Technical Appendix A10.1
Ecological Impact Assessment

Proposed Owenreagh / Craignagapple Wind Farm Development, east of Strabane, Co. Tyrone.

Prepared by Woodrow
on behalf of
Ørsted Onshore Ireland Midco Limited

Woodrow APEM Group
Upper Offices,
Ballisodare Centre,
Station Road,
Co Sligo.
Ireland.
F91 PE04
Tel: +353 (0) 719140542
Email: info@woodrow.ie

August 2023

Non-technical summary – Ecological Impact Assessment (EcIA)

Surveys were undertaken within and adjacent to Ecological Study Area (ESA), in order to ascertain the status of ecological features, including habitats, terrestrial mammals, bats, fish and aquatic invertebrates (including freshwater pearl mussel / marsh fritillary). The Development lies within and adjacent to the Sperrins Area of Outstanding Natural Beauty (AONB), as well as upstream of internationally and nationally designated sites, including River Foyle and Tributaries SAC and River Foyle and Tributaries ASSI.

The main potential impacts of the initial decommissioning, construction, and operational phases of the Development on ecological receptors are considered to be:

- Indirect impacts on the following designated sites:
    - River Foyle and Tributaries SAC / ASSI
    - Owenkillew River SAC / ASSI
    - River Finn SAC
    - Lough Foyle SPA (NI / RoI)
    - Silverbrook Wood ASSI

- Direct loss of habitats including 0.133ha Annex I habitat;
- Degradation of habitats;
- Degradation of aquatic habitat (watercourses) and potential downstream ecological impacts;
- Disturbance of protected species; and,
- Bat collision with turbines or barotrauma.

Habitat surveys included general mapping and quadrat surveys, aimed at identifying habitat types either likely to fall under the footprint of the Development or with potential to be affected by it. Habitat surveys also facilitated the creation of a Habitat Management and Enhancement Plan (HMEP) for the Development Site.

A riparian habitat assessment and electrofishing was undertaken along watercourses within the ESA, however, no evidence of salmon (*Salmo salar*) or brown trout (*Salmo trutta*) were recorded here, and subsequently these species are unlikely to be affected by the proposed Development. In addition, the watercourses within the ESA were not suitable for freshwater pearl mussel (*Margaritifera margaritifera*).

Bat surveys were undertaken by the use of transects, roost surveys and, primarily, automated surveys using static bat detectors, with 3 deployments of a minimum 14 no. static detectors at the site during 2019 and 2021, and 6 deployments of 4 no. static detectors in 2018 as part of the scoping exercise. Permanent, context detectors were also deployed along with a weather station to monitor conditions throughout deployment periods. Results showed that overall, the site is used by bats only to a limited extent, and that the risk of significant impacts on bats at the site is low. The potential for impacts upon bats at proposed T13 (specifically soprano pipistrelle (*Pipistrellus pygmaeus*) / common pipistrelle (*Pipistrellus pipistrellus*)) was deemed to be potentially significant as a result of habitat connectivity from a small pipistrelle roost to this location via a partially defunct hawthorn hedgerow.

Surveys for protected mammals such as badgers (*Meles meles*) and otter (*Lutra lutra*) found that, although badger occurs within the ESA, they were unlikely to be significantly affected by the Development, as no badger setts exist within 300 m of the proposed infrastructure or within 240m of the existing infrastructure at the Study Area. Otter, an EU Habitats Directive Annex IV species and also a Priority Species in NI, were also recorded within the ESA and have been considered further for potential impacts. Other mammals surveyed for included red squirrel (*Sciurus vulgaris*), a species for which it was considered there would be no significant impacts due to a lack of direct impacts on local conifer plantations, and Irish hare (*Lepus timidus*), which were observed using the ESA and included as a potential receptor of significant impacts based on their Priority Species status in Ireland. Finally, pine marten (*Martes martes*) was not recorded

within the ESA but are assumed to potentially inhabit the coniferous woodlands in the environs. This species is an NI Priority species.

Reptile surveys at the site (using refugia mats) found that the ESA holds a low population of common lizard (*Zootoca vivipara*). This species is a Priority Species in NI. Bogland provides an important habitat for common lizard, and there is the potential to affect the local population of lizard through removal of suitable habitat.

Surveys for marsh fritillary butterfly (*Euphydryas aurinia*) identified no evidence of this species and no suitable habitat was recorded within the ESA. Consideration was given to other lepidoptera species within the ESA. It is considered that the NI Priority Species' argent & sable moth (*Rheumaptera hastata*) is unlikely to occur here as its foodplant was not present is significant quantities. Suitable habitat does exist within the ESA for the large heath butterfly (*Coenonympha tullia*) and the small heath butterfly (*Coenonympha pamphilus)*. The HMEP measures prescribed as part of this EIA will endeavour to enhance suitable habitats for these species.

A number of mitigation measures are proposed that include, minimisation of the works footprint (embedded design-stage mitigation), measures to time specific works to avoid disturbance or potential direct mortality of species (such as bats, common lizard or otter), removal of a *c.* 100 m stretch of defunct hawthorn hedgerow which runs towards T13 to prevent use by bats (and replacement habitat along an adjacent riparian corridor), measures to avoid downstream pollution, as well as habitat restoration and enhancement measures (as per the HMEP). Important documents in the delivery of these measures include the Outline Decommissioning/Construction Environmental Management Plan (oDCEMP), which sets out work approaches and requirements during construction, including the avoidance of downstream water quality impacts) and a Draft Habitat Management and Enhancement Plan (Draft HMEP), which commits to largescale habitat restoration and enhancement measures.

It is considered that all significant ecological impacts can be fully mitigated as part of the EIA process. Short term residual impacts are anticipated until habitat restoration measures are in place and functioning. However, the combination of the use of the existing infrastructure (repowering), and the provision of habitat restoration and enhancement measures in the form of a HMEP means that residual impacts have been reduced as far as possible. The recommended peatland habitat restoration measures endeavour to restore and enhance 42.719 ha of peatland habitat (currently varying from recovering blanket bog to degraded wet modified bog) as part of the Development. These measures aim to enhance habitats across the ESA for the benefit of the local ecology.

Table of Contents

DOCUMENT CONTROL

Document	Ecological Impact Assessment for the Proposed Owenreagh / Craignagapple Wind Farm Development, east of Strabane, Co. Tyrone.
Client	Ørsted Onshore Ireland Midco Limited
Prepared by	Woodrow, Upper Offices, Ballisodare Centre, Station Road, Ballisodare, Co. Sligo, F91 PE04, Ireland. T: +353 719140542
Lead Author	Emmeline Cosnett
Checked by	Róisín NigFhloinn
Approved by	Will Woodrow
Checked by client	27.03.2023
Status / Version / Date	R01 / 17/08/2023

Statement of Authority

This EcIA report was authored by Emmeline Cosnett QCIEEM, checked by Róisín NigFhloinn MCIEEM, and approved by Will Woodrow CEcol MCIEEM. Inputs from specialist Woodrow staff were also sought for certain sections of the assessment, including from James O'Connor and Patrick Quinn ACIEEM (Aquatic / Fisheries assessment), Alice Clarke ACIEEM (Bat assessment), and Bridget Keehan ACIEEM (Botanical assessment).

Róisín NigFhloinn, is an Associate Director with Woodrow, and a project manager for several large infrastructure schemes, as well as for smaller Development projects. She has completed an honours degree, specialising in Botany, and holds a masters in Ecology and Management of the Natural Environment. She is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). She regularly carries out reporting for EcIA, EIAR Biodiversity Chapters / ES Ecology Chapters, and reporting to inform Appropriate Assessment / Habitat Regulations Assessment carried out by statutory authorities. Furthermore, she has more than 13 years' experience in habitat surveys, mammal surveys, bird and bat surveys for a number of large infrastructure schemes, commercial and residential projects. Róisín is also an experienced Ecological Clerk of Works (ECoW).

Emmeline Cosnett QCIEEM is an Ecologist with Woodrow. She has worked in a variety of terrestrial and aquatic environments and has carried out independent published research on botany/pollination ecology and has worked on agri-environmental schemes and botanical habitat surveys across Ireland. Emmeline has excellent habitat classification skills using several classification systems including Fossitt 2000, JNCC Phase 1 and IVC/NVC. Emmeline is also experienced in undertaking mammal, bird and bat surveys. She has experience carrying out site monitoring to assess compliance with habitat management plans and planning conditions and has worked on a wide variety of reports for clients, including those to inform Appropriate Assessment / Habitat Regulations Assessment, Habitat Management Plans and Ecological Impact Assessment reports.

This report has been reviewed and approved by Will Woodrow. Will is a Director at Woodrow APEM Group. He is a Chartered Ecologist, and a full member of CIEEM, with over 30 years of experience in ecological surveys and assessment. He has particular expertise in ornithological assessment, invertebrate identification, and habitat management, particularly when working within peatland environments.

Róisín NigFhloinn – Qualifications:
B.A. Mod (Hons) – Natural Sciences (specialising in Botany), Trinity College, Dublin, 2008.
M. Sc. – Ecology and Management of the Natural Environment, University of Bristol, England, 2011.

Emmeline Cosnett – Qualifications:
BSc (1.1 Hons) – Environmental Science, National University of Ireland, Galway, 2018.
MSc – Wildlife Biology and Conservation, Edinburgh Napier University, 2020-2023 (in progress).

Will Woodrow – Qualifications:
M.Sc. – European Environmental Policy and Regulation, Lancaster University, 1994.
M.Sc. (Arch) – Advanced Environmental and Energy Studies. University of East London, 2006

1. INTRODUCTION

1.1. Background

Woodrow was commissioned by Ørsted Onshore Ireland Midco Limited ("Ørsted") ("The Applicant") to undertake an Ecological Impact Assessment ("EcIA") for the development of the proposed Owenreagh / Craignagapple Wind farm, which includes the decommissioning of the Operational Owenreagh I and Owenreagh II Wind farms and the re-powering of the existing Owenreagh I and II sites and consented Craignagapple site, Co. Tyrone.

This Ecological Impact Assessment (EcIA) evaluates the effects of the Development on terrestrial and aquatic biodiversity (non-avian ecology) and is provided as a separate Technical Appendix A10.1 to the Ecology Chapter (Chapter 10) of the Environmental Statement "ES" for the Development. An assessment of effects on avian ecology is provided in a standalone Ornithology chapter (Chapter 11) and informed by an Ornithological Report within Technical Appendix A11.1 of the ES.

The Development is to be located in the townlands of Craignagapple, Ballykeery, Knockinarvoe, Owenreagh, Ligfordrum and Lagavadder, Co. Tyrone. The location of the Development is illustrated in **Figure A10.1.1 – Geographic Context.**

For the purposes of the EcIA **"The Ecological Study Area" (ESA)**, henceforth referred to as the 'Study Area' encompasses *c*. 596 ha and is the key area in the vicinity of which the ecological surveys were conducted. This is illustrated in **Figure A10.1.2.** The specific survey area for each ecological feature will vary and is dependent upon the feature being assessed and follows the appropriate guidance for each ecological feature according to the Guidelines for Ecological Impact Assessment (CIEEM 2018). These feature-specific variations within the Study Area have been detailed respectively within Section 3 of this report.

The Development includes the Haul Route Options, which are also described and assessed further in **Appendix IV** of this report (these encompass the Abnormal Load Route Works (ALRW)). Further details of the Haul Route Options are shown in **ES Chapter 13: Traffic and Transport** and ES **Figure 13.1**. The potential for significant effects on ecological receptors from works required along the Haul Route have been scoped out of the EIA, as documented in ES **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)**, and hence are not included in the ES Chapter 10. However, any ecological survey and assessment aspects relevant to those works are included in this technical report (See **Appendix IV – Haul Route Assessment**).

While the grid connection forms an important piece of infrastructure associated with the Development, grid applications can only be made after full planning permission for the Development has been obtained. The grid connection will be subject to a separate planning application. This will either be done by SONI (Northern Ireland's transmission system operator) or by the Applicant.

In initial discussions with SONI, they identified two potential grid connection points: Strabane 110kV substation and Killymallaght 110kV substation. Once an application is made, SONI will conduct studies to determine which is the best point of connection. The wind farm will connect to the substation via either an overhead line (OHL) or underground cable along the public road system.

There will also be an electricity substation on site with control and safety equipment for the grid connection. The substation will be located adjacent to the Glenmornan Road for ease of access. The substation building is included in the Development planning application and has been surveyed as part of the Study Area for this assessment. Further details can be found in ES **Chapter 3: Development Description**.

The assessment details the methods used to establish the terrestrial biodiversity interest within the Study Area, and the process used to determine the nature conservation importance of the populations likely to be present here. It then sets out the potential effects on local biodiversity during construction, operation and decommissioning and assesses the significance of these effects. Means to mitigate any adverse

and/or significant effects are then proposed (it should be noted that the ES takes account of 'Significant Effects' only and general adverse impacts are addressed here within the EcIA (which is supported by the documents listed below). As well as considering potential impacts on flora and fauna, the assessment also considers impacts on Designated Sites.

The EcIA and ES are supported by the following appendices:

- **Technical Appendix A10.2 of ES: Shadow Habitats Regulation Assessment and HRA;**
- **Technical Appendix A10.3 of ES: National Vegetation Classification (NVC) Assessment;**
- **Technical Appendix A10.4 of ES: Active Peat Assessment (APA);**
- **Appendix III of EcIA: Confidential Badger Report (note that this is provided separately to the EcIA so that its circulation can be appropriately restricted to relevant consultee bodies only);**
- **Technical Appendix A3.2 of ES: Draft Habitat and Species Management and Enhancement Plan (Draft HMEP) (including Peatland Restoration Report); and,**
- **Technical Appendix A3.1 of ES: Outline Draft Construction Environmental Management Plan (oDCEMP).**

1.2. Legislation, Policy and Guidance

A number of pieces of national and international legislation and policy are applicable to proposals that have the potential to impact on ecological receptors. This section aims to contextualise legislation with respect to the proposal.

1.2.1.Legislation

1.2.1.1. The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017

These Regulations apply the retained aspects of the Environmental Impact Assessment (EIA) Directive (Directive 85/337/EEC, as amended) to the planning process in Northern Ireland.

The EIA Directive requires an assessment of the effects of certain public and private projects on the environment before Development consent is granted. Ecological Impact Assessments (EcIA's) can be carried out as part of an Environmental Impact Assessment (EIA) process or as a means to provide an appropriate level of ecological assessment for a proposal for which a full EIA is not required. Where an EcIA is undertaken as part of an EIA, it is subject to the relevant EIA Regulations. The associated report is the Environmental Statement (ES).

1.2.1.2. Conservation (Natural Habitats &c.) Regulations (NI) 1995 (as amended)

The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended) implement the EU Habitats Directive and EU Birds Directive in Northern Ireland and provide protection to habitats listed in the Habitats Directive Annex I and species listed in Annex IV (a), such as bats and otter, through their inclusion in Schedule 2 of the Conservation Regulations.

In Northern Ireland, the provisions of the Birds Directive have been transposed through the Wildlife (Northern Ireland) Order 1985; the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 and the Conservation (Natural Habitats, &c.) (Northern Ireland) Regulations 1995 (as amended). These establish a system of general protection for all wild birds throughout Europe. 175 bird species that are rare, vulnerable to habitat changes or in danger of extinction within Europe. Wherever those species occur, they should be the subject of special conservation measures concerning their habitat in order to

ensure their survival and reproduction in the area of distribution. Similar actions should be taken regarding migratory species, even if they are not listed in Annex I.

The Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended) requires action to be taken to protect habitats and species listed by various measures including the designation of UK National Sites. Species such as otter and all bats are protected wherever they occur.

1.2.1.3. The Wildlife (Northern Ireland) Order 1985 (as amended)

The Wildlife (Northern Ireland) Order 1985 (as amended) implements the requirements of the European Directives. All wild birds are protected under the Order and a number of species listed in Schedule 1 are also afforded additional protection under the Order. Other animals, such as badger are also protected through their inclusion in Schedule 5 of the Order. This makes it an offence to intentionally kill, injure or to damage, destroy or obstruct access to its resting place. The legislative requirements associated with these protected habitats and species are considered in this report.

1.2.1.4. The Environment (Northern Ireland) Order 2002 (as amended)

Areas of Special Scientific Interest (ASSIs) were first designated under the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985. ASSIs are now designated under the Environment (Northern Ireland) Order 2002. The Order makes it an offence for anyone to intentionally or recklessly damage any natural feature of an ASSI. ASSIs are designated based on their scientific interest relating to the flora or fauna that is found in the area, or because of geological features.

1.2.1.5. Bern and Bonn Convention

The Bern Convention is implemented by The Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended). Under the Bonn Convention, the legal requirement for the strict protection of Appendix I species is provided by the Wildlife (Northern Ireland) Order 1985, and the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985.

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

1.2.1.6. The Water Framework Directive

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. In response to the increasing threat of pollution and the increasing demand from the public for cleaner rivers, lakes and beaches, the EU developed the Water Framework Directive (WFD). This Directive is unique in that, for the first time, it establishes a framework for the protection of all waters including rivers, lakes, estuaries, coastal waters and groundwater, and their dependent wildlife/habitats under one piece of environmental legislation.

1.2.2.Policy

1.2.2.1. Strategic Planning Policy Statement for Northern Ireland (SPPS)

The Planning Policy Statement for Northern Ireland (SPPS)[1] was published in 2015 and consolidates 20 separate policy documents into a single publication, setting out planning policy for a wide range of planning matters. SPPS is linked to the restructuring of local government in Northern Ireland, whereby councils will have responsibility for a number of planning functions including local plan-making, development

[1] Department of Environment (2015): Strategic Planning Policy Statement for Northern Ireland (SPPS). Available at: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/SPPS.pdf [Accessed December 2022].

management and planning enforcement. The policy provisions of Planning Policy Statement (PPS) 2 'Natural Heritage' and Planning Policy Statement 18 (PPS18) 'Renewable Energy', which apply to the Development, are retained under SPPS and are discussed below[2].

1.2.2.2. Planning Policy Statement 2 'Natural Heritage'

The Planning Policy Statement 2 (PPS2) 'Natural Heritage' (published July 2013) supersedes PPS2 Planning and Nature Conservation (1997). Within the context of the precautionary principal, the objectives of PPS2 are to further improve abundance, diversity and distinctiveness of the region's natural heritage through conservation, enhancement and restoration of existing habitats. The policy document also assists in meeting international, national and local responsibilities. PPS 2 advises that Development must be sustainable and consider the role of biodiversity in contributing to rural and urban regeneration.

This Planning Policy Statement, considered to be a material consideration, directs to further assist compliance with international, national and local commitments in conservation, protection and enhancement of natural heritage within Northern Ireland.

PPS2 encompasses the following hierarchal policies, the following of which deal with ecological occurrences:

1. Policy NH1 – European and Ramsar Sites – International. States that planning permission will only be granted if a proposal, either on its own or in combination with existing or planned projects/proposal does not have a significant effect on a European Site (e.g., Special Area of Conservation (SAC) or Special Protection Area (SPA)) or a Ramsar Site.
2. Policy NH2 – Species Protected by Law – International and National. States that planning permission will only be granted for a Development that is not likely to harm a European protected or any other statutorily protected species.
3. Policy NH3 – Sites of Nature Conservation Importance – National. States that planning permission will only be granted to Developments that are not likely to have any adverse effect on the integrity of Areas of Special Scientific Interest (ASSI), Nature Reserves, National Nature Reserves, or Marine Nature Reserves.
4. Policy NH4 – Sites of Nature Conservation Importance – Local. States that planning permission will only be granted to Developments that are not likely to have an adverse impact on a local nature reserve or a wildlife refuge.
5. Policy NH5 – Habitats, Species or Features of Natural Heritage Importance. States that planning permission will only be granted for Developments that are 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 important for wild flora and fauna, rare or threatened native species, wetlands, or other natural heritage features worthy of protection. Each project must be considered on a case-by-case basis and the benefits of the proposed Development are a material consideration under Policy NH5 *"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] Retained NI Planning Policy can be viewed here: https://www.infrastructure-ni.gov.uk/publications/retained-planning-policy

1.2.2.3. Planning Policy Statement 18 'Renewable Energy'

The Planning Policy Statement 18 (PPS18) 'Renewable Energy'[3] (2009) with the objective of facilitating the siting of renewable energy generating projects in appropriate locations within built or natural environments, ensuring that environmental, landscape, visual and amenity impacts of such projects are addressed.

In relation to natural heritage, renewable energy projects must not result in unacceptable adverse impacts on biodiversity or nature conservation. This should include details regarding proposed compensatory measures, e.g., the inclusion of a habitat management plan, or details on the creation of new habitat. Wind energy projects must consider the cumulative impacts from wind turbines in the locality – both existing consented turbines, and those at the planning stage. PPS18 also clarifies that unacceptable development on active peatland is not permitted unless there are imperative reasons of overriding public interest. Where a project is likely to result in unavoidable damage during its installation, operation or decommissioning, the planning application must clearly demonstrate how it intends to minimise impacts and to mitigate for these.

As such, the guidance recommends that developers should consult NIEA at an early stage through a scoping exercise.

1.2.2.4. Planning Policy Statement 21 'Sustainable Development in the Countryside'

Published in 2010, *"the aim of this policy is to protect the Region's water resources from the actual or potential polluting effects of on-site treatment plants, particularly in areas identified for the abstraction of water for human consumption. The Department also recognises recent technological advances in non-mains sewerage systems aimed at mitigating potential pollution problems."*

Of particular relevance for this Development are the key considerations to *"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."*

1.2.2.5. Derry City and Strabane District Council Local Development Plan (LDP) 2023- Evidence Base Paper EVB 21 - Natural Environment

This Natural Environment Evidence Base paper updates the baseline LDP Preferred Options Paper (POP) position and sets out the evidence base that has informed the strategy, designations and policies within the draft LDP Plan Strategy. Evidence has been informed by feedback from public consultation, discussions with Elected Members, input from statutory consultees, stakeholder groups, from other Departments within the Council, liaison with adjoining Councils and through the iterative Sustainability Appraisal process. The Evidence Base is published as a 'supporting document' in accordance with Article 15(a) of the Planning (LDP) Regulations (NI) 2015. This Paper relates to the natural environment and particularly to the designated areas – European, National and Local designations. Whilst there is obviously overlap, it also deals with the wider landscape characteristics of the Derry City and Strabane District.

[3] Department of Environment (2009): Planning Policy Statement 18: Renewable Energy. Available at: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/PPS18%20Renewable%20Energy.pdf [accessed December 2022].

1.2.3. Guidance

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

The CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine[4] ("the CIEEM Guidelines"), published by the Chartered Institute of Ecology and Environmental Management ("CIEEM"), are the acknowledged reference on ecological impact assessment and reflect the current thinking on good practice in ecological impact assessment across the UK and Ireland. They are consistent with the British Standard on Biodiversity, which provides recommendations on topics such as professional practice, proportionality, pre-application discussions, ecological surveys, adequacy of ecological information, reporting and monitoring.

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

1.3. Overview of the Development

The Development is located on Owenreagh Hill within the townlands of Craignagapple, Ballykeery, Knockinarvoe, Owenreagh, Ligfordrum and Lagavadder, Co. Tyrone.

An existing regional road "Glenmornan Road" runs through the Ecological Study Area, hereafter referred to as the Study Area, with the wind turbines and associated infrastructure of 'the Operational Owenreagh I Wind farm (Planning Ref: J/93/0286)', "Owenreagh 1 Wind farm" and 'the Operational Owenreagh II Wind Farm (Planning Ref: J/2004/1015/F)' "Owenreagh II Wind farm" incorporated into the extent of the Study Area.

A detailed Development Description has been provided in Chapter 3 of the ES.

The proposed layout of the Development has been illustrated in **Figure A10.1.2 – Ecological Study Area.**

1.4. Embedded Mitigation

The Development is the result of lengthy and detailed collaboration between engineers, hydrologists, hydrogeologists, landscape architects and ecologists. It incorporates significant embedded mitigation to inform the minimisation of potential impacts during the design phase. This included several design workshops, as well as Technical workshops held between Arcus Hydrologists and Woodrow Ecologists to inform the site design. This has included an initial design principle of wherever possible, maximising the extent of existing infrastructure to be re-used in the Development in order to minimise the extent of works impacting on important conservation habitats and prioritising the avoidance of areas of 'Active Peat'.

Note: The layout of the development was also altered to avoid impacts upon a Leisler's bat tree roost (a turbine was dropped at this location during the detailed design in 2022).

The Development has also been designed with all identified badger setts lying more than 250m outside of any proposed infrastructure.

The embedded mitigation includes the drainage design as detailed within **Technical Appendix A8.5: Outline Drainage Strategy** and the **oDCEMP** provided within **Technical Appendix A3.1**.

[4] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

2. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

Terrestrial ecology surveys of the Study Area and Haul Route were undertaken following specific guidelines for habitats and species as outlined in the following sections, and with reference to the legislation and policy outlined in Section 1.2. The importance of the habitats and species present is evaluated using the guidance document *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine*, published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018). This document outlines an accepted approach for the evaluation of potential impacts from such Developments.

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

2.1. Desk Study Methodology

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

- Centre for Environmental Data and Recording (CEDaR);
- OSNI Spatial NI map viewer;
- NIEA/NED/DAERA map viewer;
- NBDC online map viewer;
- EPA online map viewer;
- JNCC standard data forms and site synopsis;
- NPWS Map Viewer;
- NPWS site synopses; and,
- Ulster Bat Group.

2.1.1. Protected Areas / Designated Sites

Shapefiles of designated sites in both the Republic of Ireland and Northern Ireland, including Natural Heritage Areas (NHAs), Areas of Special Scientific Interest (ASSIs), Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) were downloaded from the NPWS and NIEA websites and imported onto ArcGIS Pro.

Proximity of the proposal to designated areas and potential for connectivity with the proposal was assessed using ArcGIS Pro, orthophotographs and Ordnance Survey maps as well as shapefile datasets of watercourses as potential connecting features. The potential for connectivity (such as resulting from adjoining watercourses or proximity) with the proposal was assessed using available NI datasets and professional judgement including cross-referencing the findings within the **Hydrology Chapter 8 of the ES**.

2.1.2.Site Investigations Undertaken

Table A10.1.1 details the surveys and investigation undertaken within the Study Area. Field surveys the Development have been ongoing since January 2017. The results from these surveys, in combination with the desk study and the assessment contained within the Environmental Impact Statement that accompanied the consented 2010 Craignagapple Wind Farm application (Planning Ref: J/2010/0481/F), have informed the findings of this EcIA.

Table A10.1.1: Overview of Field Investigations Undertaken (2017-2022)

Note: NIEA were consulted regarding the scope of surveys and requirements for any repeat surveys following initial survey results as per the below table.

Survey	Description	Coverage	Dates
Habitat surveys	Active peat assessment (APA) to inform project design within the Study Area boundary an in consultation with Arcus team to inform design.	Conducted in accordance with NIEA Guidance note on Active Peat assessment[5]. The aim from the offset was to design the Development so that it would not impact directly on identified Active Peat (in accordance with NIEA Active Peat Assessment).	20-21 July 2022
	NVC Quadrat survey and active peat assessment (APA) within the Study Area boundary focussing on areas likely to be affected by the footprint of the Development.	Study Area – This NVC survey was conducted within the ESA, with the emphasis placed around the proposed footprint of the Development.	26-28 October 2021
	Extended Phase 1 Habitat Survey (JNCC), concentrating on highlighting areas of conservation importance and initial active peat assessment (APA).	Study Area - Conducted in accordance with NIEA Guidance note on Active Peat assessment (NIEA, 2012).	31 May 2021 11 August 2021 19 August 2021 04 October 2021
	Preliminary Extended Phase 1 Habitat Surveys to JNCC specifications. [This included assessment of quadrats to NVC level at selected locations in 2019]	Study Area	2017-2019
	Habitat enhancement potential surveys. Assessment of suitability for enhancements to maintain and encourage biodiversity within the Ecological Study Area. Included detailed ecohydrological / peatland restoration surveys.	Study Area and draft Habitat & Species Management Enhancement Plan (Draft HMEP) Study Area Landholdings	Jan 2023 Oct 2022 Nov 2021

[5] NIEA (2012) Development Management Team Advice Note: Active Peatland and PPS18. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-guidance-active-peatland-and-pps18-2012.pdf Accessed: May 2022

Survey	Description	Coverage	Dates
Bat Surveys	Four years of active bat season surveys including: - Seasonal static bat detector deployment at each turbine location over spring, summer and autumn (2018, 2019 and 2021); - Static bat detector at height for comparative data (2021); - Permanent static detector for comparative data (2018, 2019 and 2021); - Bat Roost Assessment Surveys (April 2019 & March 2023 for off-road haul route section under NIEA License); - Building inspections under NIEA License (19th August 2019); - Emergence and re-entry surveys on potential and confirmed bat roost buildings (19th and 20th August 2019 at four different locations; 16th June 2021, 20th July 2021, 26th August 2021 and 14th September 2021 at three different locations; and 14th July 2022 at two different confirmed roost locations); - Bat Transect Surveys (2018, 2019 and 2021); - Haul route driven bat transect (2022); and - Bat fatality monitoring at existing wind farm (July 2020, July and August 2021).	Study Area, haul route and potential bat roosts within 200m of the Ecological Study Area (the area where turbines may be located; see **Figure A10.1.2**). *Note: The most recent guidelines (SNH et al., 2021) recommend that "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 200m plus rotor radius of the boundary of the proposed development should be subject to further investigation". This survey guidance also aligns with Hundt L. (2012) Bat Surveys: Good Practice Guidelines, 2nd edition, Bat Conservation Trust - Chapter 10 which informed the bat roost assessment surveys in 2018.* All potential bat roost sites within the Study Area and potentially within 200m plus of the rotor-swept area underwent a preliminary assessment (external survey) for their potential to support roosting bats in April 2019. Internal building inspections were conducted under NIEA license No. BDL/104/19 and Licensee No. 2423. Buildings considered to have the potential, or which were likely to support a bat roost were surveyed under license in August 2019. These (4 no. identified buildings) then underwent an Emergence and re-entry survey on the evening of 19th August, and a pre-dawn re-entry survey on the morning of 20th August 2019 to confirm the likely presence of roosting bats. Emergence surveys were repeated at 2 no. confirmed bat roosts in July 2022. A bat roost was identified in a tree on the Study Area on 26th August 2021. This underwent an additional dusk survey on 14th September 2021 and final update survey on 14th July 2022.	2022 2021 2019 2018
Badger Surveys	Walkover of entire site and deployment of trip cams at identified active sett locations.	Badger surveys were conducted in accordance with NIEA's survey specifications. Surveys were conducted	Trip Cameras deployed

Survey	Description	Coverage	Dates
	Mammal walkover surveys.	within the Study Area and ensured that they encompassed the area within 50m of the Site Boundary. The surveys were also conducted along the potential Haul Routes (Further details with regards to the Haul Route are provided in **Appendix IV** of this EcIA).	from 14 – 29 Sept. 2021 And from 5 – 14 October 2021 Overall badger surveys 2017-2022
Red Squirrel Surveys	Transect walks and drey counts within the coniferous plantations within the immediate vicinity of the Study Area. These surveys were conducted pre-design, applying the precautionary principle. It was later ascertained that no conifer plantation would be impacted by the Development.	Surveys were conducted in accordance with NIEA specifications. Each survey period consisted of a repeated transect walk through the forestry plantation with predetermined 100m stops along the route where at every stop all foraged pine cones were collected. Dreys were observed through binoculars and the locations were recorded using a GPS device. This survey transect was carried out 4 times over the course of a 2-week survey period during September/October 2019, October 2021 and April 2022.	19 / 21 / 26 / 28 April 2022 12 / 14 / 18 / 19 October 2021 2 / 17 / 26 / Sept. 2019 and 1 October 2019
Reptile Surveys	Repeated monitoring of artificial refugia (reptile mats) under licence from NIEA.	Study Area, this survey included a combination of visual searching and searching 75 No. reptile mats (artificial refugia) which were temporarily placed in suitable habitat across the Study Area during the survey periods, in agreement with the landowners and in accordance with NIEA specifications. • Surveys in 2019 were undertaken under Licence No. LRS/12/19 and Licensee No. 2696. • Surveys in 2021 were undertaken under Licence No. LRS/30/21 and Licensee No. 2876. • Surveys in 2022 were undertaken under License No. LRS/5/22, Licensee No. 3137 and License No. LRS/6/22, Licensee No. 3138.	19 April 2022 26 April 2022 5 May 2022 13 May 2022 29 Sept. 2021 5 October 2021 12 October 2021 27 October 2021 17 Sept. 2019 26 Sept. 2019

Survey	Description	Coverage	Dates
			1 October 2019
Otter Surveys	Walkover survey of suitable habitat for signs and deployment of trip cams	This survey was conducted within the Study Area in accordance with NIEA specifications. A visual survey up and downstream for 250m at riparian corridors in proximity of the Ecological Study Area was conducted (**Figure A10.1.2**). Streams at potential traffic crossing points were also surveyed within the Study Area. Trip cameras were installed at the location where evidence of otter activity was noted during the surveys, placed under the bridge at Naple Rd; IG Ref: H 44086 97024 (following consultation with Dr Jon Lees NIEA Wildlife Officer, a license was not required to place a camera on this mammal trail).	31 May 2021 – updated look for signs 13 – 23 February 2019 – trip cam 17 December 2018 – trip cam
Marsh Fritillary Larval Web Survey	Walkover habitat condition assessment	This survey constituted a habitat condition assessment and simultaneous larval web search carried out by experienced surveyors within the optimal survey season, conducting a search of all areas supporting devil's-bit scabious (*Succisa pratensis*) (DBS) to determine any potential habitat suitability for this species within the Study Area under License No. SBP/18/19; Licensee No – 2423. Survey methodology followed NIEA (2017)[6] survey specifications. Note: Plants of DBS were scattered, and the vegetation was considered to support sub-optimal habitat for this species at the Study Area in 2019, no larval webs were observed. Subsequently no further surveys for this species were considered necessary, and this was monitored by Woodrow throughout the site visits to ensure the baseline remained the same throughout this study.	25 Sept. 2019 29 Sept. 2021
Woodrow HMEP Surveys	HMEP suitability surveys. Assessment of suitability for site enhancements to maintain and encourage biodiversity in the Study Area	These surveys covered all identified HMEP areas and aimed to ascertain their suitability for habitat restoration and enhancement for species local to the Study Area.	5 October 2022 23 November 2021

[6] NIEA (2017) Marsh Fritillary Butterfly Surveys – NIEA Specific Requirements. Available online at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/marsh-fritillary-butterfly-survey-specifications.pdf

Survey	Description	Coverage	Dates
Dipwell Monitoring	Continued dipwell monitoring using dipwell meter (on behalf of Arcus Hydrology).	35 dip well locations across the Study Area in the vicinity of proposed turbine locations.	Every month from 29 Sept. 2021 – 28 August 2022
Aquatic Surveys	Electrofishing survey	Within identified watercourses in the Study Area and adjacent (**Figure A10.1.3**) • *Note: Freshwater pearl mussel (Margaritifera margaritifera) surveys were not commissioned due to the nature of the water features within the Study Area. Although the lower reaches of several streams were classified as suitable for salmonids (salmonids are essential host species for FWPM and would be considered an indicator of FWPM suitability) this was when applying the precautionary principle and the suitability was close to sub optimal habitat available to salmonids.* *While the potential to affect downstream FWPM is considered to be low due to the lack of suitable habitat and lack of salmonid species within the ESA, applying the Precautionary Principle, the potential for indirect effects on water quality to affect salmonids downstream of the ESA has still been considered further as part of the impact assessment to ensure there are no possible indirect effects on FWPM. This is also supported by **Chapter 8: Hydrology and Hydrogeology** of this ES, which illustrates that there is no potential for significant effects on water quality downstream of the Development.*	27 Sept. 2022
	Chemical aquatic surveys - grab samples for chemical analysis of water samples		27 Sept. 2022
	Salmonid suitability survey.		21 and 22 July, 2021
	Biological aquatic surveys (aquatic macroinvertebrate surveys with water quality parameters measured in-situ)		21 and 22 July 2021
Haul Route Surveys	Habitat, Bat Roost Assessment Surveys, Ecological Constraint Surveys (including mammal survey) along the potential Haul routes.	Target note survey of haul route options (driven 'on-line' survey with targeted walkover surveys 'off road' where habitats / species has the potential to be affected).	Updated 8-9 August 2022, Sept. 2020 23 March 2023

Survey	Description	Coverage	Dates
		Off road section assessment (including Potential Roost Feature (PRF) surveys of trees and buildings along this section).	
Peatland Restoration Surveys	Detailed ecohydrological / peatland restoration surveys were carried out.	Study Area and any HMEP areas identified by Ørsted through landowner consultation. These sites were surveyed by EHA and once confirmed as suitable, further monitoring was conducted here according to the report provided by EHA to inform the Draft HMEP.	2022 / 2023
Note: Given the acidic and 'flashy' nature of the watercourses in the Study Area, following the site scoping surveys there are no suitable smooth newt (Lissotriton vulgaris) breeding ponds or ditches within the Study Area or nearby which might be in any way affected by the Development. In addition, it is widely accepted in the literature that smooth newts on the island of Ireland tend to avoid boglands due to unsuitable pH related factors (Cooke & Frazer, 1976; Yalden, 1986; Denton, 1991, Marnell 1998) therefore due to the lack of suitable breeding sites for this particular species, newt surveys were not deemed to be necessary at this site. *Common frog (Rana temporaria) which is not protected in Northern Ireland in the same way that smooth newt is but are still protected in the UK under the Wildlife and Countryside Act, 1981 was commonly noted across the Study Area throughout the surveys and is likely utilising occasional bog pools to breed in the area. Frogs breed around February and spawn around March, the tadpoles hatch and grow from April to May. Following this, tadpoles metamorphose into froglets, and leave the pond in June/July. Consideration is given to amphibians within this EcIA to ensure they are not inadvertently harmed or undergo significant disturbance during the Development.*			

2.2. Haul Route Assessment

The Haul Route for the Development was first surveyed in September 2020 by Woodrow Ecologists, and this information was updated in August 2022. An additional survey was carried out to assess the potential for impacts within an off-road section of the proposed haul route on 23 March 2023. This included habitat identification, a mammal survey and a potential bat roost feature (PRF) assessment under license from NIEA (Licence No: BDL/4/23 Licensee No: 3279). All surveys were carried out during bright, dry weather conditions.

Surveys consisted of driven assessment, coupled with targeted walkover surveys by Woodrow Ecologists in areas where pinch-points were identified to ensure that all potentially effected habitats and species could be properly assessed. Mammal surveys, potential bat roost features and JNCC habitat assessment have been conducted along the proposed haul route.

Full details regarding EIA scoping of the haul route are provided in **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)** of the ES. Details regarding the ecological assessment of the haul route is available in **Appendix IV** of this EcIA.

2.3. Field Survey Methodology

All surveys undertaken followed industry-standard methodologies and NIEA survey specifications, as detailed in the following sections. Field survey data was recorded on maps and each record was accompanied by a photo and six figure grid references, using ArcGIS 'Survey123' software operating on a mobile phone or tablet device. As a result, the data collected could then be used in a Geographic Information System ("GIS").

2.3.1. Aquatic surveys

The methodologies for the aquatic assessment surveys performed at the Development site are described below.

Field surveys were undertaken within the Ecological Study Area and included macroinvertebrate surveys ('kick sampling') with biological (Q-value index) scoring, basic water quality parameter assessment (e.g., substratum types, depth, flow, velocity) to ascertain a baseline water chemistry profile, habitat suitability for salmonids and an electrofishing survey to assess juvenile fish stocks.

Surveys were performed at locations within the Study Area (see **Figure A10.1.3**) during the periods of July 2021 and September 2022. These comprised the following:

- Water samples were collected at each of the Q-value collection points identified in **Figure A10.1.3** for chemical analysis. Each sample was collected prior to any macroinvertebrate surveys in a pre-sterilized sampling bottle that was then pre-rinsed with river water. Water samples were taken from just below the surface in order to minimise disturbance of the substrate. Once sample bottles were filled, they were transported to an accredited laboratory (ENSEN®, Ireland) for analysis within the recommended holding time for the selected water quality parameters.
- Macroinvertebrate surveys were then undertaken at Q-value points (**Figure A10.1.3**) to establish an appropriate ecological baseline within the Study Area. Biological scoring (Q-value index) is conducted by adopting a sampling method currently employed by the Irish Environmental Protection Agency (EPA)[7]. Basic water quality parameters (e.g., Temperature (°C), pH etc.) were also measured in-situ to provide a baseline water chemistry profile.
- An ecological assessment of the streams within the Study Area was carried out (notably with respect to salmonid suitability). These streams have been highlighted on **Figure A10.1.3**. Streams were assessed in conjunction with the leaflet 'The Evaluation of habitat for Salmon and Trout' (DANI, 1995). This leaflet (Advisory leaflet No. 1) was produced by the Department of Agriculture for the Northern Ireland Fisheries Division and was designed for use in the EU salmonid enhancement programme[8].
- Electric fishing assessments of selected streams as illustrated in **Figure A10.1.3** were carried out, following authorization from the Northern Ireland Loughs Agency under sections 69 of the Foyle Fisheries Act (Northern Ireland) 1952 and 70 of the Foyle Fisheries Act 1952 (Section 69/70 Survey Permit). These surveys were carried out to assess fish populations present and were performed in accordance with UK Environment Agency guidelines[9] using a portable battery powered electric fishing device (Hans-Grassl™ IG600).

A desk study considering potential for any direct or indirect impact upon freshwater pearl mussel (*Margaritifera margaritifera*) was carried out.

Freshwater pearl mussel *(Margaritifera margaritifera)* surveys were not commissioned due to the nature of the water features within the site and based on the results of the initial aquatic assessment carried out by Woodrow. While applying the Precautionary Principle, the lower reaches of several streams were classified as having some low suitability for salmonids (salmonids are essential host species for FWPM and would be considered an indicator of FWPM suitability). While the potential to affect downstream FWPM is considered to be low due to the lack of suitable habitat and lack of salmonid species within the ESA, applying the Precautionary Principle, the potential for indirect effects on water quality to affect salmonids downstream of the ESA has still been considered further as part of the impact assessment to ensure there are no possible indirect effects on FWPM. This is also supported by **Chapter 8: Hydrology and Hydrogeology of this ES**, which illustrates that there is no potential for significant effects on water quality downstream of the Development. This assessment has also been supported by the results of the electrofishing surveys carried out by Woodrow in 2022.

[7] Toner, P., Bowman, K., Clabby, K., Lucey, J., McGarrigle, M, Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MaCarthaigh, M., Craig, M., & Quinn, R. (2005) Water Quality in Ireland 2001-2003. Environmental Protection Agency, Wexford, Ireland.
[8] This survey technique is devised by DANI and the Loughs Agency. This method evaluates habitat units and grades them according to substrate availability, water depths and flow.
[9] Environment Agency (2002) Development of Best Practice for Agency Electric Fishing Developments, Environment Agency, Bristol, UK.

2.3.2. Botanical & Vegetation Surveys

2.3.2.1. Walkover Surveys – JNCC Phase 1 Habitat Assessment

Habitat surveys were carried out using the methods and classification system of the Joint Nature Conservation Committee (JNCC) Handbook for Phase 1 habitat Survey. Where possible, peatland habitats and any other Northern Ireland Priority Habitats were classified using the National Vegetation Classification (NVC) system. Flora was identified using Collins Wildflower Guide and Mosses and Liverworts of Britain and Ireland. The DAFOR (Dominant, Abundant, Frequent, Occasional, Rare) scale was utilised to categorise species abundance and the DOMIN scale was similarly used to inform the more detailed assessments.

Surveys for protected / priority fauna were carried out with reference to the Northern Ireland Environment Agency's survey specifications as required.

Table A10.1.14 lists the habitat types (JNCC, 2016) which occur within the Study Area. A description of each habitat at the Study Area is given below. **Figure A10.1.7** illustrates the distribution of these habitats within the Study Area.

Results of the Phase 1 JNCC Habitat Survey have been detailed within **Section 3.5.**

2.3.2.2. Habitat Surveys and Active Peat Assessment

A Joint Nature Conservation Committee (JNCC) Phase 1 habitat survey was carried out across the entire Ecological Study Area from 31 May – 21 October 2021, this provided an update on previous habitat surveys carried out within the Ecological Study Area from August 2017 to September 2019. The habitat survey gave cognisance to the potential presence of any habitats which had the potential to correspond to Northern Ireland Priority Habitats and EU Habitats Directive Priority Habitats.

Post-survey analysis was then carried out by cross-referencing habitat and plant community types to Habitats Directive habitats and Northern Ireland Priority Habitats, using JNCC's correspondence rules (JNCC, 2010) and NIEA priority habitats guidance. The location of habitat types was noted, and, during the survey, consideration was given to identifying important or protected habitats and habitats that could be used by protected species.

In recognition of the high importance afforded to active peatland by the Department of the Environment's Planning Policy Statement 18: Renewable Energy (2009) and the Strategic Planning Policy Statement for Northern Ireland: Planning for Sustainable Development (2015), it was determined that an Active Peat Assessment (APA) would be required to determine the extent of areas of active peat and to ensure that the design would seek to avoid and minimise detrimental impact on areas of peat. This was undertaken during 20-21 July 2022 based upon the previous APA data gathered between May – October 2021.

Further details of the habitat and active peat assessments are provided in **Technical Appendix A10.3 National Vegetation Classification** Survey and **Technical Appendix A10.4 Active Peat Assessment** respectively of the ES Chapter 10 – Ecology.

2.3.2.3. National Vegetation Classification (NVC) Quadrat Survey

National Vegetation Classification (NVC) Quadrat surveys were carried out on 26-28 October 2021 within the Study Area to inform the design process. NVC communities were ascribed to each quadrat based on "JNCC NVC field guide to mires and heaths[10]" (Elkington *et al*. 2001) and "British Plant Communities[11]" (Rodwell *et al*.1991). A total of 68 No. standard 2x2 m vegetation quadrats located within the Study Area

All vascular plants, bryophytes and lichens, and their respective percentage cover, was recorded for each quadrat. Other parameters were also recorded such as approximate peat depth, cover of bare peat, rocky outcrops and other abiotic factors such as slope and aspect.

[10]Elkington *et al*. (2001). *JNCC NVC field guide to mires and heaths*. .Available at: https://data.jncc.gov.uk/data/1d0037bd-6c77-4677-8040-2f6e1d852eb1/JNCC-NVC-MiresHeaths-2002.pdf

[11] Rodwell, J.S. (2006) NVC Users' Handbook, JNCC, Peterborough, ISBN 978 1 86107 574 1

The quadrat data was additionally supplemented by previous quadrat analysis undertaken in October 2019 at 13 no. locations across the Study Area.

Results and illustrated maps of the NVC habitat assessment and quadrat locations are provided in **ES Technical Appendix A10.3 National Vegetation Classification Survey.**

2.3.2.4. Active Peat Assessment (APA)

Following the scoping and consultation exercises carried out during 2021 for the Development and in recognition of the high importance afforded to active peatland by the Department of the Environment's Planning Policy Statement 18: Renewable Energy (2009) and the Strategic Planning Policy Statement for Northern Ireland: Planning for Sustainable Development (2015), it was determined that an Active Peat Assessment (APA) would be required to determine the extent of areas of active peat and to ensure that the design would seek to avoid and minimise detrimental impact on areas of peat. This was undertaken during 20-21 July 2022 based upon the previous APA data gathered between May – October 2021.

The habitat assessment input for the APA was informed by the aforementioned JNCC habitat walkover surveys undertaken during site visits during summer and autumn in 2018 and 2021, JNCC habitat classification was supplemented by the collation of peat status points during these walkovers, and then habitat classifications were verified and further detailed using quadrat information.

Quadrats (also known as Relevés) were carried out according to the National Vegetation Classification (NVC) Guidance of 68 No. standard 2x2 m vegetation quadrats located across the full extent of the Ecological Study Area during the period 26-28 October 2021 (the latter was also supplemented by quadrat data undertaken in October 2019 at 13 no. locations across the Ecological Study Area).

Peat status points were undertaken to provide fine-scale mapping of areas of 'active peat'. This assessment was based on the presence of indicator plant species, the depth of the underlying peat layer and the hydrological condition of the peatland unit (based on NIEA-NED Guidance note on Active Peat[12]).

Active Peat Assessment was carried out with a particular focus within proposed infrastructure locations and utilised to determine 'Active Peat Constraints' as illustrated in **Figure 10.4.1** of the **Technical Appendix A10.4 Active Peat Assessment.**

Results and illustrated maps showing survey locations of the APA are provided within **Technical Appendix A10.4 Active Peat Assessment within the ES.**

2.3.3.Bat Surveys

Bat surveys were conducted by suitably qualified ecologists from Woodrow within the wind farm Ecological Study Area over four years of active bat seasons (2018, 2019, 2021, 2022), which ensured compliance with the most recently published guidelines pertaining to surveying, impact assessment and mitigation for bats at onshore wind turbines (SNH *et al.* 2019). This guidance document supersedes previous guidelines (Collins, 2016 updating Hundt, 2012 & BCI, 2012) and requires a site-by-site approach to survey design, with the only prescriptive element being the positioning, number and duration of static bat detector deployments, as well as the strongly recommended continual monitoring of site-specific weather data on rainfall, temperature and wind speeds. Given the timing of these survey years, the most recent bat survey guidance was applied as appropriate, with the latest suite of surveys following SNH Guidance since its publication in 2019.

Pre-planning surveys for bats at proposed wind farm sites aim to identify the species occurring within the proposed development area and provide an understanding of how local bat populations utilise the area in

[12] NIEA (2012) *Natural Heritage, Development Management Team Advice Note Active Peatland and PPS18*. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-guidance-NIEA-natural-heritage-development-management-team-advice-note-2012.pdf

terms of density of use for foraging, roosting (maternity and hibernation) and social interactions. This information allows for the identification and assessment of the potential impacts the proposed development is likely to have and for appropriate avoidance and/or mitigation measures to be implemented as part of the design phase of the project.

Bat surveys were conducted by suitably qualified ecologists from Woodrow at Craignagapple wind farm over four years of active bat seasons (2018, 2019, 2021, 2022), which ensured compliance with the most recently published guidelines pertaining to surveying, impact assessment and mitigation for bats at onshore wind turbines (SNH 2021). This guidance document supersedes previous guidelines (Collins, 2016 updating Hundt, 2012 & BCI, 2012) and requires a site-by-site approach to survey design, with the only prescriptive element being the positioning, number and duration of static bat detector deployments, as well as the strongly recommended continual monitoring of site-specific weather data on rainfall, temperature and wind speeds. Given the timing of these survey years, the most recent bat survey guidance was applied as appropriate, with the latest suite of surveys following SNH Guidance since its publication in 2019 (and subsequent minor revisions in 2021).

Information gathered during the 2018-2019 survey periods is attached separately in **Appendix 11.1.3 - Bat Report 2018-2019** to ensure this EcIA is a concise document which focusses on the more recent results of the 2021 and 2022 survey periods which are presented and analysed within this EcIA. All bat surveys (2018 – 2022) have been considered when assessing the significance of the bat activity at this site.

The latest guidelines (SNH, 2021) require as a minimum three deployments of static detectors aimed at covering spring (April to May), summer (June to mid-August) and autumn (mid-August to October), each with a minimum deployment period of 10 nights (within compliant weather parameters). Seasonal deployments of static detectors are set out at all potential turbine locations for proposals comprising ten or less turbines, with a third of any additional locations also covered up to a maximum of 40 detectors. Compliant weather conditions are defined as: temperatures at ≥ 8°C at dusk, maximum ground level wind speed of 7 m/s and no, or only very light, periodic rainfall.

Additional requirements of the SNH (2021) guidelines include swarming surveys and winter roost inspections if potential hibernation roosts are identified. Transect and/or vantage point surveys are seen as methods used to complement the static detector surveys, with applicability being discretionary and site-specific.

A desk-based review of habitat availability in the environs of the proposed development, and the available bat data was used to inform the scope of bat surveys required. As recommended by both BCI (2012) and (SNH 2021) the area covered by the desk-based review was extended to 10 km surrounding the wind farm site. The desk-based study included:

- Reviewing distances from closest UK National and European sites designated for bats (only bat SACs on the island of Ireland are for lesser horseshoe bat *Rhinolophus hipposideros* in RoI.) - the Study Area of interest (Co. Tyrone, Northern Ireland) is outside the range for lesser horseshoe bat and there are no bat SAC sites near the Development.
- Examining aerial imagery and 6-inch maps to identify potential bat foraging and roosting habitats.
- Lundy *et al.* (2011) provides a high-level assessment of potential habitat suitability for different species of bat occurring in Ireland.
- Review of data received from Northern Ireland (NI) Bat Group within 10km of the wind farm site and the results of Biodiversity Maps report for the 10km squares covering the Study Area (H39 & H49), including species recorded and known roosting sites.

Maps for Static Bat Detector placement, Survey Effort for Static Bat Detector Surveys and Site Photographs for Bat Roost Assessments are provided in **Appendix 11.1.1** of this report.

2.3.3.1. Roost Assessment Surveys

A site suitability assessment was conducted over the entire Study Area and environs, in order to identify any potential bat roosts, on 11th April 2019.

The most recent guidelines (SNH 2021) recommend that "*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 200m plus rotor radius of the boundary of the proposed development should be subject to further investigation*".

Turbine specification, as well as locations are regularly altered during the design phase of projects and as a precaution Woodrow always conduct roost assessment surveys within 300m of the potential build area and features along the access tracks between turbines (within *c*. 30m). Wide reaching roost and foraging habitat assessment of the wind farm site were undertaken during 2018, as part of a scoping exercise.

Surveyors utilised the assessment criteria described in Collins (2016), which provides guidelines for assessing potential suitability of habitat features as bat roosts and for foraging bats. This allows surveyors to assign features, a 'negligible', 'low', 'moderate' or 'high' status in terms of their potential for bats, i.e., the presence of Potential Roost Features (PRFs). Based on the features present and the location of the trees or other structure, the potential use of the feature can also be considered, and classified (as in Hundt, 2012):

- Maternity (breeding roost)
- Summer / transitional (to include transitional, occasional, satellite, night and day roosts)
- Hibernation roost

Alterations made to the Site Boundary in 2021, as shown in **Figure A10.1.4**. Surveyors initially employed non-invasive external and internal inspection techniques for any building encountered, and trees were assessed from the ground. When deemed appropriate, full building/tree inspections were undertaken under license from NIEA and included inspecting any potential hibernation roosts.

Based on the findings of the roost assessment surveys features classed as having moderate to high suitability for bats and/ or demonstrating likely occupancy, (e.g. bat droppings found) were targeted for further bat activity surveys, including dusk emergence/dawn re-entry surveys. Potential roost features deemed to be in the Zone of Influence of the proposal and therefore requiring further surveys are shown in **Figure A10.1.5.** These were internally and externally inspected under NIEA license No. BDL/104/19, Licensee No. 2423 on 19 August 2019 (and during 4 November 2019 for the Winter Roost Inspections).

Once bat roosts had been confirmed within the Study Area and environs of the Development, and internal inspections on confirmed bat roosts had been carried out – these were not repeated in subsequent years so as to minimise disturbance to roosting bats. However, all confirmed bat roosts underwent repeat emergence and re-entry surveys to monitor the bat roost activity at these sites.

2.3.3.2. Roost Emergence / Re-Entry Surveys

Repeat dusk emergence/dawn re-entry surveys were completed on each bat roost. Transect and dusk emergence/dawn re-entry surveys were carried out using Bat logger bat detectors to collect geo-referenced records of bat activity, which were then analysed using BatExplorer / Kaleidoscope.

During the 2022 transect and roost surveys, a Wildlife Acoustics EM3 detector and Echo Meter Touch (EMT) phone application and attached recording device were both also used, and the data analysed using Kaleidoscope. Bat activity surveys were undertaken across the active bat season in 2019, 2021 and 2022. Surveys undertaken in 2019 are presented in **Appendix 11.1.3 – Bat Survey Report 2018-2019** for conciseness**.**

2.3.3.3. Survey Year 2021

Three areas were surveyed in 2021, targeted initially at two areas (farm buildings, treeline) and upon the discovery of a Leisler's roost, this tree was included in the final survey in September. A summary of the emergence / re-entry survey effort for 2021 is presented in **Table A10.1.2.**

Table A10.1.2: Summary of survey effort - roost survey locations (2021)

No. (see Figure A10.1. 7)	Structure	Location	Dusk / Dawn	Date
1	**Building 1**	H 43 96	Dusk	16/06/2021
			Dusk	20/07/2021
			Dawn	20/07/2021
2	**Treeline (Ruins 1)**	H 41 96	Dusk	26/08/2021
			Dawn	
3	**Leisler's Bat tree roost**	H 41 96	Dusk	14/09/2021

2.3.3.4. Survey Year 2022

Two dusk surveys were conducted simultaneously at each of the two locations shown in **Figure A10.1.8** and **Table A10.1.3** below. Given roosts have already been identified at these two locations in previous surveys, the 2022 surveys were undertaken to identify the nature of the roost, i.e., to ascertain if a bat roost was a transitional roost or maternity roost.

Table A10.1.3: Summary of survey effort for 2022 roost surveys

No. (see Figure A10.1.8)	Structure	Location	Dusk / Dawn	Date
1	**Building 1**	H 43 96	Dusk	14/07/2022
2	**Leisler's Bat tree roost**	H 41 96	Dusk	14/07/2022

2.3.3.4.1. Winter Roost Inspections

SNH Guidelines (SNH, 2021) recommend that winter roost surveys should also be carried out for any potential hibernation roost within 200 m plus rotor radius of developable area (the area where turbines may be located) – this relates to the Ecological Study Area in this report. This survey was conducted on 4 November 2019, within the timeframe in which bats would still be hibernating, and as per the old turbine layout shown in **Figure A10.1.4**. Surveys involved searching for and collecting bat faecal samples, under NIEA license No. BDL/104/19, Licensee No. 2423. Where confirmed evidence of bats was found, closer examination of roost suitability and likely use was conducted, also making use of a thermal imaging camera. Four structures of moderate – high roost potential and likely structures for winter roost occupation were examined (same as buildings surveyed for summer roost suitability in 2019). These are presented in **Table A10.1.4** below. For clarity, whether structures are in or outside the most up to date Study Area is provided in the below table. The structures inspected for hibernating bats are the same as those shown in **Figure A10.1.5.** surveyed for summer roosting potential.

Table A10.1.4: Summary of survey effort for winter roost inspections

Structure	Location (NGR)	Inspection Date
Building 1	H 43 96	04/11/2019
Building 2	H 43 98	04/11/2019
Building 3	H 44 97	04/11/2019
Building 4	H 41 97	04/11/2019

The suitability of a structure for occupation by hibernating bats was assessed according to the criteria outlined in Collins (2016). In carrying out this assessment the following aspects were considered:

- General suitability of roosting features for bats;
- The temperature and humidity of the potential roosting structure during winter;
- The presence of connecting features such as hedgerows / treelines; and,
- The presence of a known summer roost within the structure.

2.3.3.4.2. Walked / driven transect

Under the guidance (SNH 2021), the application of transect surveys is discretionary, with survey requirements designed on a site-by-site basis. Transects are complementary to data collected from static bat detectors; and are important for identifying flight lines and for gaining understanding of bat abundance within the survey area.

Driven transects can provide useful information on the wider landscape in the vicinity of the proposed development site. During the driven transects, appropriate microphones were used on the detector and were directed above the vehicle. Drivers remained at a constant low speed (< 10 km/h). Point counts (of a fixed duration) were occasionally incorporated into the transects to survey specific suitable features in the landscape, in order to provide information on comparative density of use.

Field records were made of bat species encountered, number of bat passes, activity (where known, e.g., foraging, commuting), travelling direction and approximate height (where known). Temperature and wind speed were measured at intervals throughout the survey.

Figure A10.1.9 to **Figure A10.1.12** illustrate the transect survey routes undertaken separated by year for 2021 and 2022, with the transect routes for 2018 and 2019 presented in **Appendix 11.1.3 – Bat Report 2018-2019.**

2.3.3.4.3. Bat fatality monitoring (carcass search)

Bats are at risk of collision with turbines or experiencing injury through barotrauma when flying too close to an actively rotating turbine blade, as a result of the extreme atmospheric pressure change. Leisler's bat in particular is susceptible to collision with turbine blades, as a higher-flying species (Nature Scot, 2021), while common pipistrelle is another species at risk of collision. New literature suggests this species may even be attracted to turbines, although it is unknown why (Richardson *et al.*, 2021). Soprano pipistrelle

and Nathusius' pipistrelle are also noted as being of particular risk of collision risk in a Northern Irish context (NIEA, 2021).

Walked surveys within a 200 m radius of specific turbines were undertaken throughout the active bat season (spring to autumn), to search for any dead bats that could potentially have come in contact with or come too close to a turbine. Additionally, trail cameras were deployed to cover any potential predators that may have taken carcasses between searches. This survey was conducted in 2020 and repeated in 2021.

The survey methodology was agreed with NIEA, and all surveys followed the Protocol Provided in **Appendix 11.1.4**.

2.3.3.4.4. Static Bat Detector Surveys

Static detector surveys were undertaken in 2021 using Wildlife Acoustics Song Meters (SM2, SM4 and SM Mini). Surveys in 2021 were undertaken on three separate occasions per year, covering spring, summer and autumn, as per SNH Guidelines (2019, updated in 2021). Static bat detectors were deployed to record the types of bat species present and to provide an overview of how bat activity is broadly distributed over the Study Area and specifically at selected turbine locations. For the 2021 survey period, statics were deployed for a minimum of 10 nights, as per SNH Guidelines. Additionally, upon the discovery of two bat roosts within the Zone of Influence of the Development, eight targeted static detectors were deployed in 2021, to determine direction of commute from the roost to foraging site, in order to inform the impact assessment on roosting bats.

Dates and locations of static detectors deployed in 2021 and 2022 are tabulated and presented in **Appendix 11.1.1**, along with associated maps of the static detector locations provided in **Figure A10.1.13.**

2.3.3.4.5. Monitoring Climatic Conditions

Monitoring of climatic conditions was undertaken through the deployment of an on-site fully automated weather station with 3G connectivity.

The Davis Vantage Vue wireless integrated sensor suite weather station deployed during bat surveys to monitor weather during these periods, provided data on a real-time basis. This allows weather station functionality to be checked on a daily basis during the survey season and for action to be taken if a station fails or there are concerns regarding the data. This obviates the need for a second (backup) weather station. The weather station collected the full range of weather data, including temperature, wind speed and rainfall, which allows surveyors to determine whether deployments nights were compliant with the prescribed weather parameters (≥ 8°C at dusk, max. ground level wind speed of 5m/s and minimal rainfall).

Deployment periods can then be adjusted to ensure 10 nights of compliant data are captured. In addition, site specific weather data can be useful for investigating the recorded patterns of site usage by bats, for instance exposed, open sites can receive an influx of foraging bats during nights that are warm and relatively still, especially towards the end of the summer and into the autumn, as bats disperse from maternity roosts.

2.3.3.4.6. Calibration and Testing of Recording Equipment

Calibration and testing of recording equipment is required by the SNH Guidelines, and as a standard operating procedure Woodrow have a stringent schedule of testing all bat recording equipment prior to and during deployment in the field. Checks are logged in excel, providing an audit trail to ensure that all data can be relied on and form a robust and defendable data set. Unique numbering of static detectors, SD cards and microphones allows for reverse checking, if any issues arise, e.g. following a microphone

failure. Checks undertaken include pre-deployment device setting and battery checks, and post- and pre-deployment microphone sensitivity checks.

2.3.3.4.7. Data Analysis

For data collected using Song Meter 2s (SM2s) and Song Meter 4s (SM4s) analysis of sound recordings was undertaken using Kaleidoscope software to confirm species (or genus for *Myotis* species[13]) and exact number of bat passes for each transect survey or deployment. For data collected using the BatLoggers, analysis of sound recordings was undertaken using BatExplorer software. Russ (2012) and Middleton *et al*. (2014) were used to aid in identification of bat calls during data analysis.

All sounds files were run through auto-identification and then manual verification was undertaken by Woodrow operatives. Recordings identified as noise were determined to fall outside of the recording parameters for the survey and were manual classified as noise. Common and Soprano pipistrelles which Kaleidoscope determined to be a match ratio of 100% (every pulse recorded matched the species call parameters) were considered to be accurate to a level not requiring manual verification. Recordings in which multiple species were recorded were split into separate passes. The number of passes generated were considered synonymous with Registrations, as defined by Ecobat, which is considered to be species presence within a 15 second sound file. SNH Guidelines recommend using the online tool *Ecobat* to allow for a measure of relative bat activity using a ranking system by comparing the data collected with bat survey information collected from similar areas during similar times of year. Through correspondence with the UK mammal society, we learned that there is an Ecobat base median pass rate for pipistrelles classified to genus level on all pipistrelle species activity. In order to avoid complications with inflated median levels of pipistrelle activity the small number of calls which could only be classified to a genus level for pipistrelles were not included in the presentation of Ecobat analysis results.

Ecobat allows users to upload activity data and compare it to results within a reference range filtered by geographic location, time of year and the make of bat detector used. This generates robust reports tailored for a dataset's specific location, timeframe and equipment. The continued use of Ecobat improves its future accuracy as the data from each survey uploaded adds to their reference database (Lintott *et al.* 2018).

2.3.4.Other (Non-Avian) Protected Species Surveys

Surveys undertaken for protected species likely to occur in the Study Area were as follows:

2.3.4.1. Badger Surveys

In Northern Ireland, badgers *(Meles meles)* and their setts are protected under the Wildlife Order (Northern Ireland) 1985 as amended by the Wildlife and Natural Environment Act (Northern Ireland) 2011. It is a criminal offence to harm or disturb these animals, obstruct access to their place of refuge or destroy or damage anything which conceals or protects their place of refuge. Badgers are also protected by the Welfare of Animals Act (Northern Ireland) 2011. This prohibits acts of cruelty such as badger baiting.

Badger *(Meles meles)* surveys were undertaken on 29 September 2021, 5 October 2021 and previously on several occasions during 2017- 2020 within the Study Area in accordance with the DAERA (2017) survey protocols[14].

The survey recorded all signs of badger activity, and any possible setts, within the Study Area, with particular emphasis on the proposed Development infrastructure layout. Boundary features, fence lines

[13] Bats should be identified to species, or where these cannot be separated with confidence, to species group e.g. *Myotis spp.* (SNH 2021)

[14]DAERA (2017). *NIEA Badger Survey Requirements*. Available at; https://www.daera-ni.gov.uk/sites/default/files/publications/daera/badger-survey-specifications.pdf

and habitats were systematically surveyed for all evidence of badgers, including feeding areas, hair traces, latrines and paths.

Ad hoc incidental recordings of badger signs/activity were similarly noted during other surveys of the Study Area according to the aforementioned survey protocols.

In the interests of conservation and wildlife protection, badger survey results have been provided in a confidential appendix to the ES that is not for circulation **Appendix III – Confidential Badger Report.**

2.3.4.2. Otter Surveys

Otter (*Lutra lutra*) are afforded protection under Annex II of the EU Habitats Directive, The Wildlife (Northern Ireland) Order 1985 (as amended) and as a priority species in Northern Ireland. Under this legislation it is illegal to damage an otter's resting place or to disturb an otter within it, or indeed anywhere else.

The most recent otter survey was carried out in dry weather on 31 May 2021. This survey was intended to update the previous otter surveys that were conducted within the Study Area on 17 December 2018 and 13 February 2019. Otter surveys followed guidance by CIEEM (2013)[15], DAERA (2017)[16] and DAERA (2011)[17].

Otter surveys were carried out within the Study Area for field signs during walkover assessments, while paying particular attention to riparian corridors, water body edges, and any areas of woodland or scrub. All streams on site, and in the vicinity of road crossing points were thoroughly surveyed during dry weather conditions.

The surveys included a 250 m survey up and down stream of any potential watercourse crossings for the works, such as that at the Legnahone Burn in the north-east of the Study Area (where construction and operation vehicles for the Development are likely to cross).

The watercourses walked were checked for spraint on prominent stones and for signs of tracks and slides, with particular attention being paid to crossing points and confluences. The ditch-sides and banks were checked for holes and cavities under boulders. All patches of dense scrub that might have offered resting places away from the watercourses (back to about 25m) were also checked.

2.3.4.3. Red Squirrel Surveys

Red squirrel (*Sciurus vulgaris)* is afforded protection under The Wildlife (Northern Ireland) Order 1985 (as amended) and as a priority species in Northern Ireland. In Northern Ireland, occupied red squirrel dreys are also protected.[18].

Evidence suggesting the presence of red squirrel was noted during surveys in the mature coniferous plantation habitat both within the Study Area (a small strip c. 0.5 ha located approximately 100 m from the proposed T8 and <10 m from the proposed T9 access track) and outside the Study Area in the south-west corner (a large, mature plantation c. 50 ha) during walkover and habitat surveys.

