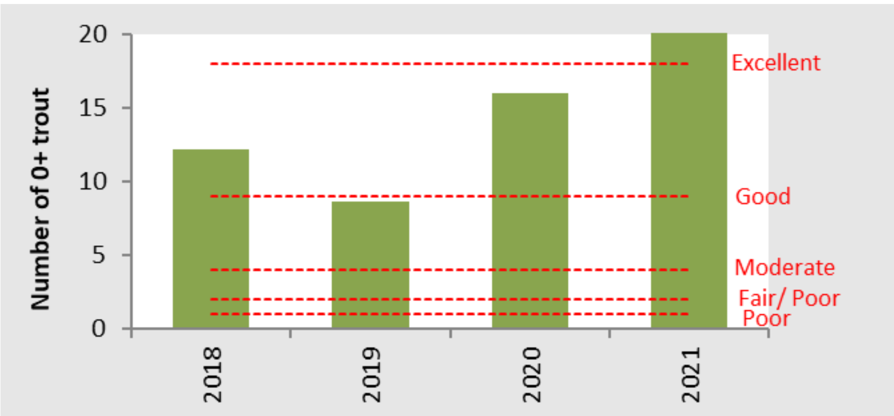


Chart 4b. Average abundance of Age 0 Brown trout across sites in the Burn Dennett catchment, 2018-2021 (Source: Loughs Agency).

Angling

9.89 The Owenkillew and Glenelly are popular recreational fisheries providing angling for both the local population and visitors to the area. Most of the angling is controlled and administered by the Omagh Anglers' Association who lease the fishing rights from local riparian owners; some stretches are operated privately by riparian owners. The season opens on 1 April and closes on 20 October but most angling takes place from late June onwards.

9.90 The Burn Dennett is a moderately sized spate river that has a season running from May 20th to October 20th (Loughs Agency, 2014). Fishing rights are owned by the Honourable the Irish Society and leased by the Dennet Anglers Association. While salmon are caught, it is renowned for its quality of Sea trout angling, with most angling focused on the lower stretches.

9.91 Details of angling activity and catches of salmon are shown in Table 9.10. As these returns are based on incomplete licence/ logbook returns, a raising factor is applied in line with Loughs Agency methodology which is based on an analysis by Small (1991). Adjustment of the catch returns for 2016-2021 would suggest average annual catches respectively of 138 and 47 salmon for the Glenelly and Burn Dennett Rivers, indicative of moderately and low productivity fisheries. Voluntary catch and release is now practised widely on the Foyle system; for the 2017-2021 period, catch and release was 69% for the Burn Dennett River, and for the period 2020-2021, was 93% for the Glenelly River.

Table 9.10: Atlantic salmon and Sea trout angling catches for the Glenelly and Burn Dennett Rivers indicating adjustment according to annual rate of licence/logbook returns, 2016-2021 (Source: Loughs Agency)

Catch statistics	2016	2017	2018	2019	2020	2021	Average
% licence/logbook return	15%	11%	13%	9%	30%	34%	18.67%
Raising factor	2.7	3.43	3.01	4.03	1.7	1.58	2.74
			Glenelly River				
Reported salmon catch	99	29	32	23	29	11	45.75
Adjusted salmon catch	267	99	96	93	49	17	138.75
			Burn Dennett River				
Reported salmon catch	-	33	8	11	33	29	23
Adjusted salmon catch	-	113	24	44	56	46	47

9.92

Site Survey: Fisheries Habitat

Overview

9.93 The Development spans both the Upper Burn Dennett River and small drains that drain to upper tributaries of the Eden River within the Glenelly River sub-catchment. Three main tributaries drain into the main Upper Burn Dennett River via the Site boundary with the Glengarrow Burn and the Stroanbrack Burn (Tributaries 1 and 2) the largest. In addition, a section of the main channel Upper Burn Dennett River lies within the north-eastern boundary of the Site.

9.94 Within the Eden River catchment, two small tributaries (Eden River tributaries 1 and 2) are sourced by small drains within the southern portion of the Site. Site drainage is described in further detail in Chapter 10 Geology & Water Environment.

9.95 The fish habitat survey consisted of a walkover assessment of the main drainage streams (**as shown in Vol 3 Figure 9.2**), and main channels of the Upper Burn Dennett, and the tributaries of the Eden River.

General Description / Observations

Eden River tributaries

9.96 Both Tributaries 1 and 2 occur to the south-west of the Site boundary, but appear to be hydrologically linked via small drains at the Site boundary; both tributaries flow in a southerly direction to meet c. 2km downstream of the Site boundary. This channel then flows further south to meet several additional tributaries that ultimately form the main channel Eden River. Upstream of the small road, and within the landholding boundary, Eden River Tributary 1 runs along the edge of a blanket bog field boundary with an area of rough cattle grazing. It presents as a straight, very narrow drainage channel over a steep gradient with moderate flow and is at best Grade 3 Nursery though trout presence is unlikely (**Vol 3 Figure 9.3; Plate 1**). Further upstream into landholding, these streams are sourced by a series of ill-defined drains and that salmonid habitat quality deteriorates.

9.97 A small field drainage channel (c. 1km south-west of the Site) with a peat bed joins the tributary on the true left but has no fisheries significance (**Figure 9.3; Plate 2**). Further downstream of the Site and road intersection, the stream is very narrow with incised banks and land use a mixture of grazed blanket bog and rough pasture. The stream bed is a mixture of peat and small pebbles and gravel, c. 0.3m wide with a depth up to 0.3 due to the presence of small bog-like pools with tannin coloured water interspersed with very shallow runs (**Figure 9.3; Plate 2**). Habitat is barely Grade 3 Nursery but a few trout may be present.

9.98 Habitat quality improves c. 1.5km downstream of the landholding though the channel is very narrow with flow habitat a series of small shallow runs and pools (**Figure 9.3; Plate 7**). Habitat quality is Grade 3 Nursery and Resting Pools.

9.99 Eden River Tributary 2 appears to be hydrologically linked to the Site via small drains on the southern Site boundary, and the source of Tributary 1. The channel is steep, incised and c. 0.2-0.4m wide with a very shallow depth of 0.01-0.04m; the stream bed comprises mainly shattered flat broken rocks, tannin coloured water, and appears as straight and drain-like (**Figure 9.3; Plate 5**). Salmonid habitat quality is poor due to depth and substrate and is barely Grade 2 Nursery with very low fisheries significance. Further upstream, it becomes even steeper and less suitable.

9.100 The main channel Eden River at c. 3.5km downstream of the Site is 2-3.5m wide and has well defined riffles, runs and small pools over a relatively steep gradient. Habitat quality is a mixture of Grade 1 and 2 Nursery with Grade 2 and 3 Resting Pools and there was no fine sediment deposition observed on the river bed (**Figure 9.3; Plate 8**).

Stroanbrack Burn (Tributary 1)

9.101 The Stroanbrack Burn flows under Stroanbrack Bridge just within the northern landholding boundary, and is formed by two key tributaries (1 and 2) that meet just upstream of the bridge (**Figure 9.4**). The main burn is essentially Tributary 1, and this flows for c. 2.3km within the landholding. In the lower burn in the vicinity of the bridge, the channel is c. 1-3m wide with good quality resting pools (Grade 2) and riffle/run flow habitat consistent with Grade 3 Nursery with a bed of boulder and cobble. The water is peat stained and the riverbed has patches of coarse sand but is free of any fine sediment (**Figure 9.4; Plate 9**).

9.102 Further upstream beyond the confluence with Tributary 2, the channel is partly shaded by riparian growth, a residential garden, and a small area of plantation conifer but becomes more open and less shaded. Land use is rough grazing although mainly tall herbs and rushes with no obvious impact of any sheep grazing. There is good flow and a very clean bed with riffles and run flows, a boulder and cobble bed with scattered gravels consistent with Grade 3 Spawning and a mixture of Grade 2 and 3 Nursery (**Figure 9.4; Plate 10**).

9.103 The burn intersects the main farm track here via a clear span stone bridge with a cobble base that would permit free passage of fish. Downstream of the track, the gradient flattens with the channel a long series of small pools (Grade 3) and riffle/ runs (Grade 3 Nursery) (**Figure 9.4; Plate 11**).

9.104 Further upstream of the track, the channel narrows to c. 0.6-1.0m and the gradient steepens into a series of faster flowing riffles and runs with occasional small pools over moss, pebble, cobble, boulder and bedrock (**Figure 9.4; Plate 12**). Habitat quality is mainly Grade 3 Nursery and Pools3 with patches of Grade 3 Spawning gravels (**Figure 9.4; Plate 12).** All of the channel below this point has good potential to support trout.

9.105 The channel becomes significantly narrower, incised and almost appears as a trickle at c. 700m upstream of the farm track. Most of the flow downstream of here is likely contributed by drainage from the extensive heather and BB. It shallow (depth 0.02-0.05m), and slower flowing with a bed of moss, peat and fine gravel - habitat is barely Grade 3 Nursery and trout presence is highly unlikely (**Figure 9.4; Plate 13**).

Stroanbrack Burn (Tributary 2)

9.106 This much smaller tributary of the Stroanbrack Burn is narrow at c. 0.4m but clear flowing with tannin colour and a bed of small pebbles and cobble with patches of ferruginous sludge. It is surrounded by wet rushy pasture and is barely consistent with Grade 3 Nursery due to its depth and limited substrate complexity but may support trout spawning (**Figure 9.4; Plate 14**).

9.107 Although the mapping would indicate that a second tributary joins some 170m upstream, this was not defined at ground level, with the area an expanse of wet rushy pasture. C. 850m further upstream the channel remains very shallow and is met on the true right side by a series of obliquely cut field drains (e.g. see **Figure 9.4; Plate 15)** that have very low fisheries significance. Here, the tributary remains very shallow with habitat that is barely Grade 3 Nursery with a bed of pebbles, occasional cobble and peat.

9.108 Further upstream, the channel emerges from a very overgrown section at a field boundary and fence. Here, it is shallow and more open with riffles and runs but remains and a bed of cobble and gravel fines in a peat cut channel surrounded by rough sheep grazing (**Figure 9.4; Plate 16**); habitat quality is Grade 3 Nursery at best.

9.109 Further upstream towards a rough farm track crossing, the channel is very overgrown and covered with grasses and rushes; flow is low, depth is shallow and the overall channel gradient is also shallow. The stream bed is a mixture of cobble, fines and sand but the habitat is barely Grade 3 Nursery and mainly is Unclassified (**Figure 9.4; Plate 17**).

9.110 Upstream of the farm track, this tributary is formed as a wet flush/ seepage within steep rough pasture and bog, flows across the track, and has no fisheries significance (**Figure 9.4; Plate 18**).

Upper Burn Dennett River – main channel

9.111 The main channel Upper Burn Dennett River towards the northern landholding boundary runs parallel to a farm track. The channel is c. 4m wide and the banks have been fortified with large boulders placed as “rip-rap” to provide flood protection; however, in-river habitat is mainly of good quality with boulder, large cobble, and pebble in moderately flowing riffle and run habitat consistent with Grade 2 Nursery (**Figure 9.5; Plate 19**).

9.112 C. 600m upstream on the edge of the north-eastern landholding boundary, the channel emerges from an inaccessible gorge/ ravine that is tree lined and with banks that are almost vertical (**Figure 9.5; Plates 20 & 21**). It was unsafe to tray to access this section to well above the confluence of the Glengarrow Burn, c.480m upstream.

9.113 The gradient below the gorge shallows somewhat and is c. 3.0-3.8m wide, 0.05-0.15 deep with Grade 1-3 Nursery and some moderately deep Grade 2 resting Pools, and patches of potential spawning gravels. The riverbed substrate was dominated by boulder and cobble in mainly riffle and runs and there was no evidence of deposited fine sediment. Overall, the habitat has very good potential to support salmonid fish.

9.114 Much further upstream to just above the landholding boundary, the Upper Burn Dennett river gradient flattens out in a shallow U-shaped valley. The river runs parallel to a rough farm track and is c. 2.5.5m wide with areas of channel braiding. Habitat quality is Grade 2 Nursery with boulder and cobble interspersed with Grade 2 resting Pools and scattered gravels consistent with Grade 3 Spawning habitat (**Figure 9.5; Plate 22).**

Site Survey: Stream Quality

9.115 Six sites were surveyed in the watercourses draining the Development (Sites A-F; **Volume 3- Figure 9.6**) as follows:

- Site A – Eden River Tributary 1 downstream of road immediately c. 1.2km below the landholding boundary.
- Site B – Eden River Tributary 2 downstream of road immediately c. 1.3km below landholding boundary.
- Site C – Stroanbrack Tributary 1 inside north-western landholding boundary
- Site D – Stroanbrack Tributary 2 lower just above confluence with Tributary 1
- Site E – Upper Burn Dennett River just within landholding boundary
- Site F – Glengarrow Burn lower end just above the confluence with the main Burn Dennett River

Chemical Water Quality: Basic Parameters

9.116 All streams had satisfactory dissolved oxygen levels with lower conductivity recorded in Eden River Tributary 1 (site A) and the main Upper Burn Dennett River (Site E; Table 9.11); coupled with the lower recorded pH values in both watercourses, this suggests low productivity systems and the potential impacts of the upper catchment blanket bog on low levels of dissolved ions. However, in the Glengarrow Burn, where pH was below 7.0, conductivity appeared as a high outlier when compared with all other sampling sites and suggests either some form of enrichment from further upstream, or naturally elevated dissolved ions due to local geology.

9.117 In all other sampling sites, pH was circum-neutral while conductivity was generally low as expected for these higher elevation catchment positions.

Table 9.11: Water chemistry parameters measured at six survey sites measured in August 2022. Where a second parameter value is shown for conductivity and pH, these were recorded during fish surveys in September 2022 for selected sites.

Site	River/ stream location	Diss. Oxygen (mg/l; % sat)	Conductivity (µS/cm)	pH
A	Eden River Tributary 1	9.9 (99%)	71; 119	6.05-6.76
B	Eden River Tributary 2	9.4 (96%)	151	7.35
C	Stroanbrack Tributary 1	10.2 (97%)	118; 164	7.06; 7.38
D	Stroanbrack Tributary 2	8.9 (89%)	265	7.05

E	Upper Burn Dennett River	10.7 (98%)	74; 86	6.8; 6.95
F	Glengarrow Burn	11.0 (99%)	230	6.8

9.118 It should be noted that spot measurements of physico-chemical parameters provide only a snap-shot of stream water quality; consensus on overall quality should consider consider additional indicators such as those provided by stream macroinvertebrate communities (see below).

Physical Habitat Quality

9.119 Most of the streams draining the Site boundary were narrow (0.5-c. 2.0m; Sites B-D and F), shallow, and of moderate flow velocities (Table 9.12); their substrate was generally a mixture of substrate types of intermediate to coarse grade dominated by cobbles and boulders. These riverbed coarseness indices were generally above or close to values in rivers with good salmonid habitat quality reported elsewhere in Northern Ireland (Johnston, 2012).

9.120 An exception was Site A on the Eden River Tributary 1, which was very narrow and incised, was subject to some bank poaching, and had a stream bed dominated by peat with occasional cobble and pebbles. The finer material and silts contributed to a fine sediment cover exceeding 50% of the bed, and a riverbed with much lower coarseness than would be expected in streams with good salmonid habitat quality (Table 9.12).

9.121 While Stroanbrack Tributary 2 (Site D) had fine sediment cover of c. 50% of the bed, this was driven by high levels of sludge-like ferruginous material associated with naturally occurring iron-reducing bacterial growths.

9.122 The widest watercourse was the Upper Burn Dennett main channel at c. 3.5m and this location (Site E) had excellent quality substrate with low fine sediment cover, high coarseness, and a bed dominated by boulder and large cobble consistent with good quality salmonid habitat.

Table 9.12: Stream habitat quality at each site from baseline surveys, August 2022.

Site	River/ stream	Sediment cover (%) & type	Mean width (m)	Mean water depth (m)	Mean flow velocity (ms-1)	Coarse-ness index (CI)	Substrate hetero-geneity (SD)	Inferred substrate
A	Eden River Tributary 1	64; silt	0.35	0.09	0.066	2	1.24	Heterogeneo us; almost smooth
B	Eden River Tributary 2	0; none	1.0	0.07	0.1	4.08	0.81	Mixture, coarse
C	Stroanbrack Tributary 1	32; peat & silt	1.63	0.16	0.25	3.8	0.6	Mixture; inter-mediate coarseness
D	Stroanbrack Tributary 2	50; silt	0.52	0.07	0.15	2.72	0.8	Mixture; inter-mediate coarseness
E	Upper Burn Dennett River	2.6; silt	3.56	0.13	0.17	3.92	0.9	Mixture, coarse
F	Glengarrow Burn	2.4; silt	2.16	0.1	0.13	4.08	0.81	Mixture, coarse

Aquatic Ecology

9.123 Recorded benthic macro-invertebrate community metrics for the six survey sites are shown in Table 9.13. Based on the benthic invertebrate indicator element, and the “one out, all out” philosophy, site B (Eden River Tributary 2), was the only site classed at “HIGH” WFD-based ecological quality based both on the NTAXA and WHPT-ASPT indicator elements. This assessment corresponds well with the sites physical habitat quality, which indicated a site free of fine sediment with coarse substrate.

9.124 Sites C, E and F, (Stroanbrack Tributary 1, the main Upper Burn Dennett River, and the Glengarrow Burn, were classed as having at least “GOOD” WFD-based ecological quality. The assessment generally corresponds with the high-quality physical habitat assessed at these sites, where substrate was of intermediate to high coarseness and fine sediment cover generally low.

9.125 Site D (Stroanbrack Tributary 2) was classed as having “MODERATE” WFD-based ecological quality largely based on the WHPT-ASPT derived class although the NTAXA derivation was “GOOD” quality. The observation of extensive natural ferruginous sludge in Site D may have had a negative influence on the benthic macroinvertebrate community sensitivity by limiting the availability of open habitable spaces within the substrate of the stream bed.

9.126 The lowest ecological quality assessment of POOR for site A (Eden River Tributary 1) is based largely on the WHPT-ASPT index derivation despite a MODERATE quality derivation from the NTAXA index value. The dominance of peat in the bed of this narrow stream, coupled with a low substrate coarseness and the low pH value, may have provided sub-optimal conditions for sensitive macroinvertebrate taxa such as mayflies, stoneflies, and cased caddis larvae.

Table 9.13: WFD-based ecological quality classes at each site derived from benthic invertebrate baseline surveys, September 2022.

Site	River/ stream	BMWP WHPT score	Number of taxa	N-TAXA WFD-based invert. class	WHPT ASPT	ASPT WFD-based invert. Class
A	Eden River Tributary 1	46.2	10	MODERATE	4.6	POOR
B	Eden River Tributary 2	110	17	HIGH	6.47	HIGH
C	Stroanbrack Tributary 1	70	12	HIGH	5.83	GOOD
D	Stroanbrack Tributary 2	72.8	14	HIGH	5.2	MODERATE
E	Upper Burn Dennett River	66.5	11	GOOD	6.04	GOOD
F	Glengarrow Burn	56.1	9	MODERATE	6.23	GOOD

Site Survey: Juvenile Fish Stocks

9.127 The survey of fish stocks was conducted in late September at 17 sites (1, 1b, 4, 6, 6b, 7, 9, 12, 14, 18, 20, 21, 21b, 22, 23, 23b, and 26) located on the Burn Dennett, Glengarrow, and Eden Rivers, and key drainage tributaries (Table 9.14; **Volume 3 - Figure 9.6**). Sites were selected on the basis of their potential to support salmonid fish from habitat quality assessments. Additional sites were surveyed in an upstream direction in situations where good salmonid habitat was present but no fish were recovered (e.g. Glengarrow Burn sites 20-22).

9.128 Fish survey sites generally corresponded with Stream Quality survey site locations but were more widespread and extended further upstream into the landholding to ensure that sensitivity was assessed in sections corresponding to infrastructure development.

9.129 Salmon were absent at all fish survey sites within the Site boundary but occurred at Fair abundance at survey site 23b on the main Burn Dennett River below a marked waterfall (**Vol 3, Figure 9.7**; Table 9.14). This distribution corresponds with local knowledge on the limit of salmon and "white-trout" (local term for Sea trout) in the Burn Dennett River; a landowner indicated to the author that the waterfall prevents upstream passage of these migratory species.

9.130 Trout fry occurred at 9 of the 17 sites at Fair to Good abundance throughout the Upper Burn Dennett, Eden River, and tributaries within or draining the Site (**Figure 9.7**). Trout were absent at 8 of the survey sites.

Population Age Structure

9.131 The age structure of the salmon and trout stocks sampled in the Burn Dennett and Eden River drainages was verified by constructing composite length frequency distributions **(Charts 5 and 6).**

Chart 5: Length frequency distribution of salmon caught at Site 23b in the main Burn Dennett River

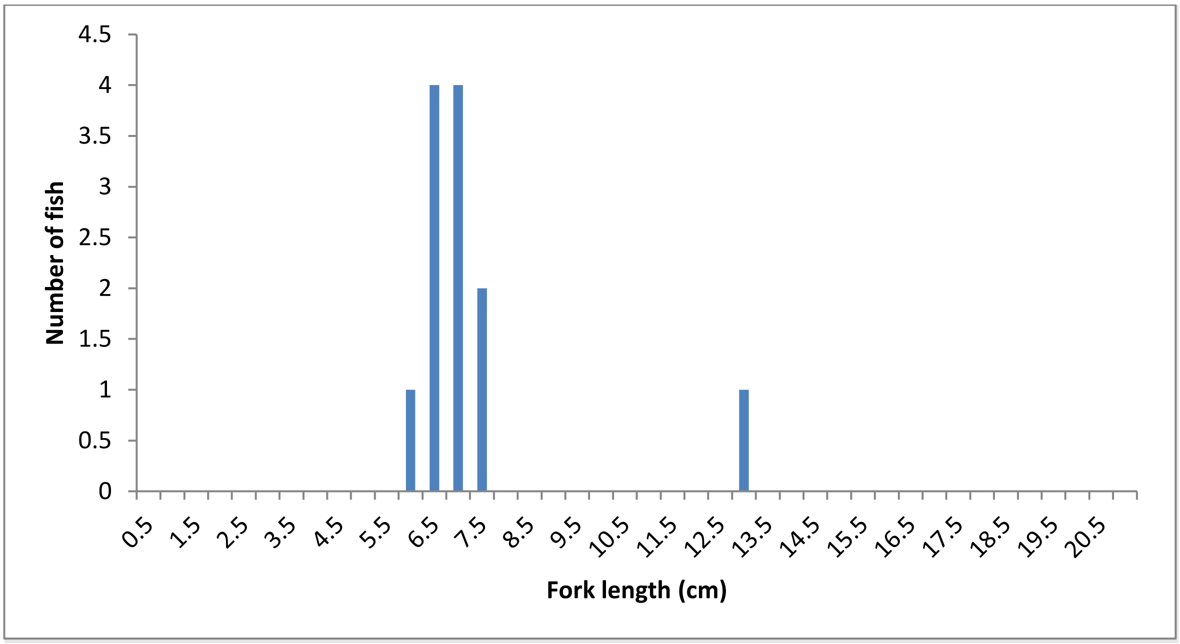
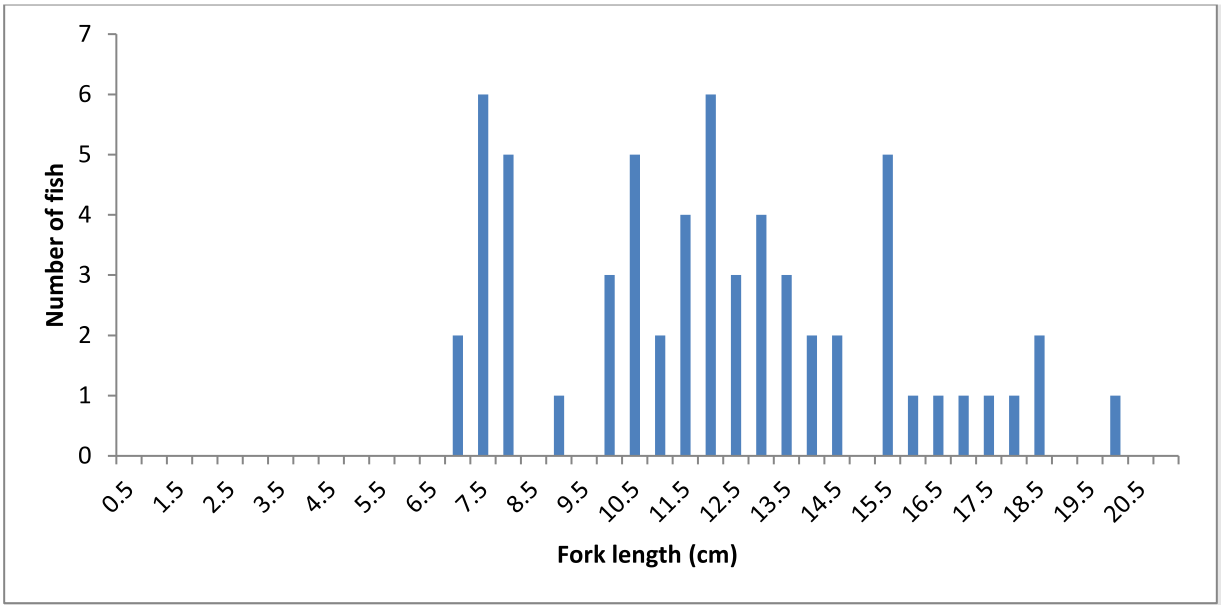


Chart 6: Length frequency distribution of trout caught across sites in the Burn Dennett and Eden River catchments



9.132 The salmon length frequency shows a clear separation of Age 0 fry (<8.0cm) from the single Age greater than 1 fish (13.0 cm) and that fry were dominant at this site

9.133 The trout length frequency shows that the separation between Age 0 (7.0-c. 9.0cm) and Age greater than 1 fish is less distinct. There is some overlap between these age groups but it is likely that trout greater than 10.0cm are Age 1 and older. Trout greater than 15.5cm are most likely Age 2 and older.

9.134 The trout distribution indicates a broad range of Age classes present in the catchments and suggests that many of the older trout would be resident and contribute to spawning and recruitment. For example, the waterfall much further downstream on the main Burn Dennett River (upstream of Site 23b) that appears to limit the upstream distribution of salmon would also limit any upstream migration and spawning of Sea trout.

Fish Distribution & Abundance

9.135 The results of the semi-quantitative survey are shown in Table 9.14 with the numbers of trout and salmon at each site separated into age groups.

9.136 In the Burn Dennett catchment, the lack of salmon in any tributary within the Site or immediately downstream (see **Vol 3 Figure 9.7**) is consistent with the presence of the impassable waterfall on the main Burn Dennett c. over 3km downstream. This is supported by the presence of salmon fry in the lower sampling site below this waterfall at Site 23b (Table 9.14).

9.137 In the Eden River, the lack of salmon in any sampling site in the upper river and tributaries is possibly explained by the steep gradient since salmon have been recorded regularly by the Loughs Agency in the gentler gradient lower river just above the confluence with the Glenelly River (Chart 3a).

9.138 Brown trout were widely distributed in the streams draining the Site, occurring in Eden Tributaries 1 and 2 below the Site boundary (Sites 1b and 6), and in the main Eden River downstream (Site 6b). Trout fry occurred at Fair to Moderate abundance with older age classes also present.

9.139 Brown trout were also present in the main Upper Burn Dennett River adjacent to and upstream of the northern Site boundary (Sites 23, 23b and 26), and in the Stroanbrack Tributary 1 within the Site boundary **(Sites 7, 9, and 12**). Trout fry occurred at Fair to Good abundance with multiple age classes also present (**Table 9.14; Vol 3 Figure 9.7**).

9.140 There were no fish present in the sampling sites of the Eden River tributaries 1 and 2 within or at the Site boundary, or in the 2 sampling sites of the Stroanbrack Tributary 2, which is most likely related to the poor habitat quality described earlier for these drainages.

9.141 The lack of fish at any of the four sites sampled in the Glengarrow Burn was surprising given the high-quality habitat observed (see earlier). However, the most likely explanation for the absence of fish is the large impassable waterfall that occurs where the Glengarrow Burn meets the main Upper Burn Dennett River, and subsequent impassable waterfalls further upstream.

9.142 Overall, the data indicate that trout spawning and recruitment is extensive within the main Upper Burn Dennett River adjacent to, and downstream of, the landholding. Stroanbrack Tributary 1, within the landholding boundary, the Eden River downstream of the landholding, and Eden Tributary 2 just downstream of the landholding, all support trout spawning and recruitment. Within the landholding. the absence of trout in the large Glengarrow Burn is likely to be due to natural barriers to dispersal whereas the lack of trout in the Stroanbrack Tributary 2 is most likely caused by poor habitat quality. Salmon occur only in the Upper Burn Dennett River over 3km downstream of the landholding below a large waterfall.

Table 9.14: Summary results of electrofishing survey indicating numbers of age 0 and older trout and salmon caught; fry abundance indices and other fish species also indicated (see also Figure 9.7).

Site	Watercourse	Trout (Age)		Salmon (Age)		Fry abundance index	
		(0)	(1++)	(0)	(1++)	Trout	Salmon
1	Eden tributary 1	0	0	0	0	Absent	Absent
1b	Eden tributary 1	3	8	0	0	Fair	Absent

Site	Watercourse	Trout (Age)		Salmon (Age)		Fry abundance index	
		(0)	(1++)	(0)	(1++)	Trout	Salmon
4	Eden tributary 2	0	0	0	0	Absent	Absent
6	Eden tributary 2	2	2	0	0	Fair	Absent
6b	Eden River	7	27	0	0	Moderate	Absent
7	Burn Dennet tributary 1 (Stroanbrack Burn)	9	9	0	0	Good	Absent
9	Burn Dennet tributary 1 (Stroanbrack Burn)	7	3	0	0	Fair	Absent
12	Burn Dennet tributary 1 (Stroanbrack Burn)	2	1	0	0	Fair	Absent
14	Stroanbrack tributary 2	0	0	0	0	Absent	Absent
18	Stroanbrack tributary 2	0	0	0	0	Absent	Absent
20	Glengarrow Burn	0	0	0	0	Absent	Absent
21	Glengarrow Burn	0	0	0	0	Absent	Absent
21b	Glengarrow Burn	0	0	0	0	Absent	Absent
22	Glengarrow Burn	0	0	0	0	Absent	Absent
23	Upper Burn Dennet River	9	23	0	0	Good	Absent
23b	Upper Burn Dennet River	7	12	17	2	Moderate	Fair
26	Upper Burn Dennet River	2	8	0	0	Fair	Absent

Assessment of Effects

9.143 Potential effects were assessed for construction, operational and decommissioning phases of the Development. Construction impacts cover the discharge of suspended solids, release of other pollutants and interruption of fish passage. Post-construction (operational) impacts include habitat loss at watercourse crossings, obstruction of fish passage and surface water run-off.

9.144 Impact assessments are primarily based on their effect on salmonids either directly or upon their habitats. However, these assessments would be equally relevant to eels and lamprey if present in these waters.

Fisheries Significance / Aquatic Ecological Sensitivity

9.145 Using the information assembled through the baseline assessment, the Fisheries Significance/Sensitivity for the main watercourses draining the area within the Site Boundary and downstream of this area are shown respectively in Table 9.15. A watercourse was deemed to have a High/ Very High sensitivity if its WFD class was at least Good and/or Annex II species were present (e.g. salmon).

9.146 The main Upper Burn Dennett River adjacent to the landholding boundary was assessed as generally of High sensitivity because of the assessed GOOD WFD-based ecological quality, with the presence of a healthy trout population also informing the assessment (Table 9.15).

9.147 Of the tributaries within the Site boundary within the Burn Dennett River catchment, Stroanbrack Tributary 1 was assessed at High sensitivity due to having GOOD WFD-based ecological quality, with the presence of trout population and moderate to good quality habitat quality also factors.

9.148 Within the Site boundary, the Glengarrow Burn and Stroanbrack Tributary 2 were assessed at Medium sensitivity due largely to having MODERATE WFD-based ecological quality despite the absence of fish.

9.149 Within the Eden River subcatchment of the Glenelly River, Eden Tributary 2 was assessed as having High sensitivity owing to its HIGH WFD-based ecological quality, with the presence of trout and moderate quality spawning and nursery habitat also factors. Eden Tributary 1 was assessed at Medium sensitivity owing to slightly lower WFD-based ecological quality (MODERATE) and the presence of trout.

9.150 The main Eden River downstream of both small tributaries was assessed at Very High sensitivity owing to the presence of Annex II salmon in the lower reaches (Table 9.15).

9.151 The downstream main channel rivers, the Glenelly and the Middle-lower Burn Dennett River, were assessed at Very High sensitivity due to the presence of Atlantic salmon and their habitats.

Construction Phase

9.152 The potential for impacts on fisheries and aquatic habitats during the construction phase is mainly associated with ground disturbance and the entrainment of sediments in surface water drainage. There is also a potential impact from the accidental spillage of other hazardous substances (oil and fuel) used in the construction process.

9.153 Temporary obstruction of fish passage within the Site is a potential impact at several small tributaries where culvert crossings are proposed.

Table 9.15: Sensitivity of receiving watercourses within Site Boundary and downstream to main Burn Dennett, Eden River and Glenelly River.

River/Stream	Key Species/ receptors	WFD class	Sensitivity
Site drainage streams			
Eden River Tributary 1	Trout; trout spawning and nursery habitat	**MODERATE**	**Medium**
Eden River Tributary 2	Trout; trout spawning and nursery habitat	**HIGH**	**High**
Eden River	salmon present in lower reach, trout, moderate/good trout spawning/nursery habitat	**-**	**Very High**
Stroanbrack/ Burn Dennett Tributary 1	Trout; good quality trout spawning and nursery	**GOOD**	**High**
Stroanbrack/ Burn Dennett Tributary 2	Fish absent; at best moderate quality physical habitat	**MODERATE**	**Medium**
Glengarrow Burn	Fish absent; physical habitat quality very good	**MODERATE**	**Medium**
Upper Burn Dennett River	Trout; good trout nursery and spawning habitat quality	**GOOD**	**High**
Sensitive downstream watercourses			
Glenelly River	Designated salmonid river ; Salmon; Trout; Sea trout; eels; possible lamprey spp.; good salmonid spawning and nursery habitat quality	**POOR**	**Very High**
Middle-Lower Burn Dennett River	Salmon present; sea trout/ brown trout, eels; possible river and brook lamprey	**GOOD**	**Very High**

Sediment Run-off

9.154 The release of fine sediment (grain size <2mm) is potentially a major cause of environmental impacts and is associated with clearly defined negative impacts (Newcombe and Jensen, 1996; Turley et al. 2014). Sensitive fish species such as brown trout and Atlantic salmon are highly vulnerable to suspended and deposited sediment in spawning and nursery habitats (Kemp et al. 2011). In spawning gravels, incubating salmonid eggs require good water circulation to provide oxygen and remove waste products. As deposited fine sediment content increases, gravels become embedded, resulting in restricted water circulation and reduced egg and alevin survival. After emergence, juvenile salmonids (fry) disperse downstream to suitable nursery rearing habitat generally within 100m (Kennedy, 1984), often in faster flowing riffles/ runs, where they establish feeding territories and compete for food.

9.155 Suspended sediment can lower water clarity leading to reduce prey capture efficiency and may affect respiration rates by clogging of gills (Kemp et al. 2011). Deposited sediment can reduce habitat complexity and quality by in-filling of substrate, thus reducing territory size leading to increased aggression and ultimately lower carrying capacity. Deposited fine sediment can also indirectly affect growth and survival of juvenile salmonids by reducing the quality of habitat for preferred invertebrate prey species (Suttle et al., 1994).

9.156 Adult salmonids are prone to gill-clogging and visual impairment at high levels of suspended sediment but are much less reliant on substrate complexity, tending to occupy deeper pools, particularly during the spawning season. Adult salmonids are also more mobile than sessile eggs or juvenile stages, and thus more capable of avoiding adverse local conditions (Kemp et al. 2011).

9.157 Freshwater benthic macroinvertebrates are also an important component of river ecosystems, acting both as sentinels of general water and habitat quality, and as an important food resource for higher trophic levels such as fish and birds. Pulses of fine sediment can cause behavioural drift, whereas excessive fine sediment can reduce the quality of physical habitat by smothering and blocking of interstitial spaces and water flow (Allan, 1999). As fine sediment infiltration increases, invertebrate abundance and community diversity is reduced, resulting in the replacement of sensitive taxa (mayfly, stonefly and caddis) by more tolerant types (worms, midge larvae, molluscs; Matthaei et al. 2006; Kemp et al. 2011).

9.158 Sediment release and entrainment can also increase the risk of nutrient addition and alterations in channel morphology and hydrology (Levesque and Dube, 2007). For example, excavated bank material or soils associated with the construction process could increase inputs of sediment bound phosphorus, which could negatively affect aquatic biota by causing excessive algal and macrophyte growth, and depressed oxygen levels.

9.159 Fine sediment is partly managed by the water quality objectives and standards of the EC Freshwater Fish Directive 2006/44/EC (FWFD), where a mean total suspended solids (TSS) concentration of 25 mg/L is specified for salmonid waters. While Article 6 of the Water Framework Directive has now repealed the FWFD, new standards that provide the same level of protection have been proposed (UKTAG, 2010). However, there is no national environmental standard or guideline for deposited fine sediment in the UK. Fine sediment cover above a threshold of 20% bed cover, based on recommendations in New Zealand by Clapcott et al. (2011), and published research (e.g. O'Connor & Andrew,1998; Kemp et al. 2011), provides a general indication of increasing risk for both invertebrates and salmonids.

9.160 The discharge of suspended solids during construction of the proposed Mullaghclogher Wind Farm could result from:

- Excavations associated with construction of access tracks and turbine foundations
- Excavations associated with watercourse crossings
- Surface peat disturbance and subsequent erosion of the underlying soils
- Stockpiling of soils and excavated materials
- Run-off from access roads
- Landslide resulting from slippage of access roads or excavated materials.

9.161 The proposed site is hydrologically connected to watercourses of significant fisheries interest via on-site and off-site watercourses which are potential routes for suspended solids run-off. The main Burn Dennett River, lower Eden River and Glenelly River channels downstream of the Site are significant as they provide spawning and nursery habitat for Atlantic salmon, listed in Annex II of the EU Habitats Directive, and an important recreational angling species. The associated tributaries of the Eden River and Burn Dennett River within the Site boundary, are of particular significance due to their importance in providing spawning and nursery for trout. With a high likelihood that this area also is a source for smolts that supplement the sea trout population below the impassable barriers. All of these watercourses would be susceptible to sediment run-off particularly because of the presence of sensitive salmonid fish species.

Release of other pollutants

9.162 As the Site drains into tributaries of the Upper Burn Dennett and Eden River, there is potential for accidental spillage or release of diesel, oil or other polluting substances, with likely negative impacts on resident fish together with invertebrate organisms that underpin the generally Moderate/ High ecological health observed in these streams.

9.163 During construction, with high usage of plant fuel and oil, there is an increased risk of accidental spillage and discharge to the any of the drainage streams and thence to the Burn Dennett, Eden River and Glenelly River. Similarly, the application of ready-mix concrete in construction processes carries some risk of inadvertent discharge with the potential to impact on resident fish and invertebrate organisms in these watercourses.

Fish passage: temporary obstruction

9.164 Poor management of works adjacent to stream banks or at crossing points may lead to obstruction of the channel during periods of fish migration and spawning. It is intended to install pipe culverts at crossings of minor watercourses and a bottomless culvert at the crossing of the Glengarrow Burn, a major watercourse (Chapter 10 Geology and Water Environment). For clarity, minor watercourses are those where a 10m buffer is proposed from all site works. A 50m buffer is proposed from site works at all other major watercourses within the Site.

9.165 As per **Chapter 10 (Geology & Water Environment),** the layout of the Development would indicate fourteen crossings of watercourses within the planning application boundary (**Figure 9.7**). Culverts will ensure that track crossings are accommodated and that the full length of affected channel is minimised. However, the only significant watercourses where crossings are proposed are as follows:

- The main Glengarrow Burn south-east of Turbine 9
- Upper Burn Dennett Tributary 1 (Stroanbrack) east of Turbine 2

9.166 Temporary obstruction of fish passage is highly unlikely on the proposed crossing of the Upper Burn Dennett/ Stroanbrack Tributary 1; for example, the salmonid habitat assessment at this location considered trout presence to be unlikely given the shallow depth, incised character of the channel, and sub-optimal nursery habitat quality (see **Figure 9.4; Plate 13**).

9.167 Temporary obstruction of fish passage at the proposed crossing of the Glengarrow Burn will not impact on fish passage as fish were absent over the entire survey sections within the landholding.

9.168 The remaining proposed watercourse crossings are on small drains with no significant fisheries interest.

Operational Phase

9.169 The potential for any impacts will be significantly reduced during the operational phase with the construction process complete, site infrastructure in place, and a reduced requirement for any hazardous materials on-site. Potential impacts at Mullaghclogher are essentially limited to surface water run-off, permanent fish passage obstruction, and loss of habitat.

Surface Water Run-off

9.170 Surface water run-off from hard surfaces (access tracks, hard stands, control buildings) could lead to sediment-laden run-off to the receiving watercourses with potential effects on fish and other forms of aquatic life as outlined above; however, the effects during the operational phase are expected to be less severe because no soil/ peat disturbance will occur.

9.171 Wash-out of areas of excavated peat during or following periods of heavy rainfall could also result in run-off of sediment to the receiving watercourses with potential increases in sediment load.

Fish Passage obstruction/ inhibition

9.172 As indicated above, the construction of bridges and culverts has the potential to prevent or hinder normal fish movement within the stream or upstream migrations of pre-spawning adults unless consideration is given at the design stage.

9.173 Obstructions can occur if inverts are not sufficiently embedded to below the water level or if the length and gradient over which the culvert is installed causes high flow and an inability to find flow refuges due to a lack of baffles or natural stream substrate.

9.174 Within the area of the planning application boundary track roads and associated watercourse crossings, watercourse crossings are proposed on only two major watercourses, the Upper Burn Dennett/ Stroanbrack Tributary 1 and on the Glengarrow Burn. As documented under “Fish Passage: temporary obstruction”, fish are absent in the Glengarrow Burn, whereas the habitat within the Upper Burn Dennett crossing was deemed sub-optimal for trout so that permanent obstruction of fish passage will not occur. However, see mitigations under Operational phase, where a clear span structure will be installed on the Glengarrow Burn.

Habitat loss at stream crossings

9.175 Depending on the length of culvert used, a watercourse crossing may result in significant loss of habitat, particularly where the original channel bed is lost and cannot be restored. Removal of bed material also can result in long term loss of habitat and channel diversity. Enclosure of the channel over significant lengths restricts light penetration which inhibits growth of benthic algae and aquatic plants, in turn leading to reduced potential for macroinvertebrate and fish productivity.

9.176 Only the two proposed watercourse crossings of the more significant watercourses within the landholding, the Glengarrow Burn and the Upper Burn Dennett/ Stroanbrack Tributary 1, have the potential to cause the loss of a very small area of stream habitat. However, this small area is expected to have a negligible effect on primary (algae/ plants) and secondary production (macroinvertebrates) given the overall spatial scale in relation to existing watercourse area.

Decommissioning Phase

9.177 Decommissioning of the Development would have potential effects on fish stocks and aquatic habitats in the drainage tributaries and the more distant Eden River, lower

Burn Dennett and Glenelly rivers. Impacts will be like those predicted for the construction phase but will ultimately depend on the level of reinstatement required.

9.178 In this case the decommissioning process will involve the removal of all above ground structures, removal of underground structures to one metre below ground level, and reinstatement of disturbed areas; access tracks are likely to remain for farm use. However, it is unlikely that any of the structures at or near to the main watercourses will be removed or modified in any way.

9.179 The effects of decommissioning on fish habitats and fish stocks are therefore likely to be like those of construction for sediment run-off and the release of other pollutants, although of lower magnitude.

Mitigation

Construction Phase

Sediment Run-off

9.180 Mitigation measures to control sediment run-off are described in detail in **Chapter 10 (Geology & Water Environment)** and summarised as follows:

Buffer Zones

9.181 During the construction phase it is important that works should be avoided within the area of sensitive watercourses, with the preservation of intact vegetated buffer zones between development infrastructure and stream channels. To this end, buffer zones of 10m and 50m minimum width are specified in **Chapter 10 Geology and Water Environment** for minor and major watercourses, respectively. The larger minimum buffer of 50m will apply to the main channel Upper Burn dennett River, the Glengarrow Burn, Burn dennett tributaries 1 (Stroanbrack) and 2, which are watercourses with potential fisheries sensitivity (excluding the Glengarrow Burn where no fish were recovered).

9.182 Turbine bases, access roads (apart from watercourse crossings) and associated infrastructure will be located out-with buffer zones

9.183 The application of buffer zones will minimise the risk of sediment run-off from site construction works to on-site watercourses and the most sensitive reaches such as the middle and lower sections of Stroanbrack Tributary 1, the main Upper Burn Dennett River along the north-eastern landholding boundary, and more distant receiving reaches in the Burn Dennett, Eden River and Glenelly River.

Timing of Works

9.184 DCAL (now DAERA) Inland Fisheries Section produced Guidelines for Fisheries Protection during Development Works (undated) which identified the likely impact of construction and development work on fisheries habitat and outlines practical measures for the avoidance and mitigation of damage.

9.185 Of the major watercourses with proposed crossings (Stroanbrack Tributary 1 and Glengarrow Burn), local fisheries sensitivity is Negligible (Stroanbrack Tributary 1) and Absent (Glengarrown Burn). However, in-stream works would have the potential to generate sediment and increase the risk of other pollutants affecting sensitive reaches nearby downstream, such as the middle reaches of Stroanbrack Tributary 1 and main Upper Burn Dennett River (where trout fry are present at Fair to Good abundance). Therefore, any in-stream works for the construction of watercourse crossings at these locations should be avoided between October 1st and April 30th (as per DAERA guidelines), when trout would be spawning, and eggs incubating, within the streams.

9.186 No restrictions to the timing of works would be required at all other minor watercourse crossings because of the lack of suitable salmonid habitat and thus low fisheries significance.

9.187 All works at stream crossings will adhere to the measures outlined in the Good Practice Guidance (GPP) notes (https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/,) particularly those near to water, including but not limited to the following;

- GPP1: Understanding your environmental responsibilities – good environmental practices;
- GPP5: Works and maintenance in or near waters;
- PPG6: Working at construction and demolition sites;
- GPP21: Pollution incident response planning;

9.188 It is also recommended that to minimise the risk of suspended sediment entrainment in surface water run-off, the site drainage system should only be constructed during periods of low rainfall and therefore low run-off rates. This restriction will also apply to any works at watercourse crossings, which will also include the following mitigations;

- Installation of silt fences parallel to the watercourse channel in the vicinity of the proposed crossing;
- Installation of small cut-off drains to prevent natural surface runoff entering area of construction activity;

- Installation of filtration or other silt entraining features within the watercourse channel immediately downstream of the works location; and
- Use of over pumping where deemed appropriate.

Surface Water Management

9.189 The potential for pollution of watercourses by silt-laden runoff is addressed in detail in **Chapter 10: Geology & Water Environment**. A surface water management plan will be developed using the principles of Sustainable Drainage, based on the on-site retention of flows and use of buffers, swales, check-dams and other silt removal techniques.

9.190 Implementation of the management plan will prevent any adverse effects on the ecology of the principal receiving watercourses during the construction phase of the project.

9.191 Soil and subsoil excavation and movement will be undertaken in accordance with best practice guidelines such as Good Practice Guide for Handling Soils (see Chapter 10) to minimise potential for silt laden runoff from spoil and excavations. Areas of stockpiled spoil including stored peat:

- will not be permitted within previously identified watercourse buffer zones; and
- will not be permitted to obstruct the flow of overland surface water with specific drainage to spoil mounds to be provided.

Water Quality Monitoring

9.192 Chapter 10 also proposes the implementation of a water quality monitoring programme to examine the effects of the infrastructure construction, operational and decommissioning phases of the Proposed Development works on surface water quality.

Release of other pollutants

Site Management

9.193 All precautions will be taken to avoid spillages of diesel, oil or other polluting substances during the construction phase. This will be achieved through good site practices as described in the Good Practice Guidance notes proposed including:

- GPP 1 Understanding Your Environmental Responsibilities - Good Environmental Practices;
- GPP 2 Above Ground Oil Storage Tanks;
- GPP 3 Use and Design of Oil Separators in Surface Water Drainage Systems;

- GPP 4 Treatment and disposal of Wastewater where there is no connection to the public foul sewer;
- GPP 5 Works and Maintenance in or near Water;
- GPP 6 Working at Construction and Demolition Sites;
- PPG 7 Safe Storage – The Safe Operation of Refuelling Facilities; and
- GPP 8 Safe Storage and Disposal of Used Oils;
- PPG 18: Managing Fire Water and Major Spillages.
- GPP 20 Dewatering Underground Ducts and Chambers;
- GPP 21 Pollution Incident Response Planning;
- GPP 22 Dealing with Spills;
- GPP 26 Safe Storage of Drums and Intermediate Bulk Containers;

9.194 A Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of the Construction & Decommissioning Method Statement (CDMS) to be agreed with the local planning authority at the pre-construction stage (see also **Chapter 10: Geology and Water Environment).** This will incorporate a contingency plan setting out the procedure to be followed in the event of a significant spillage occurring.

9.195 As per **Chapter 10: Geology and Water Environment**, preference shall be given to construction techniques that do not require use of cementitious materials where suitable practicable alternatives exist. When concrete / cement is used, concrete batching will not be permitted on site. Wet concrete operations will not be carried out within watercourses or adjacent to watercourses. Measures to prevent discharge of alkaline wastewaters or contaminated storm water to watercourses will be outlined in a detailed PPP for the Proposed Development to be approved by NIEA before commencement of works. Wastewater spillage will be minimised by using settling tanks and recycling water.

Surface Water Management

9.196 The proposed surface water management plan and associated SuDS system will also facilitate the interception of diesel, oil or other polluting substances during the construction phase.

Operational Phase

Surface Water Run-off

As outlined in **Chapter 10**, site drainage will use the principles of SuDS, with installations to incorporate a "treatment train" of two to three stages of pollutant removal to all surface water runoff, nominally by:

- Ensuring that drainage swales are designed to convey flows at a low velocity by using a wide, flat bottomed drain;
- Providing settlement and filtration features in all linear drainage swales (check dams, filtration dams) to reduce flow velocity and encourage settlement;
- Encouraging appropriate vegetation growth in the base of all linear drainage to provide additional filtration to flows;
- Providing settlement ponds at turbine hard standing areas and other key discharge locations in order to provide treatment to contaminated runoff prior to discharge;
- Discharging surface water runoff over undisturbed vegetated ground, hence allowing any remaining silts and other pollutants to drop out of flows before entering the watercourse (having the effect of polishing the runoff);
- Preventing the discharge of surface water runoff flows directly to existing watercourses or drainage. All discharges shall seek to be via SuDS and buffer zones which will act as a filter strip, allowing deposition of suspended solids and other pollutants; and
- Providing settlement features in water channels downstream of areas of peat infilling and ditch blocking area proposed as part of habitat management and enhancement planning.

Fish passage obstruction/ inhibition

9.197 As indicated earlier under temporary obstruction of fish passage, permanent obstruction of fish passage is unlikely to be of concern because of the lack of fish in the proposed crossing locations. The only location with habitat deemed potentially suitable for trout was the Glengarrow Burn. However, after intensive fish surveying, no fish were encountered most likely due to the impassable natural barrier where this watercourse meets the main Burn Dennet river downstream (see earlier). The proposed installation of an open bottom (clear-span) culvert at the crossing of the Glengarrow Burn will ensure that, in the highly unlikely event that trout colonise this watercourse, fish passage will not be impacted.

Loss of habitat at stream crossings

9.198 Culverts will be designed to accommodate track crossings and minimise length of channel affected (**Chapter 10 Geology and Water Environment**). In the Glengarrow

Burn, the installation of a bottomless culvert (Clear span) will preserve the stream bed habitat and ensure no loss of habitat for productivity of algae/ plants and benthic invertebrates; note that no fish were present in this watercourse most likely because of the natural impassable waterfall where it meets the main Upper Burn Dennet river

Decommissioning Phase

9.199 Mitigation measures during decommissioning will be the same as during the construction phase regarding addressing the potential for run-off of suspended solids and other polluting substances. However, the level of mitigation will be determined by the level of reinstatement required.

Residual Effects

9.200 The potential effects of the Development on fish stocks and their habitats in the Burn Dennett, Eden River, and associated tributaries draining the Site, are measured against proposed mitigations, as a means of assessing the residual effects of the project.

9.201 The magnitude of the potential effects and their residual significance were assessed according to the procedure outlined in the Methodology section of this chapter. It is the residual effects associated with the Development that most accurately reflect the overall predicted effects on fisheries and the aquatic environment during the construction, operational and decommissioning phases.

Construction Phase

9.202 Mitigation measures employed through the surface water management plan outlined in **Chapter 10** based on SuDS technology to control drainage and silt management on the Development site will remove the potential for damage to fish or their habitat from siltation of spawning and nursery habitats. These measures in association with the Pollution Prevention Plan will also minimise the risk for release of other construction related polluting substances into the river network. Fisheries interests are mainly focused on watercourses where 50m hydrological buffers are proposed, which will further mitigate the risk of surface run-off and the release of other pollutants. For the larger tributaries where major watercourse track crossings are proposed within the Site, there will be no effect on fish migrations or spawning activity given the lack of fish or low fisheries significance.

9.203 The magnitude and significance of potential effects during the construction phase before mitigation are summarised for each watercourse in Table 9.16 along with the predicted residual effects after mitigation.

9.204 Without mitigation, the effects during the construction phase for watercourses draining the immediate Development, are predicted to be at worst of Major Magnitude and of Large/ Very Large Significance, depending on specific effects and the sensitivity of individual watercourses e.g. the release of other pollutants to the Stroanbrack Tributaries, and the Upper Burn Dennett, as watercourses with trout and/ or Good to High WFD status. However, with mitigation the effects are reduced to **Neutral.**

9.205 This assessment also applies to the sensitive lower Burn Dennett, Eden River and Glenelly River, which occur downstream of watercourses draining the Site, but also contain Annex II listed Atlantic salmon and possibly lamprey spp.

Operational Phase

9.206 Although there will be an increase in the area of hard surface due to the Development, the surface water management plan / drainage design features for the control and attenuation of storm water run-off will protect receiving watercourses from excessive inputs of sediment.

9.207 The magnitude and significance of potential effects during the operational phase before mitigation are summarised for each watercourse in Table 9.17 along with the predicted residual effects after mitigation.

9.208 Without mitigation the effects during the operational phase are predicted to be at worst of **Major Magnitude and of Very Large Significance**, depending on specific effects and the sensitivity of individual watercourses. For example, the release of other pollutants to the main Upper Burn Dennett River along the north-eastern site boundary could pose a risk to the abundant trout population and its Good WFD-based ecological status. However, with mitigation the effects are reduced to **Neutral.**

Decommissioning Phase

9.209 The magnitude and significance of potential effects during the decommissioning phase before mitigation are summarised for each watercourse in Table 9.18 along with the predicted residual effects after mitigation.

9.210 Without mitigation the effects during the decommissioning phase are predicted to be at worst of Moderate Magnitude and of Moderate/ Large Significance, depending on specific effects and the sensitivity of individual watercourses (see paragraph 9.197 onward). For example, the release of other pollutants could impact on highly sensitive watercourses such as the Burn Dennett, Eden River and Glenelly River where Atlantic salmon are present. Mitigation measures will ensure that the effects remain as **Neutral**.

Table 9.16: Construction Phase - Magnitude and Significance of Effects without Mitigation, and Residual Effects after Mitigation.

River/ Stream	Key receptors	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Eden River Tributary 1	Trout present; WFD status Moderate	Medium	Sediment run-off	Moderate	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate	Neutral
Eden River Tributary 2	WFD status High; Trout present	High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Eden River	Salmon present	Very High	Sediment run-off	Moderate	Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Stroanbrack/ Burn Dennett Tributary 1	Trout present; WFD status Good	High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Stroanbrack/ Burn Dennett Tributary 2	Fish absent; WFD Moderate	Medium	Sediment run-off	Moderate	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate	Neutral
Glengarrow Burn	Fish absent; WFD status Moderate	Medium	Sediment run-off	Moderate	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate	Neutral
Upper Burn Dennett River	Trout present; WFD status Good	High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Glenelly main channel	Designated salmonid river ; Salmon; lamprey; sea trout/ brown trout;	Very High	Sediment run-off	Moderate	Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Middle-Lower Burn Dennett River	Salmon present; sea trout/brown trout, eels; lamprey	Very High	Sediment run-off	Moderate	Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral

Table 9.17: Operational Phase – Magnitude and Significance of Potential Effects without Mitigation, and Residual Effects after Mitigation.

River/ Stream	Key receptors	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Eden River Tributary 1	Trout present; WFD status Moderate	Medium	Sediment run-off	Moderate	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate	Neutral
Eden River Tributary 2	WFD status High; Trout present	High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Eden River	Salmon present	Very High	Sediment run-off	Moderate	Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Stroanbrack/ Burn Dennett Tributary 1	Trout present; WFD status Good	High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Stroanbrack/ Burn Dennett Tributary 2	Fish absent; WFD Moderate	Medium	Sediment run-off	Moderate	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate	Neutral
Glengarrow Burn	Fish absent; WFD status Moderate	Medium	Sediment run-off	Moderate	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate	Neutral
Upper Burn Dennett River	Trout present; WFD status Good	High	Sediment run-off	Moderate	Moderate/ Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Glenelly main channel	Designated salmonid river ; Salmon; lamprey; sea trout/ brown trout;	Very High	Sediment run-off	Moderate	Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral
Middle-Lower Burn Dennett River	Salmon present; sea trout/brown trout, eels; lamprey	Very High	Sediment run-off	Moderate	Large	Neutral
			Release of other pollutants	Major	Very Large	Neutral

Table 9.18: Decommissioning - Magnitude and Significance of Effects without Mitigation, and Residual Effects after Mitigation.

River/ Stream	Key receptors	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Eden River Tributary 1	Trout present; WFD status Moderate	Medium	Sediment run-off	Minor	Slight	Neutral
			Release of other pollutants	Moderate	Moderate	Neutral
Eden River Tributary 2	WFD status High; Trout present	High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate/ Large	Neutral
Eden River	Salmon present	Very High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Moderate	Large	Neutral
Stroanbrack/ Burn Dennett Tributary 1	Trout present; WFD status Good	High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate/ Large	Neutral
Stroanbrack/ Burn Dennett Tributary 2	Fish absent; WFD Moderate	Medium	Sediment run-off	Slight	Neutral	Neutral
			Release of other pollutants	Moderate	Neutral	Neutral
Glengarrow Burn	Fish absent; WFD status Moderate	Medium	Sediment run-off	Slight	Neutral	Neutral
			Release of other pollutants	Moderate	Neutral	Neutral
Upper Burn Dennett River	Trout present; WFD status Good	High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Moderate	Moderate/ Large	Neutral
Glenelly main channel	Designated salmonid river ; Salmon; lamprey; sea trout/ brown trout;	Very High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Moderate	Large	Neutral
Middle-Lower Burn Dennett River	Salmon present; sea trout/brown trout, eels; lamprey	Very High	Sediment run-off	Minor	Moderate	Neutral
			Release of other pollutants	Moderate	Large	Neutral

Cumulative Effects

Additional Developments

9.211 This section considers other wind farm developments which, in combination with the Proposed Development, could give rise to the potential for cumulative effects on fisheries and the aquatic environment in local rivers. In this context, the potential for cumulative effects is only relevant regarding existing or proposed developments that are either hydrologically connected or which drain to the same receiving environment. It is therefore more important to consider additional developments in the context of river catchments, both locally and on a wider river basin scale.

9.212 A list of wind farm developments within a radius of 30km was provided by RES. There are four wind farm developments (Eglish, Slieve Kirk, Carrickatane, and Craignagapple) within the Burn Dennett River catchment that might thus be considered to have the potential for cumulative impacts on the freshwater environment (Table 9.19). Three are already operational whereas Craignagapple is under construction. There are no listed wind farm developments within the Glenelly River sub-catchment that might be considered to have the potential for cumulative impacts on that system.

Table 9.19. Additional Wind Farm developments/ proposals within the Burn Dennett River catchment indicating their location by WFD waterbody within the Burn Dennett and Foyle LMA.

Wind Farm	Planning reference	WFD Waterbody	Number of turbines	Status
Eglish	A/2005/0223/F	Burn Dennett River (Ballymallaght) 1071	6	Operational
Slieve Kirk	(A/2004/1130/F	Burn Dennett River (Ballymallaght) 1071	**12**	**Operational**
Carrickatane	J/2005/0211/F	Burn Dennett River (Milltown) 1070	**9**	**Operational**
Craignagapple	J/2010/0481/F	Dunnyboe Burn, Burn Dennett River 1072	**9**	**Approved; under construction**

Assessment

9.213 The greatest risk to the aquatic environment from Wind Farm developments is during the construction phase when land excavation and possible in-river works are conducted, resulting in a heightened risk of sediment, release of other pollutants, and obstruction of fish passage. Although there have been documented incidents of sediment run-off from a wind farm at Bin Mountain in County Tyrone, and a large peat-slip at Meenbog Wind Farm on the Donegal/ Tyrone border (November 2020), no reports of similar issue shave been documented in any of the operational sites in the Burn Dennett River catchment.

9.214 The Craignagapple Wind Farm was planning approved in 2017 and and is located where a small tributary of the Dunnyboe Burn occurs, with the latter an upper tributary of the Burn Dennett. The Craignagapple development is located c. 4.5km from the confluence of the Dunnyboe Burn with the main Upper Burn Dennett River; any site drainage from the current proposed Mullagclogher Wind Farm to the Upper Burn Dennett, is located >9km from that rivers confluence with the Dunnyboe Burn.

9.215 A surface water management plan (SWMP) was submitted in 2013 and updated in 2014 due to an FEI; this accounted for mitigation as per best practice guidelines and included adherence to recommended buffer distances between the development and watercourses as per NIEA advice (see Brookfield, 2014). Planning permission (granted in 2017) was given provided that the various mitigations were implemented, with this signed off by Loughs Agency.

9.216 Hence the distance between the developments to the receiving Burn Dennett River, coupled with mitigations outlined in the Environmental Statement and FEI report, are expected to ensure that there is a very low likelihood of cumulative impacts on fisheries and aquatic ecology of the Upper Burn Dennett River.

9.217 Carrickatane Wind Farm was planning approved in 2009 and is operational. To our knowledge, there are no reports of any adverse environmental impacts of the development. The following conditions of the approved planning permission related to environmental stewardship and protection:

- Precautions to ensure that the integrity of the River Foyles and Tributaries SAC and ASSI are not damaged.
- Awareness of their responsibility to ensure that pollution that may be deleterious to fish and fish habitat is not impacted

9.218 The drainage to the Burn Dennett River is located almost 3km from the approved Carrickatane Wind Farm site; the drainage from the current proposed wind farm is located >15km upstream of where either site drainage could potentially meet in the main Burn Dennett River. This distance, allied to the mitigations already employed for Carrickatane Wind Farm, its already operational status, and the mitigations specified for the current project, will ensure a very low likelihood of cumulative impacts on fisheries and aquatic ecology of the Burn Dennett River.

9.219 Eglish Wind Farm was planning approved in 2013. A range of planning conditions pertaining to environmental protection were specified including manage of site drainage water via a SuDS system and adherence to then current Pollution Prevention Guidelines (PPGS), avoidance of any damage to the integrity of the SAC/ ASSI, protection of Annex-II listed species (e.g. salmon), preparation of a CMS and pollution prevention plan, and associated watercourse buffer distances.

9.220 Slieve Kirk Wind Farm was planning approved in 2009. No information was available on the NI Planning Portal on the potential impacts and mitigation for aquatic ecology and fisheries.

9.221 Both Eglish and Slieve Kirk Wind Farms are operational with no known reports of environmental impacts on aquatic ecology and fisheires. Both wind farms are connected via site drainage to the Altinaghree Burn, a key tributary of the Burn Dennett River. Drainages from both of these operational wind farms has the potential to meet drainage from the current Mullaghclogher Wind Farm development. However, drainage from the Mullaghclogher proposal would meet the Altinaghree Burn over 15km downstream where it has its confluence with the main channel Burn Dennett River. Drainage from Eglish to the confluence with the Burn Dennett River would occur c. 10km upstream; drainage from Slieve Kirk would occur almost 6km upstream of this confluence.

9.222 Again, this distance, allied to the mitigations already employed for Eglish Wind Farm and the already operational status and no known impacts of Slieve Kirk Wind Farm, together with the mitigations specified for the current project, will ensure a very low likelihood of cumulative impacts on fisheries and aquatic ecology of the Burn Dennett River

Summary

9.223 This chapter outlines the potential effects of the Development on the fish stocks and fish habitats of the receiving watercourses in the Burn Dennett and Eden River within the Burn Dennett and Glenelly River sub-catchments of the River Foyle. It provides relevant baseline information on fisheries and aquatic ecological health enabling the potential effects to be identified and evaluated.

9.224 It has been determined that potential impacts are primarily related to the sediment run-off and release of other pollutants to the receiving watercourses with related effects on fish stocks and the wider stream ecosystem. Without mitigation it is considered that these impacts have the potential to be of up to Major Magnitude and of Very Large Significance depending on the sensitivity of individual watercourses.

9.225 A series of specific mitigation measures have been designed to avoid adverse effects on fisheries and aquatic ecology with regard to both construction and operational phases of the project.

9.226 Hydrology and site drainage issues have been considered in detail in Chapter 10, which outlines a surface water management system and drainage (SuDS) designed to control drainage and silt management on the Site.

9.227 It is concluded that, provided the mitigation measures are implemented as specified, construction and operation of the proposed Development will have a neutral impact on the fish stocks and the aquatic ecology of the Upper Burn Dennett River, Eden River and associated tributaries draining the Site.

References

ABO Wind (2011). Castlegore Wind Farm: Volume 2 Environmental Statement.

Allan, J.D. (1999). Stream Ecology: Structure and Function of running waters. Kluwer Academic Publishers. Pp. 388.

Bain M., Finn J. and Brooke, H. (1985). Quantifying stream substrate for habitat analysis studies. N Am J Fish Manage 5, 499-500.

Balkham, M, Fosbeary, C, Kitchen, A, and Rickard, C (2010). Culvert Design and Operation Guide. CIRIA, London, pp. 342.

Brookfield Renewable Energy Group (2014). Wind Energy Development at Craignagapple Strabane: Further Environmental Information for Planning Ref: J/2010/0481/F KU011500 | Final November 2014

Clapcott, J.E., Young, R.G., Harding, J.S., Matthaei, C.D., Quinn, J.M. and Death, R.G. (2011) Sediment Assessment Methods: Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values. Cawthron Institute, Nelson, New Zealand.

Chartered Institute of Ecology & Environmental Management (2018). Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.

Crozier WW & Kennedy GJA (1994) Application of semi-quantitative electrofishing to juvenile salmonid stock surveys. Journal of Fish Biology 45, 159-164.

Department of Environment Food and Rural Affairs (2010). Eel management plans for the United Kingdom: Northern Ireland (UK) Eastern River Basin District.

Design Manual for Roads and Bridges (DMRB, 2019). Road Drainage and the Water Environment, Volume 11, Section 3, Part 10, LA113.

Design Manual for Roads and Bridges (DMRB, 2019b). Sustainability and Environmental Appraisal: Environmental Assessment and Monitoring, Section 2, Part 4, LA102.

Essery C. I. & Wilcock D. N. (1990) The impact of channelization on the hydrology of the upper River Main, County Antrim, Northern Ireland—a long term case study. Regulated Rivers: Research and Management 5, 17–34.

Goodwin CE, Dick JTA & Elwood RW (2009) A Preliminary Assessment of the Distribution of the Sea lamprey (Petromyzon marinus LL)), River lamprey (Lampetra fluvialilis (L)) and Brook lamprey (Lampetra planeri (Bloch)) in Northern Ireland. Biology and Environment: Proceedings of the Royal Irish Academy, vol. 109b, no. 1, 4752

Kemp, P, Sear, D., Collins, A, Naden, P., and Jones, I. (2011). The impacts of fine sediment on riverine fish. Hydrological Processes, 25, 11, 1800-1821.

Kennedy, R.J., Rosell, R., Ensing, D., Gargan, P. and McCartney, J. (2020). Standing Scientific Committee - Advice on DAERA Area Salmon Stocks 2020. (Executive Summary)

King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., Fitzpatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Levesque, L.M. and Dube, M.G. (2007). Review of the effects of in-stream pipeline crossing construction on aquatic ecosystems and examination of Canadian methodologies for impact assessment. Environmental Monitoring and Assessment, 132, 395-409.

Loughs Agency (2010). Burn Dennett and Glenmornan Rivers and Tributaries Catchment Status Report.

Loughs Agency (2011). Owenkillew River, Owenreagh East and Tributaries Catchment Status Report 2011.

Loughs Agency (2014). Burn Dennett, Glenmornan Rivers and Strabane Canal Angling Status Report 2014

Loughs Agency (2016). Sea trout (*Salmo trutta* L.) Status Report: Foyle & Carlingford Areas

Matthaei C.D., Weller, F., Kelly, D.W. & Townsend, C.R. (2006) Impacts of fine sediment addition to tussock, pasture, dairy and deer farming streams in New Zealand. *Freshwater Biology,* 51, 2154-2172.

Murray-Bligh, J. (2002) UK Invertebrate Sampling and analysis for EU-Star project. EUSTAR http://www.eu-star.at/pdf/RivpacsMacroinvertebrateSamplingProtocol.pdf

Newcombe, C.P. and Jensen, J.O.T. (1996). Channel suspended sediment and fisheries: A synthesis for quantitative assessment of risk and impact. North American Journal of Fisheries Management, 16, 4, 693-727.

O'Connor WCK & Andrew TE (1998) The effects of siltation on Atlantic salmon, Salmo salar L, embryos in the River Bush. Fisheries Management and Ecology 5 (5), 393-401.5 (5), 393-401.

SEPA (2010). Scottish Environmental Protection Agency. Engineering in the water environment: good practice guide River Crossings. Second Edition, Nov. 2010.

Suttle, K.B., Power, M. E., Levine, J. M., and McNeely, C. (2004). How fine sediment in riverbeds impairs growth and survival of juvenile salmonids. Ecological Applications, 14,4, 969-974.

Turley, M. D., Bilotta, G. S., Extence, C. A., and Brazier, R. E. (2014). Evaluation of a fine sediment biomonitoring tool across a wide range of temperate rivers and streams. Freshwater Biology, 59, 2268-2277.

WFD-UKTAG (2014). UKTAG River Assessment Method: Benthic Invertebrate Fauna. Invertebrates (General Degradation): Walley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT).

10

Geology & Water Environment

10. Geology and Water Environment

Introduction

Terms of Reference

10.1 This chapter considers the likely significant effects on the receiving hydrological, geological, and hydrogeological environments associated with the construction, operation and decommissioning of the proposed Mullaghclogher wind farm, 4km North East of Plumbridge, Northern Ireland, hereinafter referred to as the 'Proposed Development'.

10.2 The impacts caused by the construction, operation and decommissioning phases of the Proposed Development are assessed, and mitigation measures are provided where required.

10.3 The assessment also identifies where hydrological features may constrain the layout of the Proposed Development.

Supplementary Assessments

10.4 This Chapter is supported by:

- Technical Appendix 10.1: Surface Water Management Plan
- Technical Appendix 10.2: Flood Risk & Drainage Assessment
- Technical Appendix 10.3: Peat and Landslide Hazard Risk Assessment
- Technical Appendix 10.4: Outline Peat Management Plan
- Technical Appendix 10.5: Consultation Records
- Figures 10.1 to 10.3

10.5 Reference should be made to **Chapter 1: Introduction & the Proposed Development** for information regarding detailed construction proposals.

10.6 Changes to the hydrological / hydrogeological regime may create resultant effects on ecology within hydrological dependent ecosystems. Therefore, this chapter is further supported by:

- Chapter 6: Vegetation and Peatland;
- Chapter 7: Terrestrial Fauna; and
- Chapter 9: Fisheries.

Statement of Authority

10.7 The assessment has been carried out by McCloy Consulting Ltd.; an independent environmental consultancy specialising in the water environment, with specialist knowledge of hydrological and hydrogeological assessments.

10.8 The key staff members involved in this project are as follows:

- Iain Muir MSc CEnv MIEnvSc – Senior Consultant and Chartered Environmentalist experienced in Environmental Impact Assessment (EIA) specialising in the water environment, undertaking hydrology, water quality and flood risk assessments for major infrastructure projects in highland environments, and renewable energy projects in the UK and Ireland; and
- Kyle Somerville BEng (Hons) CEng MIEI – Director and Chartered Engineer with over 19 years' experience specialising in the fields of hydrology, surface water management, groundwater screening assessments and geology assessments for wind farm developments in the UK and Ireland, and has overseen outline and detailed design of surface water management for in excess of thirty onshore wind farm developments in the UK and Ireland.

Scope of Assessment

10.9 This report will assess the effects of the Proposed Development on hydrology and surface water quality, hydrogeology and groundwater quality, and geological features. The assessment covers the construction, operational, maintenance and decommissioning phases of the Proposed Development.

10.10 This assessment identifies the hydrological constraints within lands under applicant control, herein referred to as 'the Site', and assesses the potential effects of the following:

- Existing natural and artificial drainage patterns;
- Water quality of surface water and groundwater;
- Surface and groundwater dependent ecosystems;
- Usage of surface water and groundwater including abstractions;
- Groundwater - surface water interactions;
- Aquifer systems and their vulnerability;
- Superficial and bedrock geology at the site; and
- Structural geology of the area and its environs.

10.11 In order to quantifiably assess the preceding, this report:

- Outlines relevant policy relating to the water environment;
- Summarises consultations provided in response to scoping requests;
- Provides baseline information and identifies sensitive receptors;
- Identifies potential likely effects, including potential likely cumulative effects;
- Assesses the significance of any adverse effects and resulting impacts based on the magnitude of the impact and the sensitivity of the receptors;
- Discusses management of design evolution and details mitigation measures;
- Provides a residual impact assessment; and
- Discusses the cumulative effects of the development in conjunction with other proposed and existing developments in the vicinity.

Legislation and Planning Policy

10.12 Relevant Environmental planning legislation and policy and industry best-practice guidance relevant to an assessment of hydrogeology and the water environment are summarised in **Table 10.1** and the following sections.

Relevant Legislation and National Planning Policy

Table 10.1: Relevant Legislation and National Planning Policy

Legislation	
NI	Control of Pollution (Oil Storage) (Amendment) Regulations (Northern Ireland) 2011
	Drainage (Environmental Impact Assessment) Regulations (Northern Ireland) 2017
	Water Resources (Environmental Impact Assessment) Regulations (Northern Ireland) 2017
	The Environmental Liability (Prevention and Remediation) (Amendment) Regulations (NI) 2009
	The Groundwater (Amendment) Regulations (Northern Ireland) 2016
	Nature Conservation and Amenity Lands (NI) Order 1985
	The Private Water Supplies Regulations (Northern Ireland) 2017
	The Surface Waters (Dangerous Substances) (Classifications) Regulations (NI) 1998
	Drainage (Northern Ireland) Order 1973 / Drainage (Amendment) (Northern Ireland) Order 2005
	The Environment (Northern Ireland) Order 2002
	Fisheries (Northern Ireland) Act 1966
	Water (Northern Ireland) Order 1999
	The Water Supply (Water Quality) Regulations (Northern Ireland) 2017
	Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017
	Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (NI) 2015
	The Water (Amendment) (Northern Ireland) (EU Exit) Regulations 2019
	Groundwater (Amendment) Regulations (Northern Ireland) 2016
	The Surface Waters (Dangerous Substances) (Classifications) Regulations (NI) 1998
UK	UK Environmental Standards and Conditions Phase 1 and Phase 2 (UK TAG 2008)

Regional and Local Planning Policy

10.13 The Proposed Development has been reviewed in relation to local planning policy specific to geology and the water environment. A detailed planning policy and legislation review is included within **Chapter 2: Policy.**

Regional Development Strategy 2035

10.14 The RDS promotes a sustainable approach to the provision of water and sewerage services and flood risk management including grey water recycling, rainwater harvesting and sustainable surface water management e.g., Sustainable Drainage Systems (SuDS).

Planning Policy Statements

Strategic Planning Policy Statement (SPPS)

10.15 In working towards sustainable development, the Department will aim to conserve both the archaeological and built heritage and natural resources (including wildlife, landscape, water, soil and air quality), taking particular care to safeguard designations of national and international importance.

PPS15 – Revised Planning and Flood Risk

10.16 Revised PPS15 sets out planning policies to "minimise flood risk to people, property and the environment", emphasising sustainable development and the conservation of biodiversity. The policy refers to the use of Sustainable Drainage Systems (SuDS) to minimise effects on the receiving water environment.

10.17 The policy that development proposals facilitating sustainable drainage would be considered favourably by the planning authority as such a sustainable drainage approach should be adopted by the Development.

10.18 Flood risk and drainage planning policy is similarly established by the Strategic Planning Policy Statement (SPPS). Transitional arrangements stated in the SPPS at paragraph 1.10 to 1.12 confirm that until a Plan Strategy is adopted, existing policies will apply together with the SPPS. Where the SPPS is silent or less prescriptive on a matter then this should not be judged to lessen the weight afforded to the retained policy.

10.19 In relation to flood risk planning policy, RPPS15 is more prescriptive on all aspects of matters for consideration, and the policy direction contained in RPPS15 is consistent with that stated in the SPPS.

PPS18 - Renewable Energy

10.20 The PPS18 sets out the planning policy for development that generates energy from renewable resources and aims to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environments.

10.21 Policy RE 1 of PPS18 states that, 'Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on…local natural resources, such as air quality or water quality.'

Local Plans

10.22 The Proposed Development is located within the jurisdiction of Derry City & Strabane District Council.

Strabane Area Plan 2001

10.23 Derry City & Strabane District Council (DCSDC) are currently preparing a new Local Development Plan (LDP) for the district up to 2032. The LDP will replace the Strabane Area Plan 2001 and the Derry Area Plan 2011 and the suite of Planning Policy Statements (PPS's) that were produced by the Department of the Environment.

10.24 In the interim, the current area plan for the area of the Proposed Development is the Strabane Area Plan 2001.

Derry City & Strabane District Council Local Development Plan (LDP) 2032 (Draft)

10.25 The Draft Local Area Plan 2032, although not yet adopted, outlines planning policy pertinent to the water environment.

10.26 FLD1 to FLD5 sets out policy to manage development that may be at risk from Fish

10.27 flooding or that may increase the risk of flooding elsewhere; to protect flood defence and drainage infrastructure; and to promote sustainable drainage solutions to improve water quality.

10.28 NE1 to NE4 sets out policy to manage development in relation to the natural environment (i.e., nature conservation sites, protected species and habitats, biodiversity / features of natural heritage importance, and main rivers and open water bodies).

10.29 As the draft Local Development Plan is only at consultation stage, it holds no material weight in decision making.

Guidance on Conservation of Geological Features - Earth Science Conservation Review

10.30 The Earth Science Conservation Review (ESCR) is the means whereby areas of geological interest in Northern Ireland are assessed to determine their importance to science and hence to earth science conservation.

10.31 The objective of the ESCR is to define systematically all earth science localities (geological and/or geomorphologic) in Northern Ireland. The overall aim of the process is to encourage conservation of such areas to protect them from potential threats such as landfill, changes to natural systems and coastal defence work.

Industry Guidelines

10.32 The Pollution Prevention Guidelines (PPGs), published by the Northern Ireland Environment Agency (NIEA) in conjunction with the Environment Agency for England and Wales, and the Scottish Environment Protection Agency (SEPA) are currently being replaced by updated Guidance for Pollution Prevention (GPPs). Guidance notes relevant to the Development include:

- NIEA Guidance for Pollution Prevention (GPPs):
    - GPP 1: Understanding Your Environmental Responsibilities – Good Environmental Practice;
    - GPP 2: Above ground oil storage tanks;
    - GPP 3: Use and Design of Oil Separators in Surface Water Drainage Systems
    - GPP 4: Treatment and disposal of Wastewater where there is no connection to the public foul sewer;
    - GPP 5: Works and Maintenance in or near Water;
    - GPP 6: Working at Construction and Demolition Sites;
    - GPP 8: Safe Storage and Disposal of Used Oils;
    - GPP 20: Dewatering Underground Ducts and Chambers;
    - GPP 21: Pollution Incident Response Planning;
    - GPP 22: Dealing with Spills; and
    - GPP 26 Safe Storage – Drums and Intermediate Bulk Containers.
- In the absence of revised specific guidance, works shall similarly consider the lapsed NIEA Pollution Prevention Guidance Notes (PPGs):
    - PPG 7: The Safe Operation of Refuelling Facilities; and
    - PPG 18: Managing Fire Water and Major Spillages.

10.33 Other relevant industry guidance includes:

- BS6031: 2009 Code of Practice for Earthworks;

- BS 5930 2015: Code of Practice for Ground Investigations (+A1:2020);
- CIRIA C523 - Sustainable Urban Drainage Systems; Best Practice Manual (2001);
- CIRIA C532 - Control of Water Pollution from Construction Sites (2001);
- CIRIA C741 - Environmental Good Practice On-Site (2015);
- CIRIA C609 - Sustainable Drainage Systems: hydraulic/structural/water quality (2004);
- CIRIA C753- The SuDS Manual (2015);
- CIRIA C786- Culverts, Screen and Outfall manual (2019);
- DEFRA Construction Code of Practice for Sustainable Use of Soils on Construction Sites (2009);
- DAERA - A Guide to EIA and Planning Considerations: Environmental Advice for Planning Practice Guide - Water Features Survey (2018);
- DAERA - A Guide to EIA and Planning Considerations: Wind Farms and Groundwater Impacts (2019);
- DAERA Standing Advice on Pollution Prevention Guidance;
- DAERA Standing Advice on Commercial or Industrial Developments;
- DAERA Standing Advice on Culverting;
- DAERA Standing Advice on Abstraction and Impoundments;
- DAERA Standing Advice on Sustainable Drainage Systems; and
- DAERA Standing Advice on Discharges to the Water Environment.

Consultation

10.34 Pre-application consultation and data gathering to form opinion and requirements with regards to the hydrological and geological environments was sought from local and regional stakeholder organisations, including organisations who would be anticipated to be consulted by the planning authority in relation to the planning application. The consultation is intended to pre-empt any pre-application or in-application consultation that would be undertaken on notification or submission of the planning application and EIA. The informal consultation excludes NIEA: NED whose concerns are addressed separately in **Chapter 6: Vegetation and Peatland**.

10.35 A summary of the specific data provided by, and information / concerns raised by the various stakeholders is included in the following table. Site specific input provided is included in the following baseline assessment. Stakeholder responses are included in **Technical Appendix 10.5**.

Table 10.2: Consultee Summary

Consultees		Summary of Response	Addressed in Assessment
Derry City & Strabane District Council	Environmental Health	Provided details of 3 no. properties within 5 km radius of the proposed windfarm site were provided. All are believed to be spring / well-fed. Also noted that private water supplies to single private dwellings are not required to be registered with DWI and the Council's Environmental Health Service does not maintain an up-to-date record of such supplies.	10.96
DAERA	NIEA Private Water Supply / Drinking Water Inspectorate	DWI does not hold information on private water supplies which supply single dwellings, and any details should be obtained from the Environmental Health Department of Derry City & Strabane District Council. Advised that the locations of registered private water supplies are available via a Spatial NI web-based app.	
DAERA	Aquaculture and Fish Health Marine & Fisheries Division	Stated that there were no issues or concerns from an aquaculture perspective as there are no aquaculture sites in proximity to the development.	10.154
DAERA	Environmental Crime Department	Did not provide a response to an information request regarding unlicenced landfills.	10.75
DAERA	NIEA Water Management Unit	Conducted a search of the groundwater monitoring database and found there are no groundwater abstraction points within the search area. Provided water quality data for the requested search area along with details on industrial consents. WMU also noted that all the information requested (except for groundwater quality), is available on the new Water Information Request Viewer.	10.96 and 10.129 to 10.133
Loughs Agency		Provided water quality information for watercourses in the vicinity of the development. Provided specific guidance for fisheries protection during development	10.129 to 10.133 and 10.220

Consultees		Summary of Response	Addressed in Assessment
		works to be adhered to during construction phase.	
Department for Infrastructure	Rivers	Confirmed the proposals affect several watercourses which are undesignated under the terms of the Drainage (Northern Ireland) Order 1973 (with maintenance responsibilities resting with riparian landowners), as well as affecting a watercourse designated under the Order known to the Department as the Craig River, watercourse number MW1104. Acknowledged that a portion of the development site falls within or adjacent the predicted 1 in 100-year floodplain.	10.142
Department for Economy	Geological Survey of Northern Ireland (GSNI)	Confirmed no known constraints with regards to abandoned mines and geohazards. Advised that a peat slide assessment would be required.	10.77
		Confirmed no mineral development restrictions associated with the development.	0

Assessment Methodology

Baseline Characterisation

10.36 This qualitative assessment has been undertaken based on experienced professional judgement and assessment of compliance with statutory and industry guidance, including site visits for verification.

Study Area

10.37 Potential effects were considered within 'the Site' (refer to para 10.10) within which the 'Planning Application Boundary' lies, and the wider geological and hydrogeological setting of the area.

10.38 The hydrological study area includes surface water catchments draining the area within the Site and the downstream river reaches affected by this area as defined by the relevant River Basin Management Plans, Local Management Areas (LMAs) and Catchment Stakeholder Groups.

10.39 The hydrogeological and geological study area extends to the underlying aquifer catchments and extents of the geological units.

Additional Areas Considered

10.40 Consideration has been given to potential likely significant effects in respect of the proposed turbine delivery route and access route. Details of the work comprising junction widening, passing bays and general road widening, and potential effects on the geology and water environment are summarised within **Chapter 12: Transport & Traffic**.

10.41 A potential grid connection route is described within **Technical Appendix 1.4: Assessment of Potential Grid Connection**. Although the grid route is not part of the Proposed Development, consideration has been given to potential likely significant effects.

Desk Study

10.42 The desktop study involved collation and assessment of the relevant information from the following sources:

- Close scale Ordnance Survey mapping in addition to aerial photography to assess land use and environs and to identify water features and watercourse catchments;
- Local authority and regulatory body consultation responses;
- NIEA river quality data and natural heritage data;
- DfI Rivers Flood Maps NI;
- NIEA Drinking Water Inspectorate and Water Management Unit data;
- Review of CEH Flood Estimation Handbook (web portal) for details of river catchment data;
- Review of Inland Fisheries information;
- Review of detailed site topographic survey;
- GSNI GeoIndex (1:10,000 bedrock and superficial geology maps);
- GSNI GeoIndex (aquifers and aquifer vulnerability);
- GSNI GeoRecords database;
- General Soil Type Map of Northern Ireland at 1:250 000 scale;
- NIEA Groundwater quality data and abstractions / discharges database; and
- NIEA Drinking Water Inspectorate and Water Management Unit data.

Determination of Sensitivity, Magnitude, Likelihood and Significance

10.43 This assessment determines the nature, scale and significance of the effects of the Development on the baseline (current) scenario in accordance with a methodology stated within The Institute of Environmental Management and Assessment guidance[1].

10.44 The potential impact significance is defined by the combination of the sensitivity of the receptor and the magnitude of the effect. Following this, an overall impact significance is determined by considering the potential impact significance and the likelihood of the effect occurring.

Sensitivity Criteria

10.45 The scale and sensitivity of the receiving environment (receptor) has been categorised on a scale of "Very High" to "Low". The sensitivity criteria used for this assessment are presented in **Table 10.3** and are based on:

- Vulnerability of a receptor to a particular pressure (degree of environmental response to any particular effect); and
- The importance or 'value' of the receptor e.g. an area of international importance should be considered more sensitive to effect than a local area of little or no conservation value.

Table 10.3: Evaluation of Hydrological / Hydrogeological Receptor Sensitivity Criteria

Scale / Sensitivity of the Environment (Receptor)		
International and / or Very High	Attribute has a very high quality / rarity at an international scale.	Important on a European or global level, e.g. Ramsar Sites, SAC, SPA and Habitats Directive Sites with dependence on the water environment.
National and / or High	Attribute has a high quality and rarity at a national scale.	Important in Northern Ireland, e.g. ASSI or National Nature Reserve (NNR) with respect to the hydrological environment and / or geological environment. WFD classification of 'High' with the watercourse providing a nationally important resource or supporting river ecosystem. Public water supplies and highly productive aquifers or local water supplies, including private water supplies where there is no alternative to private supplies. Principal aquifer providing a nationally important resource. Source Protection Zone 2 (Outer Source Protection Zone).

[1] Institute of Environmental Management and Assessment (2004) Guidelines for Environmental Impact Assessment.

Scale / Sensitivity of the Environment (Receptor)		
Regional and / or Medium	Attribute has a medium quality and rarity at a regional scale.	Important in the context of the region, e.g. catchment scale issues, main river within the catchment, local Nature Reserves or Sites of Local Importance for Nature Conservation (SLNCI). Site of regional geological importance. Sites of Nature Conservation Importance in relation to earth science interest. WFD classification of 'Good' with the watercourse providing an important resource or supporting river ecosystem or upstream of a designated fishery. Active floodplain area. Designated fishery, catchment regionally important for fisheries. Domestic private water supplies located within vicinity of mains water supply or private water supplies used only for agricultural purposes and not drinking water. Groundwater dependent terrestrial ecosystems in hydraulic continuity with the Site. Principal aquifer providing a regionally important resource e.g. industrial use with limited connection to surface water. Source Protection Zone 3 (catchment of groundwater source).
Local and / or Low	Attribute has a low quality and rarity at a local scale.	WFD classification of 'Moderate' or less with the watercourse providing a locally important resource or supporting river ecosystem. Geological features not currently identified as ASSI, ESCR that may require protection in the future. Areas with properties (geology / soils) abundant on a local or regional scale or with little or no agricultural value. Domestic private water supplies located within vicinity of mains water supply or private water supplies used only for agricultural purposes and not drinking water. Groundwater dependent terrestrial ecosystems in hydraulic continuity with the Site. Aquifer providing a locally important resource e.g. For agricultural or small-domestic supplies.

Magnitude of Effect

10.46 The magnitude of change / effect is influenced by the timing, scale, size and duration of the hazardous effect; magnitude has been categorised on a scale of “High” to “Low”; defined in**Table 10.4**.

Table 10.4: Evaluation of Magnitude of Effect Criteria

Magnitude of Effect / Description		Definition of Criteria	
High	Fundamental change resulting in loss of an attribute and /or the quality and integrity of conditions.	Water Quality	Potential high risk of pollution to surface water changing water quality status.
		Water Supply	Loss of local water supply or change in quality with respect to drinking water standards (DWS).
		Flood Risk / Erosion Potential	Significant increase in risk due to a significant change in the proportion of hard standing and altered surface water flows.
		Groundwater	Significant change in groundwater levels, flow regime, groundwater quality or extensive change to an aquifer.
		Surface Water Dependent Ecosystem	Loss of, or extensive change to, a surface water dependent ecosystem or fishery.
		Geology and Soils	Partial (greater than 50%) or total loss of a geological site or mineral deposit. Major or total loss of topsoil, soils or peatland.
Medium	Detectable change to conditions resulting in non-fundamental temporary or permanent consequential changes.	Water Quality	Potential medium risk of pollution to surface water, changing water quality status.
		Water Supply	Temporary loss of local water supply or minor change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	Detectable increase in flood risk and erosion potential due to a medium change in the proportion of hardstanding and altered surface water flows.
		Groundwater	Measurable change in groundwater levels, groundwater flow regime, groundwater quality or identifiable change to an aquifer.

Magnitude of Effect / Description		Definition of Criteria	
		Surface Water Dependent Ecosystem	Partial loss or change to a surface water dependent ecosystem or fishery.
		Geology and Soils	Partial (between 15% - 50%) loss of topsoil, soils or peatland, or where the value of the area would be affected, but not to a major degree. The site's integrity would not be adversely affected, but the scheme may lead to a loss of or damage to key characteristics, features or attributes.
Low	Results in minor effect on attribute of insufficient magnitude to affect the use or integrity.	Water Quality	Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations.
		Water Supply	No change in pressure or flow to local water supply or minor change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	Minor changes in the proportion of hardstanding and altered surface water flows result in no detectable increase in flood risk and erosion potential.
		Groundwater	Minor alteration to one or more characteristics, features or elements or no observable effect
		Surface Water Dependent Ecosystem	Any measurable change in groundwater levels does not affect groundwater flow regime, groundwater quality with regards to DWS or result in any change to an aquifer.

Magnitude of Effect / Description		Definition of Criteria	
		Geology and Soils	Small effect on a geological/ geodiversity site or mineral deposit (up to 15%). Partial loss of topsoil, soils or peatland, or where soils will be disturbed but the value of the area would not be affected. No significant loss of or damage to key characteristics, features or attributes.
Negligible	Results in negligible effect on attribute	Water Quality	No perceptible change in water quality.
		Water Supply	No change in pressure or flow to local water supply and negligible change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	No measurable change in the proportion of hardstanding and altered surface water flows result in no detectable increase in flood risk and erosion potential.
		Groundwater	No alteration to groundwater characteristics, features or elements.
		Surface Water Dependent Ecosystem	No measurable change in groundwater levels, groundwater flow regime, groundwater quality with regards to DWS. No change to an aquifer.
		Geology and Soils	Negligible change from geological, mineral and soil baseline conditions. No significant loss of or damage to key characteristics, features or attributes.

Impact Significance Criteria

10.47 The magnitude of effect and receptor sensitivity are combined to evaluate and qualify if an impact is of high, moderate, low, or negligible significance as outlined in **Table 10.5**.

Table 10.5: Evaluation of Potential Effect Significance

Scale / Sensitivity of the Environment (Receptor)	Magnitude of Effect			
	Negligible	Low	Medium	High
International / Very High	Moderate	Moderate	High	High
National / High	Low	Moderate	Moderate	High
Regional / Medium	Negligible	Low	Moderate	Moderate
Local / Low	Negligible	Negligible	Low	Low

Likelihood of Occurrence Criteria

10.48 The likelihood of the potential effects occurring is assessed based on historical data, quantitative analysis and professional judgement based on relevant experience as shown in **Table 10.6**.

Table 10.6: Evaluation of Likelihood of Occurrence

Likelihood of occurrence	Criteria
Certain	Likely consequential effect in medium term and inevitable in long term (within the life of the development).
Likely	Possible consequential effect in the medium term and likely but not inevitable in the long term.
Unlikely	Unlikely that any consequential effect would arise within the lifetime of the development.
Rare	It is unlikely that any consequence would ever arise.

Determination of Overall Impact Significance

10.49 Potential Impact Significance (**Table 10.5**) and Likelihood of Occurrence (**Table 10.6**) are combined to determine an Overall Impact Significance as shown in the matrix in **Table 10.7**.

Table 10.7: Evaluation of Overall Significance

Potential Significance	Likelihood of Occurrence			
	Rare	Unlikely	Likely	Certain
High	Minor	Moderate	Major	Major
Moderate	Minor	Minor	Moderate	Major
Low	Not Significant	Minor	Minor	Moderate
Negligible	Not Significant	Not Significant	Minor	Moderate

Site Characteristics & Baseline Conditions

Site Description

10.50 The Proposed Development is located approximately 4 km north-east of Plumbridge, Northern Ireland. The assessment area (the Site) considered within this assessment occupies an area of approximately 6.3 km^2.

Topography

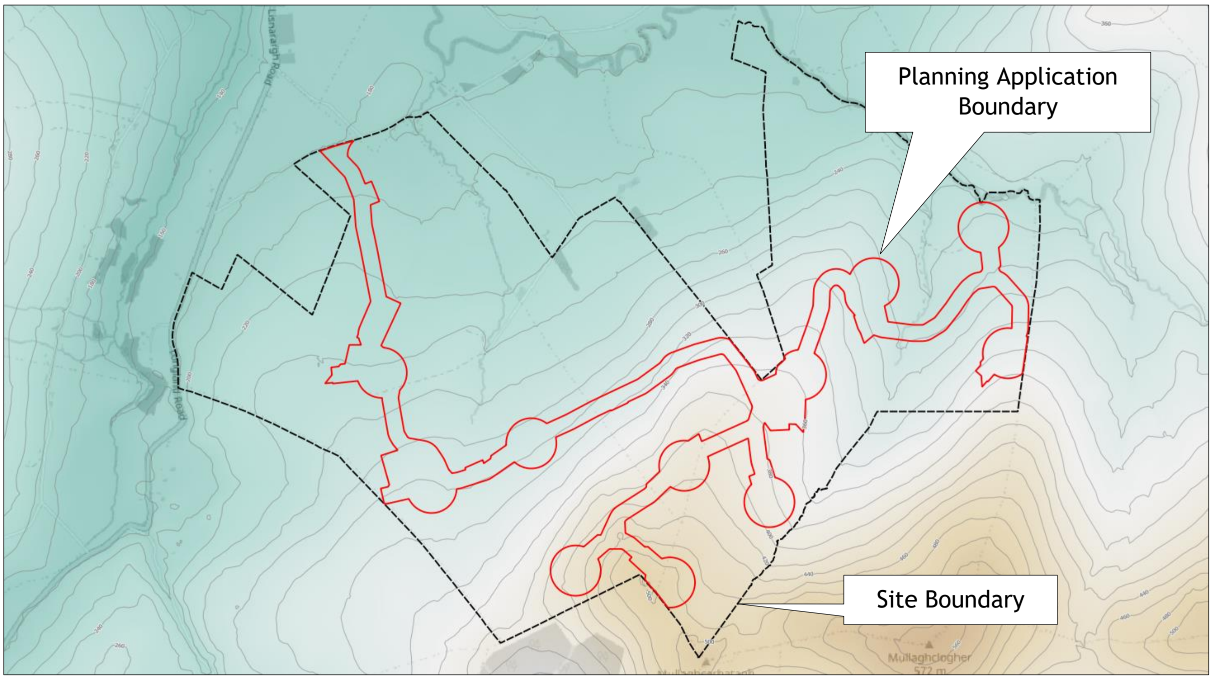
10.51 Topography within the Site generally slopes south-east to north-west. Maximum ground levels are approximately 510 m OD at the southern extent of the Site near the summit of Mullaghcarbatagh Mountain. Minimum ground levels of approximately 183 m OD are found at the western / north-western extent of the Site near to Lisnarargh Road.

Land Cover

10.52 The majority of the Site consists of upland slopes which descend into improved and semi-improved agricultural fields along parts of the northern site boundary. The majority of the Site consists of blanket mire of varying quality and condition which periodically grades into mosaics with rush pasture and acid grassland. Further information on land cover and species present within the Site is in detail within Chapter 6: Vegetation and Peatland.

10.53 Access to the site is available via Lisnaragh Road B48 to the east and Carrickayne Road to the north of the site.

Plate 10-1: Topography



Meteorological Data Summary

10.54 The Standard Percentage Runoff (SPR) is a parameter used in runoff and flood estimation, which represents the percentage of total rainfall likely to contribute to direct runoff and storm flow. Review of the site in relation to FEH catchment descriptors indicates a SPR of approximately 58.7%. For context, SPR values in the UK range from 2% (sand or chalk with slow response / low runoff) to a maximum of 60% (peat bog with rapid response / high runoff).

10.55 Rainfall data from the Castlederg Climate Station[2] (approx. 25 km south-west from the Proposed Development) records an annual average rainfall total of 1167.20 mm during the 1991 – 2020 climatic period. Based on the Meteorological Office banding of annual average rainfall (1991 – 2020), rainfall in the vicinity of the Site is within the fifth highest of nine bands (1000 - 1250 mm) and is typical for elevated regions in Northern Ireland.

Geology

Agricultural Land Classification

10.56 DAERA published a classification index for Agricultural Land Classification (ALC) in 1997 based on a document "Agricultural Land Classification of England and Wales"

[2] Met Office, Castlederg Climate. Available at https://www.metoffice.gov.uk/public/weather/climate/gcg9gvrs8 Accessed 28/08/2023.

published by the Ministry of Agriculture and Fisheries and Food (now Department for Environment, Food and Rural Affairs)[3] in 1988. The index classifies agricultural land into five grades based on climate, topography, soil, slope and altitude characteristics, with Grade 1 excellent quality and Grade 5 very poor quality.

10.57 Using the guidance from the ALC of England and Wales, along with available site information, including site walkover observations and gradients of the land, the most suitable land classifications for the site range from Grade 3b – 'moderate quality agricultural land' to Grade 4 – 'poor quality agricultural land'.

10.58 The loss or partial loss of agricultural function on the site is therefore not significant and does not inform constraints to development.

Soil Conditions

10.59 A review of the UK Soil Observatory interactive map viewer indicates a varied soil type coverage on the site.

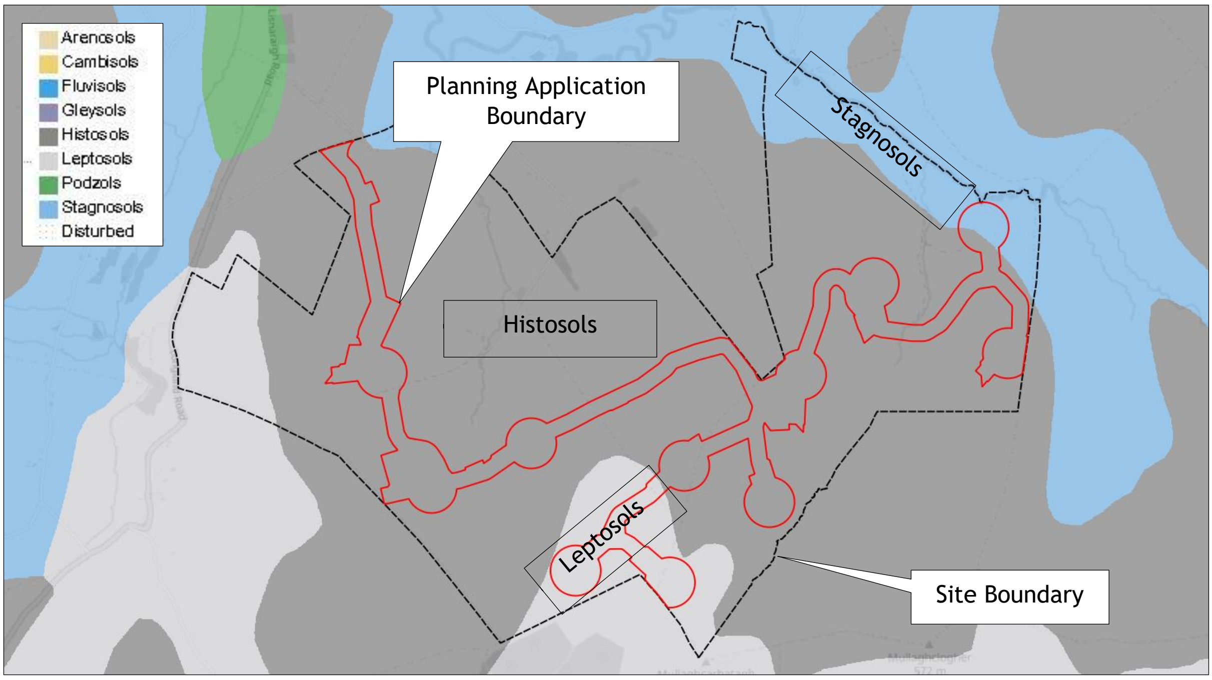
10.60 The majority of the Site is characterised by 'Histosols' comprising peaty soils with a deep surface layer of organic material. Histosols are generally poorly draining due to high clay content and high organic content.

10.61 The westernmost extents and the area around the summit of Mullaghcarbatagh Mountain are characterised by 'Leptosols' which are a very shallow soil which have an inability to hold water.

10.62 Areas of lower elevation around larger watercourses are comprised of 'Stagnosols' which are usually developed on unconsolidated materials, such as, glacial till and alluvial deposits due to stagnating water and poor drainage. For use of agricultural purposes, this soil type requires drainage channels, however, in areas with low permeability subsoil engineered drainage channels are often insufficient. In summary, they comprise very poorly draining clay soils.

3 Ministry of Agriculture, Fisheries and Food: Agricultural Land Classification of England and Wales (1988) http://publications.naturalengland.org.uk/file/5526580165083136

Plate 10-2: Soils

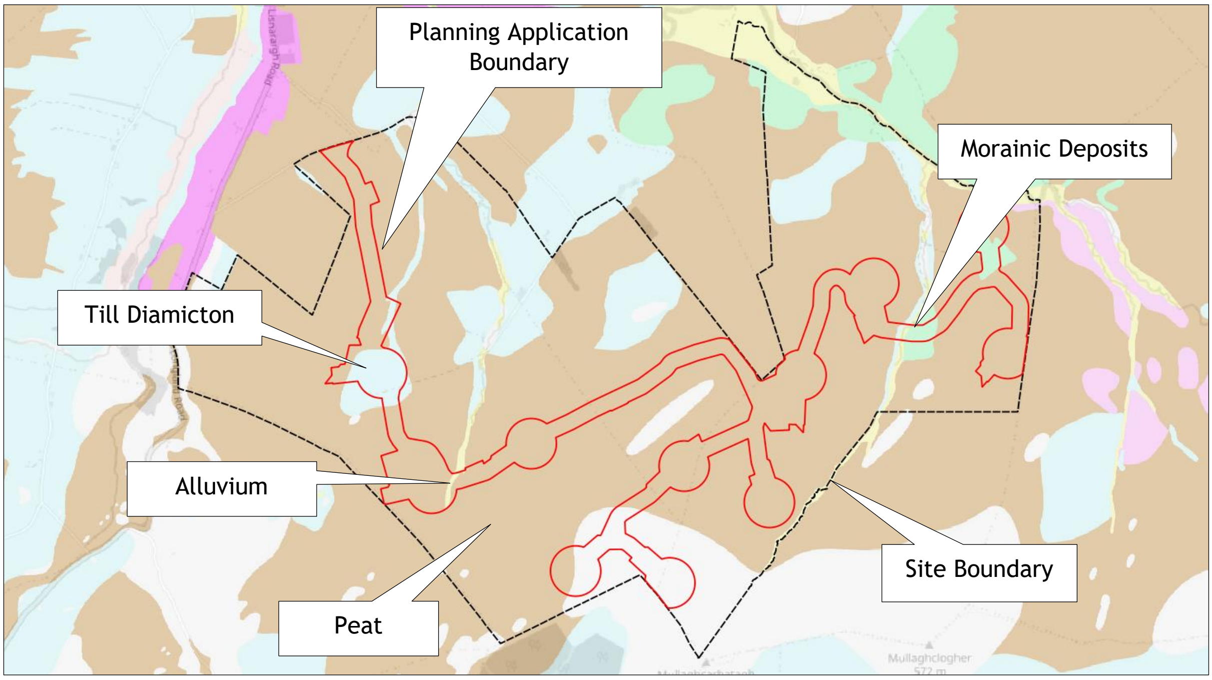


Superficial Deposits

10.63 The Site has been reviewed in relation to the 1:10,000 mapping available from the GSNI GeoIndex WMS layers.

10.64 The majority of the Site is underlain by peat deposits, with areas of alluvium and till diamicton coinciding with the route of some larger mapped watercourses. Discrete areas of morainic deposits are also noted throughout the eastern areas of the Site, largely coinciding with watercourses. The areas around the summit of Mullaghcarbatagh Mountain do not have superficial deposits mapped inferring bedrock is close to the surface in these areas.

Plate 10-3: Superficial Deposits



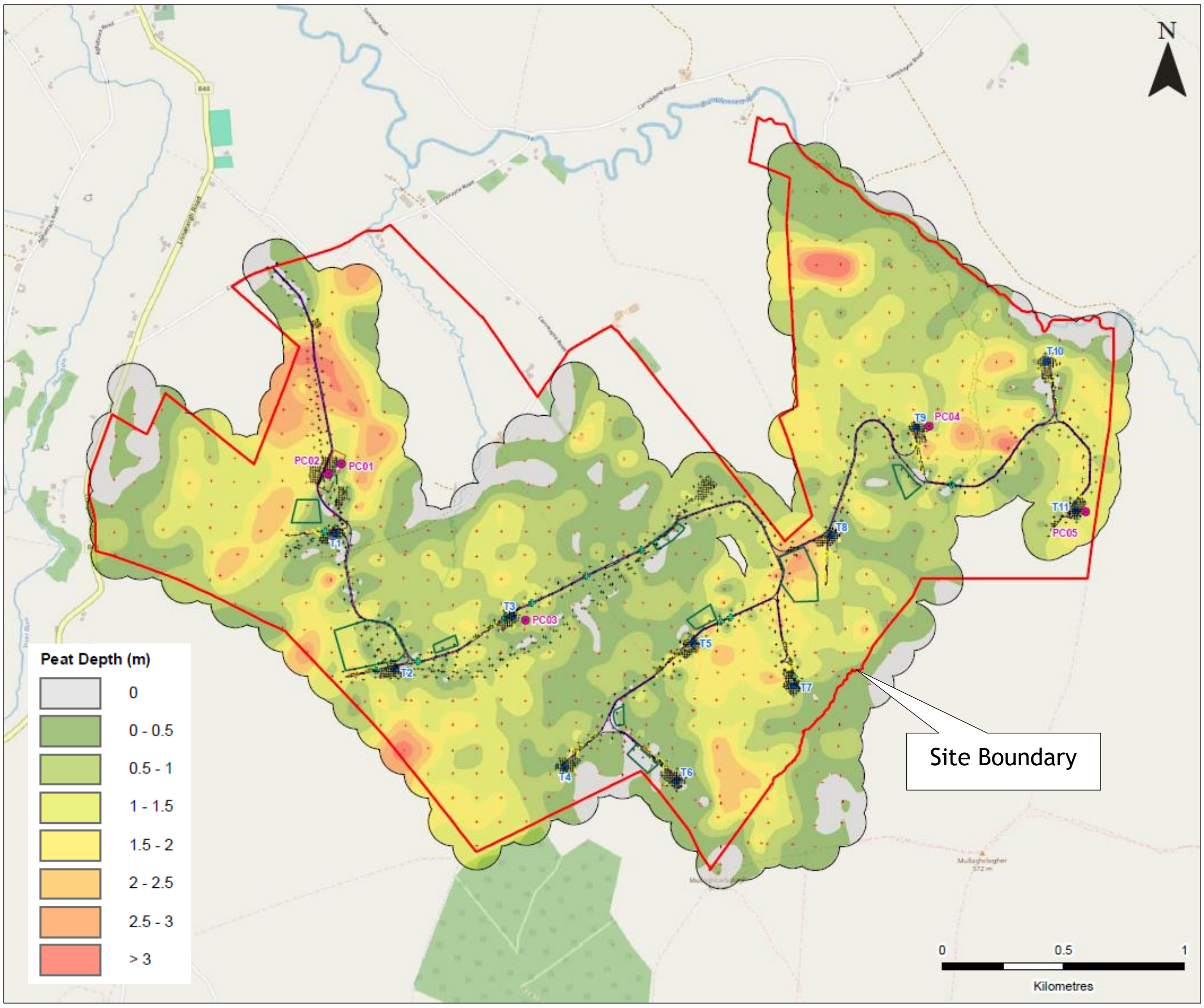
Peat

10.65 The presence of peat coverage is initially identified by GSNI 1:10,000 mapping (shown on

10.66 **Plate** 10-3) and the NIEA Natural Environment Map Viewer, both of which indicate peat coverage within the Site. A Peat and Landslide Hazard Risk Assessment (PLHRA) has been produced by a 3rd party for the applicant and is included in **Appendix 10.3** and the findings of that intrusive investigation take precedent over desktop sources in relation to peat coverage at the Site.