Following NatureScot Guidance[19] it was considered that there was potential for the Development to have a disturbance impact on the smaller woodland which is located *c.* 100 m from the proposed T8 and *c.* 7 m at the closest point from the access track to T9.

---

[15] CIEEM (2013). *Competencies for Species Survey: Eurasian Otter.* Available at: https://cieem.net/wp-content/uploads/2019/02/CSS-EURASIAN-OTTER-April-2013.pdf

[16] DAERA (2017). *NIEA Otter Survey Requirements.* Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/otter-survey-specifications.pdf

[17] DAERA (2011). *NIEA Otters & Development*. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-information-otters-and-development-2011.pdf

[18] Red Squirrel Conservation Strategy for Northern Ireland 2022 – 2032. Ulster Wildlife Available online at:. https://www.ulsterwildlife.org/sites/default/files/2022-04/Ulster%20Wildlife%20-%20Squirrel%20Strategy%20FINAL%208.4.22_0.pdf

[19] NatureScot (2020). *Standing Advice for Planning Consultations – Red Squirrels*. Available at: Standing advice for planning consultations - Red Squirrels | NatureScot.

The larger woodland habitat which lies adjacent to the southwest corner of the Study Area was similarly surveyed in order to inform the wind farm layout during the design process, as there was potential for micro-siting of Turbines and access tracks within that area that may have caused disturbance risk.

Given that the potential impacts to conifer plantations (and thereby potentially affecting this protected species) as a result of the proposal were not fully known prior to Design of the Development, Red squirrel transect surveys and drey counts were carried out over the course of three survey periods within the coniferous plantation both within and immediately adjacent to the Study Area in September 2019, October 2021 and April 2022. These surveys followed DAERA survey specifications[20] and Forestry Commission Guidance[21] in order to determine whether red squirrels have established dreys or use the coniferous plantation areas for foraging.

Each survey period consisted of a repeated transect walk through the forestry plantation with predetermined 100 m stops along the route where at every stop all foraged pinecones were collected. Observations were made through binoculars and the locations of any potential dreys were recorded using a GPS device. This survey transect was carried out four times over the course of a two-week survey period over three years (2019, 2021 and 2022) within the coniferous plantation habitats in the vicinity of the ESA.

Red squirrel survey results have been detailed in **Section 3.6.4**, and in **Figure A10.1.24** and **Figure A10.1.25 .**

2.3.4.4. Other Mammal Surveys

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

2.3.1.*Other (Non-Avian) Protected Species Surveys*

2.3.1.1. Reptiles

The common lizard (*Zootoca vivipara*) is the only reptile that is native to Ireland. This species has a widespread distribution on the island of Ireland, and there is no evidence of any significant decline here (Farren *et al*., 2010). The common lizard is a Northern Ireland priority species and is afforded protected under the Wildlife (Northern Ireland) Order 1985 (as amended).

Common lizard tend to be strongly associated with heathland, bogs and coastal habitat in Ireland[22] similar to the peatland habitats found across the majority of the Study Area.

Reptile surveys for the native common lizard (*Zootoca vivipara*) were conducted under license across the Study Area following best practice DAERA survey specifications[23] and referring to FrogLife UK[24] and CIEEM (2014) [25] guidelines.

Reptile surveys were conducted under license during sunny, dry, weather conditions and during suitable daylight hours, within the Study Area to inform any likely mitigation required to avoid impacts upon this species over the course of three separate survey periods; in September - October 2019, September - October 2021 and April - May 2022.

---

[20]DAERA (2017). Red Squirrel Surveys NIEA Specific Requirements https://www.daera-ni.gov.uk/sites/default/files/publications/daera/red-squirrel-survey-specifications.pdf

[21] Gurnell *et al*., (2001). *Practical Techniques for Surveying and Monitoring Squirrels.* Available at: https://treesforlife.org.uk/docs/079_360__practicaltechniquesforsurveyingandmonitoringsquirrels_1446049986.pdf

[22] Farren, A., Prodöhl, P.A., Laming, P. & Reid, N. (2010). Distribution of the common lizard (*Zootoca vivipara*) and landscape favourability for the species in Northern Ireland. *Amphibia-Reptilia* 3 Vol 31 p387

[23] DAERA (2017). *Common or Viviparous Lizard Surveys NIEA Specific Requirements.* Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/common-lizard-survey-specifications.pdf

[24] FrogLife (2014) *Surveying for Reptiles*. Available at: https://www.froglife.org/wp-content/uploads/2013/06/Reptile-survey-booklet-3mm-bleed.pdf

[25] CIEEM (2014) *Reptile Survey Guidelines*. Available at: https://cieem.net/wp-content/uploads/2019/02/CSS-REPTILES-October-2014.pdf

- Surveys in 2019 were undertaken under Licence No. LRS/12/19 and Licensee No. 2696.
- Surveys in 2021 were undertaken under Licence No. LRS/30/21 and Licensee No. 2876.
- Surveys in 2022 were undertaken under License No. LRS/5/22, Licensee No. 3137 and License No. LRS/6/22, Licensee No. 3138.

These surveys used the combined approach of both a visual search and the presence of artificial refugia. Survey sites were selected for their reptile suitability and surveys were undertaken in 5 different locations over the 3 years so as to survey a representative area of habitats across the Study Area.

Each survey period involved one day of setting out 75 No. refugia tiles within suitable habitat. Locations were also geared towards suitable habitat in proximity of the Development. Return visits were carried out during suitable times (morning to midday as appropriate) and weather conditions (dry and sunny). Once the refugia had been installed on site, 3 no. visits were undertaken per survey year in total to check these refugia tiles for the presence of lizard in addition to visual searches of the area.

Reptile survey results have been detailed within **Section 3.6.9**, and in **Figure A10.1.26.**

2.3.1.2. Invertebrates

During the walkover surveys, invertebrate species with particular attention to Odonata (dragonflies and damselflies as well as pollinating insects (butterflies, moths, hoverflies, solitary bees and bumblebees) were recorded on an *Ad hoc* basis. Particular attention was paid to habitats or food plants that are associated with NI priority invertebrate species such as hare's-tail cotton grass (*Eriophorum vaginatum*) which is a common foodplant of the NI priority large heath butterfly (*Coenonympha tullia*). The lack of certain foodplants throughout the Study Area, for example bog myrtle *(Myrica gale)*, reduced the occurrence rate of certain NI priority species which would commonly be associated with upland blanket bog habitats such as the argent and sable moth (*Rheumaptera hastata*).

Surveys to assess the ESA's suitability to support habitat for the marsh fritillary butterfly (*Euphydryas aurinia*) were conducted. This is a protected species under the Habitat's Directive, and a Priority Species in Northern Ireland. A targeted habitat condition assessment survey was carried out under License No. SBP/18/19; Licensee No – 2423 in 2019. This survey constituted a habitat condition assessment by undertaking a search of all areas supporting the larval food plant; devil's-bit scabious (*Succisa pratensis)* (DBS) within the Study Area. Plants of DBS were scattered, and the vegetation was considered to support sub-optimal habitat for this species at this site in 2019. Subsequently no further surveys for this species were considered necessary. This was monitored by Woodrow ecologists throughout the site visits to ensure the baseline remained the same throughout this study.

2.4. Impact Assessment Methodology

The impact assessment methodology applied is from the CIEEM Guidance[26], as well as building on other recognised methodologies for specific faunal groups. The general approach is to identify and characterise potential impacts, assess the magnitude / extent and probability of occurrence of each impact, and relate these factors to the value and sensitivity of the receptor. These terms are quantified in the following subsections.

2.4.1. Identifying Ecological Features within the Zone of Influence

Information acquired during the desk-study and field surveys will determine those ecological features which have the potential to be affected by the Development and as such occur within the 'Zone of Influence' of the Development. The Zone of Influence depends on the type of Development taking place, its likely impacts and the presence of ecological connections which provide a pathway for such impacts to

[26] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. Chartered Institute of Ecology and Environmental Management, Winchester. Available online at: ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.2-April-22-Compressed.pdf (cieem.net)

an ecological feature of interest which is sensitive to such impacts. As such, the Zone of Influence may extend beyond the boundaries of the Study Area due to the presence of ecological connections with an ecological feature of interest. Similarly, ecological features which have no ecological connection with the Development, and as such no pathway for impacts, are not within the Zone of Influence regardless of their proximity to the Development. Any such ecological / hydrological connections which provide pathways for impacts are identified and described below.

2.4.2. Evaluating Ecological Features within the Zone of Influence

Those ecological features which occur within the Zone of Influence such as nature conservation sites, habitat or species are then evaluated in geographic hierarchy of importance. Depending on the receptor's status and its context in the wider area, its nature conservation value may be assigned one of the categories detailed in **Table A10.1.5.**

Approaches to attributing nature conservation value to species have been developed for some specific groups such as bats and birds. The approach outlined *in 'Valuing Bats in Ecological Impact Assessment'*[27] is summarised in **Table A10.1.6** (Note – guidance on attributing rarity and ascertaining what constitutes a 'small' or 'large' number exists within this text but is not reproduced here). **Table A10.1.7.** and **Table A10.1.8** list the conservation status of individual Irish bat species.

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

[27] Wray S, Wells D, Long E, Mitchell-Jones T (December 2010). *Valuing Bats in Ecological Impact Assessment*, IEEM In-Practice p 23-25

Table A10.1.5: Value of Ecological Resources

(Adapted using professional judgement from NRA 2009[28] and adhering to "the CIEEM Guidelines").

Importance	Criteria	Sensitivity of Receptor*
International Importance	• Sites, habitats and species populations of importance in a European wide context. • 'European Site / UK National Sites' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. • Proposed Special Protection Area (pSPA). • Site that fulfils the criteria for designation as a 'European Site / UK National Site' (see Annex III of the Habitats Directive, as amended). • Features essential to maintaining the coherence of the Natura 2000 Network (including UK National Sites).[29] • Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. • Resident or regularly occurring populations (assessed to be important at the national level) of species of animal and plants listed in Annex II and/or IV of the Habitats Directive. • Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). • Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). • Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). • World Heritage Sites (implications for biodiversity value only). • Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).	Very High

National Importance	• Sites, habitats and species populations of importance in a national context.
	• Site designated as an Area of Special Scientific Interest (ASSI).
	• National Nature Reserve.
	• Undesignated site fulfilling the criteria for designation as an Area of Special Scientific Interest (ASSI) or National Nature Reserve.
	• Resident or regularly occurring populations (assessed to be important at the national level) of the following:
	  ○ Species protected under the Wildlife (Northern Ireland) Order 1985; and/or,
	  ○ Species listed on the relevant Red Data list.
	• Site containing 'viable areas'[30] of habitat types listed in Annex I of the Habitats Directive.
		High

Regional Importance (Northern Ireland)	• Area of Special Amenity.
	• Area subject to a Tree Preservation Order.
	• Area of High Amenity, or equivalent, designated under the County Development Plan.
	• Resident or regularly occurring populations (assessed to be important at the 'Regional' level) of the following:
	  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
	  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
		High

[28] NRA (2009) Guidelines for Assessment of Ecological Impacts of National Roads Schemes, available at: https://www.tii.ie/technical-services/environment/planning/Guidelines-for-Assessment-of-Ecological-Impacts-of-National-Road-Schemes.pdf (Accessed: May 2022).

[29] See Articles 3 and 10 of the Habitats Directive

[30] A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

Importance	Criteria	Sensitivity of Receptor*
	- Species protected under the Wildlife Acts Ireland); and/or - Species protected under the Wildlife (Northern Ireland) Order 1985; and/or - Species listed on the relevant Red Data list. • Regional important populations of species; or viable areas of semi-natural habitats; or natural heritage features identified in the National or Local BAP; if this has been prepared. • Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. • Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the region. • Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level. • SLNCIs supporting county important populations of species, or viable areas of semi-natural habitats identified as Northern Ireland Priority Habitats.	
District level Importance (Derry City & Strabane)	• Resident or regularly occurring populations (assessed to be important at the 'District' level)[31] of the following: • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; • Species protected under the Wildlife (Northern Ireland) Order 1985; and/or • Species listed on the relevant Red Data list. • Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. • District important populations of species, or viable areas of semi-natural habitats or natural heritage features identified as Northern Ireland Priority Habitats or Species. • Sites containing semi-natural habitat types with high biodiversity in a district context and a high degree of naturalness, or populations of species that are uncommon within the district. • Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a regional level.	Medium
Local Importance (higher value)	• SLNCIs supporting locally important habitat assemblages and /or locally important populations of Northern Ireland Priority Species Sites, habitats and species populations of importance in a parish and district context, including Locally important populations of Northern Ireland Priority Species or Habitats. • Locally important populations of priority species or habitats or natural heritage features identified in the Local Biodiversity Action Plans, if this has been prepared. • Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality. • Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value. • Resident or regularly occurring populations (assessed to be important at the Local level) of the following:	Medium

[31] It is suggested that, in general, 1% of the District population of such species qualifies as a District important population. However, a smaller population may qualify as District important where the population forms a critical part of a wider population, or the species is at a critical phase of its life cycle.

Importance	Criteria	Sensitivity of Receptor*
	○ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; ○ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; ○ Species protected under the Wildlife (Northern Ireland) Order 1985; and/or, ○ Species listed on the relevant Red Data list.	
Local Importance (lower value)	• Habitats and species populations of less than local importance but of some value. • Sites or features containing non-native species that is of some importance in maintaining habitat links.	Low - Negligible

**Sensitivity of receptor is provided for context within the Ecological Impact Assessment Framework (CIEEM, 2018)*

Table A10.1.6: Scoring system for valuing commuting and foraging bats

Geographic Frame Reference	Score
Regional	31-40
County	21-30
District / Local / Parish	11-20
Not Important	1-10

Table A10.1.7: Methodology for valuing foraging areas (scoring in brackets)

Species	Number of Bats	Roosts / Potential Roosts Nearby	Foraging Habitat Characteristics
Common (2)	Individual bats (5)	None (1)	Industrial or other site without established vegetation (1)
		Small number (3)	Suburban areas or intensive arable land (2)
Rarer (5)	Small number of bats (10)	Moderate number / Not known (4)	Isolated woodland patches, less intensive arable and / or small towns and villages (3)
		Large number of roosts or close to NHA for species (5)	Larger or connected woodland blocks, mixed agriculture, and small villages (4)
Rarest (20)	Large number of bats (20)	Close to or within SAC for species (20)	Mosaic of pasture, woodlands and wetland areas (5)

Table A10.1.8: Conservation status of bat species in Ireland (taken from an aggregate of Russ, 2008[32] and Marnell *et al*. 2009)[33]

Species	Common Name	Overall conservation status in Ireland	Irish Red List status
Myotis daubentonii	Daubenton's bat	Favourable	Least Concern
Myotis mystacinus	Whiskered bat	Favourable	Least Concern
Myotis nattereri	Natterer's bat	Favourable	Least Concern
Nyctalus leisleri	Leisler's bat	Favourable	Least Concern
Pipistrellus nathusii	Nathusius' pipistrelle	Unknown	Least Concern
Pipistrellus	Common pipistrelle	Favourable	Least Concern
Pipistrellus pygmaeus	Soprano pipistrelle	Favourable	Least Concern
Plecotus auritus	Brown long-eared bat	Favourable	Least Concern

Important Ecological Receptors are those features which are within the Zone of Influence and are evaluated as being of Local Importance (Higher Value) or greater.

[32] Russ, J., Briggs, P. and Wembridge, D. *The Bats and Roadside Mammals Survey 2008. Final Report on Fourth Year of Study.* The Bat Conservation Trust and People's Trust for Endangered Species, London.
[33] Marnell, F., Kingston, N. & Looney, D. (2009). Ireland Red List No. 3: Terrestrial Mammals, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

2.4.3. Identification and Characterisation of Impacts

Where possible, ecological impacts have been assessed with reference to the following characteristics (in accordance with CIEEM, 2018), both before and after mitigation [and where relevant, for both the construction, operational and decommissioning phases of this proposal]:

- Positive or negative;
- Extent;
- Magnitude;
- Duration;
- Timing;
- Frequency; and,
- Reversibility.

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

However, the assessment only needs to describe those characteristics relevant to understanding the ecological effect and determining the significance and as such does not need to incorporate all stated characteristics (CIEEM, 2018).

2.4.4. Impact Probability

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

Certain/ near certain – probability of occurrence estimated at 95% chance or higher;

Probable – probability of occurrence estimated above 50% but below 95%;

Unlikely – probability of occurrence estimated above 5% but less than 50%; and,

Extremely unlikely – probability of occurrence estimated at less than 5%.

2.5. Significant Effects on Important Ecological Receptors

Depending upon the type of effect, and the sensitivities of the Important Ecological Receptor, an effect may be assessed as being 'significant'. For the purpose of EcIA, a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for those ecological features which have been identified as IERs (Important Ecological Receptors). Conservation objectives may be specific (e.g., for a designated site) or broad (e.g., national/local nature conservation policy). Subsequently, effects can be considered significant in a wide range of geographic scales from international to local. Consequently, 'significant' effects should be qualified with reference to the appropriate geographic scale (CIEEM, 2018), as outlined above in **Section 2.4.2.**

Within the CIEEM guidelines *"A significant effect is simply an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project"*. *"For the purpose of EcIA, a 'significant negative effect' is an effect that undermines biodiversity conservation objectives for 'Important Ecological Receptors', or for biodiversity in general".* Where significant effects are identified, measures are then taken to avoid, minimise or compensate for effects.

Note: Within the associated EIA, Chapter 10 – Ecology, 'significance' is based on interpretation in the context of the EIA Regulations following "the CIEEM Guidelines" and applying Professional Judgement. See **Section 10.3.11 "Significance of Effect" of ES Chapter 10.**

In the context of the EIA Regulations; Significant effects are considered to be those that are found to be of Local (Higher) importance or above, in the absence of mitigation. Therefore, anything assessed as being of Local Importance (Lower Value) within this report is not carried through into the ES. Mitigation in relation to such impacts is provided within this EcIA where applicable, and where relevant to planning, this has also been discussed as general recommendations within **Section 10.6 of ES Chapter 10**.

2.5.1. Impact Significance (degree of impact)

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

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

2.5.2. Assessment of Residual Impacts and Effects

After characterising the potential impacts of the Development and assessing the potential effects of these impacts on the 'Important Ecological Receptors', mitigation measures are proposed to avoid and / or mitigate the identified ecological effects. Once measures to avoid and mitigate ecological effects have been finalised, assessment of the residual impacts and effects is undertaken to determine the significance.

2.5.3. Assessment of Cumulative Impacts and Effects

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

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

Development occurring within the vicinity of this project are outlined further in **Technical Appendix A2.4 – Cumulative Developments** of the ES.

2.6. Survey Limitations

2.6.1. Aquatic Survey Limitations

A key limitation of the aquatic surveys performed, is that the biological water quality assessments (i.e., macroinvertebrate surveys) and chemical analysis were performed at different times during the study period (July 2021 and September 2022, respectively). The high BOD_5 levels observed in WQ2 and WQ3 suggest a deterioration in water quality during this period, particularly with regard to organic pollution. However, physico-chemical parameters can vary according to flow and run-off conditions (particularly at a significantly drained upland site like the Study Area), and likely only provides a snapshot of the water quality at the time of sampling. Thus, results from these analyses should be interpreted with care.

2.6.2. Habitat Survey Limitations

The unpredictable weather changes and exposed nature of the habitats hindered and prevented site visits on several occasions due to health and safety considerations and typical operational wind farm access limitations during bad weather. However, the wide range of surveys carried out across the seasons has ensure a robust and complete data set has been used in this assessment.

It should also be noted that initial NVC quadrat surveys were undertaken outside the optimum field survey season for peatland habitats (generally defined as April-September); however, upland habitats can generally be satisfactorily surveyed throughout most of the year as the key species present can be readily identified vegetatively. Woodrow's botanical team are highly experienced in undertaking surveys in upland habitats.

These surveys were also supported by extensive additional NVC surveys and included 'Active Peat' assessments and previous NVC assessment carried out from 2017 – 2022 across the entire survey period, as outlined in **Table A10.1.1** during optimal survey seasons. As such, there were no limitations due to seasonality in relation to the assessment on habitats here.

Additionally, owing to the extensive peat cutting, drainage and grazing across the Study Area the habitats are present in a highly mosaiced nature which presented a further difficulty in precise habitat classification in some instances. However, overall habitat types were accurately identified due to the species present, and their cover and distribution. This has been supported by the NVC quadrat survey information.

2.6.3. Non-Avian fauna Survey Limitations

2.6.3.1. Bat Survey Limitations

In the case of bat surveys, survey limitations often relate to weather conditions at the time of the surveying and equipment failing in the field, for example microphones can be damaged by livestock or can lose sensitivity when exposed to prolonged episodes of heavy rainfall.

Overall, it considered that the combined survey approach and coverage over the 2018, 2019, 2021 and 2022 survey seasons, provides robust data from which a full insight into the use of the proposed development by bats can be obtained. As such, this information can be used to assess the potential impacts of the proposed wind farm development on the local bat population. Given the survey methodologies used to ensure full coverage of proposed development across the bat activity seasons, over four years of surveys, it is considered that the data obtained complies, in full, with the recommended guidelines set out within *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH 2021).

2.6.3.1.1. Data Handling

Given the changeover from BCT to SNH Guidelines in 2019 (and subsequent updates to the SNH Guidelines in 2021), different survey guidelines were applied in 2018 than for the following survey years, therefore, data may be presented and analysed slightly differently for 2018 to the other survey years within this report. To ensure a robust and current assessment, the reporting on the results and determinations made from these, focus primarily on the most recent survey data (2021 and 2022), while also drawing comparisons between the older data (provided in Appendix 11.1.3).

2.6.3.1.2. Livestock

Although all precautions were taken to avoid livestock interference, some static detectors were caused to fail as a result of cattle chewing on the microphone wires. This was a very infrequent occurrence and was remedied quickly through the installation of stock-proof fencing around any deployed static detectors at risk of cattle interference.

2.6.3.1.3. Equipment Failures

Some static detectors failed across each year of surveying. It was determined that while there were a few failures across the survey years, the data collected from the working detectors was sufficient to cover the windfarm site and all of the proposed turbine locations. Subsequently, conclusions could be made from the abundance of data collected across the Study Area across four years, and the utilisation of a variety of survey techniques to supplement static deployment.

2.6.4. Implications for Assessment

Despite the above limitations, all surveys were supported by data carried out during the optimal seasons for relevant flora and fauna (on repeated surveys), it is therefore determined that the assessment does not have any limitations or information gaps.

3. BASELINE DESCRIPTION

3.1. Ecological Study Area

The Development is located on Owenreagh Hill within the townlands of Craignagapple, Ballykeery, Knockinarvoe, Owenreagh, Ligfordrum and Lagavadder, Co. Tyrone.

An existing regional road "Glenmornan Road" runs through the Study Area Study Area with the wind turbines and associated infrastructure of 'the Operational Owenreagh I Wind farm (Planning Ref: J/93/0286)', "Owenreagh 1 Wind farm" and 'the Operational Owenreagh II Wind Farm (Planning Ref: J/2004/1015/F)' "Owenreagh II Wind farm" incorporated into the extent of the Study Area.

The Study Area lies within a rural landscape, approximately 5.5 km from the River Foyle, at an average altitude of 350m above sea level. Owenreagh Hill is generally composed of cutover, drained and degraded upland blanket bog, acid grassland and more improved pasture with steep slopes and uneven terrain, underlain by a quartzite bedrock[34]. The surrounding habitats include areas of coniferous plantation and farmland.

The approximate centre of the Study Area is located at Irish Grid Reference H 42284 96380. The geographic location of the Study Area can be seen in **Figure A10.1.1**.

3.2. Protected Areas / Designated Sites

The Source-Pathway-Receptor (S-P-R) model has been applied in this assessment. A summary of all nationally and internationally designated sites occurring within an initial 15 km of the Study Area, including their features of interest, is provided in **Table A10.1.9** and **Table A10.1.10** below. This 15 km initial desktop radius provides a basic overview of designated sites with likely potential for connection that can then be narrowed down to sites considered to be within the 'Zone of Influence' of the Development. The Zone of Influence can also extend beyond the initial 15 km search as it includes all designated sites with a potential S-P-R linkage through identified connectivity with the Development (often hydrological) which may extend beyond 15km. For illustrative purposes, the locations of all international and national designated sites within 15 km of the Study Area site centre are shown in **Figure A10.1.14** and **Figure A10.1.15** respectively. Publicly available orthophotography and online maps were utilised in order to identify any likely S-P-R linkages (see **Section 2.1.** for such resources used in this assessment).

3.2.1.Sites of International Importance

In the context of Northern Ireland, internationally designated sites refer to Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar Sites. Special Areas of Conservation are designated

[34] Geological Survey of Northern Ireland, 2020. *Ordanance Survey Ireland*, 1:120,000 Scale (map). Available online at: GSNI GeoIndex (bgs.ac.uk)

under the EU Habitats Directive and facilitated in Northern Ireland through the Conservation (Natural Habitats, &c.) (Amendment) Regulations (Northern Ireland) 2007 as amended. SACs are designated to afford protection to a suite of habitats and species listed on Annex I and Annex II of the Directive. Special Protection Areas (SPAs) are designated under the EU Birds Directive (2009/147/EEC) and facilitated in Northern Ireland through the Conservation (Natural Habitats, &c) Regulations (NI) 1995 (as amended). SPAs provide protection to birds listed on Annex I of the Birds Directive, and also provide protection to populations of migratory species regularly occurring at a site. Potential impacts on SPAs are covered within in **ES Chapter 11 Ornithology**.

The closest internationally designated site to the Study Area is River Foyle and Tributaries SAC (UK0030320) which lies c. 5.5 km west by direct distance and c. 12.8 km via downstream hydrological connection. Of particular importance within the River Foyle system are the populations of Annex II species Atlantic Salmon (*Salmo salar*), which is one of the largest in Europe, and Otter (*Lutra lutra*) which is found throughout the system. The area is also important as a river habitat designated for 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation'. In their upper catchments, the rivers are all fast-flowing spate rivers with dynamic flow regimes characterised by sequences of rapid, riffle and run. The River Foyle below Strabane is slow-flowing and is influenced by a tidal regime, rising and falling with the tidal cycle. This river is also nationally designated as an Area of Special Scientific Interest (ASSI).

The closest SPA to the Study Area is Lough Foyle SPA, which lies c. 22.9 km north-west with a *c*. 40 km hydrological connection. Lough Foyle is considered as outside of the Zone of Influence for this aspect of the impact assessment but as the closest SPA to the Development and given the mobility of bird species, applying the Precautionary Principle, it has been discussed further within Chapter 11 of the ES: Ornithology.

Internationally designated sites within the Zone of Influence of the Development have been illustrated in **Figure A10.1.14: Internationally designated sites located within proximity of the Development.**

3.2.2. Sites of National Importance

Areas of Special Scientific Interest (ASSI) are designated under the Environment (Northern Ireland) Order 2002 (as amended). Designations are given to features of scientific interest and include significant geological features, and areas which support rare or significant flora or fauna populations.

Nature Reserves (NRs) are defined under Article 2 of The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985. NRs are identified for the purpose of conserving flora, fauna or features of geological, physiographical or other scientific or special interest therein, and they are also valuable in that they provide an opportunity to study such features in a controlled environment. District councils have the power to acquire, declare and manage Nature Reserves. Nature Reserves that have been declared by local authorities are known as NRs.

As the Study Area site centre is located only *c.* 9.3 km east of the border with the Republic of Ireland (R.O.I.), all R.O.I nationally designated sites that have a source-pathway-receptor linkage to the Study Area were similarly considered within this desk study. This included Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs).

As shown in **Table A10.1.10** (and **Figure A10.1.15**) designated sites have been described along with an assessment of the potential for them to lie within the Zone of Influence of the Development. The closest site of national importance considered to be within the Zone of Influence, through S-P-R hydrological connectivity is Lisnaragh ASSI, which maintains a *c.* 3.5 km north-east hydrological connection of the Site Centre. Similarly, Silverbrook Wood ASSI maintains a *c.* 3.5 km hydrological connection to the north-east of the Development and Corbylin Woods maintains a 11.93 km hydrological connection.

The closest Nature Reserves or Natural Heritage Areas are Boorin Nature Reserve which lies at a direct distance *c.* 13.3 km south-east of the Development and River Foyle, Mongavlin to Carrigans pNHA which lies at a direct distance *c.* 12.4 km north-west of the Development. No NR's or NHA's are considered to have S-P-R linkages and are therefore not considered to be within the Zone of Influence of the Development.

3.2.3. Sites of Local Importance

Sites of local biodiversity importance are identified at the local level, and while these are not statutorily designated, they are offered a degree of protection through the planning process, by the application of PPS2, policies NH4 and NH5 (see **Section 1.2**).

As defined by DAERA: "*Sites of Local Nature Conservation Importance (SLNCIs) are identified as supporting habitats, species, or earth science features. As well as making a contribution to the local natural heritage, they contribute to National and European biodiversity. Their location is identified through the relevant area plan".* (DAERA, 2020).

Similarly, Local Wildlife Sites are defined as "*sites with 'substantive nature conservation value'…identified and selected for their nature conservation value, based on important, distinctive, and threatened habitats and species [within a region]*" (The Wildlife Trusts, n.d). Local Wildlife Sites in Northern Ireland are identified on the DAERA Natural Environment Map Viewer (DAERA, 2020) [but at present this does not necessarily include all local biodiversity sites, such as SLNCIs, currently identified in Local Plans.]

During the desktop study undertaken for this project, the Natural Environment Map Viewer (DAERA, 2020) and the Derry City and Strabane District Council (2032), Local Development Plan DRAFT[35] were consulted in order to identify sites of local wildlife importance with potential S-P-R linkages.

Nationally protected areas that occur in the Zone of Influence of the Study Area have been illustrated in **Figure A10.1.15.** Priority species, local wildlife sites and areas of Northern Ireland Priority Habitat that occur within a 15km radius of the Study Area, as shown on the DAERA Natural Environment Map Viewer (DAERA, 2020)[36] have been reproduced **Plate 1** and **Plate 2** below.

Derry City and Strabane District Council are in the process of updating their Local Development Plan. The document *Derry City and Strabane District Council LDP Draft Plan Strategy – Natural Environment.*

[35] Derry City and Strabane District Council LDP Draft Plan Strategy – Natural Environment. Available at: https://www.derrystrabane.com/getmedia/7e71857f-f225-4a13-b82a-0c8880b14a6c/53-DS-233-EVB-21-Natural-Environment.pdf
[36] DAERA Natural Environment Map Viewer. Available at: NIEA Natural Environment Map Viewer (daera-ni.gov.uk)

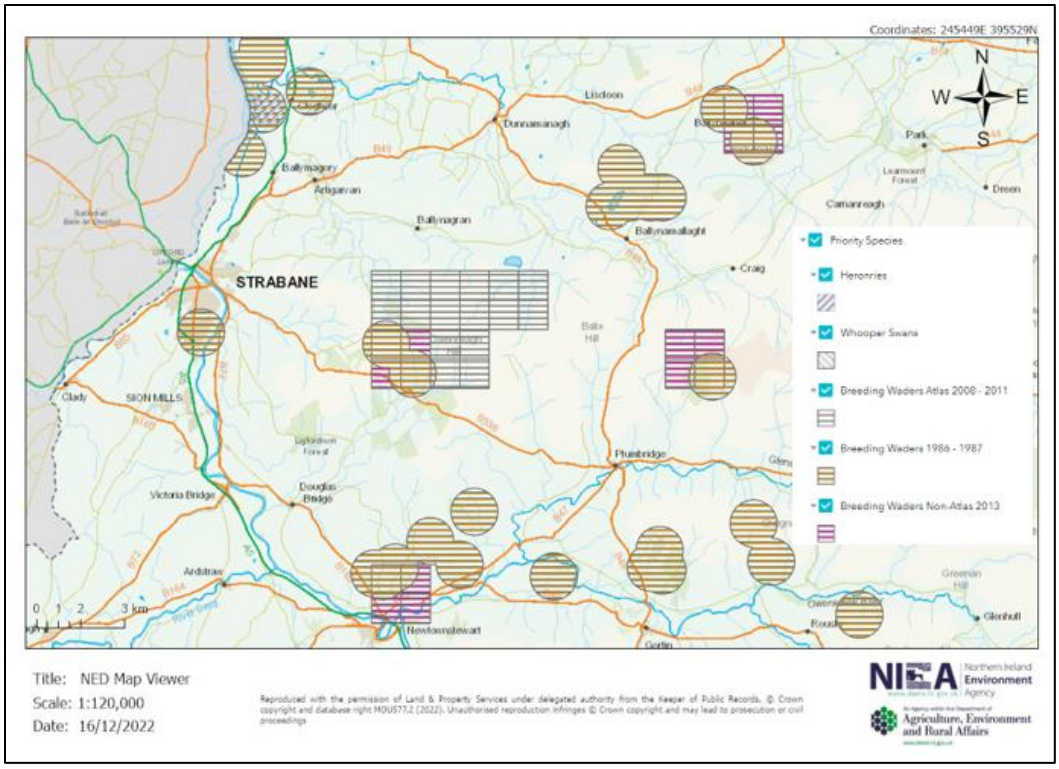


Plate 1: Priority Species that occur in the ZoI of the Study Area, reproduced from DAERA's Natural Environment Map Viewer (DAERA, 2020)

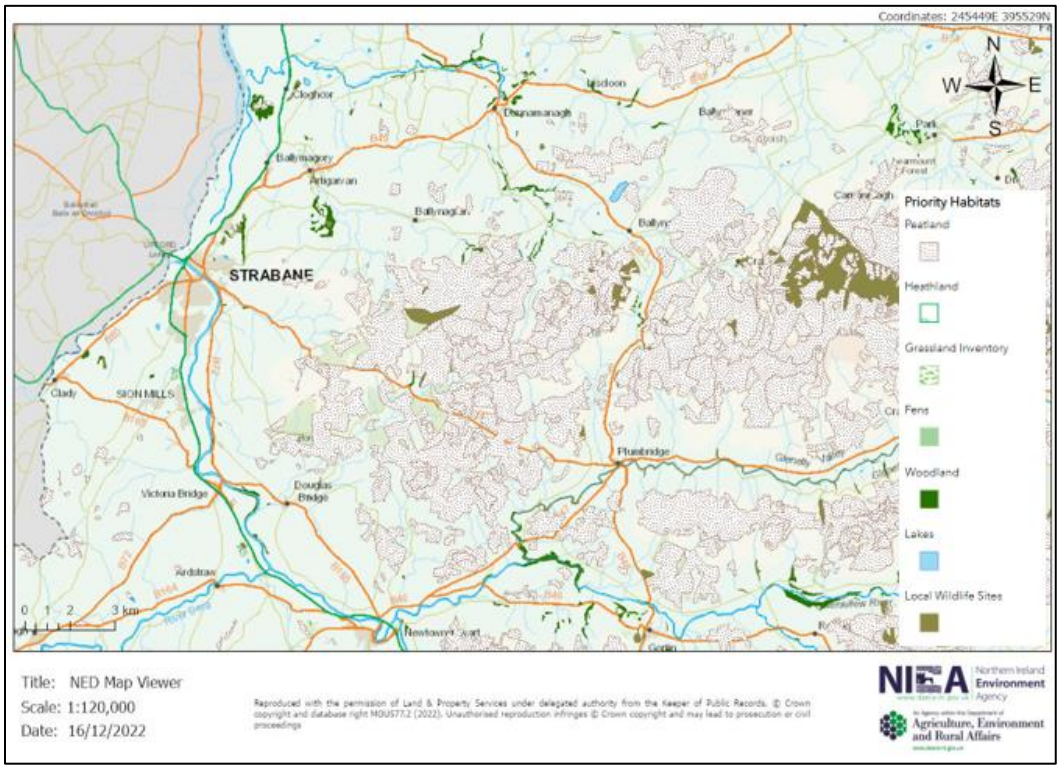


Plate 2: Local Wildlife Sites and Priority Habitats that occur in the ZoI of the Study Area, reproduced from DAERA's Natural Environment Map Viewer (DAERA, 2020)

Table A10.1.9: Summary of internationally designated sites considered to be within the ZoI and have source-pathway-receptor (S-P-R) linkages. Those considered further in this assessment have been highlighted in green and bold.

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Potential S-P-R connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
Special Areas of Conservation (SACs)						
River Foyle and tributaries SAC (NI)	**UK0030320**	• **Atlantic Salmon (*Salmo salar*)** • **Otter (*Lutra lutra*)** • **Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitricho-Batrachion* vegetation** • **Sea lamprey (*Petromyzon marinus*)** • **River lamprey *(Lampetra fluviatilis*)** • **Brook lamprey (*Lampetra planeri*)** • **Freshwater pearl mussel (*Margaritifera margaritifera*)**	***c.* 5.5 km west by direct distance.** ***c.* 12.8 km via closest downstream hydrological connection**	**Hydrological connectivity**	**Potential for pollution and/or sedimentation impacts**	**P** **Water quality impacts**
River Finn SAC (NI)	**IE0002301**	• **Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)** • **Northern Atlantic wet heaths with *Erica tetralix*** • **Blanket bogs (* if active bog)** • **Transition mires and quaking bogs** • **Salmon (*Salmo salar*)** • **Otter (*Luta lutra*)**	***c.* 6.5 km west by direct distance.** **13 km via downstream hydrological connection**	**Hydrological connectivity**	**Potential for pollution and/or sedimentation impacts**	**Water quality impacts**
River Faughan and Tributaries SAC (NI)	UK0030361	• Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles • Salmon (*Salmo salar*) • Otter (*Lutra lutra*)	*c.*10.8 km (direct distance) To the north-east	No direct connectivity via habitat or through hydrological linkages.	None	None

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Potential S-P-R connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
Owenkillew River SAC (NI)	UK0030233	• Old sessile oak woods with Ilex and Blechnum in the British Isles • Water courses of plain to montane levels with the *Ranunculion fluitantis and Callitricho-Batrachion* vegetation • Freshwater Pearl Mussel (*Margaritifera margaritifera*) • Salmon (*Salmo salar*) • Otter (*Lutra lutra*)	c. 5.8 km direct distance south-east No hydrological connection	No potential for direct hydrological connection as the nearest tributary of the Owenkillew River SAC is c. 1.3km from the Study Area.	None	None
Special Protection Areas (SPAs)						
Lough Foyle SPA (NI)-RAMSAR	**UK12014**	• **Ramsar criterion 1a: this is a particularly good representative example of a wetland complex including intertidal sand and mudflats with extensive seagrass beds, saltmarsh, estuaries and associated brackish ditches.** • **Ramsar criterion 1c: this is a good representative example of a wetland, which plays a substantial hydrological, biological and ecological system role in the natural functioning of a major river basin which is located in a trans-border position.** • **Ramsar criterion 2a: the site supports an appreciable assemblage of rare, vulnerable or endangered species or sub-species of plant and animal.** • **Ramsar criterion 3: the site supports a diverse assemblage of wintering waterfowl which are**	**c. 22.7 km north-west by distance** **40 km via downstream hydrological connection**	**Hydrological connectivity**	**Potential for pollution and/or sedimentation impacts**	**Water quality impacts**

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Potential S-P-R connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
		indicative of wetland values, productivity and diversity. • **Ramsar criterion 5: the site supports about 29000 migrating birds.** • **Ramsar criterion 6: species/populations occurring at levels of international importance**				
Lough Foyle SPA (ROI)	**IE0004087**	• **Red-throated Diver (*Gavia stellata*) [A001]** • **Great Crested Grebe (*Podiceps cristatus*) [A005]** • **Bewick's Swan (Cygnus *columbianus bewickii*) [A037]** • **Whooper Swan (*Cygnus cygnus*) [A038]** • **Greylag Goose (*Anser anser*) [A043]** • **Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]** • **Shelduck (*Tadorna tadorna*) [A048]** • **Wigeon (*Anas penelope*) [A050]** • **Teal (*Anas crecca*) [A052]** • **Mallard (*Anas platyrhynchos*) [A053]** • **Eider (*Somateria mollissima*) [A063]** • **Red-breasted Merganser (*Mergus serrator*) [A069]** • **Oystercatcher (*Haematopus ostralegus*) [A130]** • **Golden Plover (*Pluvialis apricaria*) [A140]**	**c. 27 km north-west by distance** **40 km via downstream hydrological connection**	**Hydrological connectivity**	**Potential for pollution and/or sedimentation impacts**	**Water quality impacts**

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Potential S-P-R connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
		• **Lapwing (*Vanellus vanellus*) [A142]** • **Knot (*Calidris canutus*) [A143]** • **Dunlin (*Calidris alpina*) [A149]** • **Bar-tailed Godwit (*Limosa lapponica*) [A157]** • **Curlew (*Numenius arquata*) [A160]** • **Redshank (*Tringa totanus*) [A162]** • **Black-headed Gull (*Chroicocephalus ridibundus*) [A179]** • **Common Gull (*Larus canus*) [A182]** • **Herring Gull (*Larus argentatus*) [A184]** • **Wetlands [A999]**				

Table A10.1.10: Summary of nationally designated areas occurring within proximity of the Development.

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Hydrological connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
Nature Reserves (NR's)						
Boorin Nature Reserve	NR18	• Heathland with mature Oak-Birch woodland.	*c.*13.3 km to the south-east	No direct connectivity via habitat or through hydrological linkages.	None	None
Areas of Special Scientific Interest (ASSI)						
Lisnaragh ASSI	**ASSI 288**	• **Designated for the physiographical features of moraine (sand, gravel and mud) ridge and outwash terrace.**	***c.* 3.5 km to the north-east via downstream hydrological connection**	**Hydrological Connectivity**	**Potential for pollution and/or sedimentation impacts**	**Water quality impacts**
Silverbrook Wood ASSI	**ASSI 95**	• **Designated by reason of the flora and fauna including its 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.**	***c.* 3.5 km to the north-east via downstream hydrological connection**	**Hydrological Connectivity**	**Potential for pollution and/or sedimentation impacts**	**Water quality impacts**
River Foyle ASSI	**ASSI 229**	• **Designation by reason of the physical features of the river and its associated riverine flora and fauna. The River Foyle and Tributaries ASSI includes that part of the River Finn which lies within Northern Ireland, the**	**c. 5.5 km west by distance.** ***c.* 12.8 km via downstream hydrological connection**	**Hydrological Connectivity**	**Potential for pollution and/or sedimentation impacts**	**Water quality impacts**

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Hydrological connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
		River Mourne and its tributary the River Strule (up to its confluence with the Owenkillew River) and the River Derg, along with two of its sub-tributaries, the Mourne Beg River and the Glendergan River. In total, the area encompasses 120km of watercourse and is notable for the physical diversity and naturalness of the banks and channels, especially in the upper reaches, and the richness and naturalness of its plant and animal communities, in particular the population of Atlantic Salmon *Salmo salar*, which is of international importance.				
Corbylin Wood ASSI	**ASSI 197**	• **Designation by reason of its woodland flora and fauna. Corbylin Wood is an extensive semi-natural woodland. Because of the variety of environmental conditions, there are several distinctive woodland plant communities. As a result, the area is one of the richest for woodland plants in Northern Ireland. There are a number of notable plants and animals.**	***c.* 11.9 km to the north via downstream hydrological connection**	**Hydrological connectivity**	**Potential for pollution and/or sedimentation impacts**	**Water quality impacts**

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Hydrological connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
Owenkillew River ASSI	ASSI 213	• Designated by reason of the physical features I river and its associated riverine flora and fauna, with adjacent woodlands providing additional interest. In comparison to other rivers of its type, the Owenkillew River is notable for the physical diversity and naturalness of the bank and channel, and the plant and animal communities. It is a very important river for rare species and includes the largest known population of the Freshwater Pearl Mussel *Margaritifera margaritifera* in Northern Ireland.	*c.* 5.8 km direct distance	No potential for direct hydrological connection as the nearest tributary of the Owenkillew River SAC is *c.* 1.3km from the Study Area.	None	None
Owenkillew and Glenelly Woods ASSI	ASSI 62	• Designated by reason of the woodland flora and characteristic associated fauna. It represents the second largest intact seminatural deciduous woodland block surviving in the Sperrins and is one of the finest river valley woodlands in Northern Ireland. The wood is notable for the wide diversity in both its structure and in the plant communities occurring, and in its species richness.	*c. 5.8* km direct distance	No direct connectivity via habitat or through hydrological linkages.	None	None
Butterlope Glen ASSI	ASSI 35	• Designated for its geological features which are important for understanding Dalradian stratigraphy, a geological rock	*c.* 6.4 km to the east	No direct connectivity via habitat or through hydrological linkages.	None	None

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Hydrological connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
		series, both within Ireland and between Ireland and Scotland.				
Aghabrack ASSI	ASSI 304	• Designated for the physiographical features of flat outwash plains and hummocky moraine ridge. These features, in combination with the esker ridge alongside a minor tributary of the Bun Dennet, are an excellent example of a deglacial landform assemblage.	*c.* 6.6 km to the east	No direct connectivity via habitat or through hydrological linkages.	None	None
Strabane Glen ASSI	ASSI 58	• Designated by reason of the woodland flora and characteristic associated fauna. The majority of the woodland canopy is composed of a mixture of Ash *Fraxinus excelsior* and Hazel *Corylus avellana*, with Wych Elm *Ulmus glabra* occasionally prominent. • The ground flora exhibits high floristic diversity throughout, the principal components of which are Opposite-leaved Golden Saxifrage *Chrysosplenium oppositifolium*, Ivy *Hedera helix*, Lesser Celandine *Ranunculus ficaria*, ferns, principally Soft Shield-fern *Polystichum setiferum*, and calcicolous bryophytes.	*c*. 7.2 km to the west	No direct connectivity via habitat or through hydrological linkages.	None	None

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Hydrological connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
		• The rarity of this type of woodland in this region along with the geomorphological interest combine to increase the overall scientific value of the site.				
McKean's Moss ASSI	ASSI 128	• Designated by reason of its physiographical features and peatland flora and associated fauna. Biological interest relates to the position of the bog within Northern Ireland, in addition to the diversity of the peatland flora and structural features, and the presence of rare and notable species. The site represents the most north-westerly lowland raised bog in the country, lying within the valley of the River Foyle at an elevation less than 10m O.D. Special features include a moderately well-defined dome, which exhibits hummock and lawn complexes and small pools.	*c.* 8.8 km to the north-west	No direct connectivity via habitat or through hydrological linkages.	None	None
Bonds Glen ASSI	ASSI 227	• Designation by reason of its woodland flora and fauna and other associated habitats. Wet and dry woodland types are present, often occurring in an unbroken transition from wet woodland on the valley floor to dry acid woodland on the upper valley slopes. Calcareous springs and	*c.* 10.8 km to the north-east	No direct connectivity via habitat or through hydrological linkages.	None	None

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Hydrological connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
		flushes are scattered along the slopes, with wet grassland on the valley floor.				
River Faughan and Tributaries ASSI	ASSI 296	• Designated for the physical features of the river and its associated riverine flora and fauna. Includes the River Faughan and its tributaries Burntollet River, Bonds Glen and Glenrandal River / and is tributary of the Inver River) – approx. 60km of watercourse in total. Notable for the physical diversity and naturalness of the banks and channels, and of its plant and animal communities, notably its internationally important Atlantic salmon population.	*c.* 11.7 km to the north-east	No direct connectivity via habitat or through hydrological linkages.	None	None
Grange Wood ASSI	ASSI 196	• Designation by reason of its woodland flora and fauna. Grange Wood has a range of woodland vegetation types, including base-rich woodland communities that are more characteristic of the Carboniferous limestone rocks of County Fermanagh. Due to the diversity of woodland communities the wood has one of the richest plant assemblages in the Sperrins region.	*c.* 11.9 km to the south	No direct connectivity via habitat or through hydrological linkages.	None	None

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Hydrological connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
Mullaghcarn ASSI	ASSI 309	• Designation by reason of its earth science features, and its upland habitat mosaic of peatland, lakes and woodland together with associated flora and fauna. Mullaghcarn ASSI displays important examples of glacial landforms. The landform within the Gortin delta complex is one of the largest and best examples of a proglacial delta landform assemblage in Northern Ireland. The main landform dates from the end of the last glacial period when the Owenkillew Valley was part of an extensive lake formed between the high ground of the Sperrins and an ice sheet blocking the Foyle valley. The lake was fed by water from the melting ice sheets which also fed huge quantities of gravel, sands and clays into the lake.	*c.* 12.8 km to the south-east	No direct connectivity via habitat or through hydrological linkages.	None	None
Baronscourt ASSI	ASSI 349	• Designation by reason of its parkland habitat and associated species. Baronscourt is situated 3kms to the south-west of Newtownstewart. The site is part of the Baronscourt demesne and was laid out as a landscape park from the mid-I8 century. It lies within a valley and is characterised by a landscape of improved and	*c.* 14.4 km to the south	No direct connectivity via habitat or through hydrological linkages.	None	None

Site name	Site code	Summary of qualifying features	Closest distance from Study Area	Hydrological connectivity with Study Area?	Potential sources of impact	Summary of potential impacts
		semi-improved grassland interspersed with open-grown trees, which occur at various densities.				
Drumlea and Mullan Woods ASSI	ASSI 56	• Designation by reason of its woodland flora and characteristic associated fauna. It is one of the largest intact, semi-natural deciduous woodland sites in the Sperrins. Indeed, it represents one of the largest representative examples of a mature calcifugous (acid) Oak wood remaining in Northern Ireland.	*c.* 14.5 km to the south-east	No direct connectivity via habitat or through hydrological linkages.	None	None

3.2.4. Protected Areas / Designated Sites within the Zone of Influence

Protected areas that occur in the ZoI Zone of Influence of the Study Area have been illustrated in Figure A10.1.5. The only S-P-R linkages identified have been via hydrological connection. It is considered that there is no potential for effects upon designated sites not hydrologically connected to the Development.

Therefore, designated sites identified within the Zone of Influence of the Study Area, and which have the potential for hydrological connectivity via source-pathway-receptors as stated in **Table A10.1.9** and **Table A10.1.10** above, have been listed below. These are considered to be the only designated sites which could potentially be at risk from sediment mobilisation during construction:

- River Foyle and Tributaries SAC;
- River Finn SAC;
- River Foyle and Tributaries ASSI;
- Silverbrook Wood ASSI;
- Corbylin Wood ASSI; and,
- Lisnaragh ASSI.

As outlined in **Table A10.1.9** and **Table A10.1.10**, these sites have been designated for species such as otter, lamprey spp., Atlantic salmon, and freshwater pearl mussel amongst other Important Ecological Receptors that are considered to have Very High sensitivity to changes in water quality.

As discussed within **Chapter 8 of the ES: Hydrology and Hydrogeology**, it is considered that designated sites with hydrological connectivity at distances greater than 10 km are not considered to be subject to significant impact from such Development due to attenuation and dilution factors which reduce pollution and sedimentation effects on the water environment to a negligible level.

As the River Foyle and Tributaries SAC lies c. 12.8km downstream of the Study Area, no internationally designated sites have been assessed as holding potential for S-P-R hydrological linkages within 10km of the Study Area.

The two nationally designated sites considered within the Zone of Influence (Silverbrook Wood ASSI and Lisnaragh ASSI), which maintain *c.*3.5 km connection with the Study Area, are designated primarily for their geological and woodland features.

3.3. Desktop study for recorded important and protected species.

A Centre for Environmental Data and Recording (CEDaR) information request[37] was submitted for all species records within a 2km buffer from the Study Area of protected species / 10km buffer for bats and birds (NM–I/IR5274 – CEDaR Information Request). This desk study was supplemented with an NBDC records request. The Study Area is located within the 10km Grid Square H49 (according to the National Biodiversity Data Centre 'Biodiversity Maps')[38]. The ecological records data from this 10km grid square was interrogated for notable or protected species records (including invasive species). A summary of all records is presented in **Table A10.1.11** below, along with an indication of the likelihood of occurrence within the Study Area.

[37] CEDaR Information Request form : Microsoft Word - CEDaR_IRF.doc (nationalmuseumsni.org)
[38] NBDC Biodiversity Maps. Available at: Home - Biodiversity Maps (biodiversityireland.ie)

Table A10.1.11: Notable or protected species with potential to occur within the Study Area, resulting from the desk study review (Source: 10km grid square (H49) NBDC Database for protected species and bats as well as a 2km protected species / 10km bats NM–I/IR5274 – CEDaR Information Request).

Species	Scientific Name	Habitats Dir. (Annex II / IV)	Wildlife Acts (as amended)	Red List Status	Northern Ireland Priority Species	Birds of Conservation Concern in Ireland (2020-2026)	Likelihood on site	Likelihood within 2 km	Most recent record	Record Source
Mammals										
Badger	*Meles meles*	-	Y	LC	-	-	1	1	2012	NBDC, CEDaR 10km
Eurasian Red Squirrel	*Sciurus vulgaris*	-	Y	NT	Y	-	3	1	2014	NBDC, CEDaR 10km
Otter	*Lutra lutra*	Y	Y	NT	Y	-	1	1	2012	NBDC, NPWS, CEDaR 2km
Irish Hare	*Lepus timidus subsp. Hibernicus*	-	Y	LC	Y	-	1	1	1999	NBDC, CEDaR 2km
Bats (within 10km)										
Brown Long-eared Bat	*Plecotus auritus*	Y	Y	LC	Y	-	1	1	2006	NBDC
Common Pipistrelle	*Pipistrellus pipistrellus sensu lato*	Y	Y	LC	Y	-	1	1	2009	NBDC
Daubenton's Bat	*Myotis daubentonii*	Y	Y	LC	Y	-	1	1	2009	NBDC
Soprano Pipistrelle	*Pipistrellus pygmaeus*	Y	Y	LC	Y	-	1	1	2009	NBDC
Invertebrates										
Beetle (Coleoptera)	*Nebrioporus depressus*				-		4	4	1996	NBDC
Small Heath Butterfly	*Coenonympha pamphilus*	-	-	-	Y	-	2	2	2021	NBDC, CEDaR
Large Heath Butterfly	*Coenonympha tullia*	-	-	-	Y	-	2	2	2021	NBDC
Wood White Butterfly	*Leptidea reali*	-	-	-	Y	-	3	3	2008	CEDaR
Double Dart Moth	*Graphiphora augur*				Y		3	3	1993	CEDaR
Shaded Broad-Bar Moth	*Scotopteryx chenopodiata*	-	-	-	Y	-	3	3	1993	CEDaR
White Ermine Moth	*Spilosoma lubricipeda*	-	-	-	Y	-	3	3	1993	CEDaR
Latticed Heath Moth	*Semiothisa clathrata*	-	-	-	Y	-	3	3	2006	CEDaR
Cinnabar Moth	*Tyria jacobaeae*	-	-	-	Y	-	3	3	2007	CEDaR
Buff Ermine Moth	*Spilosoma luteum*	-	-	-	Y	-	3	3	1993	CEDaR
Grey Dagger Moth	*Acronicta psi*	-	-	-	Y	-	3	3	1993	CEDaR
Amphibian										
Smooth newt	*Lissotrton vulgaris*	-	Y	LC	-	-	4	4	2013	NBDC
Common Frog	*Rana temporaria*	-	Y	LC	-	-	1	1	2018	CEDaR
Mollusc										
Common Whorl Snail	*Vertigo pygmaea*	-	-	NT	-	-	4	4	2002	NBDC
English Chrysalis Snail	*Leiostyla anglica*	-	-	V	Y	-	4	4	2002	NBDC

Freshwater Pearl Mussel	*Margaritifera margaritifera*	Y	Y	E	Y	-	4	4	1905	CEDaR
Marsh Whorl Snail	*Vertigo antivertigo*	-	-	V	Y	-	4	4	2002	NBDC
Striated Whorl Snail	*Vertigo substriata*	-	-	NT	-	-	4	4	2002	NBDC
Plants										
Heath Cudweed (FPO)	*Gnaphalium sylvaticum*	-	-	V	Y	-	4	4	1999	NPWS
Small Cudweed	*Filago minima*	-	-	V	-	-	4	4	1999	NBDC
Invasive Species										
American Mink	*Mustela vison*	-	-	-	-	-	1	1	2007	NBDC
Feral Goat	*Capra hirus*	-	-	-	-	-	4	4	1998	NBDC
Eastern Grey Squirrel	*Sciurua carolinensis*	-	-	-	-	-	3	3	2010	NBDC
European Rabbit	*Oryctolagus cuniculus*	-	-	-	-	-	2	2	2005	NBDC
Sika Deer	*Cervus nippon*						4	3	2005	NBDC
Sycamore	*Acer pseudoplatanus*	-	-	-	-	-	1	1	2010	NBDC
Indian Balsam	*Impatiens glandulifera*	-	-	-	-	-	4	3	2010	NBDC
Japanese Knotweed	*Fallopia japonica*	-	-	-	-	-	4	2	2010	NBDC
Rhododendron	*Rhododendron ponticum*	-	-	-	-	-	3	2	2010	NBDC
Cherry Laurel	*Prunus laurocrasus*	-	-	-	-	-	3	2	2010	NBDC
Jenkins' Spire Snail	*Potamopyrgus antipodarum*	-	-	-	-	-	4	4	2002	NBDC

Key to likelihood of species presence: 1 = Confirmed; 2 = Likely; 3 = Possible; 4 = Unlikely
Key to Red List Status: E: Endangered; CR = Critical; NT = Near threatened; VU = Vulnerable; LC = Least Concern

The bat landscapes habitat suitability map (**Plate 3**) showed the Study Area (within H49) to be of 'Low Suitability' for bats (Lundy *et al*, 2011). A data request was submitted to NI Bat Group for known roost records within 10 km of the Development. A total of 121 bat records were provided of which 57 were confirmed bat roosts, ranging in size from one occupant to several hundreds of bats. The nearest recorded bat roost lies just over 3 km away at the Development's closest point to this site and is relevant as bats are capable of foraging several kilometres from their roosts (Lundy *et al,* 2011). This roost is indicated to be small and unoccupied at the time of survey, with the surveyor noting that the roost probably only supports a single bat. A second roost lies 3.3km northeast, an unidentified *Myotis* spp. Is roosting above a garage in a residential dwelling, and a third lies *c.* 4km south, also noted as being an unidentified *Myotis* spp. Roost. All further NI Bat Group records are located ≥4.7km from the Development. The NI Bat Group data provided in **Appendix I** - Bat Surveys Additional Information (reduced grid references only are provided in this report in the interests of bat roost conservation) shows bat data recorded in transect and *ad hoc* surveys, and indicates five specific species have been recorded in the 10km search area from 1985 to 2018, including:

- Common pipistrelle (*Pipistrellus pipistrellus*)
- Soprano pipistrelle (*Pipistrellus pygmaeus*)
- Leisler's bat (*Nyctalus leisleri*)
- Brown long-eared bat *Plecotus auritus*)
- Daubenton's bat *Myotis* d*aubentonii*)

In addition to the above list, there were multiple records of bats identified down to the family rank *Chiroptera,* as well as *Myotis* spp. Not identified further than genus rank, meaning there are potentially more than five species occurring within 10km of the Development. There are no Special Areas of Conservation (SACs), or Special Protection Areas (SPAs) designated for bat species in Northern Ireland, although they are protected under the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995, as amended).

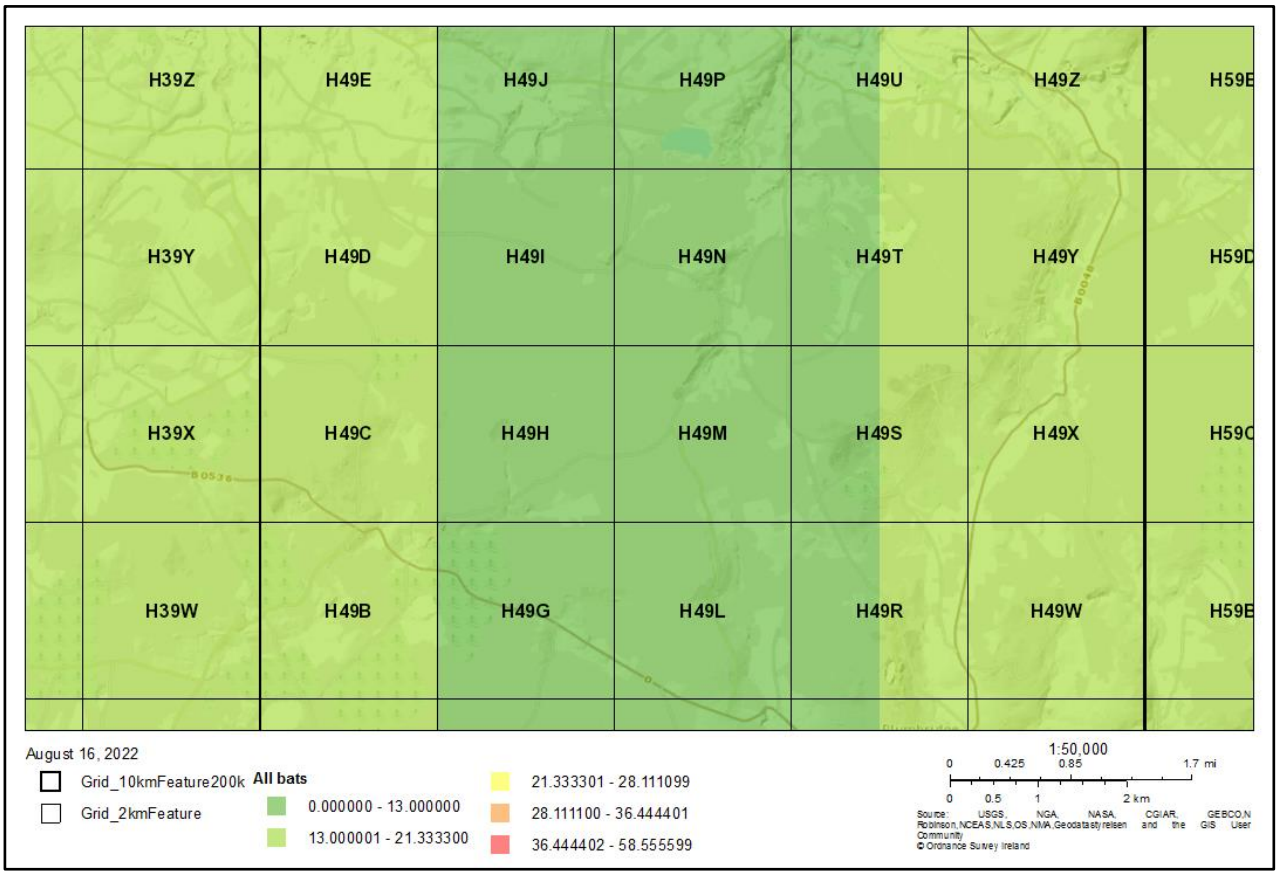


Plate 3: Bat Habitat Suitability Index for H49 10km Grid Square (Lundy *et al*., 2011)

3.4. Aquatic Ecology

3.4.1. Water quality

The Study Area lies predominantly within the River Foyle hydrological catchment, with sub-catchments including, Glenmornan River, Owenreagh Burn and Dunnyboe Burn. The location of the Development in relation to the Hydrological Catchments has been illustrated in **Chapter 8 of the ES – Figure 8.2.** The River Foyle catchment is described on catchments.ie[39] as follows:

"The Foyle catchment includes the area drained by the River Foyle and by all streams entering tidal water between Culmore Point, Co. Derry and Coolkeeragh, Co. Derry. This is a cross border catchment with a surface area of 2,919km², 914km² of which is located within the Republic of Ireland (RoI). The largest urban centres in the catchment are Ballybofey and Stranorlar. The population (in the RoI) is approximately 29,650, with a population density of 32 people per km². The eastern half of the catchment, located in Northern Ireland, drains most of County Tyrone and a small part of north-western County Derry. The part of the catchment located in Donegal is largely mountainous and is underlain by granites and metamorphic rocks of various types that are relatively poor aquifers."

The surface hydrology features and water quality status of each of the tributaries assessed has been outlined in further detail in **Chapter 8 of the ES: Hydrology: Surface Hydrology- Section 8.4.3.** Similarly, a summary of these hydrological features can be seen in **Figure A8.1.1** in **Technical Appendix A8.1 of Chapter 8.**

Results of the water quality surveys have been summarised in **Table A10.1.12** below. Results showed that the biological water quality of the watercourses assessed as part of this study, ranged from unpolluted (Q4) to slightly polluted (Q3-4). While nutrient levels in the two streams analysed (i.e., WQ2, WQ3) were mostly satisfactory[40, 41], BOD_5 levels of 6 and 8 mg/l, indicate that these watercourses have been impacted by organic pollution, at least around the time of sampling (September 2022). See **Figure A10.1.3** for locations of water quality sampling points WQ1-4 and electrofishing surveys.

3.4.2. Atlantic salmon

The River Foyle and Tributaries SAC is a large cross-border designation which has been primarily selected for its populations of Atlantic salmon (*Salmo salar*). Stretches of stream within the Study Area (see **Figure A10.1.3**) that were considered during habitat surveys to be suitable for salmonids (e.g., salmon and brown trout (*Salmo trutta*) were fished using electric fishing equipment in September 2022. Results of these surveys have been presented in **Table A10.1.13** below. However, no species of interest were recorded as part of these surveys.

3.4.3. Freshwater pearl mussel

Freshwater pearl mussel (*Margaritifera margaritifera*) (FWPM) surveys were not commissioned due to the nature of the water features within the Study Area coupled with the lack of direct hydrological connection to extant FWPM records and the distance of the closest records to the Development.

During the glochidia stage FWPM rely on salmonid fish as a host (Bauer and Vogel 1987), and it is considered that any adverse effects on host fish (see 4.3.1.2.1 Atlantic salmon) also further the decline of freshwater pearl mussel populations. Although the lower reaches of several streams elsewhere in the Study Area were classified as suitable for salmonids allowing the precautionary principle, no salmonids were recorded during surveys. Therefore, FWPM has not been considered further within this assessment.

[39] River catchments can be viewed at: https://gis.epa.ie/EPAMaps/Water (Accessed November 2022).
[40] S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009.
[41] S.I. No. 278/2007 - European Communities (Drinking Water) (No. 2) Regulations 2007.

Table A10.1.12: Summary of results from the biological and chemical surveys that were undertaken at the Craignagapple Study Area in July 2021 and September 2022

Water Quality Site	WQ1	WQ2	WQ3	WQ4
Location in relation to the Development / Infrastructure Layout	On site. <200m south-east of T13	On site. <100m north-east of T8	Off site. > 550m west of T1/T2 access track	Onsite. <100m north of T1
River/Stream Name	Legnahone burn	Legnahone burn	Altnamoola burn	Glenawanda burn
ITM Coordinates	644058, 897149	643551, 896710	641001, 897053	641781, 897217
ING Coordinates	H 44111 97139	H 43604 96700	H 41053 97043	H 41833 97207
River/Stream Order	1st Order	1st Order	1st Order	1st Order
River code	GBNI0102302	GBNI0102302	GBNI0102195	GBNI0102196
Q-Value	Q4	Q4	Q4	Q3-4
WFD Class	A	A	A	B
WFD Status	Good	Good	Good	Moderate
Dissolved Oxygen %	65	50	68	29
Dissolved Oxygen (mg/l)	6.12	5.00	6.52	3.14
pH	7.23	7.06	7.12	7.0
Conductivity µs/cm	165	171	233	86
Turbidity NTU	0.9	0.4	1.0	0.7
Temperature °C	17.5	15.6	16.7	11.8
ORP (REDOX) mV	55.7	62.6	75.5	47
Total Suspended Solids (TSS) (mg/l)	-	<2.0	2.0	-
Ammonia (mg/l)	-	<0.05	<0.05	-
Nitrite (mg/l)	-	<0.5	<0.5	-
Nitrate (mg/l)	-	<0.02	<0.02	-
Orthophosphate (mg/l)	-	0.114	0.0293	-
Total Phosphorus (mg/l)	-	0.12	0.03	-
Chloride (mg/l)	-	9.2	12.0	-
BOD (mg/l)	-	6.0	8.0	-
COD (mg/l)	-	8.0	42.0	-
Plate Ref.	1	2	3	4

Table A10.1.13: Summary of results from the salmonid suitability / electrofishing surveys that were undertaken at the Craignagapple Study Area on 21 and 22 July 2021

Survey locations	Area 1	Area 2	Area 3	Area 4	Area 5
River/Stream Name	Glenawanda Burn	Unnamed stream	Unnamed stream	Legnahone burn	Altnamoola Burn
Substrate description	Flush area/wet grassland	Peat substrate	Gravel areas present but not suitable for FPM	Gravels and stones present	Gravels and stones present
Salmonid Suitability	No	No	No	Yes	Yes
FPM Suitability	Sub-optimal for FPM – due to no suitable substrate available such as gravels and stones, flow rates and water depths are sub-optimal for salmon to inhabit and so no potential for FPM to exist without any host fish to transport them there.	Sub-optimal for FPM – due to no suitable substrate available such as gravels and stones, flow rates and water depths are sub-optimal for salmon to inhabit and so no potential for FPM to exist without any host fish to transport them there.	Sub-optimal for FPM – due to no suitable substrate available such as gravels and stones, flow rates and water depths are sub-optimal for salmon to inhabit and so no potential for FPM to exist without any host fish to transport them there.	Sub-optimal for FPM – No presence of salmonids detected during electrofishing therefore no potential for FPM to exist without any host fish to transport them there.	Sub-optimal for FPM – No presence of salmonids detected during electrofishing therefore no potential for FPM to exist without any host fish to transport them there.
ITM Coordinates	642115, 896955 to 641686, 897270	643032, 895600 to 643435, 895938 642966, 895813 to 643231, 896075	643450, 896059 to 643557, 896824 643258, 896114 to 643555, 896820	643564, 896844 to 644034, 897031	641295, 896593 to 640979, 897041 641527, 896864 to 640962, 897052
ING Coordinates	H 42167 96945 to H 41738 97260	H 43085 95590 to H 43488 95928 and H 43019 95803 to H 43284 96065	H 43503 96049 to H 43610 96814 and H 43311 96104 to H 43608 96810	H 43617 96834 to H 44087 97021	H 41347 96583 to H 41031 97031 and H 41579 96854 to H 41014 97042
River/Stream Order	1st Order	1st Order	1st Order	1st Order	1st Order
Plate	5	6	7	8	9

3.5. Habitats within the Ecological Study Area

As described in Section 3.1, the Study Area comprises *c.* 596 ha of land and is situated within a moderate-steeply sloping landscape, rising to a maximum height of 400 m above sea level at the top of Owenreagh Hill.