10.67 The PLHRA confirmed peat is present across much of the Site. Where peat is present, an interpolated peat depth map of the 2,232 soil probes collected during the peat survey is shown on **Plate 10.4** below. The deepest recorded areas of peat are in excess of 4.0 m. All deep/moderate areas of peat are avoided where feasible. The PLHRA is included as **Appendix 10.3**.

Plate 10-4: Peat Depth (excerpt from PLHRA – Appendix 10.3)



Bedrock Geology

10.69 The bedrock geology of the site has been reviewed in relation to the 1:10,000 mapping available from the GSNI GeoIndex WMS layers. Two dominant types of bedrock geology are present within the Site boundary; Glenga Amphibolite Member (which is described as a schist with subsidiary limestone); and Dart Formation (Psammite) (which is described as psammite and intercalated graphitic mica schist). These dominant areas are interspersed with bands of Dart Formation (Metalimestone) and sills comprised of metagabbro.

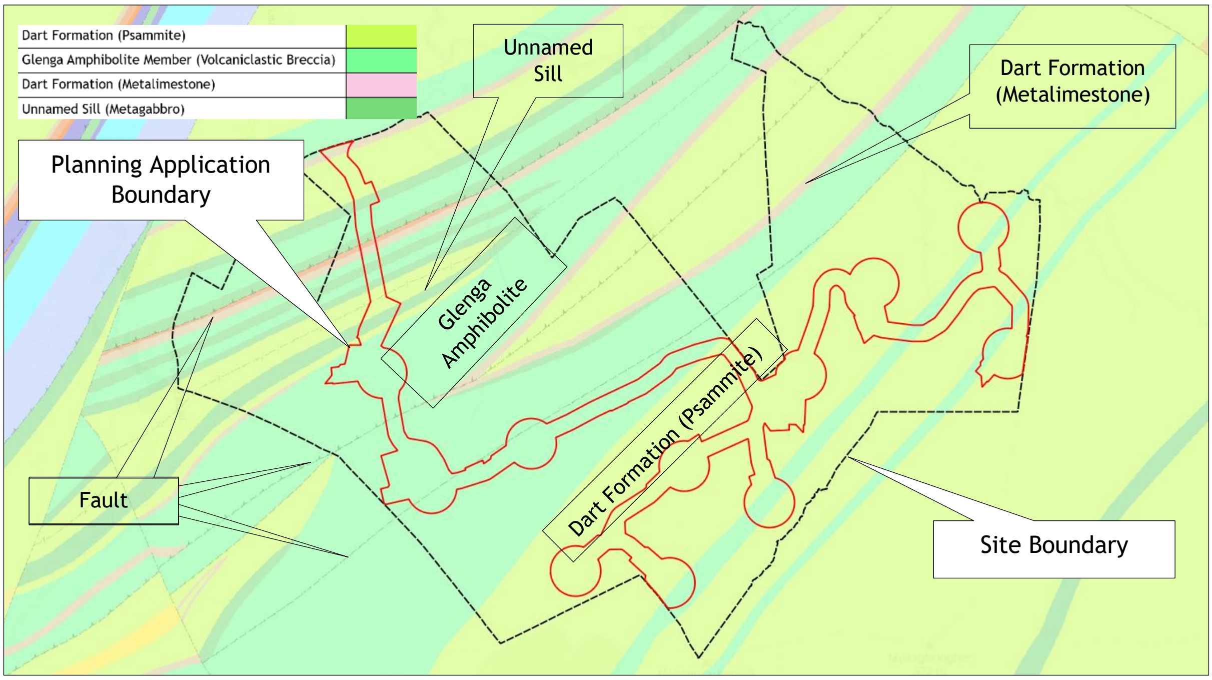
Exposed Bedrock

10.70 Exposed bedrock was not observed during the site walkover. Superficial mapping indicates areas around the summit of Mullaghcarbatagh Mountain where pockets of no superficial deposits are identified. It is likely that rockhead will be at or near ground level in these areas.

Faults

10.71 Review of GSNI 'linear features' mapping indicates 3 no. faults located within the Site boundary, all orientated south-west to north-east. The locations of large regional fault systems are *inferred* from the BGS mapping. Their presence is not noted in the PLHRA (**Appendix 10.3**) as a source of potential local ground instability and, therefore, is not considered further in this assessment as a potential constraint to development.

Plate 10-5: Solid Geology



Mass Movement

10.72 A review of the 1:10,000 mapping on the GSNI GeoIndex did not identify areas of mass movement within the Site.

Radon

10.73 The UK interactive radon map[4], based on the Indicative Atlas of Radon in Northern Ireland[5], indicates that the parts of the Site area are situated in the highest band of radon potential i.e., less than 1 -30 % of homes above the Action Level.

[4]Public Health England (2015) UK Maps of Radon. Available at http://www.ukradon.org/information/ukmaps. Accessed 28/08/2023.

[5] Public Health England (2015) Radon in Northern Ireland: Indicative Atlas. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/453711/PHE-CRCE-017__maps_with_place_names_.pdf. Accessed 28/08/2023.

Waste and Minerals

Waste Site Licence Exemptions and Sites

10.74 NIEA datasets did not identify any waste sites situated within 1 km of the Site.

Landfills

10.75 A review of the opensource NIEA authorised landfill sites dataset does not identify any within 1 km of the Site.

10.76 An information request was made to the DAERA Environmental Crime Department. No response was received with regards to any unlicensed landfills within 2 km of the Site.

Industrial Consents

10.77 Review of DAERA mapping identified 7 no. domestic and industrial consents within 2 km of the Site boundary. They are described as 'private sewage – domestic' (3 no.), 'private sewage – unspecified' (3 no.), and 'site drainage – unspecified' (1 no.). All are located down gradient from the Site and, therefore, are not considered a constraint to the Proposed Development.

Historic Quarries / Mines

10.78 A review of GSNI Historic Mine Workings (Group) dataset did not identify any mapped shafts and /or adits within the Site boundary that would be considered a constraint to the Proposed Development.

Active Quarries

10.79 Consultation of the GSNI GeoIndex identified no quarries within a 2 km radius of the site.

Mineral Occurrences

10.80 Information available on the GSNI GeoIndex shows there is 1 no. mineral occurrences within a 2 km radius of the Site. The occurrences are not a constraint to development.

Mineral Prospecting Licences March

Review of the GSNI GeoIndex indicated the Site is within a mineral prospecting licence zone; however, in consultation, GSNI Minerals Branch confirmed there are no mineral development restrictions associated with the development.

Summary of Geohazards

Table 10.8: Summary of Identified Geohazards

Geohazard Type	Applicable to the Development?	Rationale / Potential Constraint	Consider Further?
Extractions	No	No active quarries were identified within 2 km from the Site. GSNI confirmed there is no known economic mineralisation in the area to constraint development at this time.	No
Adit / Shafts (Mine Entries)	No	None located within the Site boundary.	No
Land Slip	Yes	The PLHRA (Appendix 10.3) notes that a landslide occurred outside of site boundary but within relative proximity to the Proposed Development.	Yes – refer to PLHRA (Appendix 10.3)
Peat	Yes	Peat is present within the Site boundary. The occurrence of peat is a potential constraint to development. The PLHRA (Appendix 10.3.) includes a hazard impact assessment which concluded that, subject to micro-siting and the employment of appropriate mitigation measures, all the areas can be considered as an insignificant risk with regards to peat instability.	Yes – refer to PLHRA (Appendix 10.3)
Running Sands	No	No mapped sands on site.	No
Compressible Ground	Yes	Peat is present within the Site. The PLHRA outlines key control measures which are required to ensure the risk of peat slide remains at insignificant levels.	No
Landfill	No	There is no evidence (current or historic) of landfill(s) present within the Site boundary.	No
Karst Features	No	No recorded features within the vicinity of the Site.	No
Radon	Yes	The site is situated in the highest band of radon potential i.e., less than 10-30 % of homes above the Action Level.	No

Hydrogeology

Groundwater Body

10.81 The groundwater body underlying the Site is the Claudy Groundwater Body (UKGBNI4NW003) which has an overall area of 917 km^2. The characteristics of the groundwater body are summarised in the following sections.

Groundwater Quality

10.82 The European Water Framework Directive (2000/60/EC) (WFD) requires the status of groundwater management units (groundwater bodies) within each river basin to be determined as 'Good' or 'Poor'. The latest published results (2020) in relation to groundwater quality are available from the NIEA River Basin Management site[6]. Both the quantitative and chemical status of the Claudy bedrock groundwater body is 'Good'; therefore, the overall status of the body is classified as 'Good.'

10.83 Review of the online NIEA Water Information Request Viewer found no groundwater monitoring points within 5 km of the Site.

Bedrock Aquifer Classifications

10.84 A review of the online data available on GSNI GeoIndex indicates the bedrock aquifer underlying the Site is classified as Bl(f) indicating that moderate yields are unusual in this aquifer type and low yields are more common. Flow tends to be mainly shallow / local with limited regional flows.

10.85 The GSNI Groundwater Vulnerability Map indicates that groundwater within the Site is classified as 4c, 4e and 5, on a vulnerability scale of 1 (very low) to 5 (very high). Note: Class 4 can be further subdivided according to the nature of the pathway; and 4c is categorised as 'low permeability cover'; and 4e where superficial aquifers are present.

10.86 The vulnerability mapping indicates the parts of the Site classed as 5 are associated with areas with no superficial geology is mapped and lands at higher elevations.

Superficial Aquifer

10.87 GSNI 1:250k mapping indicates there is a potential superficial aquifer to the north of the Site boundary (as per GSNI Groundwater Vulnerability Class 4e).

10.88 Areas of potential superficial aquifers are defined based upon superficial deposits considered to have potentially significant permeability and storage properties. The area identified is located along the route of the Burn Dennet River which is underlain by glaciofluvial ice contact deposits, alluvium, and morainic deposits (all comprising silts, sands, and gravels).

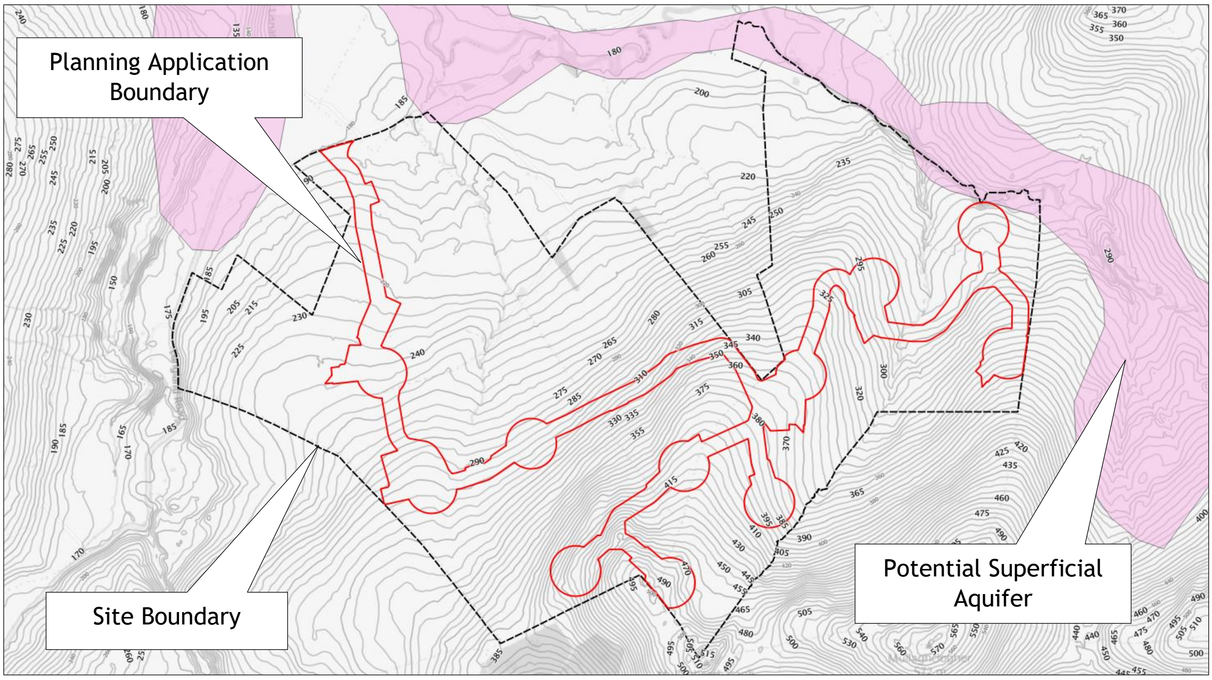
10.89 At its nearest point, the Proposed Development is located on lands c. 30 m higher than the potential aquifer and would not affect subsurface flows in superficial deposits.

10.90 No potential private water supplies or abstractions have been identified in the region of the potential superficial aquifer (refer to paragraphs 10.97 to 10.100);

[6] https://gis.daera-ni.gov.uk/arcgis/apps/webappviewer/index.html?id=16fddc459bd04d64b9e8f084f3a8e14a

therefore, it is not considered further in this assessment as a potential constraint to development.

Plate 10-6: Superficial Aquifer



Groundwater Recharge

10.91 NIEA data[7] indicates that recharge of the Claudy groundwater body will be direct where bedrock is at / close to surface. A proportion of recharge through overlying till deposits may also occur especially where these are thin. Recharge is expected to be reduced where thicker tills overlie bedrock. Recharge to the superficial aquifer will be mostly direct. Recharge acceptance by the Bl(f) aquifers will be restricted due to low permeability and storage.

10.92 Long term recharge rates for the body are approximately ~ 324mm/a (for Bl(f) aquifers actual recharge likely to be limited and assumed to be 100mm/a).

Groundwater Flow

10.93 NIEA data[8] indicates that within the groundwater body, fracture flow is dominant within the bedrock. Flow paths are generally considered to be short (tens to hundreds of metres) with flow mainly following topography. The dominant flow zone will be the upper 10-30 m. The PLHRA (Appendix 10.3) notes that that water

[7] Characterisation of groundwater bodies within Northern Ireland (2012). Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/water-report-characterisation-of-groundwater-bodies-within-Northern-Ireland-June-2012.pdf (Accessed 05/08/2023)

[8] Characterisation of groundwater bodies within Northern Ireland (2012). Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/water-report-characterisation-of-groundwater-bodies-within-Northern-Ireland-June-2012.pdf (Accessed 05/08/2023)

is likely to be present in the peat and that groundwater may be present within sand and gravel horizons within the Glacial Till (if present) and within fractures or fault zones within the bedrock deposits.

10.94 Groundwater flow within the bedrock is expected to be mainly shallow and discharging locally to surface waters especially in upland areas. Within the river valleys some limited discharge from bedrock to the sand / gravel aquifers is likely to occur with eventual discharge from these deposits to the rivers.

Springs / Wells

10.95 A review of the OSNI historical maps available from PRONI[9] and the Historical Map Viewer[10] indicated there are no historical springs within the Site boundary and immediate vicinity. GSNI do not hold records of any springs within 1 km of the Preliminary Site Boundary.

Boreholes

10.96 GSNI and DCSDC confirmed they do not hold records of any boreholes within 1 km of the Site boundary.

Groundwater Abstractions

10.97 In order to identify potential groundwater users, data was sought from a number of sources. Findings from this is summarised as follows:

- NIEA Water Management Unit carried out a search of the Groundwater Monitoring Database. They advised they found no groundwater monitoring points within 5 km of the Site. Their response is included in **Appendix 10.5**.
- Review of NIEA Drinking Water Inspectorate (DWI) data confirmed there are 3 no. private drinking water supplies registered with the Inspectorate 5 km of the Site under the Private Water Supplies Regulations (Northern Ireland) 2017.

  It is considered that due to the distance (>2 km), and the breaks in hydrological connection inferred by sub-catchment delineation between the Site and the private water supplies, they could not feasibly be affected by works associated with the Proposed Development. Therefore, no further consideration is required within this assessment.
- Derry City and Strabane District Council was contacted with respect to information on private water supplies which supply single dwellings. They noted that private water supplies to single private dwellings are not required

[9] PRONI Historical Maps. Available from https://apps.spatialni.gov.uk/EduSocial/PRONIApplication/index.html

[10] Department for Communities Historical Environment Map Viewer. Available from https://dfcgis.maps.arcgis.com/apps/webappviewer/index.html?id=6887ca0873b446e39d2f82c80c8a9337

to be registered with DWI and the Council's Environmental Health Service does not maintain an up-to-date record of such supplies. The Council response is included in **Appendix 10.5**.

- The DAERA Abstraction and Impoundment Licencing (AIL) information available on the Water Information Request Viewer was reviewed for licenced groundwater-fed abstractions within 5 km of the Site. None were identified.

10.98 In addition to identification of potential abstractions from records, the various consultees indicated that they do not hold a definitive database of individual properties served by a private water supply. In order to ensure a robust assessment, screening has been undertaken to identify properties potentially served by local, unrecorded water abstractions within the vicinity of the Proposed Development based on property and occupancy information determined by the applicant.

10.99 To a ensure a precautionary approach to the assessment, a 500 m screening radius (i.e., 2 x NIEA Guidance) has been applied to the Planning Application Boundary in order to identify likely water supplies for receptors in that area. Screened properties are shown on the following

10.101 Plate 10-7 and scheduled in

10.103 Table 10.9.

Plate 10-7: Property Screening

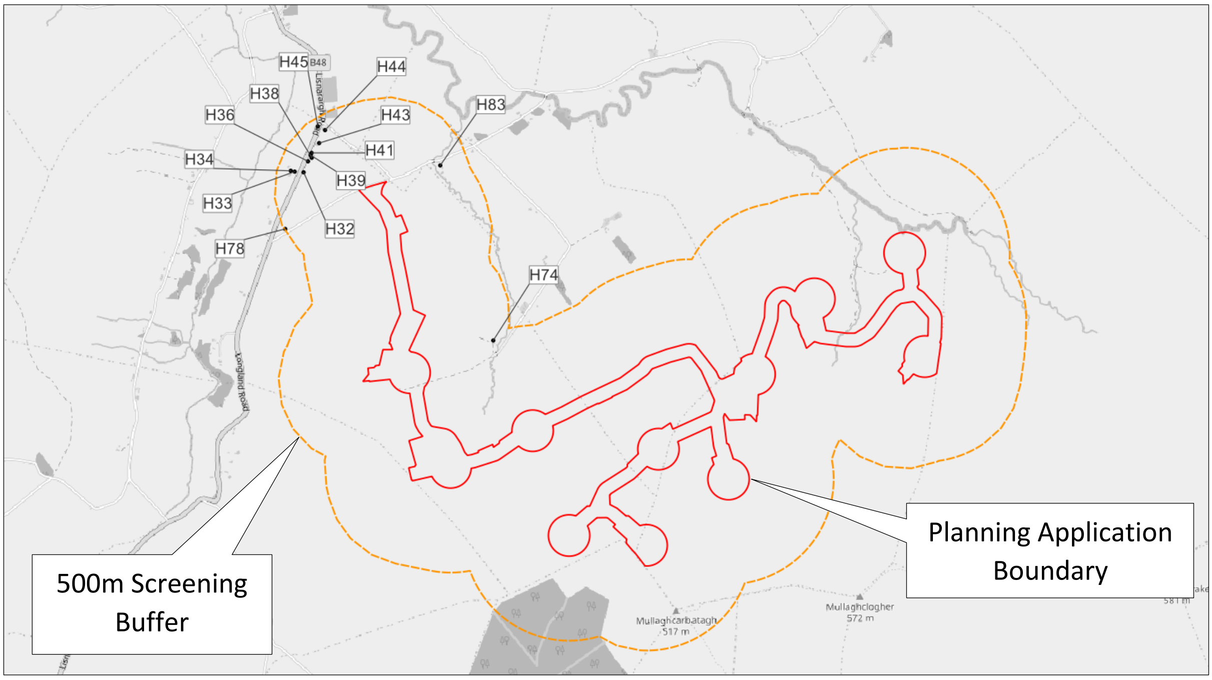


Table 10.9: Summary of Dwellings

Feature ID	Description	Significance and Rationale for Scoping Out
H6	Uninhabited property	Uninhabited building, no drinking water requirements.
H32	Uninhabited property	Uninhabited building, no drinking water requirements.
H33	Occupied property	NI Water main present, unlikely to rely on a private supply.
H34	Occupied property	NI Water main present, unlikely to rely on a private supply.
H36	Occupied property	NI Water main present, unlikely to rely on a private supply.
H38	Occupied property	NI Water main present, unlikely to rely on a private supply.
H39	Occupied property	NI Water main present, unlikely to rely on a private supply.
H41	Occupied property	NI Water main present, unlikely to rely on a private supply.
H43	Occupied property	NI Water main present, unlikely to rely on a private supply.
H44	Occupied property	NI Water main present, unlikely to rely on a private supply.
H45	Occupied property	NI Water main present, unlikely to rely on a private supply.
H74	Uninhabited property	Uninhabited building, no drinking water requirements.
H78	Occupied property	NI Water main present, unlikely to rely on a private supply.
H83	Occupied property	NI Water main present, unlikely to rely on a private supply.

10.104 The screening exercise confirms no additional properties downgradient from the Site boundary within the screening buffer that are likely to rely on private water supply abstractions; therefore, no private water supplies are likely to be affected by the Proposed Development.

Catchment Hydrology

Surface Water Bodies

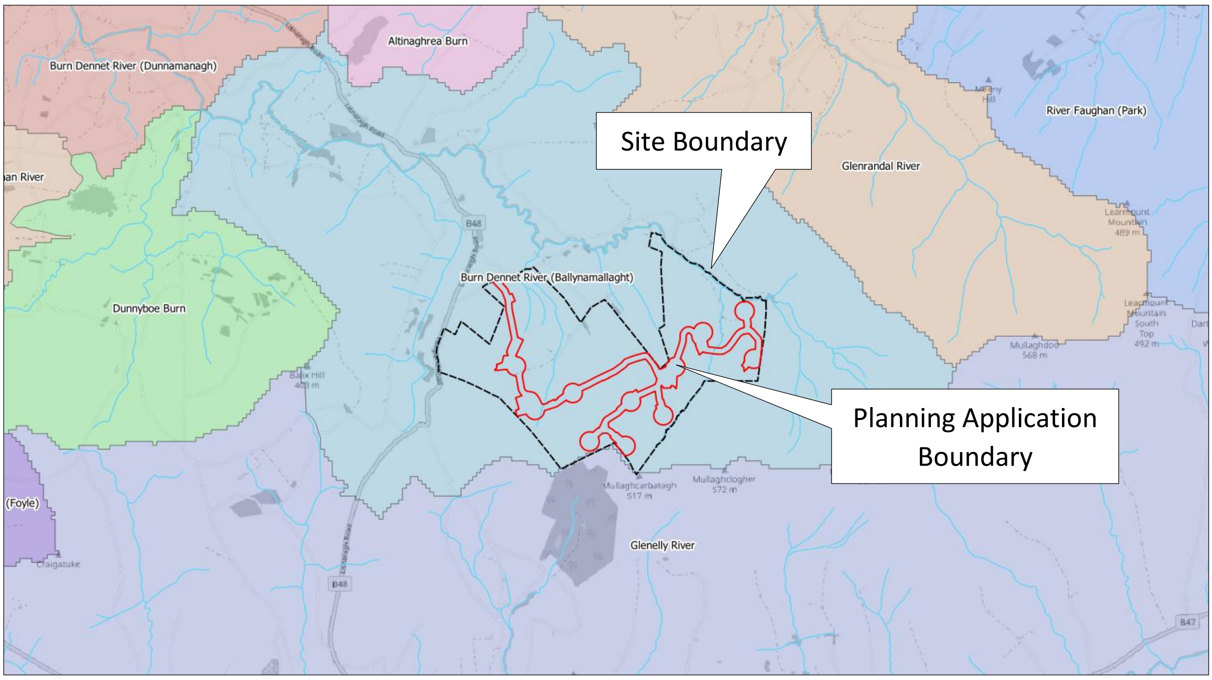
10.105 DfI Rivers map of 'Designations approved by the Drainage Council (NI)' indicate a section of the Craig River (Ref: MW1104) designated as a minor watercourse is located along the north-eastern extent of the Site boundary; however, no development is proposed in proximity to this section of the watercourse. All other watercourses within the Site boundary are subject to riparian ownership and maintenance only.

10.106 Site reconnaissance observations indicate that the current hydrology of the Site consists of several natural source watercourses and streams and artificially modified drainage ditches and peat drains.

10.107 The hydrological regime of the Site and discharge locations of onsite watercourses as determined by desktop studies and site walkovers are shown on **Figure 10.1: Site Hydrology.**

10.108 NIEA River Water Body dataset boundaries show the Site drains to one delineated and named waterbody - the Burn Dennett River (Ballynamallaght) (UKGBNI1NW010101071) which has an overall area of 37.26 km^2 and in a north-westerly direction away from the Site.

Plate 10-8: Watersheds and NIEA Waterbodies



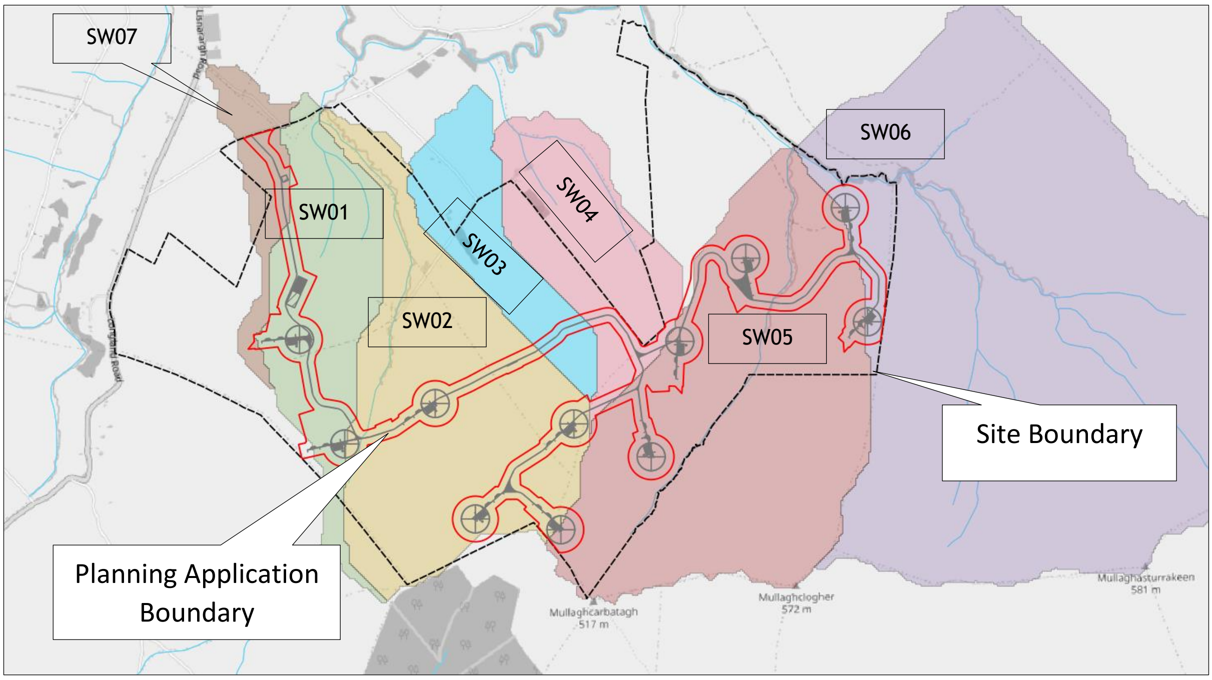
10.109 Internal site drainage on elevated parts within the Site boundary comprises headwaters of minor drains, peat drainage, and artificial trackside drains. More significant watercourses are sited at lower elevations within the northern sections of the Site. Detailed site hydrology identified following several walkovers, tracing surveys, and desktop analysis of flow routes and catchments based on height data is shown on **Figure 10.1: Site Hydrology**.

Sub-catchments / Watersheds

10.110 For purposes of differentiation of effects and consistency with associated assessments (i.e., **Chapter 9: Fisheries and Aquatic Ecology**), the hydrology of the Site can be split into 7 no. sub-catchments which discharge to the Burn Dennett catchment. Those sub-catchments / main internal streams are shown on **Figure 10.4**.

10.111 Where applicable, the following sections include both the surface water (SW) catchment reference numbers used in this assessment and the naming convention used in **Chapter 9: Fisheries and Aquatic Ecology** (provided in brackets).

Plate 10-9: Internal Catchment



SW01 (Burn Dennet Tributary 2 (Stroanbrack))

10.112 The lower reach of this watercourse within the Site boundary is narrow at c. 0.4 m, but clear flowing and a bed of small pebbles, cobbles, and patches of ferruginous sludge. It is surrounded by wet rushy pasture. A tributary is mapped

c. 170 m upstream, however it was not defined at ground levels, rather the area is characterised by an expanse of wet rushy pasture.

10.113 Approximately 850 m further upstream the channel remains very shallow with a bed of pebbles, occasional cobble, and peat. From the right bank a series of obliquely cut field drains discharge into the main channel.

10.114 Upstream, the channel emerges from a very overgrown section at a field boundary and fence. It is shallow and more open with riffles and runs with a bed of cobble and gravel fines in a peat cut channel surrounded by rough sheep grazing.

10.115 Further upstream towards a rough farm track crossing, the channel is very overgrown covered with grasses and rushes. The stream bed is a mixture of cobble, fines, and sand. The upper reaches of the watercourse are formed as a wet flush / seepage within steep rough pasture and bog.

10.116 Watercourse SW01 is shown on shown on historic mapping to have been previously realigned at several reaches within the Site boundary.

10.117 The **Fisheries & Aquatic Ecology assessment (Chapter 9)** suggests that the lower reaches may support trout spawning.

SW02 (Burn Dennet Tributary 1 (Stroanbrack))

10.118 Watercourse SW02 flows for c. 2.3 km within the Site boundary. In the lower reaches the channel is c. 1 - 3 m wide with a bed of boulder and cobble. The water is peat stained and the riverbed has patches of coarse sand but is free of any fine sediment.

10.119 Further upstream, land use is rough grazing although mainly tall herbs and rushes with no obvious impact of any sheep grazing. There is a very clean bed with riffles and run flows, and a boulder and cobble bed with scattered gravels.

10.120 In the mid-reach within the Site, the watercourse intersects a farm track via a clear span stone bridge with a cobble base that would permit free passage of fish. Downstream of the track, the gradient flattens with the channel a long series of small pools and riffle / runs.

10.121 Further upstream of the track, the channel narrows to c. 0.6 - 1.0 m and the gradient steepens into a series of faster flowing riffles and runs with occasional small pools over moss, pebble, cobble, boulder, and bedrock.

10.122 In the upper reaches, the channel becomes significantly narrower, incised, and almost appears as a trickle at c. 700 m upstream of the farm track.

10.123 The **Fisheries & Aquatic Ecology assessment (Chapter 9)** suggests that all of the channel downstream from the farm track has good potential to support trout.

SW03 & SW04

10.124 These catchments drain the central sections the Site via numerous field drains. In the lower reaches, the main channels are straight agricultural ditches c. 0.5 wide, heavily vegetated and dominated by rushy pasture. In the mid- to upper-reaches, channels are steep, narrow (c. 0.3 m) and shallow (c. 0.2 m) and fed by numerous grassy / soil substrate ephemeral land drains.

10.125 Surface water flow is evident in the upper reaches were water flows through peat hags, some c. 5 m wide. Pebble and gravel-sized materials constitute the substrate where water has formed channels within the hags. Grasses and heather are dominant in the upper catchments.

10.126 These watercourses are not assessed as part of the **Fisheries & Aquatic Ecology assessment (Chapter 9)**; therefore, they are considered to have limited fisheries potential.

SW05 (Glengarrow Burn)

10.127 This watercourse flows for c. 2.3 km within the Site boundary. It exhibits a very clean bed with riffles and run flows, and a boulder and cobble bed with scattered gravels throughout its length within the Site boundary.

10.128 The **Fisheries & Aquatic Ecology assessment (Chapter 9)** indicates that the reaches in the vicinity of the Proposed Development have high quality habitat; however, no fish were noted to be present during aquatic surveys. This most likely due to a large impassable waterfall that occurs where the Glengarrow Burn meets the main Upper Burn Dennet River, and subsequent impassable waterfalls further upstream.

SW06 (Upper Main Channel Burn Dennett River)

10.129 This watercourse is located along the northern extent of the Site boundary flowing parallel to a farm track. At this location the channel is c. 4 m wide, and the banks have been fortified with large boulders placed as “rip-rap” to provide flood protection. Substrate consists of boulder, large cobble, and pebble.

10.130 In the vicinity of the Proposed Development, this watercourse has a shallow gradient as it flows through a shallow U-shaped valley. The river runs parallel to a rough farm track and is c. 2.5 m wide with areas of channel braiding. Substrate at this reach of the watercourse is boulder and cobble interspersed with scattered gravels.

10.131 The **Fisheries & Aquatic Ecology assessment (Chapter 9)** suggests the watercourse has good trout nursery and spawning habitat quality.

SW07

10.132 Watercourse SW07 is an unmapped (as per OSNI mapping) heavily vegetated drainage ditch flowing east to west on the eastbound side of Carrickayne Road. It flows in the roadside for c. 350 m before being culverted under the road and flowing north towards a mapped watercourse which ultimately discharges into the Inver Burn c. 500 m north from the Site.

10.133 This watercourse is not assessed as part of the **Fisheries & Aquatic Ecology assessment (Chapter 9)**; therefore, it is considered to have limited fisheries potential.

Surface Water Quality

10.134 The following section is intended to provide a qualitative appraisal of existing surface water quality in those catchments the Proposed Development lies within.

10.135 Following the publication of the Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015 waterbodies are given a classification based on annual average / percentile results from several individual monitoring stations.[11]

10.136 The WFD classification is a combination of chemical, biological and hydromorphological elements; whereby, the overall status is the lowest of the combined constituents.

10.137 All of the Site is located within the Burn Dennett River (Ballynamallaght) (UKGBNI1NW010101071) catchment. This watercourse ultimately discharges in the Claudy Water catchment and on to the Foyle River. The status of the receiving river waterbody is summarised in the table below.

Table 10.10: River Water Body Status

River Waterbody	2021 Status	2027 Target
Burn Dennett River (Ballynamallaght) UKGBNI1NW010101071	Good	Good

10.138 Burn Dennett Upper and Burn Dennett Middle (at and immediately downstream from the Site) was designated under the WFD as Freshwater Fish Directive protected areas due to the presence of economically significant species. The

[11] The European Water Framework Directive (2000/60/EC) has been transposed into Northern Ireland regulations through The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. The Water (Amendment) (Northern Ireland) (EU Exit) Regulations 2019 ensures that the Water Framework Directive (as transposed) and the various supporting pieces of water legislation continue to operate here after 1 January 2021 (https://www.daera-ni.gov.uk/articles/water-framework-directive)

Directive 2006/44/EC has since been revoked, however NIEA: WMU continues to recognise them as protected areas containing economically significant species.

Project Specific Water Quality Assessment

10.139 In addition to a review of water quality data held by statutory bodies, independent water quality monitoring has been undertaken as part of this assessment to provide baseline water quality standards of water features within the Preliminary Site Boundary prior to any development.

10.140 Sampling was carried out on the 15th August 2023. Weather conditions in the days immediately preceding sampling were dry with high temperatures of c. 20°C and < 3 mm of rain accumulation. Conditions during sampling were also noted to be dry.

10.141 The baseline assessment collected and assessed representative water samples from watercourses draining the Site for a range of physio-chemical parameters. Monitoring locations are shown on **Figure 10.2**.

10.142 Water quality results were assessed for compliance against key parameter limits outlined in the Water Framework Directive (2000/60/EC), transposed in Northern Ireland through the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017, and the Directive 2013/39/EU is transposed through the Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015. In terms of the key indicators of water quality and / or pre-existing pollutants, chemical results obtained showed:

- pH results were within the naturally excepted range and classified as ‘High’, based on WFD standards for this parameter for all large watercourses sampled. One location (SW05) was found to have pH values equivalent to ‘Poor’ WFD status;
- Dissolved oxygen levels are classified as ‘High’ under the WFD;
- Orthophosphate levels were below the LOD at all sample locations;
- BOD results signified ‘High’ water quality in all locations based on WFD classifications; and
- Alkalinity concentrations were found to be within the expected range under normal conditions.

10.143 Water quality for watercourses draining the Site is generally consistent with the WFD status of ‘Good’ for the downstream waterbodies outlined previously. Therefore, preservation of the baseline water quality results within the upper reaches would be important at a local level to preserve the downstream NIEA classifications.

Surface Water Abstractions

10.144 In order to allow assessment of potential for the Proposed Development to affect surface water abstractions in the catchment at and up to 5 km downstream of the Site, an initial screening review of the NIEA WMU Water Information Request Viewer was carried out.

10.145 A 500 m screening radius has also been applied to the Site boundary. No surface water abstractions were identified.

Northern Ireland Water Infrastructure

10.146 A review of Northern Ireland Water asset information did not identify any assets within proximity to the Site boundary (i.e., 2 km) that could feasibly be affected by the Proposed Development.

Flood Risk

10.147 The Proposed Development was assessed in relation to Flood Maps (NI) and similar DfI Rivers datasets, which provide an indication of predicted flood extents for a 1% Annual Exceedance Probability (AEP) fluvial flood and 0.5% AEP Surface Water Flood, and for reservoir inundation. DfI Rivers have also been consulted regarding flooding; the response (IN1-22-13133) is included in **Appendix 10.5**.

Historical Flood Extents

10.148 Flood Maps (NI) indicates no recorded incidents of historic flooding in the vicinity of the Site.

Fluvial Flooding

10.149 Out of bank flooding in the upper reaches of the Craig River (Ref: MW1104) / Burn Dennett River (Ballynamallaght) is identified on the Flood Maps (NI) indicative predicted 1 % AEP fluvial (river) flood extents.

10.150 A site-specific flood modelling exercise has been undertaken to better define flood risk to the land, and supersedes data shown on the indicative flood map. The outcomes of that assessment are detailed in a Flood Risk and Drainage Assessment, refer to **Appendix 10.2 - Flood Risk & Drainage Assessment** and mapped on **Figure 10.1**.

Pluvial Flooding

10.151 Surface water flooding is predicted by the indicative 0.5 % AEP surface water flood extent mapping at a limited number of discrete locations within the survey boundary, and generally coincides with the headwaters of watercourses. Surface water flooding coinciding with watercourses is more appropriately assessed as fluvial and would be superseded by the site-specific flood modelling described above.

10.152 Surface water flooding would not constrain development but would inform design of the infrastructure with a view to ensuring that surface water flow paths are maintained, and a suitable standard of protection if afforded to any development adjacent to areas predicted to be affected by flooding.

Reservoir Flooding

10.153 The risk of reservoir flooding was assessed using Reservoir Flood Mapping for Emergency Planning[12], which shows the indicative area that may flood from an uncontrolled release of water from all possible dam failure scenarios. The Proposed Development is unaffected.

Summary

10.154 Flood extents are shown on **Figure 10.1: Site Hydrology**. Mitigation of flood risk is described in subsequent sections and is addressed in detailed in **Appendix 10.2 - Flood Risk & Drainage Assessment** in the format normally requested by DfI Rivers in consultation.

Eco-Hydrology & Water Dependent Habitats / Species

10.155 Consideration has been given to local surface water and groundwater dependent ecosystems and habitats dependent on, or prone to change due to variation in surface water and groundwater patterns on the Site within **Chapter 6: Vegetation and Peatland**. No further consideration is given to those aspects within this chapter.

Fisheries

10.156 Detailed consideration has been given to fisheries on and downstream of the Site within **Chapter 9: Fisheries and Aquatic Ecology**.

10.157 The criteria by which Chapter 9 assigns sensitivity / importance of receptors is not as per those outlined in Table 10.4 of this chapter. Therefore, the criteria provided in Chapter 9 should be consulted to provide context on the points listed below. That assessment, when considering a wider survey boundary, has determined that:

- Burn Dennett Tributary 2 (Stroanbrack) (SW01) is of medium sensitivity as fish were absent and the watercourse exhibits moderate quality physical habitat;

[12] DfI Rivers (2017) Reservoir Flood Mapping for Emergency Planning. Available at http://riversagency.maps.arcgis.com/apps/webappviewer/index.html?id=006872dcdd7b43b89d352e0b93190e67. Accessed 31/08/2023

- Burn Dennett Tributary 1 (Stroanbrack) (SW02) is of high sensitivity with trout and good quality trout spawning and nursery;
- Glengarrow Burn (SW05) is of medium sensitivity as fish were absent but the watercourse exhibits very good quality physical habitat;
- Upper Main Channel Burn Dennett River (SW06) is of high sensitivity with trout and good quality trout spawning and nursery; and
- Middle-Lower Burn Dennett River (SW06) is of very high sensitivity with salmon present.

10.158 Further details, including figures of watercourses downstream of the Site, are included in **Chapter 9: Fisheries and Aquatic Ecology** and associated appendices.

Aquaculture

10.159 DAERA Fisheries Inspectorate confirmed no aquaculture sites in the vicinity of the Site and, therefore, is not considered further in this assessment.

Water Framework Directive - Fisheries Classification

10.160 Burn Dennet Upper and Burn Dennet Middle (at and immediately downstream from the Site) were given status under the now revoked Directive 2006/44/EC 'on the quality of fresh waters needing protection or improvement in order to support fish life'; more commonly known as the Freshwater Fish Directive.

10.161 NIEA Water Management Unit data, on the NIEA Catchment Data Map Viewer[13] designates this river as protected areas containing economically significant species.

Designated Sites

10.162 Designated sites such as Special Areas of Conservation (SAC), Special Protected Areas (SPA), Areas of Special Scientific Interest (ASSI), Ramsar sites, and similarly designated environmental receptors, have been identified as part of this assessment. Sites were identified utilising the datasets available on the NIEA Natural Environment Map Viewer and Join Nature Conservation Committee[14] website and were screened to identify:

- Hydrological sites with sensitivities to the water environment that are connected to the Site, i.e. sites which lie in the upstream catchment of or are on downstream streamlines of the watercourses draining the Site;

[13] https://www.daera-ni.gov.uk/articles/daera-map-viewers (Accessed 31/07/2023)

[14] Joint Nature Conversation Committee (2016) Protected Sites. Available at: https://jncc.gov.uk/our-work/uk-protected-areas/ (Accessed 31/07/2023)

- Terrestrial sites of geological importance on or immediately adjacent to the Site.

10.163 Only sites meeting these criteria are discussed further in this assessment. Terrestrial sites with ground or surface water-dependent habitats are considered in **Chapter 6: Vegetation and Peatland**.

Table 10.11: Initial Screening of Designated Sites

Name	Designation	Reason for designation and qualifying features relevant to this assessment	Distance from Preliminary Site Boundary at Nearest Point (km)	Considered further and rationale.
Aghabrack	ASSI (ASSI304)	This area is of special scientific interest as a raised bog encompassing fossil landforms that cannot be replaced. This habitat supports unique raised bog plant communities with vegetation such as bog mosses, heather, and bog cotton.	0 km – adjacent to the north-western extent of the Site boundary.	No: Although a hydrological feature, it is ombotrophic in nature (i.e., supplied with only rain and snow); therefore, no proposed works associated with the proposed development will affect the habitats and / or species for which the site is designated.
Lisnaragh	ASSI (ASSI288)	The features of interest at Lisnaragh were formed by the action of water and ice toward the end of the last Ice Age. The main features are a moraine (sand, gravel and mud) ridge and an outwash terrace. During the ice age, ridges of moraine were deposited by the ice across the Burn Dennett River valley.	3.7 km north-west of the Site boundary.	No: no works associated with the proposed development will affect the geological features for which the site is designated.
Silverbrook Wood	ASSI (ASSI195)	Silverbrook Wood has a rich species diversity and is home to endangered species such as the red squirrel and otter.	5.2 km north-west of the Site boundary.	Yes: The designated site is hydrologically connected to the Proposed Development site.
	SAC (UK0030320)	River Foyle and Tributaries is notable for the physical		Yes: The designated site is hydrologically

Name	Designation	Reason for designation and qualifying features relevant to this assessment	Distance from Preliminary Site Boundary at Nearest Point (km)	Considered further and rationale.
River Foyle and Tributaries	ASSI (ASSI229)	diversity and naturalness of the banks and channels, especially in the upper reaches, and the richness and naturalness of its plant and animal communities. Of particular importance is the population of Atlantic Salmon (*Salmo salar*), which is one of the largest in Europe and Otter which is found throughout the system. The area is also important as a river habitat. In their upper catchments, the rivers are all fast-flowing spate rivers with dynamic flow regimes characterised by sequences of rapid, riffle and run.	15 km north-west of the Site boundary.	connected to the Proposed Development site.

Baseline Summary and Receptor Sensitivities

10.164 The baseline assessment identified the receptors which have the potential to demonstrate a sensitivity to the Proposed Development; the receptors and their scale / sensitivity value are summarised in **Table 10.12**. Sensitivity is based on the baseline assessment and determined in accordance with the rationale previously described in **Table 10.3**.

Table 10.12: Receptor Sensitivity

Type	Receptor	Scale / Sensitivity	Rational
Geological	Soils / Drift Deposits	Local / Low	Site with little geological value or of widespread local abundance. Loss of the land on the Site would not be considered significant in the context of the region.

Type	Receptor	Scale / Sensitivity	Rational
Hydrological	On-site significant watercourses Burn Dennett River (Ballynamallaght) / Craig River (SW05); and Burn Dennett Tributary 1 (Stroanbrack) (SW02)	National / High	Burn Dennett River (SW05) is denoted as a designated salmonid river. The fisheries assessment highlights the river as having trout present. Burn Dennett Tributary 1 (Stroanbrack) (SW02) also noted as having trout present. Fluvial flooding is predicted on Craig River / Burn Dennett (SW05) with FMNI flood extents indicating an active floodplain area along a reach within the Site boundary.
	On-site significant watercourses Tributary of Burn Dennett River (Ballynamallaght / Burn Dennett Tributary 2 (Stroanbrack) (SW02)	Regional / Medium	Within the Site boundary, a tributary of Burn Dennett River (SW01) are considered significant in terms of the contributing catchment areas. Fluvial flooding is predicted with FMNI flood extents indicating an active floodplain area along a reach within the Site boundary. However, no development is proposed in the vicinity of this reach. The current physico-chemical conditions of the water feature (within the survey boundary) results in limited / negligible fisheries potential.
	On-site Minor Drainage	Local / Low	All other on-site watercourses are generally characterised by vegetated overgrown field drains / cut peat drainage / trackside drainage and have low fisheries and other ecological potential and have no other use of significant value.
	Off-site designated sites (Silverbrook Wood ASSI)	National / High	Designated sites with national and internal importance are hydrologically connected to the Proposed Development Site.
	Off-site designated sites (River Foyle and Tributaries SAC)	International / Very High	
Hydro-Geological	Private Water Supply	Local / Low	Domestic private water supplies and potential water supplies have been identified within a screening distance from the Site.
	Bedrock Groundwater / Aquifers	Local / Low	Aquifer with limited productivity and no significant abstractions. Potential for discrete local supply sources.

Type	Receptor	Scale / Sensitivity	Rational
	Shallow Groundwater / potential superficial Aquifers	Local / Low	Superficial aquifer identified at the north-eastern extent of the Site; however, no potential abstractions / private water supplies are known to operate in the area.
Terrestrial	The Development	Local / Low	Proposed infrastructure prone to damage including potential for water damage of electrical infrastructure in a flood event; potential for structural damage of access infrastructure in the event of hydraulic incapacity.
	Buildings	Local / Low	The Site is shown to be within the radon affected area. Any buildings located within this area would be subject to inclusion of protection measures.

Predicted Environmental Effects

Preamble

10.165 This section outlines and describes the potential likely effects of the Proposed Development on hydrological patterns and water quality on the Site, and in the downstream environment, that have the potential to arise in the absence of mitigation. The following phases of the Proposed Development are considered;

- Wind farm construction;
- Wind farm operation and maintenance;
- Wind farm decommissioning

10.166 During each phase some of the activities undertaken have the potential to modify hydrological regimes and affect water quality on the site and the downstream environment. Due to the nature of the Site and work undertaken, the hazards and associated effects will be similar for each phase, with an increased likelihood during the construction phase.

Components Contributing to Predicted Environmental Effects

Activities Associated with Construction, Operation and Decommissioning

10.167 During construction, the Proposed Development comprises construction of infrastructure which would be likely to cause change to local hydrology and water quality, comprising earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with construction of temporary compounds, turbine foundations, building foundations, access tracks, and cable trenches.

10.168 The operational phase of the Proposed Development (the designed operating life estimated to be 35 years) would cause runoff from access tracks, turbine bases and hard standings via drainage features, would require onsite welfare facilities with associated waste, includes the provision of battery energy storage systems (BESS) (i.e., 20 no. lithium ion battery energy storage containers), and potentially necessitate storage and use of oils, fuels and lubricants on-site, each with the potential to cause adverse effects on the environment without adequate avoidance, design, or mitigation measures.

10.169 Activities associated with the decommissioning phase at the end of the operating design life are generally as per those for the construction phase i.e., earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with removal of turbines, buildings, hard standing areas, and buried structures followed by reinstatement and restoration of ground cover.

Likely Significant Effects

10.170 The likely effects of the Proposed Development on the surface and ground water environment prior to any avoidance, careful design, or additional mitigation are summarised in the following sections.

Changes in Runoff and Flow Patterns

10.171 New temporary and permanent impermeable surfaces, as well as temporary compaction of soils due to construction phase plant and site traffic movements, may cause increased rate and volume of surface water runoff due to the reduced permeable area on the Site through which rainfall can infiltrate. Impermeable surfaces will cause an increased “flashy” response to rainfall events, with increased water velocities in new and existing drainage features. As a consequence, the effect would be likely to cause temporary or permanent increases in surface water runoff rates and volumes, leading to increased flood risk and increased effects of erosion and scour in downstream watercourses. Similarly, loss of permeable areas is likely to cause reduced potential for groundwater recharge affecting aquifers.

10.172 Significant excavations, in particular linear works such as access tracks, drainage ditches and cable trenches, are likely to act as barriers to runoff resulting in ponding, or development of preferential flow routes, diverting surface water away from its current route. Consequently, temporarily or permanently redirected surface water flows may starve areas where water currently flows, or cause flooding of areas where water currently does not flow.

10.173 Works to existing surface watercourses (such as installation of culverts or bridges) have the potential to cause an obstruction to flow and may alter conveyance capacities, potentially causing temporary or permanent restrictions in watercourse channels, affecting upstream water levels and increasing flood risk.

Changes to Water Quality

Sediment / Suspended Pollution

10.174 Temporary activities required to construct windfarm infrastructure would require excavations, ground disturbance (due to excavations and plant and vehicle movements), stripping and excavation of peat and soils, and temporary spoil deposition. Exposed soils have potential to release fine sediments in surface water runoff or where excavations come in contact with surface watercourses.

10.175 Construction of hardstanding areas and access tracks would require importing, handling and placement of aggregate, which would have the potential to release fine sediments into surface water runoff. The proximity of such works to surface watercourse will increase the risk of pollution to the wider water environment.

10.176 Temporary surface water or shallow groundwater gathering in significant excavations has the potential to be significantly polluted due to contact with excavated surfaces and aggregates. Discharge of intercepted contaminated groundwater during passive or active dewatering has the potential to pollute the wider water environment if not disposed of correctly.

10.177 Silt and suspended sediments and debris entering watercourses would have the potential to adversely modify stream morphologies, smother habitats and harm aquatic flora and fauna.

Chemical Pollution of Surface Water and Groundwater

10.178 Temporary storage and use onsite use of chemicals, fuels and oils associated with construction activities, and use of wet concrete and other cementitious material, may result in potentially harmful substances entering the water environment. Possible pathways to hydrological receptors may include; accidental spillages, improper transport and refuelling, or inappropriate storage and disposal procedures, by gradual leakage or single failure of storage tanks or refuelling mechanisms. Temporary presence of alum-based flocculants (used to remove suspended solids from surface water) has the potential to enter surface waters if unregulated.

10.179 During the operational phase of the Proposed Development, the permanent presence of oils and lubricants associated with turbine maintenance has a similar potential to enter and pollution the water environment.

10.180 Wastewater effluent from temporary construction phase welfare facilities and permanent substation building welfare facilities has the potential to enter surface water or shallow groundwater.

10.181 During the operational phase of the Proposed Development, accidental fire at the BESS facility on site may potentially risk contamination to land and water from release and fallout of gases and particulates.

10.182 As a consequence, chemical pollutants from construction activities, storage of materials, or from coliforms from wastewater entering watercourses have the potential to adversely affect water quality, with associated effects to potable supplies, fish and aquatic ecology.

Design Evolution: Constraints and Avoidance Measures

10.183 The magnitude and significance of those effects determined as being likely to be a consequence of the Proposed Development can be substantially reduced or eliminated through a proactive design approach to avoid identified baseline receptors, with particular emphasis in relation to fishery habitats.

10.184 This section identifies the avoidance measures imposed and outlines the resulting magnitude and significance of residual effects. Additional mitigation is then specified to further reduce or eliminate remaining residual effects.

10.185 Detail of the design evolution highlighting considerations made with regards to hydrology and water quality management is presented in **Chapter 3: Design Evolution & Alternatives.**

10.186 The Proposed Development layout has evolved so that the design avoids conflict with the water and geology environment, as demonstrated in the following sections.

Water Features

10.187 As a precautionary measure and in accordance with the guidance previously advocated by NIEA Natural Environment Division, buffer (exclusion) zones to valuable water features are adopted as constraints to built development, and for incorporation as a construction buffer in relation to permissible land uses in proximity to watercourses.

10.188 Impact avoidance and design of mitigation have been developed in accordance with legislation and best practice guidance outlined in **Table 10.1** and paragraphs 10.32 and 10.33, respectively. Mitigation for all water features aims to preserve existing water quality ratings as a minimum.

10.189 Establishment of intact vegetated buffer zones between infrastructure and water features allows:

- Protection of water quality by filtering runoff within riparian vegetation before it enters the watercourse;
- Space for natural fluvial processes such as channel shape and planform adjustment which help restore and maintain the natural dynamic balance of river systems and associated habitats;
- Establishment of vegetation to stabilise banks and reduce soil erosion;
- Access for the maintenance and inspection of watercourses and for dealing with any residual risk of pollution incidents; and
- Habitat for plants and animals to form part of a habitat network.

10.190 The sensitivity of the water feature and the associated degree of protection it is therefore afforded, is primarily dependent on;

- Environmental designations on the water feature or downstream environment;
- Fisheries or ecological potential in the water feature or in the downstream environment;
- Water feature morphology (natural substrate or artificial channel, soil/ground type);
- Water feature size, capacity to convey water and hydrological potential (flows) – proportionate to the size of the catchment drained by the water feature;
- Nature and topography of the surrounding land, i.e. wet, poorly drained soils and steep slopes (>10°) would require greater protection;

10.191 Sensitivity of the water feature to particular types of pollution, i.e. silts / nutrient enrichment / chemical pollution.