The habitats are highly mosaic in nature due to the extensive evidence of historical land-use practices throughout the Study Area, however they have been assessed as originally derived from blanket bog habitat, as would be expected given the climate, topography and altitude.

Upland blanket bog occurs on flat or gently sloping ground above 150 m (a loosely applied limit) and is widespread on hills and mountains throughout Ireland. Peat depths are frequently > 50 cm, usually between 1-2 m (or deeper in pockets). Vegetation is typically dominated by *Tricophorum germanicum*, *Eriophorum* spp., *Calluna vulgaris*, *Erica tetralix* and *Vaccinium myrtillus*. *Molinia caerulea* and *Empetrum nigrum* are often frequent. *Sphagnum* cover is usually high in areas of undamaged blanket bog. Different *Sphagnum* species are indicative of different habitat conditions. *Sphagnum* are Locally abundant in areas assessed as Recovering and as Intact Blanket Bog. Due to the mosaic nature of the habitats , localised pockets of abundant *Sphagnum* associated with active peat can still be found throughout the ESA, this required careful assessment as to whether they represented a wider unit of active peat or were indeed just a localised pocket in a wider unit that had been so severely damaged it no longer retained active peat potential (See Technical **Appendix A10.4 Active Peat Assessment** in the ES).

The Study Area has been extensively cut over for peat, and many exposed hags and cuttings can be seen in the landscape. In addition, many drains run throughout the area and there are a number of historic access tracks cut deep into the substate, which are now acting as large drains. These have frequently been colonised by a luxuriant growth of flat-topped bog-moss (*Sphagnum fallax*), common haircap-moss (*Polytrichum commune*) and rushes (*Juncus* spp.) indicating movement of water and nutrients.

The peat underlying the Study Area tends to exceed 0.5 metres in depth and is much deeper in many areas. The exception to this is the western part of the survey area (the proposed locations for Turbines 1 and 2) where the peat, where present, is shallower and the vegetation tends towards improved or semi-improved grassland habitats with some flush.

Botanical and vegetation surveys of the Study Area indicated that the peatland habitat was in poor condition throughout with numerous drainage ditches and severely affected hydrology throughout much of the area.

Sheep and small numbers of cattle are currently grazed within the improved fields, mainly to the west and north of the Study Area, however evidence suggests that the Study Area has been overgrazed and burnt in the past, which has continued in localised areas until recently.

It is likely that the degraded peatland vegetation communities present are derived from M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire. Where the hydrology has become compromised, the vegetation is considered to correspond to the M19b *Empetrum nigrum* ssp. *Nigrum* sub-community (where *Calluna vulgaris* is the dominant species). Where the vegetation appears to be transitional to acid grassland, this has been classified as a mosaic between this community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. Sub-community. M20 mire communities can develop from M19 blanket mire as a result of drainage, intensive grazing and burning.

Much of the vegetation in the area now appears transitional between blanket bog and acid grassland, with ling heather (*Calluna vulgaris*), hare's-tail cottongrass (*Eriophorum vaginatum*), wavy hair-grass (*Deschampsia flexuosa*) and bilberry (*Vaccinium myrtillus*) tending to dominate the vegetation. Hypnoid mosses are generally abundant throughout, while bog mosses (*Sphagnum* spp.) are present in many areas but are patchy in their distribution. Pockets of relatively intact blanket bog still occur in localised areas where the hydrology has not been too compromised. Areas of species-poor flush, likely to result from water movement arising from the damaged hydrology, intersect the areas of modified bog.

Linear features including treelines and hedgerows were very limited across the Study Area due to the exposed nature of the landscape.

JNCC Habitats identified within the Study Area have been listed in **Table A10.1.14** and illustrated in **Figure A10.1.17** with NVC habitat equivalents illustrated in **Figure A10.1.18.**

Table A10.1.14: Habitat types occurring within the Ecological Study Area (JNCC, 2010) * Denotes a mosaic habitat

JNCC Habitat Code	JNCC Habitat Name	NVC Habitat Code	NVC title	Area within Study Area (ha)
E1.6.1	Intact Blanket Bog	M19	M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire	22.467
E1.6.1 – modified in past	Recovering Blanket Bog	M19	M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire	188.119
E1.8	Dry Modified Bog	M19b / M20b *	M19b *Empetrum nigrum* ssp. Nigrum sub-community (where *Calluna vulgaris* is the dominant species) / M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. Sub-community	208.479
E1.7 – very degraded example	Wet Modified Bog	M20a	M20a *Eriophorum vaginatum* blanket and raised mire, species poor sub-community.	19.356
B1.2 / E2.1*	Acid Grassland / Flush	U2b / M6c *	Mosaic of M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* subcommunity and U2b *Deschampsia flexuosa* grassland, *Vaccinium myrtillus* sub-community.	88.445
B4 / B2.2*	Improved / poor semi-improved Grassland	MG10	MG10 *Holcus lanatus – Juncus effusus* rush pasture grassland – now heavily grazed.	24.763
E2.1	Flush & Spring – species-poor acid/neutral flush	M6c	M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* subcommunity	34.398
J2.6 / E2.1*	Dry Ditch / Flush & Spring – species-poor acid/neutral flush	-	-	4.580
A.1.2.2	Planted coniferous woodland	-	-	0.482
J2.2 / A2.2*	Hedges and Scrub	-	-	5.702

3.5.1. Haul Route

The haul route comprises an existing road network and adjacent associated habitats. The areas potentially affected by works along the haul routes to facilitate turbine delivery access, in terms of temporary road widening and creation of turning areas, comprise a mosaic of B2.2 ‘Poor semi-improved grassland’ and B4 ‘Improved Agricultural Grassland’. Some vegetation clearance works, such as tree trimming, tree removal, hedgerow removal (and replacement of like for like vegetation) is likely to be required in habitats comprising

J2.3 ‘Hedgerow with trees’. Locations of likely clearance works to facilitate temporary construction works required within both these Haul Route Options are illustrated in **Technical Appendix A2.3: Abnormal Load Route Works (ALRW).**

Some hedgerows that would be considered as part of the Haul Route contain a small number of larger single trees such as semi-mature Sycamore and Ash. The hedgerows along the route are dominated by hawthorn.

3.5.2. Intact Blanket Bog (E1.6.1)

Two units of Active Blanket Bog habitat (E1.6.1) totalling 22.467 ha have been classified as ‘intact’ following the combined results of **Chapter 8 – Hydrology and Hydrogeology** and **Technical Appendix A10.4 – Active Peat Assessment.** These areas contain ‘active’ peat and the typical range of blanket bog species which are capable of peat formation coupled with an intact hydrological unit. ‘Active’ is defined as supporting a significant area of vegetation that is normally peat-forming. Typical species include the important peat-forming species, such as bog-mosses (*Sphagnum* spp.) and cotton grasses (*Eriophorum* spp.), or purple moor-grass (*Molinia caerulea*) in certain circumstances, together with ling heather (*Calluna vulgaris*) and other ericaceous species (**Plate 4**). The peat depth within these areas exceeds 0.5 m and the substrate remains wet and spongy underfoot. Thus, these areas have been classed as intact despite the extensive erosion and modification evident throughout the Study Area.

Therefore, this habitat is considered to correspond to that of Annex I habitat quality and is therefore considered to be of ***National (Higher)*** importance for the purposes of this assessment.

Plate 4: Intact Blanket Bog Habitat which corresponds to Annex 1 quality.

3.5.3. Recovering / Modified Blanket Bog (E1.6.1 – modified in the past)

Several units of ‘Recovering Blanket Bog’ totalling *c.* 188.119 ha were identified across the Study Area (**Plate 5**). These mosaic habitat units retain a significant proportion of the typical range of blanket bog species identified within pockets of ‘active’ peat throughout and are thus overall considered as Active Blanket Bog units. This habitat type would similarly be considered an NI Priority habitat. The hydrology throughout these areas remains complex and has evidently been severely affected by historical land drainage and turf cutting. However, many of the smaller drains within these units were noted to be naturally revegetating and infilling with *Sphagnum* mosses with the ground remaining spongy underfoot. It was considered that these units retained the highest potential to naturally ‘recover’, and that appropriate management may improve the peat forming potential of these areas.

Although modified, this habitat is considered to retain the potential for recovery and restoration to that of Annex 1 quality, through means of natural regeneration, and has thus been considered as a feature of ***District (Higher)*** importance for the purposes of this assessment.

Plate 5: Recovering / Modified Blanket Bog – evidence of historic turf cutting / draining.

3.5.4.Dry Modified Bog (E1.8)

The majority of the peatland habitat totalling *c*. 208.479 ha within the Study Area has been classified as 'Dry Modified Bog' (E1.8).

This habitat is derived from blanket bog; however, it has been subject to extensive modification as a result of past cutting, drainage, grazing and/or burning (**Plate 6**). The ground within these areas is very uneven, criss-crossed by hags and dry drainage ditches that are overgrown by tall, leggy heathers (*Calluna vulgaris*). The vegetation is generally drier underfoot and although the bryophyte cover is relatively high, this is composed mainly of hypnoid species with very little *Sphagnum* spp. Present.

The hydrology within these units has been severely affected by the historic modification and it is considered that these areas no longer support 'active' peat potential. Despite the damaged state of this peatland habitat, it is still included as an NI Priority habitat.

For the purposes of this assessment this habitat is considered as a feature of ***Local (Higher)*** importance.

Plate 6: Dry Modified Bog

Illustrating Leggy heather with hypnoid moss understory and minimal/absence of Sphagnum mosses.

3.5.5. Wet Modified Bog (E1.7)

An area *c.*19.396 ha of 'wet modified bog' habitat was identified towards the southeast corner of the Study Area (**Plate 7**). The effects of drainage and turf cutting are evident throughout this area. The majority of the peat here remains bare, dry or covered with an algal mat. Large swathes of common cotton grass (*Eriophorum angustifolium)* dominate the vegetation cover, this single-species dominance is often seen in severely degraded peatland habitats where (*E.angustifolium)* is often a pioneering species on areas of bare peat.. This habitat is criss-crossed by a herringbone style drainage system, and it is evident that the hydrology has been severely affected.

Due to significant deep drainage here, it is considered that this area no longer supports the potential for 'active peat' and thus for the purposes of this assessment this habitat has been defined as a feature of ***Local (Higher)*** significance. Due to the peatland nature of this habitat, and as a derivative of blanket bog, this area is still recognised as an NI Priority habitat.

Plate 7: Wet Modified Bog

3.5.6. Flush and spring – species poor acid/neutral flush (E2.1)

Several areas totalling *c*. 34.398 ha have been identified as supporting a species poor example of an acid/neutral flush habitat (**Plate 8** and **Plate 9**). The substrate at these locations is very wet, typically with a floating mat of vegetation. Soft-rush (*Juncus effusus*) is often dominant with a layer of flat-topped bog-moss (*Sphagnum fallax*) and common haircap moss (*Polytrichum commune*) beneath. The peatland either side of the flush habitat is often hagged and dry with leggy heather and hypnoid mosses. This habitat occurs in steeper sloped areas where it is evident that water is moving downslope. Owing to the species-poor example of this habitat, for the purposes of this assessment this habitat has been categorised as a feature of ***Local (Higher)*** significance. When designing the site, consideration has been given to the potential for flush habitat to feed into peatland downslope within the Arcus Hydrology reporting and the **ES Chapter 8 – Hydrology and Hydrogeology**.

Plate 8: Species-poor flush typical across the Study Area

Plate 9: Species-poor rush-dominated flush

3.5.7. Acid grassland / flush (B1.2/E2.1)

On level to moderately sloped locations the flushed habitat transitions into an acid grassland mosaic covering a total area *c.* 88.445 ha (**Plate 10** and **Plate 11**). The vegetation at these locations is often dominated by soft rush (*Juncus effusus*) or sharp-flowered rush (*Juncus acutiflorus*), wavy hair-grass (*Deschampsia flexuosa*) and some hare's-tail cottongrass (*Eriophorum vaginatum*) with a layer of hypnoid mosses (e.g., little shaggy-moss *Rhytidiadelphus loreus* and glittering wood-moss *Hylocomiun splendens*) and some flat-topped bog-moss (*Sphagnum fallax*). Heath bedstraw (*Galium saxatile*) was typically abundant with occasional sprigs of bilberry (*Vaccinium myrtillus*) or heather as this habitat transitioned towards dry modified bog.

Evidence of sheep grazing was frequently noted throughout these areas (dung and trails). Owing to the species-poor example of this habitat, for the purposes of this assessment this habitat has been categorized as a feature of ***Local (Lower)*** significance.

Plate 10: Acid grassland with elements of poor-flush

Plate 11: Acid grassland transitions on gentler slopes

3.5.8. Improved agricultural grassland / poor semi-improved grassland mosaic (B4 / B2.2)

Improved agricultural grassland (B4) and poor semi-improved grassland (B2.2) totalling *c.* 24.763 ha was recorded predominantly in the western section of the Study Area (**Plate 12**) and within vicinity of T1, T7 and T13. Much of these areas have been reseeded with perennial ryegrass (*Lolium perenne*) and are used for livestock grazing. More established leys are also dominated by perennial ryegrass (*Lolium perenne*) but contain other grass species such as sweet vernal-grass (*Anthoxanthum odoratum)* and Yorkshire fog (*Holcus lanatus*) with scattered white clover (*Trifolium repens*). In all cases fertiliser is applied regularly and re-seeding takes place every few years. As a result, species diversity is poor and ecological value of such areas is very limited. This habitat type is considered to be a feature of ***Local (lower)*** ecological importance and therefore it is not considered to be an Important ecological feature for the purposes of this impact assessment.

Plate 12: Improved / Semi-improved Grassland within the Study Area

3.5.9. Dry ditch / poor flush (J2.6 / E2.1)

Numerous dry ditches, drains and uneven terrain criss-crosses the Study Area totalling an estimated *c.* 4.580 ha (**Plate 13**). Dry ditches are often revegetated by grasses and can be difficult to see. Elements of species-poor flush were noted upon occasion within these ditches and drains, where water movement was possible due to the sloped ground. This habitat type is considered to be a feature of ***Local (lower)*** ecological importance and therefore it is not considered to be an Important ecological feature for the purposes of this impact assessment. Impact assessment in relation to **hydrology is dealt within in Chapter 9 of the ES,** and peatland restoration through drain blocking and other techniques has been recommended within the draft HMEP.

Plate 13: Example of a large dry ditch, common across the Study Area

3.5.10. Coniferous forestry plantation (A2.2)

Coniferous forestry plantations are limited within the Study Area to a small strip *c.* 0.5ha just east of the proposed T8. However, extensive areas of coniferous plantation lie within close proximity to the Study Area, the closest of which is a large, mature plantation *c.* 50ha immediately adjacent to the south-west corner of the Study Area (**Plate 14**). These plantations were notably devoid of biodiversity and considered to be species poor monoculture habitats (however their potential to support red squirrel has been assessed within this report). This habitat type is considered to be a feature of ***Local (lower)*** ecological importance and therefore it is not considered to be an Important Ecological Receptor for the purposes of this impact assessment.

Plate 14: Mature uniform coniferous plantation adjacent to the Study Area, with lack of biodiversity clearly visible

3.5.11. Boundary features – hedgerows, scrub, treelines and earth banks

A number of the field boundaries constitute 'species-poor hedgerows with trees' (J2.3.2) composed of low earth banks planted with hawthorn (*Crataegus monogyna*). These were recorded within the Study Area and are generally restricted to the north-eastern section. They are concentrated most notably in the vicinity of a derelict farmstead *c.*100 m south of the proposed turbine T13 (**Plate 15**). Previously planted mature trees at this farmstead include horse chestnut (*Aesculus hippocastanum*), beech (*Fagus sylvatica*) holly (*Ilex aquifolium*) and sycamore (*Acer pseudoplatanus*). Occasional isolated scrubby outcrops (A2.2) of willow (*Salix* spp.) or gorse (*Ulex europaeus*) were similarly noted along some fence lines and boundaries within the Study Area. Patches of willow (*Salix* spp.), gorse (*Ulex europaeus*) and rowan (*Sorbus acuparia*) were noted as a gappy, naturally regenerating, riparian buffer in the vicinity of the proposed T13.

Treelines and Hedgerows were very limited across the Study Area due to the exposed nature of the landscape.

Hedgerows are listed as an NI Priority Habitat (JNCC, 2016; DAERA, 2017). Such boundary features are not necessarily species-rich; however, they can provide food and shelter for a range of birds, small mammals and invertebrates, and also provide foraging habitat for bats which feed on the flying insects associated with such features. These linear features contribute towards a network of habitats along which animals can safely move to other areas of feeding or sheltering habitat.

Overall, the limited vegetated boundary features within the Study Area represents a feature of ***Local Importance (Higher value)***.

Plate 15: Species poor, mature hawthorn hedgerow near the proposed T13

3.5.12. Watercourses

The watercourses identified within the Study Area as described in **Section 3.4. Aquatic Ecology**, do not support protected aquatic species as shown by the results of the electrofishing surveys of the streams with potential salmon suitability, however it is considered that the aforementioned watercourses have hydrological connectivity to important downstream watercourse features which support known populations of salmon and other protected aquatic species, therefore, watercourses within the Study Area are considered to be features of ***Local Importance (Higher value)***.

Habitats are illustrated in **Figure A10.1.7: JNCC Habitats within the Study Area** and **Figure A10.1.8: Equivalent NVC Habitat Classification.**

3.6. Survey Results for Non-avian fauna

Information is provided below for species of conservation interest and / or protected species that were recorded within the Ecological Study Area. As described in **Section 2.2**, terrestrial mammal surveys were undertaken within the Study Area over the course of several site visits (with incidental recording at other times).

3.6.1.Bats

3.6.1.1. Bat Habitat and Roost Suitability Assessment

Based on Lundy *et al.*, (2011) habitat suitability index, the overall suitability within the H49 10km grid square, in which the wind farm site is located, has been scored as holding low suitability for all bat species combined (see **Section 3.3. Plate 3**). For individual species, the area was ranked as being of high suitability for common pipistrelle, soprano pipistrelle and natterer's bat, moderate suitability for Leisler's bat, and of low suitability for the remaining bat species.

The Study Area comprises very exposed habitat with little in the way of 'expected' bat foraging features (such as treelines or hedgerows), with the exception of forestry plantation encroaching on the south-eastern boundary and a small conifer plantation in the east of the Study Area. However, the habitat (including bog and heath peatland habitats) is likely to provide suitable feeding opportunities for bats when weather conditions are relatively favourable, i.e., during low wind, warm, dry weather. The slightly lower altitude areas around the Study Area hold commercial forestry areas, the edges of which will provide suitable foraging areas, both providing prey and protection from adverse weather conditions (both for prey and feeding bats). A full description of all habitats can be found in **Section 3.5**.

Study Area and a habitat map highlighting areas of bat habitat suitability within the Study Area has been illustrated in **Figure A10.1.19**.

Table 3.1 similarly provides a further summary of bat habitat and roost suitability within the Study Area.

Preliminary surveys of potential roost features conducted in April, August and November 2019, identified four structures of moderate or higher potential roost within the Study Area. These were inspected under license from NIEA (License no: BDL/104/19) using an endoscope and thermal imaging camera. The locations of buildings inspected in 2019 are presented in **Appendix 11.1.3 – Bat Survey Report 2018 – 2019**.

Buildings were inspected for roosting bats under NIEA License No. BDL/104/19, Licensee No. 2423.

Buildings with the potential to be impacted by the proposal changed in 2021 upon the re-design of the Site Boundary, and only one building remains within the Zone of Influence of any proposed turbines, namely, Building 1, located at H 43 96.

As described in **Section 2.3.3**, a Leisler's bat tree roost was also identified during the surveys undertaken at Ruin 1 to the west of the Study Area on 27 August 2021 (Confidential **Figure A10.1.8**). A follow-up roost survey was conducted on this tree, specifically, upon the discovery of the roost.

Along the Haul Route (see **Section 3.8**), trees were provisionally assessed for their suitability to support Potential Roost Features for bats. Further details on this are provided in **Appendix IV**. Overall the standard trees within hedgerows along the Haul Route comprised Low – Moderate PRFs within ash and sycamore trees.

Table A10.1.4: Summary of bat habitat and roost suitability

Turbine No.	Habitat in which proposed turbine is located	Roost potential within *c.* 300m of turbines of moderate or higher suitability OR linear features with commuting / foraging potential within *c.* 100m of turbines
T1	Modified Bog / Acid Grassland / Cutover Flush (E1.7/ B1.2 / E2.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T2	Blanket Bog / Acid Grassland Mosaic (E1.7/B1.1) and Modified Bog / Acid Grassland / Cutover Flush (E1.7/ B1.2 / E2.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T3	Blanket Bog / Acid Grassland Mosaic (E1.7/B1.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T4	Modified Bog / Acid Grassland / Cutover Flush (E1.7/ B1.2 / E2.1) and Flush and spring - acid/neutral flush (E2.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T5	Blanket Bog / Acid Grassland Mosaic (E1.7/B1.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T6	Modified Bog / Acid Grassland / Cutover Flush (E1.7/ B1.2 / E2.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T7	Improved grassland (B4) and Flush and spring - acid/neutral flush (E2.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T8	Modified Bog / Acid Grassland / Cutover Flush (E1.7/ B1.2 / E2.1) and Blanket Bog / Acid Grassland Mosaic (E1.7/B1.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T9	Modified Bog / Acid Grassland / Cutover Flush (E1.7/ B1.2 / E2.1) and Flush and spring - acid/neutral flush (E2.1)	Existing path at this location is cut into bog habitat. The raised verges either side of the path may provide a suitable linear feature for bats, in an otherwise open area. No suitable roost features within *c.* 300m.
T10	Wet Modified Bog (E1.7)	No suitable roost features within 300m and no linear features within *c.* 100m.
T11	Flush and spring - acid/neutral flush (E2.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T12	Recovering Blanket Bog (E1.6.1)-Modified in past, Blanket Bog / Acid Grassland Mosaic (E1.7/B1.1) and Flush and spring - acid/neutral flush (E2.1)	No suitable roost features within 300m and no linear features within *c.* 100m.
T13	Improved grassland (B4) and Modified Bog / Acid Grassland / Cutover Flush (E1.7/ B1.2 / E2.1)	Located < 150 m of known common / soprano pipistrelle roost. Precise bat roost locations are confidential, but available on request. Turbine base is located < 50m of treeline suitable for commuting / foraging bats.

T14	Modified Bog / Acid Grassland / Cutover Flush (E1.7/ B1.2 / E2.1) and Dry ditch (J.2.6) / Flush and spring - acid/neutral flush (E2.1)	No suitable roost features within 300m and no linear features within *c.* 100m.

The majority of habitat found within the Study Area is open, comprising bog, grassland and flush and spring. There are few linear features, those present comprise species-poor hedgerows, treelines, scrub, and coniferous woodland, and few features with roosting potential. Suitability for foraging and commuting bats is generally confined to the edges of coniferous plantations outside the Ecological Study Area and to the minimal linear habitats available in the vicinity, including one or two copses of broadleaved trees around old farmsteads.

3.6.1.1.1. Emergence and Re-Entry Surveys

Throughout the duration of the survey seasons, emergence and re-entry surveys were conducted at sites deemed to hold potential for roosting bats. These are separated by year (2021 and 2022) and detailed further below. Roost surveys were not conducted in 2018, while results relating to 2019 are presented in **Appendix 11.1.3 – Bat Report 2018-2019.** The survey effort for 2021 emergence / re-entry bat roost surveys is summarised below and discussed in further detail in the subsequent paragraphs. Three locations were surveyed and for ease are referred to as Building 1, Ruin 1 and Leisler's bat tree roost.

3.6.1.1.1.1. Survey Year 2021: Roost Survey Results

Building 1 Emergence Survey – 16 June 2021

An emergence survey was conducted on the 16-Jun-2021 at an abandoned house (Building 1) in the Eastern section of the Study Area. The survey is described in further detail below.

Date: **16 June 2021** ***Sunset:*** **22:40** ***Start:*** **21:55** ***End:*** **23:40**

Surveyor 1: Two soprano pipistrelles were the first bats recorded at 22:30 and 20:31, emerging from the house, (these bats were also noted by Surveyor 2). Between 22:34 and 23:23 two common pipistrelles and between one and two soprano pipistrelles were recorded foraging over the farmyard. At 23:14, a faint Leisler's bat call was recorded on the detector but not observed.

Surveyor 2: Social calls were recorded suspected to be coming from within the house at 22:27, however no bats were seen. At 22:29, another Soprano pipistrelle was seen emerging from the top left window of the house. At 22:30, a Soprano pipistrelle was foraging and re-entered the shed attached to the house. At 22:30, a Soprano pipistrelle was seen emerging from the centre window. At 22:31, another Soprano pipistrelle was seen emerging from the house. It was difficult to discern if it emerged from the centre window directly above the door or the door itself. A common pipistrelle was foraging back and forth over the farmyard at 22:31. Another pipistrelle was recorded flying in and out of the shed at 22:33. The common pipistrelle was foraging continuously and going between two sheds. At 22:46, the common pipistrelle was noted swooping to the ground in front of the house. A second common pipistrelle arrived above the farmyard at 22:34. Common and soprano pipistrelles were foraging until 23:25. A Leisler's bat was heard at 23:07 and 23:16, however it was not seen. A Brown long-eared bat was also recorded but not observed at 23:24.

- Confirmed soprano pipistrelle roost in Building 1

Ruins 1 Emergence Survey - 20 July 2021

An emergence survey was conducted in the western section of the Study Area with surveyors either side of Ruin 1, which comprised two small ruins surrounded by treelines. The surveys are described in further detail below.

Date: **20 July 2021** ***Sunset:*** **21:51** ***Start:*** **21:35** ***End:*** **23:12**

The first bat recorded was a soprano pipistrelle at 22:25, however it was a very faint call indicating it was further away from the surveyor. A common pipistrelle was seen commuting from North to South down the track at 22:32. At 22:33, a common pipistrelle was seen foraging between the ruins and then began commuting towards the South. A Leisler's bat was heard but not seen at 22:34. At 22:37, a Soprano

pipistrelle was seen commuting from South to North. A single Leisler's bat was recorded but not observed. Between 22:35 and 23:17 at any given time between 1 and 3 common pipistrelles were recorded foraging constantly in the trees surrounding the ruin. A Soprano pipistrelle was also seen foraging at 22:57.

- No confirmed roost in Ruins 1 to west of site

Building 1 Re-entry Survey – 21 July 2021

Date: **21 July 2021** ***Sunrise:*** **05:20** ***Start:*** **03:40** ***End:*** **05:35**

A Re-entry survey was conducted in the Eastern section of the Study Area at Building 1 and associated lambing shed.

The first bat recorded was a common pipistrelle at 03:39, however it was only heard and was not seen. At 03:50, the surveyor noted there was still one common pipistrelle foraging between 15-20m in height above their head. This pipistrelle was then foraging low at 04:01. A soprano pipistrelle was also noted foraging at 04:01. At 04:07, a Leisler's bat was heard but not seen. Common pipistrelles were recorded foraging above the farmyard at 04:23 and 04:32., along with a foraging Soprano pipistrelle at 04:24. A Common pipistrelle was seen entering and re-emerging from the lambing shed at 04:27. At 04:33 and 04:40, a common pipistrelle was again seen entering and re-emerging from the shed attached to the house. At 04:41, a common pipistrelle was seen entering the lambing shed, however this time it did not re-emerge. A Leisler's bat was heard but not seen at 04:43. A *Myotis* species was seen fleetingly above the farmyard flying towards the shed behind the surveyor and opposite the house. A bat was seen at 04:51 re-entering this shed through a doorframe crack. At 05:05, a common pipistrelle was seen re-entering into a crevice between the roof and wall which connects the centre and right window. Finally, around 05:30. one *Myotis* sp. was observed entering a small crack between the stonework of the shed near Building 1.

- Confirmed common pipistrelle roost in Building 1 and attached shed.
- Confirmed common pipistrelle roost in shed opposite Building 1 (behind surveyor).

Building 1 / Ruins 1 Emergence / Re-entry Survey - 26 August 2021

Emergence and re-entry surveys were conducted in the western and eastern sections of the Study Area simultaneously. Four surveyors were on site for these surveys. Surveyors 1 and 2 covered treelines in the Western section of the Study Area near Ruins 1, while Surveyors 3 and 4 covered treelines in the Eastern section near Building 1. The surveys are described in further detail below.

Date: **26 August 2021** ***Sunset:*** **20:36** ***Start:*** **20:21** ***End:*** **22:53**

Surveyor 1: This treeline near Ruins 1 was made up of mature trees including a beech tree and an ash tree. The first bat recorded was a Leisler's bat at 20:45. The call was faint meaning the bat was likely very far away. Between 20:46 and 21:42, there were passes of Leisler's bats, a common pipistrelle and soprano pipistrelles which were all heard but not seen. At 21:39, there was a brown long-eared bat which was heard but not seen. At 21:42, there were 2 passes of a Leisler's bat. common pipistrelles were heard again at 22:01 and 22:05, both which were heard but not seen.

Surveyor 2: A Leisler's bat was the first bat recorded at 20:45. Leisler's bats were recorded between 20:45 and 20:57. A Brown long-eared bat was heard at 21:21 and 21:29. Another commuting brown long-eared was heard again at 21:42. A Leisler's bat was heard again at 21:41 commuting and 21:56.

Date: **26 August 2021** ***Sunset:*** **20:36** ***Start:*** **20:21** ***End:*** **22:06**

Surveyor 3: The surveyor was facing the treeline south of Building 1. It was noted the detector could not be used due to a technical issue. At 21:17, a bat was seen through the treeline likely to be foraging. The surveyor noted there was no activity or emergences seen at the treeline.

Surveyor 4: The surveyor noted no emergences during the survey. The first bat recorded was a soprano pipistrelle at 21:10 which was commuting. At 21:15, there were three soprano pipistrelles flying together. A Leisler's bat was recorded commuting at 21:40. A common pipistrelle was seen at 22:04 commuting.

Date: **27 August 2021** ***Sunrise:*** **06:27** ***Start:*** **04:57** ***End:*** **06:42**

Surveyor 1: A re-entry survey was conducted on the treelines surrounding Ruins 1. The first bat recorded was a common pipistrelle which was heard but not seen. It was passing continuously for one minute. Between 05:05 and 05:13, multiple common pipistrelles, soprano pipistrelles and Leisler's bats were recorded foraging, however their numbers and positions were difficult to ascertain as it was noted there was a substantial fog in the air. The surveyor noted a breeze picking up slightly at 05:22, giving better visibility. A common pipistrelle was heard feeding at 5:24, but not seen. Visibility was reduced again at 05:28. At 05:33, a Common pipistrelle was seen flying high by an ash tree and stream over the badger sett. At 05:37 and 05:40, Leisler's bats were heard but not seen. Visibility improved again due to light breeze and the surveyor noted that the fog lifted at 05:50. A 05:02, a Leisler's bat entering a tree approx. 6m tall. At 06:11, two more Leisler's bats were seen entering the roost through the same crack. The survey ended at 06:45.

Surveyor 2: A re-entry survey was conducted at the western section of the Study Area on a mature treeline near Building 1. No bats were recorded re-entering any potential roosting features. The first bat recorded was a common pipistrelle at 04:50. Between 05:00 and 05:28 a common pipistrelle, a soprano pipistrelle and a Leisler's bat were recorded foraging. At 05:47, a Soprano pipistrelle was recorded flying from South to the Northwest and back again while feeding. A Leisler's bat was recorded again at 06:02.

***Date:* 27 August 2021 *Sunset:* 06:27 *Start:* 04:57 *End:* 06:42**

Surveyor 3: There were no re-entries recorded during this survey. The surveyor noted there was a lot of activity from common pipistrelles along the track up to Building 1. They suggested that the track could be used to commute from the building. At 05:47, a faint Leisler's bat call was heard commuting but was not seen. A faint Leisler's bat call was heard again at 05:53 commuting and was only heard but not seen.

Surveyor 4: There were no re-entries during this survey. The surveyor was observing mature trees to the Southeast of the farmhouse. A brown long-eared bat was recorded commuting at 05:18. Leisler's bats were seen between 05:34 and 05:57 commuting.

- Confirmed Leisler's bat roost in ash tree with butt rot.
- No emergences or re-entries observed at Building 1.

Leisler Tree Roost Emergence Survey - 14 September 2021

***Date:* 14 September 2021 *Sunset:* 21:51 *Start:* 21:35 *End:* 23:12**

Repeat surveys were conducted at the western section of the Study Area after the discovery of a Leisler's tree roost during surveys of the adjacent treeline in August 2021. There were no emergences observed during this survey. Species recorded commuting / foraging within the vicinity of surveyors included Leisler's bat, common pipistrelle and soprano pipistrelle. The last pass recorded was at 22:01, when a common pipistrelle passed through the area; following this no more bats were recorded for the duration of the survey.

- **No confirmed roost**

3.6.1.1.1.2. Survey Year 2022: Roost Survey Results

Table A10.1. 15: Summary of roost emergence survey effort (2022)

Survey No.	Structure	Location	Date	Sunset / Sunrise	Start	End
1	Building 1	H 4392 9693	14/07/2022	21:43	21:28	22:30
2	Leisler's bat tree roost	H 4133 9665	14/07/2022	21:43	21:28	22:30

Emergence – 14 July 2022

Two emergence surveys were conducted simultaneously at the abandoned buildings on the eastern side of the Study Area at Building 1 and the Leisler's bat tree roost in the west of the Study Area near Ruins 1.

***Date:* 14 July 2022 *Sunset:* 21:43 *Start:* 21:28 *End:* 22:30**

Survey 1: 6 common pipistrelle emergences were observed by surveyors watching Building 1, while a single Leisler's bat emergence was observed from the nearby small stone shed (behind surveyor). No further emergences were observed, but a small number of soprano pipistrelles remained foraging in the nearby area.

Survey 2: Little to no activity was observed on this survey at the Leisler's bat tree roost. A small number of soprano pipistrelles were recorded foraging in the wider area around 22:10, and no emergences were observed. This suggested to the surveyors that the tree roost may be a transitional night roost.

3.6.1.1.1.3. Winter Roost Inspection Surveys

Structures within the Study Area or within the Zone of Influence of the Development were assessed for their ability to support hibernating bats.

Buildings within the Zone of Influence were visited on 4 November 2019 to assess their suitability to support hibernating bats. It was considered that Building 1 has the potential to support a small number of bats during winter (likely Low to Moderate potential for Pipistrelle species) – however no definitive evidence of this was confirmed during the survey.

3.6.1.1.2. Transect Surveys

The results of the transect surveys are split by survey year, covering 2021 and 2022 and are discussed in further detail in the following Sections. Transect survey results for 2018 and 2019 are presented in **Appendix 11.1.3 – Bat Report 2018-2019.** All transect surveys were conducted in appropriate weather conditions, on dry, warm evenings / mornings, with little to no wind.

3.6.1.1.2.1. Survey Year 2021: Transect Survey Results

Two transect surveys were undertaken across the Study Area during the 2021 survey period on 16 June 2021 and 26 August 2021 as shown in **Figure A10.1.9**.The results of the surveys are described in further detail in the following paragraphs.

Transect 1:

***Date:* 16 June 2021** ***Sunset:* 22:10** ***Start:* 23:40** ***End:* 01:10**

The first bat recorded was a brown long-eared bat which was heard but not seen at 23:44. At 23:46 and 23:47, a soprano pipistrelle and common pipistrelle were heard but not seen. At 23:48, a Leisler's bat was seen commuting in the open. common pipistrelles were seen foraging at 23:56 and 23:58. At 01:03, a Leisler's bat was seen commuting. At 00:19, a common pipistrelle and soprano pipistrelles were seen foraging. Another brown long-eared bat was heard faintly at 00:20. A point count was conducted at the plantation at 00:28. A soprano pipistrelle was seen commuting at 00:28. Another point count was conducted at 00:56, however no bats were recorded.

Transect 2:

***Date:* 26 August 2021** ***Sunset:* 21:51** ***Start:* 22:10** ***End:* 22:53**

The transect began at 22:10, straight after the emergence survey was conducted. The first bat recorded in the transect survey was a common pipistrelle at 22:10, commuting from the Northwest to East. soprano pipistrelles were heard but not seen at 22:11 and 22:12. A common pipistrelle was seen again commuting from Northwest to East, approx. 15m high in the treetops. Between 22:29 and 22:53, there were Leisler's bat, common and soprano pipistrelle passes all of which were heard but were not seen. At 22:45, the surveyors noted fog, which would've made visibility poor. The transect ended at 22:53.

3.6.1.1.2.2. Survey Year 2022: Transect Survey Results

Transect surveys conducted in the 2022 survey period comprised driven transects of the entire haul route between the Foyle Port and the Study Area, stopping at highlighted 'pinch points', shown in **Figure A10.1.11** and **Figure A10.1.12.**

Transect 1:

***Date:* 14 July 2022** ***Sunset:* 21:43** ***Start:* 22:30** ***End:* 23:00**

The transect began at 22:30, straight after the emergence survey was conducted. The transect was conducted by two ecologists, who split the route and drove a half of the transect each, making short stops at each of the pinch points and meeting in the middle. The first bat recorded on the transect was a Leisler's bat, passing at 22:33. While species were heard on the detector and observed passing, they were not all picked up by the recordings.

Species	Total bat passes	BP/h
Common pipistrelle	7	4.7
Leisler's bat	2	1.3
Myotis spp.	4	2.7

Transect 2:

Date: 25 August 2022 Sunset: 20:30 Start: 21:00 End: 22:15

The transect commenced at 21:00, starting at the Craigavon bridge in Derry city, and terminating at the docks by Strathfoyle, with stops at each of the pinch points highlighted in **Figure A10.1.10**. The first and last species recorded on the bat detector were both Common pipistrelles, however, the last species observed by surveyors was soprano pipistrelle at 21:49.

Species	Total bat passes	BP/h
Common pipistrelle	3	2.4
Soprano pipistrelle	18	14.4
Leisler's bat	2	1.6

3.6.1.1.2.3. Bat fatality monitoring (carcass search)

Bat carcass searches conducted during 2020 and 2021 according to the Protocol provided in **Appendix 11.1.4.** did not locate any dead or injured bats within 200m of the selected operational Owenreagh I and II Wind Farm turbines on-site. Searchers did find dead rats and one dead buzzard, demonstrating the reliability of searchers in locating carcasses and confirming further that there were no bat-related collisions.

3.6.1.1.3. Static Detector Surveys

In compliance with SNH Guidelines, static bat detectors were deployed three times over the 2021 active season at or in areas adjacent to the proposed turbines, alongside one permeant context detector placed by a mature coniferous woodland to the west of the Study Area. Weather conditions during the three deployment periods were proven to be compliant with SNH requirements, that is, 10 nights above thresholds for minimum dusk temperature (8°C) and little to no rainfall.

Bat activity for survey year 2021, based on bat passes per hour, was assessed using activity levels as adapted from Kepel *et al*. (2011). **Table A10.1.16** shows the levels attributed to 'Low', 'Medium' and 'High' activity.

Table A10.1.16: Bat activity levels associated with bat passes per hour (bp/h) - sourced from A Review of the Impacts of Wind Energy Developments on Biodiversity Kepel *et al*. (2011)

Bat activity	*Nyctalus* species	*Pipistrellus* species	All bat species
Low	2.5	2.5	3.0
Medium	4.3	4.1	6.0
High	8.6	8.0	12.0

Further context for activity levels was provided for the 2019 and 2021 survey periods through the analysis of the data with Ecobat. The percentiles generated by Ecobat for specific nights of bat activity allow for the objective classification of bat activity as 'Low', 'Moderate' or 'High'. As Ecobat uses median percentile data it is less influenced by large variance in the data as averages such as bp/h can be. **Table A10.1.17** shows the

levels of bat activity categories by Ecobat percentile scores, which is suggested by SNH for use in the assessment of risk to local bat population from wind farm developments.

Table A10.1.17: Bat activity levels categorised by percentile scores
Source: SNH (2019)

Ecobat Percentile	Bat Activity Level
81 - 100	**High**
61 - 80	**Moderate-High**
41 - 60	**Moderate**
21 - 40	**Moderate-Low**
0 - 20	**Low**

The following Sections detail the results from static monitoring surveys for each of the static deployments, split up seasonally (spring, summer, autumn) for 2021. The bp/h from the static bat detector surveys show the relative levels of bat activity for each unit deployed in 2021 across all deployments.

Figures are provided for each static deployment in 2021, illustrating the location of each static detector with pie charts, with the divisions representing the number of bat passes recorded for each species present – See **Figure A10.1.20, A10.1.21** and **A10.1.22** for spring, summer and autumn deployments, respectively. Weather data for the 2021 deployment period has been extracted and is illustrated in **Graph 2, 4** and **6** for the spring, summer and autumn deployments in 2021.

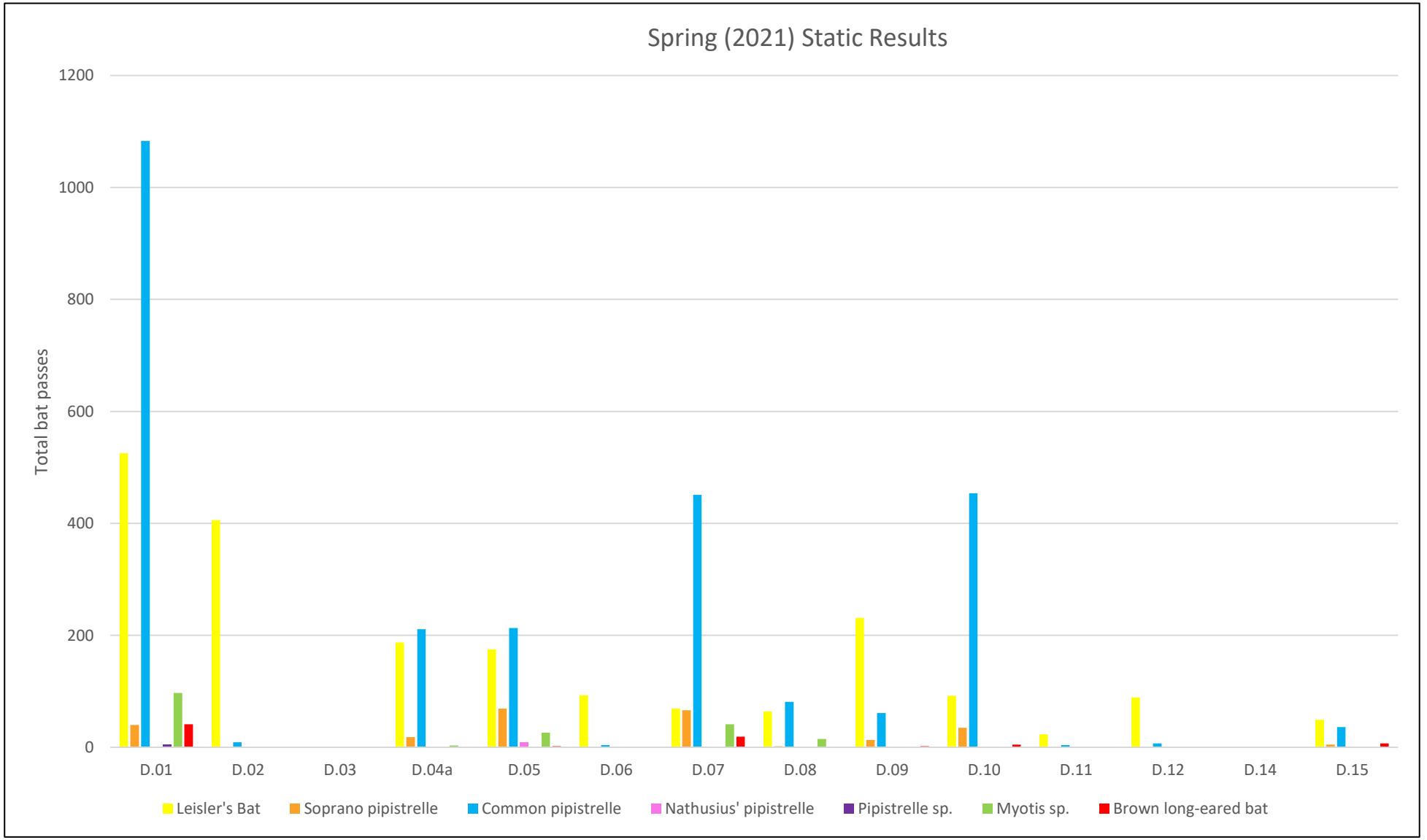
3.6.1.1.3.1. Static Results: Survey Year 2021

The tabulated results of the total bat passes and bat passes per hour for statics deployed in 2021 are presented below **in Table A10.1.18** to **Table A10.1. 20**, **Graph 1** to **Graph 6** and discussed in further detail in **Section 3.6.1.1.3.1.1 to Section 3.6.1.1.3.1.3**.

Table A10.1.18: Spring 2021 (31 May 2021 to 16 June 2021) static deployment results

Unit ID	Map ID	Leisler's Bat		Soprano pipistrelle		Common pipistrelle		Nathusius' pipistrelle		Pipistrelle sp.		Myotis sp.		Brown long-eared bat		Total	
		Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h		
SS027	D.01	525	3.8646	40	0.2944	1083	7.97203	0	0	5	0.0368	97	0.714	41	0.3018	1791	13.184
WSS049	D.02	406	2.9886	1	0.0074	9	0.06625	0	0	0	0	1	0.0074	0	0	417	3.0696
WSS041	D.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSS043	D.04a	187	1.3765	18	0.1325	211	1.55318	0	0	0	0	3	0.0221	0	0	419	3.0843
WSS031	D.05	175	1.2882	69	0.5079	213	1.56791	8	0.0589	0	0	26	0.1914	2	0.0147	493	3.629
WSS033	D.06	93	0.6846	0	0	4	0.02944	0	0	0	0	0	0	0	0	97	0.714
WSS053	D.07	69	0.5079	66	0.4858	451	3.31984	0	0	0	0	41	0.3018	19	0.1399	646	4.7552
WSS037	D.08	64	0.4711	2	0.0147	81	0.59625	0	0	0	0	15	0.1104	1	0.0074	163	1.1999
WSS035	D.09	231	1.7004	13	0.0957	61	0.44902	0	0	0	0	0	0	2	0.0147	307	2.2598
WSS036	D.10	92	0.6772	35	0.2576	454	3.34192	0	0	0	0	1	0.0074	5	0.0368	587	4.3209
WSS055	D.11	23	0.1693	0	0	4	0.02944	0	0	0	0	0	0	0	0	27	0.1987
WSS052	D.12	89	0.6551	0	0	7	0.05153	0	0	0	0	0	0	0	0	96	0.7067
WSS051	D.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSS028	D.15	49	0.3607	5	0.0368	36	0.265	0	0	0	0	0	0	7	0.0515	97	0.714
TOTAL		2003	14.7442	249	1.8328	2614	19.24181	8	0.0589	5	0.0368	184	1.3545	77	0.5668		

Graph 1: Results of the spring 2021 static deployment



Graph 2: Weather conditions during the spring 2021 deployment

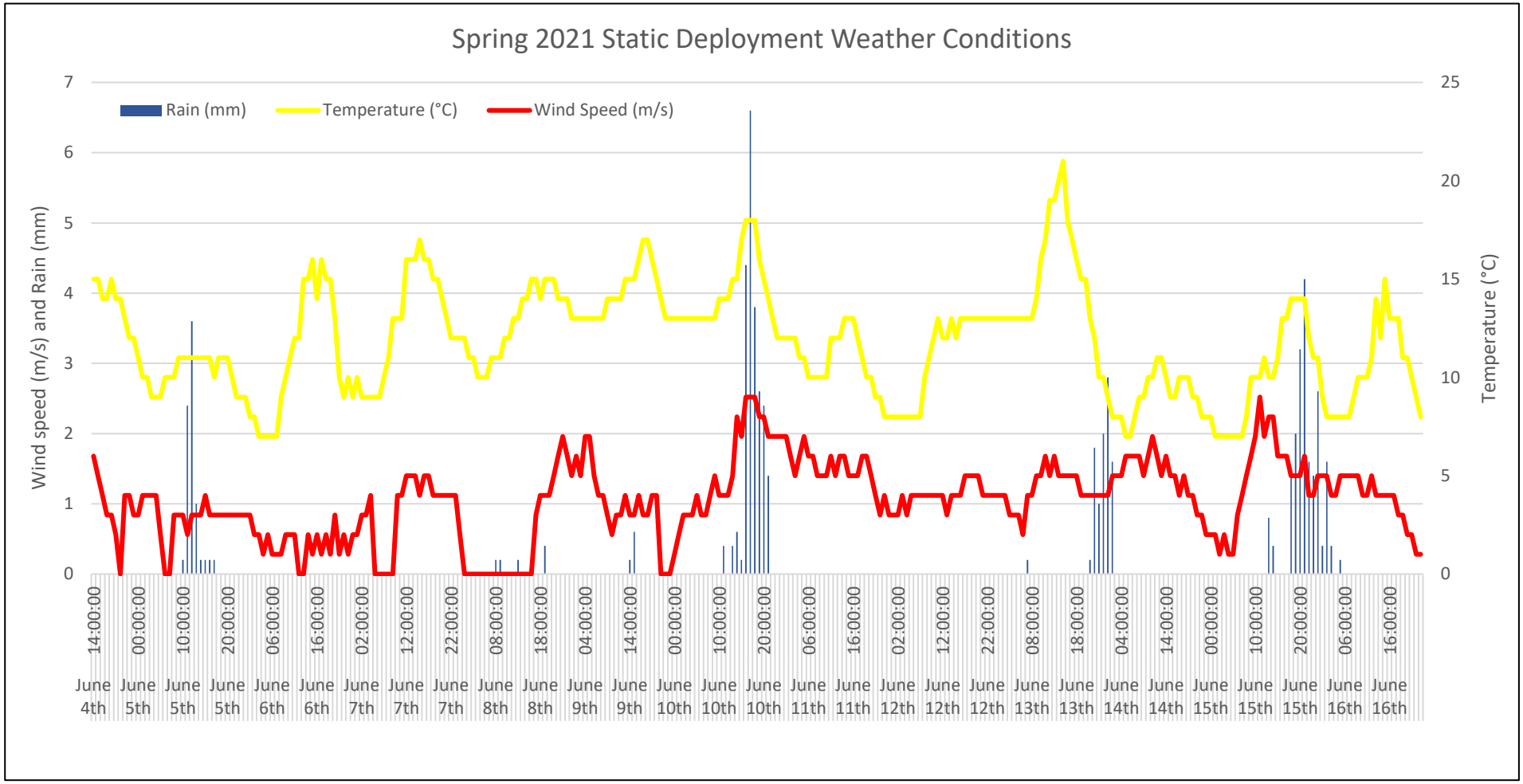
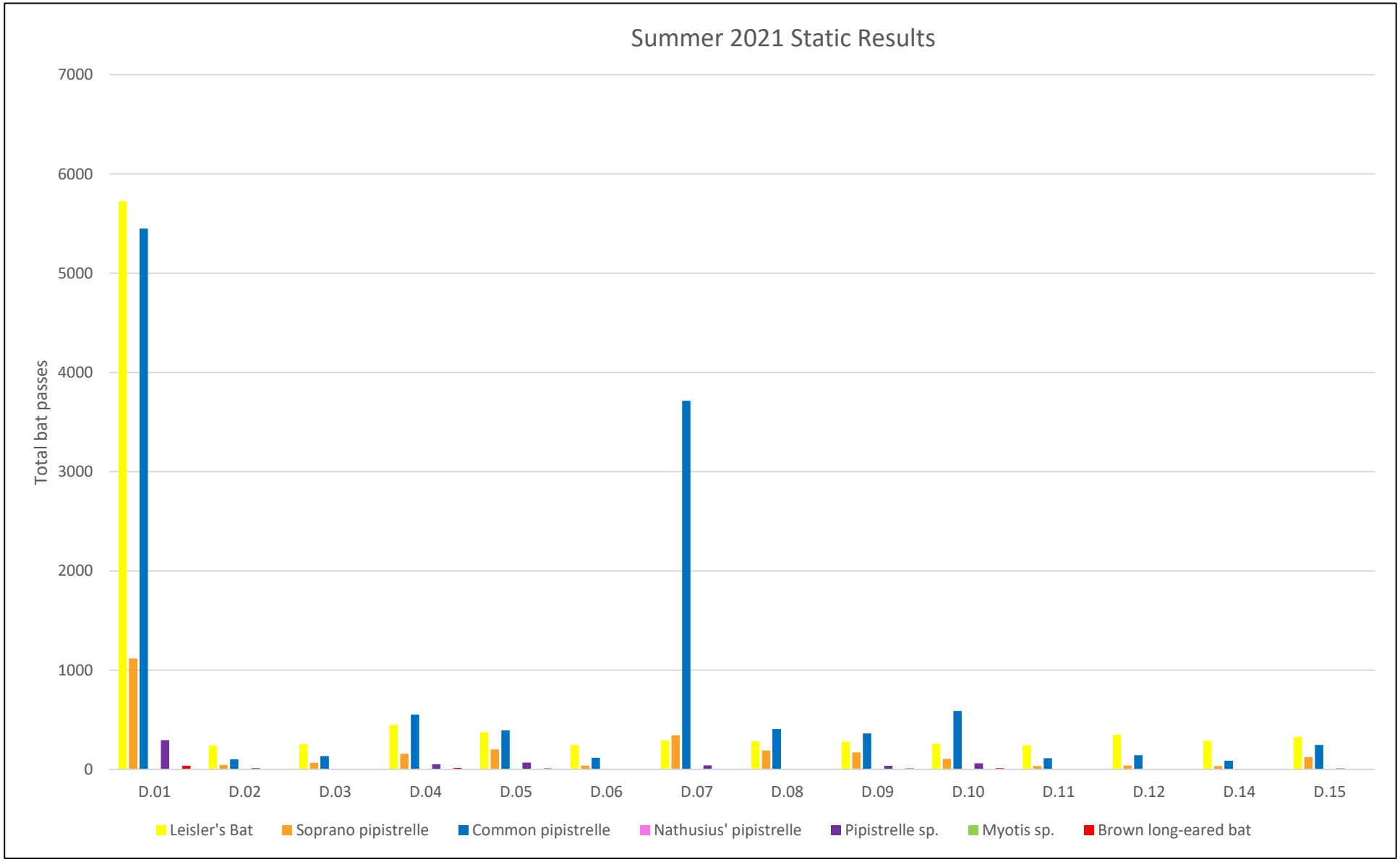


Table A10.1. 19: Summer 2021 (20 July 2021 to 7 August 2021) static deployment results

Unit ID	Map ID	Leisler's Bat		Soprano pipistrelle		Common pipistrelle		Nathusius' pipistrelle		Myotis sp.		Brown long-eared bat		Total	
		Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h
WSS033	D.01	5725	37.418	1118	7.3072	5451	35.6275	1	0.0065	296	1.9346	37	0.2418	12628	82.536
WSS051	D.02	242	1.5817	45	0.2941	101	0.66013	0	0	14	0.0915	1	0.0065	403	2.634
WSS052	D.03	252	1.6471	66	0.4314	133	0.86928	0	0	5	0.0327	3	0.0196	459	3
WSS030	D.04	448	2.9281	157	1.0261	551	3.60131	0	0	52	0.3399	16	0.1046	1224	8
WSS025	D.05	375	2.3072	202	1.2428	393	2.41797	0	0	68	0.4184	11	0.0677	1049	6.4541
WSS055	D.06	247	1.5197	39	0.24	117	0.71985	0	0	3	0.0185	2	0.0123	408	2.5103
WSS031	D.07	293	5.6202	344	6.5985	3715	71.2596	0	0	41	0.7864	5	0.0959	4398	84.361
WSS032	D.08	283	1.8497	190	1.2418	407	2.66013	0	0	5	0.0327	0	0	885	5.7843
WSS046	D.09	278	1.7104	172	1.0582	362	2.22724	0	0	36	0.2215	10	0.0615	858	5.2789
WSS027	D.10	257	1.6797	107	0.6993	590	3.85621	0	0	61	0.3987	14	0.0915	1029	6.7255
WSS026	D.11	242	1.5817	33	0.2157	112	0.73203	0	0	4	0.0261	5	0.0327	396	2.5882
WSS034	D.12	351	2.2941	38	0.2484	144	0.94118	0	0	5	0.0327	0	0	538	3.5163
WSS053	D.14	289	1.8889	34	0.2222	88	0.57516	0	0	4	0.0261	0	0	415	2.7124
WSS028	D.15	327	2.1373	124	0.8105	247	1.61438	0	0	11	0.0719	2	0.0131	711	4.6471
TOTAL PASSES BY SPECIES		**9609**	**66.1638**	**2669**	**21.6362**	**12411**	**127.762**	**1**	**0.0065**	**605**	**4.4317**	**106**	**0.7472**		

Graph 3: Results of the summer 2021 static deployment



Graph 4: Weather conditions during the summer 2021 deployment

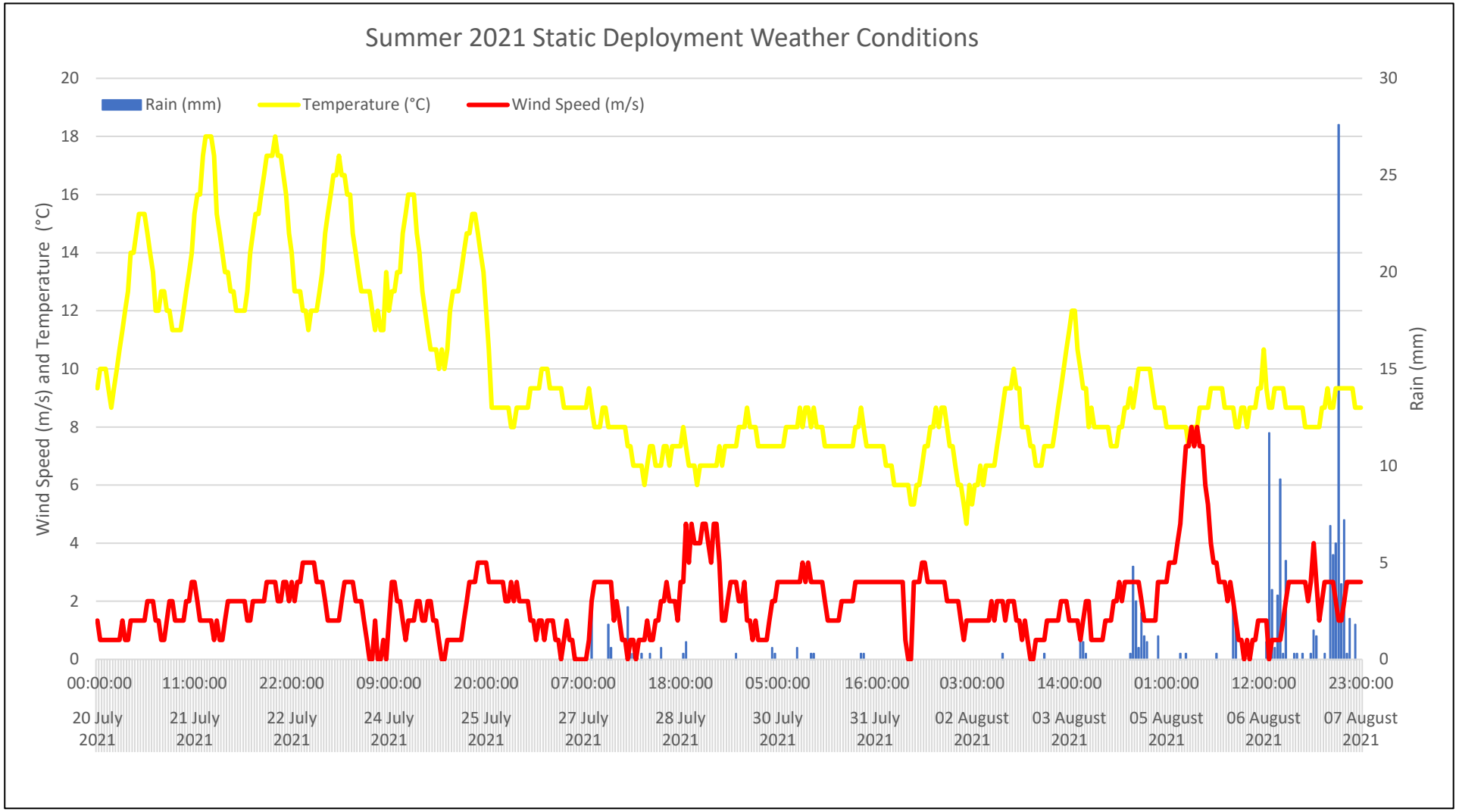
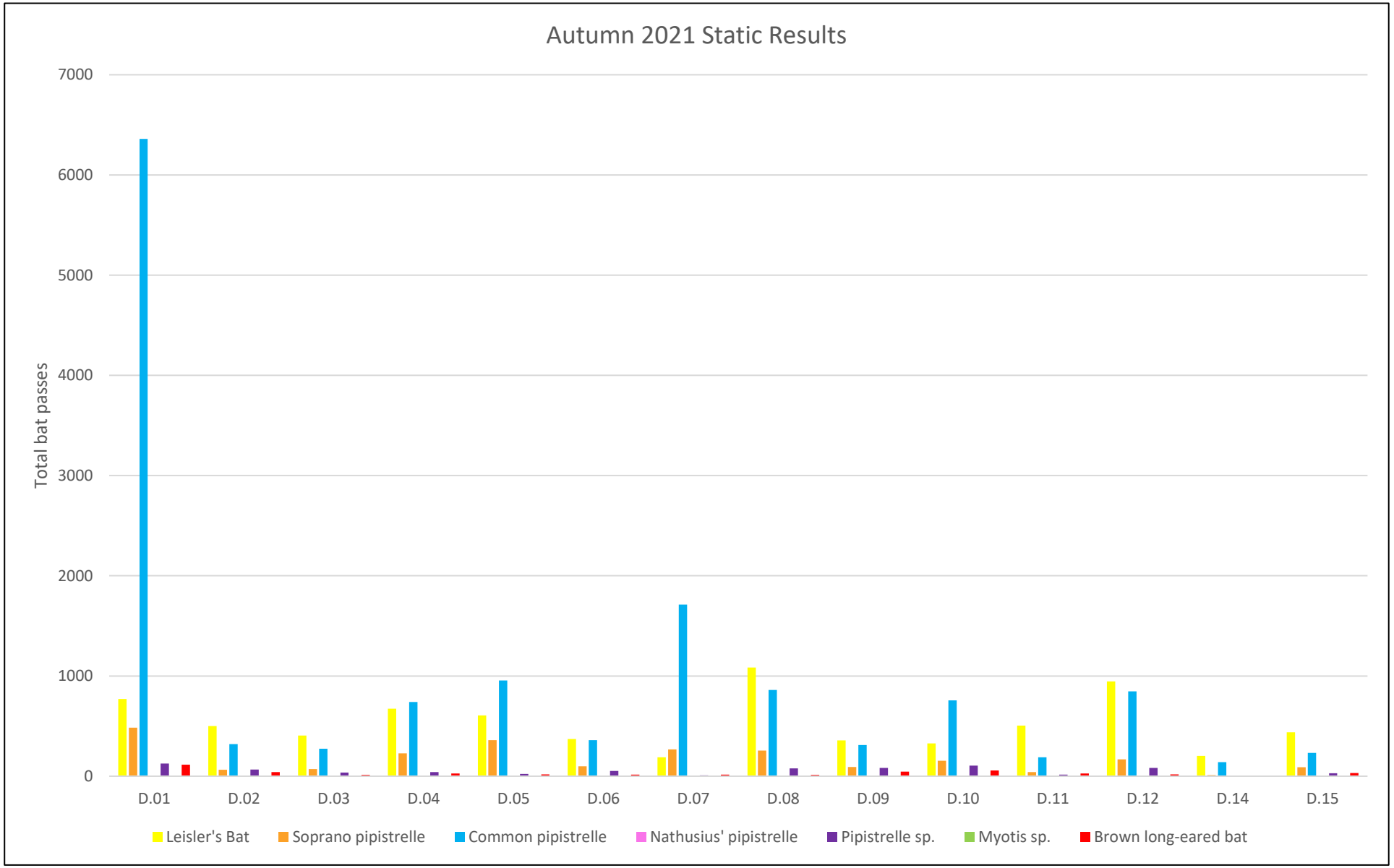


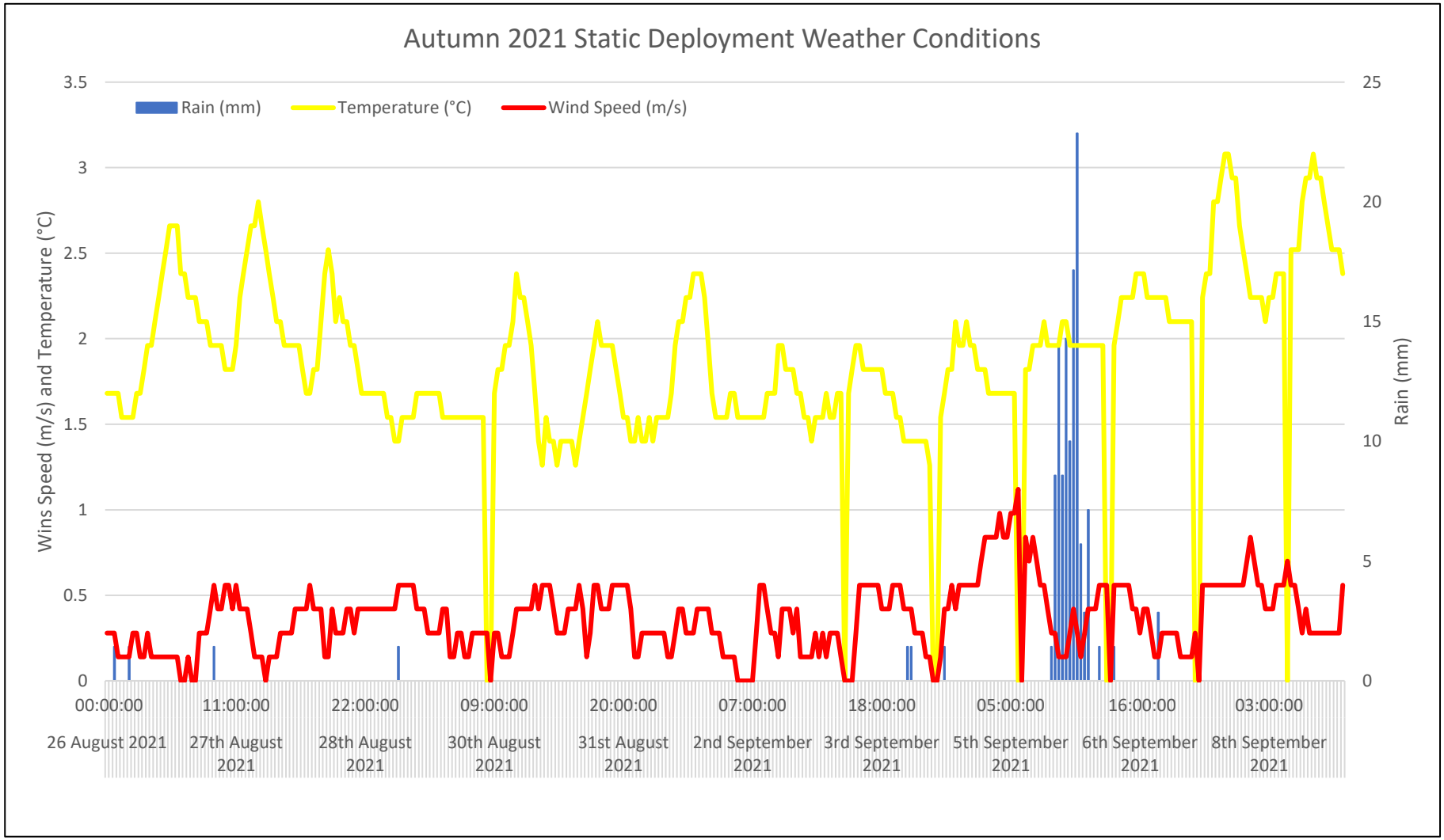
Table A10.1. 20: Autumn 2021 (26 August 2021 to 9 September 2021) static deployment results

Unit ID	Map ID	Leisler's Bat		Soprano pipistrelle		Common pipistrelle		Nathusius' pipistrelle		Myotis sp.		Brown long-eared bat		Total	
		Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h	Passes	BP/h
WSS060	D.01	770	4.8647	484	3.0578	6361	40.1874	4	0.0253	127	0.8024	114	0.7202	7860	49.658
WSS036	D.02	501	2.945	65	0.3821	320	1.88106	0	0	66	0.388	41	0.241	993	5.8372
WSS030	D.03	405	2.3807	70	0.4115	274	1.61066	0	0	37	0.2175	13	0.0764	799	4.6968
WSS055	D.04	674	4.2582	229	1.4468	740	4.67516	1	0.0063	41	0.259	28	0.1769	1713	10.822
WSS032	D.05	607	3.8349	360	2.2744	956	6.0398	0	0	22	0.139	18	0.1137	1963	12.402
WSS052	D.06	372	2.1867	98	0.5761	359	2.11032	3	0.0176	53	0.3116	16	0.0941	901	5.2964
WSS037	D.07	189	1.1941	268	1.6932	1712	10.816	1	0.0063	9	0.0569	15	0.0948	2194	13.861
WSS038	D.08	1085	6.8548	255	1.611	861	5.43961	2	0.0126	77	0.4865	13	0.0821	2293	14.487
WSS046	D.09	358	2.1044	92	0.5408	312	1.83404	2	0.0118	82	0.482	45	0.2645	891	5.2376
WSS034	D.10	327	1.9222	153	0.8994	756	4.44401	0	0	105	0.6172	56	0.3292	1397	8.212
WSS031	D.11	504	2.9627	41	0.241	189	1.111	0	0	15	0.0882	28	0.1646	777	4.5675
WSS040	D.12	946	5.5609	167	0.9817	847	4.97894	0	0	83	0.4879	18	0.1058	2061	12.115
WSS024	D.14	203	1.1933	11	0.0647	141	0.82884	0	0	4	0.0235	5	0.0294	364	2.1397
WSS053	D.15	439	2.7735	89	0.5623	233	1.47204	2	0.0126	29	0.1832	32	0.2022	824	5.2059
TOTAL		7380	45.0361	2382	14.7428	14061	87.42888	15	0.0925	750	4.5429	442	2.6949		

Graph 5: Results of the autumn 2021 static deployment



Graph 6: Weather conditions during the autumn 2021 deployment



3.6.1.1.3.1.1. Spring deployment (31 May 2021 – 16 June 2021)

Static bat detectors were deployed for a total of up to 16 nights adjacent to or at the proposed turbine locations (See **Figure A10.1.20**). A permanent context static bat detector was deployed in the southwest of the Study Area along an area of coniferous woodland. **Table A10.1.18** shows the number of bat passes recorded on each detector over the spring survey period as well as the bat passes per hour. **Figure A10.1.20** shows the location of each detector during the spring survey period and the total bat passes recorded per species for that deployment period. **Graph 1** illustrates the number of species recorded per detector during the deployment.

As can be seen in **Graph 2,** weather data for the Spring (May-June) deployment shows compliance with SNH Guidelines of temperatures >8^{o}C at dusk little or no rain, on most nights. As expected of an exposed upland site such as this, wind levels were slightly elevated with a number of nights rising to 1 to 2m/s above those recommended in SNH Guidelines. However, this is absolutely typical and representative of such an extremely exposed site. All of the deployment nights fell within acceptable levels, 7 m/s or less, with the exception of the night of 10th June, where wind speed rose to 8m/s, while evening temperatures were 8^{o}C or above at dusk on all evenings. The static detector deployment for spring is considered to be in compliance with SNH Guidelines.

Across almost all of the deployment locations, registrations were dominated by either common pipistrelle or Leisler's bat. Aside from the context detector at D.01 which recorded 1791 passes, the highest number of bat passes was recorded at D.07, with a total of 646 passes, located in a cluster of trees and shrubs in the centre of an open field. Similarly, 587 bat passes were recorded at D.10, located 250m south of a small strip of coniferous woodland. While the detector is located in open heath, the dirt track through the heath is at a lower elevation, which may provide bats some cover and linear features within the area, leading down to the area of coniferous woodland and a small river which runs alongside the path in a northerly direction. In addition, D.05, located within a strip of hedgerow / treeline recorded 497 bat passes. The lowest number of bat passes recorded was 27, at D.11, which was placed in an area of open heath, with little cover or linear features for bats.

D.13 and D.03 malfunctioned while deployed, and therefore recorded no bats during the spring 2021 survey period. Static detectors D.06, D.11 and D.12, all located in open heath around the existing turbines, and D.15, located in open heath, east of the existing windfarm, all recorded less than 100 bat passes during the spring survey period. As anticipated, there appears to be a correlation between the presence of linear features and the number of bat passes recorded.

Species-wise, the results are similar to what would normally be expected at an exposed site in the spring. Shiel *et al* (1999) highlight that Leisler's bats tend to range further from maternity roosts, often using day roosts, prior to giving birth (which occurs in June). The authors often see peaks in Leisler's bats in May (and September) in areas where roost availability is limited. In this instance, the most commonly registered species was common pipistrelle (2614 passes) followed by Leisler's bat (2003 passes), soprano pipistrelle (249 passes), Myotis species (184 passes), brown long-eared bat (77 passes), Nathusius' pipistrelle (8 passes) and unconfirmed *Pipistrellus* spp. (5 passes). The use of the Study Area by brown long-eared bats is interesting for such an exposed site, but not totally unusual.

As detailed in **Table A10.1.18**, all bat passes per hour species totals for each detector were considered to be 'Low', with the exception of common pipistrelle at the context detector, classed as being 'High' (7.97203). In terms of total aggregated bat passes for all species, total bat passes per hour were considered *low* for all static detectors, with the exception of the Context detector (D.01), considered to be 'High', and D.07 and D.10, both classed as being 'Medium'.

3.6.1.1.3.1.2. Summer deployment (20 July 2021 – 7 August 2021)

Static bat detectors were deployed for a total of 18 nights at each of the 14 locations. **Table A10.1.** 19 shows the number of bat passes recorded on each detector over the survey period as well as the bat passes per hour. This table indicates the location of each detector and the total number of bat passes recorded per species during the summer deployment period. **Graph 3** presents the number of species recorded per detector during the deployment.

As can be seen in **Graph 4,** weather data for the summer (July-Aug) deployment also shows compliance with SNH Guidelines of temperatures >8^{o}C at dusk and wind speeds <5m/s (11 mph) and little or no rain, on

most nights. One exception was the night of 28th July, where wind speeds reached 7m/s, however this is considered to still be within acceptable levels, given the exposed nature of the upland site. Temperatures remained above 8°C, with the exception of the night of the 1st July, when temperatures dipped by one degree to 7°C, however by the next hour temperatures levelled out to 8°C again. As with the spring deployment, there was little to no rain recorded. The static deployment for summer 2021 is considered to be in compliance with SNH Guidelines.

During the summer 2021 deployment, bat registrations were a mix of common and soprano pipistrelle bats, Leisler's bat, *Myotis* sp. and brown long eared bat. Common pipistrelle bat registrations were the most numerous during this deployment (12,411), followed by Leisler's bat (9,609), soprano pipistrelle (2,669), *Myotis* sp. (605), brown long-eared bat (106) and just one Nathusius' pipistrelle pass. As with the spring deployment, the greatest number of bat passes were recorded at the Context detector (12,628), followed by the adjacent D.07 detector (4,398). This is an increase of approx. 85% from the spring season activity. The lowest number of bat passes were recorded at D.11 – with 396 passes, followed closely by D.14 with 408 passes and D.14 with 415 passes, all positioned within areas of open heath, with little to no refuge.

Comparative usage levels across the Study Area was somewhat clearer in showing lower activity in the more exposed areas, near existing turbines, and higher activity in the more sheltered areas, such as detectors near the proposed T2 and T13, which are both located near patches of woodland, both of which recorded over 1000 bat passes across the summer survey period. As detailed in **Table A10.1.** 19**,** all bat passes per hour species totals were determined to be 'Low', aside from activity at D.01 (Context) and D.07. Leisler's bat, common pipistrelle and soprano pipistrelle activity at the context detector were all classed as 'High', whereas at D.07, common and soprano pipistrelle activity was classed as being 'High', and Leisler's bat 'Moderate'.

In terms of total aggregated bat passes for all species, total bat passes per hour were considered 'Low' for D.02, D.03, D.06, D.11, D.12 and D.14, 'Medium' for D.04, D.05, D.08, D.09, D.10 and D.15, and 'High' for D.01 (Context) and D.07.

3.6.1.1.3.1.3. Autumn deployment (26 August 2021 – 9 September 2021)

Static bat detectors were deployed for a total of up to 14 nights at each of the survey locations **Table A10.1. 20** shows the number of bat passes recorded on each detector over the survey period as well as the bat passes per hour. This table indicates the location of each detector and the total number of bat passes recorded during the autumn deployment period. **Graph 5** presents the number of species recorded per detector during the deployment.

As can be seen in **Graph 6**, data for the autumn (Aug-Sept) deployment also shows compliance with SNH Guidelines of temperatures >8°C at dusk, generally low wind speeds and little or no rain, on most nights. Wind speeds remained below 7 m/s for the entirety of the deployment. One significant occurrence of rain was on the night of 5th September, when 7mm was recorded across a 2-hour period. The static detectors for the autumn deployment are considered to be in compliance with SNH Guidelines, notably taking account of the time of year.

As before, the highest number of bat passes was recorded at the context detector D.01 (7,860). This is followed by D.08 (2,293), east of the proposed T1 turbine, and D.07 (2,194), located west of the proposed T2 turbine. The high level of activity near T1, an area of heath with no linear features, may be attributed to the steep slope / valley on which this detector was located, which while being open, may offer some protection to commuting / foraging bats. The lowest number of bat passes was recorded at D.14 (364), located on the existing windfarm at Owenreagh, in an area of open heath with little protection from the elements. In general, activity was highest during the autumn deployment, particularly in areas with sections of woodland, treelines and other linear features, such as by T2, T8 and T13.

As with the previous deployments, common pipistrelle (14,061) and Leisler's bat (7,380) passes dominated the registrations, followed by soprano pipistrelle (2382), *Myotis* spp. (750), brown long-eared bat (442) and Nathusius' pipistrelle (15).

As detailed in **Table A10.1.** 20**,** there were a number of 'High' and 'Moderate' levels of bat passes by all species across the Study Area, with recordings at D.01, D.04, D.05, D.07, D.08 and D.12 registering as being of 'High' bat activity. D.02, D.03, D.06, D.09, D.10, D.11 and D.15 all recorded a 'Moderate' level of bat activity for all species. Only one detector was deemed of having a 'Low' level of bat passes, D.14.

3.6.1.1.3.1.4. Soprano / Common pipistrelle roost survey – (8 September 2021 – 15 September 2021)

In addition to the manual roost surveys, targeted static detectors were placed around the two identified roosts within the Study Area *(which cannot be identified in this report for bat conservation reasons, but the information is available on request)*, in order to gain a greater understanding of the importance of adjacent linear features to commuting bats. Detectors were placed along linear features located in different directions from the roost, with the aim of determining which direction bats were commuting from their roosts to their foraging sites. The results are tabulated below.

Detector No.	Latitude	Longitude	Direction from roost	Total Soprano pipistrelle passes
WSS008	-7.31886	54.81821	W	31
WSS012	-7.31821	54.81933	N	121
WSS023	-7.31634	54.81794	SE	39
WSS042	-7.31761	54.81847	E	1414

Detectors were deployed on 8 September 2021 to the 15 September 2021. The majority of activity was concentrated around the detector deployed along a hedgerow to the southeast of the roost, adjacent to a watercourse flowing north. Little activity was recorded on the detector to the west of the roost, while higher activity was recorded on the detector to the north (connected to T13), but overall contributed to approx. 20% of the activity recorded across all four detectors.

3.6.1.1.3.1.5. Leisler's bat tree roost survey – (8 September 2021 - 15 September 2021)

Similarly, to the above, four detectors were placed around the Leisler's tree roost in different directions, with the intention of determining which linear features are preferred by commuting Leisler's bats. The results are summarised in the table below.

Detector No.	Latitude	Longitude	Direction from roost	Total Leisler's bat passes
WSS007	-7.35606	54.81636	E	13
WSS017	-7.35843	54.81688	NW	0
WSS021	-7.35605	54.81478	W	63
WSS047	-7.3576	54.81637	SE	22

The detector placed to the south of the roost recorded the most bat passes from Leisler's bat, which may relate to connectivity with the coniferous woodland to the south, where the majority of bat activity was recorded throughout the 2021 survey period.

3.6.1.2. Summary and Discussion of Bat Survey Results

The bat surveys undertaken at the Study Area in the form of transect surveys, roost surveys and static detector deployment across the 2018-2022 survey period provide a valuable understanding of bat usage of the Study Area. The surveys showed that there is a variable level of usage of the Study Area by bats and that bat usage of the Study Area is generally associated with habitat features such as forestry edge, treelines and hedgerows. At this site, Leisler's bat was more likely to forage / commute over open habitat than common pipistrelle and soprano pipistrelle, although activity over open habitat was still Low overall.. Bats recorded during surveys included a variety of species with common pipistrelle, soprano pipistrelle, Leisler's bat and to a lesser extent brown long-eared bat, *Myotis* species and Nathusius' pipistrelle being represented in the results.

A comparison of the static detector results revealed similarities in where the highest level of bat activity is recorded, within or near linear features, utilised by commuting bats, particularly the coniferous woodland to the southwest of the Development. D.01 (context), placed at this location, recorded the highest number of

total bat passes in both summer and autumn, with much lower activity in spring, while D.07, located within the treeline just north of this coniferous woodland recorded the next highest level of passes, in both autumn and summer, and, similarly to D.01, lower passes in spring. For 2018, the only 'High' number of total bat passes was between two strips of coniferous woodland to the northeast, however, as the Site Boundary has changed, this area is no longer within the Site Boundary.

The main difference between survey seasons 2019 (see **Appendix 11.1.3 – Bat Report 2018-2019**) and 2021 is level of activity during the autumn survey periods; while a low level of activity was recorded throughout the Study Area in autumn 2019, whereas the highest level of activity for the 2021 survey period was recorded during the autumn surveys. This could be attributed to the different weather conditions during the deployments. The 2019 autumn survey period comprised the deployment of static detectors between 16 and 29 October 2019, during which time temperatures occasionally dropped below 8ºC, and higher wind speeds reaching up to 13m/s were recorded. Conversely, the 2021 autumn deployment was undertaken from 26 August 2021 to 9 September 2021, with an average of 13ºC across the survey period, wind speeds averaging 2m/s and little to no rain.

The most widespread bat species recorded across all survey years was common pipistrelle and the highest level of common pipistrelle activity was recorded in autumn in 2021. Highest soprano pipistrelle activity was recorded during the summer deployment. Leisler's bat activity was notably highest in autumn in 2021.

Detectors that recorded high and moderate levels of activity across 2021 are listed in **Table A10.1.21** below. The final column indicates whether one specie was responsible for the majority of recordings, which could lead to an overall 'Moderate' or 'High' rating, despite all other species being present in 'Low' numbers. The purpose of this table is to clarify that not all species are present in 'High' numbers, even when there is a 'High' level of activity overall.

Table A10.1.21: 'High', 'Moderate' and 'Low' bat passes recorded during static detector deployment in 2021.

Season / Survey Year	Detector No.	Total bat passes recorded	Associated linear feature / Open habitat?	Bat species with highest number of passes (and activity level of that individual species)
Spring 2021	D.01 (context)	1791	Forest edge	Common pipistrelle
	D.07	646	Treeline	Common pipistrelle
	D.10	587	Open (raised verges either side of path may provide cover in this area and connectivity with strip of woodland to the north)	Common pipistrelle
	D.05	493	Treeline	Common pipistrelle
	D.04a	419	Open	Common pipistrelle
	D.02	417	Open	Leisler's bat
	D.09	307	Open – *c.* 118m southwest of strip of woodland	Leisler's bat
	D.08	163	Open (on slope)	Common pipistrelle
	D.06	97	Open	Leisler's bat

Season / Survey Year	Detector No.	Total bat passes recorded	Associated linear feature / Open habitat?	Bat species with highest number of passes (and activity level of that individual species)
	D.15	97	Open (on slope)	Leisler's bat
	D.12	96	Open (raised verge to the south may provide some cover)	Leisler's bat
	D.11	27	Open (raised verge along path to the east may provide cover)	Leisler's bat
	D.03	0	Open	N/A
	D.14	0	Open	N/A
Summer 2021	D.01 (context)	12628	Forest edge	Leisler's bat
	D.07	4398	Treeline	Common pipistrelle
	D.04	1224	Open	Common pipistrelle
	D.05	1049	Treeline	Common pipistrelle
	D.10	1029	Open (raised verges either side of path may provide cover in this area and connectivity with strip of woodland to the north)	Common pipistrelle
	D.08	885	Open (on slope)	Common pipistrelle
	D.09	858	Open – *c.* 118m southwest of strip of woodland	Common pipistrelle
	D.15	711	Open (on slope)	Leisler's bat
	D.12	538	Open (raised verge to the south may provide some cover)	Leisler's bat
	D.03	459	Open	Leisler's bat
	D.14	415	Open	Leisler's bat
	D.06	408	Open	Leisler's bat
	D.02	403	Open	Leisler's bat
	D.11	396	Open (raised verge along path to the	Leisler's bat

Season / Survey Year	Detector No.	Total bat passes recorded	Associated linear feature / Open habitat?	Bat species with highest number of passes (and activity level of that individual species)
			east may provide cover)	
Autumn 2021	D.01 (context)	7860	Forest edge	Common pipistrelle
	D.08	2293	Open (on slope)	Leisler's bat
	D.07	2194	Treeline	Common pipistrelle
	D.12	2061	Open	Leisler's bat
	D.05	1963	Treeline	Common pipistrelle
	D.04	1713	Open	Common pipistrelle
	D.10	1397	Open (raised verges either side of path may provide cover in this area and connectivity with strip of woodland to the north)	Common pipistrelle
	D.02	993	Open	Leisler's bat
	D.06	901	Open	Leisler's bat
	D.09	891	Open – *c.* 118m southwest of strip of woodland	Leisler's bat
	D.15	824	Open (on slope)	Leisler's bat
	D.03	799	Open	Leisler's bat
	D.11	777	Open (raised verge along path to the east may provide cover)	Leisler's bat
	D.14	364	Open	Leisler's bat

Leisler's bats appear to be at their most active across the entire site in autumn. Although a greater number of Leisler's bat passes were recorded in the summer than in autumn, the majority of activity is attributed to one detector (D.01 context) by a woodland edge in the southeast of the Study Area. In autumn, these bats appear to forage further afield than in the summer. There is considerably lower activity form this species in spring. This is mirrored in the 2019 surveys, where the number of Leisler's bats recorded across all detectors as opposed to concentrated to a few detectors increases from spring to the second summer deployment. This correlates with the bat breeding season being in late spring, a time when bats tend to stay close to their roost to stay warm and look after young (Lundy *et al,* 2011). Leisler's bat were the most commonly recorded species in open areas with little cover, for example a 'High' number of passes was recorded at D.08, placed in an area of open heath. This behaviour is not unusual for Leisler's bat, and this

species is known to be less selective with regards to the presence of linear features when foraging (Shiel *et al,* 1998; Russ *et al,* 2006; Lundy *et al,* 2011).

Common pipistrelle is, in general, the most commonly recorded species across the Study Area in both the 2019 and 2021 deployments, which, given that common pipistrelle are one of the most common species across the island of Ireland (Roche *et al*, 2011), is expected. This species was recorded in highest numbers near features such as woodland or treelines and is consistently present in high numbers at D.01 by the plantation to the southwest of the Study Area. As with Leisler's bat, activity was lower in the spring, gradually increasing with more occurrences across the Study Area by the autumn deployment.

Soprano pipistrelles were recorded in either low numbers or no recordings at all across the 2019 survey period, peaking during the second summer deployment. This is mirrored in the 2021 surveys for spring and autumn, however soprano pipistrelle passes were recorded as being 'High' at D.01 and D.07, near the plantation woodland to the southwest and group of trees / treeline just north of the plantation.

Leisler's bat passes dominated in areas of open habitat, whereas other species such as common and soprano pipistrelle were more likely to dominate along linear features, such as hedgerows, treelines and woodland edges. This was true throughout the 2021 survey period and the 2019 period.

Some detectors recorded a 'Moderate' number of total bat passes, as shown in **Table A10.1.21** above, but all species as individuals were present in 'Low' numbers.

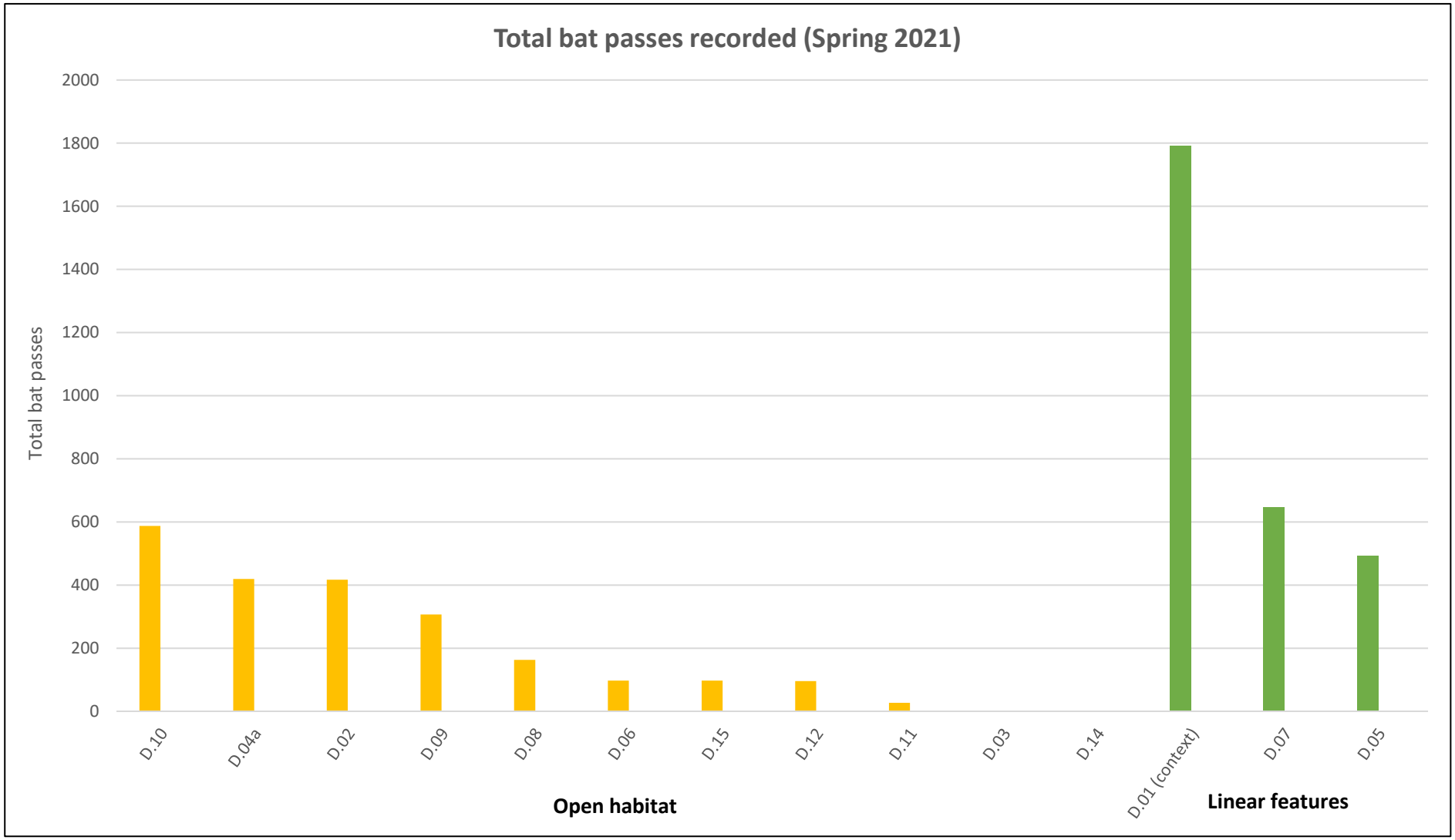
3.6.1.2.1. Association of Bat Activity with Features

Association of bat activity with features is gained, with deployments including 'paired' detectors at open habitat locations as well as at features. Results reveal an association between bat passes and habitat features. Bat activity recorded during the survey season was largely associated with habitat features such as hedgerows, treelines, mature trees and forestry edge. Overall, bat activity levels differed greatly between static detectors located at features and non-features. While common and soprano pipistrelle were more likely to be found along features, Leisler's bats were more likely to forage over open habitat, particularly as the survey season progressed from spring to autumn. This is supported by the literature, which outlines the preference for linear features by common and soprano pipistrelle; additionally, while common pipistrelle undertake more individual flights, soprano pipistrelle bats are more likely to fly further and make less journeys, suggesting an even more specific habitat preference in soprano pipistrelle than common pipistrelle (Shiel *et al*, 1998; McAney, 2006; Rachwald *et al,* 2016).

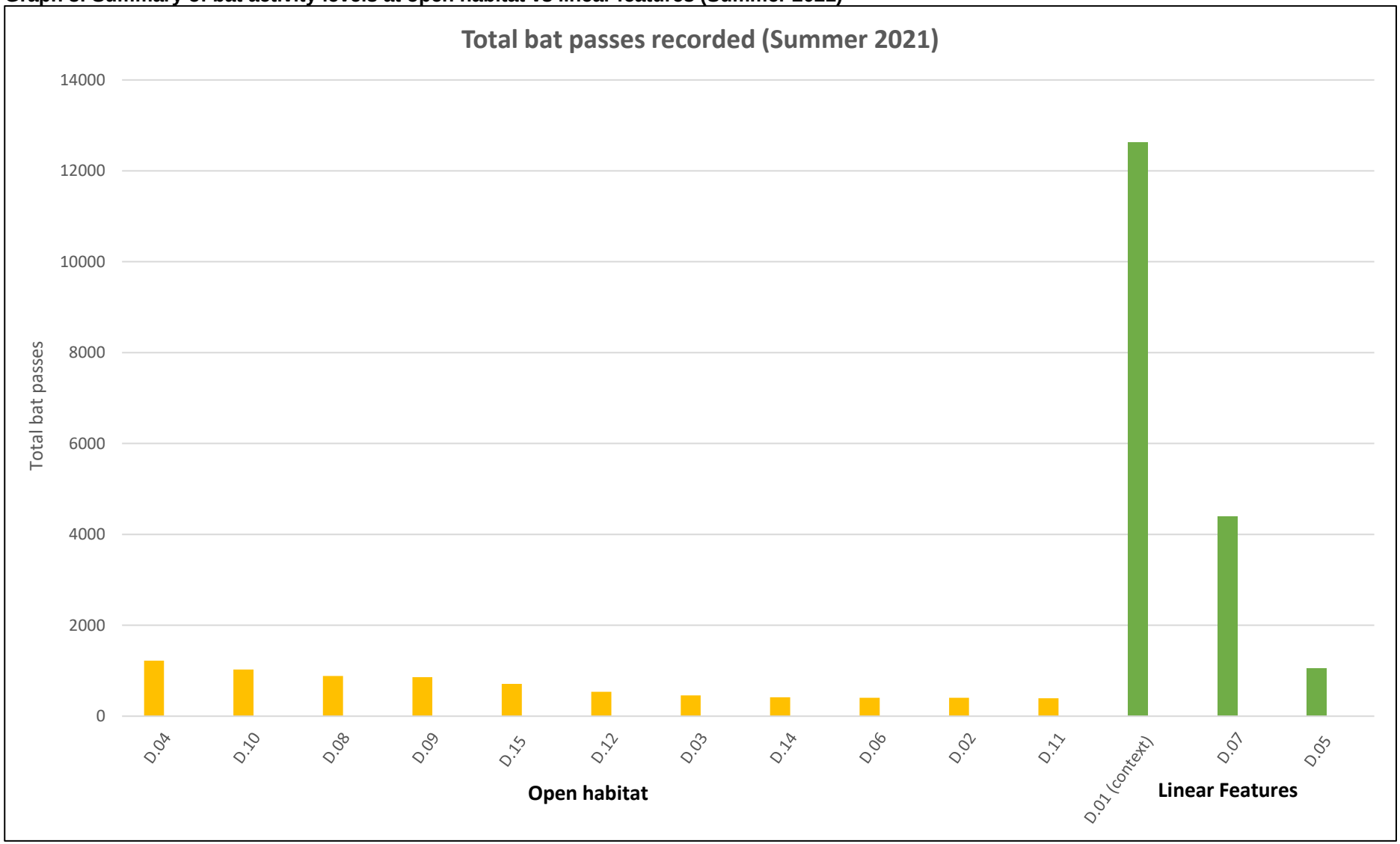
Bat activity increased from the spring deployment to the final deployment in autumn, with an increase in range of activity coinciding with the reproductive cycle of bats[42]. While in late spring and early summer, bats will stay closer to the roost to keep warm and take care of their young, by autumn (late August – September) nursery roosts begin to break-up, baby bats are fully fledged and will forage for themselves farther afield. **Graph 7** to **Graph 9** below illustrate the reduction in bat activity levels when comparing detectors deployed in open habitat with detectors deployed near linear features, during the 2021 survey period.

[42] BCT Website. Available at: https://www.bats.org.uk/about-bats/a-year-in-the-life-of-a-bat

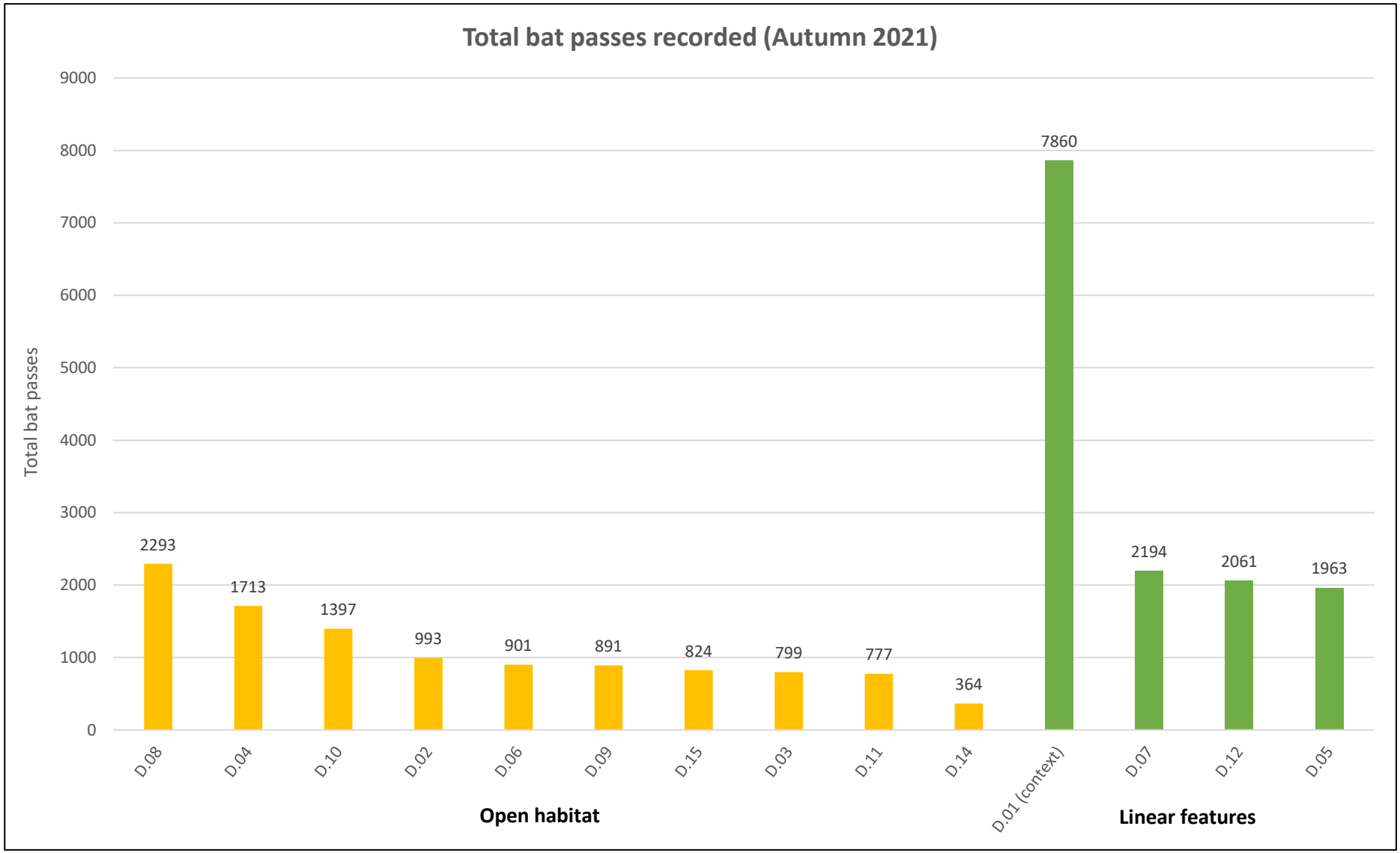
Graph 7: Summary of bat activity levels at open habitat vs linear features (Spring 2021)



Graph 8: Summary of bat activity levels at open habitat vs linear features (Summer 2021)



Graph 9: Summary of bat activity levels at open habitat vs linear features (Autumn 2021)



3.6.2. Badger

Three badger setts were recorded within the Study Area. The largest of these setts was considered an active main sett, with up to six entrances observed, and was located within an area of dense leggy heather and dry peat hags. The remaining sett locations were considered to be peripheral or outlier setts with single entrances and only subject to occasional use.

No badger setts were identified which are considered likely to be affected by the Development. All identified badger setts lie > 240m away from all existing site infrastructure and will lie >300m away from any proposed infrastructure and their likely working corridor.

Given their protected status of this species, please note the locations of the badger setts should not be made publicly available. A confidential map indicating the location of the badger setts, and required buffers, is provided in **Appendix III: Confidential Badger Report**. Please note, to ensure conservation of this protected species, this will not be available for public circulation.

The Study Area and surrounding area provides suitable habitat for foraging and breeding badger, and usage of the Study Area corresponds with that which would be expected for this location.

No evidence of badger was recorded along the chosen Haul Route (See **Appendix IV** for further details); however, they are likely to be foraging and resting within the wider environs and this should be considered during pre-construction surveys of the site.

3.6.3. Otter

Several signs of otter have been recorded at the Legnahone Burn (**Plate 16**), which flows under a small concrete road bridge to the north-east of the Study Area (**Figure A10.1.23**). Here, the Legnahone Burn flows in a north-easterly direction away from the Study Area before joining the Dunnyboe Burn, a tributary of the Burn Dennett River which joins the River Foyle *c.*12.8 km north-west of the Study Area. It was noted that there is limited fencing along the agricultural fields which run adjacent to the Burn and that cattle have access to the river.

Survey results included field evidence of both fresh and old spraint, slides and a short trackway which were identified by the bridge over the Legnahone Burn. No lay-ups, couches or holts were identified anywhere with the Study Area or its immediate environs. As a result of the field evidence, a trip camera was deployed over the course of 10 consecutive nights (13 - 23 February 2019) under the road crossing location (in consultation with Dr Jon Lees, NIEA Wildlife Officer this deployment along a commuting route did not require a license from NIEA).

A single, adult otter was observed on camera commuting under the bridge during the trip camera deployment once on 23 February 2019. The camera also recorded Dipper (*Cinclus cinclus)*, which is referred to in the Ornithology Synopsis (**Technical Appendix A11.1** and **Chapter 11 of the ES: Ornithology**), and a single pass by the invasive mammal species American Mink (*Mustela vison*) as seen in **Plate 19**, **Section 3.7**.

No evidence of otter was recorded along the chosen Haul Route (See **Appendix IV** for further details); however, they are likely to be foraging and resting within the wider environs, particularly in and around watercourse crossing points, and this should be considered during pre-construction surveys of the site.

Plate 16: Road bridge over the Legnahone Burn

Plate 17: An adult otter pictured commuting under the bridge in February 2019

3.6.4.Red Squirrel

Red squirrel survey consisted of feeding signs (the remnant 'cores' of eaten pinecones) and breeding habitat (the presence of potential dreys visible in trees along the transect route). However, it should be noted that squirrel dreys can be especially difficult to distinguish from corvid nests in coniferous forestry, as the primary distinction is usually the presence of abundant leaf litter found in squirrel dreys which is typically absent in that of corvids. In coniferous forestry the lack of broad-leaf litter means that dreys can sometimes be more difficult to distinguish. Evidence has suggested that squirrels often utilise old corvid nests as a base for their dreys.

Therefore, drey survey results were deemed inconclusive, but it was considered that red squirrels were likely to be using both plantations for feeding and breeding purposes, due to the presence of several potential dreys and abundant eaten cores collected during each transect.

Following consultation with NIEA, red squirrel was also confirmed as being known to occur in the wider area; physical sightings within plantation woodlands (Pers. Comm., NIEA) and a roadkill red squirrel was recorded along the Ligford Road (B536) (within *c.* 2.8km of the Development) on 1 June 2021 by Woodrow Ecologists.

In conclusion, although red squirrel is known to exist within close proximity to the ESA, it is considered that the Development site itself is of limited suitability for red squirrel due to the restricted extent of woodland habitat within the Study Area (*c*. 0.5ha). There will be no direct loss of woodland habitat as a result of the Development and all potential dreys identified within the smaller woodland plantation (the only woodland that falls within the potential disturbance distance of the final Development layout) are located outside the necessary 50m maximum disturbance buffer following Nature Scot Guidance.[43]

Locations of all potential red squirrel dreys, maximum disturbance buffers and the survey transects in relation to the Development have been illustrated in **Figure A10.1.24** and **Figure A10.1.25**.

No evidence of Red Squirrel was recorded along the chosen Haul Route (See **Appendix IV** for further details); however, they are likely to be foraging and resting within the wider environs and this should be considered during pre-construction surveys of the site.

3.6.5.Irish Hare

The Irish hare (*Lepus timidus hibernicus*) is an NI Priority species due to the fact that it is a genetically distinct subspecies of mountain hare endemic to Ireland and given its largescale population declines (25% over the last 25 years)[44].

It is also offered limited protection under the Wildlife (Northern Ireland) Order 1985 (as amended), although it is also cited in this Order as a species that may be hunted in season. According to the Hare Preservation Trust *'Organised hare coursing has now been banned in Northern Ireland but remains widespread in the Republic of Ireland. Throughout Ireland, the Irish hare remains a quarry species and may be hunted with guns or dogs despite evidence of on-going long-term decline… survey data available suggests that hare numbers have declined in Northern Ireland by around 50% over a six-year period between 2004 and 2010.'*

This species is offered limited protection under the Games Acts and Schedule 6 of the Wildlife (Northern Ireland) Order 1985. It is listed in Annex V (a) of the EU Directive (92/43/EE) (Habitats Directive) and is an internationally important Irish Red Data Book species.

There was a total of five sightings of Irish hare during field surveys carried out in 2021 and 2022. It is considered that the acid grassland / flush mosaic (B1.2 / E2.1) and the Improved grassland (B4) within the Study Area provides suitable habitat for this species.

The relatively low level of occurrence at the Study Area, coupled with the high suitability of surrounding areas for this species, mean that Irish hare has not been included as an Important Ecological Receptor for the purposes of this impact assessment as it is considered that the proposed Development will not have any significant impacts on this species. It is considered likely that the Study Area supports a population of Irish hare that is of ***Local (Lower)*** importance when considered within the context of the wider environment around the Development.

No evidence of Irish Hare was recorded along the chosen Haul Route (See **Appendix IV** for further details); however, they are likely to be foraging and resting within the wider environs and this should be considered during pre-construction surveys of the site.

3.6.6.Fox

Signs of fox (*Vulpes vulpes*) were recorded within the Study Area during walkover surveys 2017 – 2021 and during habitat surveys undertaken from May – October 2021. On 31 May 2021 a large, active fox den was discovered with cubs observed playing outside. This den was located within an area of blanket bog surrounded by peat hags and situated on the edge of a large dry ditch. The fox den is located *c*. 228m outside the footprint of the Development. It is not considered that the Development will have any negative impact on this species.

[43] NatureScot (2020). *Standing Advice for Planning Consultations – Red Squirrels*. Available Online: Standing advice for planning consultations - Red Squirrels | NatureScot. Accessed: Jan 2021.
[44] Northern Ireland Priority Species (Habitats.org, 2023) http://www.habitas.org.uk/priority/species.asp?item=42516

Fox is a common and widespread species which inhabits a range of habitat types and is not specifically protected under wildlife legislation. The wider area provides an abundance of suitable habitat for fox, and taking these factors into account fox is not considered to be an Important Ecological Receptor of the Study Area.

3.6.7. Pine Marten

Pine marten (*Martes martes*) is protected under Annex V of the Habitats Directive and are listed as a Northern Ireland priority species. They are also protected under the Wildlife (N.I.) Order of 1985 (as amended). Pine marten are present in all counties in Northern Ireland.

Pine marten were not observed within the Study Area during any of the surveys or walkovers and there was no evidence found to confirm that they might occur within the ESA, or along the Haul Route.

Pine marten rely on mature expanses of coniferous woodland for successful breeding and foraging habitat. The Study Area itself contains limited woodland habitat which is restricted to a small woodland strip *c.*0.5 ha, however, as previously outlined, *c.* 50ha of mature coniferous plantation is located just outside the south-west corner of the Study Area, *c.* 230m from the nearest proposed Turbine (T2). This larger plantation (lying outside of the ESA to the south of the Development) was the only woodland habitat considered to retain suitable habitat to support a population of pine marten. It is therefore considered that the areas of optimal habitat for this species (which exist outside of 200m from the infrastructure) will be unaffected by the Development.

Pine marten is not considered to be an Important Ecological Receptor of the Study Area and has not been considered further within this impact assessment.

3.6.8. Amphibians

Common frog (*Rana temporaria)* is protected in the UK under the Wildlife and Countryside Act, 1981 and consideration was given to the presence of this species within the Study Area as there are several vegetated wet drains, ditches and fields that may be suitable for breeding common frogs and the wider area provides an abundance of suitable habitat for frog and frogs were noted regularly throughout the surveys of the ESA and suitable habitat for frogs exists along the Haul Route.

No specific surveys were considered to be required given the regularly observed presence of common frog and the lack of still ponds within the Haul Route and the ESA.

Due to the stable and abundant populations of this species throughout the Study Area coupled with the habitat availability throughout the area, this species is not considered further as an IER. However, to ensure compliance with legislation and in the interests of amphibian conservation, this species has been considered within the mitigation proposals, in order to minimise any impacts upon the local frog population and prevent unnecessary mortality during construction works.

There are no NPWS, NBDC or CEDaR records of smooth newt (*Lissotriton vulgaris*) within 2 km of the Study Area, and it is widely accepted in the literature that smooth newts on the island of Ireland tend to avoid boglands due to unsuitable pH related factors (Cooke & Frazer, 1976; Yalden, 1986; Denton, 1991, Marnell 1998) therefore due to the lack of suitable breeding sites for this particular species, newt surveys were not deemed to be necessary at this site.

While amphibians have not been assessed as an Important Ecological Feature within this report, the presence of live amphibians in the Study Area (namely frogs) is considered further within the mitigation proposals (**Section 5** of this EcIA). These aim to ensure that appropriate mitigation minimises any impacts upon the local amphibian population and reduces potential amphibian mortality during construction works.

Restoration and enhancement recommended within the Study Area include re-wetting of bog and are discussed in the **Draft HMEP (Technical Appendix A3.2).** This work is likely to increase habitats for use by amphibians as a result of a reduction in land drainage.

3.6.9. Reptiles

The common lizard occurs throughout Northern Ireland, but its population numbers are unknown. It is listed in Schedule 5, 6, and 7 of the Wildlife (N. Ireland) Order 1985 and listed in Annex III of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). It is considered that this species is likely to have declined in NI due to habitat loss and it is also listed as a Priority Species in NI, with the loss of upland heath considered to be a continuing threat[45].

A map of reptile refugia locations and illustrated survey results is provided in **Figure A10.1.26** and the results of the reptile surveys have been outlined in **Table A10.1.22** below.

Table A10.1.22: Schedule and results of reptile surveys conducted within the Study Area.

Survey Dates	Survey Times and Conditions	Results
19 April 2022 **26 April 2022** **5 May 2022** **13 May 2022**	Times: 10:00 to 13:00 Conditions: Dry, sunny and above 10˚C	On 19.04.22 a juvenile common lizard (*Zootoca vivipara*) was observed underneath a refugia mat within the survey area at H 42190 96359
29 September 2021 **5 October 2021** **12 October 2021** **27 October 2021**	Times: 10:00 to 14:00 Conditions: Dry, sunny and above 10˚C	On 27.10.21 a common lizard carcass was found within the survey area at H 43441 96941. This find was photographed (See Plate 18).  **Plate 18: Lizard carcass (likely predated, missing front leg and tail) found in the Study Area on 27.10.21**
17 September 2019 **26 September 2019** **1 October 2019**	Times: 10:00 to 13:00 Conditions: Dry, sunny and above 10˚C	On 01.10.2019 an adult common lizard was observed under a refugia mat at H 43783 96580.

[45]Northern Ireland Priority Species (Habitats.org, 2023) http://www.habitas.org.uk/priority/species.asp?item=5069

Given its level of protection and its presence across the Study Area (albeit low numbers recorded) common lizard has been included as an Important Ecological Receptor for the purposes of this impact assessment and is considered a feature of ***Local (Higher)*** importance.

Given the low recorded reptile numbers across the Study Area over three survey seasons, coupled with the extensive suitable habitat within the Study Area and outside the Development footprint, it is considered that populations of common lizard within the Study Area will not be negatively affected by the Development and that the limited population within the Study Area is of ***Local (Lower)*** significance. The Haul Route provides some suitable habitat for this species in the form of hedge embankments; however this is generally well managed for road safety purposes and farming. Furthermore, as discussed in Section 6, standard mitigation measures will aim to reduce the likelihood of reptile mortality and disturbance during construction works which will further reduce the minimal impact of the Development on this species. As such, this species has not been carried forward into the EIA, however, mitigation proposals within Section 6 of this EcIA ensure that it any potential for impacts will be avoided and reduced.

3.6.10. Invertebrates

The Study Area was noted to provide habitats which support a typical peatland invertebrate population including moth species such as emperor moth (*Saturnia pavonia*), fox moth (*Macrothylacia rubi*) and latticed heath (*Chiasmia clathrate*). The aforementioned species are characteristic of peatland habitats. Many pollinating insects similarly rely upon peatland habitats for the abundant cover of flowering heathers which provide nectar and pollen for a wide range of pollinators including the heath bumblebee (*Bombus jonellus*).

No suitable habitat for the protected marsh fritillary butterfly (*Euphydryas aurinia*) occurs within the Study Area. However, its larval food plant devil's-bit scabious (*Succisa pratensis)* was identified within the wider environs during a licensed marsh fritillary habitat condition assessment survey carried out on 25 September 2019 (Licence No. SBP/18/19; Licence No – 2423). This survey identified that in the areas where the foodplant was identified, these habitats were considered to support sub-optimal habitat in 2019, largely due to being heavily over-grazed by sheep with little or no evidence of DBS presence (sparse cover of DBS where it existed). Repeat habitat assessment confirmed that the baseline of the Study Area remained the same in later years.

There were no rare or protected invertebrates recorded in the Study Area or along the Haul Route during the surveys from 2017 to 2022. However, Northern Ireland priority species such as the large heath butterfly (*Coenonympha tullia*), the small heath butterfly (*Coenonympha pamphilus)* and the argent & sable moth (*Rheumaptera hastata*) were considered as part of the wider site impact assessment and measures to improve the habitats within the Study Area for these species have been considered within the Draft HMEP (Woodrow, 2023). Recent (2021), National Biodiversity Data Centre (NBDC) records of both small and large heath butterflies have been recorded *c.* 1km from the Study Area and it is considered likely that these species occur within the Study Area itself as they rely upon farmland and peatland habitats which support many of their larval food plants including hare's-tail cotton grass which is the main food plant of the large heath butterfly. The argent & sable moth is considered unlikely to occur within the Study Area due to the lack of its larval food plant bog myrtle (*Myrica gale*). There were no desk-study records of argent & sable moth within 2km of the Study Area.

3.6.11. Fish

As previously outlined in Section 4.1.2 in the aquatic ecology survey results, Salmon (*Salmo salar*) and brown trout (*Salmo trutta*) were fished using electric fishing equipment in September 2022. However, no species of interest were recorded as part of these surveys. There are no in-stream works proposed as part of the Haul Route Works (See **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)**).

3.7. Invasive Alien Species (IAS)

An adult American mink was recorded on one occasion on the trip camera deployment under the bridge at the Legnahone Burn in February 2019 (**Plate 19** below).

No Scheduled Invasive Alien Species (IAS) plants were recorded within the ESA and therefore no mitigation in relation to this is currently necessary within the Red Line Boundary. However, Scheduled invasive plant

species were recorded along the Haul Route (See **Appendix IV**) and best practice procedures in relation to IAS will be implemented across the ESA and the Haul Route Works.

Plate 19: An invasive American mink pictured commuting under the bridge in February 2019

3.8. Haul Route Survey Results

Trees were identified which require removal. Some of which have Low to High suitability to support roosting bats. In addition, hedgerows dominated by hawthorn along the route will be impacted, including hedgerow embankments. Some areas of gorse scrub and roadside grassland are also affected. No sensitive or botanically diverse habitats were recorded along the chosen route during the surveys.

Scheduled and non-scheduled invasive non-native plant species were also recorded in some affected passing bay locations. Full details regarding habitats affected by the proposed Haul Route are outlined in **Appendix IV.**

An additional Potential bat Roost Feature (PRF) survey was conducted on 23.03.2023 along an **off-road** section of proposed Haul Route (results of this survey are also provided in **Appendix IV**).

At this off-road location a number of mature trees and a derelict building were considered to have low to moderate potential to support roosting bats and as such were inspected under licence from NIEA (License No. BDL/4/23). The endoscope survey did not identify any roosting bats, while some knots and holes which were previously viewed from the ground, once surveyed using the endoscope, were discovered to be shallow or damp, and unsuitable for bats.

The derelict building will remain intact during turbine delivery, while a number of trees may require removal. The trees along the off-road section of the haul route were all deemed to have Negligible-Low suitability upon internal inspection.

While mammals are likely to forage within the area, there was no evidence of any resting sites recorded during the survey of the chosen Haul Route, or along the chosen off road section.

4. ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS

The Ecological Impact Assessment is undertaken in this section.

In relation to the impact assessment, the methodology is applied to 'Important Ecological Receptors' only, these refer to any feature which is assessed as being of Local (higher) importance.

Table A10.1. in **Section 5** provides a summary of all IERs identified.

Within the following sections, only those 'Important Ecological Receptors' identified as having the potential to be affected by each phase of the Development are discussed. An assessment of the potential impact of both the proposed Wind farm Development and the Haul Route Option is provided. The potential impact of the Haul Route Option applies to the Initial Decommissioning and Construction stage of the Development only when the turbine infrastructure is intended to be transported to the Development site.

In the absence of mitigation, the potential impacts during the **Construction Phase** encompass both direct impacts and indirect impacts, which are summarised as follows:

Potential sources of direct impacts during the Construction Phase

- Removal of the operational Owenreagh I and Owenreagh II turbines and existing substation during decommissioning.
- Removal of peat: The footprint of the works has been designed so as to avoid intact blanket bog. The design footprint requires the removal of areas of dry modified bog and highly modified upland heathland – these are NI Priority Habitat types (**See the ES Technical Appendix A10.4: Active Peat Assessment (APA); Technical Appendix A10.3: National Vegetation Classification (NVC) report; and Chapter 10 – Ecology** for further details);
- Cause further dewatering of peat: The proposal has the potential to result in dewatering by causing drainage to occur within an upland environment where peat substrates are affected (see **ES Chapter 8: Hydrology and Hydrogeology** for further details and **Technical Appendix A8.3: Indirect Effects on Groundwater within Peat, this is also discussed in ES Technical Appendix A10.4: Active Peat Assessment (APA)** and in **ES Technical Appendix A8.5: Outline Drainage Strategy**);
- Clearance of vegetation, soil and rock for access roads, hardstands and turbine bases;
- Removal of *c*. 100m in length of mature intact/non-intact / species rich / species poor hedgerow within the ESA;
- **Appendix IV** outlines the potential for tree and hedgerow removal as part of the proposed Haul Route;
- Loss and disturbance of habitat through the creation of temporary infrastructure such as welfare facilities, construction compounds, blade set-down areas and crane pads;
- Disturbance to habitat via the placement of excavated materials arising from infrastructure works; and,
- Compaction and disturbance to habitats caused by associated construction traffic.

Potential sources of indirect impacts during the Construction Phase

Potential sources of indirect impacts have been identified and addressed within the embedded mitigation outlined within **Technical Appendix A3.1: oDCEMP**.

The **Operational Phase** impacts of Wind farms are largely limited to those on aquatic ecology, birds and bat species during operation of the Development. There is considered to be minimal potential for negative impact on other faunal species or habitats following the completion of the construction phase.

Potential sources of direct impacts during the Operational Phase include:

- Impacts on fauna within adjacent watercourses from generation of silt-laden run-off due to bare ground and / or lack of balancing ponds and drainage associated with infrastructure; and,
- Collisions with turbines for aerial species e.g., notably bats *(Note: Birds are dealt with in **Chapter 11: Ornithology of the ES** accompanied by the **Technical Appendices: Ornithology Synopsis A11.1 and Collision Risk Model A11.2**).*
- Potential for impacts upon low numbers of pipistrelle bats commuting/foraging along a defunct hawthorn hedgerow adjacent to T13, which requires specific mitigation (see **Section 6.2.1.4**).

Potential sources of indirect impacts during the Operational Phase

Indirect Operational Phase impacts of Wind farms are largely limited to impacts on nearby watercourses from continued generation of silt-laden run-off due to bare ground and / or lack of balancing ponds and drainage associated with infrastructure. This can potentially result in low level impacts on downstream aquatic habitats and species. In addition, operation wind farms can generate noise and dust disturbance which may affect wildlife through adverse impacts on habitats and species in the vicinity of the Development.

4.1. The 'Do-Nothing' Impact

The Study Area has been described in terms of flora and fauna in the paragraphs above. It encompasses upland blanket bog and farmland habitat that is currently managed through grazing practices as well as the existing Wind farm sites (Owenreagh I and Owenreagh II) and the associated site infrastructure. The area is considered likely to remain in agricultural use in the future with both cattle and sheep grazing carried out here.

In the 'Do-Nothing' scenario, the Study Area would remain as an operational wind farm. The existing turbines are towards their operational life expectancy and are likely to require maintenance to ensure that they are functioning appropriately. The consents are in perpetuity, and as a result the owner has planning consent to maintain and replace the turbines like for like.

The habitats on site are notably degrading (see Draft HMEP for further information) due to existing land drainage, dewatering from significant historic peat cutting, grazing and poaching of ground from cattle, and occasional burning of heath in the area (although the latter is not permitted in the area, it is still occasionally occurring here). In the 'Do-Nothing' scenario, these adverse impacts are likely to continue at current levels. In addition, it is apparent that illegal shooting occasionally occurs at this site without the permission of the landowner – this is likely to continue to impact upon local wildlife through potential killing, injuring and disturbance of mammals and birds.

Intact blanket bog habitat (E1.6.1) is considered to be the most ecologically valuable habitat type within the Study Area *(along with rivers and streams which are an NI Priority Habitat type)*; however, the majority of the Study Area has been subject to a range of historic management practices and land-use changes such as burning, drainage, turf cutting and/or grazing which has resulted in widespread habitat fragmentation and degradation. Fragments of relatively species-rich blanket bog habitat, considered to be of good ecological value remain and thus qualify as the Annex I habitat – *"7130 Blanket bogs".* These areas are likely to degrade further over time due to land management practices in addition to existing dewatering effects from land drainage already existing in the Study Area.

During the surveys of the Study Area which were conducted over several years, it was notable that significant surface water drainage and erosion is occurring in the Study Area. This is strongly influenced by past land management practices (including historic peat cutting) which have resulted in undermined hydrological units across the entire Study Area (further information is provided in **ES Chapter 8: Hydrology and Hydrogeology** and **ES Technical Appendix A8.5: Outline Drainage Strategy**). Features such as the Legnahone Burn notably had obvious iron rich pollutants which were particularly visible during low water conditions when they were allowed to accumulate. This can be typical within a peatland environment where naturally occurring, organic acids contribute significantly to water acidity in peatland catchments. However, this can be exacerbated by drainage which causes drying of the soil and which can increase oxidation of organic matter and generate carboxylate anions. In addition, peatland drainage can result in preferential flows being further enhanced, leading to faster transport of pollutants to streams. Degraded peatlands negatively impact water quality, and release nitrous oxide and CO_2 to the atmosphere, sediment and nutrients to water courses, and lead to a reduction in biodiversity (Pschenyckyj *et al.* 2021).

It is noted in recent research in this area (such as Pschenyckyj *et al.* 2021) that *"Studies show concentrations of nitrogen, phosphorus, base cations, heavy metals, dissolved organic carbon (DOC) and particulate organic carbon (POC) are increased with drainage, although this depends on site-specific characteristics and management. However, rewetting results in long term decreases of inorganic nitrogen, base cations, suspended solids and DOC, as well as increasing biodiversity and the carbon sequestration potential. In addition, degraded peatlands may have significantly higher nitrous oxide emissions (a greenhouse gas), whilst rewetted organic soils have decreased emissions."*

In the 'Do-Nothing' scenario the existing peatlands within the ESA will continue to dry out over time due to land management practices and significant cut drains existing within the Study Area, resulting in further shrinkage and continued degrading of peatland habitat at this site. Subsidence of peat and cracking increases the slope of the bog surface, and this increases the discharge of water. Dewatering eventually destroys the acrotelm, the upper layer of the blanket bog which contains the *Sphagnum* moss assemblage (and constitutes the peat forming community). Consequently, the bog loses its peat forming capacity over time. With continued loss of water, the vegetation changes from a *Sphagnum* dominated community to a vegetation type dominated by dryer bog species such as heather species. This can be seen to be occurring across much of the Study Area within areas of 'Dry Modified Bog (E1.8)', where tall leggy heathers are present on dryer hags of peat, with little or no *Sphagnum* moss and regular signs of 'bleaching' and drying out within remnant moss hummocks.

4.2. Potential Impacts on Designated Sites

As discussed in **Section 3.2**, 2 internationally designated sites and four nationally designated sites have been found to lie within the potential Zone of Influence of the proposal and have been listed below. However only those highlighted are considered to have potential for significant effects through S-P-R hydrological linkages within the 10 km hydrological assessment buffer from the Study Area (as described in **Chapter 8: Hydrology and Hydrogeology**).

- River Foyle and Tributaries SAC;
- River Finn SAC;
- **Lisnaragh ASSI;**
- **Silverbrook Wood ASSI;**
- River Foyle ASSI; and
- Corbylin Woods ASSI.

It is concluded that best practice embedded construction measures outlined in **Technical Appendix A3.1: oDCEMP** will be in place to limit erosion and the release of sediment to surface watercourses and waterbodies and that this will provide sufficient embedded mitigation to prevent water quality deterioration and impact upon these designated sites. **Therefore, effects on designated sites, which are considered to be of High sensitivity, have the potential to be of Negligible magnitude of change and of Negligible significance. This is not significant in terms of the EIA Regulations.**

4.2.1. Initial Decommissioning and Construction Phase

4.2.1.1. Direct Impacts

There are no designated sites which lie directly within the Study Area or in close proximity of the works. The proposed haul route will exist largely within made ground (existing roadways) and where any 'pinch points' occur, these lie well outside of designated sites (Woodrow, 2023). Subsequently, there will be no direct impacts upon any designated sites as a result of the decommissioning and/or construction of the proposed Development.

Direct impacts upon designated sites as a result of the decommissioning and construction phase of the Development ***will not occur.***

4.2.2. Operational Phase

4.2.2.1. Direct Impacts

The operation of the proposed wind farm is not considered to have any potential for direct impacts upon designated sites given that these sites lie well outside of the Study Area (*c*. 5.5 km by direct distance to closest site and *c.* 13 km via a hydrological connection).

Direct impacts upon designated sites as a result of the operation phase of the Development ***will not occur.***

4.2.2.2. Indirect Impacts

Post-construction, during operation, there is the potential for continued run-off of silt-laden water if disturbed ground in the vicinity of watercourses is not re-vegetated, and if there are unmitigated direct surface water connections between worked areas, hard surfaces (e.g. access roads, hardstands and parking areas) and the adjacent watercourses, which would result in an ongoing impact to the local aquatic fauna, and potentially affect downstream designated sites in the event that a large amount of pollution is released that could reach these areas (e.g. through a significant chemical/oil/fuel spillage).

In the absence of mitigation, the potential for such impacts to occur are considered likely to be both ***Temporary*** and ***Significant***.

4.3. Potential Impacts on Watercourses and Associated Downstream Ecology

4.3.1.Initial Decommissioning and Construction Phase

4.3.1.1. Direct Impacts

The Development crosses one stretch of stream in the east of the Study Area and comes in close proximity to two streams located in the west. Moreover, three first-order streams rise on the south side of Owenreagh hill, just outside the Study Area Boundary. Despite this, there is considered to be limited potential for direct impacts on any aquatic ecological receptors within the Study Area. While the Foyle is considered to be an important catchment for salmonids, there were no juvenile salmon or brown trout recorded in any of the watercourses during the electric fishing surveys conducted in 2022.

Salmonid species require very high levels of water quality in order to complete their life cycles, and the physico-chemical parameters of September 2022 suggest that these streams do not meet salmonid requirements[46], despite having obtained relatively high scores as part of biological assessments performed the previous year. While physico-chemical analyses only typically provide a short-term indication of environmental conditions around the time of sampling, the high BOD_5 levels observed, implies there was a likely deterioration in water quality between the time of macroinvertebrate surveying in July 2021 and water quality analysis/electric fishing in September 2022. This suggests that the streams within the Study Area may be already impacted.

However, as these streams form part of larger river networks (i.e., Glenmoran, Burn Dennet and Douglas Burn Rivers), a further deterioration in water quality may impede efforts of ensuring that hydrologically connected waterbodies reach or maintain at least “good status”, and fulfil targets set out in the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017. Moreover, downstream ecological receptors may experience indirect impacts as a result of a deterioration in water quality, such as reduced prey availability.

As such, in the absence of appropriate and implemented mitigation there is considered to be the potential for indirect impacts on water quality and ecological receptors that are ***significant* at *local***, **and potentially *regional* level** depending on the severity of a polluting event.

There are no in-stream works proposed as part of the Haul Route Works (See **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)**).

4.3.1.2. Indirect Impacts

4.3.1.2.1. Atlantic salmon

Potential indirect impacts on downstream ecological receptors such as salmonids include the release of suspended solids or hydrocarbons into the watercourse to the south of the Study Area during the construction phase, either directly (spillage of contaminant into watercourses, or siltation of watercourses through disturbance, vegetation clearance and/or drainage activities clearance) or indirectly (seepage of pollutants into groundwater). Salmonid species require very high levels of water quality in order to complete their life cycles and increases in contaminated or silt-laden water entering the watercourse to the south of the Study Area are likely to impact upon local fish fauna. Such impacts would be short-term in character but may nonetheless persist beyond the term of construction (see Potential Impacts of the Operational Phase, **Section 6.3.2**).

[46] S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988.

One water crossing is contained within the eastern end of the Study Area. This is where the Legnahone Burn River (Segment Code: GBNI0102302) is culverted beneath Glenmornan Road. As such, proposed works within this area provide some potential for water quality impacts on the Legnahone Burn – discussed within **Technical Appendix A3.1: oDCEMP.**

There are no in-stream works proposed as part of the Haul Route Works (See **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)**).

4.3.1.2.2. Freshwater pearl mussel

A decline of freshwater pearl mussel has been strongly linked to increased suspension of sediments in rivers and its settlement onto the riverbed. Each time siltation of gravel occurs the juvenile mussels below the age of 5 are killed (Buddensiek, 2001). Direct ingestion of silt by adult mussels can also lead to rapid death, as can continuous turbidity over several days (particularly from fine peat) (Buddensiek *et al.,* 1993, Buddensiek, 1995). Due to the lack of direct hydrological connection, distance of the closest records to the Site Boundary, and the upstream location of the Owenkillew river extant populations these impacts can be ruled out. However, during the glochidia stage freshwater pearl mussels rely on salmonid fish as a host (Bauer and Vogel 1987). These hosts are mobile and therefore within the ZoI. Any adverse effects on host fish (see 6.3.1.2.1 Atlantic salmon) also further the decline of freshwater pearl mussel populations.

In summary, it is considered that, although unlikely to occur given the results of the electrofishing surveys, there is some limited potential for water quality impacts resulting from the construction and operational stages of the Development on host fish of freshwater pearl mussel. The potential impacts are those largely related to sediment release and pollution vents. Such issues can be controlled by standard mitigation practices well-established as effective in these circumstances.

It is concluded that best practice embedded construction measures outlined in **Technical Appendix A3.1: oDCEMP** will be in place to limit erosion and the release of sediment to surface watercourses and waterbodies and that this will provide sufficient embedded mitigation to prevent water quality deterioration and any impact upon the associated downstream ecology.

There are no in-stream works proposed as part of the Haul Route Works (See **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)**).

Therefore, effects on watercourses and the associated downstream ecology, which are considered to be of High sensitivity, have the potential to be of Negligible magnitude of change and of Negligible significance. This is not significant in terms of the EIA Regulations.

Operational Phase

As stated above, there is limited potential for direct impacts on water quality within the Study Area drainage. There is one watercourse crossing within the Study Area, at its eastern end, where the Legnahone Burn River (Segment Code: GBNI0102302) is culverted beneath Glenmornan Road. Other than this, no significant watercourse occurs within or immediately adjacent to the proposed infrastructure, other than a network of small, vegetated drainage ditches. The main direct threats to watercourses during operation are sedimentation, through overland flow. It is not considered that the Development is likely to materially increase the potential for overland flow into connecting watercourses and, following revegetation of the Study Area, there will be no increase in suspended solids being generated by the works. Therefore, the potential ongoing impact of the Development on watercourses and downstream ecology is considered to be ***Not Significant***. It is considered that baseline watercourse conditions in the environs of the proposed Development are likely to be improved through habitat restoration practices and mitigatory actions being recommended within the draft HEMP.

4.4. Potential Impacts on Habitats

Due to the strongly mosaic nature of the habitats within the Study Area and the degradation of peatland habitats here, it was not possible to definitively calculate habitat areas per habitat classification. Instead, these areas are classified by their primary habitat mosaics as per upland survey guidance. Estimates of the affected primary habitat mosaics (area in hectares) are provided below. This method has taken a

precautionary approach, and due to its complexity, the 'peatland habitat loss' within the survey area should be considered a worst-case scenario (illustrated on **Figures A10.1.17** and **A10.1.18**).

Full details on the potential impacts upon hydrology and soils are provided within **Chapter 8: Hydrology and Hydrogeology** and **Chapter 9: Geology and Peat** respectively. A detailed assessment of the potential for any impacts on Active Peat has been undertaken and can be seen in **Technical Appendix A10.4 Active Peat Assessment.**

The habitat loss assessment has been considered in terms of the potential for both direct and indirect effects as a result of the Development. It should be noted that the estimated total loss of individual habitats could potentially include some overlap given that these habitats occur within complex mosaics. Subsequently, best estimates of habitat area loss are provided within this assessment, taking the precautionary approach.

Across much of the existing Owenreagh I and II wind farm sites, acid grassland has formed on spoil heaps either side of the existing hardstanding and access tracks. Some of the habitat mosaics include areas of naturally occurring, non-Annex acid grassland and poor flush, however the majority of the Study Area supports a highly modified 'inactive' derivative of Blanket Bog that has been classified as 'Dry Modified Bog' and is not considered to be of Annex I quality. There are areas where erosion is evident due to run-off and exposure. Some of this is likely to be naturally occurring, and some is more likely to be associated with existing land management practices (drainage, peat cutting, burning and grazing) and potentially the aftereffects of the existing infrastructure being constructed within the Study Area. It is difficult to be certain of the cause and effect of these impacts given the time period since the existing wind farm was first constructed and the significant land management and habitat degradation which has occurred in the area over the years.