10.192 The rationale adopted in relation to water feature buffers is informed by NIEA Natural Environment Division guidance, which has typically, in response to similar development, advised no infill, disturbance, construction activity or storage of materials within 50 m of natural watercourses. NIEA has indicated that justification for buffer zones applied is the responsibility on the Applicant, while any rationale for reducing the scale of the buffer zone must be demonstrated requiring the submission of detailed information using a number of additional factors e.g. soil typology, topography, size of watercourse and climatic conditions.

10.193 NIEA, in Practice Guide to EIA and Planning Considerations, outlines buffer zones for water features as per the below table:

Table 10.13: NIEA Buffer Zones for Water Features

Width of Watercourse	Width of Buffer Strip
Surface Watercourse	10 m (minimum detailed in GGP 5)
Water Feature (surface watercourse, spring, well, borehole used for Drinking Water – public or private)	250 m

Width of Watercourse	Width of Buffer Strip
Water Feature (surface watercourse, spring, well, borehole not used for water supply – but could provide preferential flow pathway)	50 m
Designated Wetland	250 m

10.194 Additional industry guidance relevant and similar in nature to the construction and operational activities for the Development has been reviewed and taken into account:

- Guidance for Pollution Prevention (GPPs): GGP5-Works and Maintenance in or near water;
- Pollution Prevention Guidance (PPGs);
- Best practice in relation to forestry works (in particular on upland and peat sites) recommends riparian buffer reflecting stream size, with buffers from 5 –20 m;
- Best practice in management of sediments and runoff from exposed ground in relation to agriculture recommends buffers of up to 10 m in order to protect surface waters from pollution by suspended solids, and nutrient enrichment by organic/inorganic fertilisers.

10.195 Water features considered significant for the purposes of the Proposed Development are shown on Figure 10.1 and drainage drawings within Appendix 10.1: Surface Water Management Plan.

10.196 Significance has been determined following desktop studies and verified by site walkovers, with all streamlines subject to catchment and flow analysis by GIS - flow-raster accumulation analysis.

Significant watercourses

10.197 Significant watercourses identified and requiring application of a buffer to the proposed turbines and infrastructure are largely as per OS close scale vector mapping and were subject to ground truthing on Site.

10.198 A 50 m buffer has been applied to the significant watercourses identified in the baseline assessment, i.e., significant where catchment within Site is >0.25 km^2.

10.199 Examples of the significant watercourses on the site are shown on the following Plate 10-9.

Plate 10-10: Significant Watercourse Example

Location	Upper catchment of Burn Dennet River (Ballynamallaght) (within context of Site boundary)
Grid Ref.	252899, 396556
Photo Ref.	IMG_5747
	

Minor Watercourses

10.200 Minor watercourses were given buffers of 10 m based on SEPA and NatureScot (previously SNH) guidance and represent tributary channels on the Site where the catchment area was less than 0.25 km^2. Many are the sources / upper reaches of the more identifiable downstream channels and appear as grass / heather-covered depressions in the land. They are distinct and easily identifiable on aerial imagery but often harder to differentiate from the surrounding land at ground level during dry conditions. Others are more defined channels cut into peat.

10.201 Minor watercourses will either be protected on their present alignment, or where works or diversions are required then this shall be as enabling work adhering to strict procedures for working in or near water (described later in this assessment) with the proposed alignment then protected from the development.

10.202 Examples of minor watercourses on the site are shown on the following **Plate 10-10.**

Plate 10-11: Minor Watercourse Examples

Location	Minor watercourse draining to Burn Dennet River (Ballynamallaght) in eastern section of the Site.	Minor watercourse draining central section of the Site.
Grid Ref.	252532, 396122	251331, 396572
Photo Ref.	IMG_6041	IMG_6345
		

Other Drainage Features

10.203 All other minor drainage features (mapped or otherwise) comprising; dry or partially dry agricultural ditches, ephemeral drains, dry track drainage, grips, peat cuttings or other drainage features, are considered insignificant in the context of site hydrology and habitat potential.

10.204 Such features would be managed during and following construction by means of diversion and/or temporary blocking (with prior settlement features upstream of and outwith the drainage channel), using filtration check dams or similar, in order to prevent residual indirect potential pollution downstream caused by connectivity to downstream waterways.

Adopted Watercourse Buffers

10.205 The significance of watercourses is shown on Figure 10.1: Site Hydrology. Conservative minimum hydrological buffer zones are adopted and implemented as shown in Table 10.14. The buffer widths adopted exceed those recommended in industry guidance; the allowance provided gives due consideration to the nature of peat soil conditions on the Site, antecedent weather, moisture and base flow and a significantly increased factor of safety in all instances given the significance of fishery interests within downstream catchments.

Table 10.14: Minimum Adopted Hydrological Buffer Zones

Water Features	Minimum Width of Buffer Strip
Significant Watercourses (catchment >0.25 km^2)	50 m
Minor Watercourses (catchment <0.25 km^2)	10 m
Other Drainage Features	Managed on-site by diversion / temporary blocking in accordance with GGPs and PPGs.

10.206 The buffer widths adopted meet the criteria as recommended in industry guidance. Discretion has been adopted where applying buffers to 'other drainage features' based on observed site conditions and using professional judgement. Given the number and insignificance of ephemeral features, peat drains, and artificial drainage features (in the context of site hydrology and habitat potential), it is not practical to apply buffers to all 'surface water drains' (as per GPP5). Protection of other drainage features would be implemented via observational design at the time of implementing the development to suit site conditions and would include appropriate buffer strips or other appropriate temporary measures. Such an approach is routine and well understood and managed by the onshore wind development sector.

10.207 Buffers are indicated on Surface Water Management drawings included at Appendix 10.1.

10.208 New infrastructure is designed to lie outwith the 50 m hydrological buffer zones for significant watercourses in all instances. This includes those elements of the works associated with significant earthworks and greatest potential for spillage or leakage of chemical pollutants, i.e.:

- All turbine bases, crane pads and associated working areas;

- Temporary and permanent spoil storage areas;
- Enabling works compound, substation and construction compound, fuel and chemical storage areas and any other platforms;
- Spoil movements and earthworks (placement of donor turves and contour ploughing) associated with proposed habitat enhancement and ecological mitigation.

10.209 New permanent access tracks are to lie outside of buffer zones; with the exception of unavoidable crossings of water features. Careful consideration has been given to the routing of access tracks in order to avoid / limit crossing of watercourses. Where crossings are proposed, appropriate design measures shall be incorporated to control or reduce the potential effect of the Proposed Development on the receiving environment (refer to paras. 10.223 to 10.230).

10.210 For areas of proposed road widening on existing roads surrounding the Proposed Development, potential risk to water will be managed by complying with GPP5 and the principles for construction in or adjacent to water outlined in the site SWMP (Appendix 10.1).

10.211 Temporary track infrastructure (such as temporary widening and turning heads) that may encroach into buffers shall be managed through the use of additional surface water management measures, discussed in paragraphs 10.239 through 10.249.

Abstractions

10.212 The proposed infrastructure layout within the Site is such that no development (tracks, turbines or other significant infrastructure) is sited within 250 m of any known or potential potable water abstraction identified in the previous screening assessment. No further constraint is required.

Floodplains

10.213 All development, other than the access track at watercourse crossing to turbine T7, are located beyond the extents of the 1 % AEP indicative fluvial floodplain based on refined site-specific river modelling and flood mapping.

10.214 Pluvial flood extents noted along watercourses on-site (shown on **Figure 10.1: Site Hydrology**) generally coincide with the headwaters of watercourses. Surface water flooding coinciding with watercourses is more appropriately assessed as fluvial and would not pose an additional constraint.

10.215 Infrastructure is designed to ensure that conveyance of watercourse and surface water flooding is not impeded by means of providing drainage culverts / under track crossings where necessary.

10.216 Electrical infrastructure that would be susceptible to damage by floodwater is designed such that it does not have potential to be affected by fluvial (watercourse) or surface water flooding.

10.217 Areas of isolated surface water flooding generally coincide with source areas of on-site water features or isolated low points. Site drainage and culverts shall allow passage of local surface flooding as considered within **Appendix 10.1: Surface Water Management Plan, Appendix 10.2 Flood Risk & Drainage Assessment**, and accompanying drainage management drawings.

Designed Measures

10.218 Normal design measures associated with development of the type proposed are not considered “mitigation” in EIA terms, but are important in their effect of controlling or reducing the potential effect of the Proposed Development on the receiving environment. Such measures are outlined in the following sections.

Site Drainage Management and SuDS Design

10.219 The Proposed Development will adopt a surface water management plan / site drainage design using the principles of Sustainable Drainage, promoting the principles of onsite retention of flows and use of buffers and other silt removal techniques. All drainage related mitigation measures proposed will be encompassed by a robust and proven Sustainable Drainage System (SuDS) design which will be used to control drainage and silt management on the site.

10.220 Onsite drainage design will minimise modification and disruption of the existing natural hydrology by:

- Maintaining existing overland flow routes and channels. Existing natural flow paths lateral to access roads will be maintained through the use of piped crossings under road alignments at natural depressions and at regular intermediate intervals. The spacing of cross drains will be specified at detailed design stage;
- Avoiding transporting rainfall runoff in long linear drainage swales by providing regular channel “breakouts”, whereby water is encouraged to flow overland, thus maintaining existing natural hydrological patterns;
- Reducing surface water flow rates and volumes by attenuating runoff from tracks and hard standings “at source” by providing check-dams in swales, whereby the flow velocity and rate of discharge is artificially reduced to mimic natural properties;
- Providing settlement ponds at turbine hard standing areas and other main surface water discharge locations, where runoff from significant new

impermeable areas is treated and attenuated before being released overland; and

- All swales, crossings and other hydraulic features will be engineered to ensure that dimensions are suitable to convey predicted flows and so prevent build-up of surface water and / or flooding.

10.221 Drainage design will reduce chemical, silt and other suspended pollutant transport by providing a "treatment train" of two to three stages of pollutant removal to all surface water runoff, nominally by:

- Ensuring that drainage swales are designed to convey flows at a low velocity by using a wide, flat bottomed drain;
- Providing settlement and filtration features in all linear drainage swales (check dams, filtration dams) to reduce flow velocity and encourage settlement;
- Encouraging appropriate vegetation growth in the base of all linear drainage to provide additional filtration to flows;
- Providing settlement ponds at turbine hard standing areas and other key discharge locations in order to provide treatment to contaminated runoff prior to discharge;
- Discharging surface water runoff over undisturbed vegetated ground, hence allowing any remaining silts and other pollutants to drop out of flows before entering the watercourse (having the effect of polishing the runoff);
- Preventing the discharge of surface water runoff flows directly to existing watercourses or drainage. All discharges shall seek to be via SuDS and buffer zones which will act as a filter strip, allowing deposition of suspended solids and other pollutants; and
- Providing settlement features in water channels downstream of areas of peat infilling and ditch blocking area proposed as part of habitat management and enhancement planning. Refer to **Appendix 6.2** for full Habitat Management Plan (HMP) measures. Areas of ditch blocking are shown on Surface Water Management drawings included in **Appendix 10.1: Surface Water Management Plan**.

10.222 Consideration specific to the proposed infrastructure elements are documented in the detailed site-specific drainage management / SuDS design – see **Appendix 10.1: Surface Water Management Plan** and accompanying drainage drawings.

Watercourse Crossings

10.223 As noted previously, the number of watercourse and drainage crossings has been minimised through the principle of avoidance at the layout design stage. Proposals submitted in conjunction with this assessment indicate:

- 1 no. crossing of a significant watercourses.
- 13 no. crossings of minor watercourses.

10.224 Culverts will be designed to accommodate track crossings and minimise length of affected channel in order to comply with Revised PPS15 policy FLD4.

10.225 Hydraulic design of crossings will be undertaken as per the guidance and requirements provided in CIRIA C786 “Culverts, Screen and Outfall Manual” (or other standard as may be required by DfI Rivers in post-consent consultation), with primary parameters likely to include:

- Width of the culvert will be greater than the width of the active drainage channel;
- Alignment of the culvert will suit the alignment of the drainage channel, i.e. preserve the existing direction of flow;
- The slope of the culvert will not exceed the slope of the bed of the existing drainage channel.
- Detailed design of crossings will assume a hydraulic capacity requirement of 1% Annual Equivalent Probability flow including factor for climate change as required by DfI Rivers Technical Flood Risk Guidance in relation to Allowances for Climate Change in Northern Ireland as a conservative measure. Detailed hydraulic design of culverts and similar structures post permission is normal and accepted practice for wind farms in Northern Ireland.
- Fisheries shall be protected by adopting the guidance stated in Guidelines for Fisheries Protection during Development Works as published by Loughs Agency.

10.226 Culvert form is informed by the site-specific fisheries assessment (**Chapter 9: Fisheries & Aquatic Ecology**). In instances where fish passage is a requirement (which is limited to the Glengarrow Burn x1)), culverts will be designed to ensure that the channel bed and banks remain intact in order to preserve fisheries habitats and allow continued fish passage; i.e. the structure will be a bottomless culvert. Elsewhere culverts shall be of a closed conduit type.

10.227 Typical design drawings for a bottomless culvert and closed culvert have been provided as part of the planning application and are included as part of the Drainage Management Drawings within **Appendix 10.1: Surface Water Management Plan.**

10.228 Consultation and approval will be sought from all relevant parties as required by the DAERA Surface Waters Alteration Handbook (November 2017), including and DfI Rivers in particular, at the pre-construction detailed design stage for all works in and affecting watercourses and drains, as per the requirements of Schedule 6 of the Drainage (Northern Ireland) Order 1973 and subsequent amendments.

10.229 While detailed design of minor watercourse crossings (comprising simple closed culverts) can satisfactorily be deferred post-consent of any planning application, a design of the crossing over the Glengarrow Burn has been undertaken to inform the **Flood Risk & Drainage Assessment (Technical Appendix 10.2)** as the crossing would otherwise have potential to impede a floodplain.

10.230 The resultant structure comprises a clear span crossing of the significant watercourse, which has been demonstrated to ensure that the effect on flood conveyance is satisfactorily managed and would have no significant adverse effect on flood levels and flood extent within the Site and no adverse effect elsewhere. Preliminary DfI Rivers approval has been sought for the significant watercourse crossings.

Radon

10.231 The Site is within an area of highest elevated radon potential, where less than 10-30% buildings are above the action level. Radon protection measures are advised to be implemented for the permanent control building or as may be directed by the local Building Control office suitable to the nature of the proposed enclosed space.

BESS

10.232 The battery energy storage systems (BESS) comprise 20 no. lithium-ion battery energy storage containers. The storage containers are designed such that the batteries are within sealed units to ensure that a single cell thermal runaway will not propagate and result in multiple cell thermal runaways. This has been tested and confirmed in the UL9540A test (refer to Appendix 1.3). Therefore, the amount of potential pollutants will be limited to the gas vented from one cell but will be contained within the sealed unit limiting any potential impact to the wider environment (i.e., via fallout to land or surface waters and thereafter to groundwater).

Effect of the Proposed Development

10.233 Magnitude and likelihood of the potential environmental effects have been determined based on criteria outlined within paragraphs 10.43 to 10.49 taking into account the effect of avoidance measures and normal designed-in measures proposed and described in preceding sections.

10.234 The associated impact significance of these effects on the receptors affected (following the implementation of avoidance and design measures proposed) has been determined in accordance with the rationale described previously and the results are presented in summary **Table 10.15**

Table 10.15: Potential Magnitude and Significance of Impacts to Receptors - Including Effect of Avoidance & Design

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
Soils / Drift Deposits (Local / Low)	Ground Movement / Instability	Low	Negligible	Unlikely	Not Significant	The Peat Landslide Hazard Risk Assessment has concluded that with micro-siting and the employment of appropriate mitigation measures, all the areas can be considered as an insignificant risk.
On-site significant watercourses Burn Dennett River (Ballynamallaght) / Craig River (SW05); and Burn Dennett Tributary 1 (Stroanbrack) (SW02) (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of significant watercourses within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	High	High	Likely	Major	Temporary short-term construction activities within watercourses would be likely to cause a significant but temporary fundamental change in water quality in watercourses on the Site.
	Chemical pollution of surface waters	High	High	Likely	Major	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in watercourses on the Site.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
On-site significant watercourses Tributary of Burn Dennet River (Ballynamallaght / Burn Dennett Tributary 2 (Stroanbrack) (SW01) (Regional / Medium)	Changes in runoff and flow patterns	Negligible	Negligible	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of significant watercourses within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	High	Moderate	Likely	Moderate	Temporary short-term construction activities within watercourses would be likely to cause a significant but temporary fundamental change in water quality in watercourses on the Site.
	Chemical pollution of surface waters	High	Moderate	Likely	Moderate	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in watercourses on the Site.
On-site Minor Drainage (Local / Low)	Changes in runoff and flow patterns	Negligible	Negligible	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of minor watercourses within channels on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Silt / suspended solid pollution of surface waters	Medium	Low	Likely	Minor	Temporary short-term construction activities within watercourses would be likely to cause a significant but temporary fundamental change in water quality in watercourses on the Site.
	Chemical pollution of surface waters	Medium	Low	Likely	Minor	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in watercourses on the Site.
Off-site designated sites (Silverbrook Wood ASSI) (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. The drainage strategy adopted ensures that natural catchments are mirrored and ensures that water is not lost from the catchment that would result in a loss of available water for the designated site.
	Silt / suspended solid pollution of surface waters	Medium	Moderate	Unlikely	Minor	Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the Site to have no effect exceeding normal seasonal or pre-existing fluctuations. Temporary short-term construction activities within upstream watercourses would be likely to cause a detectable but temporary change in water quality in the immediate downstream environment that would have an effect on water quality.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Chemical pollution of the watercourse	High	High	Likely	Major	Spillage of oils, chemicals, or cementitious material associated with temporary construction, particularly at works adjacent to or within watercourses, and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in the downstream environment that would have an effect on water quality.
Off-site designated sites (River Foyle and Tributaries SAC)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. The drainage strategy adopted ensures that natural catchments are mirrored and ensures that water is not lost from the catchment that would result in a loss of available water for the designated site. The survey boundary as a proportion of the overall catchment shared with the designated site is not significant (i.e., c. 0.2%). Given this, and the distance between the Site and the SAC (c. 22 km downstream), it is unlikely the designated site could feasibly be affected by works associated with the Proposed Development.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the Site to have no effect exceeding normal seasonal or pre-existing fluctuations. Temporary short-term construction activities within upstream watercourses would be likely to cause a detectable but temporary change in water quality in the immediate downstream environment that would have an effect on water quality. However, the survey boundary as a proportion of the overall catchment shared with the designated site is not significant (i.e., c. 0.2%). Given this, and the distance between the Site and the SAC (c. 22 km downstream), it is unlikely the designated site could feasibly be affected by works associated with the Proposed Development.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Chemical pollution of the watercourse	Negligible	Low	Rare	Not Significant	Spillage of oils, chemicals, or cementitious material associated with temporary construction, particularly at works adjacent to or within watercourses, and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in the downstream environment that would have an effect on water quality. However, the survey boundary as a proportion of the overall catchment shared with the designated site is not significant (i.e., c. 0.2%). Given this, and the distance between the Site and the SAC (c. 22 km downstream), it is unlikely the designated site could feasibly be affected by works associated with the Proposed Development.
Bedrock Groundwater / Aquifers (Local / Low)	Alteration of Groundwater	Low	Negligible	Unlikely	Not Significant	No significant excavations within the bedrock are expected. Significant dewatering with the potential for affecting groundwater levels is not anticipated.
	Chemical pollution of groundwater	Low	Negligible	Likely	Minor	Bedrock is expected to be shallow in several areas, with limited thickness of Superficial Deposits however depth to groundwater is anticipated to be significant and dominated by fracture flow.
Private water supplies (Local / Low)	Disruption to quantity or quality of supply	Negligible	Negligible	Unlikely	Not Significant	No infrastructure is proposed within 250m of any known or potential abstraction location and as such no supply would be affected.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
Tracks, turbines and associated buildings. (Local / Low)	Risk to occupants and infrastructure due to identified potential risk of flooding.	Low	Negligible	Unlikely	Not Significant	The Proposed Development has been designed to avoid areas potentially susceptible to fluvial flooding and pluvial ponding.
	Risk to occupants due to presence of Radon	Low	Negligible	Unlikely	Not Significant	Proposed buildings will be designed to incorporate appropriate radon / gas protection measures.
Watercourses, Groundwater and Land / Soils – (Varies up to National / High)	Risk of contamination due to accidental fire at BESS facility.	Negligible	Low	Rare	Not Significant	Battery storage containers are sealed to ensure that any potential single cell thermal runaway is contained. Therefore, the amount of potential pollutants will be limited to the gas vented from one cell but will be contained within the sealed unit limiting any potential impact to the wider environment.

Additional Mitigation Measures – Construction Phase

10.235 Additional mitigating measures, over and above the avoidance and buffer zones previously detailed, are intended to reduce or prevent the residual significant hazards which may not be fully mitigated by the design evolution and avoidance.

Water Quality Monitoring

10.236 A water quality monitoring program will be implemented to monitor effects on the surface water quality regime during the infrastructure construction, operational and decommissioning phases of the Proposed Development, in order to;

- Demonstrate that the mitigation measures and surface water management is performing as designed;
- Provide validation that the in-place mitigation measures are not having an adverse effect upon the environment;
- Indicate the need for additional mitigation measures to prevent, reduce or remove any effects on the water environment, such as additional temporary settlement or filtration structures or short-term flocculant dosing to suit observed site conditions.

10.237 The monitoring would be informed by existing water quality baseline data presented in paragraphs 10.139 through 10.143 of this assessment and baseline monitoring rounds undertaken prior to the commencement of the construction phase.

10.238 It is intended that the water monitoring extent, duration and frequency will be agreed with the Department of Infrastructure or the relevant regulating body (nominally NIEA WMU) post consent and will nominally consist of physicochemical and biological monitoring. The extent, duration and frequency of the monitoring will be proportionate to the level of activity during each phase of the Proposed Development and the associated perceived risks.

Pollution Prevention

Pollution Prevention Plan

10.239 A detailed Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of a full Construction & Decommissioning Method Statement (CDMS) for the project, to be submitted post-consent following detailed site investigations and agreed with the local planning authority. Although this will be of particular importance during construction, it will apply to potentially polluting activities during all phases of the Proposed Development.

10.240 The detailed PPP will be produced following consultation and agreement with NIEA, and all appropriate personnel working on the Proposed Development will be trained in its use. As a minimum, the PPP will comply with Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidelines (in particular GPP 21: Pollution Incident Response Planning) and best practice as advocated by CIRIA. The PPP will identify site-specific measures and incorporate a Pollution Incident Plan, which will include emergency contact details, details of spill kits on the Proposed Development and instructions on actions in case of spillage / emergency.

10.241 Measures to be incorporated within the PPP are identified in the following sections.

Pollution Prevention Measures

10.242 During all phases the site manager will ensure that mitigation measures as identified within this assessment are fully implemented and that activities are carried out in such a manner as to prevent or reduce effects. The following construction and decommissioning phase-specific measures will be implemented. The following sections should be read in conjunction with the construction management information provided within **Chapter 1: Introduction & Proposed Development.**

10.243 To ensure best practice on site and to help avoid pollution release to watercourses and groundwater, the following NIEA Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidance (PPGs) will be adhered to:

- GPP 1 Understanding Your Environmental Responsibilities - Good Environmental Practices;
- GPP 2 Above Ground Oil Storage Tanks;
- GPP 3 Use and Design of Oil Separators in Surface Water Drainage Systems;
- GPP 4 Treatment and disposal of Wastewater where there is no connection to the public foul sewer;
- GPP 5 Works and Maintenance in or near Water;
- GPP 6 Working at Construction and Demolition Sites;
- GPP 8 Safe Storage and Disposal of Used Oils;
- GPP 20 Dewatering Underground Ducts and Chambers;
- GPP 21 Pollution Incident Response Planning;
- GPP 22 Dealing with Spills;
- GPP 26 Safe Storage of Drums and Intermediate Bulk Containers;
- PPG 7 Safe Storage – The Safe Operation of Refuelling Facilities; and
- PPG 18: Managing Fire Water and Major Spillages.

10.244 Key requirements for control of chemical pollution risk are identified in the above guidance and will include the following:

Storage

10.245 All equipment, materials and chemicals on the Proposed Development will be stored away from any watercourse (i.e. outwith previously stated buffer zones). Chemical, fuel and oil stores will be sited on impervious bases in accordance with GPP2 and within a secured bund of 110% of the storage capacity, within the temporary storage compound.

Vehicles and Refuelling

10.246 Standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Refuelling of vehicles and machinery will be carried out on an impermeable surface in designated areas, well away from any watercourse or drainage ditches (i.e. outwith previously stated buffer zones) and will adhere to best practice as detailed in PPG 7.

Maintenance

10.247 Onsite maintenance to construction plant will be avoided in all practicable instances, unless vehicles have broken down necessitating maintenance at the point of breakdown. Suitable measures in accordance with a Pollution Prevention Plan (PPP) will be put in place prior to commencement of maintenance in this instance.

Cement and concrete batching

10.248 Preference shall be given to construction techniques that do not require use of cementitious materials where suitable practicable alternatives exist. When concrete / cement is used, concrete batching will not be permitted on site. Wet concrete operations will not be carried out within watercourses or adjacent to watercourses. Measures to prevent discharge of alkaline wastewaters or contaminated storm water to watercourses will be outlined in a detailed PPP for the Proposed Development to be approved by NIEA before commencement of works. Wastewater spillage will be minimised by using settling tanks and recycling water.

Mess and welfare facilities

10.249 Mess and welfare facilities will be required during construction and decommissioning and will be located at the construction compound. Foul effluent disposal shall be via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on site).

Construction Best Practice

Construction in the vicinity of Watercourses

10.250 The following procedures apply to the general construction activities either within the watercourses or in defined watercourse buffer zones:

- Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works in order to ensure that in-channel works are undertaken during periods of predicted low flow and low rainfall in order to minimise contact with water; and
- Ensure that roadside drains do not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation as denoted on design drawings.

Construction of Watercourse Crossings

10.251 Construction of watercourse crossings will be programmed to coincide with periods of predicted low flow in the affected channel (determined by rainfall and would generally coincide with summer months) and adhere to working period restrictions imposed. Construction will be strictly as per the design for each identified watercourse crossing and will fully implement all SuDS and additional mitigating measures proposed at the detailed design stage. For purposes of outline design, the proposed mitigation will include:

- Installation of silt fences parallel to the watercourse channel in the vicinity of the proposed crossing;
- Installation of small cut-off drains to prevent natural surface runoff entering area of construction activity;
- Installation of filtration or other silt entraining features within the watercourse channel immediately downstream of the works location; and
- Use of over pumping where deemed appropriate.

Temporary SuDS

10.252 Temporary drainage and silt management features (SuDS) will be constructed prior to earthworks (including preliminary or enabling works) proceeding to construct any linear works (tracks / hardstanding areas / cable routes), turbine bases, and other infrastructure. Drainage will be provided to temporary works and reinstated to suit the final footprint of the completed development.

10.253 Temporary drainage measures in particular will be employed in enabling works to facilitate widening of existing tracks and diversion of minor watercourses where specifically proposed.

10.254 Temporary measures may include:

- Temporary silt fences erected in areas where risk of pollution to watercourses has been identified e.g. watercourse crossing locations and areas where tracks or other infrastructure lie within watercourse buffer zones;
- Placing temporary filtration silt fences within drainage channels where siltation is observed;
- Installing temporary constructed settlement features such as sumps or settlement ponds / lagoons where required;
- Upslope cut-off drainage channels approximately parallel to the proposed track alignment installed in advance of any excavated cuttings for the track or turbine hardstanding areas;
- Watercourses, drains, natural flow paths and cut-off drain outlet locations should be identified and charted, in order to ensure that piped crossings can be installed in advance of or adjacent to the track construction;
- Settlement ponds should be constructed in advance of commencing excavations for foundations and at any other locations identified as required at detailed design stage; and
- Trackside drainage swales should be installed in parallel with track construction. Note that this may require that drainage swales are reformed on an ongoing basis as temporary track alignments are modified to their eventual finished design level.

10.255 Suitable prevention measures should be in place at all times to prevent the conveyance of silts to receiving watercourses.

Electrical Cable Laying

10.256 Due consideration will be given to the prevailing ground conditions and season when programming the execution of cable trench excavations in order to ensure works are undertaken during periods with low rainfall and elevated shallow groundwater levels in order to reduce the likelihood of runoff entering the excavations.

10.257 Excavation of cable trenches will be carried out over short distances, with frequent backfilling of trenches to minimise opportunity for the ingress of water into open trenches, temporary silt traps will be provided in longer trench runs and on steeper slopes and spoil will be stored in line with a spoil management plan, which will be produced as part of the CDMS at the pre-construction stage.

Excavations and Spoil Management

10.258 Soil and subsoil excavation and movement will be undertaken in accordance with best practice guidelines such as Good Practice Guide for Handling Soils (MAFF, 2000) in order to minimise potential for silt laden runoff from spoil and excavations. Areas of stockpiled spoil including stored peat:

- will not be permitted within previously identified watercourse buffer zones; and
- will not be permitted to obstruct the flow of overland surface water with specific drainage to spoil mounds to be provided.

10.259 Material produced from excavations on the Site will be reused where reasonably practicable in the reinstatement of the site. Excavated materials will be separated into rock material, subsoil, reusable peat and vegetated sod material and will be stored in the designated temporary stockpile zones, under the supervision of a geotechnical expert. These materials will be reused where possible to re-grade slopes, and to re-vegetate and stabilise the sides of access tracks and hard standing areas.

10.260 Spoil drainage will be designed on a bespoke basis for spoil storage areas to allow controlled dewatering and prevent washout of suspended solids to the receiving water environment. As part of the detailed CDMS a spoil management strategy will be developed by the appointed competent contractor for the development. Outline designs for drainage arrangements for temporary spoil areas are shown on the Drainage Management Drawings within Appendix 10.1: Surface Water Management Plan.

Ditch Blocking and Earthworks for Habitat Enhancement

10.261 It is proposed that localised ditch blocking, permanent and seasonal, be carried out for the purposes of habitat enhancement / restoration. Details are provided in the **Outline Habitat Management Plan (OHMP) in Appendix 6.2**.

10.262 Ditch blocking downgradient of areas of earthworks will have an additional beneficial effect by providing settlement to reduced quality runoff from lands upgradient.

Dewatering of Excavations

- The majority of the turbine base foundations will be on bedrock or other hard strata above bedrock (to be confirmed by detailed site investigation prior to detailed design); therefore, deep excavations within bedrock and the associated bedrock aquifer are not anticipated and dewatering below the bedrock aquifer groundwater table is therefore not anticipated.
- Shallow groundwater (e.g. in areas of glacial sand and gravel) or rainfall runoff collected in excavations will be discharged via settlement ponds or filter strips prior to entry to the receiving water environment.
- Any settlement lagoons or filter strips associated with dewatering will be regularly inspected, particularly after periods of heavy rainfall and prior to periods of forecast heavy rainfall. Maintenance (to clear blockages or remove

silt) will be carried out in periods of dry weather where practicable. Maintenance requirements are further considered in **Appendix 10.1: Surface Water Management Plan**.

Dust Management

10.263 Loose track material generated during the use of access tracks and the construction compound will be prevented from reaching watercourses by maintenance to surface water drainage systems installed at aggregate based hard standing areas. In dry weather dust suppression methods such as by dust suppression bowser will be employed.

Borrow Pits

10.264 For the avoidance of doubt, no borrow pits are proposed at the Proposed Development, therefore associated pollution risks associated with rock extraction activities are not a consideration.

Maintenance of Pollution Prevention Measures

10.265 All SuDS and additional pollution prevention measures installed will be subject to a regular maintenance regime for the life of the construction phase in order to maintain functionality of all features. This will comprise:

- Unblocking of drains;
- Maintenance of access road and other hard standing surfaces;
- Replacement of filtration features; and
- Removal of silt build-up from settlement and filtration features.

Mitigating Measures - Operational Phase

10.266 Mitigation of the effects of the Proposed Development will comprise the following:

- Ensure best practice is adhered to on the Site and avoid pollution release to watercourses by incorporating NIEA Pollution Prevention Guidance notes into management policy;
- In the event that permanent welfare facilities are installed as part of control building / substation facilities, foul effluent will be disposed of through the use of sealed cesspools or chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on the site); and
- Cyclical maintenance of permanent SuDS drainage features installed during the construction phase, including unblocking of drains, maintenance of access road and other hard standing surfaces, and removal of silt build-up from settlement features. An outline maintenance programme is included in **Appendix 10.1: Surface Water Management Plan.**

Mitigating Measures and Residual Effects

10.267 The following table details the assessed impact magnitude, likelihood and associated significance as a function of the matrix stated previously of all receptors identified as previously having an unmitigated impact significance greater than 'not significant'.

Table 10.16: Mitigated Effects

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
On-site significant watercourses Burn Dennet River (Ballynamallaght) / Craig River (SW05); and Burn Dennet Tributary 1 (Stroanbrack) (SW02) (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt "soft" rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of significant watercourses on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
On-site significant watercourses Tributary of Burn Dennet River (Ballynamallaght / Burn Dennet Tributary 2 (Stroanbrack) (SW01) (Regional / Medium)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of significant watercourses on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
On-site Minor Drainage (Local / Low)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. Design of crossings of minor watercourses on-site when adopting best practice design standards as stated result in no significant localised effect in terms of restricted capacity that would cause any change to flood risk.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Surface water management and pollution control and in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Off-site designated sites (Silverbrook Wood ASSI) (National / High)	Changes in runoff and flow patterns	Negligible	Low	Rare	Not Significant	Increased runoff from impermeable infrastructure is to be attenuated to a greenfield equivalent rate and will adopt “soft” rural SuDS features to ensure response to rainfall is not exacerbated. The drainage strategy adopted ensures that natural catchments are mirrored and ensures that water is not lost from the catchment that would result in a loss of available water for the designated site.
	Silt / suspended solid pollution of surface waters	Negligible	Low	Rare	Not Significant	Riparian buffer zones, avoidance, and control of reduced quality runoff from the temporary and permanent works would cause runoff from the site to have no effect exceeding normal seasonal or pre-existing fluctuations. Surface water management and pollution control in particular to work in and adjacent to watercourses, is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Chemical pollution of the watercourse	Negligible	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions. Robust water quality monitoring will permit a rapid response to any residual risk.
Bedrock Groundwater / Aquifers (Local / Low)	Alteration of Groundwater	Low	Negligible	Unlikely	Not Significant	No significant excavations within the bedrock are expected. Significant dewatering with the potential for affecting groundwater levels is not anticipated.
	Chemical pollution of groundwater	Low	Negligible	Unlikely	Not Significant	Bedrock is expected to be shallow in several areas, with limited thickness of Superficial Deposits however depth to groundwater is anticipated to be significant and dominated by fracture flow. Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.
Watercourses, Groundwater and Land / Soils – (Varies up to National / High)	Risk of contamination due to accidental fire at BESS facility.	Negligible	Low	Rare	Not Significant	A fire management response plan will be prepared in conjunction with the battery supplier and with the local Fire Service prior to construction. This will outline containment measures and chemical fire suppressant methods which will be implemented to mitigate risk of potential contamination to land or water environment. In the event of a fire all wastes will be dealt with appropriately through the procedures agreed within the site-specific Fire Management Plan to be prepared post-consent.

Cumulative Effects

10.268 An assessment has been undertaken of the cumulative effect on geology and the water environment of the Proposed Development in conjunction with other known wind farms and other significant developments in planning, construction or operation at the time of the application.

10.269 The assessment aims to determine potential for cumulative impact within the hydrological, hydrogeological and geological setting of the Proposed Development caused by an accumulation of similar developments.

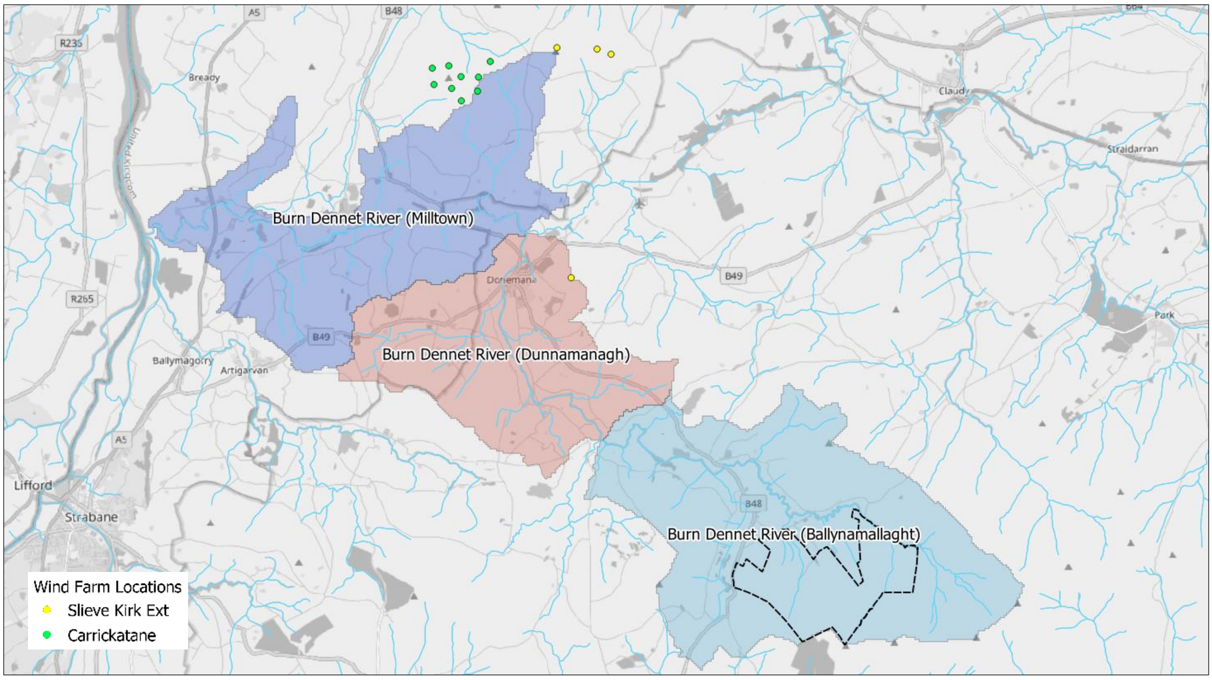
10.270 The hydrological and hydrogeological setting of the site for the purposes of the assessment is the downstream Burn Dennet River catchment as identified on the NIEA Catchment Data Map Viewer and shown on Plate 10-12.

10.271 Windfarms identified within the setting are detailed within the table below:

Table 10.17: Cumulative Assessment

Wind Farm	Number of turbines	Status
Slieve Kirk Ext	1 of 4	Existing
Carrickatane	1 of 9	Existing

Plate 10-12: Cumulative Assessment Area & Hydrological Setting



10.272 As no likely significant residual water environment or geological effects are predicted arising from the current Proposed Development, there is no potential significant cumulative effect to water or the geological environment in conjunction with any other pre-existing or Proposed Development.

Summary and Conclusions

10.273 This assessment identifies the potential geological, hydrological, and hydrogeological impacts, including surface and groundwater quality of the Proposed Development. It summarises the relevant legislation and guidance and provides appropriate baseline information, enabling the potential effects to be identified.

10.274 Aspects of the design, construction and operation of the Proposed Development that may potentially impact on the receiving geological and water environment have been identified and the pathways for impacts assessed. It has been determined that without mitigation, the Proposed Development would be likely to cause adverse impacts of major significance primarily driven by the sensitivity of fisheries interests on and shortly downstream of the Site. As such, informed by the baseline assessment and pathways identified, mitigation integrated as part of outline design and proposed during construction phase includes:

- Avoidance of water features based on baseline constraints mapping;

- Design of site elements to minimise impact on the geological and water environment;
- Implementation of a comprehensive surface water management plan comprising the use of SuDS (drainage) and silt management in order to prevent pathways for pollution;
- Construction phase pollution prevention procedures in accordance with NIEA requirements and guidance.

10.275 Monitoring of the effect of the Proposed Development on the water environment and fisheries habitat will be provided by the Applicant through physicochemical and biological water quality monitoring. Implementation of the mitigation proposed eliminates or reduces the potential significance to all receptors to "not significant".

10.276 There is no likelihood of significant cumulative impacts over and above any pre-existing effect caused by existing or consented wind development.

11

Acoustic Assessment

Acoustic Assessment

Introduction

11.1 This chapter contains an assessment of the acoustic impact of the proposed Mullaghclogher Wind Farm (hereafter referred to as the Proposed Development). The report assesses wind farm operational noise and discusses construction noise at the nearest residential properties.

11.2 This chapter is supported by the following:

- Figure 11.1 – Predicted Noise Footprint due to the Proposed Wind turbines;
- Figure 11.2 – Predicted Battery Energy Storage System Sound Footprint;
- Technical Appendix 11.1 - Assessment of Battery Energy Storage Facility;
- Technical Appendix 11.2 – Scope of Assessment;
- Technical Appendix 11.3 – Calculating Standardised Wind Speed;
- Technical Appendix 11.4 – Background Noise Survey Photos;
- Technical Appendix 11.5 – Instrumentation Records;
- Technical Appendix 11.6 – Charts;
- Technical Appendix 11.7 – Suggested Planning Conditions: Noise; and
- Glossary.

11.3 Figures and Technical Appendices are referenced in the text where relevant.

Statement of Authority

11.4 This assessment has been undertaken by RES, with at least one in-house Member of the Institute of Acoustics involved in its production. RES has undertaken acoustic impact assessments for every single one of its UK wind farm development applications since 2000. RES has also carried out noise assessments and reported to several local planning authorities on operational wind energy projects, including taking measurements on newly constructed wind farms to ensure compliance with planning conditions.

11.5 Additionally, RES has been project co-ordinator for several Joule[1] projects, leading European research into wind turbine noise, was involved in producing the guideline 'The Assessment and Rating of Noise from Wind Farms'[2] for the DTI in 1996, acted as peer reviewer for the 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'[3], and contributed to the RenewableUK work on Amplitude Modulation[4]. Publications include:

- 'An Investigation of Blade Swish from Wind Turbines', P Dunbabin, Proceedings of the 1996 International Congress on Noise Control Engineering (Internoise '96), 30 July – 2 August 1996, Book 1, pp 463 – 469;

[1] DGXII European Commission funded projects in the field of Research and Technological Development in non-nuclear energy.

[2] 'The Assessment and Rating of Noise from Wind Farms', The Working Group on Noise from Wind Turbines, ETSU Report for the DTI, ETSU-R-97, September 1996. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/49869/ETSU_Full_copy__Searchable_.pdf

[3] 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise', Institute of Acoustics, May 2013. Available at: https://www.ioa.org.uk/publications/wind-turbine-noise

[4] 'Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effects', RenewableUK, December 2013. Available at: https://salford-repository.worktribe.com/

- ‘An Automated System for Wind Turbine Tonal Assessment’, R Ruffle, Proceedings of the 1996 International Congress on Noise Control Engineering (Internoise ‘96), 30 July – 2 August 1996, Book 6, pp 2997 – 3002;
- ‘Wind Turbine Measurements for Noise Source Identification’, ETSU W/13/003914/00.REP, 1999, Dr P Dunbabin, RES et al;
- ‘A Critical Appraisal of Wind Farm Noise Propagation’, ETSU W/13/00385/REP, 2000 Dr J Bass, RES;
- ‘Aerodynamic Noise Reduction for Variable Speed Turbines’, ETSU/W/45/00504/REP, 2000, Dr P Dunbabin, RES;
- ‘Fundamental research in amplitude modulation - a project by RenewableUK’, Dr J Bass et al, Fourth International Meeting on Wind Turbine Noise, Rome, April 2011;
- ‘Investigation of the ‘Den Brook’ Amplitude Modulation methodology for wind turbine noise’, Dr J Bass, Acoustics Bulletin Vol 36 No 6 November/December 2011;
- ‘How does noise influence the design of a wind farm?’, Dr M Cassidy, Fifth International Conference on Wind Turbine Noise, Denver, 2013;
- ‘Propagation of Noise from Wind Farms According to the Good Practice Guide’, A Birchby, Sixth International Conference on Wind Turbine Noise, Glasgow, 2015;
- ‘Addressing the Issue of Amplitude Modulation’, Dr M Cassidy, Sixth International Conference on Wind Turbine Noise, Glasgow, 2015;
- ‘A Method for Rating Amplitude Modulation in Wind Turbine Noise’, Institute of Acoustics Noise Working Group, August 2016; and
- ‘Pre-construction Site Prediction Tool for Wind Farm AM – Do We Now Know Enough?’, A Birchby, Seventh International Conference on Wind Turbine Noise, Rotterdam, 2017.

Operation

11.6 In the context of other sources of environmental noise, the noise levels produced by wind turbines are generally low and have greater dependence upon wind speed. The combination of these two factors implies that a degree of masking would often be provided by background noise.

11.7 As described by the Department of the Environment in Best Practice Guidance to Planning Policy Statement 18[5]:

“There are two quite distinct types of noise source within a wind turbine. The mechanical noise produced by the gearbox, generator and other parts of the drive train; and the aerodynamic noise produced by the passage of the blades through the air. Since the early 1990s there has been a significant reduction in the mechanical noise generated by wind turbines and it is now usually less than, or of a similar level to, the aerodynamic noise. Aerodynamic noise from wind turbines is generally unobtrusive – it is broad-band in nature and in this respect is similar to, for example, the noise of wind in trees.”

Construction

11.8 Noise associated with the construction of wind turbines can arise from activities relating to the introduction of turbine foundations at the site; the introduction of access tracks; the use of cranes to install the towers, hubs and blades; the introduction of ancillary

[5] ‘Best Practice Guidance to Planning Policy Statement 18 ‘Renewable Energy’ ’, Department of the Environment, August 2009

equipment and cabling; upgrades to existing access routes; and, from construction traffic travelling along access routes and the local road network.

11.9 The sources of construction noise, which are temporary, would vary both in location and duration as the different elements of the Proposed Development are constructed and would arise primarily through the operation of large items of plant and activities near to dwellings.

Scope of Assessment

11.10 Noise can have an effect on the environment and on the quality of life enjoyed by individuals and communities. The effect of noise, both in the construction and operational phase, is therefore a material consideration in the determination of planning applications.

Operation

11.11 The main focus of the assessment of operational noise presented here is based on the most relevant type of noise emission for modern wind turbines: aerodynamic noise, which is broadband in nature. Mechanical noise, which can be tonal in nature, is also considered albeit less relevant to modern wind turbines. Implicitly incorporated within this assessment is the normal character of the noise associated with wind turbines (commonly referred to as 'blade swish') and consideration of a range of noise frequencies, including low frequencies.

11.12 An acoustic assessment considering the operation of the proposed Battery Energy Storage Facility can be found in **Technical Appendix 11.1**.

11.13 Low frequency content of the noise from wind farms shall be considered through the use of octave band specific noise emission and propagation modelling, however it is considered that specific and targeted assessment on low frequency content of noise emissions from the proposed wind turbines is unjustified. Details for scoping out low frequency noise from the acoustic assessment, as well as infrasound, sleep disturbance, vibration, amplitude modulation and wind turbine syndrome can be found in **Technical Appendix 11.2**.

11.14 A summary of the findings of a comprehensive study into wind turbine noise and associated health effects can be found in **Technical Appendix 11.2**.

Construction

11.15 The construction of turbines, ancillary electrical equipment, compounds and the corresponding access tracks will occur at large distances from neighbouring residences. The resultant noise and vibration, which would be temporary in nature, is only very rarely cause for concern in terms of the potential for disturbing the inhabitants of neighbouring residences. Whilst the noise associated with the construction of these aspects may well be audible to people residing in the area, the levels would be below established noise limits and planning requirements in this respect. Nevertheless, typical mitigation measures, including the use of 'best practicable means' would be incorporated into the construction practices for the proposed wind farm with a view to reducing noise levels where possible and practical. As a result, this aspect is only discussed in generalised terms with reference to standard noise limiting requirements; typical working practices;

hours of work, and standard mitigation measures in this respect. A detailed assessment has therefore not been undertaken.

11.16 Construction relating to the provision of access to the site, including the upgrade of local roads and their use thereof, may well occur at locations near by residences. As a result, and in instances where this is likely to occur, consideration of enhanced mitigation measures which would be reasonably possible to implement, have been discussed. In any event, typical noise limiting requirements would apply and the contractor undertaking the works would be responsible for potential issues and taking appropriate and reasonable steps to address these should they occur. As a result, this aspect is also discussed in generalised terms and a detailed assessment has not been undertaken as this would require a detailed construction plan to provide confidence in the results, which is not available at this time. However, certain details as to construction practices would be provided within a final Construction Environmental Management Plan (CEMP), with reference to potential noise and vibration impacts, where necessary.

11.17 Noise and vibration associated with the movement of additional vehicles, including heavy goods vehicles (HGVs) along local roads and access routes may well be noticeable to residents adjacent to these. However, this would essentially only result in a minor increase in the average noise levels from existing roads, with the most noticeable noise and perceptible vibration effects resulting from the sporadic and increased number of HGV pass-bys at residences along the access routes, with resulting levels for individual events being similar to that created by existing HGV movements.

Legislative Framework & Guidance

Operational Noise

11.18 Within Northern Ireland, noise from wind farms is defined within the planning context by Planning Policy Statement 18: Renewable Energy[6]. Best Practice Guidance to Planning Policy Statement 18: Renewable Energy refers to the use of the Department of Trade and Industry's 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97). In relation to noise from wind farms the Planning Policy states:

"The report, 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97), describes a framework for the measurement of wind farm noise and gives indicative noise levels calculated to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development."

11.19 It is therefore considered that the use of ETSU-R-97, as a criterion for assessment of wind farm noise, fulfils the requirements of Planning Policy Statement 18.

11.20 The methodology described in ETSU-R-97 was developed by a working group comprised of a cross-section of interested persons including, amongst others, environmental health officers, wind farm operators and independent acoustic experts.

11.21 ETSU-R-97 makes it clear from the outset that any noise restrictions placed on a wind farm must balance the environmental impact of the wind farm against the national and global benefits that arise through the development of renewable energy resources. The

[6] 'Planning Policy Statement 18: Renewable Energy', Department of the Environment, August 2009

principle of balancing development needs against protection of amenity may be considered common to any type of noise control guidance.

11.22 The basic aim of ETSU-R-97, in arriving at the recommendations contained within the report, is the intention to provide:

"Indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."

11.23 An article published in the Institute of Acoustics Bulletin (IoA Bulletin) Vol. 34 No. 2, March/April 2009[7], recommends a methodology for addressing issues not made explicit by, or outside the scope of, ETSU-R-97, such as in relation to wind shear or noise propagation modelling. Whilst this article does not represent formal legislation or guidance it was authored by a group of independent acousticians experienced in wind farm noise issues who have undertaken work on behalf of wind farm developers, local planning authorities and third parties and as such is a good indicator of best practice techniques. The assessment presented herein adopts the recommendations made within this article.

11.24 A Good Practice Guide (IoA GPG) to the application of ETSU-R-97 for the assessment and rating of wind turbine noise[3], issued by the Institute of Acoustics in May 2013 and endorsed by the Northern Ireland Executive, along with the governments in England, Scotland and Wales, provides guidance on all aspects of the use of ETSU-R-97 and reaffirms the recommendations of the Acoustics Bulletin article with regard to propagation modelling and wind shear. The assessment presented herein adopts the recommendations of the Good Practice Guide.

11.25 Supplementary guidance notes were published by the Institute of Acoustics in July and September 2014, and these provide further details on specific areas of the IoA GPG[8]. The assessment presented herein adopts the recommendations made within these supplementary guidance notes.

11.26 ETSU-R-97 has been applied at the vast majority of wind farms currently operating in the UK and provides a robust basis for assessing the noise impact of a wind farm when used in accordance with the IoA GPG. It is the only relevant guidance referenced in Northern Irish planning policy for rating and assessing operational wind farm noise. Based on planning policy and guidance, as outlined above, a wind farm which can operate within noise limits derived according to ETSU-R-97 shall be considered acceptable. This approach has been agreed with Derry City & Strabane District Council.

Construction Noise

11.27 In Northern Ireland, advice on construction noise assessment is referred to in 'The Control of Noise (Codes of Practice for Construction and Open Sites) Order (Northern Ireland)

[7] 'Prediction and Assessment of Wind Turbine Noise', Bowdler et al, Acoustics Bulletin Vol 34 No 2 March/April 2009

[8] 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise - Supplementary Guidance Notes', Institute of Acoustics, July & September 2014. Available at https://www.ioa.org.uk/publications/wind-turbine-noise

2002’[9]. This legislation points to BS 5228: Part 1:1997 for guidance on appropriate methods for minimising noise from construction and open sites in Northern Ireland.

11.28 Since the 1997 version of BS 5228 has been superseded by BS 5228-1:2009+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites - Part 1: Noise’[10] this has been identified as being the appropriate source of guidance on appropriate methods for minimising noise from construction activities and is adopted herein. This document provides guidance on construction noise limits, noise modelling techniques and best practicable measures for the reduction of noise generated during construction activities.

11.29 BS 5228-2:2009+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration’[11], provides guidance on construction vibration limits, vibration modelling techniques and best practicable measures for the reduction of vibration generated during construction activities.

11.30 The Pollution Control and Local Government (NI) Order 1978 provides information on the need for ensuring that best practicable means are employed to minimise noise[12].

Consultation

11.31 Details of the consultation undertaken are outlined in **Table 11.1**.

Table 11.1: Acoustic Assessment Consultation

Consultees	Date of Consultation	Nature and Purpose of Consultation
Derry City & Strabane District Council	13/12/2022	‘Planned Acoustic Assessment at the Proposed Mullaghclogher Wind Farm’ document sent to the Environmental Health Officer (EHO) to review. This report details the proposed assessment methodology along with suggested background noise survey locations. Invitation to attend installation of the equipment for the background noise survey also given.
Derry City & Strabane District Council	22/12/2022	Discussion with EHO on the proposed assessment methodology and suggested background noise survey locations.
Derry City & Strabane District Council	4/1/2023	Invitation given to attend installation of the equipment for the background noise survey on Wednesday 11th January 2023.
Derry City & Strabane District Council	5/1/2023	Response confirming general agreement with assessment methodology and suggested background noise survey locations, subject to some points/observations. Invitation accepted to attend installation of the equipment for the background noise survey.

[9] ‘The Control of Noise (Codes of Practice for Construction and Open Sites) Order (Northern Ireland) 2002’, The Department of the Environment, November 2002

[10] ‘Code of Practice for Noise and vibration control on construction and open sites - Part 1: Noise’, British Standards Institution, BS 5228-1:2009+A1:2014, 2014

[11] ‘Code of Practice for Noise and vibration control on construction and open sites - Part 2: Vibration’, British Standards Institution, BS 5228-2:2009+A1:2014, 2014

[12] ‘Pollution Control and Local Government (NI) Order 1978’, published by Her Majesty’s Stationary Office, 1978

Consultees	Date of Consultation	Nature and Purpose of Consultation
Derry City & Strabane District Council	6/1/2023	Response given to points/observations made. Additional background noise survey location proposed (H83).
Derry City & Strabane District Council	11/1/2023	Overseeing locations for installing equipment with EHO at the start of the background noise survey.
Derry City & Strabane District Council	1/8/2023	Report of installed background noise survey locations provided to EHO.

Methodology

Operation

11.32 To ensure adequate assessment of the potential impacts of the operational noise from the proposed wind farm the following steps have been taken, in accordance with relevant guidance detailed above:

- The baseline noise conditions at each of the nearest residential properties to the wind farm are established by way of representative background noise surveys;
- The noise levels at the nearest residential properties from the operation of the Proposed Development are predicted using a sound propagation model considering: the locations of the wind turbines; the intervening terrain; and the likely noise emission characteristics of the wind turbines;
- With due regard to relevant guidance and regulations the acoustic assessment criteria are derived; and
- The evaluation of the acoustic impact is undertaken by comparing the predicted noise levels with the assessment criteria.