Table 6.14 outlines the habitat features associated with the infrastructure and includes an estimate area measurement of habitat types directly and indirectly impacted on by the footprint of the works.

The term 'Footprint' is inclusive of:

- Construction Compounds;
- Site Access Tracks;
- Crane Hardstanding's; and
- Substation.

Table A10.1.23 outlines the habitat features associated with the haul route and includes an estimate area measurement of habitat types directly and indirectly impacted on by the 'pinch points' for this proposed route.

Details in relation to the potential for infrastructure to be micro-sited post consent are detailed within **Chapter 3 - Development Description** of the ES.
Habitat impacts in relation to the Haul Route are outlined in **Appendix IV of this EcIA.**

The potential impacts from the various works along the haul route, as described in the **Appendix IV**, are not significant in terms of the EIA Regulations, either individually, together, or when considered on top of a cumulative baseline that includes potential effects from other developments.

This is because:

- The works are small-scale and would have only localised impacts;
- The works do not have the potential to affect any designated sites;
- The works are (except in one case) along existing roads and comprise minor amendments to the width and design of this road in certain places only;
- The works are not close to other development that is proposed but not yet consented; and,
- Typical mitigation for such impacts has been committed in Appendix IV, which would be effective in reducing any effects to a negligible level.

As a result, and as described in **ES Technical Appendix A2.3**, the potential for ecological impacts associated with the haul route have been scoped out of the EIA.

Table A10.1.23: Habitat features estimated potential impact area calculation (ha / m)

(Habitats that are identified as being Important Ecological Receptors for the purposes of this impact assessment are highlighted in green)

JNCC Habitat Description	NVC	Important Ecological Receptor	Total area directly affected (ha)	Total potential area indirectly affected (ha)	Total max potential area affected (ha)	Total area of habitat within the Study Area (ha)
Intact Blanket Bog (E1.6.1)	M19	Y	0.0	0.017	0.017	22.467
Recovering Blanket Bog (E1.6.1)- Modified in past	M19	Y	0.0022	0.011	0.132	188.119
Dry Modified Bog (E1.8)	M19b/M20b	Y	10.783	3.908	14.691	208.479
Wet Modified Bog (E1.7) - very degraded	M20a	Y	0.970	0.580	1.478	
Acid Grassland / Flush (B1.2 / E2.1)	U2b/M6c	N	5.304	1.952	7.256	19.356
Species-Poor Flush and Spring (E2.1)	M6c	Y	3.063	1.041	4.104	88.445
Improved Grassland / Poor Semi-Improved Grassland Mosaic (B4 / B2.2)	MG10	N	1.457	0.457	1.914	34.398
Hedgerows and Scrub (J2.2 / A2.2)		Y	100 m		100 m	24.763
Dry Ditch / Poor Flush (J2.6 / E2.1)	-	N	0.211	100 m	0.265	5.702
Coniferous Plantation (A1.2.2)	-	N	-	0.054	-	4.580

*Note: replacement planting should aim to comply with regional and national policy for biodiversity – such as within PPS2 (2013): *"to contribute to rural renewal and urban regeneration by ensuring developments take account of the role and value of biodiversity in supporting economic diversification and contributing to a high quality environment and to protect and enhance biodiversity, geodiversity and the environment"* and PPS21 (2010): *"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."*[47]

4.4.1. Initial Decommissioning and Construction Phase

4.4.1.1. Peatland Habitats (Blanket Bog, Dry Modified Bog and Wet Modified Bog)

4.4.1.1.1. Direct Impacts

The National Vegetation Classification (NVC) study that was carried out on peatland habitats within the Study Area has been provided in **Technical Appendix A10.3: National Vegetation Classification.**

Although avoidance of peat has been a key consideration during the design process of the Development (see **Technical Appendix A10.4: Active Peat Assessment**), it is acknowledged that due to the upland nature of the Study Area, the construction phase of the Development is expected to result in the **direct loss** of *c.* 11.75 ha of peatland habitat. As described in **Section 4.2** (and **Technical Appendix A3.2 draft HMEP**) the majority of this peatland habitat is currently considered to be in a degraded and heavily modified state owing to practices of historic land use change including agricultural improvement, burning, turf cutting, drainage, and/or grazing.

[47] Further information is available at: Derry City And Strabane District Council Local development plan (ldp) 2032 evidence base paper evb 21 Natural environment https://www.derrystrabane.com/getmedia/7e71857f-f225-4a13-b82a-0c8880b14a6c/53-DS-233-EVB-21-Natural-Environment.pdf (Accessed January 2023)

As illustrated in **Table 10.1.23**, a large proportion of the peatland habitat that will be directly impacted by the Development during construction has been classified as Dry Modified Bog (E1.8) – 10.783 ha and Wet Modified Bog (E1.7) 0.970 ha, respectively. These habitats are derived from blanket bog but are now considered to be in a state of such modification that they no longer retain the potential for 'Active Peat Formation'. As discussed in **Section 1.1.** for the purposes of this Assessment 'Active Peat' is a term used for Blanket bog or heath which is considered to be capable of currently actively forming peat. It generally equates to blanket bog, which is in favourable condition, as per the Priority Habitat Guide – Blanket Bog (DAERA, 2020).

Areas of Intact Blanket Bog (E1.6.1) or Recovering Blanket Bog, have been identified as Important Ecological Receptors for the purpose of this assessment. These habitats are NI priority habitats and support a wide variety of flowering plant species. They are also likely to support a good diversity of invertebrates as well as providing a foraging, nesting and sheltering habitat for a range birds, amphibians, reptiles and mammals, a number of which are NI Priority Species (see **Section 4.5**). Subsequently, these habitat types represent features of **National** and **Regional level importance** (respectively) at the Study Area (See Section 5) – and direct impacts upon these habitats has been avoided within the design.

Careful consideration during the design phase of the Wind farm (discussed further in **Section 1.4 – embedded mitigation**), has minimised the loss of any peatland habitat that may contain pockets of 'Active Peat' including loss within any blanket bog habitat that has been classified as 'Intact' or with 'Potential for Recovery' through natural regeneration. This consideration has minimised the **direct** loss of active peat habitats to nil underneath the construction footprint, including earthworks.

Despite the highly modified and typically species-poor characteristics of the vast majority of peatland habitat within the Study Area, they are still considered to be of high ecological value and likely support a high number of associated peatland flora and fauna of local value. These habitats are Northern Ireland priority habitats and continue to support NI Priority Species (as outlined in **Section 4.3**).

The heather-dominated peatland areas (Dry Modified Bog (E1.8) and Wet Modified Bog (E1.7)) continue to provide foraging habitat for Irish hare, badger and birds, and nesting habitat for ground-nesting birds such as meadow pipit, red grouse and skylark. Therefore, these habitat types have been identified as Important Ecological Receptors of ***Local (Higher) importance*** for the purposes of this assessment. It is considered that without mitigation there is the potential for ***significant impacts*** upon peatland at the Development, and their associated local ecology.

From the outset, the Development design has aimed to avoid areas of peat as far as possible, and particularly habitat considered to be 'Active Peat'. Subsequently, the total area of peatland habitat likely to be affected (**directly**) within the ESA is *c.* 11.75 ha within a proposed Development footprint of 22.334 ha, and none of the directly affected areas are considered to support active peat.

Overall, both **direct and indirect** effects on peatland are estimated to amount to *c.* 16 ha.

As outlined in **Section 1.2.1.2,** due cognisance has been given to Planning Policy Statement 2, under which Policy NH5 states 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"*.

The outcome of leaving the site as it currently stands is provided in **Section '4.1 – The 'Do-Nothing' Impact assessment'**. Within the design of the Development, all efforts have been made to avoid priority habitats and species within the design of the Development. Where this is not possible, appropriate mitigation has been designed and is discussed further in **Section 7** and within the ES and the relevant Technical Appendices.

4.4.1.1.2. Indirect Impacts

The wind farm infrastructure and associated drainage ditches may disrupt local shallow groundwater levels and therefore may indirectly impact on groundwater flow/ supply to soils supporting Active Peat at the Development and risk their dewatering. This impact was calculated using the most appropriate analytical

solutions for the site conditions, See **Technical Appendix A8.3: Note on Indirect Effects on Dewatering.** Drainage design is discussed further in **Technical Appendix A8.5: Outline Drainage Strategy.**

4.4.1.2. Grassland Habitats (Improved/Semi-Improved Grassland, Acid Grassland and Poor Flush)

4.4.1.2.1. Direct Impacts

Improved and Semi-improved Agricultural Grassland (B4 / B2.2)

The majority of these habitat types are located towards the western side of the Study Area, with some scattered fields located to the north of Glenmornan Road (T11 location) and within the vicinity of the proposed T13 at the abandoned farmstead. There are also patches of grassland recorded along the proposed haul route. These grassland habitats contain a species-poor assemblage dominated by agricultural graminoids. As stated in **Table 10.1.23**, the proposed works will result in the loss of approximately 1.46 ha of these habitats underneath the construction footprint and a loss of approximately 0.80 ha of these habitats under the expected haul route option. These species-poor grassland habitats are highly modified examples that are of low ecological value and therefore, have not been identified as Important Ecological Receptors for the purposes of this assessment. Given their low biodiversity (See **Section 3.5.8**) and the relative abundance of similar of habitats within the environs of the ESA, the impacts upon improved and species-poor semi-improved grasslands as a result of the Development are considered to be ***Not Significant*** within the context of this assessment.

Acid Grassland and Species-poor Flush and Spring (B1.2 / E2.1)

Several proposed Turbines are located within areas of acid grassland / species-poor flush mosaic; T5, T8, T4 and T1 are the main examples. As such, the proposed works will result in the direct loss of *c.* 8.37 ha of these habitats during construction. These habitats are dominated by rushes, mainly soft-rush (*Juncus effusus*) with typically abundant Heath bedstraw (*Galium saxatile*), some wavy-haired grass (*Deschampsia flexuosa*) and a reduced bryophyte layer dominated by species such as little shaggy-moss (*Rhytidiadelphus loreus*), glittering wood-moss (*Hylocomiun splendens*) and some flat-topped bog-moss (*Sphagnum fallax*). Botanically, these are considered relatively species-poor habitats and do not fall into any Annex I habitat classification. It was evident that several of these areas are periodically grazed by cattle or sheep resulting in some poaching.

While these habitats may be botanically poor, it is likely that they are also used by feeding snipe in winter, as this species was recorded on several occasions in the Study Area during winter surveys. Similarly, these grassland habitats provide foraging habitat for wildlife such as Irish hare, badger and countryside birds, as well as a potential nesting habitat for ground-nesting birds such as meadow pipit and skylark (see ES **Chapter 11: Ornithology** for further information). For these reasons this habitat is considered to be of ***Local (Higher)*** conservation importance and without mitigation the loss of this habitat could have impacts upon the local ecology which are considered to be ***Significant.***

4.4.1.2.2. Indirect Impacts

It is similarly considered that the Acid Grassland and Poor-Flush Habitats within the Study Area could be indirectly affected during the Construction Phase of the Development by the dewatering as outlined in **Section 6.4.1.2.** These habitats are often very wet and particularly in the case of Poor-Flush habitat, they are dependent upon continued water movement. However, these habitats are grazed, improved, generally species-poor and at best, provide minimal foraging and nesting habitat for birds. It is considered that this impact is ***Not Significant*** even in the absence of mitigation given that water flow through these areas will not be wholly impeded by the proposed Development and the Indirect Impacts of the Development are considered not to *c.* 2.993 ha within Acid Grassland and Poor-Flush Habitats in the Study Area.

4.4.1.3. Boundary Features (Hedgerows with Trees and Scrub)

The construction phase of the Development is expected to result in the loss of a minimal section of boundary features. As described in preceding sections, the extent of the boundary habitats within the Study Area are focused within the vicinity of proposed T13 in the vicinity of a derelict farmstead. In addition, **Appendix IV** outlines areas of trees**,** scrub and linear features such as hedgerows which are likely to be impacted by the Haul Route. However, occasional isolated scrubby outcrops (A2.2) of willow (*Salix* spp.) or gorse (*Ulex*

europaeus) were similarly noted along some fence lines and boundaries within the Study Area. The total area of scrub and hedgerow (with trees) habitat identified within the Study Area, amounts to *c.* 5.702 ha. The hedgerows within the vicinity of T13 are typically species poor hawthorn (*Crataegus monogyna*) hedgerow (J2.2) on low earth banks, containing varying quantities of mature and semi-mature trees, including horse chestnut (*Aesculus hippocastanum*), beech (*Fagus sylvatica*) holly (*Ilex aquifolium*) and sycamore (*Acer pseudoplatanus*).

Along the Haul route, species recorded largely comprised of non-native boundary planting and included; ash, sycamore and horse chestnut along with occasional conifer trees. Native species recorded included holly and rowan, with small amounts of birch and willow in places. There were several residential areas which supported cherry laurel hedgerows (this is an invasive species).

Hedgerows and trees along the Haul Route were notably lacking in potential bat roost features during the PRF survey due to their immaturity and/or management.

Hedgerows and treelines support a wide range of invertebrate, bird and small mammal species, as well as providing foraging habitat for birds, bats and larger mammals. They also function as wildlife corridors, providing a continuum of habitat along which fauna may travel between different foraging and sheltering areas. These habitats support a good diversity of invertebrates, as well as providing a food source and shelter for small mammals and seed and berry eating birds such as finches. As such, they are considered to represent features of ***Local importance (Higher Value)*** in the Study Area. Consequently, they are likely to be of local conservation value, albeit at this site, they are notably limited in their value by the exposed nature of the landscape and heavy management and grazing within the Study Area[48]. Hedgerows are also listed as a Priority Habitat in Northern Ireland[49].

The Development is likely to result in the loss of *c.* 100m of species-poor hawthorn hedgerow (J2.2) habitat in the vicinity of T13 and loss of trees, scrub and linear features such as hedgerows are outlined in **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)** and **Appendix IV of this EcIA.**

The area of linear features and scrub to be removed within the Study Area has been kept to a minimum. These habitats enrich the biodiversity and provide valuable feeding, breeding and commuting habitat for local species in an area that is otherwise largely exposed and agricultural in character. Overall, it is considered that, without mitigation, the Development has the potential to result in a ***Significant*** effect at the ***Local* (Higher)** scale upon boundary features and scrub habitat.

4.4.1.4. Other Habitats (Dry Ditches and Coniferous Plantation)

Several Dry Ditches (J2.6) and a strip of coniferous woodland plantation (A1.2.2) *c.* 0.482 ha, were identified within the Study Area. The woodland habitat provides valuable foraging and sheltering habitat within a relatively exposed landscape. However, this coniferous plantation habitat is common within the wider site environs, with a large area *c.* 50 ha located just outside the Site Boundary to the south-west, and it has been deemed that this small, isolated strip is not a significant ecological feature within the Study Area. **No woodland habitat will be lost as a result of the Development.**

A total area *c.* 4.58 ha of Dry Ditch (J2.6) habitat was noted across the ESA, these areas include several existing farm access tracks that are now presenting as revegetated dry ditches and gullies within the wider peatland environment. The location of these habitats is indicated on the habitat map in **Figure A10.1.7.** An approximate area of 0.21ha of these habitats falls within the direct footprint of the Development. The direct impacts of the construction phase of the Development upon these habitats are considered ***Not Significant***.

The proposed Haul Route largely follows the existing roads, and their verges support stretches of Improved Grassland (B4) and Amenity grassland (J1.2). No areas corresponding to Annex I habitat were identified along the Haul Route. Any impacts upon grasslands along the Haul Route are thus considered to be ***Not Significant*** even in the absence of mitigation.

[48] Ideally to enhance biodiversity hedgerows should be maintained to at least 2m wide, trimmed only every three years on one side (which is alternated during each trim), allowing a thick base and maintaining occasional mature trees.
[49] NI Priority Habitats https://www.daera-ni.gov.uk/sites/default/files/publications/doe/ni_priority_habitats_april__10.pdf

4.4.2.Operational Phase

There is considered to be **no potential for any direct impacts** on the terrestrial habitats recorded within the Study Area resulting from the Operational Phase of the Development proposal as access to the infrastructure will occur via defined tracks, the installation of which have been assessed as part of the construction phase. However, there is potential for indirect dewatering action during the Operational Phase of the wind farm as outlined above in 4.4.1.1.2.

Operational Phase (no active pumping/dewatering, applies to all infrastructure):

- The infrastructure will feature adjacent drainage ditches, to allow for surface water to flow from areas of hardstanding and from upslope areas as part of the surface water drainage design. The drains are assumed to have a maximum depth of 1 m.
- In areas where the groundwater level lies above the bottom of the ditch, there will be a dewatering action via any surface water drainage and the groundwater level will be drawn down. The Zone of Influence on the drawdown is calculated as a maximum of **3 m** from the drain.
- Other literature evidence (Boelter 1972[50]) outlines evidence that water table drawdown in well humified peatlands can extend as far as **5 m** from the edge of the drain. Based on consideration of both a theoretical approach outlined above, and this site-based evidence, a buffer of 5 m is recommended as a conservative approach.

4.5. Potential Impacts on Protected Species

4.5.1.Bats

4.5.1.1. Initial Decommissioning and Construction Phase

4.5.1.1.1. Direct Impacts

Habitat loss

Potential direct impacts on bats resulting from wind farm construction include vegetation removal, resulting in a loss of potential roost sites in mature trees / stone structures. None of the turbine installations require removal of any woodland habitat or other suitable roosting locations, nor will there be removal of hedgerow / treeline / other linear habitat suitable for foraging and commuting bats, in order to facilitate turbine installation. Therefore, in terms of loss of bat-suitable habitat within the Study Area, there is no potential for direct impacts.

Habitats affected along the Haul Route are outlined in **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)** and **Appendix IV of this EcIA.**

The majority of habitat affected by removal is modified blanket bog, acid grassland and/or improved grassland, within more open environments. The results of the bat surveys have clearly illustrated how bats in the Study Area tend to favour linear and edge habitats for commuting and foraging. In addition, the activity levels for bats within this open upland environment has been monitored across the seasons for several years and when comparing it to other wind farm sites in Ireland and or the UK, the assessment tools used indicate that the activity here is Low overall.

Given that no bat roosts are proposed to be removed for the Development, and as a result of the overall Low levels of bat activity at this site and the design of the layout which has aimed to avoid the areas where bats are shown to be more active (albeit at Low levels), there is considered to be ***no potential for direct impacts*** on roosting bats during the construction phase, and therefore this impact is considered to be ***Not Significant*** even in the absence of mitigation. The potential for indirect impacts upon bats is considered further below.

4.5.1.1.2. Indirect Impacts

Light disturbance

Disturbance of roosting bats and disturbance of foraging bats though lighting impacts was considered.

In general, working hours for the decommissioning and construction phase will be from 07:00 to 19:00 throughout the week, with reduced working hours at weekends. It should be noted that during the turbine erection phase, operations may proceed around the clock to ensure that lifting operations are completed safely. As such, localised, temporary lighting is likely to be needed to illuminate areas being worked on during hours of darkness. Generally, this will be late in the day during wintertime, but only when and where

[50] Boelter (1972). Water Table Drawdown around an open ditch in organic soils. Journal of Hydrology, 15, (1972) 329-340.

personnel are present and working in the area. In addition, it is possible that out-of-hours working may be required for turbine erection – this will be a very limited number of days and is much less likely to occur in darkness. Subsequently, construction related lighting, will be very limited in duration, highly localised and is unlikely to be required during the active season for bats.

In addition, the species utilising this site mostly – Leisler's bat, soprano pipistrelle and common pipistrelle – are generally less sensitive to light pollution (BCT, 2018[51], Mathews, *et al.* 2015). The lesser recorded, brown long-eared bats and *Myotis* species which do occur in some parts of the Study Area, are a more light-sensitive species. However, given that the proposed Development is situated within an open, exposed environment, with low levels of bat activity being recorded here, the potential for impacts as a result of light disturbance is considered to be ***Unlikely*** and ***Not Significant*** even in the absence of mitigation.

Roost disturbance

The Leisler's tree roost is located >300m from the nearest turbine (during the design phase, the proposed turbine near this roost was dropped to avoid impacts), the common / soprano pipistrelle roost is *c.* 135m south of the proposed T13, directly connected by a hedgerow.

The targeted static detectors deployed at the latter roost identified the watercourse to the east as being the most frequently used route during the survey period, low levels of bats were recorded commuting along the hedgerow to the north, and towards the proposed T13 turbine location. Therefore, there is the potential for impacts on this roost resulting from bats being directed from the roost towards the turbine and facilitating a possible collision via this connectivity. In the absence of mitigation there is the potential for ***Negative Significant Impacts*** on this roost for the duration of the operation of the T13 turbine during the active bat seasons (generally late March until late October). This impact would be ***Reversible*** upon decommissioning of the turbine.

Habitat loss

Potential indirect impacts on bats also include the loss of foraging and commuting habitats/ features. The Study Area and the Haul Route support watercourses, hedgerows, treelines, scrub and patches of trees and plantation woodland that are known to be used by foraging and commuting bats (particularly along linear features and woodland edges, away from more open environments). In order to facilitate the installation of turbines at the Study Area, there is a requirement to remove a range of habitats types such as modified bog and improved grassland. These are not favourable habitats for foraging and commuting bats, given the lack of cover from the elements / predators; there are no linear / roosting features proposed for removal. Given that there is to be no removal of linear habitat to facilitate turbine installation, the potential for significant impacts on bats as a result of habitat removal is ***Extremely Unlikely.***

Impacts upon bats as a result of Haul Route Works is considered to be minimal, can be appropriately mitigated against, and is discussed in detail in **Appendix IV.** Associated impacts involve some hedge and tree removal (largely managed hawthorn hedgerow, and ash / sycamore trees which exist along the chosen route), the full details of vegetation removal can only be known at the construction stage, and a worst-case scenario has been assessed. Habitats affected along the Haul Route are outlined in **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)** and the proposed mitigation for this at each location potentially affected is provided in **Appendix IV of this EcIA.**

Overall potential indirect impacts on bats

In the absence of mitigation, the potential indirect impacts upon bats as a result of the proposed Development are considered to be ***Not Significant.*** This is due to the limited potential for foraging / commuting habitat loss and the overall Low levels of bats using this exposed upland Study Area.

[51] Please note: An update on this guidance note is due for release sometime in 2023.

4.5.1.2. Operational Phase

4.5.1.2.1. Direct Impacts

The potential impacts on the bat population at Craignagapple during the Operational phase of the wind farm needs to be considered for each individual species. Different bat species have different foraging behaviours and ecological requirements, infrastructure such as wind turbines may affect the species of bat which are found in the Study Area in different ways. Each bat species recorded at the Proposed Development Site is considered in the following sections. It is important to note that the probability of impact is lower for those turbines located away from habitat features such as linear vegetation, watercourses, trees and scrub. As discussed in **Section 4.3.1**. within more open habitat types (i.e., bog / grassland), the probability of significant impacts occurring to bat species is generally considered to be low and this is backed up by the results of the bat surveys carried out at the Development, including the carcass searches conducted across 2020 and 2021, during which no dead bats were identified at the Study Area at selected searched turbines. However, where turbines are located within closer proximity to features such as hedgerows, treelines and watercourses, notably for T13 and T1, there is more potential for a greater occurrence of bats within the rotor-swept area, resulting in increased potential for impacts to occur.

4.5.1.2.1.1. Common and Soprano Pipistrelle

Both common pipistrelle (*Pipistrellus pipistrellus*) and soprano pipistrelle (*Pipistrellus pygmaeus*) are considered to be of high risk of injury or mortality from turbines (SNH, 2021), resulting from either barotrauma (injuries to internal air cavities and blood vessels caused by sudden change in air pressure behind a moving blade) or collision, based on the behaviour and foraging techniques of this species. They typically show an affinity to habitat features that provide shelter, such as scrub, treelines and hedgerow habitat, as reflected in the static deployment results. Both common pipistrelle and soprano pipistrelle are widespread and common in Ireland, while common pipistrelle was the most commonly recorded species throughout the entire 2021 survey period.

Some of the proposed infrastructure at the Development site is near to features that are used by these species for foraging, notably, T2, T8 and T13, which are between 60m to 250m from coniferous woodland / treelines. High levels of common pipistrelle activity were recorded at D.01 in spring and D.01 and D.07 in summer, while high levels of soprano pipistrelle activity were recorded at D.01 and D.07 in summer only. These two detectors, D.01 and D.07 were located approx. 402m and 359m from T2, respectively.

Potential impacts in the absence of mitigation

In the absence of mitigation, the impacts of the Operational phase upon common pipistrelle and soprano pipistrelle have the potential to be ***Long-term Negative impacts*** that are ***Reversible*** upon decommissioning of the turbines. Given the results of the bat surveys, the overall low numbers found to be using the site and due to the removal of Owenreagh I and II turbines, it is considered that there will be almost net zero change in the potential for impacts upon bats at this site.

4.5.1.2.1.2. Leisler's Bat

Leisler's bats are considered as being at high risk of impact from wind turbines (SNH, 2021), based on species behaviour and foraging techniques, in terms of both the likelihood of barotrauma or collision. Leisler's bat is listed as Near Threatened on the Irish Red List of Terrestrial Mammals (Marnell *et al*. 2019).

Leisler's bat activity levels were low across the Study Area in spring, with a marked increase during the summer recording period, declining slightly in autumn. This species was the second most commonly recorded after common pipistrelle, and in general, was more likely to be recorded flying over open habitat than common pipistrelle. Similarly, to common and soprano pipistrelle, 'High' levels of Leisler's bat activity was recorded at D.01 in summer, associated with the coniferous woodland to the southwest of the Study Area. High activity levels were also recorded at D.08 in autumn, which, while being in open habitat, may be related to the watercourse *c.* 177m north of this detector. While a higher total number of Leisler's bat passes were recorded in summer, these were attributed mostly to one detector, however, in autumn, Leisler's bat

passes increased across the Study Area in both open habitat and along features. It is likely that such a pattern is consistent with intensive foraging by bats that then move to a different area, and also coincides with increased juveniles having left the roost.

The weather data for the autumn surveys suggests that overall, there was little to no rain and higher temperatures than would usually be expected in this season, with the exception of the night of 5th September 2021. This indicates that low wind speeds, higher night temperatures and a general lack of rain during the times of year when Leisler's bats are ranging more widely are likely to be the conditions that could result in a greater risk to Leisler's bats. However, during lower wind speeds, the turbines are likely to be oscillating more slowly, or shutdown during such periods. Subsequently, collision risk for Leisler's bat has been considered taking a precautionary approach given their higher risk of impact when compared to other bat species.

Potential impacts in the absence of mitigation

The turbine swept area is within a similar range to the average flying height of Leisler's bat (*c.* 30m – 100m). The potential impact risk level is likely to vary depending on weather conditions and whether or not juvenile bats are in flight.

As such, in the absence of mitigation, the potential impacts of the Operational phase upon Leisler's bat are considered to be Long-term negative impacts that are Reversible upon decommissioning of the turbines.

4.5.1.2.1.3. Nathusius' pipistrelle

Nathusius' pipistrelle are considered to be of high risk of collision with offshore and onshore wind turbines due to their migration patterns (Kruczynski *et al.,* 2021), however, they show a negative association with upland areas such as Owenreagh (Lundy *et al.,* 2010) largely due to their association with large waterbodies such as Lough Neagh. According to the latter study, this species tends to favour broadleaved woodlands, pastures and freshwater habitats. There was a low level of activity recorded for Nathusius' pipistrelle across the Study Area, across all survey years, and the risk of significant impact on this species is deemed to be ***Extremely Unlikely.***

Potential impacts in the absence of mitigation

In the absence of mitigation, the potential impacts of the Operational phase upon Nathusius' pipistrelle bat are deemed to be Not Significant.

4.5.1.2.1.4. Myotis spp.

Myotis bats are considered to be at a low risk of impact from wind turbines (SNH, 2021) either resulting from barotrauma or collision. This is based on the species behaviour and foraging techniques. As a result of their typically lower flight height and the low levels of recordings across the Study Area, the probability of such an impact is ***Unlikely****.*

Potential impacts in the absence of mitigation

In the absence of mitigation given the above including low levels of recordings across the Study Area, the potential impacts of the Operational phase upon *Myotis* spp. are considered to be ***Not Significant.***

4.5.1.2.1.5. Brown Long-Eared Bat

Brown long-eared bats are considered as being at low risk of impact from wind turbines (SNH, 2021), either resulting from barotrauma or collision, based on species behaviour and foraging techniques. The static deployments across all survey periods revealed little to no brown-long eared bat activity across the Study Area. Because of the behaviour of this species and low levels of activity throughout the Study Area across all survey years, the probability of such an impact is ***Extremely Unlikely***.

Potential impacts in the absence of mitigation

In the absence of mitigation and given that this species was infrequently present throughout the Study Area, potential impacts of the Operational phase upon brown long-eared bat are considered to be ***Not Significant***.

4.5.1.2.2. Indirect Impacts

Disturbance of roosting bats and disturbance of foraging bats though lighting impacts during the Operational Phase was considered to be ***Unlikely***, as the installation of additional lighting proposed will be minimal. The proposed lighting across the Development will consist of automatic security lights at the substation, which will be turned off when not in use and more regularly in use in wintertime when mammals are hibernating / less active. While lighting added to the turbines themselves (required, based on their height) will be red, a colour shown to have reduced impacts on bats compared with other colours in the light spectrum (Spoelstra *et al.,* 2017; Zeale *et al.,* 2018).

While there will be additional security lighting on the substation, this area, in general, registered low-moderate levels of bat activity, and lies within an open habitat immediately adjacent to the public road.

The species recorded most regularly within the Study Area, namely Leisler's bat, soprano pipistrelle and common pipistrelle, are all less sensitive to light pollution than the less commonly recorded species, brown long-eared bats and Myotis species (BCT, 2018, Mathews, *et al.* 2015).

Potential impacts in the absence of mitigation

In the absence of mitigation, potential indirect impacts of the Operational phase upon all bat species recorded at the Development are considered to be ***Not Significant.***

4.5.1.Badger

The population of badger within the Study Area is as would be expected for such a large area, composed of peatland habitats and farmland with patches of scrub and trees.

As a species that is protected under The Wildlife (Northern Ireland) Order 1985 (as amended), the population of badger at this site is considered to be of ***Local (Higher)*** importance with a 'moderate' sensitivity to magnitude of environmental change.

4.5.1.1. Initial Decommissioning and Construction Phase

4.5.1.1.1. Direct Impacts

Potential direct impacts on badgers from construction works are generally limited to loss of setts, although at an extreme level, construction operations directly over a sett have the potential to result in mortality since this species is largely nocturnal.

A main sett (containing 6 entrances) and 2 outlier setts with single entrances, were identified during the mammal surveys within or near the Study Area. Further details including photographs of each sett and associated maps are provided in **Confidential Appendix III** of this EcIA.

As stated in **Section 3.6.2** the badger setts identified within the Study Area are at a sufficient distant from the proposed Development infrastructure (all setts are located >240m from the Development). Given the distance from any proposed works as part of the Development, it is considered that direct disturbance as a result of construction is unlikely to occur. Impacts during the decommissioning and construction phases of the Development are considered to be limited to the potential for any open excavations on the Development site inadvertently entrapping badgers. And mitigation to avoid such impacts has been advised in **Section 6.**

Taking this into account (and the lack of direct impacts upon any badger resting sites within an open habitat type), the potential for direct effects on badgers resulting from the construction phase is considered to be ***Not Significant*** and it is considered that even in the absence of mitigation, the proposed Development will not adversely affect the local badger population to a significant degree. However, according to best practice, given that this species is the most likely protected terrestrial mammal to be found foraging across this site, appropriate mitigation should be included which aims to reduce any potential for adverse impacts to this species as a result of the development.

4.5.1.1.2. Indirect Impacts

As previously stated, none of the setts identified during the mammal surveys are likely to be directly affected by the Development. However, indirect effects of construction are likely to include the loss of some habitats used by foraging badger (i.e., modified peatland and grassland habitats).

Potential impacts in the absence of mitigation

Without mitigation, indirect impacts of the decommissioning and construction phases upon badger are considered to be ***Significant***.

4.5.1.2. Operational Phase

Operational phase impacts on badger populations within the Study Area are limited to the potential for low-level noise disturbance within areas adjacent to potential foraging habitat. In addition, there is likely to be an increase in vehicles accessing the Development site at certain periods (e.g., during maintenance of the turbines). As such, there is the potential for badger commuting to be disrupted on occasion by disturbance by personnel visiting the Development site, or their vehicles. However, as badgers are typically a nocturnal species and the majority of site activity will take pace during daylight hours, any potential disturbance to badger during the Operational phase of the wind farm is considered to be ***Not Significant.***

4.5.2.Otter

As shown in Section 3.6.3, it is considered that the ESA is of limited suitability for otter due to the restricted extent of high-quality riverine habitat and a lack of good vegetation cover for breeding sites. However, they have been confirmed to be present in the area and as an Annex IV species under the Habitats Directive and an NI Priority species, otter it is considered to be a feature of at least ***Local (Higher)*** importance in the context of this site and is therefore similarly considered as an Important Ecological Receptor with moderate sensitivity to changes in water quality and fish stocks.

4.5.2.1. Initial Decommissioning and Construction Phase

4.5.2.1.1. Direct Impacts

Development has the potential to cause disturbance to otters. In addition, the proposed Development could result in pollution, and fragmentation and/or loss of otter habitat, which could ultimately result in the loss of such species in an area. The ideal objective is to ensure that proposed developments will not result in the loss of any otter resting sites (e.g., layups / holts) and that the design fully considers the wider needs of foraging otters in the environs.

Otter are primarily nocturnal / crepuscular species. However, they are known to be inquisitive animals and can be easily injured during construction if appropriate measures are not put in place.

Otter signs noted at the road bridge over the Legnahone Burn included spraint, slides and a mammal track. No layups, couches or holts were identified; however, a single, adult otter was observed on camera foraging in this area during the survey period.

Under the Habitats Directive it is illegal to damage an otter's resting place or to disturb an otter within it, or indeed anywhere else. DAERA / NIEA (2011) guidance indicates that *disturbance due to construction activity is only likely to occur within about 30m of a resting place.* No such resting features for otter were identified during the surveys, and all otter signs were located at least 200m from any proposed turbine position and >150m from any proposed infrastructure (see **Figure A10.1.23**). Therefore, no direct disturbance of an otter resting site would be expected during the decommissioning or construction phases of the proposed wind farm and the potential for direct effects on otter resulting from the Development is deemed to be ***Not Significant***.

4.5.2.1.1. Indirect Impacts

In the absence of mitigation, there is potential for the proposal to indirectly affect downstream populations of otter, through impacts upon water quality which could arise during the construction or Operational phases of the Development. This could result from accidental spillage or leakage of pollutants; the release of

suspended solids through dewatering or surface water run-off; or deposition of dust. Such impacts could have a deleterious effect on downstream populations of fish, which provide a food supply for otter.

Potential impacts in the absence of mitigation

Otter is protected under the Wildlife Order (NI) 1985 (as amended), as a result of its inclusion within Annexes II and IV of the EU Habitats Directive. It is a criminal offence to deliberately disturb any of the species so protected, in such a way as to affect their local distribution or abundance, or impair its ability to survive, breed, reproduce or care for young or to hibernate or migrate (DAERA, n.d).

Given the size and location of the development and its hydrological connectivity to The River Faughan and tributaries SAC and the River Finn SAC both of which support large populations of otter which are qualifying interests of both these sites, it is considered that unmitigated, a pollution event could affect downstream otter prey availability.

However, it is concluded that best practice embedded construction measures outlined in **Technical Appendix A3.1: oDCEMP** will be in place to limit erosion and the release of sediment to surface watercourses and waterbodies and that this will provide sufficient embedded mitigation to prevent water quality deterioration and (impact magnitude will be reduced as distance of the receptor from the proposal increases, due to progressive dilution effects). **Therefore, effects on otter, which are considered to be of moderate sensitivity, have the potential to be of Negligible magnitude of change and of Negligible significance. This is not significant in terms of the EIA Regulations.**

4.5.3. Red Squirrel

Best Practice Guidance by Nature Scot (2018)[52] states that "*where red squirrels might be present, you will only need to consider them if your proposal includes either of following:*

> ***a)*** *felling trees that have a reasonable chance of containing dreys - suitable trees are usually 15 years or older and can be conifer or broadleaf species, or;*
>
> ***b)*** *felling and other works that could disturb dreys.*
>
> *This is likely to be where works are within 50m of trees containing a drey during the red squirrel breeding season (February to September inclusive). If works are confined to the non-breeding season then the risk of disturbing red squirrels is much lower, and only likely to occur where works are within 5m or one tree's distance of a potential drey location (whichever is less)".*

A narrow strip of coniferous woodland *c.* 0.48ha exists within the Study Area and was confirmed to support some potential for foraging, commuting and breeding habitat for red squirrel, with potential squirrel dreys and feeding signs identified here. However, no woodland will be lost as a result of the Development and all potential squirrel dreys within this woodland strip are located >50m from the nearest wind farm infrastructure (**Figure A10.1.24** and **Figure A10.1.25**). Therefore, it is considered that there will be ***no direct or indirect significant impacts*** upon red squirrel populations within the Study Area during any phase of the Development.

4.5.4.Irish Hare

4.5.4.1. Direct Impacts

The Study Area and surrounding area appears to support a population of Irish hare, with five individuals observed over the course of the surveys across the area. The habitats in the area, being composed of upland peatland and farmland pasture provides good-quality habitat for this species, and overall, the area is considered to support an Irish hare population of ***Local (Higher)*** importance with a medium sensitivity to environmental change.

Hare do not occupy a single 'den' but instead rest within a 'form', which is generally an area of flattened long grass hidden within taller vegetation. This, coupled, with the characteristics of young hare and the habits of nursing females, means that potential for direct impacts resulting from construction are likely to be very limited. Young hare are born fully furred and are able to run soon after birth. During daylight, they hide in

[52] Nature Scot (2018). *Species Planning Advice.* Available at: https://www.nature.scot/sites/default/files/2018-09/Species%20Planning%20Advice%20-%20red%20squirrel.pdf

long grass and are fed only once a day, at dusk. As construction will be undertaken during daylight hours, the risk of disturbance is limited to physical disturbance of young rather than disturbance and displacement of the mother. As young hares are able to move freely, mortality is unlikely to result from construction activities. Overall, direct impacts upon hare resulting from the Initial Decommissioning and Construction Phase are considered to be ***Not Significant***.

4.5.4.2. Indirect Impacts

Irish hare is widespread at this site and this species is considered likely to breed in the vicinity of the Development. Indirect impacts upon Irish hare at this Development site resulting from construction include the removal of hedgerow and the loss of small areas of improved, acid and wet grassland as well as areas of degraded peatland from the construction footprint, which represents the loss of a small amount of shelter and foraging habitat for Irish hare.

Potential impacts in the absence of mitigation

In the context of the surrounding landscape, which provides abundant suitable habitat for Irish hare, the potential indirect impacts upon Irish hare resulting from the proposal are considered to be ***Not Significant***.

4.5.5. Pine Marten

No pine marten were recorded during the surveys carried out within the Study Area. However, considering the habitats encountered within and around the Study Area, coupled with the increasing frequency with which pine marten is recorded away from woodland habitats in Ireland, the Study Area and environs is considered likely to support a pine marten population of ***Local (Higher)*** importance.

Breeding dens and refuge sites, in which pine marten rest, tend to be associated with wooded areas and as such, direct impacts to these resulting from the Initial Decommissioning and Construction Phase disturbance are unlikely to occur, as the construction footprint is located away from areas of woodland and scrub and no woodland habitat will be lost as a direct result of the Development.

Noise disturbance is unlikely to impact on foraging pine marten as this species hunts over a large area and the surrounding area contains a large amount of similar foraging habitat that may be used if construction noise causes certain areas to be avoided. Overall, it is considered that potential impacts upon pine marten resulting from the Development are ***Not Significant.***

4.5.6. Other Terrestrial Mammals

There is considered to be **no potential for significant direct or indirect impacts** on other terrestrial mammals such as fox and hedgehog which have the potential to utilise the Study Area for foraging, commuting or breeding. The Study Area offers a wide range of suitable habitats, and the proposed Development will not result in any significant reduction of habitat for these species.

4.5.7.Reptiles

4.5.7.1. Direct Impacts

Common lizard is the only reptile that is native to Ireland. This species has a widespread distribution on the island of Ireland, and there is no evidence of any significant decline here (King *et al.* 2011). However, the common lizard is a Northern Ireland priority species and is afforded protection under the 'The Wildlife (Northern Ireland) Order 1985 (as amended)'.

Common lizard tends to be strongly associated with heathland, bogs and coastal habitat in Ireland – within habitats such as the peatland habitats which can be found within the Study Area. The following actions are a threat to this protected species:

- Archaeological and geotechnical investigations;
- Clearing land, installing site offices or digging foundations;
- Cutting vegetation to a low height;
- Laying pipelines or installing other services;
- Driving machinery over sensitive areas;
- Storing construction materials in sensitive areas; and
- Removing rubble, wood piles and other debris (particularly in which reptiles could hibernate from October to March inclusive – these features are known as 'potential reptile hibernacula').

Two main aims which can be incorporated into the design of this project for the protection of reptiles are:

- To protect reptiles from harm during the Initial Decommissioning and Construction Phase; and,
- To ensure that sufficient quality, quantity and connectivity of habitat is provided/maintained to accommodate the reptile population, either on-site or at an alternative site, with no net loss of local reptile conservation status.

Survey results for reptiles at the Development site have confirmed the presence of a likely small population of common lizard within the area.

Potential direct impacts on common lizard are generally limited to direct mortality during vegetation clearance and excavation works on grassland and heath / bog habitats during the Initial Decommissioning and Construction Phase. As detailed in **Section 3.6.9,** 3 no. common lizards were recorded at three locations within the Study Area from 2019 – 2022 (1 reptile recorded per year over each survey period). Subsequently, the population of this protected species is considered likely to be of ***Local (Higher) Importance,*** with a moderate sensitivity to environmental change. The nature of the Study Area means that they have the potential to occur immediately adjacent to the existing infrastructure.

Potential impacts on common lizards can vary depending on the time of year, with destruction of hibernacula (locations being used for winter hibernation) being a particular concern. Hibernacula need to be frost-free, humid and safe from predators and flooding (ARGUK, 2018). Such areas can include bunds and rocky areas, notably when these occur within slightly drier parts of the bog and it is likely that the existing infrastructure already provides suitable hibernacula areas for the species, suggesting that re-excavation of these areas may impact on the species in the absence of mitigation.

Subsequently, there is a significant risk of common lizard mortality during the Initial Decommissioning and Construction Phase. It is considered that in the absence of mitigation the vegetation removal could impact upon the reptile population within the Study Area. Taking the above into account it is considered that, there is the potential for ***Significant*** impacts on Common Lizard. Mitigation proposals in this respect are provided in **Section 5.**

4.5.7.1. Indirect Impacts

Potential indirect effects on common lizard are generally considered to be those associated with disturbance. However, although common lizard are easily disturbed when approached, the impact of disturbance is not considered likely to carry over a significant distance. The limited likely disturbance distance on common lizard and the extensive area of suitable habitat for the species in the wider area means that it is considered that the potential for indirect effects on common lizard during the wind farm Development are considered to be ***Not Significant***.

Potential impacts in the absence of mitigation

Potential indirect impacts of the proposal upon common lizard are considered, without mitigation, to be temporary and of Slight Significance on a feature of Local (Higher) importance, as a result of disturbance during construction related activities. The reptile population at this site is considered to have become habituated to some degree to occasional vehicle and personnel access at this site since the original installation and operation of turbines over the past decades. In addition, this operational activity is focussed along access tracks, at turbines and at the substation. Subsequently, it is considered that operational impacts upon the local reptile population as a result of the proposed Development are likely to be ***Negligible*** and ***Not Significant***.

4.5.8.Invertebrates

Potential direct and indirect impacts upon terrestrial invertebrate populations across the Study Area are considered to be limited to the direct habitat loss associated with the proposed wind farm infrastructure during construction related works and the proposed decommissioning works. As no suitable habitat for marsh fritillary was noted within the Study Area or within the wider environs of the Development site during an initial survey carried out under license in 2019, it is considered that the Study Area is of limited suitability for this protected species. The potential for direct or indirect effects on invertebrate species during the Development are considered to be ***Not Significant***.

However, it has been acknowledged that the peatland nature of the Study Area provides ample habitat suitable for wide range of invertebrate species including Odonata (dragonflies and damselflies), beetles, spiders, bumblebees, solitary bees, hoverflies, butterflies and moths, many of which are included on the Northern Ireland Priority Species list. Several of these, including the large heath butterfly (*Coenonympha tullia*), the small heath butterfly (*Coenonympha pamphilus)* and the argent & sable moth (*Rheumaptera hastata*) were considered as part of the wider site impact assessment and measures to improve the habitats within the Study Area for these species have been considered within **Technical Appendix A3.2 of the ES the Draft HMEP**. Similarly, it is expected that many of the proposed habitat enhancement and peatland restoration measures will improve the overall habitat quality for a wide range of invertebrate species within the Study Area over time and on successful completion of bog 're-wetting'.

4.5.9. Fish

As previously outlined in Section 6.3.1 Potential Impacts on Watercourses and Associated Downstream Ecology, given the small size, slow flow and vegetated nature of the land drains that occur within the ESA, and the >100m separation distance between the main watercourse and closest proposed turbine, it is considered that indirect impacts upon salmonids resulting from the proposal are ***Not Significant.*** Despite this conclusion, appropriate working practices to minimise any risk of localised impact resulting from events such as mobilisation of sediment are appropriate and are detailed in **Section 7**. This will be particularly important for any proposed access crossing points at the Development site.

4.6. Potential Cumulative Impacts

In-combination impacts can be an issue when a proposal has a small impact on ecological receptors as a result of factors such as disturbance and/or pollution. If other proposals also have a further small impact, the combined result can be a significant impact on sensitive ecological receptors.

Different types of actions can cause cumulative impacts and effects. As such, these types of impacts may be characterised as:

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

It has been established that any potential for significant impacts related to ecological receptors within or close to the ESA are linked to hydrological connectivity of the Development to these receptors. Direct impacts from the Development (on its own) upon such receptors as a result of killing or injuring / or direct habitat loss due to the Development footprint require appropriate mitigation.

Additive/Incremental Impacts

The following proposed, consented, under construction and operational wind farms have been identified within 10 km of the Development:

- Ballykeery Road (operational) approximately 1.5 km south of the Development, located within the Doulas Burn catchment;
- Ballykeery Road 2 (proposed) approximately 1.5 km south of the Development, located within the Douglas Burn catchment (planning ref. LA11/2022/1099/F);
- Dunnyboe Road (proposed) approximately 3.0 km northeast of the Development, located within Burn Dennet River catchment (planning ref. LA11/2022/0938/F);
- Curlyhill Road (consented) approximately 3.0 km west of the Development, located within the Glenmornan River catchment (planning ref. LA11/2022/0731/F);
- Ballylaw Road (operational) approximately 4.5 km northwest of the Development, located within the Burn Dennet River catchment (planning ref. LA11/2022/1045/F);
- Loughan Road (under construction) approximately 5.5 km north of the Development, located within the Altinaghrea Burn catchment (planning ref. LA11/2019/0379/F);

- Carrickatane (operational) approximately 10.0 km north of the Development, located within the Sandville Burn catchment (planning ref. J/2005/0211/F);
- Eglish Mountain (operational) approximately 9.0 km northeast of the Development, located within the Faughan River catchment (planning ref. A/2005/0223/F); and
- Slieve Kirk (operational) approximately 10.0 km northeast of the Development, located within the Faughan River catchment (planning ref. A/2004/1130/F).

As Ligford Road Wind Farm (planning ref. LA11/2022/0205/F) is located outside the hydrological catchments of the Development, there is no potential for cumulative effects on downstream receptors from this project. Details regarding the potential for cumulative developments is provided within **Technical Appendix A2.4: Cumulative Developments within the ES.**

The proposed Dalradian Gold Mine grid connection application (planning ref. LA11/2019/1000/F) lies within the hydrological catchment of the Development and supports the Curraghinalt mine application (LA10/2017/1249/F) which lies outside the hydrological catchment of the Development. Both applications are subject to public inquiry by the Planning Appeals Commission (PAC), and at the time of writing, the date for the public inquiry hearings have not been scheduled. As noted above, direct impacts from the Development (on its own) on species as a result of killing or injuring through e.g., collision with overground infrastructure, or direct habitat loss due to the Development footprint, can be ruled out. As such, there is no potential for impacts arising from the Dalradian Gold Mine grid connection application in-combination with the Development.

It has been established that any potential for significant impacts related to aquatic environments is linked to hydrological connectivity of the Development to these habitats and the species they support. Outside of the projects listed and discussed above, there are limited planning applications that could have the potential to result in in-combination impacts with the Development resulting in a significant effect. These may include single residential dwellings, agricultural buildings, or quarry operations that occur within the hydrological catchment of the Development and are either in construction or operation at the same time as the Development. While hydrological impacts arising from the Development have the potential to reach downstream receptors, as described in the impact on any downstream species and habitats has been assessed as having low potential (**Sections 4.2, 4.3 and 4.5.1**). Any in-combination impacts are also considered to present a low potential impact due to the small scale of the projects, and the requirement of any planning application to have compliance with Habitats Regulations Assessment/Appropriate Assessment requirements.

It is anticipated that, in the absence of mitigation, the key cumulative effects upon ecology during the operation of the Development are largely as a result of augmentation of existing drainage within the Ecological ESA which could exacerbate peatland erosion within the vicinity of the proposed infrastructure, particularly if the current and future drainage scenarios are not maintained appropriately and in a sensitive manner, taking careful consideration of the peatland habitats here.

If similar effects resulted from equivalent actions on other wind farms or developments in the area, this could result in downstream impacts on aquatic environments. These impacts would be caused by factors such as sedimentation in watercourses, nutrient pollution and spillage/leakage of hydrocarbons or other chemicals.

Mitigation will be required to negate such potential impacts. Proposed mitigation is discussed in **Section 6.**

Associated/ Connected Impacts

The Development comprises decommissioning of the operational Owenreagh I and II Wind Farms and construction and operation of a wind farm comprising of up to 14 wind turbines. Potential impacts on European and Ramsar Sites from the Development as a whole have been assessed in the HRA (Woodrow, 2023).

The grid connection for the Development will be subject to a separate planning application, which will be accompanied by its own ES. This will either be done by SONI (Northern Ireland's transmission system operator) or by the Applicant.

In initial discussions with SONI, they identified two potential grid connection points: Strabane 110kV substation and Killymallaght 110kV substation. Once an application is made, SONI will conduct studies post

consent to determine which is the best point of connection. The windfarm will connect to the substation via either an overhead line (OHL) or underground cable along the public road system.

There will also be an electricity substation on site with control and safety equipment for the grid connection. The substation will be located adjacent to the Glenmornan Road for ease of access. The substation building is included in the Wind Farm planning application.

Underground cabling, laid where possible alongside the new access tracks, will link the turbine transformers to the onsite substation building. Where existing track is being re-used, the cables will be laid in a cable trench alongside the existing track. Generally, the redundant cable will be removed and recycled or cut off and left in situ as appropriate and in accordance with the **Technical Appendix A3.1** and **A3.2**, in order to minimise disturbance to the environment.

Largely, any ecological impacts related to such development would stem from habitat removal, disturbance to species and impacts through release of sediments into local surface water. Subsequently, these aspects which might be interconnected with the Development have been mitigated for in **Section 6**.

4.6.1. Initial Decommissioning and Construction Phase

Potential effects of the final decommissioning phase are largely similar to those during the Initial Decommissioning and Construction Phase. Potential impacts can include damage to existing habitats (including Annex I habitats where present), disturbance and direct mortality of species (including to protected species), water quality degradation from ground works, excavations and mobilisation of large machinery from sedimentation and or hydrocarbon pollution with pathways including surface and groundwater aquatic environments.

In-combination with other projects or schemes within the environs (particularly where these exist within peatlands or similarly sensitive environments) it is considered that the installation of wider surface areas for tracks, buildings and hardstand, as well as construction related and proposed operational drainage requirements, will result in greater habitat loss and potential surface water runoff in the region as a whole. Increased surface water runoff can lead to an exacerbation of erosion and/or sediments entering local watercourses, particularly during the first few years of operation.

The potential for cumulative impacts resulting from the Initial Decommissioning and Construction Phase of the Development is considered to be limited to water quality changes within local surface water catchments as outlined within **ES Chapter 8: Hydrology and Hydrogeology.**

The following wind farms have been identified as being situated within a 12km radius of the Development or with a hydrological connection to the Proposed Development:

- Ballykeery Road which is located *c.* 1.5 km south of the Development;
- **Ballykeery Road 2 which is located *c.* 1.5 km south of the Development;**
- **Dunnyboe Road which is located *c.* 3.0 km northeast of the Development;**
- Ballylaw Road which is located *c.* 4.5 km northwest of the Development;
- **Curlyhill Road, which has one turbine and is located 6.5 km west of the Proposed Development;**
- Eglish Mountain, which is located *c.* 9.3 km northeast of the Proposed Development;
- Lislafferty Road, which is located *c.* 10 km south of the Proposed Development;
- **Loughan Road, which is located *c.* 5.5 km north of the Development;**
- Carrickatane, which has nine wind turbines and is located *c.* 10 km north of the Proposed Development;
- Slieve Kirk, which is located *c.* 10.5 km north of the Proposed Development; and,
- Curryfree, which is located *c.* 11.5 km north of the Proposed Development.

Operational windfarms have been scoped out of the assessment as no construction will occur in association with the Proposed Development, while those in application or under construction are assessed further here. Four windfarms listed above (in **bold**) have potential hydrological connectivity with the Ecological Study Area, which is situated within the Foyle catchment (sub catchments are Glenmornan River, Owenreagh Burn and Dunnyboe Burn). It is assumed that, based on standard practice, that each of these wind farms will apply its own mitigation including the assessment of cumulative impacts, should construction times coincide.

Subsequently, it is determined that there is no risk of cumulative impacts as a result of the Proposed Development acting in conjunction with any other Developments in the wider area.

4.6.2.Operational Phase

The potential for cumulative impacts resulting from the Operational phase of the Development is considered to be limited to direct impacts on birds.

Direct impacts on bats are not considered to give rise to the potential for significant cumulative impacts given the low level of activity across the Study Area, general unsuitability of upland and open habitat for bats and distance between the nearest wind farm and the Proposed Development (*c.* 1.5km). The impact of the operational phase on birds is discussed in further detail in **ES Chapter 11: Ornithology**.

4.7. Potential Impacts of the Final Decommissioning Phase

Final Decommissioning Phase impacts are likely to be broadly similar to Initial Decommissioning and Construction Phase impacts, in terms of disturbance through increased noise levels, ground clearance works, and reinstatement; and potential surface water quality impacts from ground disturbance, refuelling and the storage of potentially hazardous materials onsite. The potential for cumulative impacts resulting from the Final Decommissioning is considered to be limited to water quality changes within local surface water catchments as outlined within **ES Chapter 8: Hydrology and Hydrogeology.**

There is also some potential for impacts along the proposed Haul Route for any turbine removal off site. These are likely to be limited and are discussed further in **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)** of the ES and further details are provided in **Appendix IV of this EcIA**.

5. SUMMARY OF ECOLOGICAL VALUE OF FEATURES OCCURING WITHIN THE ESA

This section is intended to provide a summary of the value assessment of the habitats and species within the ESA, based on the valuation methodology set out in **Section 2** and the existing ecological baseline as defined by the survey results set out in **Section 3.**

This summarises the impact assessment provided in **Section 4**, in which the ecological value of the ESA for target habitats and species has been assessed, and the potential impacts upon them that may result from the proposed Development are considered.

It sets out the recorded status of Important Ecological Receptors within the ESA, and their considered value, under the general categories of International, National, Regional, Local Importance (where relevant). In line with Ecological Impact Assessment guidance, features which are of Low Importance are not brought forward into the impact assessment in **Section 6**.

All species of conservation importance recorded within the Study Area during the site visits, or previously recorded in its immediate vicinity (i.e., within a 2km radius) and considered likely to occur within the ESA, have been included below. Also considered are designated sites that have biological or other connectivity with the Study Area.

Table A10.1.23: Valuation of ecological features within the ESA and Potential for Direct Impacts / Source Pathway Receptor Linkages.

Feature	Highest Evaluation / Importance	Sensitivity of Receptor	Potential Direct Impact or Source Pathway Receptor Link? Y/N	Important Ecological Receptor (IER)? Y/N	Total area directly affected by the Development	Total potential area indirectly affected[53]	Total max potential area affected
Internationally Designated Sites							
River Foyle and Tributaries SAC	International	Very High	Y – Potential indirect impact through hydrological link	Y	Negligible potential impact following best practice embedded water quality protection measures **Technical Appendix A3.1: oDCEMP.**		n/a
River Finn SAC	International	Very High	Y – Potential indirect impact through hydrological link	Y			
Nationally Designated Sites							
Silverbrook Wood ASSI	National	High	Y – Potential indirect impact through hydrological link	Y	Negligible potential impact following best practice embedded water quality protection measures **Technical Appendix A3.1: oDCEMP.**		**n/a**
Lisnaragh Wood ASSI	National	High	Y – Potential indirect impact through hydrological link	Y			
Corbylin Wood ASSI	National	High	Y – Potential indirect impact through hydrological link	Y			
River Foyle and Tributaries ASSI	National	High	Y – Potential indirect impact through hydrological link	Y			
Habitats lying within the Wind Farm and Haul Route Construction Footprints:					**Total area directly affected by the footprint**	**Total potential area indirectly affected**	**Total max potential area affected**
Intact Blanket Bog (E1.6.1)	National	High	Y – Direct Impact (construction footprint). Y- Indirect Impact (indirect hydrological impact)	Y	0.032 ha: infrastructure footprint	0.022 ha: Indirect dewatering impact	0.054 ha
Recovering / Modified Blanket Bog (E1.6.1)	Regional Importance (Northern Ireland)	High	Y – Direct Impact (construction footprint). Y- Indirect Impact (indirect hydrological impact)	Y	0.101 ha: infrastructure footprint	0.072 ha: Indirect dewatering impact	0.173 ha
Dry Modified Bog (E1.8)	Local (Higher)	Medium	Y – Direct Impact (construction footprint). Y- Indirect Impact (indirect hydrological impact)	Y	10.783 ha: infrastructure footprint	3.908 ha: Indirect dewatering impact	14.691 ha

[53] For further information on the potential for indirect effects see Technical Appendix A8.3: Note on Indirect Effects on Dewatering of the ES. This figure has applied the estimated buffer for indirect effects which has been provided by the Hydrologist and calculated the area of potential impacts on habitats according to the survey Ecological survey results, using ArcGIS.

Feature	Highest Evaluation / Importance	Sensitivity of Receptor	Potential Direct Impact or Source Pathway Receptor Link? Y/N	Important Ecological Receptor (IER)? Y/N	Total area directly affected by the Development	Total potential area indirectly affected[53]	Total max potential area affected
Wet Modified Bog (E1.7)	Local (Higher)	Medium	Y – Direct Impact (construction footprint). Y- Indirect Impact (indirect hydrological impact)	Y	0.970 ha: infrastructure footprint	0.580 ha: Indirect dewatering impact	1.478 ha
Species-Poor Flush and Spring (E2.1)	Local (Higher)	Medium	Y – Direct Impact (construction footprint). Y- Indirect Impact (indirect hydrological impact)	Y	3.063 ha: infrastructure footprint	1.041 ha: Indirect dewatering impact	4.104 ha
Acid Grassland / Flush (B1.2 / E2.1)	Local (Lower)	Low - Negligible	Y – Direct Impact (construction footprint). Y- Indirect Impact (indirect hydrological impact)	N	5.304 ha: infrastructure footprint	1.952 ha: Indirect dewatering impact	7.256 ha
Improved Agricultural Grassland / Poor Semi-Improved Grassland Mosaic (B4 / B2.2)	Local (Lower)	Low - Negligible	Y – Direct Impact (construction footprint).	N	1.914 ha: infrastructure footprint	n/a	1.914 ha
Linear habitats and boundary features within the Wind Farm and Haul Route Construction Footprints:							
Species-poor Hawthorn Hedgerow (J2.2)	Local (Higher)	Medium	Y – Potential direct impact, loss of an estimated 100m of this feature adjacent to proposed T13	Y	Approx. 100m	n/a	*c.* 100m
Dry Ditch / Poor Flush (J2.6 / E2.1)	Local (Lower)	Low - Negligible		N	0.21	0.05	0.26
Affected woody vegetation along haul route as per Appendix IV (trees, hedges, and scrub)	Local (Higher)	Medium	Y – Direct Impact at 'pinch points' (construction footprint).	Y	Affected haul route footprint outside of existing roads	n/a	Affected haul route footprint outside of existing roads
Improved Agricultural Grassland / Poor Semi-Improved Grassland Mosaic (B4 / B2.2)	Local (Lower)	Low - Negligible	Y – Direct Impact (Haul route construction footprint).	N	Haul route 'pinch points' footprint – See **Technical Appendix A2.3: Abnormal Load Route Works (ALRW) and Appendix IV of this EcIA.**	n/a	Haul route 'pinch points' footprint

Feature	Highest Evaluation / Importance	Sensitivity of Receptor	Potential Direct Impact or Source Pathway Receptor Link? Y/N	Important Ecological Receptor (IER)? Y/N	Total area directly affected by the Development	Total potential area indirectly affected[53]	Total max potential area affected
Habitats in the Study Area or close vicinity that lie outside the Wind Farm and Haul Route construction footprints							
Mature Coniferous Plantation (A1.2.2)	Local (Lower)	Low - Negligible	N – this lies to the south-east of the Study Area and >200m from the wind farm infrastructure.	N	50ha	**n/a**	**n/a**
Linear strip of Coniferous Plantation (A1.2.2)	Local (Lower)	Low - Negligible	Y – Indirect Impact (noise and vibration disturbance potential during Construction).	N	n/a	0.48 ha (indirectly via disturbance)	0.48 ha
Scrub (A2.2)	Local (Higher)	Low - Negligible	N	N	n/a	Approx. 5.70 ha	Approx 5.70 ha
Linear habitats in the Study Area or close vicinity that lie outside the Wind Farm and Haul Route construction footprint.							
Stream - Legnahone Burn	Local (Higher)	Medium[54]	Y – Indirect Impact (potential for indirect impacts on water quality through hydrological connection)	Y	n/a	*c.* 3 km	*c.* 3 km
Species-poor Hedgerow with Trees (J2.3.2)	Local (Higher)	Medium	N	N	n/a	n/a	n/a
Small copse of mature trees and scrub	Local (Higher)	Medium	N	Y	n/a	n/a	n/a
Derelict Buildings	Local (Higher)	Medium	N	Y	n/a	n/a	n/a

[54] Note: While the electrofishing survey did not identify any significant fish species, this stream is known to support commuting Otter which is an NI Priority Species (see below)

Table A10.1. 24

Feature	Highest Evaluation / Importance	Qualifies as NI Priority Habitat / Species?	Potential Direct Impact or Source Pathway Receptor Link? Y/N	Important Ecological Receptor (IER)? Y/N	Confirmed / likely to occur onsite	Potential impact in the absence of mitigation
Species within the Study Area that have the potential to be affected by the Development.						
Bat - commuting[55]	Local (Higher)	Yes	Y – directly, through noise / vibration / disturbance at commuting habitats. Y – indirectly, through collision with turbines / barotrauma.	Y	Yes	Disturbance to foraging / commuting behaviours resulting from inappropriate lighting. Collision with T13 resulting from the linear feature connecting a soprano / common pipistrelle roost and this turbine.
Bat - Foraging	Local (Higher)		Y – directly, through noise / vibration / disturbance at foraging habitats. Y – indirectly, collision with turbines / barotrauma.	Y	Yes	Disturbance to foraging / commuting behaviours resulting from inappropriate lighting. Collision with T13 resulting from the linear feature connecting a soprano / common pipistrelle roost and this turbine.
Bat - roosting	Local (Higher)		N – no direct or indirect impacts on roosting bats considered likely.	Y	Yes	n/a - Roosting sites will remain *in situ.*
Badger (particularly foraging habitat)	Local (Higher)	Yes	Y – indirectly, through loss of foraging and/or commuting habitat. Y- indirectly, though disturbance to retained / adjacent foraging habitat.	Y	Yes	Potential for loss / alteration of commuting and foraging habitat within the direct footprint of the Development. However, badger setts will not be directly impacted by the works (>240m away from any infrastructure).
Otter (Foraging)	Local (Higher)	Yes	Y – Potential for indirect impacts to downstream populations resulting from pollution (affecting individuals and/or food sources). Y- indirectly, though disturbance to retained / adjacent foraging habitat.	Y	Yes	Adverse impacts on commuting and foraging habitat through potential for adverse water quality impacts as a result of pollution and/or construction related disturbance. No otter holts recorded on site.
Red squirrel (Foraging)	Local (Higher)	Yes	Y – Indirectly through disturbance at commuting, breeding, and foraging habitat (c. 0.48 ha).	Y	Yes	Some limited potential for construction related disturbance through increased noise and personnel being on the Development site.
Other mammals (Irish hare, pine marten)	Local (Higher)	Yes	Y – directly, through noise disturbance at foraging and commuting habitats.	Y	Yes	Some limited potential for construction related disturbance through increased noise and personnel being on the Development site.

[55] Bat habitat evaluation adapted from Wray *et al.* 2010.

Feature	Highest Evaluation / Importance	Qualifies as NI Priority Habitat / Species?	Potential Direct Impact or Source Pathway Receptor Link? Y/N	Important Ecological Receptor (IER)? Y/N	Confirmed / likely to occur onsite	Potential impact in the absence of mitigation
			Y – indirectly, through loss of foraging and commuting habitat. Potential for indirect impacts e.g., disturbance.			
Amphibians (namely frogs)	Local (Lower)	No	Y – directly, through disturbance at foraging and commuting habitats. Y – indirectly, through loss of foraging and commuting habitat. Potential for indirect impacts e.g., pollution.	N	Yes	Some minor and limited potential for construction related killing/injuring and disturbance, particularly during vegetation clearance and ground excavation works.
Reptiles	Local (Higher)	Yes	Y – directly, through noise disturbance Y – indirectly, through loss of foraging and commuting habitat. Potential for indirect impacts e.g., disturbance.	Y	Yes	Potential for construction related killing/injuring and disturbance, particularly during vegetation clearance and ground excavation works.
Invertebrates	Local (Higher)	N *(No NI Priority invertebrates were identified in the Study Area during the surveys)*	Y – indirectly, through loss of habitat. Potential for indirect impacts e.g., disturbance.	Y	Yes	Potential for construction related killing/injuring and disturbance, particularly during vegetation clearance and ground excavation works.
Fish	Local (Higher)	N *(No NI Priority invertebrates were identified in the Study Area during the surveys)*	Y – Potential for indirect impacts to downstream populations resulting from pollution (affecting individuals and/or food sources). Y- indirectly, though disturbance to retained / adjacent habitat.	Y	Yes	Adverse impacts on downstream habitat through potential for adverse water quality impacts as a result of pollution and/or construction related disturbance.

6. MITIGATION MEASURES

Planning Policy Statement 2: Natural Heritage, Policy NH 5 (Habitats, Species or Features of Natural Heritage Importance) states that:

"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 stream 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."

In addition, it is noted that within Planning Policy Statement No.18- Renewable Energy - Policy RE1- Renewable Energy Development (Excerpt) that:

"…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…"

As discussed in **Section 4**, it is considered that, in the absence of mitigation, there is some potential for the proposal to have both direct and indirect impacts on protected habitats, species and features within the Study Area and its environs. However, it is important to consider this in relation to the current scenario on this site - which includes existing operational turbines as well as significant degradation through land management practices across the area.

General mitigation measures have been proposed within the relevant Impact Assessments for the management of dust and noise emissions at the Development site, and for the protection of surface water and ground water quality. It is considered that these measures will serve to minimise associated impacts, as discussed in **Section 6**, upon ecological features arising from these factors.

A peatland restoration plan is also proposed, which seeks to augment the peatland habitats within the existing Study Area and in the environs of the proposed Development both concurrent to Construction, and during the Operational phase following the wind farm completion. It is considered that the site restoration and enhancement measures will serve to minimise impacts arising from habitat loss consequent to construction of site infrastructure and associated access roues. **The draft Habitat Management and Enhancement Plan has been provided in Technical Appendix A3.2 of the ES.**

Additional mitigation measures are also proposed within this report, in order to minimise impacts upon specific site features, where it is considered that further measures are required beyond those provided by standard environmental protection measures.