Establishing Baseline Conditions

11.33 Similar to other assessments of noise impacts (most notably BS 4142[13], which ETSU-R-97 identifies as forming the basis of its recommendations), the ETSU-R-97 methodology requires the comparison of predicted noise levels due to turbine emissions (which vary with hub height wind speed) with noise limits based upon the noise levels already existing under those same conditions (i.e. the baseline conditions).

11.34 Since background noise levels depend upon wind speed, as indeed do wind turbine noise emissions, it is important when making reference measurements to put them in that context. Thus, the assessment of background noise levels requires the measurement of not only noise levels, but concurrent wind conditions, covering a representative range of wind speeds. These wind measurements are made at the wind turbine site rather than at the residential properties, since it is this wind speed that would subsequently govern the wind farm's noise generation. Often the residential properties themselves will be sheltered from the wind and may consequently have relatively low background noise levels.

[13] 'Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas', British Standards Institution, BS 4142:1990, 1990

11.35 To establish the baseline conditions, sound level meters and associated apparatus are set-up to record the required acoustic information at a selection of the nearest residential properties geographically spread around the proposed wind farm site and which are likely to be representative of other residential properties in the locale.

11.36 Wind speed and direction are recorded as 10 minute averages for the same period as for the noise measurements and are synchronised with the acoustic data to allow correlations to be established. The wind speed that is adopted for use is the same wind speed as that which drives the turbine noise levels.

11.37 The adoption of this wind speed was recommended within the article published in the IoA Bulletin and the subsequent IoA GPG. The methodology used to calculate standardised 10 m height wind speed is described in **Technical Appendix 11.3**.

11.38 Prior to establishing the baseline conditions the acoustic data is filtered as follows:

- For each background noise measurement location, the measured noise data is divided into two sets, as specified by ETSU-R-97 and shown in **Table 11.2**:

Table 11.2: Definition of Time of Day Periods

Time of Day	Definition
Quiet daytime	18:00 - 23:00 every day 13:00 - 18:00 Saturday 07:00 - 18:00 Sunday
Night-time	23:00 - 07:00 every day

- Rainfall affected data is systematically removed from the acoustic data set. To facilitate this, a rain gauge is deployed near the wind farm site to record 10 minute rainfall data and identify potentially affected noise data. Both the 10 minute period containing the bucket tip and the preceding 10 minute period are removed from the dataset as recommended in the IoA GPG to account for the time it takes for the rain gauge tipping bucket to fill.
- Periods of measured background noise data thought to be affected by extraneous, i.e. non-typical, noise sources are identified and removed from the data set. Whilst some 'extraneous' data may actually be real, it tends to bias any trend lines upwards so its removal is adopted as a conservative measure.
- In practice this means close inspection of the measured background noise levels, comparison with concurrent data measured at nearby locations and consideration of both directional and temporal variation.

Modelling Noise Propagation

11.39 Whilst there are several sound propagation models available, the ISO 9613 Part 2 model has been used[14], this being identified as most appropriate for use in such rural sites[15]. The specific interpretation of the ISO 9613 Part 2 propagation methodology recommended in the aforementioned IoA Bulletin and the subsequent IoA GPG has been employed.

11.40 To make noise predictions it is assumed that:

- The turbines are identical;
- The turbines radiate noise at the power specified in this report;
- Each turbine can be modelled as a point source at hub-height;
- Each residential property is assigned a reference height to simulate the presence of an observer.

11.41 The sound propagation model takes account of attenuation due to geometric spreading and atmospheric absorption. The assumed temperature and relative humidity are 10 ˚C and 70 % respectively, as recommended in the IoA Bulletin and IoA GPG. Ground effects are also taken into account by the propagation model with a ground factor of 0.5 and a receiver height of 4 m used as recommended in the IoA Bulletin and IoA GPG.

11.42 The barrier attenuations predicted by ISO 9613 Part 2 have been shown to be significantly greater than those measured in practice under downwind conditions[15]. Therefore, barrier attenuation according to the ISO 9613 Part 2 method has been discounted. In lieu of this, where there is no direct line of sight between the residential property in question and any part of the wind turbine, 2 dB attenuation has been assumed as recommended in the IoA Bulletin and the IoA GPG.

11.43 Additionally, verification studies have also shown that ISO 9613 Part 2 tends to slightly underestimate noise levels at nearby dwellings in certain exceptional cases, notably in a valley type environment where the ground drops off between source and receiver. In these instances, an addition of 3 dB(A) has been applied to the resulting overall A-weighted noise level as recommended by the IoA GPG.

11.44 To generate the ground cross sections between each turbine and each dwelling necessary for reliable propagation modelling, ground contours at 5 m intervals for the area of interest have been generated from 50 m grid resolution digital terrain data.

11.45 The predicted noise levels are calculated as L_{Aeq} noise levels and changed to the L_{A90} descriptor (to allow comparisons to be made) by subtraction of -2 dB, as specified by ETSU-R-97.

11.46 It has been shown by measurement-based verification studies that the ISO 9613 Part 2 model tends to slightly overestimate wind farm noise levels at nearby dwellings[15]. Examples of additional conservative assumptions modelled are:

- Properties are assumed to be downwind of all noise sources simultaneously and at all times. In reality, this is not the case and additional attenuation would be expected when a property is upwind or crosswind of the proposed wind turbines;

[14] 'Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation', International Organisation for Standardisation, ISO 9613-2:1996, 1996

[15] 'A Critical Appraisal of Wind Farm Noise Propagation', ETSU Report W/13/00385/REP, January 2000

- Although, in reality, the ground is predominantly porous (acoustically absorptive) it has been modelled as 'mixed', i.e. a combination of hard and porous, corresponding to a ground absorption coefficient of 0.5 as recommended by the IoA Bulletin and IoA GPG;
- Receiver heights are modelled at 4 m above local ground level, which equates roughly to first floor window level, as recommended by the IoA Bulletin and IoA GPG. This results in a predicted noise level anything up to 2 dB(A) higher than at the typical human ear height of 1.2-1.8 m;
- Trees and other non-terrain shielding effects have not been considered;
- An allowance for measurement uncertainty has been included in the sound power levels for the presented turbine.

Operational Noise Impact Criteria

11.47 Sound is measured in decibels (dB) which is a measure of the sound pressure level, i.e. the magnitude of the pressure variations in the air. Measurements of environmental sound are usually made in dB(A) which includes a correction for the sensitivity of the human ear.

11.48 ETSU-R-97 seeks to protect the internal and external amenity of wind farm neighbours by defining acceptable limits for operational noise from wind turbines. The test applied to operational noise is whether or not the noise levels produced by the combined operation of the wind turbines do not exceed noise limits derived in accordance with ETSU-R-97 at nearby residential properties.

Whilst ETSU-R-97 presents a comprehensive and detailed assessment methodology for wind farm noise, it also provides a simplified methodology:

"if the noise is limited to an $L_{A90,10min}$ of 35 dB(A) up to wind speeds of 10 m/s at 10 m height, then these conditions alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary".

11.49 In the detailed methodology, ETSU-R-97 states that different limits should be applied during daytime and night-time periods. The daytime limits, derived from the background noise levels measured during quiet daytime periods, are intended to preserve outdoor amenity, while the night-time limits are intended to prevent sleep disturbance. The general principle is that the noise limits should be based on existing background noise levels, except for very low background noise levels, in which case a fixed limit may be applied. The suggested limits are given in **Table 11.3** below, where L_B is the background $L_{A90,10min}$ and is a function of wind speed. During daytime periods and at low background noise levels, a lower fixed limit of 35–40 dB(A) is applicable. The exact value is dependent upon a number of factors: the number of nearby dwellings, the effect of the noise limits on energy produced, and the duration and level of exposure.

Table 11.3: Permissible Noise Level Criteria

Time of Day	Permissible Noise Level
Daytime	• 35-40 dB $L_{A90,\,10min}$ for L_B less than or equal to 30-35 dB(A) • L_B + 5 dB $L_{A90,\,10min}$, for L_B greater than 30-35 dB(A)
Night-time	• 43 dB $L_{A90,\,10min}$ for L_B less than or equal to 38 dB(A) • L_B + 5 dB $L_{A90,\,10min}$, for L_B greater than 38 dB(A)

11.50 Note that a higher noise level is permissible during the night than during the day as it is assumed that residents would be indoors. The night-time criterion is derived from sleep disturbance criterion referred to in ETSU-R-97, with an allowance of 10 dB for attenuation through an open window.

11.51 The wind speeds at which the acoustic impact is considered are less than or equal to 12 ms^{-1} at a height of 10 m and are likely to be the acoustically critical wind speeds. Above these wind speeds, as stated in ETSU-R-97, reliable measurements of background and turbine noise are difficult to make. However, if a wind farm meets the noise criteria at the wind speeds presented, it is most unlikely that it would cause any greater loss of amenity at higher wind speeds due to increasing background noise levels masking wind farm generated noise.

11.52 It is important to note that reactions to noise are subjective. Standards and guidance that relate to environmental noise are typically presented in terms of criteria that would be expected to be considered acceptable by the majority of the population.

Construction

11.53 Construction noise is discussed with reference to Annex E of BS 5228-1:2009+A1:2014 which provides guidance on setting environmental noise criteria. Several methods of assessing the significance of noise levels are presented in Annex E and the most applicable to the construction of the proposed wind farm is the ABC method.

11.54 The ABC method sets threshold noise levels for construction noise for specific periods based on the pre-existing ambient noise levels, subject to average lower Category A limiting values of 65, 55 and 45 dB L_{Aeq} for daytime (07:00 - 19:00 weekdays and Saturdays 07:00 – 13:00), evenings and weekends (19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays) and night-time (23:00 – 07:00) periods respectively, for instances where existing ambient noise levels are relatively low, which is the case here.

Baseline Conditions

Operation

11.55 The Proposed Development is located in the townlands of Carrickayne, Legnahappoge, Glengarrow, Stroanback and Doorat, 4 km north-east of Plumbridge, Northern Ireland. The surrounding area is predominantly rural in nature and used for agricultural grazing. The general acoustic character is typical of a rural environment with sound from farm activities, sheep, cattle, birds, traffic and the occasional overhead aircraft.

11.56 Background noise measurements were undertaken at five locations in accordance with ETSU-R-97 as detailed in **Table 11.4**. The locations were agreed in consultation with the environmental health department of Derry City & Strabane District Council.

Table 11.4: Background Noise Survey Details

Survey Property ID	Measurement Period		
	Start	End	Duration (days)
H4	12/01/2023	03/04/2023	60
H17	11/01/2023	03/04/2023	54
H46	12/01/2023	03/04/2023	71
H75	11/01/2023	03/04/2023	82
H83	11/01/2023	02/04/2023	74

11.57 Due to limitations in equipment powering, data was not recorded for various days during the survey.

11.58 On a minor number of days during the survey an equipment synchronisation drift of more than one minute between the noise and wind speed measurements was observed. 10-minute averaging periods with a synchronisation drift of up to 2 minutes between the noise and wind speed measurements have been included in the data analysis as these datasets were observed to correspond meaningfully. 10-minute averaging periods with a synchronisation drift in excess of 2 minutes have been excluded from the data analysis. Therefore, in combination with **11.57** as detailed above the durations stated in **Table 11.4** vary by location.

11.59 The background noise monitoring equipment was housed in weather-proof enclosures and powered by lead-acid batteries. The microphones were placed at a height of approximately 1.2 m above ground and equipped with all-weather wind shields which also provide water resistance.

11.60 The proprietary wind shields used are designed to reduce the effects of wind-generated noise at the microphone and accord with the recommendations of the IoA GPG in that they are the appropriate size and, in combination with the microphone, are certified by the manufacturer as meeting Type 1 / Class 1 precision standards.

11.61 Background noise levels are monitored continuously, and summary statistics stored every 10 minutes in the internal memory of each meter. The relevant statistic measured is the $L_{A90,10min}$ (The A-weighted sound pressure level exceeded for 90 % of the 10 minute interval).

11.62 The sound level meters were placed away from reflecting walls and vegetation. Photos of the equipment, in situ, may be seen in **Technical Appendix 11.4**. The apparatus were field-calibrated before, during and after the survey period and the maximum drift detected was 0.4 dB, which is within the required range recommended in the IoA GPG. All sound level meters had been subject to laboratory calibration traceable to national standards within the last 24 months and field calibrators had been subject to laboratory calibration traceable to national standards within the last 12 months as recommended in the IoA GPG. Details are provided in **Technical Appendix 11.5**.

11.63 **Chart 11.6.1** (see **Technical Appendix 11.6** for all charts) shows the measured wind rose over the background noise survey period, as measured by the LiDAR located on-site.

11.64 LiDAR (Light Detection and Ranging) is a remote sensing device that measures conditions in the atmosphere by using pulses from a LASER by applying the principle of the Doppler Effect, detecting the movement of air in the atmospheric boundary layer to measure wind speed and direction. LiDAR provides measurements at several heights, and this enables wind speed data to be obtained that describe the wind profile across a range of heights.

11.65 LiDAR has been successfully tested, by independent third parties using suitable test sites, against conventional anemometry[16,17]. From the technical reports, these tests have demonstrated that, over a range of relevant heights, the accuracy of the LiDAR is comparable to that of the conventional anemometry.

11.66 For illustrative purposes, **Chart 11.6.2** shows the measured wind rose over an extended period (12/1/2023 – 03/09/2023) by the LiDAR located on-site. As previously discussed, the noise prediction model employed is likely to overestimate the actual noise immission levels for locations not downwind of the turbines. **Chart 11.6.2** therefore may aid the reader as to the likelihood of over-estimation due to this factor.

11.67 The noise data has been cross-referenced with rainfall data measured on-site using a rain gauge. Any noise data identified as having been affected by rainfall has been removed from the analysis as shown in **Charts 11.6.3** to **11.6.12.**

11.68 Short-term periods of increased noise levels considered to be atypical have been removed from the dataset. The excluded data is shown in **Charts 11.6.3** to **11.6.12** and further commentary is given below to address specific comments by the Environmental Health Officer during consultation and to further demonstrate accordance with the IoA GPG.

11.69 The local area contains a number of watercourses. In the case of background noise measurements at all locations steps have been taken to minimize the influence of watercourses on measurements and to measure typical low background noise levels by selecting representative survey locations which are maximally screened from the source of watercourse sound. In the case of H4 and H46 continuous sound from watercourses are a feature of those locations and measurement data during the highest flow rates has been excluded from the data analysis, as shown in **Charts 11.6.3**, **11.6.5**, **11.6.8** and **11.6.10**. All significant watercourses in the local area are expected to be in constant flow throughout the year as Met Office data shows that rainfall occurs in the area on more than half the days each year on average[18], therefore the contribution from significant watercourses are likely to be a continuous feature of the background acoustic environment in the local area.

11.70 Forested land is present 120 m to the north-west of H4. This is likely to be commercially forested land and the trees may be harvested in the future. Sound created by wind in these trees is not a dominant factor of the background acoustic environment at H4 given the proximity of the forested land to H4. The harvesting of the trees is unlikely to have an impact on the background noise measurements given the other background sound sources in the local area.

11.71 As discussed in **11.69**, at measurement location H17 steps have been taken to minimise the influence on the measurements by watercourses and the measurement location is reasonably representative of the other properties in the local area as sound-generating vegetation is a common feature. This is substantiated as the night-time background sound levels at H17 are the lowest of all the survey measurement locations.

[16] "Evaluation of WINDCUBE", Albers et al, Deutsche WindGuard Consulting GmbH, Report PP 08007, 16 March 2008

[17] "Verification test for three WindCubeTM WLS7 LiDARs at the Høvsøre test site", Gottschall et al, DTU Report Risø-R-1732, May 2010

[18] UK Climate Averages, Met Office, available at https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcdx5x4e7

11.72 External buildings near to H46 and H75 are used in relation with farming activities which are typical of the local area. The buildings are used infrequently and possibly atypical measurement data associated with the use of these buildings has been removed from the analysis as shown in **Charts 11.6.5**, **11.6.6**, **11.6.10** and **11.6.11.** The measurement locations selected at both properties are in the amenity areas where noise levels measured are representative of typical 'low' levels likely to be experienced in the vicinity of these dwellings, and in the case of H75 are representative other dwellings in the local area also.

11.73 **Charts 11.6.3** to **11.6.7** show $L_{A90,10min}$ correlated against wind speed for quiet daytime periods at each survey location. In each case, a 'best fit' line has been fitted to the data and the noise limits added. The equation of the regression polynomial has been provided in the charts.

11.74 **Charts 11.6.8** to **11.6.12** show $L_{A90,10min}$ correlated against the wind speed for night-time periods at each survey location. In each case, a 'best fit' line has been fitted to the data and the noise limits added. The equation of the regression polynomial has been provided in the charts.

11.75 **Table 11.5** and **Table 11.6** detail the $L_{A90,10min}$ background noise levels calculated from the derived 'best fit' lines, as described above:

Table 11.5: Quiet Daytime Background Noise Levels ($L_{A90,10min}$ dB)

Survey Property ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H4	34.0	34.2	34.5	34.7	34.9	35.1	35.2	35.2	35.2	35.2	35.2	35.2
H17	30.4	30.4	30.4	30.3	30.2	30.2	30.6	31.3	32.5	34.3	36.8	40.1
H46	26.7	27.0	27.6	28.4	29.6	31.0	32.6	34.4	36.3	38.3	40.3	42.4
H75	27.5	27.5	27.5	27.7	28.7	30.3	32.6	35.2	38.1	41.2	44.4	47.4
H83	28.2	28.2	28.4	28.9	29.8	31.1	32.6	34.4	36.3	38.4	40.5	42.6

Table 11.6: Night-Time Background Noise Levels ($L_{A90,10min}$ dB)

Survey Property ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H4	34.3	34.3	34.3	34.4	34.5	34.7	34.9	35.0	35.0	35.0	35.0	35.0
H17	23.8	23.8	23.8	23.8	24.3	25.3	26.8	28.6	30.5	32.5	34.4	36.1
H46	26.2	26.4	26.9	27.6	28.6	29.9	31.4	33.4	35.6	38.2	41.2	44.5
H75	25.0	25.0	25.5	26.5	28.0	29.8	32.0	34.3	36.9	39.6	42.3	45.0
H83	25.8	25.8	26.1	26.8	27.9	29.3	31.0	32.9	34.9	37.1	39.3	41.4

Construction

11.76 The background/baseline noise levels detailed above are relatively low, as would be expected for a rural area such as that considered here, and existing ambient noise levels are also considered low. As a result limiting noise criteria, as discussed previously with reference to the 'ABC method' provided within BS 5228-1, are used to inform discussion as to the potential impacts during construction.

11.77 Existing sources of vibration in the area are expected to be related to HGV movements along local roads, localised construction/maintenance activities and the occasional earthquake and/or tremor, which may well be perceptible to people in the locale but with a certain level of habituation for some residents depending on the source. In general, existing sources of vibration are expected to be intermittent and would not be expected to be significant in terms of normal guidance in this respect.

Potential Impacts

Potential Operational Impacts

Noise Propagation Modelling

11.78 The locations of the proposed turbines are provided in **Table 11.7** and shown in **Figure 11.1**.

Table 11.7: Location of Proposed Turbines

Turbine	Co-ordinates (Irish National Grid, EPSG 29902)	
	X (m)	Y (m)
T1	250230	396189
T2	250473	395628
T3	250959	395845
T4	251171	395220
T5	251670	395732
T6	251634	395167
T7	252119	395559
T8	252273	396179
T9	252627	396625
T10	253162	396897
T11	253281	396284

11.79 The locations of the nearest residential properties to the turbines have been determined by inspection of relevant maps and through site visits. The locations are listed in **Table 11.8** and are also shown in **Figure 11.1**.

Table 11.8: Location of Nearby Properties

Property ID	Co-ordinates (Irish National Grid, EPSG 29902)	
	X (m)	Y (m)
H2	250179	393471
H3	250301	393235
H4	250711	393527
H5	250201	393093
H8	248478	395030
H12	248517	395757
H13	248569	395816
H14	248606	396239

Property ID	Co-ordinates (Irish National Grid, EPSG 29902)	
	X (m)	Y (m)
H15	249107	396255
H16	248583	396142
H17	249119	396408
H18	248658	396436
H19	248703	396550
H20	249250	396649
H21	248769	396756
H22	248785	396806
H23	249361	396884
H24	249392	397001
H25	248854	397017
H26	249405	397078
H27	248909	397114
H28	249401	397170
H29	248937	397187
H30	248948	397355
H33	249550	397378
H34	249527	397383
H35	248974	397391
H36	249629	397439
H37	249023	397451
H38	249651	397460
H39	249644	397476
H41	249650	397489
H42	249043	397492
H43	249695	397547
H44	249730	397624
H45	249687	397646
H46	252364	397658
H47	251059	397769
H48	249233	397781
H49	250871	397892
H53	252346	398019
H54	253018	398105
H56	251685	398072
H57	253092	398218
H58	249513	398225
H61	250728	397879
H63	249216	395310

Property ID	Co-ordinates (Irish National Grid, EPSG 29902)	
	X (m)	Y (m)
H64	249075	395419
H65	249057	395574
H67	249180	395670
H70	249159	395733
H71	249084	395794
H72	249196	395854
H75	250918	396584
H77	251029	396844
H78	249494	397039
H79	251393	397046
H80	251399	397076
H81	250983	397140
H82	250940	397150
H83	250412	397415
H84	250601	397496
H85	250592	397562
H86	250879	397716
H87	250950	397690
H88	251910	397904
H89	251415	397859

11.80 The following properties have financial involvement in the Proposed Development: H15, H17, H75, H81, H82 and H83.

11.81 The properties considered in the assessment, along with distances from each property to the nearest turbine, are given in **Table 11.9**. It can be seen that the minimum house-to-turbine separation is 740 m to the closest financially involved property, H75. The minimum house-to-turbine separation is 1001 m to the closest property which is not financially involved, which is H77.

Table 11.9: Distances to Considered Properties

Property ID	Distance to Nearest Turbine (m)	Nearest Turbine
H2	2011	T4
H3	2167	T4
H4	1755	T4
H5	2338	T4
H8	2082	T2
H12	1767	T1
H13	1702	T1
H14	1625	T1
H15	1125	T1

Property ID	Distance to Nearest Turbine (m)	Nearest Turbine
H16	1648	T1
H17	1132	T1
H18	1591	T1
H19	1569	T1
H20	1083	T1
H21	1567	T1
H22	1571	T1
H23	1113	T1
H24	1167	T1
H25	1606	T1
H26	1213	T1
H27	1613	T1
H28	1284	T1
H29	1633	T1
H30	1733	T1
H33	1370	T1
H34	1386	T1
H35	1738	T1
H36	1387	T1
H37	1746	T1
H38	1397	T1
H39	1414	T1
H41	1424	T1
H42	1763	T1
H43	1460	T1
H44	1520	T1
H45	1555	T1
H46	1066	T9
H47	1784	T1
H48	1878	T1
H49	1820	T1
H53	1387	T10
H54	1216	T10
H56	1727	T9
H57	1322	T10
H58	2159	T1
H61	1761	T1
H63	1296	T2
H64	1388	T1
H65	1324	T1

Property ID	Distance to Nearest Turbine (m)	Nearest Turbine
H67	1171	T1
H70	1164	T1
H71	1212	T1
H72	1087	T1
H75	740	T3
H77	1001	T3
H78	1124	T1
H79	1235	T8
H80	1252	T8
H81	1213	T1
H82	1195	T1
H83	1239	T1
H84	1359	T1
H85	1420	T1
H86	1660	T1
H87	1665	T1
H88	1466	T9
H89	1730	T9

11.82 The turbine type will be finalised prior to construction. However, for the purposes of this assessment the Vestas V150 6.0 MW has been chosen as a typical candidate turbine type. This report uses the acoustic data from the manufacturer's general specification for all analysis[19,20]. 2 dB has been added to the specified sound power levels as a conservative measure as recommended by the IoA GPG. Details used in this analysis are as follows:

- A hub height of 105 m;
- A rotor diameter of 150 m;
- Sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}), including the addition of 2 dB, as shown in **Table 11.10**;
- Octave band sound power levels, L_{WA}, for a standardised 10 m height wind speed (v_{10}) of 8 ms^{-1} and including the addition of 2 dB, as shown in **Table 11.11**;
- Tonal emission characteristics such that no clearly audible tones are present at any wind speed;
- The sound power levels at 1 ms^{-1} and 2 ms^{-1} have been assumed as equal to 3 ms^{-1} as a conservative measure.

[19] "Performance Specification EnVentus™ V150-6.0 MW 50/60 Hz", Vestas Wind Systems A/S, Document no: 0098-0749 V03, 2021-03-12

[20] "Third octave noise emission EnVentus™ V150-6.0MW", Vestas Wind Systems A/S, Document no: 0095-3747_01, 2020-11-03

Table 11.10: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Proposed Turbines

Standardised 10 m Height Wind Speed, v_{10} (ms^{-1})	Sound Power Level, L_{WA} (dB(A) re 1 pW)
1	95.0
2	95.0
3	95.0
4	98.3
5	102.5
6	105.9
7	106.7
8	106.9
9	106.9
10	106.9
11	106.9
12	106.9

Table 11.11: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at a Standardised 10 m Height Wind Speed of 8 ms^{-1} for the Proposed Turbines

Octave Band (Hz)	Octave Band Sound Power Level, L_{WA} (dB(A) re 1 pW)
31.5	77.3
63	87.9
125	95.6
250	100.3
500	102.0
1000	100.9
2000	96.8
4000	89.8
8000	79.8
OVERALL	106.9

Predictions of Noise Levels at Considered Properties

11.83 **Table 11.12** shows the predicted noise immission levels at the nearest considered properties, at each wind speed considered, for the proposed turbines. The property with the highest predicted noise immission level of 41.1 dB L_{A90} is H75, which is a financially involved property. For the properties which are not financially involved, the highest predicted noise immission level is 39.4 dB L_{A90} at H77. The maximum predicted noise levels at any property will occur at wind speeds equal to and greater than 8 ms^{-1}.

11.84 **Figure 11.1** shows an isobel (i.e. noise contour) plot for the proposed turbines at a standardised 10 m height wind speed of 8 ms^{-1}. Such plots are useful for evaluating the noise 'footprint' of a given development.

Table 11.12: Predicted Noise Levels at Considered Properties, L_{A90} dB

Property ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H2	18.6	18.6	18.6	21.8	26.1	29.4	30.3	30.4	30.5	30.5	30.5	30.5
H3	18.6	18.6	18.6	21.8	26.1	29.4	30.3	30.4	30.5	30.5	30.5	30.5
H4	19.9	19.9	19.9	23.2	27.4	30.8	31.6	31.8	31.8	31.8	31.8	31.8
H5	17.8	17.8	17.8	21.0	25.3	28.6	29.5	29.6	29.7	29.7	29.7	29.7
H8	18.3	18.3	18.3	21.6	25.8	29.2	30.0	30.2	30.2	30.2	30.2	30.2
H12	21.0	21.0	21.0	24.3	28.5	31.8	32.7	32.9	32.9	32.9	32.9	32.9
H13	21.3	21.3	21.3	24.5	28.8	32.1	33.0	33.1	33.2	33.2	33.2	33.2
H14	21.2	21.2	21.2	24.5	28.7	32.1	33.0	33.1	33.1	33.1	33.1	33.1
H15	23.0	23.0	23.0	26.3	30.5	33.9	34.7	34.9	34.9	34.9	34.9	34.9
H16	21.2	21.2	21.2	24.5	28.7	32.1	32.9	33.1	33.1	33.1	33.1	33.1
H17	22.9	22.9	22.9	26.2	30.4	33.8	34.6	34.8	34.8	34.8	34.8	34.8
H18	21.4	21.4	21.4	24.6	28.9	32.2	33.1	33.2	33.3	33.3	33.3	33.3
H19	21.4	21.4	21.4	24.7	28.9	32.3	33.1	33.3	33.3	33.3	33.3	33.3
H20	23.5	23.5	23.5	26.8	31.0	34.4	35.2	35.4	35.4	35.4	35.4	35.4
H21	21.7	21.7	21.7	25.0	29.2	32.5	33.4	33.6	33.6	33.6	33.6	33.6
H22	21.7	21.7	21.7	25.0	29.3	32.6	33.5	33.6	33.6	33.6	33.6	33.6
H23	23.3	23.3	23.3	26.6	30.8	34.1	35.0	35.2	35.2	35.2	35.2	35.2
H24	22.9	22.9	22.9	26.2	30.5	33.8	34.7	34.8	34.8	34.8	34.8	34.8
H25	21.6	21.6	21.6	24.9	29.1	32.4	33.3	33.5	33.5	33.5	33.5	33.5
H26	22.7	22.7	22.7	25.9	30.2	33.5	34.4	34.5	34.6	34.6	34.6	34.6
H27	21.6	21.6	21.6	24.8	29.1	32.4	33.3	33.4	33.5	33.5	33.5	33.5
H28	22.2	22.2	22.2	25.5	29.7	33.1	34.0	34.1	34.1	34.1	34.1	34.1
H29	21.5	21.5	21.5	24.7	29.0	32.3	33.2	33.3	33.4	33.4	33.4	33.4
H30	21.2	21.2	21.2	24.5	28.7	32.0	32.9	33.1	33.1	33.1	33.1	33.1
H33	22.0	22.0	22.0	25.3	29.6	32.9	33.8	33.9	33.9	33.9	33.9	33.9
H34	21.9	21.9	21.9	25.2	29.4	32.8	33.7	33.8	33.8	33.8	33.8	33.8
H35	21.1	21.1	21.1	24.3	28.6	31.9	32.8	32.9	33.0	33.0	33.0	33.0
H36	22.0	22.0	22.0	25.3	29.5	32.9	33.8	33.9	33.9	33.9	33.9	33.9
H37	21.0	21.0	21.0	24.2	28.5	31.8	32.7	32.8	32.9	32.9	32.9	32.9
H38	22.0	22.0	22.0	25.3	29.5	32.9	33.7	33.9	33.9	33.9	33.9	33.9
H39	21.9	21.9	21.9	25.2	29.4	32.8	33.6	33.8	33.8	33.8	33.8	33.8
H41	21.9	21.9	21.9	25.2	29.4	32.7	33.6	33.8	33.8	33.8	33.8	33.8
H42	20.9	20.9	20.9	24.2	28.4	31.8	32.6	32.8	32.8	32.8	32.8	32.8
H43	21.8	21.8	21.8	25.0	29.3	32.6	33.5	33.6	33.7	33.7	33.7	33.7
H44	21.5	21.5	21.5	24.8	29.0	32.4	33.2	33.4	33.4	33.4	33.4	33.4
H45	21.3	21.3	21.3	24.6	28.8	32.2	33.0	33.2	33.2	33.2	33.2	33.2
H46	25.3	25.3	25.3	28.6	32.8	36.1	37.0	37.2	37.2	37.2	37.2	37.2
H47	23.0	23.0	23.0	26.3	30.5	33.8	34.7	34.9	34.9	34.9	34.9	34.9

Property ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H48	19.7	19.7	19.7	23.0	27.2	30.6	31.4	31.6	31.6	31.6	31.6	31.6
H49	22.5	22.5	22.5	25.8	30.0	33.4	34.2	34.4	34.4	34.4	34.4	34.4
H53	23.8	23.8	23.8	27.1	31.3	34.6	35.5	35.7	35.7	35.7	35.7	35.7
H54	23.5	23.5	23.5	26.8	31.0	34.4	35.3	35.4	35.4	35.4	35.4	35.4
H56	23.2	23.2	23.2	26.5	30.7	34.1	35.0	35.1	35.1	35.1	35.1	35.1
H57	22.8	22.8	22.8	26.1	30.3	33.6	34.5	34.7	34.7	34.7	34.7	34.7
H58	19.7	19.7	19.7	23.0	27.2	30.6	31.5	31.6	31.6	31.6	31.6	31.6
H61	22.4	22.4	22.4	25.7	29.9	33.2	34.1	34.3	34.3	34.3	34.3	34.3
H63	22.8	22.8	22.8	26.1	30.3	33.7	34.5	34.7	34.7	34.7	34.7	34.7
H64	22.2	22.2	22.2	25.5	29.7	33.1	33.9	34.1	34.1	34.1	34.1	34.1
H65	22.4	22.4	22.4	25.6	29.9	33.2	34.1	34.2	34.3	34.3	34.3	34.3
H67	23.3	23.3	23.3	26.6	30.8	34.2	35.1	35.2	35.2	35.2	35.2	35.2
H70	23.3	23.3	23.3	26.5	30.8	34.1	35.0	35.1	35.2	35.2	35.2	35.2
H71	22.8	22.8	22.8	26.1	30.3	33.6	34.5	34.7	34.7	34.7	34.7	34.7
H72	23.6	23.6	23.6	26.9	31.1	34.5	35.3	35.5	35.5	35.5	35.5	35.5
H75	29.2	29.2	29.2	32.4	36.7	40.0	40.9	41.0	41.1	41.1	41.1	41.1
H77	27.5	27.5	27.5	30.7	35.0	38.3	39.2	39.3	39.4	39.4	39.4	39.4
H78	23.3	23.3	23.3	26.5	30.8	34.1	35.0	35.2	35.2	35.2	35.2	35.2
H79	26.4	26.4	26.4	29.6	33.9	37.2	38.1	38.2	38.3	38.3	38.3	38.3
H80	26.2	26.2	26.2	29.5	33.7	37.1	37.9	38.1	38.1	38.1	38.1	38.1
H81	26.2	26.2	26.2	29.5	33.7	37.1	37.9	38.1	38.1	38.1	38.1	38.1
H82	26.1	26.1	26.1	29.4	33.6	37.0	37.8	38.0	38.0	38.0	38.0	38.0
H83	23.9	23.9	23.9	27.2	31.4	34.8	35.6	35.8	35.8	35.8	35.8	35.8
H84	23.8	23.8	23.8	27.0	31.3	34.6	35.5	35.6	35.7	35.7	35.7	35.7
H85	23.4	23.4	23.4	26.7	30.9	34.3	35.1	35.3	35.3	35.3	35.3	35.3
H86	23.0	23.0	23.0	26.3	30.5	33.9	34.7	34.9	34.9	34.9	34.9	34.9
H87	23.2	23.2	23.2	26.5	30.7	34.1	34.9	35.1	35.1	35.1	35.1	35.1
H88	23.5	23.5	23.5	26.8	31.0	34.3	35.2	35.4	35.4	35.4	35.4	35.4
H89	23.0	23.0	23.0	26.3	30.5	33.9	34.7	34.9	34.9	34.9	34.9	34.9

11.85 The noise levels at 46 of the 67 nearest residential properties do not exceed 35 dB(A), indicating that the noise immission levels would be regarded as acceptable and the residents amenity as receiving ‘sufficient protection’ without further assessment requiring to be undertaken.

11.86 There are 21 properties that have predicted noise levels greater than this simplified noise criteria of 35 dB(A). Therefore the ‘full’ acoustic assessment need only be considered at these 21 properties. However, all of the properties considered have been included in the full acoustic assessment so as to provide a more comprehensive description of the acoustic impact of the Proposed Development.

Acoustic Acceptance Criteria

11.87 As stated previously, during daytime periods and at low background noise levels, a lower fixed limit of 35-40 dB(A) is applicable with the exact value dependent upon a number of factors: the number of noise affected properties; the potential impact on the power output of the wind farm and the likely duration and level of exposure. Through consideration of these factors, RES have adopted a 40 dB(A) daytime lower fixed limit. The justification is as follows:

- Number of noise affected properties: 17 of the considered properties which are not financially involved are predicted to experience noise levels of greater than 35dB(A) and up to 39.4 dB(A). This is a small number of properties in relation to the scale of the proposed development.
- Potential impact on the power output of the Proposed Development: The rated power would be 66 MW should the wind turbine type considered in the acoustic assessment be installed, large in comparison with the majority of other wind farms operating in Northern Ireland, suggesting that a lower limit towards the upper end of the range would be appropriate. A daytime lower fixed limit below 40 dB(A) would limit the power output of the proposed development; and
- The likely duration and level of exposure: The amount of the time that noise levels of greater than 35dB(A) are predicted at the majorty of the relevant peoperties is limited to periods of sufficiently high standardised 10 m wind speeds of 7 ms^{-1} and above, which will occur for the minority of the time. Noise levels would also be reduced when properties are not located downwind of the wind turbines. Again this does not suggest a high impact, such that a lower limit towards the upper end of the range would be appropriate.

Table 11.13: Permissible Noise Level Criteria

Time of Day	Permissible Noise Level
Daytime	• 40 dB $L_{A90,\ 10min}$ for L_B less than or equal to 35 dB(A) • L_B + 5 dB $L_{A90,\ 10min}$, for L_B greater than 35 dB(A)
Night-time	• 43 dB $L_{A90,\ 10min}$ for L_B less than or equal to 38 dB(A) • L_B + 5 dB $L_{A90,\ 10min}$, for L_B greater than 38 dB(A)

Calculation of Acceptable Noise Limits from Baseline Conditions

11.88 The ‘best-fit’ lines of **Charts 11.6.3 - 11.6.12** have been used to calculate the acceptable noise limits for the background noise measurement locations. **Table 11.14** shows the daytime noise limits and **Table 11.15** the night-time noise limits.

Table 11.14: Recommended Daytime Noise Limits ($L_{A90,10min}$ dB)

Survey Property ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H4	40.0	40.0	40.0	40.0	40.0	40.1	40.2	40.2	40.2	40.2	40.2	40.2
H17	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.8	45.1
H46	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.3	43.3	45.3	47.4
H75	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.2	43.1	46.2	49.4	52.4
H83	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	41.3	43.4	45.5	47.6

Table 11.15: Recommended Night-Time Noise Limits ($L_{A90,10min}$ dB)

Survey Property ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H4	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
H17	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
H46	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.2	46.2	49.5
H75	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.3	50.0
H83	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.3	46.4

11.89 The recommendations of ETSU-R-97 state that where there are groups of properties that are likely to have a similar background noise environment, it is appropriate to use data from one representative location as the basis for assessment at the other properties. The survey location inferred to be representative for each property is shown in **Table 11.16**. The specific choice of survey location chosen has been made considering the distance to the nearest survey location and the likelihood of experiencing a broadly similar acoustic environment as the survey location. Where the survey results have not been inferred to be representative for a property, these are marked as 'None' and a 40 dB(A) daytime lower fixed limit and 43 dB(A) night-time limit have been applied at standardised 10 m wind speeds up to and including 12 ms^{-1}, according to **Table 11.13.**

Table 11.16: Inferred Representative Background Noise Survey Locations

Property ID	Survey Property ID	Property ID	Survey Property ID	Property ID	Survey Property ID
H2	None	H30	None	H63	H17
H3	None	H33	H17	H64	H17
H4	H4	H34	H17	H65	H17
H5	None	H35	None	H67	H17
H8	None	H36	H17	H70	H17
H12	None	H37	None	H71	H17
H13	None	H38	H17	H72	H17
H14	None	H39	H17	H75	H75
H15	H17	H41	H17	H77	H75
H16	None	H42	None	H78	H17
H17	H17	H43	H17	H79	H75
H18	None	H44	H17	H80	H75
H19	None	H45	H17	H81	H75
H20	H17	H46	H46	H82	H75
H21	None	H47	H83	H83	H83
H22	None	H48	None	H84	H83
H23	H17	H49	H83	H85	H83
H24	H17	H53	H83	H86	H83
H25	None	H54	H83	H87	H83
H26	H17	H56	H83	H88	H83
H27	None	H57	H83	H89	H83
H28	H17	H58	None	-	-
H29	None	H61	H83	-	-

11.90 As recommended in ETSU-R-97, the absolute lower noise limits may be increased up to 45 dB(A) if the occupant has a financial involvement in the wind farm. H15, H17, H75, H81, H82 and H83 have financial involvement in the Proposed Development and the modified noise limits for these properties are shown in **Table 11.17** and **Table 11.18**.

Table 11.17: Daytime Noise Limits ($L_{A90,10min}$ dB) for Financially Involved Properties

Property ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H15	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.1
H17	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.1
H75	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.2	49.4	52.4
H81	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.2	49.4	52.4
H82	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.2	49.4	52.4
H83	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.5	47.6

Table 11.18: Night-Time Noise Limits ($L_{A90,10min}$ dB) for Financially Involved Properties

Property ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H15	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
H17	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
H75	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.3	50.0
H81	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.3	50.0
H82	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.3	50.0
H83	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.4

Acoustic Assessment

11.91 **Table 11.19** shows a comparison of the predicted noise levels with the recommended daytime noise limits for each residential property. The predicted noise levels at 1 ms^{-1} and 2 ms^{-1} have been assumed as equal to 3 ms^{-1} as a conservative measure as noise levels at these wind speeds would typically be less. The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended noise limit. A negative value indicates that the predicted noise level is within the limit. **Table 11.20** shows a comparison with the recommended night-time noise limits.

11.92 Noise levels at all locations are within the daytime noise limits at all wind speeds considered with a minimum margin of -0.8 dB(A). Noise levels at all locations are within the night-time noise limits at all wind speeds considered with a minimum margin of -3.6 dB(A).

Table 11.19: Comparison of Predicted Noise Levels and Daytime Noise Limits ($L_{A90,10min}$ dB)

Property ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H2	18.6	40.0	-21.4	18.6	40.0	-21.4	18.6	40.0	-21.4	21.8	40.0	-18.2
H3	18.6	40.0	-21.4	18.6	40.0	-21.4	18.6	40.0	-21.4	21.8	40.0	-18.2
H4	19.9	40.0	-20.1	19.9	40.0	-20.1	19.9	40.0	-20.1	23.2	40.0	-16.8
H5	17.8	40.0	-22.2	17.8	40.0	-22.2	17.8	40.0	-22.2	21.0	40.0	-19.0
H8	18.3	40.0	-21.7	18.3	40.0	-21.7	18.3	40.0	-21.7	21.6	40.0	-18.4
H12	21.0	40.0	-19.0	21.0	40.0	-19.0	21.0	40.0	-19.0	24.3	40.0	-15.7
H13	21.3	40.0	-18.7	21.3	40.0	-18.7	21.3	40.0	-18.7	24.5	40.0	-15.5
H14	21.2	40.0	-18.8	21.2	40.0	-18.8	21.2	40.0	-18.8	24.5	40.0	-15.5
H15	23.0	45.0	-22.0	23.0	45.0	-22.0	23.0	45.0	-22.0	26.3	45.0	-18.7
H16	21.2	40.0	-18.8	21.2	40.0	-18.8	21.2	40.0	-18.8	24.5	40.0	-15.5
H17	22.9	45.0	-22.1	22.9	45.0	-22.1	22.9	45.0	-22.1	26.2	45.0	-18.8
H18	21.4	40.0	-18.6	21.4	40.0	-18.6	21.4	40.0	-18.6	24.6	40.0	-15.4
H19	21.4	40.0	-18.6	21.4	40.0	-18.6	21.4	40.0	-18.6	24.7	40.0	-15.3
H20	23.5	40.0	-16.5	23.5	40.0	-16.5	23.5	40.0	-16.5	26.8	40.0	-13.2
H21	21.7	40.0	-18.3	21.7	40.0	-18.3	21.7	40.0	-18.3	25.0	40.0	-15.0
H22	21.7	40.0	-18.3	21.7	40.0	-18.3	21.7	40.0	-18.3	25.0	40.0	-15.0
H23	23.3	40.0	-16.7	23.3	40.0	-16.7	23.3	40.0	-16.7	26.6	40.0	-13.4
H24	22.9	40.0	-17.1	22.9	40.0	-17.1	22.9	40.0	-17.1	26.2	40.0	-13.8
H25	21.6	40.0	-18.4	21.6	40.0	-18.4	21.6	40.0	-18.4	24.9	40.0	-15.1
H26	22.7	40.0	-17.3	22.7	40.0	-17.3	22.7	40.0	-17.3	25.9	40.0	-14.1
H27	21.6	40.0	-18.4	21.6	40.0	-18.4	21.6	40.0	-18.4	24.8	40.0	-15.2
H28	22.2	40.0	-17.8	22.2	40.0	-17.8	22.2	40.0	-17.8	25.5	40.0	-14.5
H29	21.5	40.0	-18.5	21.5	40.0	-18.5	21.5	40.0	-18.5	24.7	40.0	-15.3
H30	21.2	40.0	-18.8	21.2	40.0	-18.8	21.2	40.0	-18.8	24.5	40.0	-15.5
H33	22.0	40.0	-18.0	22.0	40.0	-18.0	22.0	40.0	-18.0	25.3	40.0	-14.7
H34	21.9	40.0	-18.1	21.9	40.0	-18.1	21.9	40.0	-18.1	25.2	40.0	-14.8
H35	21.1	40.0	-18.9	21.1	40.0	-18.9	21.1	40.0	-18.9	24.3	40.0	-15.7
H36	22.0	40.0	-18.0	22.0	40.0	-18.0	22.0	40.0	-18.0	25.3	40.0	-14.7
H37	21.0	40.0	-19.0	21.0	40.0	-19.0	21.0	40.0	-19.0	24.2	40.0	-15.8
H38	22.0	40.0	-18.0	22.0	40.0	-18.0	22.0	40.0	-18.0	25.3	40.0	-14.7
H39	21.9	40.0	-18.1	21.9	40.0	-18.1	21.9	40.0	-18.1	25.2	40.0	-14.8
H41	21.9	40.0	-18.1	21.9	40.0	-18.1	21.9	40.0	-18.1	25.2	40.0	-14.8
H42	20.9	40.0	-19.1	20.9	40.0	-19.1	20.9	40.0	-19.1	24.2	40.0	-15.8
H43	21.8	40.0	-18.2	21.8	40.0	-18.2	21.8	40.0	-18.2	25.0	40.0	-15.0
H44	21.5	40.0	-18.5	21.5	40.0	-18.5	21.5	40.0	-18.5	24.8	40.0	-15.2
H45	21.3	40.0	-18.7	21.3	40.0	-18.7	21.3	40.0	-18.7	24.6	40.0	-15.4
H46	25.3	40.0	-14.7	25.3	40.0	-14.7	25.3	40.0	-14.7	28.6	40.0	-11.4

H47	23.0	40.0	-17.0	23.0	40.0	-17.0	23.0	40.0	-17.0	26.3	40.0	-13.7
H48	19.7	40.0	-20.3	19.7	40.0	-20.3	19.7	40.0	-20.3	23.0	40.0	-17.0
H49	22.5	40.0	-17.5	22.5	40.0	-17.5	22.5	40.0	-17.5	25.8	40.0	-14.2
H53	23.8	40.0	-16.2	23.8	40.0	-16.2	23.8	40.0	-16.2	27.1	40.0	-12.9
H54	23.5	40.0	-16.5	23.5	40.0	-16.5	23.5	40.0	-16.5	26.8	40.0	-13.2
H56	23.2	40.0	-16.8	23.2	40.0	-16.8	23.2	40.0	-16.8	26.5	40.0	-13.5
H57	22.8	40.0	-17.2	22.8	40.0	-17.2	22.8	40.0	-17.2	26.1	40.0	-13.9
H58	19.7	40.0	-20.3	19.7	40.0	-20.3	19.7	40.0	-20.3	23.0	40.0	-17.0
H61	22.4	40.0	-17.6	22.4	40.0	-17.6	22.4	40.0	-17.6	25.7	40.0	-14.3
H63	22.8	40.0	-17.2	22.8	40.0	-17.2	22.8	40.0	-17.2	26.1	40.0	-13.9
H64	22.2	40.0	-17.8	22.2	40.0	-17.8	22.2	40.0	-17.8	25.5	40.0	-14.5
H65	22.4	40.0	-17.6	22.4	40.0	-17.6	22.4	40.0	-17.6	25.6	40.0	-14.4
H67	23.3	40.0	-16.7	23.3	40.0	-16.7	23.3	40.0	-16.7	26.6	40.0	-13.4
H70	23.3	40.0	-16.7	23.3	40.0	-16.7	23.3	40.0	-16.7	26.5	40.0	-13.5
H71	22.8	40.0	-17.2	22.8	40.0	-17.2	22.8	40.0	-17.2	26.1	40.0	-13.9
H72	23.6	40.0	-16.4	23.6	40.0	-16.4	23.6	40.0	-16.4	26.9	40.0	-13.1
H75	29.2	45.0	-15.8	29.2	45.0	-15.8	29.2	45.0	-15.8	32.4	45.0	-12.6
H77	27.5	40.0	-12.5	27.5	40.0	-12.5	27.5	40.0	-12.5	30.7	40.0	-9.3
H78	23.3	40.0	-16.7	23.3	40.0	-16.7	23.3	40.0	-16.7	26.5	40.0	-13.5
H79	26.4	40.0	-13.6	26.4	40.0	-13.6	26.4	40.0	-13.6	29.6	40.0	-10.4
H80	26.2	40.0	-13.8	26.2	40.0	-13.8	26.2	40.0	-13.8	29.5	40.0	-10.5
H81	26.2	45.0	-18.8	26.2	45.0	-18.8	26.2	45.0	-18.8	29.5	45.0	-15.5
H82	26.1	45.0	-18.9	26.1	45.0	-18.9	26.1	45.0	-18.9	29.4	45.0	-15.6
H83	23.9	45.0	-21.1	23.9	45.0	-21.1	23.9	45.0	-21.1	27.2	45.0	-17.8
H84	23.8	40.0	-16.2	23.8	40.0	-16.2	23.8	40.0	-16.2	27.0	40.0	-13.0
H85	23.4	40.0	-16.6	23.4	40.0	-16.6	23.4	40.0	-16.6	26.7	40.0	-13.3
H86	23.0	40.0	-17.0	23.0	40.0	-17.0	23.0	40.0	-17.0	26.3	40.0	-13.7
H87	23.2	40.0	-16.8	23.2	40.0	-16.8	23.2	40.0	-16.8	26.5	40.0	-13.5
H88	23.5	40.0	-16.5	23.5	40.0	-16.5	23.5	40.0	-16.5	26.8	40.0	-13.2
H89	23.0	40.0	-17.0	23.0	40.0	-17.0	23.0	40.0	-17.0	26.3	40.0	-13.7

Property ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H2	26.1	40.0	-13.9	29.4	40.0	-10.6	30.3	40.0	-9.7	30.4	40.0	-9.6
H3	26.1	40.0	-13.9	29.4	40.0	-10.6	30.3	40.0	-9.7	30.4	40.0	-9.6
H4	27.4	40.0	-12.6	30.8	40.1	-9.3	31.6	40.2	-8.6	31.8	40.2	-8.4
H5	25.3	40.0	-14.7	28.6	40.0	-11.4	29.5	40.0	-10.5	29.6	40.0	-10.4
H8	25.8	40.0	-14.2	29.2	40.0	-10.8	30.0	40.0	-10.0	30.2	40.0	-9.8
H12	28.5	40.0	-11.5	31.8	40.0	-8.2	32.7	40.0	-7.3	32.9	40.0	-7.1
H13	28.8	40.0	-11.2	32.1	40.0	-7.9	33.0	40.0	-7.0	33.1	40.0	-6.9
H14	28.7	40.0	-11.3	32.1	40.0	-7.9	33.0	40.0	-7.0	33.1	40.0	-6.9
H15	30.5	45.0	-14.5	33.9	45.0	-11.1	34.7	45.0	-10.3	34.9	45.0	-10.1
H16	28.7	40.0	-11.3	32.1	40.0	-7.9	32.9	40.0	-7.1	33.1	40.0	-6.9
H17	30.4	45.0	-14.6	33.8	45.0	-11.2	34.6	45.0	-10.4	34.8	45.0	-10.2
H18	28.9	40.0	-11.1	32.2	40.0	-7.8	33.1	40.0	-6.9	33.2	40.0	-6.8
H19	28.9	40.0	-11.1	32.3	40.0	-7.7	33.1	40.0	-6.9	33.3	40.0	-6.7
H20	31.0	40.0	-9.0	34.4	40.0	-5.6	35.2	40.0	-4.8	35.4	40.0	-4.6
H21	29.2	40.0	-10.8	32.5	40.0	-7.5	33.4	40.0	-6.6	33.6	40.0	-6.4
H22	29.3	40.0	-10.7	32.6	40.0	-7.4	33.5	40.0	-6.5	33.6	40.0	-6.4
H23	30.8	40.0	-9.2	34.1	40.0	-5.9	35.0	40.0	-5.0	35.2	40.0	-4.8
H24	30.5	40.0	-9.5	33.8	40.0	-6.2	34.7	40.0	-5.3	34.8	40.0	-5.2
H25	29.1	40.0	-10.9	32.4	40.0	-7.6	33.3	40.0	-6.7	33.5	40.0	-6.5
H26	30.2	40.0	-9.8	33.5	40.0	-6.5	34.4	40.0	-5.6	34.5	40.0	-5.5
H27	29.1	40.0	-10.9	32.4	40.0	-7.6	33.3	40.0	-6.7	33.4	40.0	-6.6
H28	29.7	40.0	-10.3	33.1	40.0	-6.9	34.0	40.0	-6.0	34.1	40.0	-5.9
H29	29.0	40.0	-11.0	32.3	40.0	-7.7	33.2	40.0	-6.8	33.3	40.0	-6.7
H30	28.7	40.0	-11.3	32.0	40.0	-8.0	32.9	40.0	-7.1	33.1	40.0	-6.9
H33	29.6	40.0	-10.4	32.9	40.0	-7.1	33.8	40.0	-6.2	33.9	40.0	-6.1
H34	29.4	40.0	-10.6	32.8	40.0	-7.2	33.7	40.0	-6.3	33.8	40.0	-6.2
H35	28.6	40.0	-11.4	31.9	40.0	-8.1	32.8	40.0	-7.2	32.9	40.0	-7.1
H36	29.5	40.0	-10.5	32.9	40.0	-7.1	33.8	40.0	-6.2	33.9	40.0	-6.1
H37	28.5	40.0	-11.5	31.8	40.0	-8.2	32.7	40.0	-7.3	32.8	40.0	-7.2
H38	29.5	40.0	-10.5	32.9	40.0	-7.1	33.7	40.0	-6.3	33.9	40.0	-6.1
H39	29.4	40.0	-10.6	32.8	40.0	-7.2	33.6	40.0	-6.4	33.8	40.0	-6.2
H41	29.4	40.0	-10.6	32.7	40.0	-7.3	33.6	40.0	-6.4	33.8	40.0	-6.2
H42	28.4	40.0	-11.6	31.8	40.0	-8.2	32.6	40.0	-7.4	32.8	40.0	-7.2
H43	29.3	40.0	-10.7	32.6	40.0	-7.4	33.5	40.0	-6.5	33.6	40.0	-6.4
H44	29.0	40.0	-11.0	32.4	40.0	-7.6	33.2	40.0	-6.8	33.4	40.0	-6.6
H45	28.8	40.0	-11.2	32.2	40.0	-7.8	33.0	40.0	-7.0	33.2	40.0	-6.8
H46	32.8	40.0	-7.2	36.1	40.0	-3.9	37.0	40.0	-3.0	37.2	40.0	-2.8

H47	30.5	40.0	-9.5	33.8	40.0	-6.2	34.7	40.0	-5.3	34.9	40.0	-5.1
H48	27.2	40.0	-12.8	30.6	40.0	-9.4	31.4	40.0	-8.6	31.6	40.0	-8.4
H49	30.0	40.0	-10.0	33.4	40.0	-6.6	34.2	40.0	-5.8	34.4	40.0	-5.6
H53	31.3	40.0	-8.7	34.6	40.0	-5.4	35.5	40.0	-4.5	35.7	40.0	-4.3
H54	31.0	40.0	-9.0	34.4	40.0	-5.6	35.3	40.0	-4.7	35.4	40.0	-4.6
H56	30.7	40.0	-9.3	34.1	40.0	-5.9	35.0	40.0	-5.0	35.1	40.0	-4.9
H57	30.3	40.0	-9.7	33.6	40.0	-6.4	34.5	40.0	-5.5	34.7	40.0	-5.3
H58	27.2	40.0	-12.8	30.6	40.0	-9.4	31.5	40.0	-8.5	31.6	40.0	-8.4
H61	29.9	40.0	-10.1	33.2	40.0	-6.8	34.1	40.0	-5.9	34.3	40.0	-5.7
H63	30.3	40.0	-9.7	33.7	40.0	-6.3	34.5	40.0	-5.5	34.7	40.0	-5.3
H64	29.7	40.0	-10.3	33.1	40.0	-6.9	33.9	40.0	-6.1	34.1	40.0	-5.9
H65	29.9	40.0	-10.1	33.2	40.0	-6.8	34.1	40.0	-5.9	34.2	40.0	-5.8
H67	30.8	40.0	-9.2	34.2	40.0	-5.8	35.1	40.0	-4.9	35.2	40.0	-4.8
H70	30.8	40.0	-9.2	34.1	40.0	-5.9	35.0	40.0	-5.0	35.1	40.0	-4.9
H71	30.3	40.0	-9.7	33.6	40.0	-6.4	34.5	40.0	-5.5	34.7	40.0	-5.3
H72	31.1	40.0	-8.9	34.5	40.0	-5.5	35.3	40.0	-4.7	35.5	40.0	-4.5
H75	36.7	45.0	-8.3	40.0	45.0	-5.0	40.9	45.0	-4.1	41.0	45.0	-4.0
H77	35.0	40.0	-5.0	38.3	40.0	-1.7	39.2	40.0	-0.8	39.3	40.2	-0.9
H78	30.8	40.0	-9.2	34.1	40.0	-5.9	35.0	40.0	-5.0	35.2	40.0	-4.8
H79	33.9	40.0	-6.1	37.2	40.0	-2.8	38.1	40.0	-1.9	38.2	40.2	-2.0
H80	33.7	40.0	-6.3	37.1	40.0	-2.9	37.9	40.0	-2.1	38.1	40.2	-2.1
H81	33.7	45.0	-11.3	37.1	45.0	-7.9	37.9	45.0	-7.1	38.1	45.0	-6.9
H82	33.6	45.0	-11.4	37.0	45.0	-8.0	37.8	45.0	-7.2	38.0	45.0	-7.0
H83	31.4	45.0	-13.6	34.8	45.0	-10.2	35.6	45.0	-9.4	35.8	45.0	-9.2
H84	31.3	40.0	-8.7	34.6	40.0	-5.4	35.5	40.0	-4.5	35.6	40.0	-4.4
H85	30.9	40.0	-9.1	34.3	40.0	-5.7	35.1	40.0	-4.9	35.3	40.0	-4.7
H86	30.5	40.0	-9.5	33.9	40.0	-6.1	34.7	40.0	-5.3	34.9	40.0	-5.1
H87	30.7	40.0	-9.3	34.1	40.0	-5.9	34.9	40.0	-5.1	35.1	40.0	-4.9
H88	31.0	40.0	-9.0	34.3	40.0	-5.7	35.2	40.0	-4.8	35.4	40.0	-4.6
H89	30.5	40.0	-9.5	33.9	40.0	-6.1	34.7	40.0	-5.3	34.9	40.0	-5.1

Property ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H2	30.5	40.0	-9.5	30.5	40.0	-9.5	30.5	40.0	-9.5	30.5	40.0	-9.5
H3	30.5	40.0	-9.5	30.5	40.0	-9.5	30.5	40.0	-9.5	30.5	40.0	-9.5
H4	31.8	40.2	-8.4	31.8	40.2	-8.4	31.8	40.2	-8.4	31.8	40.2	-8.4
H5	29.7	40.0	-10.3	29.7	40.0	-10.3	29.7	40.0	-10.3	29.7	40.0	-10.3
H8	30.2	40.0	-9.8	30.2	40.0	-9.8	30.2	40.0	-9.8	30.2	40.0	-9.8
H12	32.9	40.0	-7.1	32.9	40.0	-7.1	32.9	40.0	-7.1	32.9	40.0	-7.1
H13	33.2	40.0	-6.8	33.2	40.0	-6.8	33.2	40.0	-6.8	33.2	40.0	-6.8
H14	33.1	40.0	-6.9	33.1	40.0	-6.9	33.1	40.0	-6.9	33.1	40.0	-6.9
H15	34.9	45.0	-10.1	34.9	45.0	-10.1	34.9	45.0	-10.1	34.9	45.1	-10.2
H16	33.1	40.0	-6.9	33.1	40.0	-6.9	33.1	40.0	-6.9	33.1	40.0	-6.9
H17	34.8	45.0	-10.2	34.8	45.0	-10.2	34.8	45.0	-10.2	34.8	45.1	-10.3
H18	33.3	40.0	-6.7	33.3	40.0	-6.7	33.3	40.0	-6.7	33.3	40.0	-6.7
H19	33.3	40.0	-6.7	33.3	40.0	-6.7	33.3	40.0	-6.7	33.3	40.0	-6.7
H20	35.4	40.0	-4.6	35.4	40.0	-4.6	35.4	41.8	-6.4	35.4	45.1	-9.7
H21	33.6	40.0	-6.4	33.6	40.0	-6.4	33.6	40.0	-6.4	33.6	40.0	-6.4
H22	33.6	40.0	-6.4	33.6	40.0	-6.4	33.6	40.0	-6.4	33.6	40.0	-6.4
H23	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	41.8	-6.6	35.2	45.1	-9.9
H24	34.8	40.0	-5.2	34.8	40.0	-5.2	34.8	41.8	-7.0	34.8	45.1	-10.3
H25	33.5	40.0	-6.5	33.5	40.0	-6.5	33.5	40.0	-6.5	33.5	40.0	-6.5
H26	34.6	40.0	-5.4	34.6	40.0	-5.4	34.6	41.8	-7.2	34.6	45.1	-10.5
H27	33.5	40.0	-6.5	33.5	40.0	-6.5	33.5	40.0	-6.5	33.5	40.0	-6.5
H28	34.1	40.0	-5.9	34.1	40.0	-5.9	34.1	41.8	-7.7	34.1	45.1	-11.0
H29	33.4	40.0	-6.6	33.4	40.0	-6.6	33.4	40.0	-6.6	33.4	40.0	-6.6
H30	33.1	40.0	-6.9	33.1	40.0	-6.9	33.1	40.0	-6.9	33.1	40.0	-6.9
H33	33.9	40.0	-6.1	33.9	40.0	-6.1	33.9	41.8	-7.9	33.9	45.1	-11.2
H34	33.8	40.0	-6.2	33.8	40.0	-6.2	33.8	41.8	-8.0	33.8	45.1	-11.3
H35	33.0	40.0	-7.0	33.0	40.0	-7.0	33.0	40.0	-7.0	33.0	40.0	-7.0
H36	33.9	40.0	-6.1	33.9	40.0	-6.1	33.9	41.8	-7.9	33.9	45.1	-11.2
H37	32.9	40.0	-7.1	32.9	40.0	-7.1	32.9	40.0	-7.1	32.9	40.0	-7.1
H38	33.9	40.0	-6.1	33.9	40.0	-6.1	33.9	41.8	-7.9	33.9	45.1	-11.2
H39	33.8	40.0	-6.2	33.8	40.0	-6.2	33.8	41.8	-8.0	33.8	45.1	-11.3
H41	33.8	40.0	-6.2	33.8	40.0	-6.2	33.8	41.8	-8.0	33.8	45.1	-11.3
H42	32.8	40.0	-7.2	32.8	40.0	-7.2	32.8	40.0	-7.2	32.8	40.0	-7.2
H43	33.7	40.0	-6.3	33.7	40.0	-6.3	33.7	41.8	-8.1	33.7	45.1	-11.4
H44	33.4	40.0	-6.6	33.4	40.0	-6.6	33.4	41.8	-8.4	33.4	45.1	-11.7
H45	33.2	40.0	-6.8	33.2	40.0	-6.8	33.2	41.8	-8.6	33.2	45.1	-11.9
H46	37.2	41.3	-4.1	37.2	43.3	-6.1	37.2	45.3	-8.1	37.2	47.4	-10.2

H47	34.9	41.3	-6.4	34.9	43.4	-8.5	34.9	45.5	-10.6	34.9	47.6	-12.7
H48	31.6	40.0	-8.4	31.6	40.0	-8.4	31.6	40.0	-8.4	31.6	40.0	-8.4
H49	34.4	41.3	-6.9	34.4	43.4	-9.0	34.4	45.5	-11.1	34.4	47.6	-13.2
H53	35.7	41.3	-5.6	35.7	43.4	-7.7	35.7	45.5	-9.8	35.7	47.6	-11.9
H54	35.4	41.3	-5.9	35.4	43.4	-8.0	35.4	45.5	-10.1	35.4	47.6	-12.2
H56	35.1	41.3	-6.2	35.1	43.4	-8.3	35.1	45.5	-10.4	35.1	47.6	-12.5
H57	34.7	41.3	-6.6	34.7	43.4	-8.7	34.7	45.5	-10.8	34.7	47.6	-12.9
H58	31.6	40.0	-8.4	31.6	40.0	-8.4	31.6	40.0	-8.4	31.6	40.0	-8.4
H61	34.3	41.3	-7.0	34.3	43.4	-9.1	34.3	45.5	-11.2	34.3	47.6	-13.3
H63	34.7	40.0	-5.3	34.7	40.0	-5.3	34.7	41.8	-7.1	34.7	45.1	-10.4
H64	34.1	40.0	-5.9	34.1	40.0	-5.9	34.1	41.8	-7.7	34.1	45.1	-11.0
H65	34.3	40.0	-5.7	34.3	40.0	-5.7	34.3	41.8	-7.5	34.3	45.1	-10.8
H67	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	41.8	-6.6	35.2	45.1	-9.9
H70	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	41.8	-6.6	35.2	45.1	-9.9
H71	34.7	40.0	-5.3	34.7	40.0	-5.3	34.7	41.8	-7.1	34.7	45.1	-10.4
H72	35.5	40.0	-4.5	35.5	40.0	-4.5	35.5	41.8	-6.3	35.5	45.1	-9.6
H75	41.1	45.0	-3.9	41.1	46.2	-5.1	41.1	49.4	-8.3	41.1	52.4	-11.3
H77	39.4	43.1	-3.7	39.4	46.2	-6.8	39.4	49.4	-10.0	39.4	52.4	-13.0
H78	35.2	40.0	-4.8	35.2	40.0	-4.8	35.2	41.8	-6.6	35.2	45.1	-9.9
H79	38.3	43.1	-4.8	38.3	46.2	-7.9	38.3	49.4	-11.1	38.3	52.4	-14.1
H80	38.1	43.1	-5.0	38.1	46.2	-8.1	38.1	49.4	-11.3	38.1	52.4	-14.3
H81	38.1	45.0	-6.9	38.1	46.2	-8.1	38.1	49.4	-11.3	38.1	52.4	-14.3
H82	38.0	45.0	-7.0	38.0	46.2	-8.2	38.0	49.4	-11.4	38.0	52.4	-14.4
H83	35.8	45.0	-9.2	35.8	45.0	-9.2	35.8	45.5	-9.7	35.8	47.6	-11.8
H84	35.7	41.3	-5.6	35.7	43.4	-7.7	35.7	45.5	-9.8	35.7	47.6	-11.9
H85	35.3	41.3	-6.0	35.3	43.4	-8.1	35.3	45.5	-10.2	35.3	47.6	-12.3
H86	34.9	41.3	-6.4	34.9	43.4	-8.5	34.9	45.5	-10.6	34.9	47.6	-12.7
H87	35.1	41.3	-6.2	35.1	43.4	-8.3	35.1	45.5	-10.4	35.1	47.6	-12.5
H88	35.4	41.3	-5.9	35.4	43.4	-8.0	35.4	45.5	-10.1	35.4	47.6	-12.2
H89	34.9	41.3	-6.4	34.9	43.4	-8.5	34.9	45.5	-10.6	34.9	47.6	-12.7

The term L_p is used to denote the predicted noise level due to the operation of the proposed wind farm
The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended noise limit

Table 11.20: Comparison of Predicted Noise Levels and Night-Time Limits ($L_{A90,10min}$ dB)

Property ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H2	18.6	43.0	-24.4	18.6	43.0	-24.4	18.6	43.0	-24.4	21.8	43.0	-21.2
H3	18.6	43.0	-24.4	18.6	43.0	-24.4	18.6	43.0	-24.4	21.8	43.0	-21.2
H4	19.9	43.0	-23.1	19.9	43.0	-23.1	19.9	43.0	-23.1	23.2	43.0	-19.8
H5	17.8	43.0	-25.2	17.8	43.0	-25.2	17.8	43.0	-25.2	21.0	43.0	-22.0
H8	18.3	43.0	-24.7	18.3	43.0	-24.7	18.3	43.0	-24.7	21.6	43.0	-21.4
H12	21.0	43.0	-22.0	21.0	43.0	-22.0	21.0	43.0	-22.0	24.3	43.0	-18.7
H13	21.3	43.0	-21.7	21.3	43.0	-21.7	21.3	43.0	-21.7	24.5	43.0	-18.5
H14	21.2	43.0	-21.8	21.2	43.0	-21.8	21.2	43.0	-21.8	24.5	43.0	-18.5
H15	23.0	45.0	-22.0	23.0	45.0	-22.0	23.0	45.0	-22.0	26.3	45.0	-18.7
H16	21.2	43.0	-21.8	21.2	43.0	-21.8	21.2	43.0	-21.8	24.5	43.0	-18.5
H17	22.9	45.0	-22.1	22.9	45.0	-22.1	22.9	45.0	-22.1	26.2	45.0	-18.8
H18	21.4	43.0	-21.6	21.4	43.0	-21.6	21.4	43.0	-21.6	24.6	43.0	-18.4
H19	21.4	43.0	-21.6	21.4	43.0	-21.6	21.4	43.0	-21.6	24.7	43.0	-18.3
H20	23.5	43.0	-19.5	23.5	43.0	-19.5	23.5	43.0	-19.5	26.8	43.0	-16.2
H21	21.7	43.0	-21.3	21.7	43.0	-21.3	21.7	43.0	-21.3	25.0	43.0	-18.0
H22	21.7	43.0	-21.3	21.7	43.0	-21.3	21.7	43.0	-21.3	25.0	43.0	-18.0
H23	23.3	43.0	-19.7	23.3	43.0	-19.7	23.3	43.0	-19.7	26.6	43.0	-16.4
H24	22.9	43.0	-20.1	22.9	43.0	-20.1	22.9	43.0	-20.1	26.2	43.0	-16.8
H25	21.6	43.0	-21.4	21.6	43.0	-21.4	21.6	43.0	-21.4	24.9	43.0	-18.1
H26	22.7	43.0	-20.3	22.7	43.0	-20.3	22.7	43.0	-20.3	25.9	43.0	-17.1
H27	21.6	43.0	-21.4	21.6	43.0	-21.4	21.6	43.0	-21.4	24.8	43.0	-18.2
H28	22.2	43.0	-20.8	22.2	43.0	-20.8	22.2	43.0	-20.8	25.5	43.0	-17.5
H29	21.5	43.0	-21.5	21.5	43.0	-21.5	21.5	43.0	-21.5	24.7	43.0	-18.3
H30	21.2	43.0	-21.8	21.2	43.0	-21.8	21.2	43.0	-21.8	24.5	43.0	-18.5
H33	22.0	43.0	-21.0	22.0	43.0	-21.0	22.0	43.0	-21.0	25.3	43.0	-17.7
H34	21.9	43.0	-21.1	21.9	43.0	-21.1	21.9	43.0	-21.1	25.2	43.0	-17.8
H35	21.1	43.0	-21.9	21.1	43.0	-21.9	21.1	43.0	-21.9	24.3	43.0	-18.7
H36	22.0	43.0	-21.0	22.0	43.0	-21.0	22.0	43.0	-21.0	25.3	43.0	-17.7
H37	21.0	43.0	-22.0	21.0	43.0	-22.0	21.0	43.0	-22.0	24.2	43.0	-18.8
H38	22.0	43.0	-21.0	22.0	43.0	-21.0	22.0	43.0	-21.0	25.3	43.0	-17.7
H39	21.9	43.0	-21.1	21.9	43.0	-21.1	21.9	43.0	-21.1	25.2	43.0	-17.8
H41	21.9	43.0	-21.1	21.9	43.0	-21.1	21.9	43.0	-21.1	25.2	43.0	-17.8
H42	20.9	43.0	-22.1	20.9	43.0	-22.1	20.9	43.0	-22.1	24.2	43.0	-18.8
H43	21.8	43.0	-21.2	21.8	43.0	-21.2	21.8	43.0	-21.2	25.0	43.0	-18.0
H44	21.5	43.0	-21.5	21.5	43.0	-21.5	21.5	43.0	-21.5	24.8	43.0	-18.2
H45	21.3	43.0	-21.7	21.3	43.0	-21.7	21.3	43.0	-21.7	24.6	43.0	-18.4
H46	25.3	43.0	-17.7	25.3	43.0	-17.7	25.3	43.0	-17.7	28.6	43.0	-14.4

H47	23.0	43.0	-20.0	23.0	43.0	-20.0	23.0	43.0	-20.0	26.3	43.0	-16.7
H48	19.7	43.0	-23.3	19.7	43.0	-23.3	19.7	43.0	-23.3	23.0	43.0	-20.0
H49	22.5	43.0	-20.5	22.5	43.0	-20.5	22.5	43.0	-20.5	25.8	43.0	-17.2
H53	23.8	43.0	-19.2	23.8	43.0	-19.2	23.8	43.0	-19.2	27.1	43.0	-15.9
H54	23.5	43.0	-19.5	23.5	43.0	-19.5	23.5	43.0	-19.5	26.8	43.0	-16.2
H56	23.2	43.0	-19.8	23.2	43.0	-19.8	23.2	43.0	-19.8	26.5	43.0	-16.5
H57	22.8	43.0	-20.2	22.8	43.0	-20.2	22.8	43.0	-20.2	26.1	43.0	-16.9
H58	19.7	43.0	-23.3	19.7	43.0	-23.3	19.7	43.0	-23.3	23.0	43.0	-20.0
H61	22.4	43.0	-20.6	22.4	43.0	-20.6	22.4	43.0	-20.6	25.7	43.0	-17.3
H63	22.8	43.0	-20.2	22.8	43.0	-20.2	22.8	43.0	-20.2	26.1	43.0	-16.9
H64	22.2	43.0	-20.8	22.2	43.0	-20.8	22.2	43.0	-20.8	25.5	43.0	-17.5
H65	22.4	43.0	-20.6	22.4	43.0	-20.6	22.4	43.0	-20.6	25.6	43.0	-17.4
H67	23.3	43.0	-19.7	23.3	43.0	-19.7	23.3	43.0	-19.7	26.6	43.0	-16.4
H70	23.3	43.0	-19.7	23.3	43.0	-19.7	23.3	43.0	-19.7	26.5	43.0	-16.5
H71	22.8	43.0	-20.2	22.8	43.0	-20.2	22.8	43.0	-20.2	26.1	43.0	-16.9
H72	23.6	43.0	-19.4	23.6	43.0	-19.4	23.6	43.0	-19.4	26.9	43.0	-16.1
H75	29.2	45.0	-15.8	29.2	45.0	-15.8	29.2	45.0	-15.8	32.4	45.0	-12.6
H77	27.5	43.0	-15.5	27.5	43.0	-15.5	27.5	43.0	-15.5	30.7	43.0	-12.3
H78	23.3	43.0	-19.7	23.3	43.0	-19.7	23.3	43.0	-19.7	26.5	43.0	-16.5
H79	26.4	43.0	-16.6	26.4	43.0	-16.6	26.4	43.0	-16.6	29.6	43.0	-13.4
H80	26.2	43.0	-16.8	26.2	43.0	-16.8	26.2	43.0	-16.8	29.5	43.0	-13.5
H81	26.2	45.0	-18.8	26.2	45.0	-18.8	26.2	45.0	-18.8	29.5	45.0	-15.5
H82	26.1	45.0	-18.9	26.1	45.0	-18.9	26.1	45.0	-18.9	29.4	45.0	-15.6
H83	23.9	45.0	-21.1	23.9	45.0	-21.1	23.9	45.0	-21.1	27.2	45.0	-17.8
H84	23.8	43.0	-19.2	23.8	43.0	-19.2	23.8	43.0	-19.2	27.0	43.0	-16.0
H85	23.4	43.0	-19.6	23.4	43.0	-19.6	23.4	43.0	-19.6	26.7	43.0	-16.3
H86	23.0	43.0	-20.0	23.0	43.0	-20.0	23.0	43.0	-20.0	26.3	43.0	-16.7
H87	23.2	43.0	-19.8	23.2	43.0	-19.8	23.2	43.0	-19.8	26.5	43.0	-16.5
H88	23.5	43.0	-19.5	23.5	43.0	-19.5	23.5	43.0	-19.5	26.8	43.0	-16.2
H89	23.0	43.0	-20.0	23.0	43.0	-20.0	23.0	43.0	-20.0	26.3	43.0	-16.7

Property ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H2	26.1	43.0	-16.9	29.4	43.0	-13.6	30.3	43.0	-12.7	30.4	43.0	-12.6
H3	26.1	43.0	-16.9	29.4	43.0	-13.6	30.3	43.0	-12.7	30.4	43.0	-12.6
H4	27.4	43.0	-15.6	30.8	43.0	-12.2	31.6	43.0	-11.4	31.8	43.0	-11.2
H5	25.3	43.0	-17.7	28.6	43.0	-14.4	29.5	43.0	-13.5	29.6	43.0	-13.4
H8	25.8	43.0	-17.2	29.2	43.0	-13.8	30.0	43.0	-13.0	30.2	43.0	-12.8
H12	28.5	43.0	-14.5	31.8	43.0	-11.2	32.7	43.0	-10.3	32.9	43.0	-10.1
H13	28.8	43.0	-14.2	32.1	43.0	-10.9	33.0	43.0	-10.0	33.1	43.0	-9.9
H14	28.7	43.0	-14.3	32.1	43.0	-10.9	33.0	43.0	-10.0	33.1	43.0	-9.9
H15	30.5	45.0	-14.5	33.9	45.0	-11.1	34.7	45.0	-10.3	34.9	45.0	-10.1
H16	28.7	43.0	-14.3	32.1	43.0	-10.9	32.9	43.0	-10.1	33.1	43.0	-9.9
H17	30.4	45.0	-14.6	33.8	45.0	-11.2	34.6	45.0	-10.4	34.8	45.0	-10.2
H18	28.9	43.0	-14.1	32.2	43.0	-10.8	33.1	43.0	-9.9	33.2	43.0	-9.8
H19	28.9	43.0	-14.1	32.3	43.0	-10.7	33.1	43.0	-9.9	33.3	43.0	-9.7
H20	31.0	43.0	-12.0	34.4	43.0	-8.6	35.2	43.0	-7.8	35.4	43.0	-7.6
H21	29.2	43.0	-13.8	32.5	43.0	-10.5	33.4	43.0	-9.6	33.6	43.0	-9.4
H22	29.3	43.0	-13.7	32.6	43.0	-10.4	33.5	43.0	-9.5	33.6	43.0	-9.4
H23	30.8	43.0	-12.2	34.1	43.0	-8.9	35.0	43.0	-8.0	35.2	43.0	-7.8
H24	30.5	43.0	-12.5	33.8	43.0	-9.2	34.7	43.0	-8.3	34.8	43.0	-8.2
H25	29.1	43.0	-13.9	32.4	43.0	-10.6	33.3	43.0	-9.7	33.5	43.0	-9.5
H26	30.2	43.0	-12.8	33.5	43.0	-9.5	34.4	43.0	-8.6	34.5	43.0	-8.5
H27	29.1	43.0	-13.9	32.4	43.0	-10.6	33.3	43.0	-9.7	33.4	43.0	-9.6
H28	29.7	43.0	-13.3	33.1	43.0	-9.9	34.0	43.0	-9.0	34.1	43.0	-8.9
H29	29.0	43.0	-14.0	32.3	43.0	-10.7	33.2	43.0	-9.8	33.3	43.0	-9.7
H30	28.7	43.0	-14.3	32.0	43.0	-11.0	32.9	43.0	-10.1	33.1	43.0	-9.9
H33	29.6	43.0	-13.4	32.9	43.0	-10.1	33.8	43.0	-9.2	33.9	43.0	-9.1
H34	29.4	43.0	-13.6	32.8	43.0	-10.2	33.7	43.0	-9.3	33.8	43.0	-9.2
H35	28.6	43.0	-14.4	31.9	43.0	-11.1	32.8	43.0	-10.2	32.9	43.0	-10.1
H36	29.5	43.0	-13.5	32.9	43.0	-10.1	33.8	43.0	-9.2	33.9	43.0	-9.1
H37	28.5	43.0	-14.5	31.8	43.0	-11.2	32.7	43.0	-10.3	32.8	43.0	-10.2
H38	29.5	43.0	-13.5	32.9	43.0	-10.1	33.7	43.0	-9.3	33.9	43.0	-9.1
H39	29.4	43.0	-13.6	32.8	43.0	-10.2	33.6	43.0	-9.4	33.8	43.0	-9.2
H41	29.4	43.0	-13.6	32.7	43.0	-10.3	33.6	43.0	-9.4	33.8	43.0	-9.2
H42	28.4	43.0	-14.6	31.8	43.0	-11.2	32.6	43.0	-10.4	32.8	43.0	-10.2
H43	29.3	43.0	-13.7	32.6	43.0	-10.4	33.5	43.0	-9.5	33.6	43.0	-9.4
H44	29.0	43.0	-14.0	32.4	43.0	-10.6	33.2	43.0	-9.8	33.4	43.0	-9.6
H45	28.8	43.0	-14.2	32.2	43.0	-10.8	33.0	43.0	-10.0	33.2	43.0	-9.8
H46	32.8	43.0	-10.2	36.1	43.0	-6.9	37.0	43.0	-6.0	37.2	43.0	-5.8

H47	30.5	43.0	-12.5	33.8	43.0	-9.2	34.7	43.0	-8.3	34.9	43.0	-8.1
H48	27.2	43.0	-15.8	30.6	43.0	-12.4	31.4	43.0	-11.6	31.6	43.0	-11.4
H49	30.0	43.0	-13.0	33.4	43.0	-9.6	34.2	43.0	-8.8	34.4	43.0	-8.6
H53	31.3	43.0	-11.7	34.6	43.0	-8.4	35.5	43.0	-7.5	35.7	43.0	-7.3
H54	31.0	43.0	-12.0	34.4	43.0	-8.6	35.3	43.0	-7.7	35.4	43.0	-7.6
H56	30.7	43.0	-12.3	34.1	43.0	-8.9	35.0	43.0	-8.0	35.1	43.0	-7.9
H57	30.3	43.0	-12.7	33.6	43.0	-9.4	34.5	43.0	-8.5	34.7	43.0	-8.3
H58	27.2	43.0	-15.8	30.6	43.0	-12.4	31.5	43.0	-11.5	31.6	43.0	-11.4
H61	29.9	43.0	-13.1	33.2	43.0	-9.8	34.1	43.0	-8.9	34.3	43.0	-8.7
H63	30.3	43.0	-12.7	33.7	43.0	-9.3	34.5	43.0	-8.5	34.7	43.0	-8.3
H64	29.7	43.0	-13.3	33.1	43.0	-9.9	33.9	43.0	-9.1	34.1	43.0	-8.9
H65	29.9	43.0	-13.1	33.2	43.0	-9.8	34.1	43.0	-8.9	34.2	43.0	-8.8
H67	30.8	43.0	-12.2	34.2	43.0	-8.8	35.1	43.0	-7.9	35.2	43.0	-7.8
H70	30.8	43.0	-12.2	34.1	43.0	-8.9	35.0	43.0	-8.0	35.1	43.0	-7.9
H71	30.3	43.0	-12.7	33.6	43.0	-9.4	34.5	43.0	-8.5	34.7	43.0	-8.3
H72	31.1	43.0	-11.9	34.5	43.0	-8.5	35.3	43.0	-7.7	35.5	43.0	-7.5
H75	36.7	45.0	-8.3	40.0	45.0	-5.0	40.9	45.0	-4.1	41.0	45.0	-4.0
H77	35.0	43.0	-8.0	38.3	43.0	-4.7	39.2	43.0	-3.8	39.3	43.0	-3.7
H78	30.8	43.0	-12.2	34.1	43.0	-8.9	35.0	43.0	-8.0	35.2	43.0	-7.8
H79	33.9	43.0	-9.1	37.2	43.0	-5.8	38.1	43.0	-4.9	38.2	43.0	-4.8
H80	33.7	43.0	-9.3	37.1	43.0	-5.9	37.9	43.0	-5.1	38.1	43.0	-4.9
H81	33.7	45.0	-11.3	37.1	45.0	-7.9	37.9	45.0	-7.1	38.1	45.0	-6.9
H82	33.6	45.0	-11.4	37.0	45.0	-8.0	37.8	45.0	-7.2	38.0	45.0	-7.0
H83	31.4	45.0	-13.6	34.8	45.0	-10.2	35.6	45.0	-9.4	35.8	45.0	-9.2
H84	31.3	43.0	-11.7	34.6	43.0	-8.4	35.5	43.0	-7.5	35.6	43.0	-7.4
H85	30.9	43.0	-12.1	34.3	43.0	-8.7	35.1	43.0	-7.9	35.3	43.0	-7.7
H86	30.5	43.0	-12.5	33.9	43.0	-9.1	34.7	43.0	-8.3	34.9	43.0	-8.1
H87	30.7	43.0	-12.3	34.1	43.0	-8.9	34.9	43.0	-8.1	35.1	43.0	-7.9
H88	31.0	43.0	-12.0	34.3	43.0	-8.7	35.2	43.0	-7.8	35.4	43.0	-7.6
H89	30.5	43.0	-12.5	33.9	43.0	-9.1	34.7	43.0	-8.3	34.9	43.0	-8.1

Property ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H2	30.5	43.0	-12.5	30.5	43.0	-12.5	30.5	43.0	-12.5	30.5	43.0	-12.5
H3	30.5	43.0	-12.5	30.5	43.0	-12.5	30.5	43.0	-12.5	30.5	43.0	-12.5
H4	31.8	43.0	-11.2	31.8	43.0	-11.2	31.8	43.0	-11.2	31.8	43.0	-11.2
H5	29.7	43.0	-13.3	29.7	43.0	-13.3	29.7	43.0	-13.3	29.7	43.0	-13.3
H8	30.2	43.0	-12.8	30.2	43.0	-12.8	30.2	43.0	-12.8	30.2	43.0	-12.8
H12	32.9	43.0	-10.1	32.9	43.0	-10.1	32.9	43.0	-10.1	32.9	43.0	-10.1
H13	33.2	43.0	-9.8	33.2	43.0	-9.8	33.2	43.0	-9.8	33.2	43.0	-9.8
H14	33.1	43.0	-9.9	33.1	43.0	-9.9	33.1	43.0	-9.9	33.1	43.0	-9.9
H15	34.9	45.0	-10.1	34.9	45.0	-10.1	34.9	45.0	-10.1	34.9	45.0	-10.1
H16	33.1	43.0	-9.9	33.1	43.0	-9.9	33.1	43.0	-9.9	33.1	43.0	-9.9
H17	34.8	45.0	-10.2	34.8	45.0	-10.2	34.8	45.0	-10.2	34.8	45.0	-10.2
H18	33.3	43.0	-9.7	33.3	43.0	-9.7	33.3	43.0	-9.7	33.3	43.0	-9.7
H19	33.3	43.0	-9.7	33.3	43.0	-9.7	33.3	43.0	-9.7	33.3	43.0	-9.7
H20	35.4	43.0	-7.6	35.4	43.0	-7.6	35.4	43.0	-7.6	35.4	43.0	-7.6
H21	33.6	43.0	-9.4	33.6	43.0	-9.4	33.6	43.0	-9.4	33.6	43.0	-9.4
H22	33.6	43.0	-9.4	33.6	43.0	-9.4	33.6	43.0	-9.4	33.6	43.0	-9.4
H23	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8
H24	34.8	43.0	-8.2	34.8	43.0	-8.2	34.8	43.0	-8.2	34.8	43.0	-8.2
H25	33.5	43.0	-9.5	33.5	43.0	-9.5	33.5	43.0	-9.5	33.5	43.0	-9.5
H26	34.6	43.0	-8.4	34.6	43.0	-8.4	34.6	43.0	-8.4	34.6	43.0	-8.4
H27	33.5	43.0	-9.5	33.5	43.0	-9.5	33.5	43.0	-9.5	33.5	43.0	-9.5
H28	34.1	43.0	-8.9	34.1	43.0	-8.9	34.1	43.0	-8.9	34.1	43.0	-8.9
H29	33.4	43.0	-9.6	33.4	43.0	-9.6	33.4	43.0	-9.6	33.4	43.0	-9.6
H30	33.1	43.0	-9.9	33.1	43.0	-9.9	33.1	43.0	-9.9	33.1	43.0	-9.9
H33	33.9	43.0	-9.1	33.9	43.0	-9.1	33.9	43.0	-9.1	33.9	43.0	-9.1
H34	33.8	43.0	-9.2	33.8	43.0	-9.2	33.8	43.0	-9.2	33.8	43.0	-9.2
H35	33.0	43.0	-10.0	33.0	43.0	-10.0	33.0	43.0	-10.0	33.0	43.0	-10.0
H36	33.9	43.0	-9.1	33.9	43.0	-9.1	33.9	43.0	-9.1	33.9	43.0	-9.1
H37	32.9	43.0	-10.1	32.9	43.0	-10.1	32.9	43.0	-10.1	32.9	43.0	-10.1
H38	33.9	43.0	-9.1	33.9	43.0	-9.1	33.9	43.0	-9.1	33.9	43.0	-9.1
H39	33.8	43.0	-9.2	33.8	43.0	-9.2	33.8	43.0	-9.2	33.8	43.0	-9.2
H41	33.8	43.0	-9.2	33.8	43.0	-9.2	33.8	43.0	-9.2	33.8	43.0	-9.2
H42	32.8	43.0	-10.2	32.8	43.0	-10.2	32.8	43.0	-10.2	32.8	43.0	-10.2
H43	33.7	43.0	-9.3	33.7	43.0	-9.3	33.7	43.0	-9.3	33.7	43.0	-9.3
H44	33.4	43.0	-9.6	33.4	43.0	-9.6	33.4	43.0	-9.6	33.4	43.0	-9.6
H45	33.2	43.0	-9.8	33.2	43.0	-9.8	33.2	43.0	-9.8	33.2	43.0	-9.8
H46	37.2	43.0	-5.8	37.2	43.2	-6.0	37.2	46.2	-9.0	37.2	49.5	-12.3

H47	34.9	43.0	-8.1	34.9	43.0	-8.1	34.9	44.3	-9.4	34.9	46.4	-11.5
H48	31.6	43.0	-11.4	31.6	43.0	-11.4	31.6	43.0	-11.4	31.6	43.0	-11.4
H49	34.4	43.0	-8.6	34.4	43.0	-8.6	34.4	44.3	-9.9	34.4	46.4	-12.0
H53	35.7	43.0	-7.3	35.7	43.0	-7.3	35.7	44.3	-8.6	35.7	46.4	-10.7
H54	35.4	43.0	-7.6	35.4	43.0	-7.6	35.4	44.3	-8.9	35.4	46.4	-11.0
H56	35.1	43.0	-7.9	35.1	43.0	-7.9	35.1	44.3	-9.2	35.1	46.4	-11.3
H57	34.7	43.0	-8.3	34.7	43.0	-8.3	34.7	44.3	-9.6	34.7	46.4	-11.7
H58	31.6	43.0	-11.4	31.6	43.0	-11.4	31.6	43.0	-11.4	31.6	43.0	-11.4
H61	34.3	43.0	-8.7	34.3	43.0	-8.7	34.3	44.3	-10.0	34.3	46.4	-12.1
H63	34.7	43.0	-8.3	34.7	43.0	-8.3	34.7	43.0	-8.3	34.7	43.0	-8.3
H64	34.1	43.0	-8.9	34.1	43.0	-8.9	34.1	43.0	-8.9	34.1	43.0	-8.9
H65	34.3	43.0	-8.7	34.3	43.0	-8.7	34.3	43.0	-8.7	34.3	43.0	-8.7
H67	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8
H70	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8
H71	34.7	43.0	-8.3	34.7	43.0	-8.3	34.7	43.0	-8.3	34.7	43.0	-8.3
H72	35.5	43.0	-7.5	35.5	43.0	-7.5	35.5	43.0	-7.5	35.5	43.0	-7.5
H75	41.1	45.0	-3.9	41.1	45.0	-3.9	41.1	47.3	-6.2	41.1	50.0	-8.9
H77	39.4	43.0	-3.6	39.4	44.6	-5.2	39.4	47.3	-7.9	39.4	50.0	-10.6
H78	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8	35.2	43.0	-7.8
H79	38.3	43.0	-4.7	38.3	44.6	-6.3	38.3	47.3	-9.0	38.3	50.0	-11.7
H80	38.1	43.0	-4.9	38.1	44.6	-6.5	38.1	47.3	-9.2	38.1	50.0	-11.9
H81	38.1	45.0	-6.9	38.1	45.0	-6.9	38.1	47.3	-9.2	38.1	50.0	-11.9
H82	38.0	45.0	-7.0	38.0	45.0	-7.0	38.0	47.3	-9.3	38.0	50.0	-12.0
H83	35.8	45.0	-9.2	35.8	45.0	-9.2	35.8	45.0	-9.2	35.8	46.4	-10.6
H84	35.7	43.0	-7.3	35.7	43.0	-7.3	35.7	44.3	-8.6	35.7	46.4	-10.7
H85	35.3	43.0	-7.7	35.3	43.0	-7.7	35.3	44.3	-9.0	35.3	46.4	-11.1
H86	34.9	43.0	-8.1	34.9	43.0	-8.1	34.9	44.3	-9.4	34.9	46.4	-11.5
H87	35.1	43.0	-7.9	35.1	43.0	-7.9	35.1	44.3	-9.2	35.1	46.4	-11.3
H88	35.4	43.0	-7.6	35.4	43.0	-7.6	35.4	44.3	-8.9	35.4	46.4	-11.0
H89	34.9	43.0	-8.1	34.9	43.0	-8.1	34.9	44.3	-9.4	34.9	46.4	-11.5

The term L_p is used to denote the predicted noise level due to the operation of the proposed wind farm

The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended limit

Potential Construction Impacts

11.93 Primary activities creating noise during the construction period include the construction of the turbine bases; the erection of the turbines; the excavation of trenches for cables; and the construction of associated hard standings, access tracks and construction compound(s). Noise from vehicles on local roads and access tracks would also arise due to the delivery of turbine components and construction materials, notably aggregates, concrete and steel reinforcement.

11.94 The exact methodology and timing of construction activities have not yet been defined and a reliable assessment of expected construction noise levels is not possible as a result. However, works expected to be undertaken at or around the proposed turbine locations would occur at distances that are highly unlikely to result in noise levels that would breach typical criteria at neighbouring residences in this regard.

11.95 The access route for the Proposed Development is expected to pass by some dwellings and upgrade works to local roads are expected to occur near by some dwellings. In these instances, the level of noise generated by construction works could be close to the thresholds defined as part of the 'ABC method' discussed earlier. As a result, typical construction noise mitigation measures are provided in the **Mitigation** section of this chapter at **11.101** – **11.105** which will minimise noise as far as reasonably practicable and/or reasonable.

11.96 The movement of additional vehicles, including heavy goods vehicles (HGVs), along local roads and access routes may well be noticeable to residents near to these in terms of the noise and vibration generated by them. The resultant impacts on local roads, that are already well used by local traffic and existing HGV movements, would be relatively minor in terms of the increase in average noise levels resulting from the additional vehicles on the roads. However, the individual events may well be noticeable to residents, with resulting levels for individual events being similar to that created by existing HGV movements. The resultant noise levels on parts of the route that are less well used by existing traffic may be noticeable to residents located along the route. However, the resultant noise and vibration levels from vehicles passing the dwellings would be highly unlikely to breach the adopted construction noise thresholds and accepted vibration thresholds.

Mitigation

Operation

11.97 One of the key constraints and considerations in designing the layout of the turbines was the minimisation of potential noise impacts at the nearest residential receptors. As such the turbine layout was designed to ensure that there is an adequate separation distance between any of the proposed turbines and the nearest residential property.

11.98 Due to this consideration of the noise impacts in the design of the wind farm, embedding mitigation measures in the turbine layout, when a conservative candidate turbine is modelled the Proposed Development meets noise limits derived in accordance with ETSU-R-97.

11.99 If planning permission is granted for the Proposed Development, planning conditions can be proposed to provide a degree of protection to nearby residents in the form of limits relating to noise level and tonality.

11.100 **Technical Appendix 11.7** contains a set of conditions that RES considers appropriate.

Construction

11.101 For all activities, measures would be taken to reduce noise levels with due regard to practicality and cost as per the concept of 'best practicable means' as defined in the Pollution Control and Local Government (NI) Order 1978.

11.102 BS 5228-1 states that the 'attitude of the contractor' is important in minimising the likelihood of complaints and therefore consultation with the local authority along with letter drops are advised to inform residents of intended activity. Non-acoustic factors, which influence the overall level of complaints such as mud on roads and dust generation, would also be controlled through construction practices adopted on the site and managed via a Construction Environmental Management Plan (CEMP). Furthermore, the following noise mitigation options will be implemented where appropriate:

- Consideration will be given to noise emissions when selecting plant and equipment to be used at the site;
- All equipment to be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources will be sited as far away as reasonably possible from residential properties; and,
- The movement of vehicles to and from the site will be controlled and employees instructed to ensure compliance with the noise control measures adopted.

11.103 Site construction operations should be limited to specific time periods except during turbine erection and commissioning or during periods of emergency work.

11.104 There are many strategies to reduce construction noise by the limitation of activities that will result in noise levels being lower than the threshold noise levels. Any such measures should be considered in proportionate terms and the mitigation adopted should not be limited to the measures proposed here.

11.105 As with operational noise, if planning permission is granted for the proposed wind farm, planning conditions can be proposed so that appropriate noise mitigation measures and construction practices are included within a final CEMP.

Residual Effects

Operation

11.106 The acoustic assessment demonstrates that predicted noise levels at all residential properties do not exceed the derived noise limits across all relevant wind speeds. No significant impacts are therefore expected. This should not be interpreted to mean that wind farm operational noise would be inaudible (or masked by background noise) under all conditions, but that the levels of noise are acceptable under ETSU-R-97 and associated guidance.

Construction

11.107 Noise and vibration during the construction of the proposed wind farm, may well be audible and/or perceptible to people residing in the area, but the levels would likely be below established threshold noise levels and planning requirements in this respect due to the large distances between the site and the surrounding dwellings. Where construction noise relating to the provision of access to the site, including the upgrade of local roads and their use thereof, is expected to occur near by residences, enhanced mitigation measures would be adopted to reduce noise and vibration where necessary.

Cumulative Effects

Operation

11.108 There are no other wind turbines operating, consented or in planning within a sufficient distance to the Proposed Development such that a cumulative acoustic impact assessment of the Proposed Development is required to be undertaken in accordance with the guidance on wind farm noise assessment; ETSU-R-97 and the IoA GPG.

Construction

11.109 A cumulative assessment of construction noise is not possible, as other construction activities in the local area in the future, during the construction of the Proposed Development, are unknown.

Summary

11.110 The acoustic impact for the operation of the Proposed Development at nearby residential properties has been assessed in accordance with the guidance on wind farm noise as issued in the DTI publication “The Assessment and Rating of Noise from Wind Farms”, otherwise known as ETSU-R-97, and the Institute of Acoustics Good Practice Guide (IoA GPG), as recommended for use by relevant planning policy.

11.111 To establish baseline conditions, background noise surveys were carried out at nearby properties and the measured background noise levels used to determine appropriate noise limits, as specified by ETSU-R-97 and the IoA GPG.

11.112 Operational noise levels were predicted using a noise propagation model, the proposed wind farm layout, terrain data and turbine emission data for a conservative candidate turbine. The predicted noise levels are within noise limits derived in accordance with ETSU-R-97 at all properties at all considered wind speeds.

11.113 Construction noise has been discussed with reference to BS 5228 and it has been determined that onsite construction noise levels are highly unlikely to exceed typical limiting noise criteria at nearby properties although appropriate mitigation measures will be adopted as a matter of due course. The access route for the proposed wind farm is expected to pass by some dwellings and with some upgrade works to local roads potentially occurring near by some dwellings. In these instances, the level of noise generated by construction works could be close to typical noise thresholds for relatively short periods. As a result, typical and enhanced construction noise mitigation measures will be implemented where appropriate to minimise noise as far as reasonably practicable and/or reasonable.

11.114 The potential impact of the Proposed Development, along with the mitigation proposed and any residual impact, is summarised in **Table 11.21**.

Table 11.21: Summary of Potential Impacts, Mitigation and Residual Impacts

Potential Impact	Mitigation Proposed	Means of Implementation	Outcome/ Residual Impact
Operation			
Potential impact on residential amenity due to operational noise.	Impact is deemed to be acceptable as the wind farm meets noise limits specified by relevant guidance. No mitigation measures are required due to absence of identified significant effects.	The limits specified in the conditions proposed in Technical Appendix 11.7.	Not significant.
Construction			
Potential for noise and vibration to be created during general construction activities and by construction traffic.	Due regard for 'best practicable means' (defined by Pollution Control and Local Government (NI) Order 1978). A range of noise mitigation measures are proposed for the construction phase in accordance with measures outlined in BS 5228. Site operations to be limited to specific time periods (except during turbine erection and commissioning/ periods of emergency work).	Noise mitigation measures will be implemented as part of the Construction and Environmental Management Plan which would be required to be agreed as a condition of consent.	Not significant.

Glossary

A-weighting

A frequency-response function providing good correlation with the sensitivity of the human ear.

Broadband Noise

Noise which covers a wide range of frequencies (see Frequency).

Decibel dB(A)

The decibel (dB) is a logarithmic unit used in acoustics to quantify sound levels relative to a 0 dB reference (e.g. a sound pressure level of $2*10^{-5}$ Pa). The 'A' signifies A-weighting.

Equivalent Continuous Sound Level (L_{eq})

The equivalent continuous sound level is a notional steady sound level, which over a given time would provide the same energy as the intermittent sound.

Frequency

Refers to how quickly the air vibrates, or how close the sound waves are to each other and is measured in cycles per second, or Hertz (Hz). The lowest frequency audible to humans is 20 Hz and the highest is 20,000 Hz. The human ear is most sensitive to the 1 kHz, 2 kHz and 4 kHz octave bands and much less sensitive at lower audible frequencies.

Frequency Spectrum

Description of the sound pressure level of a source as a function of frequency.

Percentile Sound Level (L_{90})

Sound pressure level exceeded for 90% of the time for any given time interval. For example, $L_{A90,10min}$ means the A-weighted level that is exceeded for 90% of a ten minute interval. This indicates the sound levels during quieter periods, or the background noise level. It represents the lower estimate of the prevailing sound level and is useful for excluding such effects as aircraft or dogs barking on background noise levels.

Noise Emission

The noise energy emitted by a source (e.g. a wind turbine).

Noise Immission

The sound pressure level detected at a given location (e.g. nearest dwelling).

Octave Band

Range of frequencies between one frequency ($f_0*2^{-1/2}$) and a second frequency ($f_0*2^{+1/2}$). The quoted centre frequency of the octave band is f_0.

Sound Power Level

Sound power level is the acoustic power radiated from a sound source and is independent of the surroundings. It is a logarithmic measure in comparison to a reference level (10^{-12} watts).

Sound Pressure Level

A logarithmic measure of the effective sound pressure of a sound relative to a reference value which is for minimum audible field conditions ($20*10^{-6}$Pa).

Third Octave Band

The range of frequencies between one frequency ($f_0*2^{-1/6}$) and a second frequency equal to ($f_0*2^{+1/6}$). The quoted centre frequency of the third octave band is f_0.

Tonal Noise

12

Traffic & Transport

12. Traffic & Transport

Introduction

12.1 This assessment considers the potential impacts on traffic and transport associated with the construction, operation and decommissioning phases of the proposed Mullaghclogher Wind Farm, hereinafter referred to as 'the Proposed Development'.

12.2 The Site location is described as: Mullaghclogher Wind Farm, located in the townlands of Carrickayne, Legnahappoge, Glengarrow, Stroanback and Doorat, 4KM North East of Plumbridge, Northern Ireland. The Planning Application Boundary, hereinafter referred to as the 'Site' is shown in Figure 1.2 Planning Application Boundary. The proposed site entrance is on the Carrickayne Road.

12.3 The following have been considered in this chapter:

- Legislation and policy;
- Access routes for abnormal indivisible loads (AIL), normal construction traffic and associated road improvements;
- The type and volume of traffic generated by the Proposed Development;
- Identification of sensitive/ critical locations along the delivery route;
- Assessment of construction, operation and decommissioning traffic impacts;
- Outline of suitable mitigation measures and the evaluation of residual impacts; and
- Cumulative impacts of surrounding operational, consented and proposed developments.

12.4 This assessment has been undertaken in-house by Renewable Energy Systems Ltd (RES) with at least one in-house Member of the Institution of Engineers Ireland and the Institution of Civil Engineers involved in its production.

12.5 This assessment is supported by the following:

- **Technical Appendix 12.1: Delivery Analysis**
- **Technical Appendix 12.2 - Passing Bay Locations**

- **Figure 12.1: Turbine Delivery Route**
- **Figure 12.2: HGV Routes**

Legislation, Policy and Guidance

Planning Policy Statement 3 – Access, Movement and Parking

PPS3 is retained policy for the purposes of the SPPS transitional arrangements. There is considered to be no conflict with the equivalent provisions in the SPPS, therefore until the Council adopts its Plan Strategy, its provisions will apply, together with the SPPS, with no less weight attached to the retained policy.

2.1. SPPS policy on transportation is set out on pages 106 to 110. It consolidates and restates policy set out in PPS3 and PPS13. The Environment Minister did not identify any conflicts or clarifications in his written statement launching the SPPS. The principal focus of this section is, therefore, on PPS3.

2.2. PPS3 sets out planning policies for vehicular and pedestrian access, transport assessment, protection of transport routes, and parking. It advises that the potential impact a development may have on the efficiency of the public road network or on road safety are important material considerations.

2.3. Policy AMP2 Access to Public Roads states:-

'Planning permission will only be granted for a development proposal involving direct access, or the intensification of the use of an existing access, onto a public road where such access will not prejudice road safety or significantly inconvenience the flow of traffic.'

2.4. Chapter 12 assesses the impact of the Proposed Development on the receiving road network and considers the potential impacts on traffic and transport associated with its construction, operation and decommissioning. The main traffic impacts are associated with the increase in HGV vehicle movements along the proposed delivery route and surrounding tertiary road network during the construction stage of the project.

2.5. It is concluded that there will be no significant impacts on the road network, subject to appropriate mitigation. This includes i) provision of a pre-construction Traffic Management Plan for approval and, ii) temporary off-site works (road widening and/or vegetation removal) to facilitate delivery of the turbine components, which will then be reinstated. These measures can be secured by planning conditions.

Strategic Planning Policy Statement (SPPS)

12.6 The SPPS highlights that transportation issues to be addressed in the LDP should include Protected Routes. Whilst regional policy is to restrict the number of new access and control the level of use of existing accesses onto protected routes, there are exceptions where the principle of development accords with policy elsewhere in the SPPS.

DOE – Planning Policy Statement 18: Renewable Energy (2009)

12.7 Policy RE1 of PPS18 issued by DOE in 2009 requires applications for a wind energy development to demonstrate that no part of a development will have an unacceptable impact on roads, rails or aviation safety:

- *"Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures… This matter will need to be agreed before planning permission is granted."*

DOE - Best Practice to Planning Policy Statement 18 'Renewable Energy' (2009)

12.8 Section 1 of the Guidance relates to wind energy and names the "Adequacy of local access road network to facilitate construction of the project and transportation of large machinery and turbine parts to site" as one of the main concerns that needs to be considered by the developer when applying for a wind farm development.

IEMA – Guidelines for the Environmental Assessment of Road Traffic (1993)

12.9 The Institute of Environmental Management and Assessment (IEMA) guidelines (hereinafter referred to as IEMA Guidelines (1993)) are the most widely used guidance document for assessing traffic impacts as part of Environmental Statements and are referred to throughout this Chapter.

12.10 The IEMA Guidelines (1993) suggest two general rules for identifying the extent of the assessment area:

- **Rule 1** – include highway links where traffic flows will increase by more than 30% (or the number of heavy good vehicles (HGVs) will increase by more than 30%).
- **Rule 2** – include any other specifically sensitive areas where the traffic flows have increased by 10% or more.

12.11 Where the change is less than the above thresholds, the impact shall be considered 'negligible'.

Consultation

Stakeholder consultations regarding traffic, roads, and nearby infrastructure along the delivery routes are ongoing, and as of now, no responses have been received from DFI. These consultations are critical for refining the local transport strategy, identifying locally significant issues, and gathering fundamental information about local infrastructure and structures. A summary of the consultation feedback and any suggested mitigation measures will be included in **Table 12.1** once the process is complete.

Consultee	Issue	Solution/ Further Steps
DfI Roads & structures.	Advised of proposed AIL delivery route associated with	As a component of the Proposal of Application Notice (PAN) procedure, notification has been made to DfI Roads.

	the Proposed Development. Requested to comment on suitability of structures along route	DfI Roads & Structures were briefed on the proposed primary AIL route in November 2023 and no notable issues or concerns were raised during these initial discussions. Post-consent, a review of the condition of roads and structures along the entire route will be conducted. If deemed necessary, remedial & upgrading works will be proposed in accordance with all DfI requirements. All required permits will be applied for prior to delivery of the turbine components.

12.12 Please note, further consultation is required post consent with stakeholders relevant to traffic, roads and infrastructure on and near the delivery routes to finalise the preferred HGV access route strategy to the development.

Scope of the Assessment

12.13 The main transport effects will be associated with the movement of commercial Heavy Goods Vehicles (HGVs) and Abnormal Indivisible Loads (AILs) (i.e. turbine component delivery) to and from the site during the construction phase of the proposed development.

Once operational, it is envisaged that the volume of traffic associated with the proposed development would be minimal, comprising service and maintenance visits. Occasional visits may also be made to the site for more extensive maintenance/ repairs. The vehicle used for maintenance visits is likely to be a 4x4 vehicle (or similar) but there may be an occasional need for HGV deliveries, road-going cranes or AILs to access the site for heavier maintenance and repairs. However, it is considered that the effects of such operational traffic will be negligible and therefore, detailed consideration of the operational phase of the proposed development is not included in this assessment.

The expected lifetime of the proposed development is 35 years. Decommissioning traffic will likely include the delivery of plant to site to undertake the works and the removal of turbine components, and is expected to be at lower volume than during the construction period. It is expected that should the proposed development be consented, a planning condition would be included to require the agreement of a decommissioning method statement with the relevant authorities prior to decommissioning.

12.14 For details of the assessment of construction noise associated with deliveries, see **Chapter 11: Noise**.

Abnormal Indivisible Loads (turbine component delivery)

12.15 Specialist vehicles are required to transport components to the site. One vehicle would transport turbine blades, while another type would transport the tower sections. The proposed access routes for AILs (turbine delivery) from the A6 to site is illustrated in **Figure 12.1 –Turbine Delivery Route.** Swept path analyses have been undertaken for both vehicle types to determine the works required to allow passage through pinch-points on the route.