6.1. Initial Decommissioning and Construction Phase Mitigation

6.1.1. Mitigation by Avoidance and Design

6.1.1.1. Protection of Watercourses

Protection of watercourses is outlined in **Technical Appendix A3.1: oDCEMP**. These include measures such as:

- No crossing of streams by machinery during the Initial Decommissioning and Construction Phase without sufficient bridging in place.
- Re-fuelling of construction equipment and the addition of hydraulic oil or lubricant to vehicles/equipment to take place in designated bunded areas, which are placed a suitable distance away from watercourses (minimum of 50m).
- All machinery should be pre-checked for fuel/hydraulic leaks prior to entering the works area and no machine with any leaks are permitted to work on-site.
- No concrete washout shall be permitted on-site unless a designated impermeable concrete washout area is provided containing adequate signage. The wash water will be allowed to settle and evaporate prior to the removal of the cured material, which may be broken out and removed as inert waste.
- Silt fences are to be placed at the toe of slopes, as well as in drains around the works area, in order to remove heavy settleable solids (fences must never be placed in any viable stream/river).
- Silt fences are to be placed around stockpiles, as well as between earthworks and watercourses, ensuring that a suitable buffer zone is maintained with natural vegetation left intact.
- Any culvert works necessary for the crossing of the stream in the east of the Study Area, must adhere to IFI (2016) *'Guidelines on the Protection of Fisheries During Construction Works in and Adjacent to Waters'* and Lough Agency (2019) '*Guidelines for Fisheries Protection during Development Works (Foyle and Carlingford areas) Environmental Guidelines Series - No. 1*[56], in particular Section 9 regarding Planning, Design and Construction Issues, which describe best practice for the installation of culverts on watercourses.

Revegetation of disturbed areas in the vicinity of watercourses will be undertaken immediately post construction, in order to avoid run-off of silt-laden water impacting upon water quality within the watercourses arising in the north-eastern and north-western parts of the Study Area (which ultimately connects to the River Foyle system and thus there is potential (albeit very distant) connectivity to Lough Foyle.

Mineral soils, sub-soil and turves will be stored separately in order to facilitate habitat restoration, and turves will be replaced as top-mat to facilitate rapid re-instatement of the surface vegetation of these habitats.

6.1.1.2. Protection of Important and NI Habitats

There are a number of habitats[57] and species[58] which are provided priority status in Northern Ireland. In addition, habitats and species are provided various levels of protection under international and national legislation and policy (as described in **Section 1.2**).

As detailed in Section 4.4 and **Technical Appendix A10.4 of ES: Active Peat Assessment (APA)** there is no development footprint proposed within active peat (intact blanket bog). The Development will result in the loss of mosaic areas of Annex I (and non-Annex I habitats) and potentially some dewatering effects on peatland habitats, including a small area of indirect effects from dewatering (max *c.* 0.017ha) of intact Blanket Bog which was unavoidable within the constraints of the proposed Development design. Impacts on Recovering Blanket Bog, Dry Modified Bog, Wet Modified Bog, Acid Grassland / Species-Poor Flush, and Improved / Semi-Improved Grassland have been illustrated in **Figure A10.1.17** as a result of the Development footprint. It is essential that the direct loss of any Annex I habitat is fully minimised and throughout the design of this proposal, embedded mitigation by avoidance has been implemented via

[56] Available at: https://www.loughs-agency.org/app/uploads/2019/06/loughs-agency-guidelines-for-fisheries-protection-during-development-works.pdf (Accessed November 2022).
[57] NI Priority Habitat List: ni-priority-habitats-april-2010 (daera-ni.gov.uk) (Accessed November 2022)
NI Prioriy Habitat Guides: Northern Ireland Priority Habitat Guides | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk) (Accessed November 2022)
[58] NI Priority Species: Northern Ireland Priority Species | Department of Agriculture, Environment and Rural Affairs (daera-ni.gov.uk) (Accessed November 2022)

several project team workshops, following on from detailed site assessments, aiming to limit such losses within the footprint of the Development, and its Zone of Influence.

Mitigation in this respect will include the following actions:

- The full extent of the infrastructure footprint will be marked out prior to the commencement of works by the Site Manager with the Appointed Contractor's Ecological Clerk of Works (ECoW). Demarcation will use an appropriately robust and visible fencing / marker system. Where this meets Annex I habitats, this will also include the full extent of the works corridor.
- There will be no machinery access across intact Annex I habitats (access will only be allowed on foot and only for the purposes of silt / pollution control if required), storage or other works are allowed outside this area.
- The efficacy and coherence of the marker system (and any required remediation) will form an essential part of the Site operations and will be outlined within **Technical Appendix A3.1: oDCEMP**.
- While no Invasive Alien Species (particularly scheduled plants) were recorded within the Red Line Boundary of the Development, following best practice measures, a pre-construction IAS Survey will be conducted during the optimal growing season (May to August immediately prior to works occurring at this site for the Development) and shall include data on all locations, extents, and potential construction impacts in relation to scheduled and non-scheduled IAS. This survey will be completed along with reporting on the best course of action to be implemented to avoid the spread of such IAS within the Study Area or further afield through the implementation of an Invasive Alien Species Management Plan (IASMP). If IAS are recorded on the Development site, advice will be required from an invasive species specialist, particularly in relation to the appropriate treatment / removal or waste disposal of potentially contaminated materials.

Hedgerow removal within the ESA has been minimised to a *c.* 100m stretch of species-poor hawthorn hedge within the vicinity of the proposed T13. There are also some potential impacts along the proposed Haul Route. These are limited to passing bay areas for the turbine over-sail and are discussed further in **Appendix IV**.

Turbines have generally been placed within areas of open peatland and grassland habitat. Where hedgerows and treelines do occur, some will have to be removed to avoid impact on other species such as bats, as it will be necessary to maintain a minimum separation distance between the rotor tip and the nearest habitat feature (hedgerow or treeline). Within the ESA, this will necessitate the removal of *c.* 100m of mature, but species poor, hawthorn hedgerow habitat within the vicinity of T13. **The required buffer between turbines and hedgerow features is 72m, while for treelines this figure is 84m.** These figures have been calculated on the basis of feature height, turbine height, blade length and consequent rotor-swept area, as described in the Natural England Technical Information Note TIN051 Bats and Onshore Wind farms – Interim Guidance[41]. Care will be taken to ensure any felling required is kept to a minimum, and disturbance to adjacent retained habitats will be avoided.

Mitigation for the protection of Hedgerows during construction follows Standing Advice Note: *"DAERA Environmental Advice for Planning Standing Advice Hedgerows"* (DAERA, 2020)[59].

The following principles have been, and will be applied, during the Development:

- The design of the Development aims to retain connectivity where possible.
- Removal of hedgerows with large trees, those that are species rich or those that are town boundaries shall be avoided during Construction.
- Any required removal of woody/scrub vegetation within the Development will aim to replace 'like for like' or enhanced habitat when replanting.
- Species used for replanting will be native, locally sourced and in-keeping within the environs of the site.
- Existing hedgerows which do not require removal shall be integrated into the Development as boundary features to ensure their long-term management and retention.
- New planting will aim to link to existing landscape features such as copses of trees and/or watercourses.

[59] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Hedgerows%20Template%20-Final%20February%202020.pdf (Accessed January 2023)

An Ecological Clerk of Works (ECoW) will be employed from the commencement to completion of construction works, including tracks, substation, temporary compound, hardstand areas and turbine bases and cabling works at a minimum. Primary roles for the ECoW will include the setting out and monitoring of the working corridor and review of pollution control measures and working practices during the active construction period.

6.1.1.3. Protection of Designated Sites

As detailed in **Section 6.2** above, the potential impacts on designated sites during the initial decommissioning and construction period are limited to the potential for water quality impacts within designated areas, including the Owenkillew River SAC, the River Foyle and Tributaries SAC, the River Finn SAC, the River Faughan and Tributaries SAC and the Lough Foyle SPA (ROI and NI), to a lesser degree, the Silverbrook Wood ASSI, Owenkillew River ASSI and River Foyle ASSI deriving from impacts on local watercourses.

With regards to water quality impacts, mitigation by avoidance during the initial decommissioning and construction phase is outlined under **Section 7.1.1.1** Protection of Watercourses. Further mitigation is also provided **within ES Chapter 8.** This is carried through into **Technical Appendix A3.1: oDCEMP** for the Development.

6.1.1.4. Protection of Terrestrial Mammals

Bats

Mitigation will incorporate the following measures in order to minimise impacts on bat species as a result of the decommissioning, construction, and operation of the Development.

Turbine buffers & Native Planting

An appropriate buffer will be maintained between turbines and features used by bats such as hedgerows, to minimise collision risk, based on the minimum requirements detailed in *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH 2021). This requires a minimum of 50m to be maintained between blade tip and the top of any foraging / commuting feature such as hedgerows or woodland edge. However, NIEA recommends that buffers are based on a suitable assessment of bat use for each site to enable them to advise on site suitability and potential harm to bats (DAERA, 2017[60]).

Given the current layout of the turbines, there will be the requirement for the removal of *c.* 100m of mature, but species poor, hawthorn hedgerow located *c.* 42m southwest of T13. This hedgerow provides a commuting and foraging habitat for a small number (<5 No. individuals) common and soprano pipistrelle bats (based on a tailored site assessment carried out here; See **Section 2.3.3.4.4)**. Removal of this species poor hedgerow is intended to discourage bats from commuting / foraging in the vicinity of T13.

In order to ensure an appropriate buffer will be maintained between turbines and linear features that are preferentially utilised by bats; the recommended removal of this hedgerow aims to discourage bats from commuting along this linear feature towards T13. Instead, replacement native tree and shrub planting has been recommended along the Legnahone Burn which runs to the south and east, which will provide additional cover and commuting / foraging opportunities for bats, particularly pipistrelle bats which are roosting nearby.

Required buffers at a minimum, are calculated as a 72m radius of the turbine for hedgerows, and an 84m radius for treelines. These figures have been calculated on the basis of feature height, turbine height, blade length and consequent rotor-swept area, as described in the Natural England Technical Information Note TIN051 *Bats and Onshore Wind farms – Interim Guidance*[61]. Care will be taken to ensure any felling required is kept to a minimum, and disturbance to adjacent retained habitats will be avoided.

At a minimum, the design of the Development will follow this advice and ensure the following is implemented on the site. Where possible:

[60] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Standing%20Advice%20-%20NED%20-%20%20Bats%20-%20November%202017.pdf (Accessed January 2023)
[61] Natural England, 2009. *Bats and Onshore Wind farms – Interim Guidance*. Technical Information Note TIN051.

- Retain all roosting sites;

- Maintain or effectively replace and enhance preferential foraging corridors identified during the bat surveys where impacts are identified;

- Retain lines of mature vegetation, water features and areas of woodland as far as possible. This will be implemented; however it is recommended that a species-poor hedgerow which runs from a confirmed bat roost towards T13 be removed and replaced with new planting along the adjacent riparian buffer of the Legnahone Burn, using locally sourced, native species of woody shrubs and trees. This mitigation will remove the likelihood of impacts upon a small number of pipistrelle bats, and will provide an enhanced riparian wildlife corridor, creating additional dark areas for foraging bats (see **Technical Appendix A3.2 HMEP**).

- The proposed lighting across the Development will consist of automatic security lights at the substation, which will be turned off when not in use and more regularly in use in wintertime when mammals are hibernating / less active.

- Native species of trees and shrubs are to be planted within infrastructure screening, to provide foraging habitat and to help retain connections with the existing lines of trees and hedgerows in the surrounding area (See **Chapter 6: Landscape and Visual Impact Assessment** and **Chapter 16: Mitigation** of the ES).

- Grassland re-seeding will utilise locally sourced native seed.

Haul Route – See **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)** for full details.

- Low to Moderate potential bat roost features could be impacted by required tree removal as per **Appendix IV** of this report, in relation to the proposed Haul Route passing points. Trees/scrub will require removal for the proposed route. A pre-felling endoscope survey on any mature trees which require felling will be first carried out by an experienced Ecological Clerk of Works to ensure no bat roosts are impacted. In the event that a bat roost is located within any of the trees proposed to be felled, bat activity surveys shall first be completed, and a licence sought from NIEA to progress the works.

- Mature trees along the haul route will be preferentially retained and any woody habitat shall be replaced 'like for like' in areas where vegetation removal is required to allow safe passage and access of wind turbine equipment / vehicles. Species planted on the site will be native, locally sourced and in-keeping with the area.

Badger and Otter

It was concluded in **Section 6** that the potential for impacts on terrestrial mammals such as badger and otter (direct and indirect impacts) in the initial decommissioning and construction phase was not significant. Specific mitigation is therefore not required in respect of these species within this ES Chapter. The implementation of a tight site working corridor and marked limits, as required for habitat protection, will further ensure no potential for impact.

However, it is recommended that as a precaution, given the confirmed and active presence of badger in the vicinity of the Development, a pre-construction mammal survey should be conducted at least 2 months prior to works commencing to ensure that no new mammal burrows have been created in close proximity of the proposed works.

In addition, general mitigation including capping of all open excavations at night-time (and the installation of egress ramps for wildlife in areas where this is not possible) will be implemented under the recommendations of an Appointed ECoW for the project.

Mitigation for the protection of badger during construction follows Standing Advice Note: *"DAERA Environmental Advice for Planning Standing Advice Badgers"* (DAERA, 2020)[62].

[62] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Badgers%20Template%20-Final%20%20February%202020.pdf (Accessed January 2023)

Mitigation for the protection of otter during construction follows Standing Advice Note: *"DAERA Environmental Advice for Planning Standing Advice Otters"* (DAERA, 2020)[63].

Where otters are present on or near a site, the following mitigation measures should be applied as a minimum post pre-construction site survey. Where found:

- Retain all otter holts where possible.
- Retain identified otter foraging, commuting and resting habitat where possible (including waterbodies, areas of woodland and scrub).
- All equipment and machinery must be appropriately stored to avoid curious otters to coming to harm.
- Provide adequate protection zones during construction and operation of the development as follows:
    - An otter holt or couch requires a 30m protection zone.
    - A natal den requires a 150m protection zone Protection zones should be conditioned as part of a planning approval. The protection zones should always be clearly marked out before any construction activities commence.
    - No works of any kind including clearance of vegetation and storage of materials can take place within the protection zones, unless a licence has been obtained from the Northern Ireland Environment Agency (NIEA) Wildlife Team for any works that may cause disturbance to otters.

6.1.1.5. Protection of Herpetofauna (Reptiles and Amphibians)

An Ecological Clerk of Works will be employed throughout the construction period. The ECoW will deliver a Toolbox Talk to the site staff to ensure that the works are undertaken in a sensitive manner, giving due cognisance to the potential presence of herpetofauna.

Reptiles

Low numbers of common lizard were recorded within the Study Area during surveys from 2019 – 2022. Suitable habitat for this species occurs across the Study Area, particularly within the north and north-east, in more sheltered areas.

The proposed Development has been designed with an aim to reduce habitat fragmentation by avoiding impacts on intact areas of peatlands. This is in line with mitigation outlined in Standing Advice Note: *"DAERA Environmental Advice for Planning Standing Advice Reptiles"* (DAERA, 2020)[64].

The mitigation below is devised to ensure that works are carried out when reptiles are less at risk of killing or injuring. Reptiles are particularly at-risk during hibernation from November to February.

Widescale habitat restoration and enhancement has been recommended and is described in detail within the Draft Habitat and Species Management Plan (Draft HMEP) (Woodrow, 2023). While the Development will result in direct impacts upon habitats used by reptiles, it will not result in an overall permanent loss of reptile habitat in the area due to proposals outlined within the Draft Habitat and Species Management Plan (Draft HMEP) (Woodrow, 2023). This will avoid long term impacts to the local reptile population.

Mitigation for this species can include conducting initial ground excavation during warmer weather (while reptiles are more active) in order to make areas unsuitable for them while they are active enough to move out of the working area. This is done under the supervision of an Ecological Clerk of Works (ECoW). However, it should be noted that such action can reduce the value of the turves for translocation and habitat restoration. Therefore, the following approach is proposed:

- **Preferably (and to reduce potential costs and time delays):** Works in potential reptile hibernacula areas (e.g., soils which lie adjacent to existing gravel / rock infrastructure) will commence outside the core hibernation period (October to March inclusive) to afford active reptiles the opportunity to leave these areas and under the guidance of an Appointed ECoW.
- The vegetation and site excavation work will be carried out in such a way that it encourages reptiles away from the footprint of the works and into the wider area of suitable habitat, outside of this footprint.

[63] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Otters%20Template%20-Final%20February%202020.pdf (Accessed January 2023)
[64] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Common%20Lizards%20Template%20-Final%20February%202020.pdf (Accessed January 2023)

- Where this is not feasible, a pre-construction survey will identify any potential hibernacula features (such as the periphery of gravel tracks abutting peatland and along embankments with cracks, crevices, or burrows) and for any winter excavation works that affect these areas, the following approach will be taken:
    - These areas will be preceded by a programme of capture and translocation of common lizards, under license from NIEA, during the active season (April to September inclusive). This will be employed, in conjunction with the use of a reptile barrier to ensure non-return of individuals into the demarcated working area, and advice will be sought form the Appointed ECoW regarding the areas and implementation for this mitigation on an on-going basis as part of **Technical Appendix A3.1: oDCEMP**.

6.1.1.6. Protection Against Invasive Species

- Scheduled invasive plant species were recorded along the haul route. A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route and within and immediately adjacent to the red line boundary (including the ESA). Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.

Amphibians

While they are not considered to be an Important Ecological Receptor within the Study Area given that they are regularly occurring and have sufficient habitat availability in the wider environs (and their population is not considered likely to be significantly affected by the Development), common frog was, however, regularly noted on Site throughout the surveys from 2017 - 2022.

No breeding ponds were recorded which would be directly impacted by the works. However, an Ecologist will visit the Study Area during spring (late February / March / early April) ahead of the proposed works in order to identify any key amphibian breeding areas.

As a general best practice mitigation procedure, where required, this will allow an ECoW to supervise the installation of wildlife barriers by the Appointed Contractor for this site.

Such barriers are to be installed where it is deemed necessary to minimise any impacts upon amphibian breeding features if these are later identified within the Zone of Influence of the Development and where these are likely to be indirectly affected by the works. Mitigation provided within **Section 7.2.1.1**. to protect watercourses and **7.2.1.2** for peatland habitats will also assist in protecting the local frog population here.

It should be noted that as common frog is a protected species, if it is identified during pre-construction works that breeding habitat for this species will be directly and adversely impacted, it may be necessary to obtain a license from NIEA to translocate this species or its frog spawn to alternative habitat in the environs, away from the works. The likelihood of this as a requirement can be identified during the preconstruction survey for amphibians.

While this upland, acidic site is not considered to provide optimal habitat for newts, as outlined above, it does support a significant population of frogs. As such, due cognisance has been given to the following mitigation for amphibians (as per Standing Advice Note: *"DAERA Environmental Advice for Planning Standing Advice Smooth Newt"* (DAERA, 2020)[65]:

Where amphibians are present on or near a site the following mitigation measures should be applied as a minimum:

- A pre-construction survey will be conducted by the ECoW during the Amphibian breeding season (March to June) in the months prior to construction works starting at the Development to ensure the baseline remains the same within the ESA.
- All identified and **utilised** waterbodies (standing water in ditches) will be retained where possible; and/or replaced if necessary.
- Habitat connectivity shall be retained.
- Habitat creation, habitat management including the provision of artificial breeding, and hibernation sites may be used as a means of improving habitats for amphibians. Any loss of a breeding waterbody will always require translocation under licence and may require replacement habitat creation.

6.1.2. Mitigation by Reduction

6.1.2.1. Protection of Watercourses

A **Draft Construction Environmental Management Plan (oDCEMP)** has been included within the planning pack to ensure that the project is constructed in line with best practice, national guidelines and follows the recommendations for mitigation made by the project team throughout construction and decommissioning of the project, See **Technical Appendix A3.1**.

6.1.2.2. Protection of Important and NI Priority Habitats

As detailed in **Section 7.2.1.2,** the potential impact on important habitats has been minimised during the design stage by maximising the use of the existing infrastructure for the Development and avoiding areas of 'Active Peat'. The sensitive nature of the peatland habitats within the Study Area should be of the upmost importance to all personnel working on the Development. No unnecessary impacts upon peatland habitats are to occur at the Development site. This involves avoiding unnecessary tracking of personnel, equipment, or machinery through these habitats where it is not specifically required and permitted as part of the

[65] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Smooth%20Newts%20Template%20-Final%20February%202020.pdf (Accessed January 2023)

proposed works. Infrastructure tracks must be utilised as a first preference, and anything outside of this should be done in consultation with the Appointed ECoW for the project.

In addition, as per **Technical Appendix A3.3: outline Peat Management Plan (oPMP)** materials should not be stored within these habitats unless specifically required and agreed within the oDCEMP and with the advice of the ECoW, and in such cases, this should be kept to a minimum.

Where any impacts are identified during pre-construction surveys by an ECoW, appropriate tree root protection zones will be maintained around such features, under the advice of a qualified arboriculturist.

There will be an active approach to silt control within the Study Area, this is outlined withing the oDCEMP. In areas being actively worked, dedicated construction staff will be tasked to place silt fences in areas of risk of overland flow of silt-laden water, particularly around T1, T8 and T3, which are upon sloped ground within close proximity to watercourses and drains. Silt fences must be visually checked on a weekly basis for efficacy, and daily in actively worked areas or during wet conditions. An approach to ensuring the above must be incorporated into a Construction Method Statement ("CMS") to be adopted by the contractor.

The design of the site and the mitigation proposals have carefully considered the potential for impacts upon Priority Habitats. This assessment has considered the Standing Advice Note: *"DAERA Environmental Advice for Planning Standing Advice Priority Habitats"* (DAERA, 2020)[66].

Development proposals should be sited and designed to include provision for the retention and integration of priority habitats to prevent their fragmentation and isolation. Where appropriate, the quality of priority habitats should be improved within development sites and ecological links to other priority habitats developed to enhance connectivity within and between development sites and the wider landscape. When development is taking place on or near a priority habitat, the following mitigation measures should be applied as a minimum:

- Any potential adverse impacts to priority habitats must be avoided at the design stage of the proposal;
- Buffer zones must be applied, where possible, to reduce the potential for direct impacts to priority habitats;
- Should compensatory measures be proposed, long habitat management and monitoring of outcomes must be implemented;
- All priority species important to the priority habitat should be accounted for in the planning processes.

Careful management of soil, and particularly peat will be carried out following the guidance outlined in **ES Chapter 9: Geology and Peat** and that outlined in the **Draft HMEP** to ensure the appropriate materials are utilised within restoration and enhancement areas.

6.1.2.3. Protection of Important and NI Priority Species

The design of the site and the mitigation proposals have carefully considered the potential for impacts upon Priority Habitats. This assessment has considered the Standing Advice Note: *"DAERA Environmental Advice for Planning Standing Advice Priority Species"* (DAERA, 2020)[67].

The following lists examples that could be applied when handling cases involving priority species:

- Retention of hedgerows, to prevent impact on foraging opportunities, habitat connectivity and resting/breeding sites.
- Ensure compensatory replanting of trees, hedgerow(s) and/or appropriate vegetation to minimise overall loss.
- Retention of habitats with favourable long-term management.
- Ensure that where necessary and appropriate, a priority species' foraging, nesting and resting needs are appropriately compensated during and/or after construction e.g., with the use of artificial refugia.
- Ensure that where required, site surveys and/or site works are not carried out during a time of year that will impact the nature or location of certain species' breeding or hibernation activities.
- Inclusion of buffer zones in the planning process so that interference from development to a priority species is kept to a minimum.

[66] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Priority%20Habitats%20Template%20-%20Final%20February%202020.pdf (Accessed January 2023)
[67] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/DAERA%20Priority%20Species%20Template%20-%20Final%20February%202020.pdf (Accessed January 2023)

The above recommendations have also informed the **Technical Appendix A3.1: oDCEMP** for the Development.

6.1.3. Offsetting

6.1.3.1. Compensatory Habitat and Enhancement Measures

To compensate for the loss of bat commuting/ foraging habitat, there will be a like-for-like replacement of the hedgerow habitat required to be felled in order to achieve sufficient buffers to avoid potential impacts on bats. This approach for replacement is incorporated into the Draft Habitat Management and Enhancement Plan (Draft HMEP) for the Study Area (**Technical Appendix A3.2**). The plan aims to maximise future woodland, hedgerow, and treeline ecological function by specifying an appropriate species mix and replacement locations to maximise connectivity for bats. In the latter case, full consideration must be taken of bat usage of the Study Area.

Given that T13 is in close proximity to a linear feature that is directly north of a known pipistrelle roost, this turbine in particular will require vegetation removal and appropriate replacement to guide bats away from the turbine. As per the Draft HMEP, the watercourse located to the south-east of this turbine (the Legnahone Burn) will be planted with native tree species such as hawthorn, alder, and willow spp., creating a rich, native riparian buffer, offering additional and alternative protection to commuting and foraging bats in the area. In combination with the replacement planting, post-construction monitoring is proposed with potential for redress actions such as smart curtailment. These measures will similarly help to maintain connectivity of commuting and feeding features for local birds, invertebrates, and small mammals.

In order to establish robust habitat connectivity and increase biodiversity, all replacement planting will be done at the earliest opportunity once planning permission has been secured. This will be carried out in consultation with the Appointed Landscape Architect.

Other Invertebrates

In accordance with the NI Priority Habitat Guide for Upland Heathland[68] - Land reclamation techniques such as use of fertilisers, drainage, and reseeding, can result in habitat loss or damage and should be prevented. To encourage biodiversity within HMEP areas, and for the benefit of species such as the local invertebrate population (which will have a positive effect on the food web within this peatland ecosystem), upland heathland is best managed by light, extensive grazing in the summer. In some areas specific management such as different grazing levels, the timing of grazing and other vegetation management may be required to establish light grazing, reduce the risk of damaging fires, or address particular habitat and species needs. Organic and inorganic fertilisers should not be applied as this would reduce species-richness and diversity with a loss of nature conservation value. Trees should not be planted on this heathland type and nor should it be used for supplementary feeding or storage areas. Measures for Habitat Compensation and Enhancement are outlined in detail within the Draft HMEP.

6.1.3.2. Habitat Restoration

The Study Area holds significant opportunities for habitat restoration and enhancement. This includes areas of the Study Area and wider environs, where habitat may benefit from practical intervention measures; as well as areas of the Study Area that hold existing infrastructure that have the potential to be restored to peatland habitat. In both cases, if fully successful, measures have the potential to contribute to offsetting impacts resulting from habitat loss to some degree.

The Draft HMEP has been produced (Woodrow, 2023) and is provided within **Technical Appendix A3.2**. This document includes a technical Peatland Restoration Report; Figures to inform the proposed management of the selected areas including a Site Overview; and locations of proposed Management measures.

Areas of the Development and wider area, where habitat may benefit from practical intervention measures include parts of the Study Area that have suffered from erosion, parts of the Study Area where surface drainage is impacting on the habitat, as well as areas between that have undergone historic or more recent peat cutting. These are all considered within the Draft HMEP.

[68] Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Habitat%20Guide%20-%20Upland%20heathland.PDF (Accessed January 2023).

Potential enhancement / restoration measures (which can be, and are, considered within **Technical Appendix A3.2 HMEP** and drainage design is discussed in ES **Technical Appendix A8.5: Outline Drainage Strategy**) include:

- The potential use of drainage controls and re-engineering, in combination with erosion control (e.g., the use of biodegradable erosion control mats such as Geo-jute, or similar, for locally sourced seeding to help restore eroded areas as required).
- Blocking, or partial blocking, of cut-off drains to bring the water level closer to the surface.
- Re-wetting of cutover areas.

Table A10.1. 25 Overview of Key Management Areas

Associated compensatory HMEP Key Management Area	Proposed Management	Approximate Size (ha)	Species benefitted
Key Management Area 1	**Restoration of peatland habitats (including NI Priority Peatland Habitat Blanket Bog)**	**42.719**	NI Priority Peatland Habitat and **Active Blanket Bog** habitat restoration with benefits to a wide range of species associated with blanket bog habitat -including a variety of Red-listed and NI Priority Species
1A	Reprofiling	2.993	
1B	Wave dam and zippering	17.917	
1C	Cell bunding 1	2.024	
1D	Cell bunding 2	2.467	
1E	Flow redistribution	13.318	
1F	Cell bunding / drain damming	4	
Key Management Area 2	**Enhancement of wader habitat**	**60.622**	Breeding waders; snipe and curlew
2A	Breeding wader grazing restrictions and creation of wader scrapes	51.915	
2B		8.707	
Key Management Area 3	**Red grouse heather management and blanket bog restoration**	**51.648**	Benefits for red grouse, NI Priority Peatland Habitat, **Active Blanket Bog** habitat and a wide range of species associated with peatland habitats
3A	Grazing restriction and wave dam and zippering	35.047	
3B	Grazing restriction	16.601	
Key Management Area 4	**Screening and replacement planting / supplementary planting of riparian buffer**	**Screening: *c.* 25,00m^2** **Planting: *c.* 500-700m**	Commuting, foraging, and breeding fauna: bats, birds, other mammals and invertebrates

The approach to restoration of identified areas is outlined in the Draft Habitat Management and Enhancement Plan (**Draft HMEP**) in **Technical Appendix A3.2** and will be undertaken under the following principles:

- Where restoration requires the use of peat and turves arising from the Development, restoration of identified areas will be undertaken concurrently with excavation of peat and turves. This will be undertaken both to maximise the success of restoration (through the quick and single movement of

turves from source to receptor locations) and to avoid the need for temporary turve and peat storage areas on Site.

- Restoration of areas will utilise locally arising turves and peat, subject to suitability. This will both ensure that the material being used is appropriate for the restoration location and will reduce significant movements of heavy machinery around the Study Area which would, in turn, be likely to increase the amount of aggregate to be imported due to track settlement.
- Restoration will be undertaken in a phased way to facilitate movement of turves in a single movement from source to receptor. This usually requires the setting aside of some turves (acrotelm) in order to access the lower peat (catotelm) at the source location so that it can be used as a bed at the receptor site to receive turves.

Full details of peat and turve excavation, transport and placement are provided within the Draft HMEP (**Technical Appendix A3.2**). Specific detail has been provided on the process for Wave Damming – a method for blocking of drainage channels, in Appendix A of the Draft HMEP.

Restoration of habitats will require ongoing positive management input as well as monitoring of success and necessary remedial measures. This is set out in the Draft Habitat Management and Enhancement Plan in **Technical Appendix A3.2** and includes:

- Ongoing monitoring of the success of habitat restoration and remedial actions as required; and,
- Protection of restoration areas, including monitoring of grazing levels;

Furthermore, general habitat restoration measures which are included within the oDCEMP and the draft HMEP will include:

- Mineral soils, sub-soil and turves will be stored separately in order to facilitate habitat restoration. All surface turves within improved grassland (GA1) will be lifted and stored separately from sub soil and replaced as top-mat to facilitate rapid re-instatement of the surface vegetation of these habitats.
- An ECoW will be employed from the commencement to completion of construction works; responsibilities will include ad hoc input into site remediation, including reseeding.
- Areas of hedgerow/treelines lost to facilitate access to the ESA along the Haul Route will be replaced (see **Appendix IV**). Specific mitigation measures, including the location of replacement hedgerows, on a like for like linear basis and positioned to retain maximum connectivity with other hedgerows, must be detailed in the draft HMEP for the Study Area prior to the commencement of construction. Areas have been identified where replanting will be carried out in order to offset the loss of hedgerow and a number of mature trees. This will help to maintain connectivity of commuting and feeding features for local bat species, birds, invertebrates, and small mammals.

6.2. Operational Phase Mitigation

6.2.1. Mitigation by Avoidance and Design

6.2.1.1. Designated areas

Measures to avoid post-construction impacts on watercourses will also be effective in avoiding post-construction impacts upon all internationally and nationally designated sites that as previously outlined, have the potential for impact through hydrological connection to the Study Area via the Legnahone Burn. These consist of actions to ensure revegetation of disturbed areas close to watercourses is completed as rapidly as possible.

In addition, an Appointed Ecologist will carry out post-construction, operational monitoring of the Development site in order to identify any issues at early stage and to recommend ameliorative actions in relation to water quality / soil erosion. This will be carried out in accordance with the oDCEMP.

Monitoring of imbedded mitigation will be carried out in accordance with the manufacturer's specifications (but at a minimum every second year to ensure features are operating effectively).

This will follow operational mitigation guidelines which are also set out within the **ES Chapters 8 and 9 which relate to hydrology, ecohydrology, geology and peatlands; in addition to the oDCEMP.**

6.3. Final Decommissioning Phase Mitigation

Final Decommissioning Phase impacts are likely to be broadly similar to Initial Decommissioning and Construction Phase impacts, in terms of disturbance through increased noise levels, ground clearance

works, and reinstatement; and potential surface water quality impacts from ground disturbance, refuelling and the storage of potentially hazardous materials onsite. The implementation of all mitigation measures detailed in the construction phase will help ensure that all such impacts are avoided.

Therefore, it is proposed that a Final Decommissioning Plan be drafted prior to removal of the Development infrastructure, this should be consistent with the approaches set out within the oDCEMP where applicable (See **Technical Appendix A3.1: oDCEMP**). This will be put into place containing specific actions aimed at protecting important habitats and species, including all the mitigation measures specified for the construction phase. These should also include limitations on the working corridor, pollution control measures and specific working practices in the vicinity of watercourses. These actions will relate to a revised map of important habitats, prepared not more than two years prior to decommissioning, and species surveys undertaken not more than one year prior to decommissioning.

6.3.1. Mitigation by avoidance

6.3.1.1. Badger and other protected species

Pre-construction badger surveys (as recommended in **Section 6.8.2.1.4**) will reassess badger setts identified during the surveys and ensure that no new setts have been created in close proximity to the infrastructure route that may be affected by decommissioning operations, as well as covering the area for other protected species (such as checking for the presence of Herpetofauna prior to works commencing on the Development).

6.3.1.2. Watercourses

Potential impacts arising from the decommissioning phase of the development are broadly similar to the Initial Decommissioning and Construction Phase, especially in terms of machinery access, excavations, and exposure of bare ground. As such, an emphasis should be placed on the protection of surface water drainage from silt-laden run-off, as well as hydrocarbon pollution arising from machinery and accidental spillages. The Decommissioning Plan for the Development will have an emphasis on the protection of surface water drainage from silt-laden run-off originating from bare ground, and on high quality habitat restoration to prevent ongoing potential for such run-off following the decommissioning stage.

6.3.1.3. Designated areas

As detailed above, the Final Decommissioning Plan for the Development will include measures for the protection of surface water drainage from silt-laden run-off originating from bare ground, and for high quality habitat restoration to prevent ongoing potential for such run-off following the decommissioning stage. Such measures will also be effective in avoiding decommissioning-stage impacts upon all internationally and nationally designated sites that are connected to the Study Area via the surface watercourses. These consist of actions to ensure revegetation of disturbed areas close to watercourses is completed as rapidly as possible.

6.3.2. Offsetting

The Decommissioning Plan will contain specific actions aimed at high quality habitat restoration of areas impacted by the decommissioning works.

7. RESIDUAL IMPACTS OF THE DEVELOPMENT

Table A10.1. 26 below sets out the residual impacts on Important Ecological Receptors within the Vicinity of the Development, taking account of the mitigation proposed above and the proposed restoration and site enhancements that are recommended within the draft HMEP (as appended to the ES in **Technical Appendix A3.2**).

Table A10.1. 26 Residual impacts of the Development on Important Ecological Receptors

Important Ecological Receptor	Evaluation of importance	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effects
Designated Sites of international or national importance with potential for hydrological connectivity to the Development: • River Foyle and Tributaries SAC / ASSI • Owenkillew River SAC / ASSI • River Finn SAC • Lough Foyle SPA (NI / ROI) • Silverbrook Wood ASSI This is fully assessed within the HRA (Woodrow, 2023)	International and National	Direct impacts upon designated sites as a result of the decommissioning and construction phase of the Development **will not occur.** Indirect impacts: A significant pollution event occurring which could result in a large-scale plume of sediment or hydrocarbons etc. being released downstream of the Study Area into streams or rivers within the Designated Site River Catchment. Ongoing run-off of sediment-laden water resulting from lack of revegetation and/or direct drainage connection between worked areas and watercourses. Significance is dependent upon magnitude of impact (i.e., the levels of pollution released). All impacts are considered to be temporary, but there is a low risk of impact upon QI species as a result of a large-scale pollution event occurring within the catchment (as a result of the proposed works) which could reach these designated sites.	Unlikely – but possible Moderate Significance	Avoiding soil/peat disturbance where possible (timing of works and silt controls where this is not possible). Protection of Watercourses. Minimisation of impacts upon hydrology, hydrogeology, soils, and geology. Recommended mitigation would negate this impact. This is provided in Section 5 of this EcIA. It should be noted that recommendations and mitigation to negate adverse impacts upon the hydrology and hydrogeology are provided in **Chapter 8: Hydrology and Hydrogeology** and on soils and geology are provided within **Chapter 9: Soils and Geology** of the ES and should be adhered to. **Technical Appendix A3.1 oDCEMP** outlines mitigation during construction.	**Negligible**

Important Ecological Receptor	Evaluation of importance	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effects
Watercourses and associated downstream ecology	Local (Higher) - Regional	Potential impacts on downstream ecological receptors such as salmonids include the release of suspended solids or hydrocarbons into the watercourses within the Study Area in the event of a largescale pollution event. This could potentially occur either directly (spillage of contaminant into watercourses, or siltation of watercourses through disturbance, vegetation clearance and/or drainage activities clearance) or indirectly (seepage of pollutants into groundwater). Water quality: Significance is dependent upon magnitude of impact (i.e., the levels of pollution released). All impacts are considered to be temporary, but there is a low risk of impact upon watercourses as a result of a large-scale pollution event occurring within the catchment (as a result of the proposed works).	Unlikely – but possible Moderate Significant Impact	See above.	**Negligible**
Peatland Habitats including: • Blanket Bog; • Dry Modified Bog; and • Wet Modified Bog	District-National	Habitat loss: Wind farm Infrastructure, hardstanding, access tracks, substation and construction compounds will all result in peatland habitat loss within the Study Area. There are opportunities for habitat restoration which could negate some anthropogenic erosion impacts from the existing Owenreagh I and II windfarms. This is discussed further within the Draft HMEP available in **Technical Appendix A3.2**.	Moderate Significance – to be minimised as far as is feasibly possible. Proposed works has been designed to avoid impacts upon peatland habitats as far as feasibly possible,	A Draft Habitat Management and Enhancement Plan has been provided (**Technical Appendix A3.2**) which includes restoration, management, and enhancement of peatland habitat across the Study Area.	**Likely Positive Overall:** Temporary disturbance of adjacent peatland habitats (e.g., through dust) Direct loss peatland habitats. Local hydrological dewatering impacts which are likely to be significant at the local level.

Important Ecological Receptor	Evaluation of importance	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effects
			focussing works within Grassland Habitats and on existing wind farm infrastructure.		Residual impact – Significant temporary impact on features of District-National Importance. Long-term residual impact will depend on the success of the enhancement measures. With successful mitigation, there is potential for a long-term impact of low significance on features of District-National Importance.
Species-poor Flush and Spring Grassland Habitat	Local (Low-Higher)	Proposed works will aim to avoid impacts upon peatland habitats as far as feasibly possible, focussing works within improved / semi-improved Grassland Habitats and on existing wind farm infrastructure. However, direct removal and indirect dewatering of *c.* 4.10 ha of species-poor flush and spring habitat is considered to be a significant effect on an IER within the Study Area at the local level and is permanent.	Moderate Significance	A Draft CEMP is included in **Technical Appendix A3.1.** **Technical Appendix A3.2: Draft Habitat Management and Enhancement Plan (Draft HMEP)** includes a snipe Habitat Management Plan for the management of *c*. 60 ha of acid grassland / species-poor flush and spring dominated habitat for breeding waders including the creation of wader scrapes within two identified territories. A focus on habitat enhancement for snipe and curlew.	**Not Significant**
Boundary features including Hedgerows with trees and Scrub	Local (Higher)	Removal of c. 100m of species poor, hawthorn hedgerow. This is considered to be of minor significance at the Local (Higher) level and is permanent.	Moderate Significance	Proposed compensatory planting of *c. 700m* of native trees as a riparian buffer within the vicinity of the removed hedgerow which will enhance an existing linear feature and enhance foraging and commuting habitat away from infrastructure.	**Likely Positive**

Important Ecological Receptor	Evaluation of importance	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effects
Other Habitats including Drains, Dry Ditches and Coniferous Plantation	Local (Low)	Natural drainage systems will remain *in situ*, however, where it is appropriate to block cut drains in order to improve the local habitat condition this will result in positive impacts on peatland habitats. Potential for negative impacts can arise from inappropriate installation of collector drains and silt ponds. Further details on this can be seen in the **Technical Appendix A2.1: Draft CEMP.** Potential for positive impact if appropriate drainage systems are blocked and re-wetting of peatland habitat is completed. Potential for negative impacts if inappropriate drainage is installed which could results in further habitat erosion, silt pollution and lowering of the water table within peatland habitats.	Minor Significance	**A Draft Habitat Management Plan has been provided which includes a Peatland Restoration Plan to restore ecological integrity to *c.*100 ha of blanket bog.** **The Draft HMEP is provided in See Draft HMEP in Technical Appendix A3.2.**	**Likely Positive**
Bats	Local (Higher)	Without mitigation, there is potential for significant effects on the following features that are considered to be of Local Importance (Higher Value): roosting soprano / common pipistrelles directed towards T13 by linear feature leading from roost to turbine and foraging /commuting common and soprano pipistrelle bats and Leisler's bat as a result of collision / barotrauma during operation. This report provides recommended mitigation measures above in **Section 6** which, subsequent to their implementation, have the potential to limit any adverse impacts from Permanent impacts of Slight to Moderate Significance, to impacts that are Not significant.	Permanent impacts of Minor to Moderate Significance	Retention of the majority of linear features in the Development design. Removal of *c.* 100m of hedgerow to discourage bats from migrating towards T13. Compensatory planting of *c. 700m* of native trees along the riparian zone of watercourse south-east of T13.	**Negligible - Likely Positive**

Important Ecological Receptor	Evaluation of importance	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effects
Foraging / commuting bats (all species)	Local (Higher)	**Construction** Removal of linear features (treeline / hedgerow south of T13) which has the potential to cause disconnect of commuting lines and loss of potential foraging area, leading to reduced foraging success and possible decline of local bats.	**Construction** Permanent, Minor Significance	Retention of the majority of linear features in the Development design. Compensatory planting of native species along the riparian zone of watercourse south-east of T13.	**Not significant**
Foraging / commuting common and soprano pipistrelle	Local (Higher)	**Construction** Removal of linear features (treeline / hedgerow south of T13) which has the potential to cause disconnect of commuting lines and loss of potential foraging area, leading to reduced foraging success and possible decline of local bats. **Operation** Turbine collision / barotrauma with the potential to cause direct mortality or serious injury of bats in flight leading to a possible decline of local bats.	**Construction** Permanent, Minor Significance **Operation** Permanent, Minor Significance	Retention of the majority of linear features in the Development design. Compensatory planting of native species along the riparian zone of watercourse south-east of T13. Post-construction monitoring, use of red lights on top of turbines, use of a buffer zone between any roosts / linear features and turbines to minimise chances of collision.	**Not significant**
Foraging / commuting Leisler's bat	Local (Higher)	**Construction** Removal of linear features (treeline / hedgerow south of T13) which has the potential to cause disconnect of commuting lines and loss of potential foraging area, leading to reduced foraging success and possible decline of local bats. **Operation** Turbine collision / barotrauma with the potential to cause direct mortality or serious	**Construction** Permanent, Minor Significance	Retention of the majority of linear features within the Development design. Compensatory planting of native species along the riparian zone of watercourse south-east of T13. Post-construction monitoring, use of red lights on top of turbines, use of a buffer zone between any roosts / linear features and turbines to minimise chances of collision.	**Not significant**

Important Ecological Receptor	Evaluation of importance	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effects
		injury of bats in flight leading to a possible decline of local bats.	**Operation** Permanent, Moderate Significance		
Badger	Local (Higher)	No badger setts occur closer than within 240 m of the proposed infrastructure. The extent of foraging habitat in the wider area means that loss of foraging habitat is not significant.	**Not Significant**	n/a	**Not Significant**
Otter	Local (Higher)	Water quality impacts can result in impacts on otter prey species and reduced prey availability. Indirect impact on otters as a result of prey impacts from water quality changes is considered to be significant at the Local level, and temporary.	Moderate Significance. Significance is international where relating to a QI feature of an SAC (River Foyle and Tributaries SAC and River Finn SAC).	Avoiding soil / peat disturbance where possible (timing of works and silt controls where this is not possible). Protection of Watercourses. Minimisation of impacts upon soils and geology. Recommended Mitigation would negate this impact. This is provided in Section 7 of this EcIA. It should be noted that recommendations and mitigation to negate adverse impacts upon hydrology and hydrogeology are provided in **Chapter 8** on upon soils and geology are provided within **Chapter 9** and of the ES and should be adhered to.	**Negligible**
Reptiles	Local (Higher)	Common lizard occurs in the Study Area. Construction works in areas holding common lizard have the potential to result in	Moderate Significance	Works in potential hibernacula areas (adjacent to existing infrastructure) will	**Negligible**

Important Ecological Receptor	Evaluation of importance	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effects
		direct mortality and the Development can result in loss of foraging habitat or hibernacula. Direct mortality may occur from excavators tracking over vegetation during the active season or destroying hibernacula (which may occur within the existing infrastructure for example) during the hibernation period. the Development may result in a loss of foraging habitat but may enhance areas in terms of hibernacula. Potential impact on common lizard, in terms of potential direct mortality are considered to be significant at the local scale, and temporary.		commence outside the core hibernation period (October to March inclusive). Where this is not feasible, works will be preceded by a programme of capture and translocation of common lizards, under license, this will be employed, in conjunction with the use of a reptile barrier to ensure non-return of individuals into the works area.	
Amphibians	Local (Higher)	Construction works in areas holding amphibians have the potential to result in direct mortality (on adults, tadpoles, and spawn). Potential impact on common frog, in terms of potential direct mortality and loss of breeding ponds is considered to be significant at the local scale, and temporary.	Temporary – Minor Significance	Construction works in areas holding amphibians have the potential to result in direct mortality (on adults, tadpoles, and spawn) and loss of breeding ponds.	Negligible

8. MONITORING

A number of monitoring measures are proposed below, with the aim of ensuring the continued effectiveness of the proposed mitigation measures. The primary areas that require monitoring are considered to be working practices, construction implementation and quality, as well as potential on-going impacts within the hydrological catchment of this site during the construction stage, and habitat recovery (particularly restored habitat) during the operational phase. Monitoring measures are incorporated into the **oDCEMP in Technical Appendix A3.1** and within the **HMEP** for the Development which is discussed in more detail in **Technical Appendix A3.2 of the ES.**

8.1. Post-Construction Phase Monitoring

There are a number of key mitigations activities during the construction phase of the works that are key to the success of the early operational phase mitigation for the project. These include excavation and work approaches to maximise potential for habitat restoration, water / suspended solid management measures, and re-vegetation of bare areas of substrate – discussed in more detail within the **Draft HMEP in Technical Appendix A3.2**.

Habitat monitoring measures are be incorporated into the **Draft HMEP** and incorporated into the role of the ECoW / Project ecologist on site as appropriate. All appropriate and relevant monitoring should be carried out under consultation with NIEA:NED.

8.1.1. Monitoring Protected Species

8.1.1.1. Bats

Although the extent to which bats are affected by collisions with turbines is not fully understood, measures, including extensive vegetation removal will reduce the potential for bat collisions or barotrauma occurring once the proposed wind farm is Operational. A post-construction monitoring plan for bats should be adopted, with extra consideration given to turbines where the recommended 50 m separation buffer from blade tip to habitat features (hedgerows or treelines) falls close to the turbines, considered to be notably relevant to T8 and T13. High levels of general bat activity were recorded near T13 during the autumn deployment, however for individual species Leisler's bat and common pipistrelle, bat activity was considered 'Moderate', and 'Low' for all other individual species. Moderate levels of bat activity were recorded near T8 and T9 in spring, summer, and autumn, with common pipistrelle being the most commonly recorded species at these two turbines, the exception being autumn 2021, when Leisler's bat passes became more frequent. Overall, individual species passes were considered 'Low' for all species.

Post-construction monitoring should include monitoring using static bat detectors, as well as a bat carcass search methodology. This will provide further information on the bat usage of the Development at turbine locations post-constriction and will also include monitoring of any bat fatalities at the new turbines. This information will indicate whether mitigation measures for bats which are outlined in **Section 6** are effective. Any need for remedial measures will then be assessed.

Post construction bat monitoring should be developed in line with recommendations in *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH 2021) and is outlined in **Sections 8.1.1.1.1– 8.1.1.1.4** below.

If, **after** post-construction monitoring, remedial action is required (such as curtailment of turbine activity to avoid impacts) successful remedial measures have included increasing of cut-in speeds during specific weather conditions (low wind speeds and high night-time temperatures) during the summer months ('smart curtailment').

8.1.1.1.1. Monitoring Intervals

Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (SNH 2021) state "*In order to evaluate the success of the curtailment regime, a minimum of 3 years of monitoring should take place during which time casualty searches and acoustic monitoring should take place concurrently*".

3-year monitoring programmes are recommended for bats on onshore windfarms, with monitoring in years 1, 2, and 3, post-construction. Start dates for monitoring years should be in line with either the start of the

breeding season or non-breeding season; and it is acceptable for the post-construction – monitoring year 1 to commence prior to the final close-out of construction, as long as the turbine is erected and turning, i.e., posing a collision risk.

8.1.1.1.2. Survey Area for Bat Monitoring

The bat survey area for post-construction phase monitoring is defined as the turbine locations identified as holding a risk to bats. On the basis of existing information, this is considered to be T8, T9 (based on proximity to a watercourse / wet ditch and woodland edge), T1 (based on proximity to a watercourse / wet ditch and high activity levels for an open area of habitat), and taking a precautionary approach, T2 (based on coniferous woodland and treelines existing in the area which had consistently High activity levels throughout the survey period), and T13 (based on proximity to treelines / hedgerows, watercourse / wet ditch and soprano / common pipistrelle roost).

8.1.1.1.3. Activity Surveys

In accordance with best practice for onshore wind farms, SNH recommend that post-construction methodologies for activity surveys should mirror those required for the pre-construction period. Activity surveys will include deployment of static detectors at a minimum of 3 deployments per active season, for a minimum of 10 nights per deployment. This will include one deployment between early May and mid-June, 1 deployment between mid-June and the end of August, and 1 deployment between early September and the end of October.

8.1.1.1.4. Collision monitoring

Carcass searches are implemented to detect any fatalities (and possibly injured animals) due to collisions with turbines. If deemed to be required based on initial bat activity monitoring surveys at this site, this should be first consulted on and any methodology agreed with, the local planning authority. The post-construction bat monitoring plan must include detailed methodology for conducting turbine searches where these are deemed to be required, with consideration given to the following:

- *Frequency and seasonality carcass searches* - monitoring should be undertaken at times identified as presenting the greatest risk of collision, which in this case, is spring to autumn (the active bat season).
- *Timing of searches* - searches commencing at dawn may limit scavenging of any causalities from the preceding night/ day; and while nocturnal scavengers like foxes will be active during the night, it is important to sample this period effectively.
- *Type of search team employed* - Trained wildlife detection dogs have been shown to be significantly more effective than humans in detecting fatalities from collision, especially in detection of smaller carcasses and where long/ dense vegetation limits visibility of the ground (Mathews *et al*. 2013).
- *Size of search areas around turbines* - A search area of r = 65 m is often selected, as studies monitoring collision have found that the core radius around turbines, where the majority of collision casualties fall, is within 50 m of turbines (Johnson *et al*. 2003 & Arnett 2006) and this is also an appropriately sized search area that can be effectively searched by an appropriately trained sniffer dog in a single time period.
- *Weather conditions* - Climatic conditions, such as humidity are known to affect detectability of scent particles by sniffer dogs and conditions prior to the search day will determine the likelihood of collisions occurring and it is important to try and sample periods when collisions are more likely and avoid those when collision risk is lower. Whenever possible, searches should not be undertaken on days following prolonged calm periods and when this is unavoidable, e.g., due to scheduling issues a note will accompany the search data.
- *H&S considerations* - searches will only be conducted within the weather parameters dictating access onto the Development site – specifically excluding periods of high wind speeds, when a lightning-strike risk alert has been issued, during periods of dense snow cover and when turbines are iced.
- *Survey routes* - Including transect intervals and how the route covered will be recorded (GPS, the ViewRanger app or similar).
- *Duration of searches* – Typically, for a search area of r = 65 m human search effort should last for a minimum of 1 hour per turbine (lone-surveyor) or a minimum of 40 minutes per turbine for a single dog

team. A single dog is unlikely to be able to search more than 4 turbines per day, as senses become over stimulated, and dogs lose interest especially when no carcases are located and become fatigued.

- *Information recorded* – The following information should be recorded:
  - Search method (dog/human), turbine identification number, time of dawn/sunrise, start time and search duration for each turbine, route taken using a GPS, ViewRanger App. or equivalent.
  - For any remains (including feather spots) a grid reference will be taken and the distance to the closest turbine recorded. The remains will be photographed *in situ* and described. Once photographed, all the remains will be bagged for identification and if collision is suspected as the cause of death, the carcass will be sent for autopsy.
  - Any signs or observations scavenging species in the environs.
  - A list of other species encountered.
  - Weather conditions during the search.
  - An assessment of flight conditions preceding the search day will be made.
  - At regular intervals over the survey year, the search area around each turbine will be described in terms of vegetation cover and easy of searching.
- *Determination of scavenging rates* – Baited trip cams can be deployed over a given survey year to determine what scavengers are active at the Development and how quickly carcasses are removed.
- *Determination of surveyor detection rates* – All survey teams will have detection rates tested and scored using a standardised methodology.

Note: ES Chapter 11: Ornithology recommends that a relevant monitoring protocol for the site is devised and that this is done in conjunction with the ECoW and under consultation with NIEA:NED.

8.1.2. Monitoring Habitats – Habitat Condition Assessment

Monitoring of the success of re-vegetation of bare areas will be undertaken by the use of vegetation quadrats in key areas and also by the use of fixed-point photography (**Technical Appendix A3.2: Draft HMEP**). Where areas have not been satisfactorily restored within 2 years according to the parameters outlined in the HMEP, a process of active re-seeding will be undertaken using locally (on-site) collected seed. This is discussed further within the draft HMEP**.** The Monitoring Programme will take place over year's 1-40 according to the programme outlined in the draft HMEP**.**

8.1.3. Monitoring Watercourses – Water Quality

Monitoring of watercourses in the immediate vicinity of the Site will be undertaken according to the parameters outlined in **Technical Appendix A3.1 oDCEMP** (but at a minimum the effectiveness of drainage proposals will be monitored every 2 years). Parameters will include total suspended solids or turbidity in order to ascertain any residual impact of the works on local aquatic ecological receptors and the results will be provided to the Planning Authority within a Post Construction Monitoring (PCM) report. Any elevated levels of suspended solids or turbidity above the current baseline will require remedial action, potentially including a review of operational phase drainage at the site.

9. SUMMARY OF SIGNIFICANT EFFECTS

Features of International Importance

Before mitigation there is potential for significant effects on features of International Importance, namely, Owenkillew River SAC, the River Foyle and Tributaries SAC, the River Finn SAC, and the Lough Foyle SPA (ROI and NI).

These European Sites are all connected to the proposal by watercourses that are crossed by existing / proposed infrastructure. In the case of the River Finn and River Foyle and Tributaries SACs, connection to the Development is by a limited number of watercourse crossings, with the designated sites occurring some 13 km downstream of the Development at the nearest point by watercourse connection. Potential for impact on these sites is limited and unlikely. Despite this, mitigation is appropriate both taking account of the importance of the designated sites and also the potential for cumulative impact. Mitigation to avoid impact on the above sites is proposed in the form of control measures during the construction period (including limitations on working corridor extent, buffer zones to watercourses, excavation and spoil working restrictions, and water management systems). A monitoring approach, including of surface watercourses,

will continue during the operational phase, with remedial action required should the monitoring highlight an issue arising from the operational wind farm. The monitoring approach and requirement for remedial action will be written into the Surface Water Management Plan (SWMP) and the final Habitat Management and Enhancement Plan (HMEP).

With the effective implementation of all mitigation, it is considered that ***residual impacts on Internationally Important features will be negligible.***

Features of National Importance

As previously highlighted, before mitigation there is potential for significant effects on features of National Importance, namely the Silverbrook Wood ASSI, Owenkillew River ASSI and River Foyle ASSI through potential impacts on water quality as these sites share hydrological connectivity with the Study Area and have QIs considered sensitive to changes in water quality.

Potential for impact on these sites is limited and unlikely. Similarly, to the proposed mitigation to protect internationally designated sites as outlined above, mitigation is appropriate both taking account of the importance of the designated sites and also the potential for cumulative impact. Mitigation to avoid impact on the above sites is proposed in the form of control measures during the construction period (including limitations on working corridor extent, buffer zones to watercourses, excavation and spoil working restrictions, and water management systems). A monitoring approach, including of surface watercourses, will continue during the operational phase, with remedial action required should the monitoring highlight an issue arising from the operational wind farm. The monitoring approach and requirement for remedial action will be written into the Surface Water Management Plan (SWMP) and the final Habitat Management Plan (HMEP).

With the effective implementation of all mitigation, it is considered that ***residual impacts on Nationally Important features will be negligible.***

Features of District-National Importance

Before mitigation there is potential for significant effects on features of District-National Importance, namely Annex I habitats; 'Intact (Active) Blanket Bog' and 'Recovering Blanket Bog'. Some of these habitats occur as small fragments within a wider mosaic and others occur as larger areas or form parts of more coherent wider habitat networks and may be considered as part of a nationally important feature.

The proposal will result in the direct loss of *c.*0.133 ha of these habitats (0.032 ha Active Blanket Bog, 0.101 ha Recovering Blanket Bog). There is further potential for the proposal to result in a max indirect effect on these habitats as a result of potential dewatering. Maximum estimated indirect impacts are expected to affect a further *c.* 0.094 ha (0.022 ha Active Blanket Bog and 0.072 ha Recovering Blanket Bog). Subsequently, in total a maximum area *c.* 0.227 ha of District-National Important habitats has the potential to be impacted by the Development.

There is likely to be temporary disturbance of adjacent peatland habitats (e.g., through dust or local hydrological impacts during construction) which is likely to be significant at the local level.

The significance of residual impacts on District-National Important features is dependent on the extent of restoration and enhancement measures undertaken within Study Area. It is proposed that the loss of all peatland (including non-Annex quality) habitats are compensated for through the enhancement of other areas within the Study Area.

The Draft HMEP includes a technical report focused on the management enhancement of bog habitat within the Study Area including:

- Peatland restoration of *c*. 40 ha of degraded peatland habitat utilising both tried and tested as well as pioneering approaches; and,
- A red grouse habitat management plan to manage *c*. 50 ha of peatland habitat as suitable foraging and breeding habitat for this species.

This is considered to result in a ***significant temporary impact on features of Local to National Importance.*** Long-term residual impact will depend on the success of the enhancement measures. With successful mitigation, there is potential for a ***long-term impact of low significance on features of Local to National Importance.***

Features of Local (Higher Value) Importance

Before mitigation there is potential for significant effects on features of Local Importance (Higher Value), namely, watercourses (rivers, streams, and drainage ditches), non-Annex I habitats including species-poor flush and spring as well as otter, common lizard and common frog. Mitigation measures proposed include the minimisation of the working corridor to ensure habitat loss and potential species impacts are contained, appropriate timing of works, species exclusion measures if required and pollution control measures during the construction period (including limitations on working corridor extent, buffer zones to watercourses, excavation and spoil working restrictions, and water management systems).

As outlined in **Table A10.1. 26** above and within the **Draft HMEP** (**Technical Appendix A3.2**), proposed positive steps to be taken in relation to management for habitats and associated fauna at this Site include:

- A snipe/breeding wader habitat management plan to enhance habitat suitability within acid grassland / species-poor flush habitats; and,
- Approximately 700 m of native tree planting along riparian corridors to improve habitat connectivity and commuting features within the landscape.

The above measures will have positive impacts upon local habitats, flora and fauna as specified in below.

With the effective implementation of all mitigation, it is considered that residual impacts on Locally (Higher Value) Important features will be **negligible.**

9.1. Statement of Significance

Details of potentially significant effects have been provided in **Section 6.7.2.1**.

It is considered that, the proposed mitigation, including the successful restoration of habitats (where this is found to be effective following a detailed monitoring programme) will result in an overall residual impact upon the Important Ecological Receptors that lie within the Zone of Influence of the Development varying from **negligible to low significance.**

Any features considerate to be affected from **moderate to high significance** have been brought forward into ES Chapter 10: Ecology.

Table A10.1. 27 Summary of Restoration and Enhancement Measures to be undertaken as part of the Habitat Management for the Development which are of benefit to Important Ecological Receptors

Management	Habitats and Flora	Fauna described in Ecology Chapter 10	Red Grouse	Snipe
Restoration of *c.* 42.7 ha of blanket bog habitat through a combination approach of tried and tested as well as pioneering methodologies: - Wave dam and zippering - Reprofiling - Cell Bunding - Flow redistribution	**X**	**X**	**X**	**X**
Red Grouse Habitat Management Plan – Enhancement of *c*. 51.64 ha of peatland habitat through a combination approach of heather mowing and low-intensity grazing.	**X**	**X**	**X**	**X**
Snipe / Breeding Wader Habitat Management Plan – Enhancement of *c.* 60.62 ha of acid grassland / flush habitat through a combination approach of wader scrape creation and low-intensity rough moorland grazing.	**X**	**X**	**X**	**X**
c. 500 - 700m tree planting along riparian corridors and Screening planting: *c.* 25,00m^2	**X**	**X**		**X**
Prevention of peat cutting on areas without turbary rights.	**X**	**X**		
Removal of sparse self-seeded conifers.	**X**		**X**	**X**

Please note: Mitigation in relation to birds is dealt with in **Chapter 11 – Ornithology** but has been included here for reference.

10. REFERENCES

- Amphibian and Reptile Groups of the UK and Ireland (ARGUK) (2018). Advice note 10: Reptile Survey and Mitigation Guidance for Peatland Habitats. Available at: https://www.arguk.org/downloads-in-pages/resources/advice-notes
- Bat Conservation Ireland website (online). Available at: http://www.batconservationireland.org
- Bauer, G. and Vogel, C. (1987). The parasitic stage of the freshwater pearl mussel *Margaritifera margaritifera*. I. Host response to Glochidiosis. Arch. Hydrobiol. 76, 393-402.
- BCI (2022a) *Common pipistrelle and soprano pipistrelle.* (online) Available at: https://www.batconservationireland.org/irish-bats/species/common-and-soprano-pipistrelle (Accessed July 2022).
- BCI (2022b) *Leisler's bat.* (online) Available at: https://www.batconservationireland.org/irish-bats/species/leislers-bat (Accessed July 2022).
- BCI (2022c) *Brown long-eared bat.* (online) Available at: https://www.batconservationireland.org/irish-bats/species/brown-long-eared-bat (Accessed July 2022).
- BCI (2022d) *Daubenton's bat.* (online) Available at: https://www.batconservationireland.org/irish-bats/species/daubentons-bat (Accessed July 2022).
- BCT (2018) *Bats and Artificial Lighting in the UK.* Bats & the built environment. (online) Available at: https://cdn.bats.org.uk/uploads/pdf/Resources/ilp-guidance-note-8-bats-and-artificial-lighting-compressed.pdf?v=1542109349
- BCT (2022a) *Avoidance, Mitigation and Compensation.* (online) Available at: Avoidance, Mitigation & Compensation - Buildings, planning and development - Bat Conservation Trust (bats.org.uk) (Accessed July 2022).
- Boelter (1972). Water Table Drawdown around an open ditch in organic soils. Journal of Hydrology, 15, (1972) 329-340.
- Buddensiek, V. (2001). Okologie der jungen Flussperlmusschel. In: Böttig, E. (Ed.) "The Freshwater pearl mussel in Europe: Population status and conservation strategies". Wasserwirtschaftsamt, Hof.
- Buddensiek, V. (1995). The culture of juvenile freshwater pearl mussels *Margaritifera margaritifera* L. in cages: a contribution to conservation programmes and the knowledge of habitat requirements. Biol. Conserv. 74, 33-40.
- Buddensiek, V., Engel, H., Fleischauer-Rossing, S. and Wachtler, K. (1993). Studies on the chemistry of interstitial water taken from defined horizons in the fine sediments of bivalve habitats in several northern German lowland waters. II: Microhabitats of *Margaritifera margaritifera* L., Unio crassus (Philipson) and Unio tumidus Philipsson. Arch. Hydrobiol. 127, 151-166.
- CIEEM (2013). Competencies for Species Survey: Eurasian Otter. Available at: https://cieem.net/wp-content/uploads/2019/02/CSS-EURASIAN-OTTER-April-2013.pdf
- CIEEM (2014) *Reptile Survey Guidelines*. Available at: https://cieem.net/wp-content/uploads/2019/02/CSS-REPTILES-October-2014.pdf
- CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.2. Chartered Institute of Ecology and Environmental Management, Winchester.
- Cooke, A. S. & Frazer, J. F. D. (1976). Characteristics of newt breeding sites. J. Zool. (Lond.) 178: 223– 236.
- DAERA (2011). NIEA Otters & Development. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-information-otters-and-development-2011.pdf
- DAERA (2017). NIEA Otter Survey Requirements. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/otter-survey-specifications.pdf
- DAERA (2017). Common or Viviparous Lizard Surveys NIEA Specific Requirements. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/common-lizard-survey-specifications.pdf
- DAERA (2017). NIEA Badger Survey Requirements. Available at; https://www.daera-ni.gov.uk/sites/default/files/publications/daera/badger-survey-specifications.pdf
- DAERA (2017). Red Squirrel Surveys NIEA Specific Requirements https://www.daera-ni.gov.uk/sites/default/files/publications/daera/red-squirrel-survey-specifications.pdf

- DAERA (2018): Northern Ireland Priority Habitat Guide – Blanket Bog. Available online at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Priority%20Habitat%20Guide%20-%20Blanket%20bog.PDF
- DAERA (2018): Northern Ireland Priority Habitat Guide – Purple moor-grass and rush pasture. Available online: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Habitat%20Guide%20-%20Purple%20moor-grass%20and%20rush%20pasture.PDF
- DAERA (2018): Northern Ireland Priority Habitat Guide – Upland heathland. Available online: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Habitat%20Guide%20-%20Upland%20heathland.PDF
- DAERA (2003) Northern Ireland Habitat Action Plan - Blanket Bog. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-plan-habitat-action-blanket-bog.pdf
- DANI (2005). Advisory Leaflet No. 1: The Evaluation of Habitat for Salmon and Trout. Life Cycle Unit Approach. Department of Agriculture for Northern Ireland, Fisheries Division, Salmonid Enhancement Programme. Northern Ireland.
- Denton, J. S. (1991). Newts in Cumbria. Herpetol. J. 1: 549– 554.
- Derry City and Strabane District - All -Ireland Pollinator Plan 2021 - 2025. Available at: http://meetings.derrycityandstrabanedistrict.com/documents/s36726/Appendix%201%20Pollinator%20Plan%202021%202025.pdf
- Derry City & Strabane District Council. 2019. Derry City & Strabane District Council Green Infrastructure Plan 2019-2032. www.derrystrabane.com/gi
- Derry Area Plan (2011). Available online at: Derry Area Plan 2011: Adopted Plan (archive-it.org)
- Elkington et al. (2001). JNCC NVC field guide to mires and heaths. .Available at: https://data.jncc.gov.uk/data/1d0037bd-6c77-4677-8040-2f6e1d852eb1/JNCC-NVC-MiresHeaths-2002.pdf
- Farren, A., Prodöhl, P.A., Laming, P. & Reid, N. (2010). Distribution of the common lizard (Zootoca vivipara) and landscape favourability for the species in Northern Ireland. Amphibia-Reptilia 3 Vol 31 p387
- Flynn. R (2023). EHA. Peatland Restoration Plan (incorporated into **Technical Appendix A3.2 The Draft HMEP**).
- Forestry Commission - Scottish Natural Heritage (2010) Floating Roads on Peat. http://www.roadex.org/wp-content/uploads/2014/01/FCE-SNH-Floating-Roads-on-Peat-report.pdf
- FrogLife (2014) *Surveying for Reptiles*. Available at: https://www.froglife.org/wp-content/uploads/2013/06/Reptile-survey-booklet-3mm-bleed.pdf
- Gurnell et al., (2001). Practical Techniques for Surveying and Monitoring Squirrels. Available at: https://treesforlife.org.uk/docs/079_360__practicaltechniquesforsurveyingandmonitoringsquirrels_1446049986.pdf
- Gurnell J, Lurz P, McDonald R and Pepper H (2009) Practical Techniques for Surveying and Monitoring Squirrels. Practice Note. Forestry Commission, Edinburgh.
- Hundt, L. (2012) *Bat Surveys: Good Practice Guidelines* (2nd Edition). The Bat Conservation Trust, London.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and Adjacent to waters. Inland Fisheries Ireland. Dublin, Ireland.
- JNCC (2016) Handbook for Phase 1 Habitat Survey – a Technique for Environmental Audit. Joint Nature Conservation Committee, Peterborough, ISBN 0 86139 636 7.
- JNCC (2016). UK BAP Priority Habitats. Hedgerows. Available at: Hedgerows (UK BAP Priority Habitat description) (jncc.gov.uk).
- Kelleher, C. & Marnell, F. (2006*) Bat Mitigation Guidelines for Ireland.* Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Kruszynski, C., Bailey, L.D., Bach, L., Bach, P., Fritze, M., Lindecke, O., Teige, T. and Voigt, C.C. (2021) *High vulnerability of juvenile Nathusius' pipistrelle bats (Pipistrellus nathusii) at wind turbines.* Ecological Society of America 32(2).
- Lintott, P.R., Davison, S., van Breda, J., Kubasiewicz, L., Dowse, D., Daisley, J., Haddy, E. & Mathews, F. (2018). *Ecobat: An online resource to facilitate transparent, evidence-based interpretation of bat activity data.* Ecology and evolution, 8(2) 935-941
- Lundy, M., Montgomery, I. and Russ, J. (2010) Climate change-linked range expansion of Nathusius' pipistrelle bat, *Pipistrellus nathusii*. 37 (12) 2232-2242

- Mathews Fiona, Roche Niamh, Aughney Tina, Jones Nicholas, Day Julie, Baker James and Langton Steve (2015) Barriers and benefits: implications of artificial night-lighting for the distribution of common bats in Britain and IrelandPhil. Trans. R. Soc. B3702014012420140124 http://doi.org/10.1098/rstb.2014.0124
- Marnell, F. (1998). Discriminant analysis of the terrestrial and aquatic habitat determinants of the smooth newt (Triturus vulgaris) and the common frog (*Rana temporaria*) in Ireland. Journal of Zoology (1987), 244(1), 1–6. https://doi.org/10.1111/j.1469-7998.1998.tb00001.x
- Marnell, Ferdia & Looney, Declan & Lawton, Colin. (2019). Ireland Red List No. 12: Terrestrial Mammals.
- McAney, K. (2006) A conservation plan for Irish vesper bats. Irish Wildlife Manuals, No. 20. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland. Available at: https://www.npws.ie/sites/default/files/publications/pdf/IWM20.pdf (Accessed October 2022)
- Middleton N., Fround A. & French, K. (2014) Social Calls of the Bats of Britain and Ireland.
- National Renewable Energy Laboratory (2013) *Reducing Bat Fatalities from Interactions with Operating Wind Turbines.* Available at: https://www.nrel.gov/docs/fy14osti/60427.pdf (Accessed November 2022)
- National Roads Authority (2006). Guidelines for the Treatment of Badgers prior to the Construction of a National Road Scheme. Environmental Series on Construction Impacts. Available at: http://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Treatment-of-Badgers-prior-to-the-Construction-of-a-National-Road-Scheme.pdf
- National Roads Authority (2006). Guidelines for the Treatment of Badgers prior to the Construction of a National Road Scheme. Environmental Series on Construction Impacts. Available at: http://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Treatment-of-Badgers-prior-to-the-Construction-of-a-National-Road-Scheme.pdf
- Nature Scot (2018). Species Planning Advice. Available at: https://www.nature.scot/sites/default/files/2018-09/Species%20Planning%20Advice%20-%20red%20squirrel.pdf
- NIEA (2012) Natural Heritage, Development Management Team Advice Note Active Peatland and PPS18. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-guidance-NIEA-natural-heritage-development-management-team-advice-note-2012.pdf
- NIEA (2017) Marsh Fritillary Butterfly Surveys – NIEA Specific Requirements. Available online at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/marsh-fritillary-butterfly-survey-specifications.pdf
- NRA (2006) Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes. Transport Infrastructure Ireland. Available online at: 80359 Badgers (tii.ie)
- NRW, NIEA and SEPA (2017). Guidance for Pollution Control: Works and Maintenance in or near Water. Natural Resources Wales, the Northern Ireland Environment Agency, and Scottish Environment Protection Agency. UK.
- Rachwald, A., Bradford, T., Borowski, Z. and Racey, P.A. (2016) Habitat Preferences of Soprano Pipistrelle Pipistrellus pygmaeus (Leach, 1825) and Common Pipistrelle *Pipistrellus pipistrellus* (Schreber, 1774) in Two Different Woodlands in Northeast Scotland. Zoological Studies 55(22)
- Richardson, S.M., Lintott, P.R., Hosken, D.J., Economou, T. and Mathews, F. (2021) Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats. Sci Rep 11, 3636.
- Roche, N., Langton, S., Aughney, T., Russ, M., Marnell, F., Lynn, D. and Catto, C. (2011) A car-based monitoring method reveals new information on bat populations and distributions in Ireland. Animal Conservation 14(6) 642-651.
- Rodwell, J.S. (2006) NVC Users' Handbook, JNCC, Peterborough, ISBN 978 1 86107 574 1
- Russ, J.M. (2012) British Bat Calls: A Guide to Species Identification.
- Russ, J.M., Briffa, W. and Montgomery, I. (2006) Seasonal patterns in activity and habitat use by bats (Pipistrellus spp. and *Nyctalus leisleri*) in Northern Ireland, determined using a driven transect. Journal of Zoology. 259 (3) 289-299.
- Shiel, C.B. and Fairley, J.S. (1998) Activity of Leisler's Bat *Nyctalus leisleri* (Kuhl) in the Field in South-East County Wexford, as Revealed by a Bat Detector. Biology and Environment: Proceedings of the Royal Irish Academy. 98B(2) 105-112.
- Shiel, C.B., Shiel, R.E. and Fairley, J.S. (1999) Seasonal changes in the foraging behaviour of Leisler's bats (*Nyctalus leisleri*) in Ireland as revealed by radio-telemetry. Journal of Zoology 249(3) 347 – 358.