The proposed delivery route for large turbine components (abnormal loads) will travel from Foyle Port, Along the A2 before turning onto the Glenshane road/A6. Loads will then follow along the A6 before taking the turn off onto the Baranilt Road. Passing through Claudy, before turning left onto the Learmount Road, then a right onto the Longland road at Ballyrory. The route takes a left turn after the Ballynacross road. The road continues on, before passing onto the Aghafad road the site is proposing the development of a new access track from the Aghafad road, onto the the Lisnaragh road, and continuing South towards the site before making a lefthand turn onto a connecting road, commonly known as the 'Ramper' road which brings the deliveries to the Carrickayne road.

12.16 The proposed return route is similar to that of the proposed delivery route. Once the turbine components have been delivered, the vehicles will be shortened so they are no longer than a typical articulated HGV.

12.17 Where required, approval to temporarily remove street furniture (for the minimum period as is reasonably practical), will be obtained from the appropriate bodies prior to deliveries post planning consent.

12.18 AIL delivery will be timed to avoid peak local traffic times, such as commuting hours and school start and end times to minimise disruption.

Widening Works

- To facilitate the safe transport and movement of abnormal indivisible loads (AILs), certain physical works within public and third-party lands will be required along the delivery route. These works may include temporary road widening, vegetation clearance, or other minor modifications. Locations identified to date are illustrated within the Delivery analysis (Technical appendix 12.1.) and are also listed below:
- Detail 1 – Roundabout at intersection of Maydown road and Clooney road
- Detail 2 – Altnagelvin Roundabout - Glenshane road
- Detail 3 – A6 Claudy/offslipp, Claudy/ Baranailt Road Off slip
- Detail 4 - Church St ClaudyDetail 5 - B49, Church St/ Learmount Road Junction
- Detail 6 - Learmount Road/ Longland Road Junction
- Detail 7- Lands East of and including 305A Longland Road,
- Detail 8 - Longland Road/ Ballynacross Road Junction
- Detail 9 - Aughafad Road
- Detail 10 - Aghafad road to Lisnaragh road – New track
- Detail 11 -Lisnaragh Road – Ballynamallaght Bridge

- Detail 12 - Lisnaragh Road Alticara Bridge/ Ramper Road
- Detail 13 - Ramper Road/Carrickayne Road

12.19 Widening works where required will include the installation of hardstand areas and vegetation trimming to facilitate the passage of AILs.

12.20 Widening areas will be laid with a suitable hardstand, and then reinstated once turbine delivery has been undertaken. If road widenings require the removal of boundary features such as fences, trees or hedgerows, these will be reinstated at suitable locations. Reinstatement will also be applied to any street furniture which may be removed on a temporary basis. In the unlikely event that a replacement blade is required during the operational phase of the wind farm, the widenings will need to be reopened temporarily, after which they will be reinstated.

Normal HGV Delivery

12.21 Normal HGV deliveries of concrete and stone respectively will also utilise the Lisnaragh Road but could do so from either direction dependant on the source of material and subject to confirmation with DfI Roads. Indicative HGV routes to the Site are illustrated in **Figure 12.2 - HGV Routes**.

- The sources of construction materials will be confirmed prior to the commencement of works. Passing bays will be constructed along Carrickayne Road and Ramper Road, as detailed in **Technical Appendix 12.2** – Passing Bay Locations. No additional passing bays are required beyond Lisnaragh Road, as the route transitions to two-way roads with sufficient existing passing opportunities to accommodate HGV's.

12.22 Where agreed by DfI Roads, circular HGV haul routes may be implemented for the construction phase of the project.

12.23 Post consent, a detailed review of all bridges/ structures along the preferred route will be undertaken and, if required structural surveys will be carried out. The requirement (if any) of any subsequent improvement will be undertaken following consultation with DfI Roads and detailed in the Traffic Management Plan (TMP).

Site Entrance

12.24 The site entrance is located on Carrickayne Road. It is designed accordingly to accommodate AIL deliveries however the gates and some fencing may be removed temporarily to facilitate oversail of the turbine components. These will be reinstated following turbine delivery.

12.25 The proposed site entrance is shown in ***Figure 1.10*** and has been constructed in accordance with the requirements of Development Control Advice Note (DCAN) 15, 2nd Edition.

12.26 As specified in DCAN 15, visibility splays measuring 160m x 4.5m are provided in both directions. Automated Traffic Count data on Carrickayne Road indicates the average 85th percentile over 7 days is 48.9mph, therefore the 160m visibility splay for the 60mph traffic speed has been adopted. Following construction, the site entrance will be reinstated to the gate and fencing originally installed.

Assessment Methodology

12.27 The assessment has been undertaken in accordance with the Institute of Environmental Assessment's 'Guidelines for the Environmental Assessment of Road Traffic' (1993).

12.28 The IEA Guidelines (1993) is the only document available that sets out a methodology for assessing potentially significant environmental impacts where a proposed development is likely to give rise to changes in traffic flows.

12.29 The IEA Guidelines (1993) suggest that, in order to determine the scale and extent of the assessment and the level of impact the development will have on the surrounding network, the following two 'rules' should be followed:

1. Include highways links (public roads) where traffic flows are predicted to increase by 10% or more.
2. Include any other specifically sensitive areas where traffic flows are predicted to increase by 10% or more.

12.30 Where possible, the significance of each impact is considered against the criteria within the IEA Guidelines (1993). However, the IEA Guidelines (1993) State that:
"For many effects there are no simple rules or formulae which defines the thresholds of significance and there is, therefore, a need for interpretation and judgement on the part of the assessor, backed-up by data or quantified information wherever possible. Such judgements will include the assessment of the numbers of people experiencing a change in environmental impact as well as the assessment of the damage to various natural resources."

12.31 In the absence of established significance criteria for traffic and transport impacts, professional judgement has been used to assess whether the impacts on traffic and transport are considered to be significant, using the IEA Guidelines (1993) to identify the scale and extent of the assessment to be undertaken. The significance falls into two categories; 'not significant' and 'significant', the latter corresponding to significant impacts in accordance with IEA Guidelines (1993).

12.32 The IEA Guidelines (1993) state projected changes in traffic of less than 10% creates no discernible environmental impact, given that daily variations in background traffic flow may fluctuate by this amount, and that a 30% change in traffic flow represents a reasonable threshold for including a highway link (public road) within the assessment. The threshold for a detailed assessment therefore has been set at a 30% change in HGV traffic flow.

12.33 The following receptors have been used for this assessment:

- ACT 1, Lisnaragh Road (south)
- ACT 2, Lisnaragh Road (north)
- ACT 3, Carrickayne Road
- ACT 4, Glenelly Road
- ACT 5, Longland Road

12.34 The Traffic Count (ATC) surveys were undertaken during a period of seven consecutive days starting on 13th September 2023 as listed in ***Table 11.2***.

Table 12.2 ATC Summaries

Road Reference	24hr Average Daily Flow
ACT 1, Lisnaragh Road (south)	1435
ACT 2, Lisnaragh Road (north)	1553
ACT 3, Carrickayne Road	355
ACT 4, Glenelly Road	977
ACT 5, Longland Road	2100

Potential Significant Effects

12.35 The proposed development is expected to be constructed over an 18-month period. Standard working hours will be from 07:00 to 19:00, Monday to Friday, and from 07:00 to 13:00 on Saturdays. However, certain deliveries may occur outside these hours to minimize disruption to local residents or to comply with specific Health and Safety, quality, or environmental requirements. During critical phases, such as turbine erection and decommissioning, site activities may occur seven days a week.

12.36 The associated traffic flows will vary over that time as different elements of the proposed development are constructed and will depend on the chosen contractor's preferred method of working. A comprehensive Traffic Management Plan (TMP) will be developed by the Applicant or the appointed contractor prior to construction, once the construction schedule, plant requirements, and turbine specifications have been finalised. The TMP will outline strategies to minimise traffic disruption along the delivery route and ensure the safety of road users and local residents. This plan will be submitted to DfI Roads for approval before any construction activities commence.

12.37 Estimated traffic generation during the construction stage assumes the following activities will take place:

- Delivery of components for site set-up;
- Delivery of materials for road and hard standings;
- Delivery of materials and components associated with the foundation construction;

- Delivery of components associated with turbines;
- Delivery of components and materials associated with cable installation;
- Delivery of substation components and materials;
- Other miscellaneous deliveries/ removal; and
- Construction workers commuting.

12.38 **Table 12.3** provides the estimated traffic generation across an assumed 18 month construction period. The assessment has been based on the assumption that all material has to be imported to site, including ready mixed concrete for the turbine foundations and all aggregate for the access tracks and areas of hardstanding, thus providing a worst case assessment.

12.39

Table 12.3 Estimated Traffic generation across an assumed 18-month construction period

Phase	Purpose	Delivery Vehicle	Approx. No. of deliveries for project duration	Approx. highest No. of daily deliveries	Approx. delivery period (day(s))
Site Set-Up	Portacabin delivery	Low Loader	10	10	1
	Skip delivery	Low Loader	5	5	1
	Generator delivery	Low Loader	2	2	1
	Water & fuel tank delivery	Low Loader	1	1	1
	Excavator delivery	Low Loader	3	2	1-2
	Tool container delivery	Low Loader	2	2	1-2
	Roller-compactor	Low Loader	3	1	1-2
	Articulated dumper	Tipper Lorry	3	1	1-2
Site tracks & hard standings	Stone for site tracks	Tipper Lorry	2100	40	2-11
	Stone for control building & substation compound	Tipper Lorry	40	10	2-11
	Stone for construction compound	Tipper Lorry	20	20	2-11
	Stone for pathways	Tipper Lorry	30	30	2-11
	Stone for crane hardstandings	Tipper Lorry	920	40	2-11
Foundation construction	Excavator delivery	Low loader	2	2	7-12
	Misc works	Backhoe loader	2	2	7-12
	Concrete for turbine foundations, piles & transformer plinths	Mixer truck	660	60	7-12

Phase	Purpose	Delivery Vehicle	Approx. No. of deliveries for project duration	Approx. highest No. of daily deliveries	Approx. delivery period (day(s))
	Steel delivery	Flat bed	22	22	7-12
	Foundation bolts or steel insert delivery	Flat bed	11	11	7-12
	Place foundation bolt cage or steel insert	30t – 50t crane	1	1	7-12
Turbine Erection	Tower section delivery	Clamp lift trailer	44	8	12-15
	Blade delivery	Extendible trailer	33	6	12-15
	Nacelle	Low loader	11	2	12-15
	Hub and rotor	Low loader	11	2	12-15
	Drive train	Low loader	11	3	12-15
	Large crane delivery & removal	1000t – 12000t crane	2	1	12-15
	Crane associated equipment delivery & removal	Low loader	42	10	12-18
	Smaller crane delivery & removal	150t – 200t crane	2	1	12-18
Cable Installation	Cable delivery	Flat bed	19	8	9-13
	Sand delivery	Tipper lorry	220	20	9-13
	Excavator delivery	Low loader	2	1	9-13
	Cable laying	Tele handler	2	1	9-13
Substation and Control Building	Concrete delivery	Mixer truck	36	36	7-12
	Brick delivery	Flat bed	3	3	7-12
	Roofing & Cladding	Flat bed	3	3	7-12
	Switchgear	Flat bed	2	2	7-12
	Misc. electrical equipment	Flat bed	3	3	7-12
Energy Storage	Onsite battery containers, PCS and transformer units	Flat bed	50	5	12-18
	Battery Delivery	Flat bed	50	5	12-18
	Electrical equipment delivery	Flat bed	15	5	12-18
	Concrete delivery	Mixer truck	25	25	12-18

Phase	Purpose	Delivery Vehicle	Approx. No. of deliveries for project duration	Approx. highest No. of daily deliveries	Approx. delivery period (day(s))
	Spares container delivery	Flat bed	1	1	12-18
Misc.	Waste removal	Skip lorry	90	1	1-18
	Water/ fuel deliveries	Small tanker	90	1	1-18
Site Demobilisation	Portacabin removal	Low loader	10	10	18
	Skip removal	Low loader	5	5	18
	Generator removal	Low loader	2	2	18
	Water & fuel tank removal	Low loader	1	1	18
	Excavator Removal	Low loader	3	2	18
	Tool container removal	Low loader	2	2	18
	Roller-compactor	Low loader	3	1	18
	Articulated Dumper	Tipper Lorry	3	1	18
	Misc. works	Low loader	2	2	18
TOTAL Heavy Goods Vehicles			**4635**		
Site Staff & Deliveries	Staff	Cars & minivans	11,000	65	1-18
	Miscellaneous	Vans	1,200	5	1-18
TOTAL Cars & Light Vehicles			**12,200**		
TOTAL VEHICLES			**16,835**		

12.40 **Table 12.3** has been derived from experience gained from previous wind farm construction phases and assumes approximately 40 stone deliveries per day.

12.41 The peak in construction traffic is anticipated during the concrete pouring phase for turbine foundation construction. This phase requires high-volume, time-sensitive deliveries to ensure structural integrity and prevent cold joints.

12.42 Technical 'best practice' construction requirements may necessitate that the concrete for an individual turbine base foundation will have to be delivered and poured in one day to prevent 'cold' joints forming in the structure. As a result, there may be a period in which there will be an increased number of delivery vehicles, compared with the rest of the construction period, entering and leaving the site. The total number of concrete deliveries for each turbine base may be up to 60 journeys per day.

12.43 This equates to approximately one vehicle movement every five minutes over the working day (0700 – 1900). **Table 12.4** illustrates the worst case percentage change of traffic flow (i.e. based on the busiest 6 days *144) along the proposed access route during the turbine base construction stage of the proposed development.

Table 12.4 Summary of Percentage Increase in Traffic on Local Roads

Road Reference	24hr Average Daily Flow	Average Recorded Daily HGV Flow as a percentage (No. of HGVs)	Percentage increase of HGVs (No. of HGVs)	Is the IEA (1993) threshold of 30% increase in HGV Traffic Flow exceeded?
ACT 1, Lisnaragh Road (south)	1435	25% (357)	152% (542)	Yes
ACT 2, Lisnaragh Road (north)	1553	19% (293)	163% (478)	Yes
ACT 3, Carrickayne Road	355	24% (85)	317% (270)	Yes
ACT 4, Glenelly Road	977	19% (190)	197% (375)	Yes
ACT 5, Longland Road	2100	22% (465)	140% (650)	Yes

12.44 It is predicted that there will be an increase in HGV vehicle movements of between 140% and 317%. The percentage increase is high given the low volume of HGV traffic which the roads currently experience.

12.45 It should be noted the percentage increase will likely be lower than the calculations provided in table 12.4 as this is representative of all estimated HGV traffic travelling on each respective road. In reality this will likely be reduced with the use of a circular driving route and/or by using a number of different roads for access and egress to site, rather than all traffic using a single route.

12.46 The IEA threshold of 30% us exceeded in all five monitored locations, therefore an assessment of potential significant impacts has been provided in **Table 12.5**.

12.47 **Table 12.5** provides a summary of predicted environmental effects of the route widening works.

Table 12.5: IEA Environmental Impact

Predicted Impact	Description	Applicability to Tertiary Road Network
Severance	Severance is a perception that a road is more difficult or possibly less safe to cross. Increased severance can result in the isolation of areas of a settlement or individual properties. However, it is important to note that the impact is largely a function of traffic volumes, rather than one of vehicle composition amongst traffic.	The IEA guidelines suggest changes in traffic flow of 30% are likely to affect severance. There is low existing traffic flow and little pedestrian activity. The Traffic Management Plan (TMP) will involve consulting with nearby businesses, schools, and local residents. In the event that delivery routes pass by a local school, arrangements will be established to prevent any overlap between delivery times and the school's "pick-up" and "drop-off" times that could impact access to local services. With this measure the temporary impact of severance is considered to be **Not Significant**
Driver Delay	Driver delay is that experienced by non-development related road uses on the surrounding roads and particularly as a consequence of slow moving traffic associated with construction.	The IEA guidelines suggest that delays are only likely to be of significance when the traffic on the surrounding network is at, or close to, full capacity. Given that this is not the case, this is not considered to be an issue. It is acknowledged that there may be localised delays directly attributable to construction traffic due to the large increase in traffic flow on the Lisnaragh Road and surrounding minor roads. This is most likely restricted to junctions, and local road users are familiar with encountering HGVs. The delivery of AILs will involve large, slow moving vehicles however these will be escorted and timed to cause minimal disruption. The potential impact is not considered to be significant, as the tertiary road network experiences a low volume of traffic. Additionally, these roads are sufficiently wide to allow for the safe passing of oncoming HGVs. Two-way traffic can be accommodated up to the junction of Lisnaragh with 'Ramper' and Carrickayne Roads, where passing bays are planned to further facilitate safe vehicle movements to the site entrance.

Predicted Impact	Description	Applicability to Tertiary Road Network
		Multiple routes are under consideration for HGVs, with the traffic likely spread across the tertiary road network. The increase in traffic predicted for the tertiary road network will therefore likely be reduced with the use of a circular driving route or using multiple roads for access and egress to site. Where possible, deliveries will be scheduled to minimise disruption, escorted when necessary, and information regarding deliveries will be provided through the Traffic Management Plan (TMP) prior to construction
Pedestrian Delay	Pedestrian delay is affected by changes in traffic volume, HGV movements and traffic speed. Pedestrian delay also depends on the existing level of pedestrian activity, visibility and current infrastructure provision. There is no threshold on which pedestrian delay is assessed.	Pedestrian movement on the Lisnaragh Rd and surrounding tertiary road network is minimal The area therefore has a low sensitivity rating in relation to pedestrian delay and impacts will be **Not significant**
Pedestrian Amenity	Pedestrian amenity can be affected by traffic volumes and the distance between pedestrians on the footway and passing traffic. The IEA guidelines suggest that changes to pedestrian amenity may be considered significant where traffic is doubled or halved.	There is minimal volume of pedestrian movement on the Lisnaragh Road and surrounding tertiary road network and whilst the volume of HGV sees a significant increase, given the lack of pedestrian movement this does not pose a significant risk. It is considered the impact on pedestrian's / cyclist's amenity will be **Not Significant** given that the worst case of vehicle movements will be one per five minutes on the six days associated with the turbine foundations.
Fear & Intimidation: Pedestrians	The IEA guidelines state that the degree of fear and intimidation experienced by pedestrians is affected by the volume of passing traffic, the proportion of HGV traffic and its proximity to pedestrians.	Despite the predicted temporary increase in traffic flows, the minimal volume of pedestrian movement along the Lisnaragh Road and surrounding tertiary road network combined with the two-way nature of these roads means this impact will be **Not Significant**

Predicted Impact	Description	Applicability to Tertiary Road Network
Accidents & Safety	The IEA guidelines state that road accidents are attributable to a variety of local factors and as such do not provide a threshold to determine significance. Instead, the IEA guidelines rely more on the assessor to use their own judgement.	Construction and predicted changes will be temporary and given that consultation will be undertaken with local residents, and traffic will be targeted to off peak travel times, there is unlikely to be an impact upon road safety and accident levels. Furthermore, all abnormal loads will be escorted, and the movement of these vehicles will be programmed to avoid busy periods thus reducing the potential impacts further. It is considered the overall impact on accidents and safety is **Not Significant** given that the worst case of vehicle movements will be one per five minutes on the six days associated with the turbine foundations.

Cumulative Impacts

12.48 There are four consented projects within 10 km of the proposed development. These are Eglish Wind Farm located approximately 8.18km from North from, and the Owenreagh/Craignagapple Cluster Located 6.95-7.54km of Mullaghclogher. Eglish wind farm and Mullaghclogher intend to partially utilise the same turbine delivery route for AILs, with Mullaghclogher traffic continuing to the Longland road, and taking a left hand turn onto the Ballynacross road.

12.49 Eglish wind farm is already constructed, and therefore there should be no cumulative traffic impacts. Given the low traffic volume associated with operational phase wind farm traffic, this has not been considered in this assessment.

12.50 Craignagapple wind farm's proposed AIL route utilises Londonderry Port and travels along the A6, however aside from this; there is no overlap between the route proposed for Craignagapple, and that assessed for Mullaghclogher, therefore this has not been considered in this assessment.

Table 12.6: Pre-construction Wind Farms in the Vicinity of the Proposed Development

Name	Status	Number of Turbines	Distance from Proposed Site Boundary
Craignagapple Wind Farm	Consented	6	6.95 km

Mitigation

12.51 A Traffic Management Plan (TMP) will be prepared by the Applicant in accordance with the requirements of DfI, the local PSNI, and if required, any other relevant stakeholders. Features of the TMP will include:

- Details of the access route, conformation of any points along the access route that require street furniture removal, details of traffic numbers, delivery timings, and signage and escort requirements
- A delivery schedule for normal and abnormal loads to minimise disruption as far as reasonably practicable
- Details of how any movements will comply with legislation regarding the movement of abnormal loads e.g. notice procedures and notice periods
- Details on the use of escorts where required. Where long vehicles and abnormal loads would have to use the wrong side of the carriageway or need to swing into the path of oncoming vehicles a lead warning vehicle would be used. One escort vehicle would drive ahead and pull oncoming traffic into identified passing places. An escort vehicle would travel directly in front of the convoy and pull over any oncoming traffic that comes onto the road after the first escort vehicle has passed. A further convoy escort vehicle would follow the convoy
- Information about marking of vehicles as long/abnormal loads

12.52 Information will be given on how warning signs will be used. These will be used to advise other road users of 'Caution Slow Plant Turning Ahead' and will be placed at intervals from both directions along the main road approaching the site entrance during the construction phase. The TMP will also detail additional measures to ensure impacts from traffic movements are minimised where possible, for example provision of road sweepers and/or wheel wash facilities.

12.53 If required, the wheel wash facilities will include a waterless drive over wheel wash for lorries. This will be provided at the site entrance to prevent mud and dust being brought out from the Site onto the public highway and anything being brought onto Site from public highway. Although experience has shown the majority of mud is shaken off wheels on site before the vehicle reaches the public road, the site entrance and adjacent public highway will also be monitored and cleaned if necessary.

12.54 The TMP will include details about Video Surveying and Road Repairs. A video survey of the pre-construction condition of all public roads will be recorded around the site entrances and access routes (but including the site entrance and access roads), to provide a baseline record of the state of the roads prior to construction work commencing. This will enable any repairs and maintenance work required to the relevant road due to any damage caused by the passing of heavy vehicles associated with the wind farm construction to be identified following the construction phase. The roads will be returned, at minimum, to the baseline condition at the end of the construction phase. Any damage caused by wind farm traffic during the construction period, which would be hazardous to public traffic, will be repaired immediately. These works will be carried out under permits with DfI Roads, as appropriate.

12.55 The TMP will include plans for notifying relevant stakeholders in advance of delivery periods, including the emergency services, DfI Roads, local residents, local business, local services and schools. The local community will be informed prior to the commencement of construction and prior to the commencement of turbine deliveries by letter and through local press. The contact details of the Construction Site Manager will be made available as a contact point for enquiries. Local schools on the delivery routes will be contacted to identify school and nursery drop-off and pick up locations and times. Construction deliveries will be scheduled to avoid these busy periods as far as reasonably possible.

12.56 If cutting or removal of hedges and trees is required, then this should be done outside the bird breeding season (1st March to 31st August) unless otherwise agreed. If work is to be done during the breeding season, then there should be a survey to establish whether nesting birds are present.

Summary

12.57 The main traffic impacts are associated with the increase in HGV vehicle movements during the construction stage of the project. Although these roads do have the capacity to accommodate a higher rate, these roads have low levels of existing traffic , and a small number of receptors will be affected. At worst, the frequency of vehicle movements is expected to be one vehicle every five minutes during the six days when the construction of each wind turbine foundation would occur.

12.58 Consideration has been given to the effect of increased HGV traffic flow on Severance, Driver Delay, Pedestrian Delay, Pedestrian Amenity, Fear and Intimidation, Accidents and Safety and Cumulative Impacts. Furthermore, consideration has been given to the environmental effects of any road improvement/widening works.

12.59 A TMP will be developed and agreed with relevant stakeholders post consent and pre-construction in order to control and mitigate impacts associated with increased vehicles movements.

12.60 Taking into account the existing vehicle movements on the affected roads, and the proposed type and frequency of vehicle numbers, it is considered that with the appropriate mitigation measures as set out above, there will be no significant impacts.

List of References, Figures and Appendices

References

Department of the Environment (NI) (DoE) Planning Policy Statement 3: Access, Movement and Parking (PPS3), (February 2005)

Department of Environment (2009); Best Practice Guidance to Planning Policy Statement 18 – Renewable Energy, Planning and Environmental Policy Group.

Department of Environment (2005); Access, Movement and Parking Planning Policy Statement 3, PPS 3, The Planning Service.

Department of Environment (2015); Northern Area Plan 2016. Institute of Environmental Assessment (1993);

The Institute of Environmental Assessment's Guidelines for the Environmental Assessment of Road Traffic.

Figures

Technical Appendices

13

Shadow Flicker & Reflected Light

13. Shadow Flicker & Reflected Light

Introduction & Background

13.1 In sunny conditions, any shadow cast by a wind turbine will mirror the movement of the rotor. When the sun is high, any shadows will be confined to the wind farm area but when the sun sinks to a lower azimuth moving shadows can be cast further afield and potentially over adjacent properties. Shadow flicker is generally not a disturbance in the open as light outdoors is reflected from all directions. The possibility of disturbance is greater for occupants of buildings when the moving shadow is cast over an open door or window; since the light source is more directional.

13.2 Whether shadow flicker is a disturbance depends upon the observer's distance from the turbine, the direction of the dwelling and the orientation of its windows and doors from the wind farm, the frequency of the flicker and the duration of the effect, either on any one occasion or averaged over a year.

13.3 In any event and irrespective of distance from the turbines, the flickering frequency will depend upon the rate of rotation and the number of blades. It has been recommended (Clarke, 1991) [1] that the critical frequency should not be above 2.5 Hz, which for a three-bladed turbine is equivalent to a rotational speed of 50 rpm. The candidate turbines proposed at Mullaghclogher Wind Farm would rotate at 12.6 rpm, which is well below this threshold.

13.4 The common rate or frequency at which photosensitive epilepsy might be triggered is between 3 and 30 Hz (flashes per second). Large commercial turbines, such as the proposed, rotate at low speeds resulting in less than 3 flashes per second and are therefore unlikely to cause epileptic seizures. (Harding et al., 2008 [4]; Smedley et al., 2010 [5]). Therefore, there are not considered to be any health effects associated with the project and the assessment will address the effects of shadow flicker related only to local amenity.

Reflected Light

13.5 A related visual effect to shadow flicker is that of reflected light. Theoretically, should light be reflected off a rotating turbine blade onto an observer then a stroboscopic effect would be experienced. In practice a number of factors limit the severity of the phenomenon and there are no known reports of reflected light being a significant problem at wind farms.

13.6 A limiting factor is that wind turbines have a semi-matt surface finish which means that they do not reflect light as strongly as materials such as glass or polished vehicle bodies.

13.7 Secondly, due to the convex surfaces found on a turbine, light will generally be reflected in a divergent manner.

13.8 Thirdly, as with shadow flicker, certain weather conditions and solar positions are required before an observer would experience this phenomenon.

13.9 It is therefore concluded that Mullaghclogher Wind Farm will not cause a material reduction to amenity owing to reflected light.

Policy and Guidance

13.10 The update to Shadow Flicker Evidence Base (2011) [2], published by the then Department for Energy and Climate Change (DECC), states that assessing shadow flicker effects within ten times the rotor diameter of wind turbines has been widely accepted across different European countries, and is deemed to be an appropriate area.

13.11 The Best Practice Guidance to Planning Policy Statement 18 "Renewable Energy" (2009) [3] further describes that,

"…at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low".

Assessment Methodology

13.12 Analysis was performed on all properties within 10 rotor diameters of any turbine.

13.13 This shadow flicker assessment is based on turbines with a 150 m rotor diameter and the planning application includes a 50 micro-siting distance for infrastructure. As such, this 50 m distance is added to the ten-rotor diameter (1500 = 10 * 150) m distance to give a total distance of (1550 = 1500 + 50) m from any turbine.

13.14 Analysis was undertaken for shadow flicker at all properties within 1550 m from any wind turbine.

13.15 The assessment area and properties included therein are shown in Figure 13.1.

13.16 This analysis takes into account the motion of the Earth around the Sun, the local topography and the turbine locations and dimensions. The analysis was performed using a layout of 11 turbines, each with maximum tip heights of 180 m.

Results

13.17 With due reference to the DECC report, and allowance for 50m micro-siting, the potential shadow flicker is given in Table 13.1.

Table 13.1: Predicted maximum annual potential shadow flicker

RES Property ID	Property Address	Maximum Hours of Flicker Per Year
H15*	***307 Lisnaragh Road, Dunnamanagh, BT82 0S***	***26.1***
H17*	***305 Lisnaragh Road, Dunnamanagh, BT82 0S***	***25.1***
H20	299 Lisnaragh Road, Dunnamanagh, BT82 0S	29.0
H23	295 Lisnaragh Road, Dunnamanagh, BT82 0S	33.2
H24	291 Lisnaragh Road, Dunnamanagh, BT82 0S	36.4
H26	289A Lisnaragh Road, Dunnamanagh, BT82 0S	41.8
H28	289 Lisnaragh Road, Dunnamanagh, BT82 0S	43.3
H33	281 Lisnaragh Road, Dunnamanagh, BT82 0S	23.3
H34	283 Lisnaragh Road, Dunnamanagh, BT82 0S	23.8
H36	280 Lisnaragh Road, Dunnamanagh, BT82 0S	14.9
H38	278 Lisnaragh Road, Dunnamanagh, BT82 0S	12.2
H39	277 Lisnaragh Road, Dunnamanagh, BT82 0S	11.2
H41	276 Lisnaragh Road, Dunnamanagh, BT82 0S	10.0
H43	272 Lisnaragh Road, Dunnamanagh, BT82 0S	2.6
H46	60 Carrickayne Road, Claudy, BT47 4J	86.1
H53	52 Carrickayne Road, Claudy, BT47 4J	29.4
H63	2 Butterlope Road, Plumbridge, BT79 8A	22.3
H64	328 Lisnaragh Road, Plumbridge, BT79 8A	19.9
H65	322 Lisnaragh Road, Plumbridge, BT79 8A	44.0
H67	318 Lisnaragh Road, Plumbridge, BT79 8A	59.7
H70	316 Lisnaragh Road, Plumbridge, BT79 8A	49.6
H71	315 Lisnaragh Road, Plumbridge, BT79 8A	38.2
H72	319 Lisnaragh Road, Plumbridge, BT79 8A	45.7
H75*	***94 Carrickayne Road, Dunnamanagh, BT82 0S***	***222.4***
H77	92 Carrickayne Road, Dunnamanagh, BT82 0S	159.7
H78	117 Carrickayne Road, Dunnamanagh, BT82 0S	56.4
H79	88 Carrickayne Road, Dunnamanagh, BT82 0S	146.3
H80	86 Carrickayne Road, Dunnamanagh, BT82 0S	139.8
H81*	***84 Carrickayne Road, Dunnamanagh, BT82 0S***	***74.9***
H82*	***82A Carrickayne Road, Dunnamanagh, BT82 0S***	***70.8***
H83	100 Carrickayne Road, Dunnamanagh, BT82 0S	1.5
H88	70 Carrickayne Road, Claudy, BT47 4J	36.9

**** Financially involved property***

13.18 The above predictions in Table 13.1 represent a worst-case scenario for the following reasons:

- The analysis assumes that there is always sufficient lack of cloud cover, for there to be sufficient sunlight for shadows to be cast by the turbine.
- The analysis assumes that there is always enough wind for the turbine blades to be turning.
- The analysis assumes that the wind is always coming from the right direction for the turbine rotor to be facing towards the house, to thus cast a shadow.
- The analysis assumes that the property has windows and/or glazed doors facing towards the turbine.

- The analysis assumes there is no shielding, e.g. in the form of trees or outbuildings, between the turbine and the property.

Mitigation

13.19 Mitigation measures can be incorporated into the operation of the Wind Farm to reduce the instance of shadow flicker. Mitigation measures include planting tree belts between the affected dwelling and the responsible turbine(s) and shutting down individual turbines during periods when shadow flicker could theoretically occur.

References

[1] Clarke A.D (1991), A case of shadow flicker/flashing: assessment and solution, Open University, Milton Keynes

[2] Brinckerhoff, Parsons (2011) 'Update of UK Shadow Flicker Evidence Base', Department of Energy and Climate Change, UK Government

[3] Planning Policy Statement 18 "Renewable Energy" (including Best Practice Guidance to Planning Policy Statement 18) August 2009

[4] Harding et al. (2008), Wind turbines, flicker, and photosensitive epilepsy: Characterizing the flashing that may precipitate seizures and optimizing guidelines to prevent them, Epilepsia

[5] Smedley et al. (2010), Potential of wind turbines to elicit seizures under various meteorological conditions, Epilepsia

14

Socioeconomics

14 SOCIOECONOMICS

14.1 Introduction

Background to the Study

14.1.1 RES UK & Ireland Ltd ('the applicant') commissioned Oxford Economics in the spring of 2023 to undertake a socioeconomic impact report on the proposed Mullaghclogher Wind Farm, hereafter referred to as 'the proposed wind farm', which is located in the Derry City and Strabane council area.

14.1.2 The proposed wind farm consists of 11 three-bladed turbines, with a planned operational lifespan of 35 years. The total megawatt (MW) capacity of the proposed wind farm is expected to be 66 MW, with each turbine having a 6 MW capacity.

14.1.3 This report presents estimates relating to the direct, indirect, and induced benefits that could be generated by the construction and operation of the proposed wind farm. It also provides a discussion on the current socioeconomic environment in which the investment would take place, and the energy and environmental benefits associated with a development of this type and scale.

About the Applicant

14.1.4 The applicant is the world's largest independent renewable energy company. At the forefront of the industry for over 40 years, the applicant has delivered more than 27 GW of renewable energy projects across the globe and supports an operational asset portfolio exceeding 41 GW worldwide for a large client base. The applicant employs more than 4,500 people and is active in 11 countries working across onshore and offshore wind, solar, energy storage and transmission and distribution.

14.1.5 Since it was established in the UK in 1981, the applicant has been a pioneer in renewable energy, developing the UK's second ever wind farm in 1992. The applicant has a significant portfolio of projects covering onshore and offshore wind, solar, and energy storage. The applicant is responsible for keeping ten percent of the UK's renewable energy projects operating and it provides support services—asset management and operations & maintenance—to a sizeable portfolio for leading clients in the industry.

14.1.6 RES has been building wind farms in Ireland since the early 1990s and from their office in Larne, Co. Antrim. In Northern Ireland, RES has developed 26 onshore wind farms in Northern Ireland totalling in excess of 500 MW and operates over 150 MW of wind capacity across Northern Ireland including the Craiggore and Evishagaran Wind Farms in Co. Derry/Londonderry, constructed in 2022, and Murley Mountain Wind Farm, Co Tryone more recently completed in 2024.

Structure of the Report

14.1.7 This report is structured as follows:

- Firstly, the estimated quantifiable economic benefits of the construction and on-going phases of the proposed wind farm are presented—concentrating on employment, Gross Value Added (GVA),[1] and wages. An assessment of the potential fiscal benefits is also included;

- Secondly, an overview of the socioeconomic conditions, both at the regional and local levels, is provided as context;
- Thirdly, the energy and environmental context is considered, highlighting the contribution the proposed wind farm could make towards emissions targets at the regional and national level; and
- Finally, the overall conclusions in respect to the proposed wind farm are set out.

14.2 Quantifiable Economic Benefits

14.2.1 This section analyses the estimated quantifiable benefits of the construction and operational phases of the proposed wind farm—concentrating on employment, GVA, and wages, as well as fiscal benefits. All results relate to the benefits at the regional level (Northern Ireland), unless otherwise stated.

14.2.2 A key assumption behind Oxford Economics' analysis relates to displacement.[2] Zero displacement has been assumed during both the construction and operational phases of the proposed wind farm. This assumption is in part based on an analysis of the Northern Irish construction sector (see section 14.3), which is likely to have enough spare capacity to accommodate the proposed wind farm. Additionally, although the site for the proposed wind farm is currently common land used for grazing, the applicant has informed Oxford Economics that no economic activity would be displaced. Given the above, and the fact that the total amount of on-going employment would be limited in number, the estimated benefits arising from the operational phase assume no material displacement of economic or leisure activity.

14.2.3 Renewable energy developments such as onshore wind will collectively and in the long-run displace demand for fossil fuels. However, the UK Government has set a target of net zero carbon emissions by 2050, promoting a transition away from fossil fuels towards renewable energy.[3] As such, any potential displacement is consistent with nationally stated policy aims.

Economic impact of the construction phase

14.2.4 The benefits associated with the construction phase of the proposed wind farm (in terms of employment, wages, and GVA) are presented below.[4] These results are based on data provided by the applicant regarding the expected value of investment to be realised in Northern Ireland as well as the expected levels of employment required for construction, based on previous projects. By assigning this employment and investment data to sectors of the economy, it is possible to estimate the associated direct GVA and wage impacts (using published and/or forecast data).

[1] Gross Value Added (GVA) measures the value of goods and services produced in an area, industry, or sector of an economy and is equal to output minus intermediate consumption.
[2] Displacement is the degree to which the effects which produce additional economic activity may lead to consequent reductions in activity elsewhere in the economy that would not have occurred if the intervention had not been made.
[3] UK Government. Web article: https://www.gov.uk/government/publications/net-zero-strategy. Accessed 17th July 2023.
[4] Please be aware that total values presented throughout this Chapter may not sum due to rounding.

14.2.5 An input-output model is then used to estimate the indirect and induced impacts that are likely to flow from a given level of investment/activity. An input-output table provides information on how sectors purchase from one another, and how households spend their income. UK input-output tables, published by the ONS, have been adjusted to account for regional characteristics—please see Annex 1 at the end of this Chapter for further discussion.

14.2.6 The proposed wind farm is estimated to result in a capital spend of approximately £101 million (in nominal prices).[5] This figure is based on information provided by the applicant and includes the estimated cost of turbines, Balance of Plant (BoP), local and miscellaneous spend, grid connection, and professional services. Only a portion of this investment, however, would be realised in Northern Ireland.

14.2.7 The total construction spend realisable within Northern Ireland is approximately £35 million (in nominal prices).[6] This includes, for example, the cost of connection to the electricity grid, as well as five percent of the estimated cost of turbines through activities such as the use of local haulage and crane companies. Any remaining construction spend not taking place within the region is assumed to be imports. The proportion of total investment realised regionally is comparable to an estimate published in a recent report by BiGGAR economics, on behalf of Bute Energy, for the Twyn Hywel Energy Park.[7] For modelling purposes, all expenditure information has been converted into 2019 real prices, to ensure consistency with the model's inputs and national accounts publications.[8]

14.2.8 For the purposes of this assessment, we assume a constant spend per month over the course of the construction phase. This results in an assumption of 75 percent of total spend being realised in 2027 and the remaining 25 percent in 2028. As such, Oxford Economics' baseline forecasts for GVA, productivity, and wages have been used to estimate the future economic impacts.

14.2.9 The applicant has developed 26 onshore wind projects in the UK & Ireland over the last 10 years. Based on this experience, the applicant has provided estimated figures for the total number of employees that would be required for the wind farm's construction, and the estimated length of their employment. In order to conduct the below analysis, these figures have been adjusted into job years terms and split across the relevant sectors of the economy.[9]

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[5] As the international geopolitical landscape continues to change so does the level of uncertainty around economic growth and inflation prospects in the UK. The nominal cost of the proposed wind farm, provided by RES, is an accurate estimate at the time of writing. While prices are likely to rise in the short term, we isolate the effects of inflation by calculating the economic impact in real terms.

[6] For this analysis, the total construction phase spend in Northern Ireland is defined as the cost realised regionally for turbines, Balance of Plant (BoP), food, fuel, plant hire, road maintenance, grid connection, and miscellaneous. It does not include the cost of professional services.

[7] BiGGAR Economics (2022). *Twyn Hywel: Socio-Economic Impact Appraisal*.

[8] The construction phase and operational phase benefits presented within this section, which have been estimated using an Economic Impact Model, are expressed in real/constant prices with 2019 as the base year. This is consistent with the base/reference year within the ONS' National Accounts (the Blue Book 2022) and Oxford Economics' suite of forecasting models. This is not to say 2019 data has been used: the latest available data and the relevant forecast year have been taken in every case. The construction-spend figures provided by the applicant have been adjusted accordingly for consistency.

[9] The nature of employment in the majority of sectors means that the jobs directly sustained by the construction of the proposed wind farm are on-site and based in the local area in which the proposed wind farm is located. Employment in the professional services sector sustained during the construction phase could, however, be located off-site and/or be remote in nature. This is also the case for employment sustained once the proposed wind farm is operational.

Direct construction phase impacts

14.2.10 The proposed wind farm's construction phase is estimated to create or sustain 130 direct job years of employment in Northern Ireland, 95 of which are involved with construction related activities, with the remaining job years split across other sectors in the economy (Table 14.1). This direct construction phase employment would be likely to create or sustain £3.8 million of direct wages in the Northern Irish economy, generating £10.4 million in GVA.

Table 14.1: Direct benefits from the construction phase, Northern Ireland

	Job years	Wages (£2019m)	GVA (£2019m)
Construction	95	2.2	5.9
Electricity, gas, steam & air	20	0.6	2.7
Professional, scientific & technical	5	0.4	0.6
Transportation & storage	5	0.4	0.6
Other sectors	5	0.2	0.5
Total	**130**	**3.8**	**10.4**

Source: RES/Oxford Economics. Note: May not sum due to rounding.

Indirect and induced construction phase impacts

14.2.11 The indirect (or supply chain) effects arising from the construction related activity have been estimated using the 2019 UK input-output tables adjusted to take account of the structure and size of the Northern Irish economy. In doing so, the methodology uses so-called 'Flegg-adjusted Location Quotients (FLQs)', which are consistent with the latest approaches and evidence in regional input-output modelling and regional science.[10]

14.2.12 Construction activity typically has strong "backward linkages" with sectors such as building materials, architectural services, legal services and insurance. These linkages tend to result in employment creation elsewhere in the local economy. This makes investment in construction particularly effective in fuelling economic growth, typically offering high output multipliers. The proposed investment could offer a regional employment multiplier of 2.2, and a regional GVA multiplier of 2.0 (once the indirect and induced effects have been accounted for). This means that for every 1 job year and £1 of GVA directly stimulated in the construction sector in Northern Ireland, an additional 1.2 job years and £1 of GVA could be supported through indirect and induced impacts.[11]

14.2.13 Indirect GVA impacts in Northern Ireland are therefore estimated to be approximately £6.3 million, creating or sustaining an estimated 90 job years of employment, with associated wages of £2.7 million (Table 14.2).

[10] Flegg, A. T. and Tohmo, T. (2013) "Regional input-output tables and the FLQ formula: A case study of Finland" (Regional Studies, 47 (5). pp. 703-721).
[11] These figures relate to Oxford Economics' estimates of Type II output multipliers for the UK. Type II multipliers capture direct, indirect, and induced effects.

Table 14.2: Total (direct, indirect, and induced) benefits from the construction phase, Northern Ireland

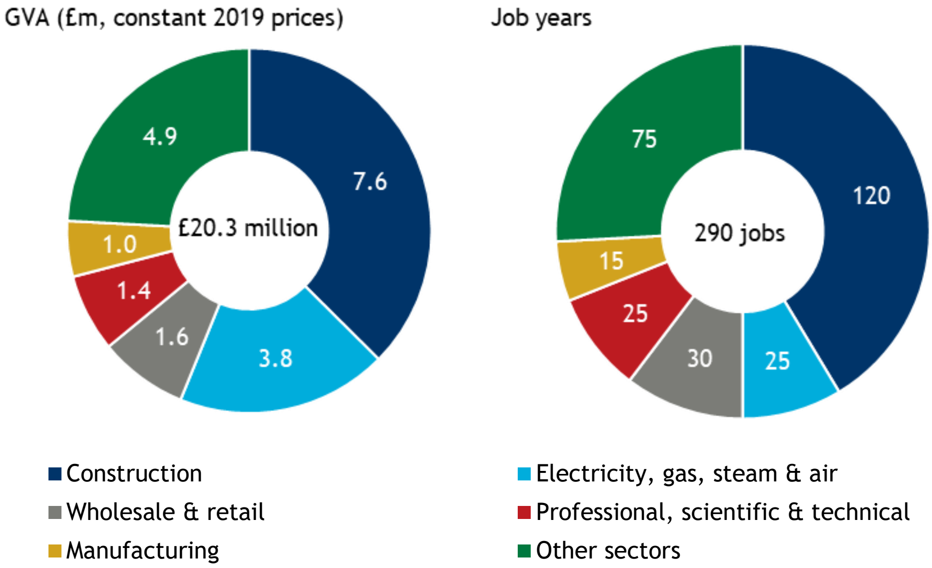
	Job years	Wages (£2019m)	GVA (£2019m)
Direct	130	3.8	10.4
Indirect	90	2.7	6.3
Induced	70	1.5	3.7
Total	**290**	**8.1**	**20.3**

Source: RES/Oxford Economics. Note: May not sum due to rounding.

14.2.14 As both direct and indirect wages generated through the construction phase are spent on goods and services in the wider economy, a further round of benefits would spread through the region. This helps to support activity in sectors like retail and leisure outlets, companies producing consumer goods, and a range of service industries. It is estimated that this induced effect would generate £3.7 million in GVA, supporting wider employment of approximately 70 job years alongside £1.5 million of wages. As a result of the numerous rounds of supply-chain and consumer spending that occur in addition to the direct impacts, the total benefits (direct, indirect, and induced) are spread across multiple sectors in the Northern Irish economy (Diagram 14.3).

14.2.15 It is worth reiterating that impacts laid to date in this chapter relate to the regional level. An exact amount attributable to Derry City and Strabane is more difficult to identify and outside the scope of this report. Invariably it depends on the location of the companies appointed that enjoy the direct benefits and the location of the suppliers who provide them with the materials. However, the applicant has informed Oxford Economics that their previous projects have utilised local contractors wherever possible and it remains their intention to use local suppliers and labour for much of the Balance of Plant (BoP) work. It makes sense, not least in terms of the costs and distance argument, to use local firms. That is, local firms can prove to be more cost efficient given the closer proximity to required capital, personnel, and resources. This means that most of the economic benefits are likely to be realised within Northern Ireland, with Derry City and Strabane enjoying some uplift at the local level.

Diagram 14.3: Total sectoral (direct, indirect, and induced) GVA and employment benefits from the construction phase, Northern Ireland



Source: RES/Oxford Economics. Note: May not sum due to rounding.

Economic impact of the operational phase

Direct operational impacts

14.2.16 The applicant has informed Oxford Economics that the proposed wind farm would sustain four direct full-time equivalent (FTE) jobs a year in Northern Ireland once operational in April 2028, three of which are in the professional, scientific & technical sector, and one of which is in the electricity, gas, steam & air conditioning sector (Table 14.4). Using forecasts for productivity in these sectors, the associated direct GVA and wage impacts have been estimated.

14.2.17 The total direct wage impact is estimated to be £140,000 per year. After applying productivity estimates, the on-going direct employment is expected to generate £460,000 of GVA a year. Given the 35-year lifetime of the proposed wind farm, this equates to a cumulative £7 million of direct wages and £24 million of direct GVA in Northern Ireland over the entirety of the operational phase.[12]

14.2.18 The electricity industry plays a significant role in enabling other parts of the economy. Electricity, gas, steam & air conditioning is one of the most productive sectors in Northern Ireland, with output per worker significantly above that of the region overall. As a result, the majority of the GVA impacts would be realised in this sector.

[12] Oxford Economics' productivity forecasts over the operational phase have been taken into account in calculating the cumulative GVA and wage impacts.

Table 14.4: Direct annual benefits from the operational phase, Northern Ireland

	Job years	Wages (£2019m)	GVA (£2019m)
Professional, scientific & technical	3	0.08	0.18
Electricity, gas, steam & air	1	0.06	0.28
Total	**4**	**0.14**	**0.46**

Source: RES/Oxford Economics. Note: May not sum due to rounding.

Indirect and induced operational impacts

14.2.19 Using the adjusted UK input-output tables to identify the supply-chain spending, it is estimated that the proposed wind farm is likely to create or sustain a further three indirect jobs in the Northern Irish economy each year, with wages of approximately £90,000 and GVA of £250,000 per year (Table 14.5). As those employed directly and indirectly spend part of their wages, there could be a further two jobs sustained in the Northern Irish economy, with associated induced wages of approximately £50,000 and GVA of £130,000.

14.2.20 Consequently, we estimate the proposed wind farm would support nine jobs in Northern Ireland per year with associated wages of £280,000 and GVA contributions of £840,000.

Table 14.5: Total (direct, indirect, and induced) annual benefits from operational phase, Northern Ireland

	Jobs	Wages (£2019m)	GVA (£2019m)
Direct	4	0.14	0.46
Indirect	3	0.09	0.25
Induced	2	0.05	0.13
Total	**9**	**0.28**	**0.84**

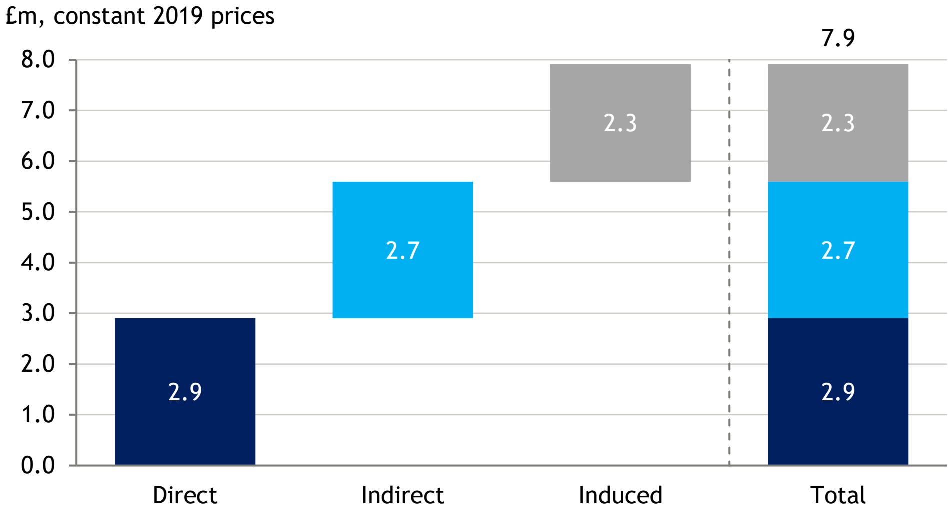
Source: RES/Oxford Economics. Note: May not sum due to rounding.

Fiscal benefits

14.2.21 The economic activity arising from the proposed wind farm would also lead to a range of fiscal benefits as a result of the tax receipts that are contributed to the public purse. These tax benefits occur through several channels, including directly through payments of corporation tax, income tax, national insurance contributions (NICs), and other direct taxes. Additionally, further tax revenues would be collected as a result of supply chain (indirect), and wage consumption (induced) effects.[13]

14.2.22 During the construction period of the proposed wind farm, tax receipts could reach £7.9 million (including direct, indirect, and induced impacts). £2.9 million of this would be generated through direct activity, with an additional £2.7 million and £2.3 million through indirect and induced impacts, respectively.

Diagram 14.6: Total fiscal impact of the proposed wind farm's construction phase, UK



Source: RES/Oxford Economics. Note: May not sum due to rounding.

14.2.23 In addition, sustaining nine operational jobs per year could provide fiscal revenues of £70,000 per year from labour taxes. Over the course of the project's 35-year lifetime, this could lead to a cumulative £2.5 million in tax revenue.

14.2.24 Alongside increased tax revenue from wages throughout the operation of the proposed wind farm, the Northern Irish Government would also benefit from business rates revenue. Business rate calculations in Northern Ireland rely on the Rateable Value (RV) of a property and the non-domestic multiplier ("poundage", or non-domestic rate (NDR)), minus any applicable reliefs. The RV is determined by the Valuations Office Agency (VOA), while the NDR is set by the Northern Irish Assembly each year. The 2023-2024 NDR for the Derry City and Strabane council area is 63.3p for every £1 of RV, of which 27.9p is a regional rate paid to the Northern Irish Assembly, and 35.4p of which is paid to the local council.

14.2.25 The applicant has provided an estimated RV of approximately £1,260,000 per year for the proposed wind farm. Multiplying the estimated RV by the NDR multiplier provides an estimated figure of almost £800,000 in annual business rates payable to the Northern Irish Government. This is equivalent to almost £28 million over the course of the project (given a 35-year operational phase).

[13] Wages that would be generated directly from the operations of the proposed wind farm would be subject to income tax and national insurance contributions (NICs). In modelling labour tax revenues that could be collected by the Treasury, we use the latest income tax and NIC rates, thresholds, and personal allowance information, and apply these to the expected sectoral earnings by decile.

14.3 Socioeconomic Context

14.3.1 The following section considers the recent and future labour market performance of the overall economy, and the construction sector more specifically, at both the regional and local level.

14.3.2 The Northern Irish labour market has shown moderate growth over the last decade. Employment growth in the region averaged 1.3 percent per year between 2012 and 2022, marginally above the equivalent rate for the UK (1.2 percent). Growth within Derry City and Strabane, however, has outperformed the regional level, growing by 1.9 percent per year on average.

14.3.3 Within the construction sector itself, growth in employment was fairly positive over the same time period. At the regional level, construction employment grew at an average rate of 1.0 percent per annum, adding 550 jobs on average each year. The construction sector in Derry City and Strabane recorded almost twice this level of growth, increasing by an average of 1.9 percent between 2012 and 2022. As a result, by 2022, the sector was 21.0 percent larger at the local level than it had been a decade previously.

14.3.4 The current economic climate suggests that the labor market may struggle to maintain this rate of growth in the near future. As inflation surged due to rising energy and food prices, central banks globally cited the need to increase interest rates in response, hiking rates to their highest levels since the onset of the 2008 financial crisis. This has increased costs for businesses and consumers, and squeezed household disposable incomes. Interest rates are expected to remain high into 2024, and therefore it is anticipated that the economy will slow as we head into the next year. It is in this context that total employment is expected to decline by 0.5 percent in 2024 at the national level. Total employment in Derry City and Strabane is forecast to perform similarly, falling by 0.6 percent, in line with the Northern Irish average.

14.3.5 The construction sector is not immune from these pressures, and is also expected to face contractions in employment in 2024. Across Northern Ireland, employment in the construction sector is expected to contract by 0.9 percent next year—losing over 500 jobs. Construction in Derry City and Strabane is expected to contract too, declining by 0.4 percent in 2024. Despite the decline, this would see Derry City and Strabane's construction sector performing better than 9 of Northern Ireland's 10 other local authorities.

14.3.6 Oxford Economics' labour market forecasts suggest little employment growth is expected over the next decade across the UK. Total employment growth in Northern Ireland will be fairly muted (0.3 percent) between 2023 and 2033, and below the national average (0.5 percent). Employment growth in Derry City and Strabane is forecast to be in line with the regional level, with an average of 0.3 percent growth per year over this period, adding a total of almost 2,000 jobs.

14.3.7 The muted forecast for labour market performance is also a reflection of a weak demographic outlook, as total and working age populations are forecast to fall in Derry City and Strabane—a trend reflected across the majority of Northern Irish local authorities.