- Smith, G., O'Donoghue, P., O'Hora, K. And Delaney, E. (2011) Best Practice Guidance for Habitat Survey and Mapping. The Heritage Council.
- Scottish Natural Heritage (SNH) (2021) Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (Version: August 2021, updated within minor revisions). Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd., University of Exeter & Bat Conservation Trust. Bats and onshore wind turbines: Interim guidance, Jan 2009 (nature.scot)
- Spoelstra, K., van Grunsven, R.H.A., Ramakers, J.J.C., Ferguson, K.B., Raap, T., Donners, M., Veenedaal, E.M. and Visser, M.E. (2017) *Response of bats to light with different spectra: light-shy and agile bat presence is affected by white and green, but not red light.* The Royal Society 284(1855).
- Streeter, C., Hart-Davies, C., Hardcastle, A., Cole, F. & Harper, L. (2016). The most complete guide to the wildflowers of Britain and Ireland, 2nd Edition. HarperCollins Publishers, ISBN10 000710621.
- Woodrow (2023) Habitat Management and Enhancement Plan (HMEP) for Owenreagh / Craignagapple Wind Farm (**See Technical Appendix A3.2**)
- Woodrow (2023). Habitats Regulations Assessment (HRA)
- Yalden, D. W. (1986). The distribution of newts, Triturus spp., in the Peak District, England. Herpetol. J. 1: 97– 101.
- Zeale, M.R.K, Stone, E.L., Zeale, E., Browne, W.J., Harris, S. and Jones, G. (2018) *Experimentally manipulating light spectra reveals the importance of dark corridors for commuting bats.* Global Change Biology 24(12) 5909-5918.

11. APPENDICES

11.1. Appendix I - Bat Surveys Additional Information

11.1.1. Static Bat Surveys – Survey Effort

Table 11.1: Static detector survey effort - Spring deployment 2021

Detector	Latitude	Longitude	Spring Deployment 31-May-2021	
			Unit	Run time
D.01	-7.35837535	54.81417068	WSS027	16 Nights (8151 min)
D.02	-7.33262315	54.80989877	WSS049	16 Nights (8151 min)
D.03	-7.32731184	54.80865165	WSS041	16 Nights (8151 min)
D.04a	-7.32674135	54.8204322	WSS043	16 Nights (8151 min)
D.05	-7.31827798	54.81942126	WSS031	16 Nights (8151 min)
D.06	-7.34026561	54.81769183	WSS033	16 Nights (8151 min)
D.07	-7.35756877	54.81558164	WSS053	16 Nights (8151 min)
D.08	-7.34906806	54.81942739	WSS037	16 Nights (8151 min)
D.09	-7.3239106	54.81551109	WSS035	16 Nights (8151 min)
D.10	-7.32049192	54.81370715	WSS036	16 Nights (8151 min)
D.11	-7.3444568	54.81348056	WSS055	16 Nights (8151 min)
D.12	-7.34144973	54.8136537	WSS052	16 Nights (8151 min)
D.14	-7.33966018	54.81279454	WSS051	n/a
D.15	-7.31313673	54.81702648	WSS028	16 Nights (8151 min)

Table 11.2: Static detector survey effort - Summer 2021

Detector	Latitude	Longitude	Summer Deployment 20-Jul-2021	
			Unit	Run time
D.01	-7.35837535	54.81417068	WSS027	17 Nights (9180)
D.02	-7.33262315	54.80989877	WSS049	17 Nights (9180)
D.03	-7.32731184	54.80865165	WSS041	17 Nights (9180)
D.04b	-7.32326845	54.81980381	WSS043	17 Nights (9180)
D.05	-7.31827798	54.81942126	WSS031	18 Nights (9752)
D.06	-7.34026561	54.81769183	WSS033	18 Nights (9752)
D.07	-7.35756877	54.81558164	WSS053	6 Nights (3128)
D.08	-7.34906806	54.81942739	WSS037	17 Nights (9180)
D.09	-7.3239106	54.81551109	WSS035	18 Nights (9752)
D.10	-7.32049192	54.81370715	WSS036	17 Nights (9180)
D.11	-7.3444568	54.81348056	WSS055	17 Nights (9180)
D.12	-7.34144973	54.8136537	WSS052	17 Nights (9180)
D.14	-7.33966018	54.81279454	WSS051	17 Nights (9180)

Table 11.3: Static deployment survey effort - Autumn 2021

Detector	Latitude	Longitude	Autumn Deployment 26-Aug-2021	
			Unit	Run time
D.01	-7.35837535	54.81417068	WSS060	14 Nights (9497 min)
D.02	-7.33262315	54.80989877	WSS036	15 Nights (10207 min)
D.03	-7.32731184	54.80865165	WSS030	15 Nights (10207 min)
D.04b	-7.32326845	54.81980381	WSS055	14 Nights (9497 min)
D.05	-7.31827798	54.81942126	WSS032	14 Nights (9497 min)
D.06	-7.34026561	54.81769183	WSS052	15 Nights (10207 min)
D.07	-7.35756877	54.81558164	WSS037	14 Nights (9497 min)
D.08	-7.34906806	54.81942739	WSS038	14 Nights (9497 min)
D.09	-7.3239106	54.81551109	WSS046	15 Nights (10207 min)
D.10	-7.32049192	54.81370715	WSS034	15 Nights (10207 min)
D.11	-7.3444568	54.81348056	WSS031	15 Nights (10207 min)
D.12	-7.318292549	54.81950023	WSS040	15 Nights (10207 min)
D.14	-7.33966018	54.81279454	WSS024	15 Nights (10207 min)
D.15	-7.31313673	54.81702648	WSS053	14 Nights (9497 min)

Table 11.4: Locations of targeted static detectors (2021)

Leisler's Roost			**Direction from roost**	**Soprano Roost**			**Direction from roost**
Detector No.	**Latitude**	**Longitude**		**Detector No.**	**Latitude**	**Longitude**	
WSS007	-7.35606	54.81636	E	WSS008	-7.31886	54.81821	W
WSS017	-7.35843	54.81688	NW	WSS012	-7.31821	54.81933	N
WSS021	-7.35605	54.81478	S	WSS023	-7.31634	54.81794	SE
WSS047	-7.3576	54.81637	W	WSS042	-7.31761	54.81847	E

Site Photos

Buildings Surveyed for Roosting Potential







House 1




House 2




House 3




House 4


Coniferous woodland south of Leisler's tree roost **Coniferous woodland east of T3**


Treeline near soprano roost

Watercourse east of T13 (for proposed riparian planting of native species)

11.1.2. Bat Roost Records from NI Bat Group

Table 11.5: BCT Roost and Survey data within 10km of the Study Area

Latin Name	Common Name	Irish Grid Reference *(Grid refs reduced for conservation reasons)*	Date recorded
Chiroptera	Unidentified bat	C3616	23/07/2001
Myotis spp.	Myotis spp.	C3701	24/08/2015
Chiroptera	Unidentified bat	C3701	15/07/2011
Chiroptera	Unidentified bat	C3737	11/07/2008
Chiroptera	Unidentified bat	C3750	02/06/1994
Pipistrellus spp.	Pipistrelle spp.	C3709	24/06/1997
Myotis spp.	Unidentified bat	C3712	11/08/2015
Pipistrellus pipistrellus	Common pipistrelle	C3802	03/10/1996
Pipistrellus pygmaeus	Soprano pipistrelle	C3802	03/10/1996
Pipistrellus spp.	Pipistrelle spp.	C3831	09/07/1999
Chiroptera	Unidentified bat	C3839	09/09/2007
Myotis spp.	Myotis spp.	C4005	22/08/2014
Myotis spp.	Myotis spp.	C4104	31/07/2015
Pipistrellus pipistrellus	Common pipistrelle	C4207	05/07/1996
Pipistrellus spp.	Pipistrelle spp.	C4420	11/06/1998
Pipistrellus spp.	Pipistrelle spp.	C4420	24/06/1998
Pipistrellus pipistrellus	Common pipistrelle	C4431	08/08/2012
Chiroptera	Unidentified bat	C4517	14/07/1995
Pipistrellus spp.	Pipistrelle spp.	C4510	24/09/2007
Chiroptera	Unidentified bat	C4505	16/05/2003
Chiroptera	Unidentified bat	C4505	16/05/2003
Pipistrellus spp.	Pipistrelle spp.	C4621	14/12/1994
Pipistrellus pipistrellus	Common pipistrelle	C4825	24/08/2012
Pipistrellus pipistrellus	Common pipistrelle	C4824	08/08/2012

Latin Name	Common Name	Irish Grid Reference *(Grid refs reduced for conservation reasons)*	Date recorded
Pipistrellus pipistrellus	Common pipistrelle	C4824	08/08/2012
Plecotus auritus	Brown long-eared bat	C4822	01/10/1997
Plecotus auritus	Brown long-eared bat	C4822	01/10/1997
Myotis daubentonii	Daubenton's bat	H3296	01/10/2010
Pipistrellus pygmaeus	Soprano pipistrelle	H3297	01/10/2010
Nyctalus leisleri	Leisler's Bat	H3297	01/10/2010
Pipistrellus nathusii	Nathusius' Pipistrelle	H3297	01/10/2010
Pipistrellus pipistrellus	Common pipistrelle	H3297	01/10/2010
Pipistrellus nathusii	Nathusius' pipistrelle	H3393	27/06/2012
Pipistrellus pygmaeus	Soprano pipistrelle	H3397	01/10/2010
Chiroptera	Unidentified bat	H3336	01/06/1990
Pipistrellus spp.	Pipistrelle spp.	H3353	01/09/1988
Pipistrellus pipistrellus	Common pipistrelle	H3496	12/08/2013
Pipistrellus pygmaeus	Soprano pipistrelle	H3464	01/09/2014
Pipistrellus pygmaeus	Soprano pipistrelle	H3464	01/09/2014
Chiroptera	Unidentified bat	H3467	21/08/1994
Chiroptera	Unidentified bat	H3467	18/05/2016
Pipistrellus spp.	Pipistrelle spp.	H3470	17/07/2018
Myotis spp.	Myotis spp.	H3488	24/08/2015
Chiroptera	Unidentified bat	H3485	26/06/1997
Pipistrellus pipistrellus	Common pipistrelle	H3486	19/06/2012
Pipistrellus pipistrellus	Common pipistrelle	H3486	19/06/2012
Chiroptera	Unidentified bat	H3487	19/05/1998
Chiroptera	Unidentified bat	H3493	16/05/1997
Pipistrellus spp.	Pipistrelle spp.	H3530	23/08/2007
Pipistrellus pipistrellus	Common pipistrelle	H3581	23/08/2012
Pipistrellus pipistrellus	Common pipistrelle	H3581	23/09/2012
Pipistrellus spp.	Pipistrelle spp.	H3514	07/08/2006
Pipistrellus spp.	Pipistrelle spp.	H3514	07/08/2006
Pipistrellus spp.	Pipistrelle spp.	H3565	27/06/2016
Nyctalus leisleri	Leisler's bat	H3565	27/06/2016
Pipistrellus spp.	Pipistrelle spp.	H3575	08/10/2007
Pipistrellus spp.	Pipistrelle spp.	H3575	08/10/2007
Chiroptera	Unidentified bat	H3601	23/06/2001
Pipistrellus spp.	Pipistrelle spp.	H3602	15/08/1988
Pipistrellus spp.	Pipistrelle spp.	H3602	20/06/1991
Pipistrellus spp.	Pipistrelle spp.	H3602	21/06/1996
Pipistrellus spp.	Pipistrelle spp.	H3602	22/06/1990
Pipistrellus spp.	Pipistrelle spp.	H3602	22/06/1993
Pipistrellus spp.	Pipistrelle spp.	H3602	23/06/1992
Pipistrellus spp.	Pipistrelle spp.	H3602	23/06/1995
Pipistrellus spp.	Pipistrelle spp.	H3602	25/06/1994
Pipistrellus spp.	Pipistrelle spp.	H3700	01/07/2008
Pipistrellus spp.	Pipistrelle spp.	H3700	06/07/2007
Pipistrellus spp.	Pipistrelle spp.	H3700	17/07/2008
Pipistrellus spp.	Pipistrelle spp.	H3700	21/05/2008
Pipistrellus spp.	Pipistrelle spp.	H3700	15/08/2006
Pipistrellus spp.	Pipistrelle spp.	H3700	01/07/2008

Latin Name	Common Name	Irish Grid Reference *(Grid refs reduced for conservation reasons)*	Date recorded
Pipistrellus spp.	Pipistrelle spp.	H3700	06/07/2007
Pipistrellus spp.	Pipistrelle spp.	H3700	17/07/2008
Pipistrellus spp.	Pipistrelle spp.	H3700	21/05/2008
Nyctalus leisleri	Leisler's bat	H3891	01/07/2011
Nyctalus leisleri	Leisler's bat	H3891	01/07/2011
Pipistrellus pipistrellus	Common pipistrelle	H3892	01/07/2011
Pipistrellus pipistrellus	Common pipistrelle	H3892	01/07/2011
Chiroptera	Unidentified bat	H39	02/08/2001
Pipistrellus spp.	Pipistrelle spp.	H3910	16/07/2001
Pipistrellus spp.	Pipistrelle spp.	H3910	23/07/1997
Pipistrellus spp.	Pipistrelle spp.	H4274	01/10/2001
Plecotus auritus	Brown long-eared bat	H4587	03/10/1986
Pipistrellus spp.	Pipistrelle spp.	H4587	15/07/1987
Plecotus auritus	Brown long-eared bat	H4587	15/07/1987
Nyctalus leisleri	Leisler's Bat	H4587	30/09/1986
Myotis spp.	Myotis spp.	H4518	08/04/2013
Chiroptera	Unidentified bat	H4893	11/06/2014
Pipistrellus spp.	Pipistrelle spp.	H4813	08/07/1999
Pipistrellus spp.	Pipistrelle spp.	H4813	08/07/1999
Pipistrellus spp.	Pipistrelle spp.	H4816	30/07/1995
Chiroptera	Unidentified bat	H4983	01/11/1985
Myotis daubentonii	Daubenton's Bat	H4913	20/08/2008
Chiroptera	Unidentified bat	H4913	20/08/2008
Chiroptera	Unidentified bat	H3487	19/05/1998
Chiroptera	Unidentified bat	C3729	03/04/1997
Pipistrellus spp.	Pipistrelle spp.	H3363	04/08/1987
Chiroptera	Unidentified bat	C3611	1985 - 1986
Pipistrellus spp.	Pipistrelle spp.	H3363	31/07/1986
Pipistrellus spp.	Pipistrelle spp.	H4816	30/07/1995
Chiroptera	Unidentified bat	H3485	26/06/1997
Chiroptera	Unidentified bat	H3575	26/06/1997
Pipistrellus spp.	Pipistrelle spp.	H4274	01/10/2001
Pipistrellus spp.	Pipistrelle spp.	H3910	16/07/2001
Pipistrellus spp.	Pipistrelle spp.	H3910	23/07/1997
Pipistrellus spp.	Pipistrelle spp.	H3602	15/08/1988
Chiroptera	Unidentified bat	H3601	23/06/2001
Pipistrellus spp.	Pipistrelle spp.	H3602	25/06/1994
Chiroptera	Unidentified bat	C3729	26/03/1997
Chiroptera	Unidentified bat	H3569	30/06/1989
Chiroptera	Unidentified bat	C4517	14/07/1995
Pipistrellus spp.	Pipistrelle spp.	C4621	14/12/1994
Chiroptera	Unidentified bat	H3926	28/06/1999
Myotis spp.	Myotis spp.	H4893	11/06/2014
Chiroptera	Unidentified bat	C3709	19/08/1996
Myotis spp.	Myotis spp.	C3814	22/07/2014
Chiroptera	Unidentified bat	H3487	23/09/1996
Myotis daubentoni	Daubenton's bat	H3477	30/06/2014
Chiroptera	Unidentified bat	C3814	22/07/2014

Latin Name	Common Name	Irish Grid Reference *(Grid refs reduced for conservation reasons)*	Date recorded
Myotis daubentoni	Daubenton's bat	H3477	30/06/2014

11.1.3. Bat Survey Report 2018 – 2019

11.1.4. Woodrow Bat Fatality Monitoring Protocol (as agreed with NIEA)

SNH Guidance (2019, updated in 2021)[69]:

"*Carcass searching at its most basic simply involves looking out for casualties of bats (and birds) underneath the turbine blades. Such searches can be carried out by appropriately trained operational staff and may be useful in identifying if an issue with bat fatalities exists at a site, provided the nature of the search area is such that casualties, if present, are likely to be detected. Searches of this type are not a substitute for the more intensive method, detailed in Appendix 4, designed to quantify casualty rates should an issue with bat fatalities be identified.*

Searches should be undertaken as early as possible in the morning during high-risk periods. Such periods could be informed by the results of pre-application activity surveys. At upland sites, accurately predicting high risk periods can be particularly challenging because they are likely to be brief and highly weather-dependent; warm, dry nights in summer with high insect abundance may result in unusually high levels of bat activity, such that the following morning would be the time to undertake a carcass search. This may not always be practical for a variety of reasons, but focusing effort in this way helps to ensure that high risk periods are monitored, and the effects of carcass decay and scavenging are minimised (Appendix 4). It should be recognised in any assessment that searches undertaken in optimum conditions may provide a biased result in terms of the frequency and extent of mortality unless the analysis accounts for this potential source of bias.

It is essential that the carcass removal rate by predators is also quantified. At many sites, almost all casualties are removed within a few days of collision. To some extent, this error can be compensated for if the carcass removal rate is known. However, it is also important to note that the impact of carcass removals can be particularly problematic where there are long intervals between searches because all casualties may be removed before a search takes place. It is therefore generally more efficient to group carcass searches into intensive blocks, rather than to spread occasional searches across the entire active season".

NIEA Guidance (2021)[70] for bat carcass searches at wind farms comprises the following:

"Carcass searches should be carried out concurrently with bat activity monitoring using static detectors to provide a comparison between bat activity levels, weather conditions and actual mortality. For wind farms carcass searches should be carried out at each turbine where activity monitoring is taking place. Carcass searches should be split into blocks of survey effort within which regular searches take place. Searches should take place every 2-4 days within each survey block with one search every two days the recommended frequency for most sites. However, sites with high levels of carcass removal through predation or scavenging may require daily searches. There should be no more than 4 days between each search. Survey blocks should be between 5 and 10 days with the minimum number of searches within each block being 3. For example, in a 10-day survey block:

- *a search every 2 days = total of 5 searches (day 1, day 3, day 5, day 7, day 9)*
- *a search every 3 days = total of 4 searches (day 1, day 4, day 7, day 10)*
- *a search every 4 days = total of 3 searches (day 1, day 5, day 10)*

Survey blocks should cover at least two seasons (including summer) on low-risk single turbine sites but should cover every season on wind farms and higher risk single turbine sites, with higher coverage during the summer or other high-risk period. Further details on recommended minimum survey effort for wind farms and single wind turbines is provided in Tables 1 and 2 below. All searches should be carried out within a search area a minimum 50m radius from the base of each turbine, i.e., a 100m x 100m grid centred on each turbine. Searches should be carried out along transects a maximum 5m wide, however, in vegetation which is hard to search (e.g., tall heather) this width should be reduced accordingly. All surveyors should have experience in searching for dead bats under wind turbines or have been trained by a suitably experienced surveyor. Carcass searches should be timed to only occur on mornings after a night when there have been favourable weather conditions for bat activity and the wind turbine has been operational.

Where any bat carcasses are found during searches the following information should be recorded and included in the report: time, date, location (turbine number and grid reference using GPS), species and sex (if possible), distance from turbine hub, vegetation type, notes on any injuries, weather conditions from previous night, any other relevant notes. Photographs of each specimen should be taken and included in the report. Bats may be collected, stored and frozen for further analysis, such as DNA testing or post-mortem."

[69] SNH (2021) Available at: https://www.nature.scot/doc/bats-and-onshore-wind-turbines-survey-assessment-and-mitigation
[70] NIEA (2021) Available at: NIEA-Guidance-on-Bat-Surveys-for-Wind-Turbine-Proposals-Final-August-1....pdf (cieem.net)

BLANK PAGE LEFT TO INSERT BAT SURVEY REPORT 2018 – 2019 HERE

11.2. Appendix II - Aquatic Surveys – Photographs of Survey Points

Plate 20: Water Quality Site 1 showing the Legnahone Burn

Plate 21: Water quality site 2 (upper parts of the Legnahone Burn)

Plate 22: Water quality site 3 located in the Altnamoola Burn

Plate 23: Water quality site 4 located in the Glenawanda burn

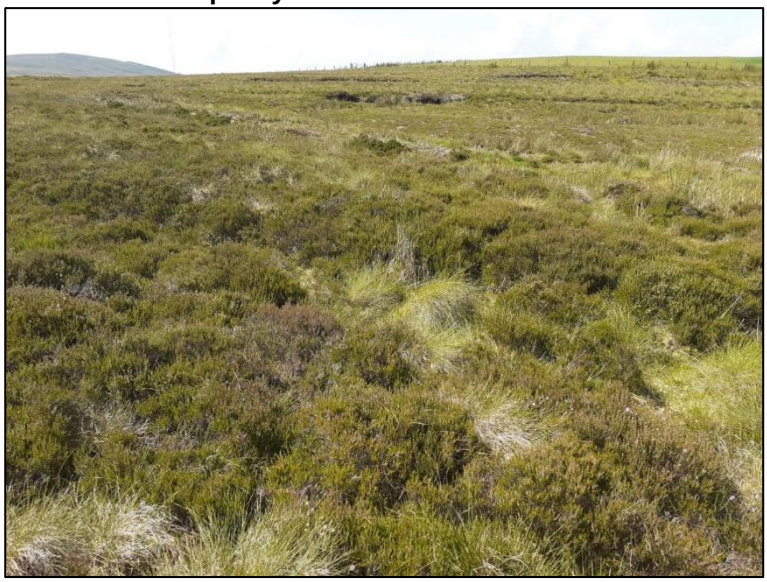


Plate 24: Salmonid suitability survey area 1

Plate 25: Salmonid suitability survey area 2

Plate 26: Salmonid suitability survey area 3

Plate 27: Salmonid suitability survey area 4

Plate 28: Salmonid suitability survey area 5

11.3. Appendix III - Confidential Badger Report (not for publication)

See Technical Appendix TA10.5 of the Environmental Statement

11.4. Appendix IV – Haul Route Assessment

The potential impacts from the various works along the haul route, as described in the table below, are not significant in terms of the EIA Regulations, either individually, together, or when considered on top of a cumulative baseline that includes potential effects from other developments.

This is because:

- The works are small-scale and would have only localised impacts;
- The works do not have the potential to affect any designated sites;
- The works are (except in one case) along existing roads and comprise minor amendments to the width and design of this road in certain places only;
- The works are not close to other development that is proposed but not yet consented; and,
- Typical mitigation for such impacts has been committed in the table below, which would be effective in reducing any effects to a negligible level.

As a result, and as described in **ES Technical Appendix A2.3**, the potential for ecological impacts associated with the haul route have been scoped out of the EIA.

Full details on vegetation clearance as a result of Haul Route and/or Abnormal Load Route Works are unknown at this stage until an Appointed Contractor can provide such information, and subsequently, this assessment has been based on a worst-case scenario.

Overarching Mitigation in relation to Haul Route (and/or Abnormal Load Route Works):

A pre-construction survey will be carried out by an experienced Ecological Clerk of Works along the entire Haul Route within the year prior to construction commencing. This pre-construction survey will aim to assess all works prior to this commencing on site. This survey will be carried out encompassing the Mitigation advised in the table below, and provide any additional recommendations based on up-to-date survey information. The survey will check for any alteration to the baseline survey results recorded within this EcIA. Particular attention will be given to recording any new mammal activity such as that of badgers / otters etc., an endoscope survey of any affected Potential Roost Features (PRFs) for bats, and a nesting bird check during March – August to check for any potential nesting birds. Where required, appropriate NIEA licences shall be applied for, and works may only commence once these are received and any agreed mitigation has been implemented, and the Appointed ECoW permits the work to proceed. This is in the interests of habitat and species conservation in accordance with the Wildlife legislation and in line with NI Policies.

Works reviewed as part of the Haul Route Assessment (Technical Appendix A2.3: Abnormal Load Route Works (ALRW))

Works number/ identifier	Location	Description (excluding street furniture works)	Ecological Assessment	Mitigation
PC/11 option 2	A5 / Woodend Road Junction, Ballymagory	Trees to be felled.	Parkland / Scattered Trees Mature Leyland cypress trees in garden; Scheduled invasive non-native species here: *Rhododendron ponticum* (X -7.430694, Y 54.856912)	Check for nesting birds prior to felling (during March – August inclusive). A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PC/13 option 1	Woodend Road/ Berryhill Road Junction, Ballymagory	Overrun area to be constructed to the south of the junction. Significant earthworks likely to be required to provide level area for vehicle.	Privet scrub	Check for nesting birds prior to felling (during March – August inclusive).
PC/13 option 2	Woodend Road/ Berryhill Road Junction, Ballymagory	Overrun area to be constructed on the inside of bend, this will require the removal of trees, wall, signposts and lighting column.	Privet scrub	Check for nesting birds prior to felling (during March – August inclusive).
PC/14	Berryhill Road/ Pine Road Junction, near Ballymagory	Overrun areas to be constructed as indicated on Drawing 4172_ALRA_0014. Earthworks may be required to level overrun areas.	Invasive non-native species noted at a number of locations around this junction: Montbretia C*rocosmia x crocosmiiflora* (X -7.418664; Y 54.852821)	Check for nesting birds prior to felling (during March – August inclusive). A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be

				implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PC/14 (B)	Berryhill Road/ Art Road Junction, near Artigarvan	The garage within the residential driveway would need to be demolished along with the gate.	Garden trees	Check for nesting birds prior to felling (during March – August inclusive).
PC/14 (B) option 2	Berryhill Road/ Art Road Junction, near Artigarvan	Overrun area to be laid on inside of bend. Overrun area to be laid on the footpath to the north of the bend.	Mature beech tree in church grounds	Avoid disturbance to all buildings and mature trees in this location. Minimise noise disturbance.
PC/14 (C)	Berryhill Road / Off Site Access Track / Sentry Road	Construction of off-site access track	Moderate to High potential for bat roosts in old barns here (however these will all remain *in situ* and will not be removed for these works). Relatively recent hedgerows planted here.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of ornamental hedgerows in agreement with homeowner. Replacement of native hedgerows with native species rich plant assemblage. Avoid disturbance to all buildings in this location. Minimise noise disturbance.
PC/15	Bend at Farmyard, Sentry Road	Overrun area to be constructed within field as indicated on drawing 4172_ALRA_0015.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage.
PC/16	Bend at 10 Sentry Road	Telegraph posts to be relocated, hedges and trees removed.	Ornamental and native hawthorn hedgerows here.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of ornamental hedgerows in agreement with homeowner. Replacement of native hedgerows with native species rich plant assemblage. Minimise noise disturbance.

PC/17	Bend beyond 3 Sentry Road	Overrun area to be constructed, wall and fence to be relocated behind overrun area.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage.
PC/18	Bends beyond Art Road, Sentry Road	Trees and hedges to be trimmed/removed as necessary, including a mature tree within the garden of the property at 30 Sentry Road	Hawthorn hedgerow. Moderate potential for bat roosts in 2 no. Ash trees to south of road at this location.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of native hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of hedgerows; native; species rich. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PC/18 option 2	Bends beyond Art Road, Sentry Road	Overrun area to be constructed within field to the west of Sentry Road. Trees to be felled on land to the south of junction.	Hawthorn hedgerow. Moderate potential for bat roosts in 2 no. Ash trees to south of road at this location.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of native hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of hedgerows; native; species rich. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PC/18 (B)	Art Road/ Sentry Road – Junction	Trees to be removed from oversail areas.	Hawthorn hedgerow. Moderate potential for bat roosts in 2 no. Ash trees to south of road at this location.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of native hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of hedgerows; native; species rich. Replacement of trees with native

				species (avoid Ash due to potential for Ash dieback).
PC/19	Bends at 33 Moorlough Road	Overrun area to be constructed within field. Fence and hedge to be removed from edge of road.	Hawthorn hedgerow. Moderate potential for bat roosts in 2 no. Ash trees to south of road at this location. Watercourse crossing. River Waterbody: UKGBNI1NW010101075 (River Segment: UKGBNI0100341) Scheduled invasive species along river here: Japanese knotweed *Fallopia japonica* (X -7.403813, Y 54.851236) Invasive non-native species noted along this road (Snowberry *Symphoricarpos albus*; Scheduled invasive species Himalayan Balsam *Impatiens glandulifera* (*X -7.403276, Y 54.851258* and *X -7.381196, Y 54.844423*) Japanese knotweed *Fallopia japonica* (X -7.403813, Y 54.851236)	Check for nesting birds prior to felling (during March – August inclusive). Replacement of native hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows; native; species rich. Replacement of trees with native species (avoid Ash due to potential for Ash dieback). Follow oDCEMP mitigation regarding the protection of watercourses. A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PC/20	Bends at 45 Moorlough Road	Overrun areas to be constructed as shown on drawing 4172_ALRA_0020. Trees to be removed as required.	Low to Moderate potential for bat roosts in Sycamore and Ash trees along this stretch. Scheduled invasive species Himalayan Balsam *Impatiens glandulifera* (X -7.396498, Y 54.848633)	Check for nesting birds prior to felling (during March – August inclusive). Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works.

				Replacement of trees with native species (avoid Ash due to potential for Ash dieback). A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PC/20 option 2	Bends at 45 Moorlough Road	Overrun area for rear of vehicles to be constructed to the north of 35 Moorlough Road. Trees to be felled. On subsequent bend, trees to be removed.	Low to Moderate potential for bat roosts in Sycamore and Ash trees along this stretch. Scheduled invasive species Himalayan Balsam *Impatiens glandulifera* (X -7.396498, Y 54.848633)	Check for nesting birds prior to felling (during March – August inclusive). Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback). A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PC/21	Bends on Moorlough road	Trees to be removed.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive).

	before Glenmornan Road		Low to Moderate potential for bat roosts in Ash trees along this stretch.	Replacement of native hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PC/22	Moorlough Road/ Glenmornan Road Junction	Trees to be removed.	Hawthorn hedgerow. Low to Moderate potential for bat roosts in Ash trees along this stretch.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of native hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PC/22 option 2	Moorlough Road/ Glenmornan Road Junction	Hedge to be relocated behind overrun area.	Hawthorn hedgerow. Low to Moderate potential for bat roosts in Ash trees along this stretch.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of native hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PC/23	Bends on Glenmornan Road	Trees and hedge to be removed.	Small water feature here. Hawthorn hedgerow. Scheduled invasive species Himalayan Balsam *Impatiens glandulifera* (X -7.381196, Y 54.844423)	Follow oDCEMP mitigation regarding the protection of watercourses. Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage.

				A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PC/24	Glenmornan Road/ Hollyhill Road Crossroad	Trees and hedge to be removed.	Hawthorn hedgerow. Low potential for bat roosts in Ash trees along this section.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PC/24 option 2	Glenmornan Road/ Hollyhill Road Crossroad	Temporary overrun areas to be constructed on the southwest boundary of the road. Hedges to be removed.	Hawthorn hedgerow. Low potential for bat roosts in Ash trees along this section.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).

Works number/ identifier	Location	Description (excluding street furniture works)	Ecological Assessment	Mitigation
PB 4	Sentry Road	Removal of hedges.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage.
PB 5	Bend on Sentry Road	Removal of hedges and relocation of fence.	Ornamental hedgerow and native mixed hedgerow. Low to Moderate potential for bat roosts in a Sycamore tree on southern side of the road.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of ornamental hedgerow in agreement with homeowner. Replacement of native hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works.
PB 7	Four-way junction on Sentry Road	Removal of hedges.	Hawthorn hedgerow. Moderate potential for bat roosts in 2 no. Ash trees to south of road at this location. Watercourse crossing. River Waterbody: UKGBNI1NW010101075 (River Segment: UKGBNI0100341) Scheduled invasive species along river here: Japanese knotweed *Fallopia japonica* (X -7.403813, Y 54.851236) Invasive non-native species noted along this road (Snowberry *Symphoricarpos albus*; Scheduled invasive species Himalayan	Check for nesting birds prior to felling (during March – August inclusive). Replacement of native hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows; native; species rich. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).

			Balsam *Impatiens glandulifera* (*X -7.403276, Y 54.851258* and *X -7.381196, Y 54.844423*) Japanese knotweed *Fallopia japonica* (X -7.403813, Y 54.851236)	Follow oDCEMP mitigation regarding the protection of watercourses. A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PB 10	Moorlough Road	Potential removal of trees. Relocation of fence.	Hedgerow already removed in this location.	Check for nesting birds prior to felling (during March – August inclusive). Potential for enhancement by replacement of native species rich hedgerow here in agreement with the landowner.
PB 11	Moorlough Road	Removal of trees.	Low to Moderate potential for bat roosts in Sycamore and Ash trees along this stretch.	Check for nesting birds prior to felling (during March – August inclusive). Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 12	Moorlough Road	Removal of hedges and relocation of fences.	Much of the hedgerow has already removed in this location.	Check for nesting birds prior to felling (during March – August inclusive). Potential for enhancement by replacement of native species rich hedgerow here in agreement with the landowner.

PB 13	Glenmornan Road	Removal of tree and relocation of fencing.	Low to Moderate potential for bat roosts in Ash trees along this stretch.	Check for nesting birds prior to felling (during March – August inclusive). Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 14	Glenmornan Road	Removal of hedges.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage.
PB 15	Glenmornan Road	Removal of hedges and tree. Relocation of fencing.	Hawthorn hedgerow. Scheduled invasive species Himalayan Balsam Impatiens glandulifera (X -7.381196134, Y 54.84442277)	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PB 16	Glenmornan Road	Relocation of fencing and removal of hedging.	Watercourse crossing.	Follow oDCEMP mitigation regarding the protection of watercourses.

			River Waterbody: UKGBNI1NW010101075 (River Segment: UKGBNI0100410) Hawthorn hedgerow. Scheduled invasive species Himalayan Balsam Impatiens glandulifera (X -7.381411, Y 54.84369)	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PB 17	Glenmornan Road	Relocation of fencing and removal of hedging.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage.
PB 18	Glenmornan Road	Relocation of fencing and removal of hedging.	Hawthorn hedgerow. Moderate potential for bat roosts in an Ash tree on northern side of the road.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).

PB 19	Glenmornan Road	Relocation of fencing and removal of hedging. Possible removal of trees	Hawthorn hedgerow. Scheduled invasive species Himalayan Balsam Impatiens glandulifera (X -7.379149, Y 54.840555)	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PB 21	Glenmornan Road	Removal of multiple trees, hedges, and relocation of fencing.	Hawthorn hedgerow with Ash trees.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows and with native species rich plant assemblage. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 22	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage.
PB 23	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow. Scheduled invasive species Himalayan Balsam Impatiens glandulifera (X -7.375205, Y 54.838501 and -7.37318, 54.836931)	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. A pre-construction invasive/non-native species survey shall be conducted in the

				year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PB 24	Glenmornan road	Removal of hedges and relocation of fencing.	Small water feature here. Hawthorn hedgerow. Scheduled invasive species Himalayan Balsam Impatiens glandulifera (X -7.37318, Y 54.836931)	Follow oDCEMP mitigation regarding the protection of watercourses. Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered.
PB 25	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive).

			Moderate potential for bat roosts in mature trees along this section.	Replacement of hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 26	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow. Moderate potential for bat roosts in mature trees along this section.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 27	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow. Moderate potential for bat roosts in mature trees along this section.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 28	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow. Moderate potential for bat roosts in mature trees along this section.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works.

				Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 29	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow. Low potential for bat roosts in Ash trees along this section.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 30	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow. Low potential for bat roosts in conifer tree along this section.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 31	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage.
PB 32	Glenmornan Road	Removal of hedges and relocation of fencing.	Hawthorn hedgerow.	Check for nesting birds prior to felling (during March – August inclusive). Replacement of hedgerows with native species rich plant assemblage.
PB 36	Glenmornan Road	Removal of tree and relocation of fencing.	Gorse scrub.	Check for nesting birds prior to felling (during March – August inclusive).

			Low potential for bat roosts in Ash and Alder trees along this section.	Potential for enhancement by replacement of native species rich hedgerow here in agreement with the landowner. Pre-felling endoscope survey on these trees by an experienced Ecological Clerk of Works. Replacement of trees with native species (avoid Ash due to potential for Ash dieback).
PB 38	Glenmornan Road	Relocation of fencing. Potential removal of bushes	Gorse scrub.	Check for nesting birds prior to felling (during March – August inclusive). Potential for enhancement by replacement of native species rich hedgerow here in agreement with the landowner.
PB 39	Glenmornan Road	Relocation of fencing. Potential removal of bushes	Gorse scrub.	Check for nesting birds prior to felling (during March – August inclusive). Potential for enhancement by replacement of native species rich hedgerow here in agreement with the landowner.

Haul Route: Off-road Section Potential Roost Feature (PRF) endoscope inspection for bats

An internal and external inspection was conducted along the proposed off-road track along the haul route between Derry Port and Craignagapple Wind Farm on 23rd March 2023 by two Woodrow Ecologists, working under license issued by NIEA (License No. BDL/4/23). **No bats were recorded during any of the internal or external inspections, nor was any evidence of use by bats identified such as droppings, urine stains or feeding signs.**

Aim

The purpose of this survey was to determine if there was any potential for roosting bats along the route, and/or PRF's with the potential to be impacted by the removal of trees to facilitate the creation of an off-road track for delivery of turbine components to the Wind Farm Site.

Methodology

Trees were first visually inspected to identify suitable potential roost features, such as holes, cracks, peeling bark, knots, broken branches or thick ivy, as per BCT Guidance (Collins, 2016).

Following this, any features which were deemed to be potentially suitable for roosting bats were systematically and carefully internally inspected using the endoscope by the licenced bat ecologist (Alice Clarke).

Results

Trees

The endoscope survey determined that PRFs which had been identified from the ground did not offer suitable space for roosting bats due to their shallow depth when inspected further.

Additionally, these features were notably damp due to ingress of rainwater, despite the survey day being relatively dry and warm. It was determined after employing internal and external inspection techniques that suitability for roosting bats within trees along the proposed off-road track was Negligible to Low.

Derelict Building

The derelict building was both internally and externally inspected.

This structure offers suitable bat roosting potential as it offers a dry, enclosed space which was somewhat sheltered from the elements.

The structure was considered to provide Low to Moderate suitability for roosting bats. However, no bats nor any signs of use by bats were identified during the survey.

Figure 1 gives an overview of the proposed off-road track, including four different locations which were the focus of the endoscope inspection survey that was undertaken. Photographs of the trees and buildings surveyed are also provided below, captioned with their corresponding Location on the map.

Mitigation

A pre-construction survey by the Appointed Ecological Clerk of Works (ECoW) is required at this site prior to undertaking the works to ensure that the baseline remains the same. This should include a PRF inspection of the derelict building adjacent to the haul route.

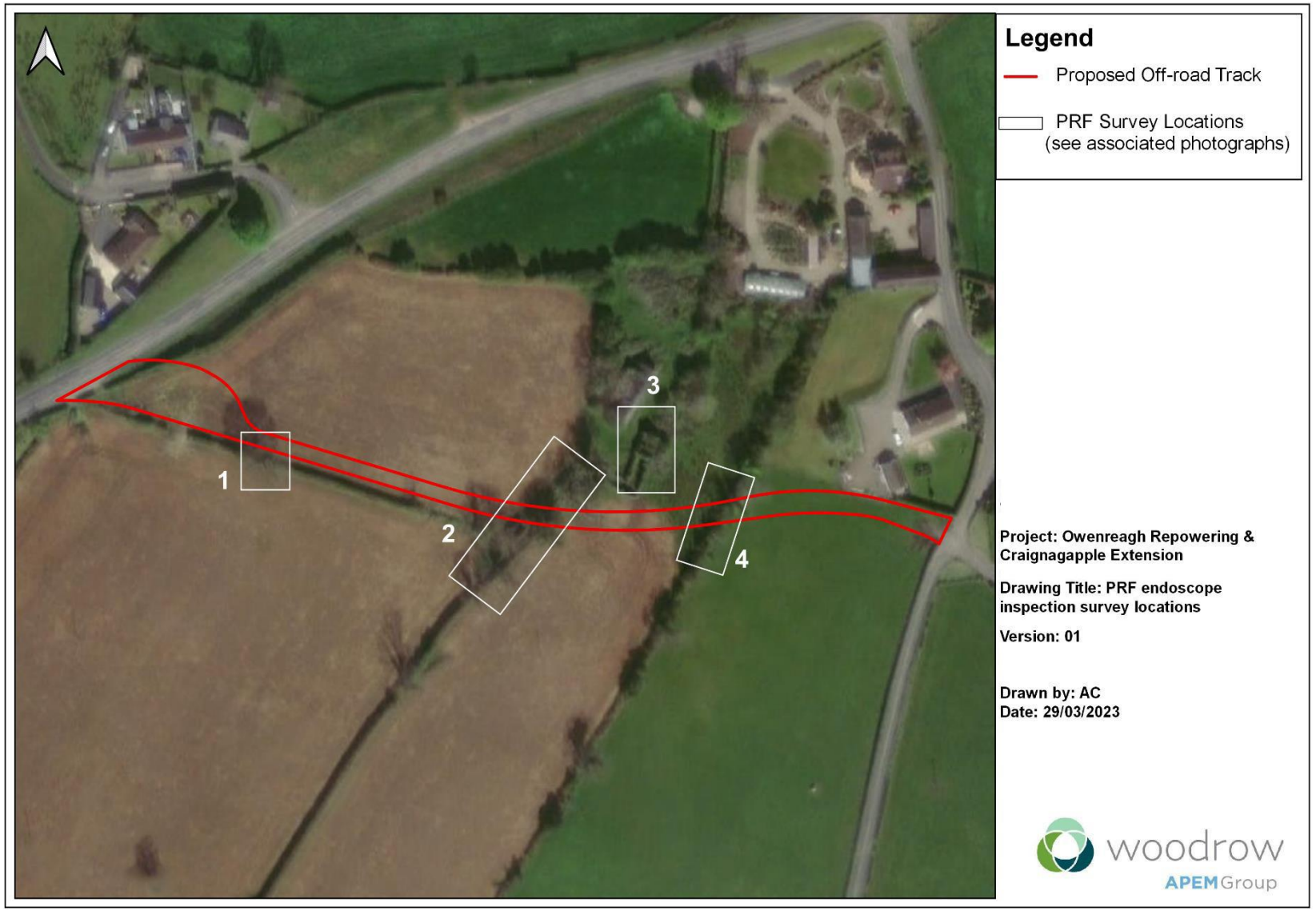


Figure AIV.1: Overview of the proposed off-road track and PRF survey locations

	
Plate AIV.1: Treeline to be removed to facilitate off road track	**Plate AIV.2:** Tree indicated by Location 1 on the map
	
Plate AIV.3: Close-up of PRF on the tree at Location 1	**Plate AIV.4:** Treeline to the north of the off-road track indicated by Location 2 on the map
	
Plate AIV.5: Treeline to the south of the off-road track indicated by location 2 on the map	**Plate AIV.6:** Close-up of PRF on one of the trees at Location 2

	
Plate AIV.7: Derelict building viewed from the south- side, indicated by Location 3 on the map	**Plate AIV.8:** Derelict building viewed from inside, indicated by Location 3 on the map
	
Plate AIV.9: Ivy-clad treeline indicated by Location 4 on the map	

BAT SURVEY REPORT TO INFORM THE PROPOSED CRAIGNAGAPPLE WIND FARM, CO. TYRONE

2018 & 2019 Surveys

Report prepared by Woodrow APEM Group

On behalf of Ørsted Onshore Ireland Midco Limited

Woodrow APEM Group
Upper Offices,
Ballisodare Centre,
Station Road,
Ballisodare,
Co Sligo, F91 PE04

Tel: +353 (0) 0719140542
Email: info@woodrow.ie

August 2023

DOCUMENT CONTROL

Document	Bat Survey Report for the proposed Owenreagh repowering & Craignagapple extension, Co. Tyrone.
Client	Ørsted Onshore Ireland Midco Ltd.
Prepared by	Woodrow APEM Group, Upper Offices, Ballisodare Centre, Station Road, Ballisodare, Co Sligo, F91 PE04, Ireland.
Report compiled by	Alice Clarke
Checked internally by	Róisín NigFhloinn
Approved by	Will Woodrow
Status / Version / Date	Revision 01 / 17/08/2023

STATEMENT OF AUTHORITY

This report was authored by Alice Clarke, an Ecologist with Woodrow APEM Group. Alice has completed an MSc in Ecological Management and Conservation Biology at Queen's University, Belfast and is an Associate member of CIEEM. She has gained experience working in ecological consultancy roles in Ireland over the past three years and has authored countless Appropriate Assessment (AA) Screenings, Natura Impact Statement (NIS) reports, Ecological Impact Assessments (EcIAs) and Ecology Chapters for Environmental Impact Assessment Reporting (EIAR). Subsequently, Alice is very familiar with the process of ecological assessment. She has worked for a wide range of clients, including within the forestry, wind energy, residential, business development and wastewater treatment industries. She is highly competent in survey and assessment work, particularly bats (being a licenced bat worker in both NI & RoI), as well as mammals (particularly badger and otter), birds and invasive species, and regularly employs the use of GIS to present and analyse data.

This report was checked by Róisín NigFhloinn. She is an Associate Director with Woodrow, and a project manager for several large infrastructure schemes, as well as for smaller Development projects. She has completed an honours degree, specialising in Botany, and holds a masters in Ecology and Management of the Natural Environment. She is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). She regularly carries out reporting for EcIA, EIAR Biodiversity Chapters / ES Ecology Chapters, and reporting to inform Appropriate Assessment / Habitat Regulations Assessment carried out by statutory authorities. Furthermore, she has more than 13 years' experience in habitat surveys, mammal surveys, bird and bat surveys for a number of large infrastructure schemes, commercial and residential projects. Róisín is also an experienced Ecological Clerk of Works (ECoW).

This report has been reviewed and approved by Will Woodrow. Will is a Director at Woodrow APEM Group. He is a Chartered Ecologist, and a full member of CIEEM, with over 30 years of experience in ecological surveys and assessment. He has particular expertise in ornithological assessment, invertebrate identification, and habitat management, particularly when working within peatland environments.

Alice Clarke - Qualifications

BSc (Hons) Biochemistry. Queen's University Belfast, 2016.

MSc – Ecological Management and Conservation Biology. Queen's University Belfast, 2018.

Róisín NigFhloinn – Qualifications:

B.A. Mod (Hons) – Natural Sciences (specialising in Botany), Trinity College, Dublin, 2008.

M. Sc. – Ecology and Management of the Natural Environment, University of Bristol, England, 2011.

Will Woodrow – Qualifications:

M.Sc. – European Environmental Policy and Regulation, Lancaster University, 1994.
M.Sc. (Arch) – Advanced Environmental and Energy Studies. University of East London, 2006

Table of Contents

1. INTRODUCTION

This report is written to serve as a technical results report to be appended to the Ecology Chapter of the Environmental Impact Assessment Report (EIAR) and the Ecological Impact Assessment (EcIA) for Craignagapple Wind Farm. It provides details of methodologies and survey effort for the suite of bat surveys conducted for the proposed development during 2018 and 2019, including tabulated results, maps and charts, as well as reports from roost suitability surveys, bat activity surveys and seasonal static bat detector surveys. These surveys allow for the baseline bat populations and habitat suitability of the proposed development to be described and to facilitate and inform a robust impact assessment.

1.1 Survey Methodology Guidance

As of 2019 the appropriate methodological approach for assessing bat populations on proposed wind farm sites is *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH *et al*., 2019)[1]. Surveys undertaken during the 2018 survey period were in line with Bat Conservation Trust (BCT) Guidelines (Collins (ed.) 2016; Hundt, 2012)

1.2 Outline of the scope of works

1.2.1 2018 Static Bat Detector Surveys

Static bat recording equipment was deployed across the Study Area once a month for a minimum of five nights during the active bat season (April to October) in 2018, in line with BCT Guidance (Collins, 2016; Hundt, 2012), which was relevant at the time of surveying. Surveys were undertaken in conjunction with continuous monitoring of climatic conditions at the Study Area to ensure recording windows were inline within compliant weather parameters. Seasonal deployments of static detectors are set out across the site at the proposed turbine locations, with consideration also given to making a comparison of activity levels at areas with commuting features vs open habitat. Compliant weather conditions under the BCT Guidelines are defined as: temperatures at ≥ 10°C at dusk, 'low' wind speeds and either none, or only very light, periodic rainfall.

1.2.2 2019 Static Bat Detector Surveys

The SNH (2019) guidelines require, as a minimum, three deployments of static detectors aimed at covering spring (April to May), summer (June to mid-August) and autumn (mid-August to October), each with a minimum deployment period of 10 nights (within compliant weather parameters). Seasonal deployments of static detectors are set out at all potential turbine locations for proposals comprising ten or less turbines, with a third of any additional locations also covered up to a maximum of 40 detectors. Compliant weather conditions are defined as: temperatures at ≥ 8°C at dusk, maximum ground level wind speed of 7 m/s and no, or only very light, periodic rainfall.

1.2.3 2018 & 2019 Roost and Transect Surveys

To supplement data collected from static bat detectors, manual roost emergence/re-entry surveys and bat activity transects were undertaken in specific areas deemed to have roosting

[1] Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter & Bat Conservation Trust (2019). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.*

potential, subsequent to an assessment of potential roost features (PRFs) within the Study Area. Observations from these additional surveys provide context to inform how bats are utilising the Study Area. To give context to this results report, the old turbine layout from 2018 / 2019 is presented in **Figure 1** alongside the current, finalised layout for 2023.

1.3 Survey limitations

In the case of bat surveys, survey limitations often relate to weather conditions at the time of the surveying and equipment failing in the field, for example microphones can be damaged by livestock or can lose sensitivity when exposed to prolonged episodes of heavy rainfall.

The following section provide details for any potential limitations to bat surveys conducted in 2018-2019. Overall, it considered that the combined survey approach and coverage over the two survey seasons, provides robust data from which a full insight into the use of the proposed development by bats can be obtained. As such, this information can be used to assess the potential impacts of the proposed wind farm development on the local bat population. Given the survey methodologies used to ensure full coverage of proposed development across the 2018-2019 bat activity seasons, it is considered that the data obtained complies, in full, with the recommend guidelines set out within *Wind Turbine/Wind Farm Development Bat Survey Guidelines* (BCT, 2012), *Bat Surveys: Good Practice Guidelines (2nd ed.)* (Hundt, 2012) and *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH, 2019).

The static bat detector coverage of the Wind Farm Site for bat activity in 2018 followed BCT Guidelines, while the coverage for 2019 was in line with the SNH Guidelines, which superseded the BCT Guidelines upon their release in 2019.

1.3.1 Equipment

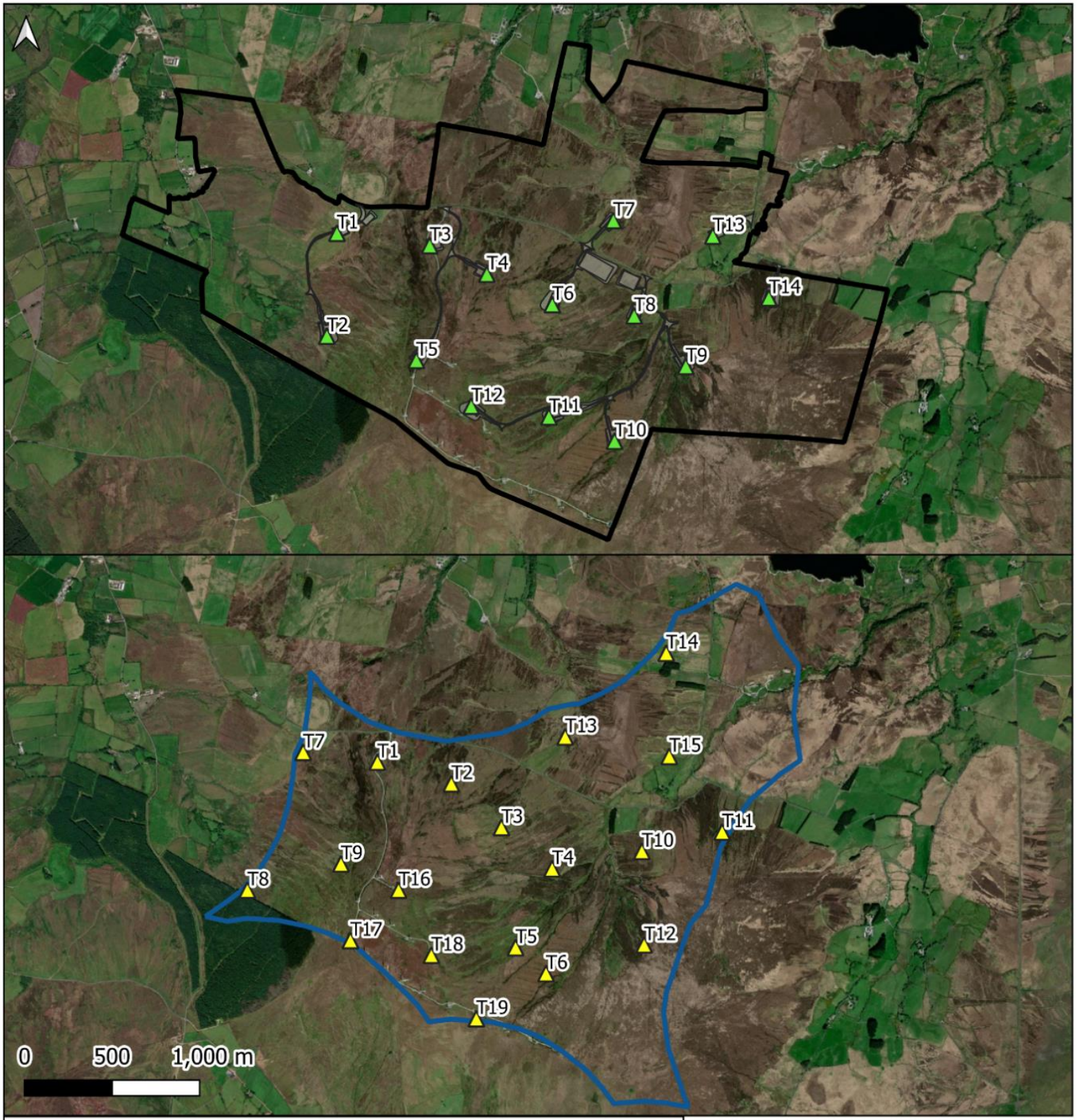
Two types of detector were used to capture data within the Study Area across 2018 and 2019, comprising Song Meter 2 and Song Meter 4 Wildlife Acoustic static bat detectors, with attachable a microphone.

There were no detector failures in 2018, and three detector failures across the four deployments in 2019 (a total of 56 detector deployments), two during the second summer deployment (WSS-008 and WSS-006) and one during the spring deployment (WSS-022). From reviewing the detector after deployment, the failure was very likely due to a faulty battery connection that became loose when erected on the tree.

Despite these technical issues it is considered that that the data collected during this survey remains robust and compliant with the relevant guidelines laid out by SNH (2019).

1.3.2 Weather

Weather data was collected using dedicated weather stations and, for both 2018 and 2019, was fully compliant with the BCT (2012) and SNH (2019) Guidelines, respectively. While some days may have dipped below the required minimum temperature (10°C for 2018 and 8°C for 2019), detectors were deployed in such a way to allow for extra nights to be captured to ensure enough data collected that did meet minimum weather condition requirements.



Legend

- Study Area (2023)
- Study Area (2019)
- Turbine locations (2023)
- Turbine locations (2019)
- Turbine infrastructure

Project: Owenreagh Repowering & Craignagapple Extension

Drawing Title: Old vs New turbine layout

Version: 01
Page Size: A4

Drawn by: AC
Date: 26/01/2023

Reference Scale: 1:52,608

woodrow
APEM Group

Figure 1: Overview of the turbine layout in 2019 vs 2023 (for context)

2. METHODOLOGY

2.1 Desk Study

A desk-based review of habitat availability in the environs of the proposed development, and the available bat data was used to inform the scope to the bat surveys required. As recommended by both BCT (2012) and SNH (2019), the area covered by the desk-based review was extended to 10 km surrounding the wind farm site. The desk-based study included:

- Reviewing distances from closest Natura 2000 sites designated for bats (only bat SACs on the island of Ireland are for lesser horseshoe bat *Rhinolophus hipposideros*) - the area of interest (in Co. Tyrone) is outside the range for lesser horseshoe bat.
- Examining aerial imagery and 6-inch maps to identify potential bat foraging and roosting habitats.
- Lundy *et al*. (2011) provides a high-level assessment of potential habitat suitability for different species of bat occurring in Ireland.
- Review of data received from BCI within 10 km of the wind farm site and the results of Biodiversity Maps report for the 10-km squares covering the Study Area (H39 & H49), including species recorded and known roosting sites.

2.2 Field Surveys

Pre-planning surveys for bats at proposed wind farm sites aim to identify the species occurring within the proposed development area and provide an understanding of how local bat populations utilise the area in terms of density of use for foraging, roosting (maternity and hibernation) and social interactions. This information allows for the identification and assessment of the potential impacts the proposed development is likely to have and for appropriate avoidance and/or mitigation measures to be implemented as part of the design phase of the project.

Bat surveys were conducted by suitably qualified ecologists from Woodrow across Study Area in 2018 and 2019 during the active bat season, which ensured compliance with the most recently published guidelines at the time, pertaining to surveying, impact assessment and mitigation for bats at onshore wind turbines (Collins, 2016 & Hundt, 2012 for the 2018 survey period; SNH, 2021 for the 2019 survey period). The SNH (2019) guidance document supersedes previous guidelines and requires a site-by-site approach to survey design, with the only prescriptive element being the positioning, number and duration of static bat detector deployments, as well as the strongly recommended continual monitoring of site-specific weather data on rainfall, temperature and wind speeds.

Seasonal deployments of static detectors are set out across the site at the proposed turbine locations, with consideration also given to making a comparison of activity levels at areas with commuting features vs open habitat. Compliant weather conditions are defined by the guidance as: temperatures at ≥ 10°C at dusk in 2018 and ≥8°C at dusk for 2019, low wind speeds, specified in the SNH Guidance as < 7m/s and either no rainfall or very light, periodic rainfall.

Additional requirements of the SNH *et al*. (2019) guidelines include swarming surveys and winter roost inspections if potential hibernation roosts are identified. Transects and/or vantage point surveys are seen as methods used to complement the static detector surveys, with applicability being discretionary and site-specific.

2.2.1 Roost Assessment Surveys

A site suitability assessment was conducted over the entire Study Area and environs in order to identify any potential bat roosts on 11th April 2019. No roost surveys were undertaken during the 2018 survey period.

The most recent guidelines (SNH 2021) recommend that "*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 200m plus rotor radius of the boundary of the proposed development should be subject to further investigation*".

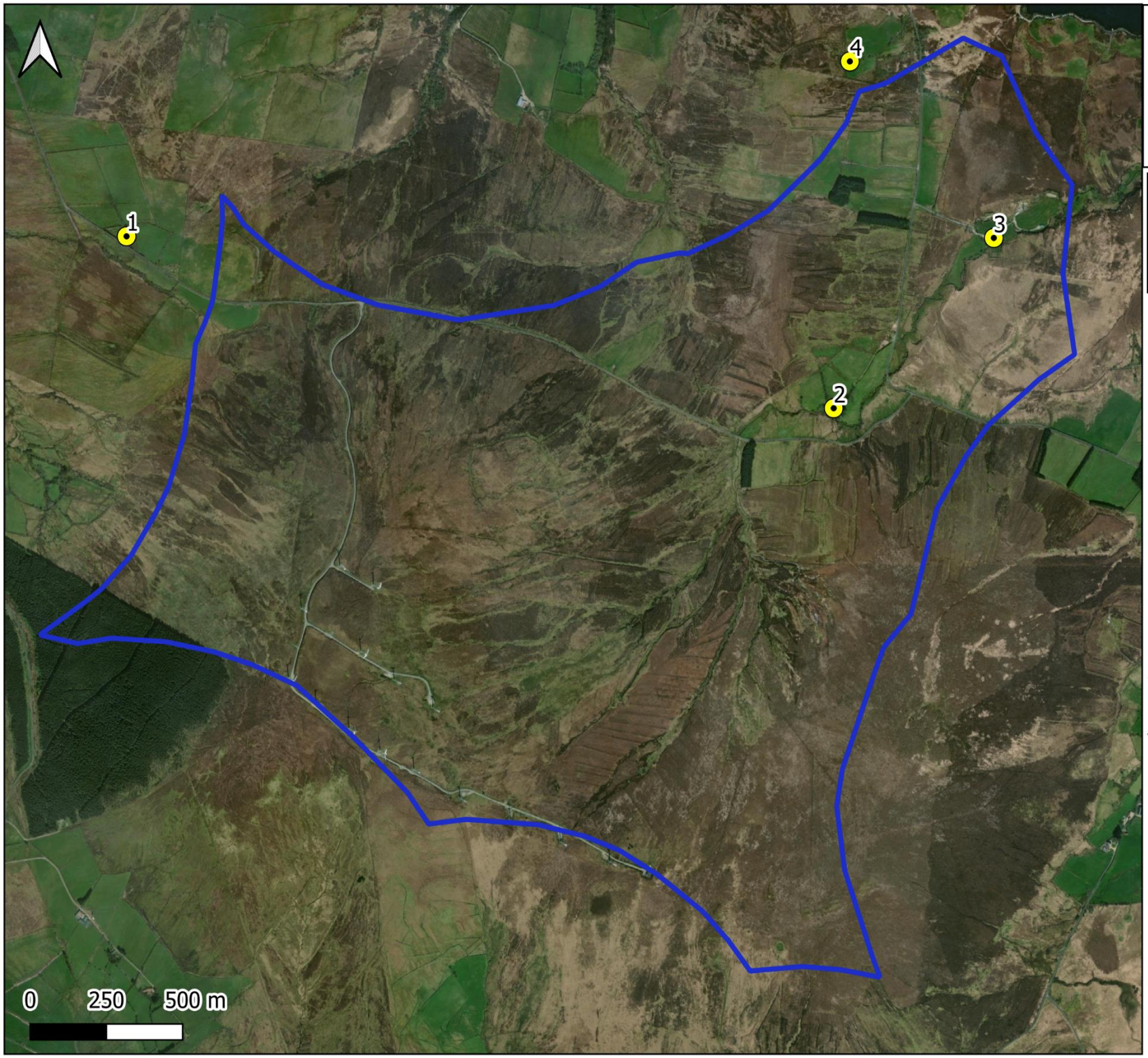
Turbine specification, as well as locations are regularly altered during the design phase of projects and as a precaution Woodrow always conduct roost assessment surveys within 300m of the potential build area and features along the access tracks between turbines (within *c*. 30m). Wide reaching roost and foraging habitat assessment of the wind farm site were undertaken during 2018, as part of a scoping exercise.