14.3.8 The region's construction sector, however, is expected to relatively outperform in employment terms over the forecast horizon. At the local level, employment in the construction sector is expected to average 1.0 percent growth per annum between 2023 and 2033, marginally above the sector's forecasted regional and national growth rates (0.9 percent). This rate of growth would see construction employment in Derry

City and Strabane growing at the second fastest rate of Northern Ireland's 11 local authorities. As a result, by 2033, the construction sector in Derry City and Strabane will be 13.8 percent above 2022 levels. This is a stronger performance for the sector than at both the regional (10.1 percent) and national (10.2 percent) levels.

14.3.9 The above analysis has shown that the local economy faces some significant short-term economic challenges in light of recent developments. Additionally, the weak employment outlook is likely to make it more challenging for the Council to address economic needs and development. However, despite short-term difficulties, employment in the construction sector is expected to be a significant contributor to employment growth at the local and regional levels over the next decade. Therefore, it is important to ensure continued investment in the sector due to its importance in promoting opportunities and economic growth prospects. Given the current economic climate, it would also provide private sector investment at a time when businesses and consumers are expected to reign in spending.

14.3.10 Indeed, investment into local climate change assets would help to support the employment recovery within the Council area, but also more widely via multiplier effects. Investment into such projects would also strengthen the UK's overall energy networks, helping to achieve the Government's target of net zero emissions by 2050 and reducing the UK's reliance on energy imports—which has become increasingly important in the aftermath of Russia's invasion of Ukraine. Given this, the proposed wind farm would also help to mitigate against rising energy costs and instability in the energy market.

14.4 Energy and environmental benefits

Contribution to emissions targets

14.4.1 Although the proposed wind farm would bring positive economic benefits to the local and regional economies, its key role should be seen as its contribution towards achieving governmental environmental targets.

14.4.2 The UK Government published its Net Zero Strategy in 2021, laying out policies and proposals for decarbonising all sectors and regions of the UK economy in order to achieve net zero carbon emissions by 2050.[14] For their part, the Northern Ireland Assembly published their own 'Path to Net Zero' energy strategy in 2021.[15]

14.4.3 Renewable energy will clearly have a huge role to play in meeting these goals. As such, the Northern Irish Assembly has set a target to achieve 80 percent of electricity demand being met from renewable electricity sources by 2030, as its energy system transitions to net zero. Northern Ireland has steadily increased its renewable energy usage over the past decade, and the latest statistics for the 12-month period from July 2022 to June 2023 show that 45.5 percent of total electricity consumption was generated from renewable sources located in the region. However, this is a 1.2 percentage point decrease on the previous 12-month period (July 2021 to June 2022).

14.4.4 Wind power is the most important source of renewable energy in Northern Ireland, with 83.5 percent of all renewable electricity generation over the 12-month period

[14] UK Government. Web article: https://www.gov.uk/government/publications/net-zero-strategy. Accessed on July 23rd 2023.
[15] Northern Ireland's Department for the Economy. Web article: https://www.economy-ni.gov.uk/articles/northern-ireland-energy-strategy-path-net-zero-energy. Accessed on 24th October 2023.

from July 2022 to June 2023 coming from wind. Due to the importance of wind energy to the renewables mix in Northern Ireland, it will be important for wind capacity to continue to grow in order for the Northern Irish Government to meet its targets for renewable energy usage, and net zero more broadly.[16]

14.4.5 The proposed wind farm has a 66 MW capacity, consisting of 11 turbines with a capacity of 6 MW each. The amount of electricity that could be produced by the proposed wind farm is estimated at almost 280 GWh per year, which is equivalent to the electricity needs of over 80,000 homes each year.[17] This is greater than the entire current housing stock in Derry City and Strabane, and almost 10 percent of the total housing stock aross Northern Ireland.

14.4.6 In addition to providing a valuable contribution to meeting electricity demand in the region, the proposed wind farm is also estimated to reduce CO_2 emissions by 118,000 tonnes each year. While this estimate represents a gross reduction in CO_2 emissions, it is acknowledged that the construction of wind farms would also produce emissions. Current literature shows that the carbon payback period—the time frame needed for a turbine to offset the carbon emissions generated throughout its life cycle—is relatively short for onshore wind farms. A recent study, 'Space, time, and size dependencies of greenhouse gas payback times of wind turbines in Northwestern Europe',[18] which focused largely on onshore wind farms, finds that the payback period of wind turbines across the region averaged 5.3 months. In addition, the Director of Centre for Energy and the Environment at the University of Exeter said that the carbon payback for onshore wind farms reduces with turbine size. He states that "[y]ou can achieve this payback with a small turbine and as the turbine size increases the payback is shorter. For large three-megawatt turbines we are talking about a 75-day payback. That is very quick".[19]

14.4.7 As renewable energy usage increases, and its costs come down, the generation of electricity through wind could have financial benefits in addition to its obvious climate effects. A recent study by Renewable UK, titled 'The Onshore Wind Industry Prospectus',[20] assesses the benefits of 30 GW of onshore wind across the UK by 2030. They estimate that developing onshore wind on this scale would pay back around £16.3 billion to consumers, or £25 a year for every UK household.

[16] Northern Ireland's Department for the Economy. Web article: https://www.economy-ni.gov.uk/news/electricity-consumption-and-renewable-generation-northern-ireland-year-ending-june-2023. Accessed 24th October 2023.
[17] The UK average domestic household electricity consumption (temperature adjusted) is taken from figures published by the Department of Business, Energy and Industrial Strategy (BEIS): https://www.gov.uk/government/statistics/energy-consumption-in-the-uk-2023.
[18] Dammeier et al (2019). *Space, Time, and Size Dependencies of Greenhouse Gas Payback Times of Wind Turbines in Northwestern Europe*. Environmental Science Technology. Volume 53, Issue 15, p. 9289-9297.
[19] Web article: *Devon can become the heart of a 'Southwest powerhouse' fuelled by onshore wind*. Accessed on 4th July 2023.
[20] Renewable UK (2021). *The Onshore Wind Industry Prospectus*.

14.5 Conclusions

14.5.1 The proposed wind farm would aid the Northern Ireland Assembly in meeting its climate target of 80 percent of electricity demand being met by renewable energy by 2030. With an estimated annual electricity production of almost 280 GWh, the proposed wind farm could provide electricity equivalent to the needs of over 80,000 homes each year, or almost 10 percent of the total current housing stock across Northern Ireland. Additionally, the proposed wind farm could reduce CO_2 emissions by 118,000 tonnes each year.

14.5.2 The proposed wind farm would also provide an economic boost to the Derry City and Strabane council area and the regional economy, creating employment and stimulating economic activity during its construction and operational phases. There is a strong likelihood of local labour involvement during the construction of the proposed wind farm, providing an economic boost to the local areas.

14.5.3 The local and regional economy face a challenging economic environment, with employment expected to contract next year and experience muted growth over the remainder of the forecast period. However, the construction sector is expected to be a leading contributor to growth both locally and regionally during this time. Therefore, it is important to ensure continued investment in the sector due to its importance for future growth. Investment of the type and scale of the proposed wind farm could provide benefits across the region, helping to support employment opportunities that would not otherwise have existed. It can also bring about catalytic benefits which can in turn attract further investment into Northern Ireland. For example, the knowledge, expertise and skills accumulated can act as a contributing factor to future investments in the area. Funding for such developments is usually project specific and involves considerable sunk costs. Therefore, if the proposed wind farm does not take place, the benefits, including the catalytic impact, are unlikely to be realised elsewhere in the Northern Irish economy.

14.5.4 The proposed wind farm is estimated to involve a capital spend of approximately £101 million in nominal prices. Of this total, £35 million would be realised within the regional economy. The projected construction phase is estimated to create or sustain 290 total (direct, indirect and induced) job years of employment, £8.1 million of wages, and £20.3 million of GVA to the Northern Irish economy.

14.5.5 The estimated total (direct, indirect, and induced) annual benefits realised in Northern Ireland by the operational phase of the proposed wind farm includes 9 jobs, £280,000 of wages, and £840,000 in GVA.

14.5.6 The proposed wind farm is also expected to provide a fiscal injection in terms of increased tax revenues. Estimated tax revenues over the construction phase are estimated to be £7.9 million, with an additional £70,000 expected in labour taxes for each year of operation. Additionally, annual business rates for the proposed wind farm are estimated at almost £800,000.

14.6 Annex 1

Glossary of definitions

Backward linkages: refers to the channels through which money, materials, or information flows between a company and its suppliers, creating a network of economic interdependence. In terms of this study, it refers to the fact that the construction phase of the proposed wind farm would require the purchase and use of raw materials from sectors like building materials, steel, architectural services etc., which themselves would create supply-chain jobs in the economy.

Full-time equivalents (FTE): all the modelling completed by Oxford Economics, and all the effects associated with this modelling, assumes that employment is expressed in terms of FTE, which is important given the prevalence of part-time working especially in the construction sector. Accordingly, two part-time workers make up one full-time equivalent worker.

Gross value added (GVA): measures the value of goods and services produced in an area, industry or sector of an economy and is equal to output minus intermediate consumption.

Direct impact: defined as the economic activity and number of people employed by the proposed wind farm (both in construction and in on-going roles).

Indirect impact: defined as economic activity that is supported because of the procurement of goods and services during construction and operations, throughout the economy. It includes not just purchases by occupiers of the proposed wind farm, but subsequent rounds of spending throughout the supply chain.

Induced impact: defined as economic activity and employment supported by those directly or indirectly employed spending their wage income on goods and services in the wider UK economy.

Job years: any references to the employment benefits from the construction phase of the proposed wind farm are expressed in terms of “job years”. This is necessary given that construction phase activity normally spans more than a single year. A job year does not necessarily mean one job. Instead, it refers to the amount of activity that is required. For example, two people could be employed for six months—this would equate to one job year of work. Alternatively, one person could be employed for two years—this would equate to two job years of employment. The term job years is not needed when talking about the on-going phase, as these benefits are all expressed in per annum terms.

Nominal prices: those which reflect the current situation and are not adjusted for seasonality or inflation.

Real prices (2019 prices): refers to values that have been adjusted to remove the effects of inflation and are thus measured in terms of the general price level in some base reference year. This measure of prices is more accurate. In this case, 2019 is the base year as it is consistent with the base/reference year used within UK ONS National Accounts, The Blue Book 2022.

Understanding economic impact assessments

Introduction

Economic impact modelling is a standard tool used to quantify the economic contribution of an investment or series of investments in an economy. As set out earlier in the report, the economic impact analysis outlined here estimates the contribution of the proposed wind farm through three channels (direct, indirect, and induced impacts).

These three channels form the estimates of the quantifiable economic benefits of the proposed wind farm. However, in practice there may be a range of wider economic benefits that occur as other economic agents respond 'dynamically' to the investment and operations of the proposed wind farm. While not typically quantifiable, these benefits nevertheless form an important part of the economic benefits of the proposed wind farm. These effects can include for instance the proposed wind farm acting as a catalyst for further clustering and agglomeration effects, providing employment opportunities for local residents, and unlocking additional growth in particular sectors.

Direct impacts

The applicant has provided Oxford Economics with the expected capital expenditure for the construction phase and provided estimates of the direct employment the proposed wind farm would create once fully operational.

The economic output produced in these sectors is translated to GVA, jobs (using local, regional, or national productivity, where appropriate), and wages, using data from published input-output tables. Oxford Economics' forecasts of sectoral productivity are also used at the national, regional and/or local level.

Indirect and induced impacts

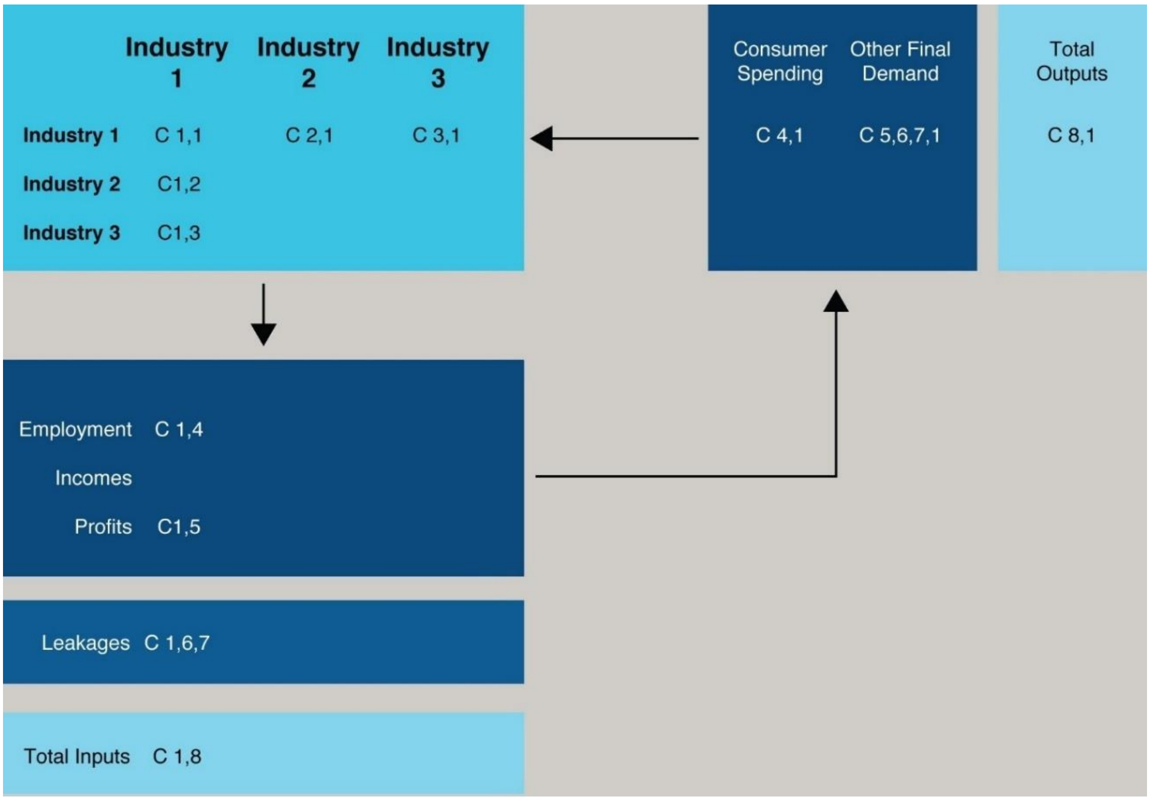
Indirect and induced impacts were estimated using an input-output model. An input-output model gives a snapshot of an economy at any point in time. The model shows the major spending flows from: final demand (i.e., consumer spending, government spending, investment, and exports to the rest of the world); intermediate spending patterns (i.e., what each sector buys from every other sector—the supply chain in other words); how much of that spending stays within the economy; and the distribution of income between employment and other forms such as corporate profits. Diagram 14.7 provides an illustrative guide to a stylised input-output model.

In building the impact model, the latest UK input-output tables published by the Office for National Statistics (ONS) have been adopted.[21] To calculate regional economic impacts, the national input-output tables are adjusted to account for the characteristics of the Northern Irish economy—namely the overall size and degree of

[21] ONS, *UK input-output analytical tables—industry by industry*, 2022, accessed 2022.

specialism within each sector. This reflects academic guidelines set out in papers such as Flegg & Tohmo (2013).[22]

Diagram 14.7: A stylised input-output model



Source: Oxford Economics

Displacement

Displacement can be defined as the proportion of impacts generated by the proposed wind farm which are offset by reductions in economic activity elsewhere.

In order to consider the potential for displacement in the construction sector, the current level and capacity of the sector was reviewed, and its outlook for growth. This analysis indicates that the sector would have capacity to absorb the additional activity arising from the proposed wind farm, which is unlikely to result in a significant degree of displacement, when placed into context of the sizeable construction sector. It is therefore assumed that no displacement occurs within the construction phase.

Similarly, the analysis of recent trends across the Northern Irish economy indicate that the operational phase is not likely to result in significant displacement effects. Displacement is unlikely to occur when considering the scale of the proposed wind farm within the sizeable Northern Irish economy. Furthermore, the current site at the proposed wind farm is common land used for grazing and the applicant have

[22] Flegg, A. T. and Tohmo, T. (2013), *Regional input-output tables and the FLQ formula: A case study of Finland*, Regional Studies (47 (5). pp. 703–721).

stated that no economic activity would be affected by the proposed wind farm. It is therefore assumed that no displacement occurs within the operational phase.

Caveats

Specific information relating to the proposed wind farm was provided where possible by the applicant. The estimated benefits are based on a mix of this information, published data, and reasonable assumptions.

The cost of construction could inflate or deflate depending on movements in variables such as exchange rates, demand for wind turbines, and metal prices. As such the information is the best current estimate at the time of writing.

This economic impact study has been developed to form part of the environmental information to be provided as part of the planning application. As such, if and when the time comes that the proposed wind farm is granted full planning permission and has been built, the economic environment may look different. The analysis assumes all facilities contained on the site are fully developed.

There is no analysis within the report focusing on how the proposed wind farm would affect income distribution and deprivation levels in the area. This is outside of the scope of this piece of work.

The quantifiable impacts calculated by Oxford Economics and outlined in this report come from an Economic Impact Model which uses an input-output framework, standard economic underpinnings, published data and few clearly documented reasonable working assumptions. The modelling presented here does not factor in industry support mechanisms.

15

Schedule of Mitigation

15 Summary of Mitigation

This chapter summarises the mitigation measures that have been proposed to offset the potential impacts of the Proposed Development. These mitigations have been proposed to reduce the level of impact to not significant. Alongside each mitigation measure identified, the proposed mechanism by which it will be adopted, implemented or enforced has been provided as well as the period by and /or timing which the mitigation measure will be undertaken.

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
Chapter 4 Landscape and Visual Impact	Landscape and visual effects	The exterior surfaces of the turbines will be painted in a recessive, non-reflective light grey colour to minimise their visual prominence against the sky in most weather conditions.	By condition.
		Ancillary facilities, such as the control building, substation and energy storage compounds, have been designed in a manner that is sensitive to the immediate landscape character with regards to location, scale, colour, and choice of materials.	By condition. A Construction & Environmental Management Plan (CEMP) will be agreed with the Planning Authority prior to construction and implemented during construction.
Chapter 5 Archaeology and Cultural Heritage	It is possible that additional, as yet unknown remains may be present within the planned areas of impact, which could be impacted	A programme of archaeological works can be implemented ahead of the development to detect and record any remains prior to any impact. The recording of archaeological remains serves to realise the research value of those remains, and enhance understanding and appreciation of the more significant remains in the wider area which would not be affected.	By condition. Programme of Recording to be agreed with the Planning Authority prior to construction and implemented during construction. To be agreed prior to construction works commencing.

	Accidental direct impacts upon other heritage assets within the ISA may arise should activities such as, but not limited to, ancillary drainage works, and uncontrolled plant movement take place in the vicinity of these heritage assets.	The Proposed Development has been designed to avoid all recorded archaeological heritage assets whose location is confirmed, and so no known buried archaeological remains would be impacted by the Proposed Development. It is possible that additional, as yet unknown remains may be present within the planned areas of impact, which could be impacted (potential cultural heritage receptors A1 - A6). In response, a programme of archaeological works can be implemented ahead of the development to detect and record any remains prior to any impact. The recording of archaeological remains serves to realise the research value of those remains and enhance understanding and appreciation of the more significant remains in the wider area which would not be affected. While this benefit does not undo or fully outweigh the loss of any remains, it would serve to partially compensate for the loss, and would reduce any residual significance of effect to minor adverse to slight adverse. As such, such a programme of archaeological works would ensure that no significant effects would arise as a result of direct physical effects to buried archaeological remains.	By condition. Programme of Recording to be agreed with the Planning Authority prior to construction and implemented during construction. To be agreed prior to construction works commencing.
	General	Given the scale of the proposed turbines, there is little scope for additional mitigation beyond the embedded mitigation undertaken by the design process, which sought to minimise the visibility of the turbines as much as possible, while also seeking to ensure the scheme remains viable. There are no proposed developments which would result in any additional physical impacts to the identified or potential buried archaeological remains within the Site. As such, the Proposed Development would not result in any cumulative effects to buried archaeological remains.	Programme of Recording to be agreed with the Planning Authority prior to construction and implemented during construction. To be agreed prior to construction works commencing.

Chapter 6 Vegetation and Peatland	Land take, resulting in the loss of Wet Heath / degraded Blanket Bog	The loss of degraded blanket bog, wet heath/heathy acid grassland and PMGRP habitats is a permanent and direct effect of medium to high magnitude on receptors of high value and sensitivity. The prime mitigation to reduce to an absolute minimum any disturbance or damage to vegetation, over and above the strict controls provided in the CMS, is habitat restoration and enhancement and vigorous supervision by the ECoW of all activities and at all stages of the Development.	By Condition. A final HMP will be agreed with the Planning Authority prior to construction /DAERA and implemented during construction and operation.
	General	Measures required to address ecological concerns during the construction phase will be incorporated into the CEMP (Construction Environmental Management Plan), which will be submitted to and agreed with the planning authority at the pre-construction stage, including: • No turbine rotors are within 50m from the edge flight-lines such as streams and shelterbelts), which is the minimum stand-off distance from blade tip to the nearest habitat feature likely to be used by bats, (Natural England 2014). • Consideration will be given to the provenance of fill materials for roads, in terms of the similarity of their physicochemical properties (particularly pH) to the present substrate. • The contractor will prepare a CEMP prior to construction activities to provide a method statement for working practices that will include measures, among others, to prevent adverse impacts on rivers and other watercourses. Please also refer to the SUDS design Statement in Appendix 9.1 Surface Water Management Plan. • A “no access” buffer will be implemented along sensitive watercourses to prevent damage to banks and to prevent	By Condition. A CEMP will be submitted and agreed with the planning authority at the pre-construction stage.

		disturbance of riparian habitats, apart from the narrow corridor required during construction. • Access of all machinery and personnel will be limited to the working area corridor. • Site compounds and stores will be sited away from any features of conservation interest, including watercourses. Any of these features in close proximity to the works or to compounds will be fenced to prevent damage by plant or stored materials. • Dust suppression filters and appropriate wetting of running and work surfaces will be used to prevent masking of vegetation outside construction corridors, where appropriate. • Appropriate speed limits will be imposed to reduce the potential for dust production. • Excavations left unattended overnight should be ramped in at least one location to allow mammals to avoid becoming trapped. • It is also recommended that, to minimise the risk of suspended sediment entrainment in surface water run-off, the site drainage system should only be carried out during periods of low rainfall and therefore minimum run-off rates.	
	Discharge of silt and pollutants into local drainage system	Containment measures may include: • Where works near or in watercourses are unavoidable, working practices will include standard methods designed to minimise sedimentation and pollution, and measures will be put in place before the works begin to ensure containment of any released sediments. These may include silt containment booms or sediment barriers, as appropriate. Land stripping will be done in stages to minimise the potential for concentrated, long-lasting	By Condition. A CEMP will be submitted and agreed with the planning authority at the pre-construction stage

		pulses of silt to discharge into watercourses. All filtration systems will be monitored frequently, and they will be replaced before they become ineffective. • Material storage compounds will be located remote from any watercourse. Surface water run-off high in suspended solids should be contained and treated prior to discharge to any watercourse. All storage tanks should be bunded and should be sited remotely from any watercourse. Works should incorporate the relevant Pollution Prevention Guidelines. Additionally, a Pollution Incident Response Plan should be put in place as part of the Construction Management Plan. • Water should be pumped from turbine bases during construction either to areas of ground capable of absorbing the water or to settlement ponds prior to discharge. Any discharged water must be free of cementitious products. • All tracks and drains will be maintained and monitored to ensure that surface water flow is directed as designed, and that ponding and blockages are prevented.	
Chapter 7 Terrestrial Fauna	Temporary disturbance to badgers during construction	A pre-construction badger survey will be completed. A 25m buffer zone around the entrances to a badger sett is usually recommended to protect the underground tunnels associated with the sett and allow badgers undisturbed access to it. However, due to the proximity of the proposed construction works associated with the development, it will not be possible to maintain this buffer in all cases. Therefore, it is proposed to close this sett (No. 4) prior to commencement of construction work, in order to ensure that it is not used by badgers. The sett closure will be carried out by a suitably qualified ecologist who has obtained a licence from NIEA to disturb badgers. Development should not fragment key foraging habitats for badgers; due to the isolated location of the site and minimal human disturbance, it is anticipated that badgers will remain free	By condition. A CEMP will be agreed with DAERA / Planning Authority prior to construction and implemented during construction.

		to roam across the site following the proposed works therefore no further mitigation / compensation is required. The cumulative impact on badgers is considered to be not significant.	
	Temporary disturbance to Viviparous (common) Lizard	Depending on the commencement of construction on site, the works corridor will be mowed. If possible, this work will be undertaken before the end February (to avoid a conflict with the bird breeding season). If this is not possible, then mowing will take place between August and September, when common lizards are likely to be fully active. Should the latter be required, the corridor will be subjected to an active nest survey by a suitably qualified ornithologist immediately prior to the commencement of mowing operations. • Clearance of stones, tree stumps, logs, brash, rocks or piles of similar debris will be undertaken carefully and by hand. Although this is only required in a few areas where the proposed site tracks traverse low stone walls. This work will not take place during the hibernation period for common lizard (i.e., mid-October to mid-March). • Clearance of tall vegetation will be undertaken using a strimmer or brush cutter with all cuttings raked and removed the same day. Cutting will only be undertaken in a phased way which will either include: • Cutting vegetation to a height of no less than 30mm, clearing no more than one third of the site in anyone day or; • Cutting vegetation over three consecutive days to a height of no less than 150mm at the first cut, 75mm at the second cut and 30mm at the third cut; Following removal of tall vegetation using the methods outlined above, the remaining vegetation will be maintained at a height of 30mm through regular mowing or strimming to discourage common lizards from	By Condition. A CEMP will be agreed with DAERA / Planning Authority prior to construction and implemented during construction.

		returning. Ground clearance of any remaining low vegetation (if required) and any ground works will only be undertaken following the works described above. As an additional precaution the ECoW will be present from the commencement of clearance/construction with a watching brief to ensure that no common lizards remain within the construction corridor and remain in situ until the area is cleared to ensure no species or habitat conflicts emerge affecting damage to the local lizard population. If any common lizards are found during excavation works, all works within the affected area will cease until the ECoW has safely removed them (under licence) from the construction corridor. Should it prove necessary during site supervision (i.e., lizards are observed returning to the construction corridor); a protective lizard barrier fence will be installed along both sides of the construction corridor in order to prevent common lizards from entering the works area.	
	Potential collision of bats with turbine blades; Mitigation for Bats	A Bat Mitigation Monitoring Plan (BMMP) will be implemented and will consist of "feathering" of the blades, and post-construction monitoring in the form of casualty searches, undertaken during years 1-3 post construction. These will be extended for a further two seasons in the event that activity levels (as recorded during the static monitoring) are moderate/high (>50 bat passes at the turbine during a single night) or if a bat carcass is found.	By Condition. A BMMP will be agreed with DAERA / Planning Authority prior to turbine erection and implemented during operation of the wind farm.
Chapter 8 Ornithology	Impacts on breeding birds during construction	No development activity will take place on the Site between 1 March and 31 August in any year until an Ornithology Mitigation Strategy (OMS) has been prepared by a suitably experienced ornithologist and approved by the Planning Authority.	By condition. OMS to be agreed with the Planning Authority prior to construction and implemented during construction.

	Compensation for the potential displacement of snipe	Proposed mitigation, habitat management measures totalling 246.6ha including 55.4ha away from the turbines to be implemented long term during the life of the proposed turbine development. This will protect breeding snipe during the construction phase.	By condition. Final HMP to be agreed with the Planning Authority prior to construction and implemented during construction.
	Monitor the effects of the Proposed Development and the HMP on local bird communities	No development activity will take place until an Ornithology Management and Monitoring Plan (OMMP) has been prepared by a suitably experienced ornithologist and approved by the Planning Authority.	By condition. OMMP to be agreed with the Planning Authority prior to construction and implemented during construction and operation.
	Timing of Works	Implementation of a water quality monitoring programme to examine the effects of the infrastructure construction works on surface water quality. It is recommended that the monitoring programme be continued through the operation and decommissioning phases of the Proposed Development.	During construction.
Chapter 9: Fisheries	Effects of construction on surface water	A Pollution Prevention Plan will be included as part of the Construction Environmental management Plan (CEMP) for the Proposed Development, to be agreed with the local planning authority at the pre-construction stage. This will incorporate a contingency plan setting out the procedure to be followed in the event of a significant spillage occurring.	By condition. SWMP to be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.

	Effects of development on surface water	The installation of culverts (clear-span) to major watercourses (Stroanbrack tributary 1 and Glengarrow Burn) will ensure no loss of the habitat of fish or sensitive benthic invertebrates, ensure free movement of any fish present in the channel and prevent any change in channel morphology or flow alteration due to in-stream structures. Typical design drawings for a bottomless culvert and closed culvert have been provided as part of the planning application and are included as part of the Drainage Management Drawings within Technical Appendix 10.1: Surface Water Management Plan. The proposed surface water management plan and associated SuDS system will also facilitate the interception of diesel, oil or other polluting substances during the construction phase.	By condition. WQMP to be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction, operation and decommissioning Schedule 6 consents will be sought for watercourse crossing design.
	Release of pollutants	The Proposed Development will adopt a surface water management plan / site drainage design using the principles of Sustainable Drainage, promoting the principles of onsite retention of flows and use of buffers and other silt removal techniques. See Technical Appendix 10.1: Surface Water Management Plan. All drainage related mitigation measures proposed will be encompassed by a robust and proven Sustainable Drainage System (SuDS) design which will be used to control drainage and silt management on the site. Onsite drainage design will minimise modification and disruption of the existing natural hydrology by: • Maintaining existing overland flow routes and channels. Existing natural flow paths lateral to access roads will be maintained through the use of piped crossings under road alignments at natural depressions and at regular intermediate intervals. The spacing of cross drains will be specified at detailed design stage; • Avoiding transporting rainfall runoff in long linear drainage swales by providing regular channel "breakouts", whereby water is	By condition. PPP to be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction, operation and decommissioning.

		encouraged to flow overland, thus maintaining existing natural hydrological patterns; • Reducing surface water flow rates and volumes by attenuating runoff from tracks and hard standings "at source" by providing check-dams in swales, whereby the flow velocity and rate of discharge is artificially reduced to mimic natural properties; • Providing settlement ponds at turbine hard standing areas and other main surface water discharge locations, where runoff from significant new impermeable areas is treated and attenuated before being released overland; • All swales, crossings and other hydraulic features will be engineered to ensure that dimensions are suitable to convey predicted flows and so prevent build-up of surface water and / or flooding. Drainage design will reduce chemical, silt and other suspended pollutant transport by providing a "treatment train" of two to three stages of pollutant removal to all surface water runoff, nominally by: • Ensuring that drainage swales are designed to convey flows at a low velocity by using a wide, flat bottomed drain; • Providing settlement and filtration features in all linear drainage swales (check dams, filtration dams) to reduce flow velocity and encourage settlement; • Encouraging appropriate vegetation growth in the base of all linear drainage to provide additional filtration to flows; • Providing settlement ponds at turbine hard standing areas and other key discharge locations in order to provide treatment to contaminated runoff prior to discharge; • Discharging surface water runoff over undisturbed vegetated ground, hence allowing any remaining silts and other pollutants to drop out	

		of flows before entering the watercourse (having the effect of polishing the runoff); • Preventing the discharge of surface water runoff flows directly to existing watercourses or drainage. All discharges shall seek to be via SuDS and buffer zones which will act as a filter strip, allowing deposition of suspended solids and other pollutants; • Providing settlement features in water channels downstream of areas of peat infilling and ditch blocking area proposed as part of habitat management and enhancement planning. Without mitigation the effects during the operational phase are predicted to be at worst of ***Major Magnitude*** and of *Very **Large Significance***, depending on specific effects and the sensitivity of individual watercourses. For example, the release of other pollutants to the main Upper Burn dennett River along the north-eastern site boundary could pose a risk to the abundant trout population and its *Good* WFD-based ecological status. However, with mitigation the effects are reduced to ***Neutral***.	
	Loss of habitat at stream crossings	Design Measures: Culverts will be designed to accommodate track crossings and minimise length of channel affected. In the Glengarrow Burn, the installation of a bottomless culvert (Clear span) will preserve the stream bed habitat and ensure no loss of habitat for productivity of algae/ plants and benthic invertebrates.	By condition. SWMP to be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction
	Obstruction of fish passage	Hydraulic design of crossings will be undertaken as per the guidance and requirements provided in CIRIA C689 “Culvert Design and Operation Guide” (or other standard as may be required by DfI Rivers in post-consent consultation), with primary parameters likely to include: • Width of the culvert will be greater than the width of the active drainage channel;	By condition. WQMP to be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented

		• Alignment of the culvert will suit the alignment of the drainage channel, i.e. preserve the existing direction of flow; • The slope of the culvert will not exceed the slope of the bed of the existing drainage channel. • Detailed design of crossings will assume a hydraulic capacity requirement of 1% Annual Equivalent Probability flow including factor for climate change as required by DfI Rivers Technical Flood Risk Guidance in relation to Allowances for Climate Change in Northern Ireland as a conservative measure. Detailed hydraulic design of culverts and similar structures post permission is normal and accepted practice for wind farms in Northern Ireland. • Fisheries shall be protected by adopting the guidance stated in Guidelines for Fisheries Protection during Development Works as published by Loughs Agency. Consultation and approval will be sought from all relevant parties as required by the DAERA Surface Waters Alteration Handbook (November 2017), including and DfI Rivers in particular, at the pre-construction detailed design stage for all works in and affecting watercourses and drains, as per the requirements of Schedule 6 of the Drainage (Northern Ireland) Order 1973 and subsequent amendments. The resultant structures comprise clear span crossings of the significant watercourses, which have been demonstrated to ensure that the effect on flood conveyance is satisfactorily managed and would have no significant adverse effect on flood levels and flood extent within the Site and no adverse effect elsewhere. Preliminary DfI Rivers approval has been sought for the significant watercourse crossings. Without mitigation the effects during the decommissioning phase are predicted to be at worst of ***Moderate Magnitude*** and of **Moderate/ Large *Significance***, depending on specific effects and the sensitivity of individual watercourses. For example, the release of other pollutants could impact on highly sensitive watercourses such as the Burn dennett,	during construction, operation and decommissioning

		Eden River and Glenelly River where Atlantic salmon are present. Mitigation measures will ensure that the effects remain as ***Neutral***.	
	Watercourse crossings	A detailed Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of the CEMP, to be submitted post-consent following detailed site investigations and agreed with the local planning authority. Although this will be of particular importance during construction, it will apply to potentially polluting activities during all phases of the Proposed Development. The detailed PPP will be produced following consultation and agreement with DAERA, and all appropriate personnel working on the Proposed Development will be trained in its use. As a minimum, the PPP will comply with Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidelines (in particular GPP 21: Pollution Incident Response Planning) and best practice as advocated by CIRIA. The PPP will identify site-specific measures and incorporate a Pollution Incident Plan, which will include emergency contact details, details of spill kits on the Proposed Development and instructions on actions in case of spillage / emergency. Significant watercourses identified and requiring application of a buffer to the proposed turbines and infrastructure are largely as per OS close scale vector mapping and were subject to ground truthing on Site. A 50 m buffer has been applied to the significant watercourses identified in the baseline assessment, i.e., significant where catchment within Site is >0.25 km^2. Minor watercourses were given buffers of 10 m based on SEPA and NatureScot (previously SNH) guidance and represent tributary channels on the Site where the catchment area was less than 0.25 km^2. Many are the sources / upper reaches of the more identifiable downstream channels and appear as grass / heather-covered depressions in the land. They are	Through CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction. Operational phase. Decommissioning Method Statement

		distinct and easily identifiable on aerial imagery but often harder to differentiate from the surrounding land at ground level during dry conditions. Others are more defined channels cut into peat.	
	Water Quality Monitoring	A water quality monitoring program will be implemented to monitor effects on the surface water quality regime during the infrastructure construction, operational and decommissioning phases of the Proposed Development, in order to; • Demonstrate that the mitigation measures and surface water management is performing as designed; • Provide validation that the in-place mitigation measures are not having an adverse effect upon the environment; • Indicate the need for additional mitigation measures to prevent, reduce or remove any effects on the water environment, such as additional temporary settlement or filtration structures or short-term flocculant dosing to suit observed site conditions. The monitoring would be informed by existing water quality baseline data and baseline monitoring rounds undertaken prior to the commencement of the construction phase. It is intended that the water monitoring extent, duration and frequency will be agreed with the Department of Infrastructure or the relevant regulating body (nominally NIEA WMU) post consent and will nominally consist of physicochemical and biological monitoring. The extent, duration and frequency of the monitoring will be proportionate to the level of activity during each phase of the Proposed Development and the associated perceived risks.	By condition. WQMP to be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction, operation and decommissioning

Chapter 10: Geology & Water Environment	Pollution Prevention	A detailed Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of a full Construction & Decommissioning Method Statement (CDMS) for the project, to be submitted post-consent following detailed site investigations and agreed with the local planning authority. Although this will be of particular importance during construction, it will apply to potentially polluting activities during all phases of the Proposed Development. The detailed PPP will be produced following consultation and agreement with NIEA, and all appropriate personnel working on the Proposed Development will be trained in its use. As a minimum, the PPP will comply with Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidelines (in particular GPP 21: Pollution Incident Response Planning) and best practice as advocated by CIRIA. The PPP will identify site-specific measures and incorporate a Pollution Incident Plan, which will include emergency contact details, details of spill kits on the Proposed Development and instructions on actions in case of spillage / emergency.	By condition. To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.
	Storage	Onsite maintenance to construction plant will be avoided in all practicable instances, unless vehicles have broken down necessitating maintenance at the point of breakdown. Suitable measures in accordance with a Pollution Prevention Plan (PPP) will be put in place prior to commencement of maintenance in this instance. All equipment, materials and chemicals on the Proposed Development will be stored away from any watercourse (i.e. outwith previously stated buffer zones). Chemical, fuel and oil stores will be sited on impervious bases in accordance with GPP2 and within a secured bund of 110% of the storage capacity, within the temporary storage compound.	By condition. Peat Slide Risk Assessment and Peat Management Plan to be incorporated into CEMP and agreed with the planning authority prior to construction.

	Vehicles and Refuelling	Preference shall be given to construction techniques that do not require use of cementitious materials where suitable practicable alternatives exist. When concrete / cement is used, concrete batching will not be permitted on site. Wet concrete operations will not be carried out within watercourses or adjacent to watercourses. Measures to prevent discharge of alkaline wastewaters or contaminated storm water to watercourses will be outlined in a detailed PPP for the Proposed Development to be approved by the planning authority before commencement of works. Wastewater spillage will be minimised by using settling tanks and recycling water. Refuelling of vehicles and machinery will be carried out on an impermeable surface in designated areas, well away from any watercourse or drainage ditches (i.e. outwith previously stated buffer zones) and will adhere to best practice as detailed in PPG 7.	By condition. To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.
	Maintenance	Mess and welfare facilities will be required during construction and decommissioning and will be located at the construction compound. Foul effluent disposal shall be via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on site). Onsite maintenance to construction plant will be avoided in all practicable instances, unless vehicles have broken down necessitating maintenance at the point of breakdown.	By condition. To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.
	Cement and concrete batching	Preference shall be given to construction techniques that do not require use of cementitious materials where suitable practicable alternatives exist. When concrete / cement is used, concrete batching will not be permitted on site. Wet concrete operations will not be carried out within watercourses or adjacent to watercourses. Measures to prevent discharge of alkaline wastewaters or contaminated storm water to watercourses will be outlined in a detailed PPP for the Proposed Development to be	By condition. To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.

		approved by NIEA before commencement of works. Wastewater spillage will be minimised by using settling tanks and recycling water.	
	Mess and welfare facilities	Mess and welfare facilities will be required during construction and decommissioning and will be located at the construction compound. Foul effluent disposal shall be via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on site).	By condition. To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.
	Construction in the vicinity of Watercourses	The following procedures apply to the general construction activities either within the watercourses or in defined watercourse buffer zones: Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works in order to ensure that in-channel works are undertaken during periods of predicted low flow and low rainfall in order to minimise contact with water; and Ensure that roadside drains do not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation as denoted on design drawings. Temporary measures may include: • Temporary silt fences erected in areas where risk of pollution to watercourses has been identified e.g. watercourse crossing locations and areas where tracks or other infrastructure lie within watercourse buffer zones. • Placing temporary filtration silt fences within drainage channels where siltation is observed. • Installing temporary constructed settlement features such as sumps or settlement ponds / lagoons where required.	By condition. To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction. Schedule 6 consents will be sought for watercourse crossing design.

		• Upslope cut-off drainage channels approximately parallel to the proposed track alignment installed in advance of any excavated cuttings for the track or turbine hardstanding areas. • Watercourses, drains, natural flow paths and cut-off drain outlet locations should be identified and charted, in order to ensure that piped crossings can be installed in advance of or adjacent to the track construction. • Settlement ponds should be constructed in advance of commencing excavations for foundations and at any other locations identified as required at detailed design stage. • Trackside drainage swales should be installed in parallel with track construction. Note that this may require that drainage swales are reformed on an ongoing basis as temporary track alignments are modified to their eventual finished design level. Suitable prevention measures should be in place at all times to prevent the conveyance of silts to receiving watercourses.	
	Construction of Watercourses	Construction of watercourse crossings will be programmed to coincide with periods of predicted low flow in the affected channel (determined by rainfall and would generally coincide with summer months) and adhere to working period restrictions imposed. Construction will be strictly as per the design for each identified watercourse crossing and will fully implement all SuDS and additional mitigating measures proposed at the detailed design stage. For purposes of outline design, the proposed mitigation will include: • Installation of silt fences parallel to the watercourse channel in the vicinity of the proposed crossing; • Installation of small cut-off drains to prevent natural surface runoff entering area of construction activity;	By condition. To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.

		• Installation of filtration or other silt entraining features within the watercourse channel immediately downstream of the works location; and • Use of over pumping were deemed appropriate.	
	Temporary SuDs	Temporary drainage and silt management features (SuDS) will be constructed prior to earthworks (including preliminary or enabling works) proceeding to construct any linear works (tracks / hardstanding areas / cable routes), turbine bases, and other infrastructure. Drainage will be provided to temporary works and reinstated to suit the final footprint of the completed development. Temporary drainage measures in particular will be employed in enabling works to facilitate widening of existing tracks and diversion of minor watercourses where specifically proposed. Temporary measures may include: • Temporary silt fences erected in areas where risk of pollution to watercourses has been identified e.g. watercourse crossing locations and areas where tracks or other infrastructure lie within watercourse buffer zones; • Placing temporary filtration silt fences within drainage channels where siltation is observed; • Installing temporary constructed settlement features such as sumps or settlement ponds / lagoons where required; • Upslope cut-off drainage channels approximately parallel to the proposed track alignment installed in advance of any excavated cuttings for the track or turbine hardstanding areas; • Watercourses, drains, natural flow paths and cut-off drain outlet locations should be identified and charted, in order to ensure that	By condition. To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.

		piped crossings can be installed in advance of or adjacent to the track construction; • Settlement ponds should be constructed in advance of commencing excavations for foundations and at any other locations identified as required at detailed design stage; and • Trackside drainage swales should be installed in parallel with track construction. Note that this may require that drainage swales are reformed on an ongoing basis as temporary track alignments are modified to their eventual finished design level. Suitable prevention measures should be in place at all times to prevent the conveyance of silts to receiving watercourses.	
	Electrical Cable Laying	Due consideration will be given to the prevailing ground conditions and season when programming the execution of cable trench excavations in order to ensure works are undertaken during periods with low rainfall and elevated shallow groundwater levels in order to reduce the likelihood of runoff entering the excavations. Excavation of cable trenches will be carried out over short distances, with frequent backfilling of trenches to minimise opportunity for the ingress of water into open trenches, temporary silt traps will be provided in longer trench runs and on steeper slopes and spoil will be stored in line with a spoil management plan, which will be produced as part of the CDMS at the pre-construction stage.	By condition. To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction. By condition To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.
	Excavations and Spoil Management	Soil and subsoil excavation and movement will be undertaken in accordance with best practice guidelines such as Good Practice Guide for Handling Soils (MAFF, 2000) in order to minimise potential for silt laden	

		runoff from spoil and excavations. Areas of stockpiled spoil including stored peat: • will not be permitted within previously identified watercourse buffer zones; and • will not be permitted to obstruct the flow of overland surface water with specific drainage to spoil mounds to be provided. Material produced from excavations on the Site will be reused where reasonably practicable in the reinstatement of the site. Excavated materials will be separated into rock material, subsoil, reusable peat and vegetated sod material and will be stored in the designated temporary stockpile zones, under the supervision of a geotechnical expert. These materials will be reused where possible to re-grade slopes, and to re-vegetate and stabilise the sides of access tracks and hard standing areas. Spoil drainage will be designed on a bespoke basis for spoil storage areas to allow controlled dewatering and prevent washout of suspended solids to the receiving water environment. As part of the detailed CDMS a spoil management strategy will be developed by the appointed competent contractor for the development. Outline designs for drainage arrangements for temporary spoil areas are shown on the Drainage Management Drawings within Appendix 10.1: Surface Water Management Plan.	
	Dewatering of excavations	It is proposed that localised ditch blocking, permanent and seasonal, be carried out for the purposes of habitat enhancement / restoration. Details are provided in the **Outline Habitat Management Plan (oHMP)** Ditch blocking downgradient of areas of earthworks will have an additional beneficial effect by providing settlement to reduced quality runoff from lands upgradient.	By condition To be included in HMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.

	Dust Management	Loose track material generated during the use of access tracks and the construction compound will be prevented from reaching watercourses by maintenance to surface water drainage systems installed at aggregate based hard standing areas. In dry weather dust suppression methods such as by dust suppression bowser will be employed.	By condition To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.
	Borrow pits	For the avoidance of doubt, no borrow pits are proposed at the Proposed Development, therefore associated pollution risks associated with rock extraction activities are not a consideration.	By condition To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.
	Operational Noise	If planning permission is granted for the proposed development, planning conditions can be proposed to provide a degree of protection to nearby residents in the form of limits relating to noise level and tonality. Technical appendix 11.7 contains a set of conditions which RES considers appropriate.	By condition To be included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction.
	Potential for noise to be created during general construction activities and by construction traffic	A Traffic Management Plan (TMP) will be prepared by the Applicant in accordance with the requirements of DfI, the local PSNI, and if required, any other relevant stakeholders. Features of the TMP will include: • Site operations to be limited to specific time periods (except during turbine erection and commissioning/ periods of emergency work). • Details of the access route, conformation of any points along the access route that require street furniture removal, details of traffic numbers, delivery timings, and signage and escort requirements	By condition. Technical appendix 11.7 contains a set of conditions which RES considers appropriate.

		• A delivery schedule for normal and abnormal loads to minimise disruption as far as reasonably practicable • Details on the use of escorts where required. Where long vehicles and abnormal loads would have to use the wrong side of the carriageway or need to swing into the path of oncoming vehicles a lead warning vehicle would be used. One escort vehicle would drive ahead and pull oncoming traffic into identified passing places. The TMP will include plans for notifying relevant stakeholders in advance of delivery periods, including the emergency services, DfI Roads, local residents, local business, local services and schools. The local community will be informed prior to the commencement of construction and prior to the commencement of turbine deliveries by letter and through local press. The contact details of the Construction Site Manager will be made available as a contact point for enquiries. Local schools on the delivery routes will be contacted to identify school and nursery drop-off and pick up locations and times. Construction deliveries will be scheduled to avoid these busy periods as far as reasonably possible.	
Chapter 11: Acoustic Assessment	Potential for noise to be created during general construction activities and by construction traffic Impact on other road users	For all activities, measures would be taken to reduce noise levels with due regard to practicality and cost as per the concept of 'best practicable means' as defined in the Pollution Control and Local Government (NI) Order 1978. BS 5228-1 states that the 'attitude of the contractor' is important in minimising the likelihood of complaints and therefore consultation with the local authority along with letter drops are advised to inform residents of intended activity. Non-acoustic factors, which influence the overall level of complaints such as mud on roads and dust generation, would also be controlled through construction practices adopted on the site and managed via a Construction Environmental Management Plan (CEMP). Furthermore, the following noise mitigation options will be implemented where appropriate:	By condition Included in CEMP, which will be agreed with the Planning Authority prior to construction and implemented during construction

		• Consideration will be given to noise emissions when selecting plant and equipment to be used at the site; • All equipment to be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable; • Stationary noise sources will be sited as far away as reasonably possible from residential properties; and, • The movement of vehicles to and from the site will be controlled and employees instructed to ensure compliance with the noise control measures adopted. • Site construction operations should be limited to specific time periods except during turbine erection and commissioning or during periods of emergency work. There are many strategies to reduce construction noise by the limitation of activities that will result in noise levels being lower than the threshold noise levels. Any such measures should be considered in proportionate terms and the mitigation adopted should not be limited to the measures proposed here. As with operational noise, if planning permission is granted for the proposed wind farm, planning conditions can be proposed so that appropriate noise mitigation measures and construction practices are included within a final CEMP.	
	Turbine Layout relative to Noise Impact	One of the key constraints and considerations in designing the layout of the turbines was the minimisation of potential noise impacts at the nearest residential receptors. As such the turbine layout was designed to ensure that there is an adequate separation distance between any of the proposed turbines and the nearest residential property. • Due to this consideration of the noise impacts in the design of the wind farm, embedding mitigation measures in the turbine layout, when a conservative candidate turbine is modelled the Proposed Development meets noise limits derived in accordance with ETSU R-97.	

	Operational Phase	Due regard to practicality and cost as per the concept of 'best practicable means' as defined in Pollution Control and Local Government (NI) Order 1978. A range of noise mitigation measures could be implemented where appropriate: • Consideration would be given to noise emissions when selecting plant and equipment to be used on site; • All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable; • Stationary noise sources would be sited as far away as reasonably possible from residential properties; and • The movement of vehicles to and from the site would be controlled and employees instructed to ensure compliance with the noise control measures adopted.	Outline maintenance programme included in Technical Appendix 10.1
	Operational noise	Site operations would be limited to 0700-1900 Monday to Saturday except during turbine erection and commissioning or during periods of emergency work.	By condition. Technical Appendix 11.7 contains a set of conditions that RES considers appropriate.
	BESS	If planning permission is granted for the Proposed Development, planning conditions can be proposed to provide a degree of protection to nearby residents in the form of limits relating to noise level and tonality. Technical Appendix 11.7 contains a set of conditions that RES considers appropriate.	Fire Management Response Plan, to be agreed with the local fire service pre-construction.
	Impact on other road users	A Traffic Management Plan (TMP) will be prepared by the Applicant in accordance with the requirements of DfI, the local PSNI, and if required, any other relevant stakeholders. Features of the TMP will include:	By condition. Through TMP, which will be submitted to and agreed with the

		• Details of the access route, conformation of any points along the access route that require street furniture removal, details of traffic numbers, delivery timings, and signage and escort requirements • A delivery schedule for normal and abnormal loads to minimise disruption as far as reasonably practicable • Details of how any movements will comply with legislation regarding the movement of abnormal loads e.g. notice procedures and notice periods • Details on the use of escorts where required. Where long vehicles and abnormal loads would have to use the wrong side of the carriageway or need to swing into the path of oncoming vehicles a lead warning vehicle would be used. One escort vehicle would drive ahead and pull oncoming traffic into identified passing places. An escort vehicle would travel directly in front of the convoy and pull over any oncoming traffic that comes onto the road after the first escort vehicle has passed. A further convoy escort vehicle would follow the convoy The main traffic impacts are associated with the increase in HGV vehicle movements along the A44 and surrounding tertiary road network during the construction stage of the project. These roads have low levels of existing traffic, and a small number of receptors will be affected. At worst, the frequency of vehicle movements is expected to be one vehicle every five minutes during the six days when the construction of each wind turbine foundation would occur.	planning authority and DfI Roads prior to the commencement of development
	Material reduction to residential amenity	In the event of shadow flicker causing a nuisance mitigation measures can be incorporated into the operation of the Proposed Development to reduce the instance of shadow flicker. Mitigation measures include planting tree belts between the affected dwelling and the responsible turbine(s) or installing blinds at the effected property. In the unlikely event that there is extreme nuisance mitigation could include shutting	By condition A shadow flicker mitigation scheme to be agreed with the planning authority prior to erection of turbines.

		down individual turbines during periods when shadow flicker could theoretically occur.	
Chapter 12: Traffic & Transport	Impact on other road users	A Traffic Management Plan (TMP) will be prepared by the Applicant in accordance with the requirements of DfI, the local PSNI, and if required, any other relevant stakeholders. Features of the TMP will include: • Details of the access route, conformation of any points along the access route that require street furniture removal, details of traffic numbers, delivery timings, and signage and escort requirements • A delivery schedule for normal and abnormal loads to minimise disruption as far as reasonably practicable • Details of how any movements will comply with legislation regarding the movement of abnormal loads e.g. notice procedures and notice periods • Details on the use of escorts where required. Where long vehicles and abnormal loads would have to use the wrong side of the carriageway or need to swing into the path of oncoming vehicles a lead warning vehicle would be used. One escort vehicle would drive ahead and pull oncoming traffic into identified passing places. An escort vehicle would travel directly in front of the convoy and pull over any oncoming traffic that comes onto the road after the first escort vehicle has passed. A further convoy escort vehicle would follow the convoy • Information about marking of vehicles as long/abnormal loads Information will be given on how warning signs will be used. These will be used to advise other road users of 'Caution Slow Plant Turning Ahead' and will be placed at intervals from both directions along the main road approaching the site entrance during the construction phase. The TMP will also detail additional measures to ensure impacts from traffic movements are minimised where possible, for example provision of road sweepers and/or wheel wash facilities.	By condition. Through TMP, which will be submitted to and agreed with the planning authority and DfI Roads prior to the commencement of development

		If required, the wheel wash facilities will include a waterless drive over wheel wash for lorries. This will be provided at the site entrance to prevent mud and dust being brought out from the Site onto the public highway and anything being brought onto Site from public highway. Although experience has shown the majority of mud is shaken off wheels on site before the vehicle reaches the public road, the site entrance and adjacent public highway will also be monitored and cleaned if necessary. The TMP will include details about Video Surveying and Road Repairs. A video survey of the pre-construction condition of all public roads will be recorded around the site entrances and access routes (but including the site entrance and access roads), to provide a baseline record of the state of the roads prior to construction work commencing. This will enable any repairs and maintenance work required to the relevant road due to any damage caused by the passing of heavy vehicles associated with the wind farm construction to be identified following the construction phase. The roads will be returned, at minimum, to the baseline condition at the end of the construction phase. Any damage caused by wind farm traffic during the construction period, which would be hazardous to public traffic, will be repaired immediately. These works will be carried out under permits with DfI Roads, as appropriate. The TMP will include plans for notifying relevant stakeholders in advance of delivery periods, including the emergency services, DfI Roads, local residents, local business, local services and schools. The local community will be informed prior to the commencement of construction and prior to the commencement of turbine deliveries by letter and through local press. The contact details of the Construction Site Manager will be made available as a contact point for enquiries. Local schools on the delivery routes will be contacted to identify school and nursery drop-off and pick up locations and times. Construction deliveries will be scheduled to avoid these busy periods as far as reasonably possible.	

		If cutting or removal of hedges and trees is required, then this should be done outside the bird breeding season (1st March to 31st August) unless otherwise agreed. If work is to be done during the breeding season, then there should be a survey to establish whether nesting birds are present.	
Chapter 13: Shadow Flicker	Material reduction to residential amenity	Mitigation measures can be incorporated into the operation of the Wind Farm to reduce the instance of shadow flicker. Mitigation measures include planting tree belts between the affected dwelling and the responsible turbine(s) and shutting down individual turbines during periods when shadow flicker could theoretically occur.	By condition A shadow flicker mitigation scheme to be agreed with the planning authority prior to erection of turbines.