Surveyors utilised the assessment criteria described in Collins (2016), which provides guidelines for assessing potential suitability of habitat features as bat roosts and for foraging bats. Based on the features present and the location of the trees or other structure, the potential use of the feature can also be considered, and classified (as in Hundt, 2012):

Surveyors initially employed non-invasive external and internal inspection techniques for any building encountered, and trees were assessed from the ground. When deemed appropriate full building/tree inspections were undertaken under license from NIEA and included inspecting any potential hibernation roosts.

Based on the findings of the roost assessment surveys features classed as having moderate to high suitability for bats and/ or demonstrating likely occupancy, (e.g. bat dropping found) were targeted for further bat activity surveys, including dusk emergence/dawn re-entry surveys. Potential roost features deemed to be in the Zone of Influence of the proposal and therefore requiring further surveys are shown in **Figure 2**. These were internally and externally inspected under NIEA license No. BDL/104/19, Licensee No. 2423 on 19th August 2019.

Once bat roosts had been confirmed within the Study Area and environs of the Development, and internal inspections on confirmed bat roosts had been carried out – these were not repeated in subsequent years so as to minimise disturbance to roosting bats. However, all confirmed bat roosts underwent repeat emergence and re-entry surveys to monitor the bat roost activity at these sites.



Legend

- Study Area (2019)
- Potential roost inspection locations

Figure 2: Potential roost features identified within or in the vicinity of the Study Area as requiring further internal inspection with an endoscope (under licence)

Project:Owereagh Repowering & Craignagapple Extension

Drawing Title:Buildings inspected under licence within or adjacent to the superseded Study Area

Version: 01
Page Size: A4

Drawn by: AC
Date: 05/05/2023

Reference Scale: 1:29,563

woodrow
APEM Group

2.2.2 Winter hibernation roost surveys

SNH Guidelines (SNH, 2019) recommend that winter roost surveys should also be carried out for any potential hibernation roost within 200 m plus rotor radius of the developable area. This survey was conducted on 4th November 2019, within the timeframe in which bats would still be hibernating**.** Surveys involved searching for and collecting bat faecal samples, where found, closer examination of roost potential using an endoscope, and the use of a thermal imaging camera. Four structures of Moderate to High roost potential and likely structures for winter roost occupation were examined. These are presented in **Table 1** below. The structures inspected for hibernating bats are the same as those shown in **Figure 2,** surveyed for summer roosting potential. These surveys were conducted under NIEA license No. BDL/104/19, Licensee No. 2423.

Table 1: Summary of survey effort for winter roost inspections

Structure	Location (NGR)	Inspection Date
Building 1	H 43 96	04/11/2019
Building 2	H 43 98	04/11/2019
Building 3	H 44 97	04/11/2019
Building 4	H 41 97	04/11/2019

The suitability of a structure for occupation by hibernating bats was assessed according to the criteria outlined in the below **Figure 3,** which is adapted from Collins (2016). In carrying out this assessment the following aspects were considered:

- General suitability of roosting features for bats;
- The temperature and humidity of the potential roosting structure during winter;
- The presence of connecting features such as hedgerows / treelines; and,
- The presence of a known summer roost within the structure.

Suitability	Description of Potential Roosting Features	Structure or Feature Name	Bat Species Potentially Over Wintering
Negligible	Negligible or No features present within the structure that are likely to be used by bats during the winter period.	None	N/A
Low	Limited number of features occur on the external surfaces of the structure, but these are exposed and/or shallow (e.g. less than 10cm deep) and/or could be fully viewed (i.e. no hidden areas). All such features would not, individually, be able to hold more than one or two bats and would not typically be regarded as providing the protection from weather or provide the favourable temperature and humidity conditions required during the winter period. **and/or** Features exist either on external portions of the structure, or are accessible to bats internally, whereby bats could occupy any given feature during the winter period, with the conditions and structure of the feature being such that full protection from the weather is offered, but the surrounding habitat is such (e.g. these are isolated features not connected to suitable surrounding habitat) that it would not typically be regarded as being attractive to bats from a commuting or foraging perspective. **and** No roosts have been found or are known to occur within the structure, or nearby, during the spring, summer or autumn period.	Structure 1	Pipistrellus pipistrellus Pipistrellus pygmaeus
Moderate	Features exist either on external portions of the structure or are accessible to bats internally whereby three or more bats could occupy any given feature during the winter period, with the conditions and structure of the feature being such that full protection from the weather is offered. The potential for suitable temperature and humidity conditions also exists. The site is well connected to suitable surrounding habitat which would typically be regarded as being attractive to bats from a commuting or foraging perspective.	Structure 2	Pipistrellus pipistrellus Pipistrellus pygmaeus
High	Features exist either on external portions of the structure or are accessible to bats internally whereby larger numbers of bats could be found hibernating in a 'classic' hibernaculum setting (e.g. stable temperature, humid conditions, cellar, underground, ice house), with the conditions and structure of the feature being such that full protection from the weather is offered and the potential for stable/suitable temperature and humidity conditions also exists. The site is well connected to surrounding suitable habitat which would typically be regarded as being attractive to bats from a commuting or foraging perspective.	None	N/A

Figure 3: Criteria for assessing suitability of a structure for hibernating bats (Middleton, 2019)

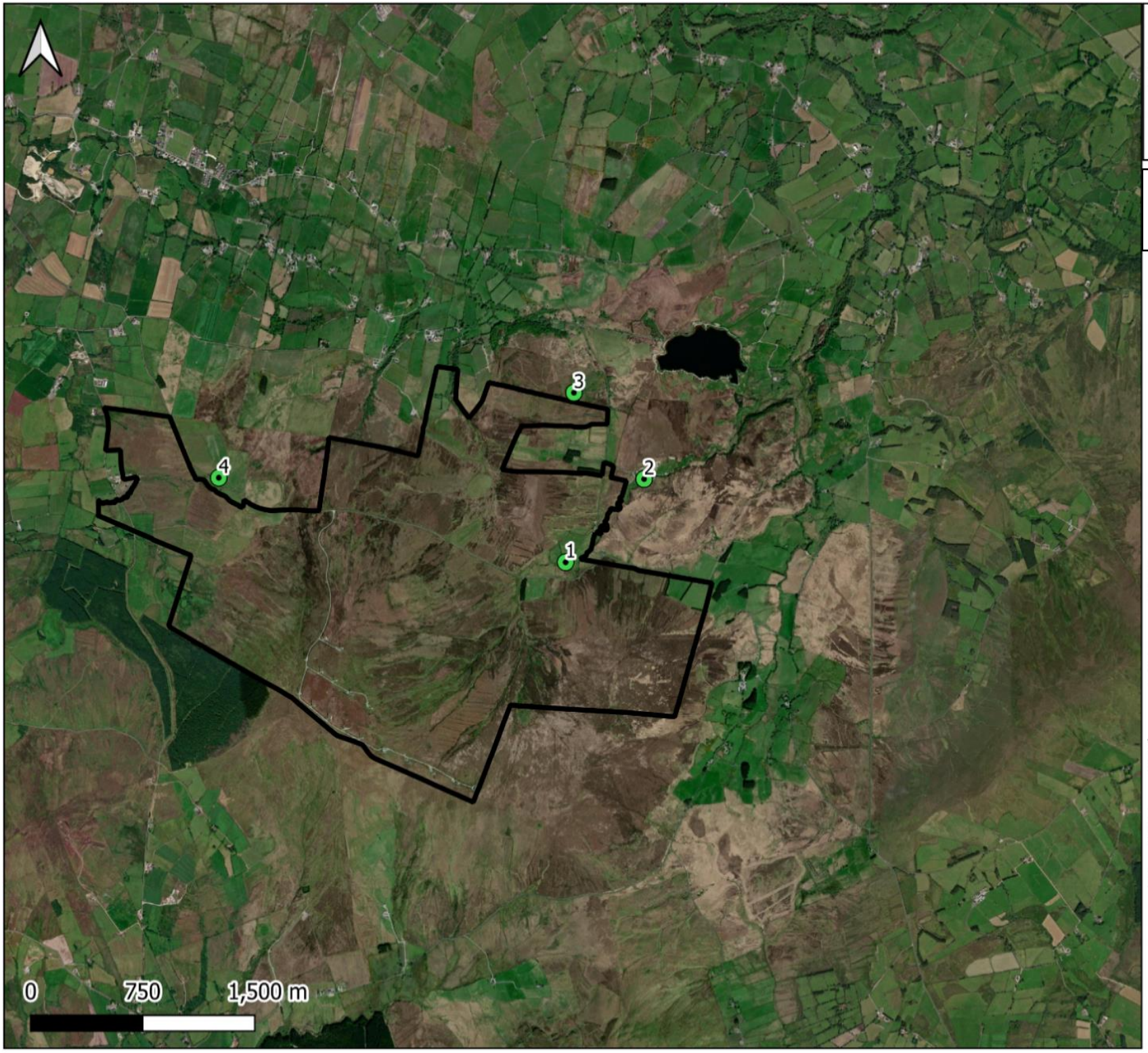
2.2.3 Roost Surveys

Repeat emergence/re-entry roost surveys were completed on each bat roost shown in **Figure 4,** during the active bat season in 2019. No roost surveys were undertaken in 2018. Dusk emergence and dawn re-entry surveys were carried out using Batlogger handheld bat detectors, which collect geo-referenced records of bat activity, which were then manually analysed using BatExplorer and Kaleidoscope software.

One dusk survey and one dawn survey were conducted across each of the four survey locations, by eight Woodrow surveyors, who all undertook surveys on the same night, 19th-20th August 2019. A summary of the roost survey effort is presented below in **Table 2,** with approximate locations of roosts given to protect the bats.

Table 2: Summary of survey effort - roost survey locations (2019)

Building	Location (NGR)	Date	Survey Type
Building 1	H 43 96	19/08/2019	Dusk
		20/08/2019	Dawn
Building 2	H 43 98	19/08/2019	Dusk
		20/08/2019	Dawn
Building 3	H 44 97	19/08/2019	Dusk
		20/08/2019	Dawn
Building 4	H 41 97	19/08/2019	Dusk
		20/08/2019	Dawn



Legend

Study Area

Roost survey locations (2019)

Figure 4: Roost survey locations (2019) NIEA license No. BDL/104/19, Licensee No. 2423

Project: Owenreagh Repower & Craignagapple Extension

Drawing Title: Roost Survey Locations (2019)

Version: 01
Page Size: A4

Drawn by: AC
Date: 14/02/2023

Reference Scale: 1:60,268

woodrow
APEMGroup

2.2.4 Transect Survey Results

2.2.4.1 Survey Year 2018

Under the superseded BCT Guidance (Hundt, 2012) used to inform the 2018 surveys, survey frequency is calculated based on the size of the site and risk to bats, and it is recommended that all areas of habitat should be covered, and surveys should be spread throughout the active bat season. For larger sites (>15ha) of medium risk, guidance recommends one visit per month between April and October, with at least one survey at dawn and one at dusk within a 24-hour period.

Line transects were walked and driven at a constant speed, while holding a handheld Batbox bat detector fitted with an SD card so recordings could be analysed later. Point counts (of a fixed duration) were occasionally incorporated into the transects to survey specific suitable features in the landscape, in order to provide information on comparative density of use. Each stop was sampled for 3 minutes as per the guidance (Hundt, 2012). Bat species encountered were noted, including number of bat passes, activity (where known, e.g., foraging, commuting, advertising), travelling direction and approximate height (where known). Temperature and wind speed were measured at intervals throughout the survey.

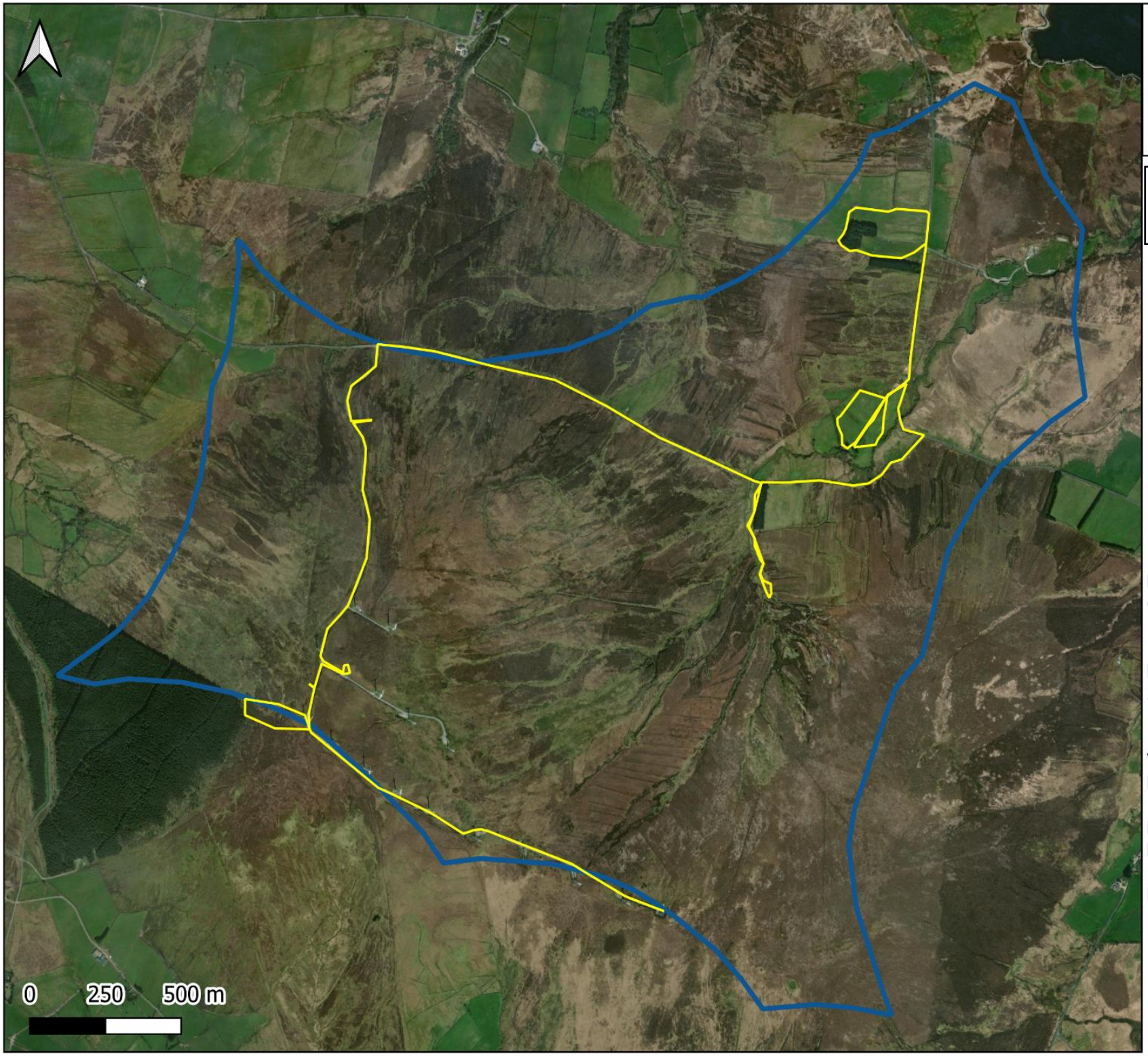
The transects undertaken in 2018 followed the above methodology. The transect route is illustrated in **Figure 5** below.

2.2.4.2 Survey Year 2019

Under the most up-to-date guidance (SNH 2019), the application of transect surveys is discretionary, with survey requirements designed on a site-by-site basis. Transects are employed as complementary data to the data collected from static bat detectors; and are important for identifying flight lines and for gaining understanding of bat abundance within the survey area.

Driven transects can provide useful information on the wider landscape in the vicinity of the proposed development site. During the driven transects, appropriate microphones were used on the detector and were directed above the vehicle. Drivers remained at a constant low speed (< 10 km/h). Point counts (of a fixed duration) were occasionally incorporated into the transects to survey specific suitable features in the landscape, in order to provide information on comparative density of use.

Field records were made of bat species encountered where possible, to include number of bat passes, activity, travelling direction and approximate height, while temperature and wind speed were measured at intervals throughout.



Legend

2018/2019 Study Area

Transect Route

Figure 5: Transect route undertaken in 2018 and 2019 designed based on the old Study Area

Project: Owenreagh Repowering & Craignagapple Extension

Drawing Title: Transect Route (2018 & 2019)

Version: 01
Page Size: A4

Drawn by: AC
Date: 05/04/2023

Reference Scale: 1:29,760

woodrow
APEM Group

2.2.5 Static Detector Deployment

Static detector surveys were undertaken in 2018 and 2019, using Wildlife Acoustics Song Meters (SM2, SM4 and SM Mini). Surveys in 2019 were undertaken on three separate occasions per year, covering spring, summer and autumn, as per SNH Guidelines, although an extra summer survey was added. Surveys in 2018 were undertaken monthly between May-September, prior to the release of SNH Guidelines, as per the BCT Guidelines (Collins, 2016; Hundt, 2012). Static bat detectors were deployed to record the types of bat species present and to provide an overview of how bat activity is broadly distributed over the Study Area and specifically at selected turbine locations. In 2018, statics were deployed for a minimum of five nights, as per BCT Guidance (Collins, 2016; Hundt, 2012), while in 2019, statics were deployed for a minimum of 10 nights, as per SNH Guidelines (SNH, 2019).

The static detector survey effort for the 2018 survey period is provided below in **Table 3** to **Table 8** and deployment locations are illustrated in **Figure 6,** while the 2019 survey period is presented in **Table 9** to **Table 12** and deployment locations illustrated in **Figure 7.**

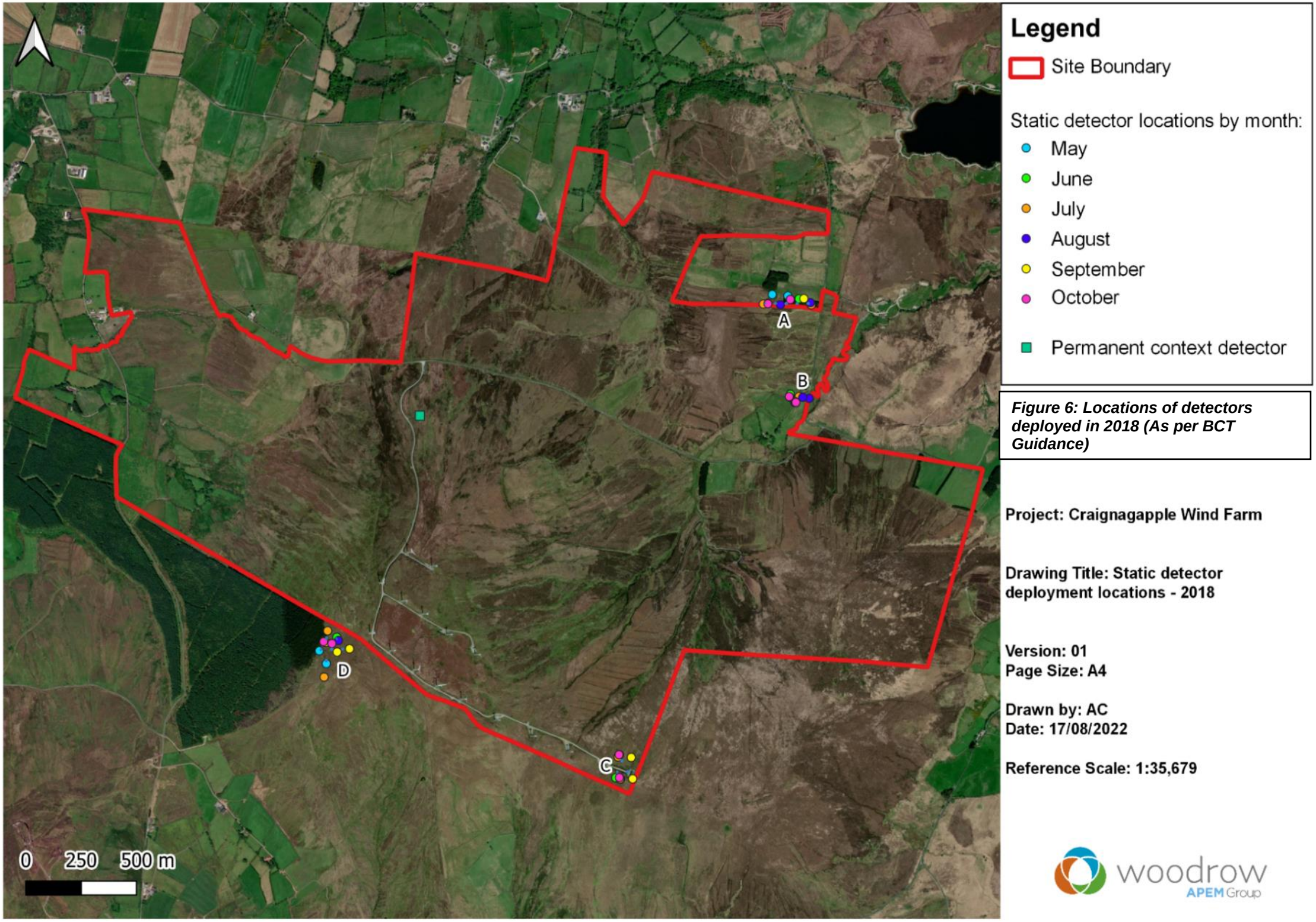


Figure 6: Locations of detectors deployed in 2018 (As per BCT Guidance)

Project: Craignagapple Wind Farm

Drawing Title: Static detector deployment locations - 2018

Version: 01
Page Size: A4

Drawn by: AC
Date: 17/08/2022

Reference Scale: 1:35,679

woodrow
APEM Group

Table 3: Static detector survey effort – May deployment (2018)

Unit No.	X coordinate	Y coordinate	Context	Run time	
2	-7.315597	54.819745	Gorse hedge above stream valley, with abandoned farmstead nearby	6 nights	2840.4 min
4	-7.34898239	54.80986955	In a forested area	12 nights	5542.8 min
5	-7.31716414	54.82403508	Bog habitat	12 nights	5542.8 min
8	-7.32780598	54.80477892	Near substation in heath	12 nights	5542.8 min
13	-7.34849056	54.80936007	Bog habitat	12 nights	5542.8 min
14	-7.315894	54.82007	Along a fenceline in rush-dominated field, adjacent to improved pasture	12 nights	5542.8 min
21	-7.32799092	54.80567274	In a patch of Conifer trees	12 nights	5542.8 min
23	-7.31606749	54.82398063	In a forested area	12 nights	5542.8 min

Table 4: Static detector survey effort – June deployment (2018)

Unit No.	X coordinate	Y coordinate	Context	Run time	
3	-7.315281	54.823866	In birch tree along edge of plantation bordering pasture	6 nights	2840.4 min
8	-7.328162	54.804824	Open fenceline in open - near sub-station	12 nights	5542.8 min
9	-7.327886	54.805735	Cluster of sparse spruce trees in open bog with - near sub-station	12 nights	5542.8 min
13	-7.315894	54.82007	Along fenceline in rushy field adjacent to improved pasture - possibly weak feature	12 nights	5542.8 min
14	-7.315567	54.819783	Gorse hedge above stream valley, with abandoned farmstead nearby surrounded by pasture	12 nights	5542.8 min
19	-7.3484	54.810666	In dead tree along edge of plantation	12 nights	5542.8 min
20	-7.347756	54.810408	On fenceline in open bog, c. 40 m out from plantation	12 nights	5542.8 min
23	-7.317475	54.823685	Open bog along fenceline c. 50 to 60 m out from plantation - moved from previous deployment	12 nights	5542.8 min

Table 5: Static detector survey effort - July deployment (2018)

Unit No.	X coordinate	Y coordinate	Context	Run time	
3	-7.31442613	54.823624	Thin plantation facing onto bog - opposite side of plantation to previous deployment	6 nights	2840.4 min
4	-7.3177887	54.823656	Open bog along fenceline *c.* 50 to 60 m out from plantation/shelter belts	12 nights	5542.8 min
10	-7.32785338	54.80477516	Open fenceline in open - near sub-station	12 nights	5542.8 min
11	-7.32799223	54.8056504	Cluster of sparse spruce trees in open bog with - near sub-station	12 nights	5542.8 min
13	-7.3159297	54.819959	Along fenceline in rush-dominated field adjacent to improved pasture - possibly weak feature	12 nights	5542.8 min
14	-7.3152827	54.81997532	Gorse hedge above stream valley, with abandoned farmstead nearby	12 nights	5542.8 min
21	-7.3484	54.810666	In dead tree along edge of plantation	12 nights	5542.8 min
22	-7.34864528	54.80882614	On fenceline in open bog, out from large plantation	12 nights	5542.8 min

Table 6: Static detector survey effort - August deployment (2018)

Unit No.	X coordinate	Y coordinate	Context	Run time	
3	-7.32697	54.80478	On bog near Redline communications beacon - near substation	6 nights	2840.4 min
4	-7.32707	54.80563	Cluster of sparse spruce trees in open bog - near sub-station	12 nights	5542.8 min
5	-7.34764	54.81028	Dead spruce tree on corner of plantation	12 nights	5542.8 min
6	-7.34686	54.80995	On open bog *c.* 50 to 100 m out from plantation	12 nights	5542.8 min
10	-7.31457	54.81991	Gorse hedgerow on track leading to abandoned farm	12 nights	5542.8 min
11	-7.31502	54.81995	Along fenceline in rush-dominated field adjacent to improved pasture	12 nights	5542.8 min
21	-7.31448	54.82371	Edge of plantation near shooting range	12 nights	5542.8 min
22	-7.31659	54.82363	Bog out from plantation	12 nights	5542.8 min

Table 7: Static detector survey effort - September deployment (2018)

Unit No.	X coordinate	Y coordinate	Context	Run time	
3	-7.32697	54.80478	On bog near Redline communications beacon - near substation	6 nights	2840.4 min
4	-7.32707	54.80563	Cluster of sparse spruce trees in open bog with - near sub-station	12 nights	5542.8 min
8	-7.348547	54.810199	Dead spruce tree on corner of plantation	12 nights	5542.8 min
9	-7.34773	54.809822	On open bog c. 50 to 100 m out from plantation	12 nights	5542.8 min
10	-7.315567	54.819783	Gorse hedge above stream valley, with abandoned farmstead nearby surrounded by pasture	12 nights	5542.8 min
11	-7.3159297	54.819959	Along fenceline in rush-dominated field adjacent to improved pasture - possibly weak feature	12 nights	5542.8 min
22	-7.314941	54.823872	Edge of plantation near shooting range	12 nights	5542.8 min
23	-7.34686	54.80995	On open bog c. 50 to 100 m out from plantation	12 nights	5542.8 min

Table 8: Static detector survey effort - October deployment (2018)

Unit No.	X coordinate	Y coordinate	Context	Run time	
1	-7.34809822	54.81015986	Gorse hedgerow	6 nights	2840.4 min
2	-7.32790133	54.80482957	Rush field	12 nights	5542.8 min
3	-7.32792646	54.80573793	Fenceline	12 nights	5542.8 min
4	-7.31597011	54.81997889	Conifer trees	12 nights	5542.8 min
17	-7.31550309	54.81974705	Bog fenceline	12 nights	5542.8 min
21	-7.31589659	54.82383777	Forested area	12 nights	5542.8 min
20-ext (C1)	-7.31746681	54.82366668	Bog heath	12 nights	5542.8 min
20-unit (C0)	-7.3486741	54.81023307	Forested area	12 nights	5542.8 min

Legend

- Old Site Boundary
- Superseded proposed turbine locations

Figure 7:
General locations of detectors deployed in 2019 (As per SNH Guidance, 2019)

Project: Craignagapple Wind Farm

Drawing Title: Proposed turbine locations in 2019

Version: 01
Page Size: A4

Drawn by: AC
Date: 06/12/2022

Reference Scale: 1:29,685

woodrow
APEM Group

Table 9: Static detector survey effort - Spring deployment (30-May-2019)

Unit No.	Latitude	Longitude	Context	Run time	
WSS-001	-7.34285	54.81978	Placed in dense heather on slight elevation c. 20 m due east of the road to Met Mask	6 nights	2840.4 min
WSS-009	-7.33183	54.8164	On mound of dense heather, c. <5m from seasonal stream on side of north facing hill	12 nights	5542.8 min
WSS-023	-7.33058	54.81019	On fencepost separating improved and moorland c. <15m from small stream	12 nights	5542.8 min
WSS-007	-7.34944	54.82029	C. 70m from T9 Context and forest boundary in open heathland	12 nights	5542.8 min
WSS-191	-7.34944	54.82029	On fenceline separating forestry and moorland. Placed within boundary corridor between two plantations	12 nights	5542.8 min
WSS-003	-7.31937	54.81517	Due south of ditch separating improved grassland and heathland	12 nights	5542.8 min
WSS-012	-7.32618	54.82108	In open heathland c. <15m from semi-improved grassland and c. <5m from slight turf-cutting belt	12 nights	5542.8 min
WSS-005	-7.31721	54.8254	On fencepost separating improved and semi-improved grassland c. <5m from 3m bank due west	12 nights	5542.8 min
WSS-010	-7.31721	54.8254	On fencepost separating improved and semi-improved grassland c. <5m from forestry	12 nights	5542.8 min
WSS-008	-7.31694	54.82007	C. <10m from turf-cutting bank in semi-improved grassland c. <20m from ruin	12 nights	5542.8 min
WSS-011	-7.34097	54.81316	On individual fence post c. <10m due south of existing turbine on opposite bank in dense heather	12 nights	5542.8 min
WSS-014	-7.34525	54.81057	On post c. <5m from road and c. <10m from existing turbine directly on corner due north of boundary fence	12 nights	5542.8 min
WSS-002	-7.33806	54.80979	On fence post c. <10m due south-east of existing turbine halfway up bank	0 nights	0 min
WSS-013	-7.33407	54.80652	C. <5m due south of existing turbine in a dense clump of heather	12 nights	5542.8 min

Table 10: Static detector survey effort - Summer deployment 1 (02-Jul-2019)

Unit No.	Latitude	Longitude	Context	Run time	
WSS-012	-7.34285	54.81978	Placed in dense heather on slight elevation c. 20 m due east of the road to Met Mask	12 nights	5544 min
WSS-003	-7.33183	54.8164	On mound of dense heather, c. <5m from seasonal stream on side of north facing hill	12 nights	5544 min
WSS-018	-7.33058	54.81019	On fencepost separating improved and moorland c. <15m from small stream	12 nights	5544 min
WSS-016	-7.34944	54.82029	C. 70m from T9 Context and forest boundary in open heathland	12 nights	5544 min
WSS-006	-7.34944	54.82029	On fenceline separating forestry and moorland. Placed within boundary corridor between two plantations	12 nights	5544 min
WSS-021	-7.31937	54.81517	Due south of ditch separating improved grassland and heathland	12 nights	5544 min
WSS-014	-7.32618	54.82108	In open heathland c. <15m from semi-improved grassland and c. <5m from slight turf-cutting belt	12 nights	5544 min
WSS-022	-7.31721	54.8254	On fencepost separating improved and semi-improved grassland c. <5m from 3m bank due west	12 nights	5544 min
WSS-005	-7.31721	54.8254	On fencepost separating improved and semi-improved grassland c. <5m from forestry	12 nights	5544 min
WSS-017	-7.31694	54.82007	C. <10m from turf-cutting bank in semi-improved grassland c. <20m from ruin	12 nights	5544 min
WSS-010	-7.34097	54.81316	On individual fence post c. <10m due south of existing turbine on opposite bank in dense heather	12 nights	5544 min
WSS-019	-7.34525	54.81057	On post c. <5m from road and c. <10m from existing turbine directly on corner due north of boundary fence	12 nights	5544 min
WSS-007	-7.33806	54.80979	On fence post c. <10m due south-east of existing turbine halfway up bank	12 nights	5544 min
WSS-004	-7.33407	54.80652	C. <5m due south of existing tubine in a dense clump of heather	12 nights	5544 min

Table 11: Static detector survey effort - Summer deployment 2 (22-Aug-2019)

Unit No.	Latitude	Longitude	Context	Run time	
WSS-013	-7.34285	54.81978	Placed in dense heather on slight elevation c. 20 m due east of the road to Met Mask	11 nights	7036 min
WSS-003	-7.33183	54.8164	On mound of dense heather, c. <5m from seasonal stream on side of north facing hill	10 nights	6369 min
WSS-019	-7.33058	54.81019	On fencepost separating improved and moorland c. <15m from small stream	11 nights	7036 min
WSS-011	-7.34944	54.82029	C. 70m from T9 Context and forest boundary in open heathland	11 nights	7036 min
WSS-008	-7.34944	54.82029	On fenceline separating forestry and moorland. Placed within boundary corridor between two plantations	0 nights	0 min
WSS-286	-7.31937	54.81517	Due south of ditch separating improved grassland and heathland	11 nights	7036 min
WSS-014	-7.32618	54.82108	In open heathland c. <15m from semi-improved grassland and c. <5m from slight turf-cutting belt	11 nights	7036 min
WSS-001	-7.31721	54.8254	On fencepost separating improved and semi-improved grassland c. <5m from 3m bank due west	11 nights	7036 min
WSS-007	-7.31721	54.8254	On fencepost separating improved and semi-improved grassland c. <5m from forestry	11 nights	7036 min
WSS-017	-7.31694	54.82007	C. <10m from turf-cutting bank in semi-improved grassland c. <20m from ruin	11 nights	7036 min
WSS-012	-7.34097	54.81316	On individual fence post c. <10m due south of existing turbine on opposite bank in dense heather	11 nights	7036 min
WSS-021	-7.34525	54.81057	On post c. <5m from road and c. <10m from existing turbine directly on corner due north of boundary fence	11 nights	7036 min
WSS-009	-7.33806	54.80979	On fence post c. <10m due south-east of existing turbine halfway up bank	11 nights	7036 min
WSS-006	-7.33407	54.80652	C. <5m due south of existing tubine in a dense clump of heather	0 nights	0 min

Table 12: Static detector survey effort – Autumn deployment (03-Oct-2019)

Unit No.	Latitude	Longitude	Context	Run Time	
WSS-200	-7.34285	54.81978	Placed in dense heather on slight elevation c. 20 m due east of the road to Met Mask	13 nights	11505 mins
WSS-002	-7.33183	54.8164	On mound of dense heather, c. <5m from seasonal stream on side of north facing hill	10 nights	8776 mins
WSS-023	-7.33058	54.81019	On fencepost separating improved and moorland c. <15m from small stream	8 nights	6967 mins
WSS-189	-7.34944	54.82029	C. 70m from T9 Context and forest boundary in open heathland	13 nights	11505 mins
WSS-017	-7.34944	54.82029	On fenceline separating forestry and moorland. Placed within boundary corridor between two plantations	8 nights	6967 mins
WSS-010	-7.31937	54.81517	Due south of ditch separating improved grassland and heathland	10 nights	8776 mins
WSS-003	-7.32618	54.82108	In open heathland c. <15m from semi-improved grassland and c. <5m from slight turf-cutting belt	10 nights	8776 mins
WSS-014	-7.31721	54.8254	On fencepost separating improved and semi-improved grassland c. <5m from 3m bank due west	10 nights	8776 mins
WSS-012	-7.31721	54.8254	On fencepost separating improved and semi-improved grassland c. <5m from forestry	10 nights	8776 mins
WSS-005	-7.31694	54.82007	On fenceline south of T15 at edge of pasture between improved and semi-improved grassland/heathland. Moved due to cattle occupying field of T15 location	10 nights	8776 mins
WSS-019	-7.34097	54.81316	On individual fence post c. <10m due south of existing turbine on opposite bank in dense heather	10 nights	8776 mins
WSS-020	-7.34525	54.81057	On post c. <5m from road and c. <10m from existing turbine directly on corner due north of boundary fence	10 nights	8776 mins
WSS-018	-7.33806	54.80979	On fence post c. <10m due south-east of existing turbine halfway up bank	10 nights	8776 mins

2.2.5.1 Monitoring Climatic Conditions

Monitoring of climatic conditions was undertaken through the deployment of an on-site fully automated weather station with 3G connectivity.

The Davis Vantage Vue wireless integrated sensor suite weather station deployed, provided data on a real-time basis. This allows weather station functionality to be checked on a daily basis during the survey season and for action to be taken if a station fails or there are concerns regarding the data. This obviates the need for a second (backup) weather station. The weather station collected the full range of weather data, including temperature, wind speed and rainfall, which allows surveyors to determine whether deployments nights were compliant with the prescribed weather parameters (≥ 10°C for 2018 and ≥ 8°C at dusk for 2019), max. ground level wind speed of 7m/s and minimal to no rainfall).

Deployment periods can then be adjusted to ensure 5 nights of compliant data are captured for surveys undertaken in 2018 and 10 nights of compliant data are captured for surveys in 2019. In addition, site specific weather data can be useful for investigating the recorded patterns of site usage by bats, for instance exposed, open sites can receive an influx of foraging bats during nights that are warm and relatively still, especially towards the end of the summer and into the autumn, as bats disperse from maternity roosts.

2.2.5.2 Calibration and Testing of Recording Equipment

Calibration and testing of recording equipment is required by the SNH Guidelines, and as a standard operating procedure Woodrow have a stringent schedule of testing all bat recording equipment prior to and during deployment in the field. Checks are logged in excel, providing an audit trail to ensure that all data can be relied on and form a robust and defendable data set. Unique numbering of static detectors, SD cards and microphones allows for reverse checking, if any issues arise, e.g. following a microphone failure. Checks undertaken include pre-deployment device setting and battery checks, and post- and pre- deployment microphone sensitivity checks.

2.2.5.3 Data Analysis

For data collected using Song Meter 2s (SM2s) and Song Meter 4s (SM4s) analysis of sound recordings was undertaken using Kaleidoscope software to confirm species (or genus for *Myotis* species[2]) and exact number of bat passes for each transect survey or deployment. In cases where a pipistrelle call fell between the frequency range for Nathusius' and common pipistrelle it was classed as an unidentified pipistrelle call. For data collected using the Batloggers, analysis of sound recordings was undertaken using BatExplorer and Kaleidoscope software. Russ (2012) and Middleton *et al*. (2014) were used to aid in identification of bat calls during data analysis.

All sounds files were run through auto-identification and then manual verification was undertaken by Woodrow operatives. Recordings in which multiple species were recorded were split into separate passes.

[2] Bats should be identified to species, or where these cannot be separated with confidence, to species group e.g. *Myotis spp.* (SNH 2021)

3. SURVEY RESULTS

This section provides the detailed results for bat surveys conducted during the 2018 to 2019 survey periods. These survey results are summarised in the subsequent sections.

3.1 Desk Study Results

The bat landscapes habitat suitability map (**Figure 8**) showed the Study Area (within H49) to be of 'Low Suitability' for bats (Lundy *et al*, 2011). A data request was submitted to NI Bat Group for known roost records within 10 km of the Development. A total of 121 bat records were provided of which 57 were confirmed bat roosts, ranging in size from one occupant to several hundreds of bats. The nearest recorded bat roost lies just over 3 km away at the Development's closest point to this site and is relevant as bats are capable of foraging several kilometres from their roosts (Lundy *et al,* 2011). This roost is indicated to be small and unoccupied at the time of survey, with the surveyor noting that the roost probably only supports a single bat. A second roost lies 3.3km northeast, an unidentified *Myotis* spp. is roosting above a garage in a residential dwelling, and a third lies *c.* 4km south, also noted as being an unidentified *Myotis* spp. roost. All other NI Bat Group records are located ≥4.7km from the Development. The NI Bat Group data provided in **Appendix II – NI Bat Group Results** shows bat data recorded in transect and *ad hoc* surveys *(NB: bat roost locations are not included for conservation reasons)*, and indicates five specific species have been recorded in the environs from 1985 to 2018, including:

- Common pipistrelle (*Pipistrellus pipistrellus*)
- Soprano pipistrelle (*Pipistrellus pygmaeus*)
- Leisler's bat (*Nyctalus leisleri*)
- Brown long-eared bat (*Plecotus auritus*)
- Daubenton's bat (*Myotis daubentonii*)

In addition to the above list, there were multiple records of bats identified down to the family rank *Chiroptera,* as well as *Myotis* spp. not identified further than genus rank, meaning there are potentially more than five species occurring within 10km of the Development. There are no Special Areas of Conservation (SACs) or Special Protection Areas (SPAs) designated for bat species in Northern Ireland, although they are protected under the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995, as amended).

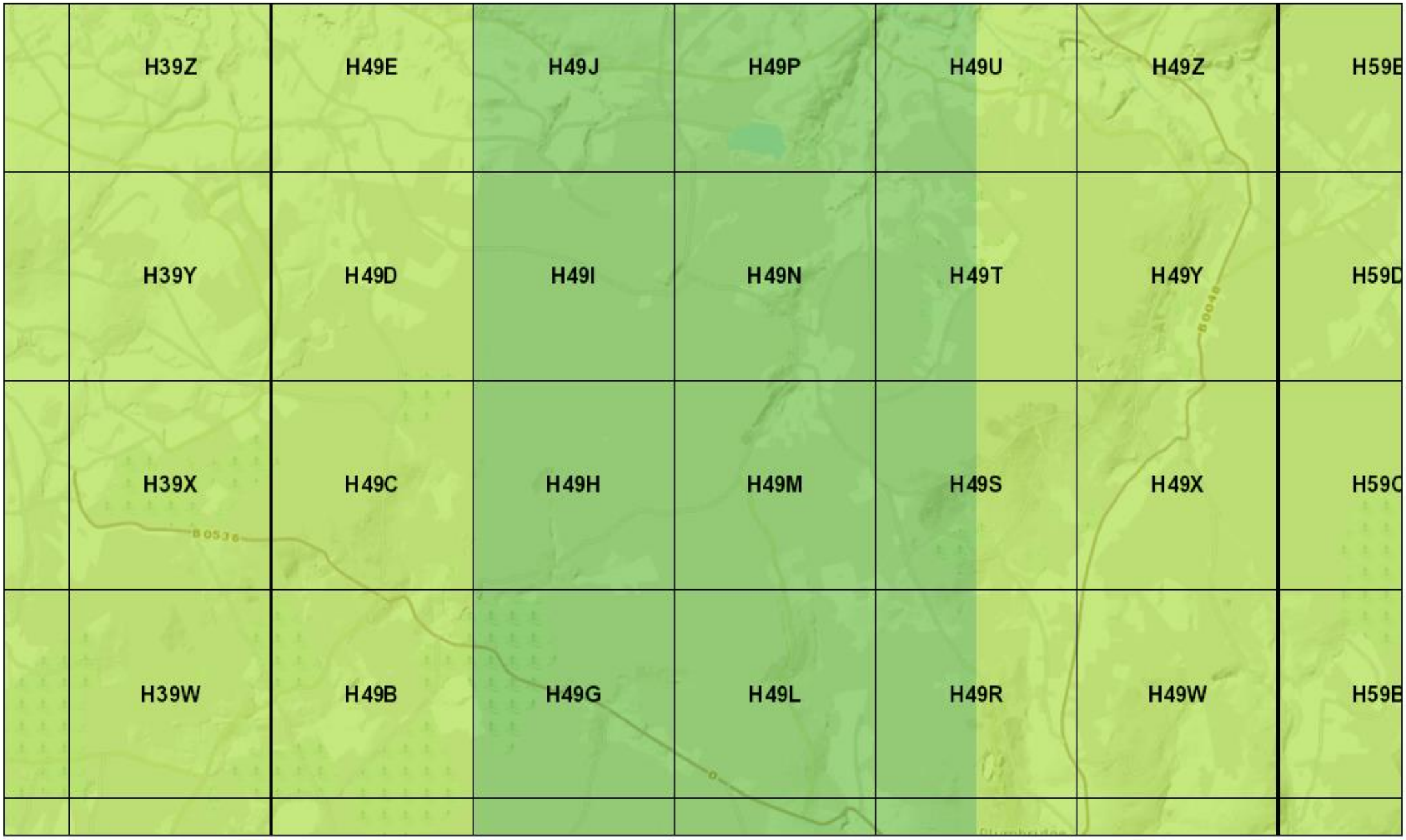


Figure 7: Bat Habitat Suitability Index for H49 10km Grid Square (Lundy et al., 2011)

3.2 Field Survey Results

3.2.1 Emergence and Re-Entry Surveys

Throughout the duration of the survey seasons, emergence and re-entry surveys were conducted at sites deemed to hold potential for roosting bats. These are separated by year and detailed further below. Preliminary scoping of the Study Area for potential bat roosts was conducted in April 2019. Initial building inspections to search for potential bat roosts were undertaken within the Study Area, and within at least 300m of any proposed turbine at that time, on 19th August 2019 under NIEA license (BDL/104/19).

The survey effort for 2019 emergence / re-entry surveys is summarised in **Table 13** below.

Table 13: Overview of roost survey location, timing and weather data (2019)

Building No.	Location (NGR)	Survey Type	Sunset / Sunrise	Start time	End time	Weather Conditions
Building 1	H 43 96	**Dusk**	**Sunset:** 20:54	20:40	22:26	Wind – Force 4 Cloud cover 7/8 Dry - Temp 12°C
		Dawn				
Building 2	H 43 98	**Dusk**				
		Dawn				
Building 3	H 44 97	**Dusk**	**Sunrise:** 06.13	04:45	06:30	Wind – Force 3 Cloud cover 8/8 Dry - Temp 9°C
		Dawn				
Building 4	H 41 97	**Dusk**				
		Dawn				

On 19 – 20 August 2019, four dusk/ dawn surveys were conducted on four derelict buildings, three inside or within 100m of the old Study Area (see: **Figure 1**). These four buildings (Builds 1-4) were surveyed as features offering suitable roosting habitat for bats due to their close proximity to proposed turbines prior to the update and finalisation of the turbine layout. The activity at each of the four locations is summarised in the following paragraphs below.

Building 1

During the dusk survey, approximately 1-3 individual bats were recorded emerging from the main farmhouse building.

Bats emerged from the outbuildings immediately attached to the main house at Building 1 and from the upper storey of the house. During the dawn survey, pipistrelles were noted entering these derelict buildings from various access points. 1 - 2 common pipistrelle bats were observed entering to the south of the derelict house through a broken door.

Building 2

At Building 2, a small number of common pipistrelles were observed emerging from the building. During the dawn survey, these bats failed to return.

Soprano pipistrelle were also recorded foraging here in small numbers, and it is possible that they were roosting within the buildings here, however this was unconfirmed during the 2019 survey.

Building 3 & Building 4

At both Building 3 and Building 4, no bats were recorded exiting or entering either of the buildings, however, some bats were noted as foraging in the area.

Conclusion

It is concluded that a small common pipistrelle roost (1-3 no. individuals noted) was located within the derelict outbuildings attached to and within the derelict two-storey building at Building 1. This small bat roost is considered to be strongly linked to the small common pipistrelle day/satellite roost (1-3 no. individuals noted), was located within the derelict building at Building 2. It is possible that these bats also make use of the out-sheds at this location, albeit small numbers of individual bats.

All data collected during the 2019 emergence / re-entry roost surveys is summarised in **Table 14** below.

Table 14: Overview of the dusk emergence / dawn re-entry surveys undertaken at four potential roost locations in 2019

Survey locations (2019)	*Leisler's bat*		*Common pipistrelle*		*Soprano pipistrelle*		*Unidentified Pipistrelle sp.*		*Brown long-eared bat*		*Myotis sp.*		*TOTAL*	
	Bat passes	*Bp/h*	*Bat passes*	*Bp/h*	*Bat passes*	*Bp/h*	*Bat passes*	*Bp/h*	*Bat passes*	*Bp/h*	*Bat passes*	*Bp/h*	*Bat passes*	*Bp/h*
DUSK (19th August 2019)														
Building 1	0	0	43	24.34	83	46.98	0	0	0	0	0	0	**126**	**71.32**
Building 2	5	2.83	31	17.55	2	1.13	0	0	0	0	3	1.70	**41**	**23.21**
Building 3	8	4.53	14	7.92	1	0.57	0	0	1	0.57	0	0	**24**	**13.58**
Building 4	0	0	2	1.13	0	0	0	0	0	0	0	0	**2**	**1.13**
TOTAL	**13**	**7.36**	**90**	**50.94**	**86**	**48.68**	**0**	**0**	**1**	**0.57**	**3**	**1.7**		
DAWN (20th August 2019)														
Building 1	0	0	177	101.14	108	61.71	0	0	6	3.43	0	0	**291**	**166.29**
Building 2	0	0	3	1.71	0	0	0	0	0	0	0	0	**3**	**1.71**
Building 3	6	3.43	16	9.14	0	0	0	0	2	1.14	0	0	**24**	**13.71**
Building 4	15	8.57	19	10.86	3	1.71	1	0.57	0	0	0	0	**38**	**21.71**
TOTAL	**21**	**12**	**215**	**122.85**	**111**	**63.42**	**1**	**0.57**	**8**	**4.57**	**0**	**0**		

3.2.2 Winter Roost Inspection Surveys

Structures within the Study Area or within the zone of influence (<300m away) of the proposed Development were assessed for their ability to support hibernating bats.

Buildings within the Zone of Influence of the superseded Study Area were visited on 4th November 2019 to assess their suitability to support hibernating bats. It was considered that Building 1 has the potential to support a small number of bats during winter (likely Low to Moderate potential for Pipistrelle species) – however no definitive evidence of this was confirmed during the survey.

3.2.3 Transect Surveys

The results of the transect surveys are split by survey year and are discussed in further detail in the following Sections. All transect surveys were conducted in appropriate weather conditions, on warm evenings / mornings, with little to no wind and little to no rain.

3.2.3.1 Survey Year 2018: Transect Survey Results

Transect surveys were conducted across the site on seven different dates between May and October in 2018, following the BCT Guidance (Hundt, 2012). The results of these seven transect surveys are summarised below, by species, in **Table 15**.

Table 15: Transect survey results (2018)

Survey dates (2018)	***Bat passes***					
	Leisler's Bat	***Common pipistrelle***	***Soprano pipistrelle***	***Unidentified Pipistrelle sp.***	***Myotis sp.***	***TOTAL***
Dusk						
May 17th	1	8	11	0	0	**20**
Jun 21st	0	0	0	0	3	**3**
Jul 19th	7	7	0	1	7	**22**
Aug 27th	0	18	3	1	1	**23**
Sept 24th	0	1	0	0	0	**1**
Oct 10th	3	28	0	2	1	**34**
Dawn						
Aug 28th	1	9	1	1	3	**15**
TOTAL	**12**	**71**	**15**	**5**	**15**	

3.2.3.2 Survey Year 2019: Transect Survey Results

Driven transects of the Study Area were conducted on 17th July 2019 and 10th October 2019. Each transect was conducted as per SNH Guidelines ensuring optimum weather conditions. **Table 16** shows the timing and weather conditions of each transect. **Table 17** shows the total number of bat passes and bat passes per hour (bp/h), for each transect survey, separated by species. The use of 'bat passes per hour' as a unit of measurement is useful since it provides an indication of the level of bat activity in the context of survey effort (time).

Table 16: Transect survey dates, timing, and weather conditions

Survey Date (2019)	*Sunset Time*	*Start time*	*End time*	*Weather Conditions*
17th July	22:07	21:19	23:39	Wind – Force 3
				Cloud cover 6/8 to 7/8
				Dry - Temp 13-14°C
10th October	19:08	18.45	20:55	Wind – Force 2
				Cloud cover 4/8 to 8/8
				Dry - Temp 9 - 10°C

Table 17: Transect survey results (2019)

Survey dates (2019)	*Leisler's Bat*		*Common Pipistrelle*		*Soprano Pipistrelle*		*Unidentified Pipistrelle sp.*		*Myotis Sp.*		*TOTAL*	
	Bat passes (bp)	*Bp/h*	*Bat passes (bp)*	*Bp/h*	*Bat passes (bp)*	*Bp/h*	*Bat passes (bp)*	*Bp/h*	*Bat passes (bp)*	*Bp/h*	*Bat passes (bp)*	*Bp/h*
17th July	***3***	***1.3***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***3***	***1.3***
10th October	***0***	***0***	***5***	***2.14***	***1***	***0.43***	***0***	***0***	***0***	***0***	***6***	***2.57***
TOTAL	***3***	***1.3***	***5***	***2.14***	***1***	***0.43***	***0***	***0***	***0***	***0***		

3.2.4 Static Detector Surveys

As per BCT (2011) guidelines, static bat detectors were deployed monthly throughout the active bat season, from May-October, supplemented using a context detector for the survey year 2018. Detectors were deployed for a minimum of 5 nights in temperatures greater than 10°C, with little to no wind and rain.

In compliance with SNH Guidelines (SNH, 2019), static bat detectors were deployed three times over the 2019 active season at or in areas adjacent to the proposed turbines, alongside one permanent context detector placed by a mature coniferous woodland to the west of the Study Area. Weather conditions during the three deployment periods were proven to be compliant with SNH requirements, that is, 10 nights above thresholds for minimum dusk temperature (8°C) and below thresholds for overnight for rainfall. Bat activity during 2019, based on bat passes per hour, was assessed using activity levels as adapted from Kepel *et al*. (2011). The below **Table 18** shows the number of bat passes attributed to 'Low', 'Medium' and 'High' activity, based on species.

Table 18: Bat activity levels associated with bat passes per hour (bp/h)
- sourced from A Review of the Impacts of Wind Energy Developments on Biodiversity Kepel *et al*. (2011)

Bat activity	*Nyctalus* species	*Pipistrellus* species	All bat species
Low	2.5	2.5	3.0
Medium	4.3	4.1	6.0
High	8.6	8.0	12.0

The following sections detail the results from static monitoring surveys for each year of static deployments, split up into monthly surveys for 2018, and seasonally (spring, summer, autumn) for 2019. The bp/h from the static bat detector surveys show the relative levels of bat activity for each unit deployed in 2019 across all deployments.

3.2.4.1 Static Results: Survey Year 2018

The tabulated results of the total maximum number of bat passes per species for statics deployed in 2018 are presented in **Table 19** and described in further detail in the below paragraphs.

Leisler's bat was the species most commonly encountered at this site across the survey period of May – October 2018. Recordings of this species were detected at all SM2 locations (A – D). The maximum bat passes for this species recorded at any one time over the survey period was 849 Leisler's bat passes at location A in May 2018.

The second most commonly recorded species was common pipistrelle bat, which was also recorded at all SM2 locations (A – D). The maximum bat passes for this species recorded at any one time over the survey period was 3245 common pipistrelle bat passes at location A in May 2018. This was also the highest number of passes at a SM2 location for any one species over the entire survey period of May to October 2018. This location also had the highest number of total bat passes for all species across the survey period (in August, 3471 passes).

Soprano pipistrelle bat were recorded at all SM2 locations across the survey period. The highest number of passes for this species was recorded at location B in July (437 passes).

Low numbers of passes for unidentified pipistrelle bat were recorded which have potential to be either Nathusius' or common pipistrelles given their call parameters. Low activity of *Myotis* bat (highest bat passes for this species recorded at conifer plantation at Location C) and brown long-eared bat species have also been identified at this site.

Table 19: Max Bat Passes over 5 nights recording on SM2 Bat Detectors in 2018

Bat Species	May			June			July			Aug			Sep			Oct		
	BP	Feature / Open	SM2 Location	BP	Feature / Open	SM2 Location	BP	Feature / Open	SM2 Location	BP	Feature / Open	SM2 Location	BP	Feature / Open	SM2 Location	BP	Feature / Open	SM2 Location
Leisler's bat	849	**F**	A	52	O	A	105	**F**	B	115	**F**	A	7	O	C	4	O	A
Common pipistrelle	1265	**F**	A	176	**F**	B	237	**F**	B	3245	**F**	A	156	**F**	A	186	**F**	A
Soprano pipistrelle	96	**F**	A	58	**F**	B	437	**F**	B	40	**F**	A	6	O	B	17	**F**	C
Unidentified pipistrelle sp.	188	O	A	10	**F**	B	0	-	-	65	**F**	A	21	**F**	A	10	**F**	A
***Myotis* spp.**	8	**F**	A	21	**F**	A	11	**F**	B	5	O	D	5	O	B	100	**F**	C

Feature = F (Woodland/tree/hedge/structure etc.)
Open = O (Open habitat grassland / bog)

3.2.4.2 Static Results: Survey Year 2019

The results of the static detector deployments for 2019 are described in detail in **Section 3.2.4.2.1** to **Section 3.2.4.2.4** below. The tabulated results of the total bat passes and bat passes per hour for statics deployed in 2019 are presented in **Table 20** to **Table 23** with rows in grey to indicate detector failure. Green indicates *low* activity levels, yellow indicates *medium* activity levels and red indicates *high*activity levels. Graphs of activity levels by bat species and weather conditions during each deployment are presented in the attached **Appendix I** at the end of this report**.**

Table 20: Static detector survey results - Spring 2019

2019 Turbine Layout	Unit No.	Leisler's bat		Common pipistrelle		Soprano pipistrelle		Unidentified pipistrelle sp.		Brown long-eared bat		Myotis sp.		TOTAL	
		Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h
T1	WSS-001	0	0.00	16	0.34	7	0.15	0	0.00	0	0.00	0	0.00	23	0.49
T3	WSS-009	0	0.00	0	0.00	21	0.23	0	0.00	0	0.00	0	0.00	21	0.23
T7	WSS-023	0	0.00	2	0.02	0	0.00	0	0.00	0	0.00	0	0.00	2	0.02
T9	WSS-007	65	0.70	318	3.44	50	0.54	5	0.05	0	0.00	0	0.00	438	4.74
T9 Context	WSS-191	92	1.00	666	7.21	12	0.13	0	0.01	1	0.01	5	0.05	776	8.40
T10	WSS-003	19	0.21	2	0.02	0	0.00	0	0.00	0	0.00	0	0.00	21	0.23
T13	WSS-012	15	0.16	28	0.30	0	0.00	0	0.00	0	0.00	0	0.00	43	0.47
T14	WSS-005	9	0.10	9	0.10	0	0.00	0	0.00	0	0.00	0	0.00	18	0.19
T14 Context	WSS-010	10	0.11	0	0.00	0	0.00	0	0.00	1	0.01	1	0.01	12	0.13
T15	WSS-008	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
T16	WSS-011	2	0.02	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	3	0.03
T17	WSS-014	7	0.08	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	8	0.09
T18	WSS-002	0		0		0		0		0		0		0	
T19	WSS-013	2	0.02	1	0.01	0	0.00	0	0.00	0	0.00	1	0.01	4	0.04

Table 21: Static detector survey results - Summer deployment (1) 2019

2019 Turbine Layout	Unit No.	Leisler's bat		Common pipistrelle		Soprano pipistrelle		Unidentified pipistrelle sp.		Brown long-eared bat		Myotis sp.		TOTAL	
		Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h
T1	**WSS-012**	59	0.64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	59.00	0.64
T3	**WSS-003**	4.00	0.04	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	10.00	0.11	14.00	0.15
T7	**WSS-018**	30	0.32	31	0.34	3	0.03	0	0.00	0	0.00	2	0.02	66.00	0.71
T9	**WSS-016**	241	2.61	138	1.49	0	0.00	0	0.00	3	0.03	44	0.48	426.00	4.61
T9 Context	**WSS-006**	6	0.06	117	1.27	1	0.01	0	0.00	0	0.00	0	0.00	124.00	1.34
T10	**WSS-021**	20	0.22	2	0.02	1	0.01	0	0.00	0	0.00	2	0.02	25.00	0.27
T13	**WSS-014**	22	0.24	15	0.16	5	0.05	0	0.00	1	0.01	7	0.08	50.00	0.54
T14	**WSS-022**	19	0.21	16	0.17	3	0.03	0	0.00	0	0.00	5	0.05	43.00	0.47
T14 Context	**WSS-005**	80	0.87	467	5.05	17	0.18	0	0.00	3	0.03	11	0.12	578.00	6.26
T15	**WSS-017**	0	0.00	0	0.00	0	0.00	0.000	0.00	0	0.00	0	0.00	0.00	0.00
T16	**WSS-010**	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1.00	0.01
T17	**WSS-019**	12	0.13	5	0.05	0	0.00	0	0.00	0	0.00	1	0.01	18.00	0.19
T18	**WSS-007**	7	0.08	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	7.00	0.08
T19	**WSS-004**	14	0.15	10	0.11	0	0.00	0	0.00	0	0.00	2	0.02	26.00	0.28

Table 22: Static detector survey results - Summer deployment (2) 2019

2019 Turbine Layout	Unit No.	Leisler's bat		Common pipistrelle		Soprano pipistrelle		Unidentified pipistrelle sp.		Brown long-eared bat		Myotis sp.		TOTAL	
		Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h
T1	WSS-013	21a	0.18	92	0.78	37	0.32	1.000	0.01	0	0.00	3	0.03	154	1.31
T3	WSS-003	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
T7	WSS-019	36	0.31	66	0.56	34	0.29	1	0.01	2	0.02	1	0.01	140	1.19
T9	WSS-011	54	0.46	61	0.52	41	0.35	0	0.00	0	0.00	3	0.03	159	1.36
T9 Context	WSS-008	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
T10	WSS-286	118	1.01	249	2.12	38	0.32	0	0.00	19	0.16	5	0.04	429	3.66
T13	WSS-014	28	0.24	83	0.71	19	0.16	0	0.00	4	0.03	12	0.10	146	1.24
T14	WSS-001	181	1.54	188	1.60	125	1.07	0	0.00	18	0.15	14	0.12	526	4.48
T14 Context	WSS-007	64	0.55	106	0.90	29	0.25	0	0.00	1	0.01	1	0.01	201	1.71
T15	WSS-017	53	0.45	45	0.39	20	0.17	0	0.00	1	0.01	3	0.03	122	1.04
T16	WSS-012	51	0.43	146	1.24	40	0.34	0	0.00	1	0.01	0	0.00	238	2.03
T17	WSS-021	29	0.25	100	0.85	19	0.16	0	0.00	0	0.00	2	0.02	150	1.28
T18	WSS-009	51	0.43	468	3.99	335	2.86	0	0.00	21	0.18	26	0.22	901	7.68
T19	WSS-006	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Table 23: Static detector survey results - Autumn 2019

2019 Turbine Layout	Unit No.	Leisler's bat		Common pipistrelle		Soprano pipistrelle		Unidentified pipistrelle sp.		Brown long-eared bat		Myotis pp.		TOTAL	
		Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h	Bat Passes	Bp/h
T1	WSS-200	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
T3	WSS-002	0	0.00	0	0.00	0	0.11	0	0.00	0	0.00	0	0.00	0	0.00
T7	WSS-023	2	0.02	26	0.22	16	0.14	0	0.00	0	0.00	0	0.00	44	0.38
T9	WSS-189	0	0.00	29	0.15	7	0.04	0	0.00	0	0.00	0	0.00	36	0.19
T9 Context	WSS-017	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
T10	WSS-010	6	0.04	19	0.13	19	0.13	0	0.00	0	0.00	2	0.01	46	0.31
T13	WSS-003	2	0.01	38	0.26	15	0.02	0	0.00	0	0.00	0	0.00	55	0.38
T14	WSS-014	2	0.01	10	0.07	3	0.02	0	0.00	0	0.00	2	0.01	17	0.12
T14 Context	WSS-012	2	0.01	25	0.17	3	0.02	0	0	1	0.01	2	0.01	32	0.22
T15	WSS-005	6	0.04	23	0.16	4	0.03	0	0.00	1	0.01	0	0.00	34	0.23
T16	WSS-019	0	0.00	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
T17	WSS-020	0	0.00	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
T18	WSS-018	0	0.00	1	0.01	1	0.01	0	0.00	0	0.00	0	0.00	2	0.01
T19	WSS-014	0	0.00	1	0.01	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01

3.2.4.2.1 Spring deployment (30 May – 12 June 2019)

Static bat detectors were deployed for a total of up to 12 nights adjacent to, or at, 12 out of the 19 proposed turbine locations, as shown in **Figure 7**. A context static bat detector was deployed in conjunction with a static placed at both D9 and D14, respectively. **Table 20** shows the number of bat passes recorded on each detector over the spring survey period as well as the bat passes per hour. The graphs in **Appendix I** illustrate bat activity levels at the context detector at D9 over the spring survey period.

As can be seen in **Appendix I,** weather data for the Spring (May-June) deployment shows compliance with SNH Guidelines of temperatures >8^{o}C at dusk and wind speeds <5m/s (11 mph) and little or no rain, on most nights. As expected of an exposed upland site such as this, wind levels were slightly elevated with a number of nights rising to 0.5 to 1m/s (approx. 1 or 2 mph) above those recommended in SNH Guidelines. However, this is typical and representative of such an extremely exposed site. The majority of deployment nights fell within acceptable levels, <7 m/s (approx. 16 mph) with the exception of three nights. The exception to this in terms of wind is high winds on the night of 01 – 02 June and 02 - 03 June with further high winds of up to 9m/s (19mph) on the night of 04 – 05 June. Evening temperatures were generally above 8^{o}C at dusk on all evenings, however decreased temperatures of between 5 and 7^{o}C at dusk were recorded for one night during June (06 – 07 June). The static detector deployment for spring is considered to be in compliance with SNH Guidelines.

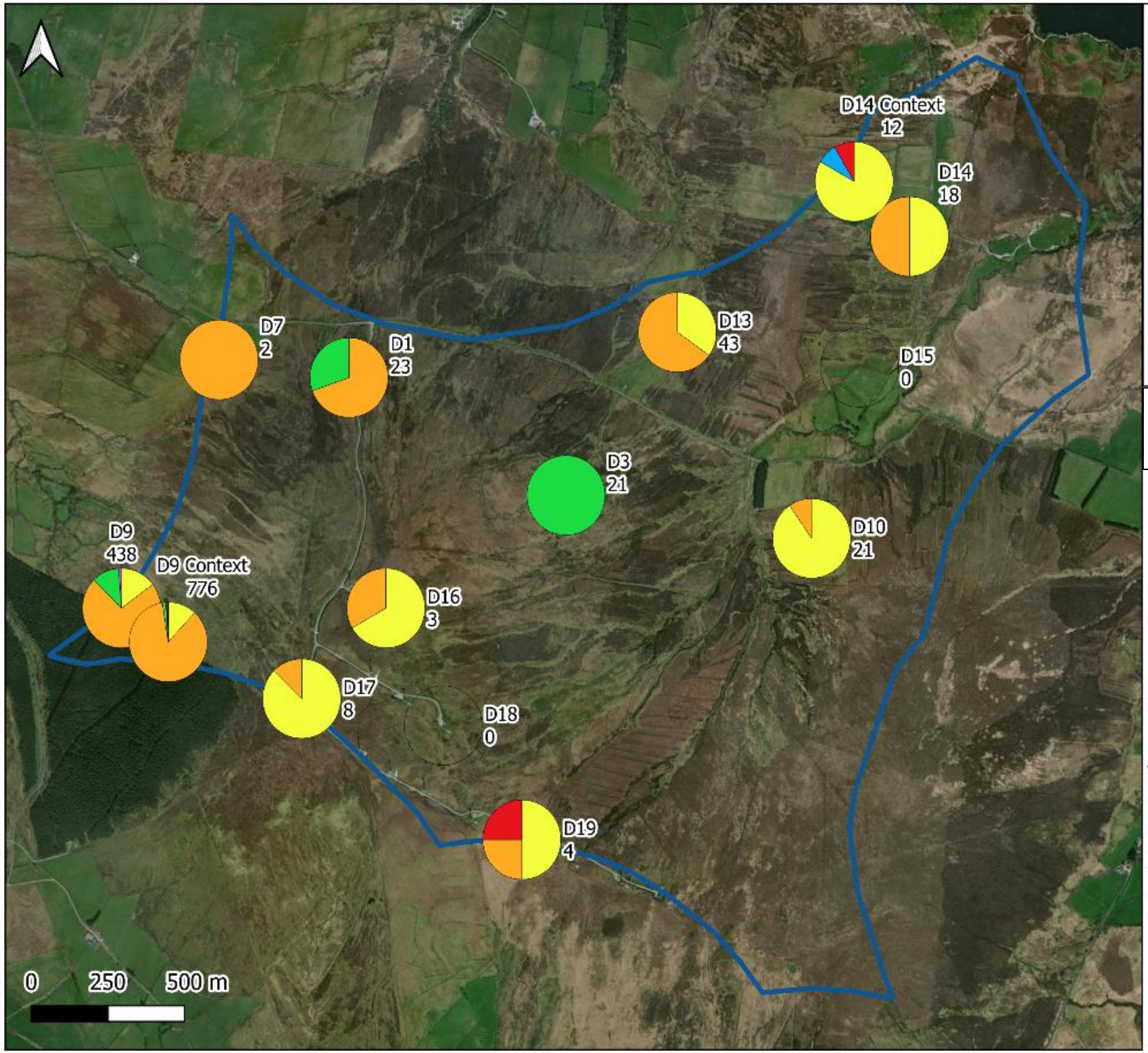
Across almost all of the deployment locations, registrations were dominated by either common pipistrelle or Leisler's bat. The highest number of bat passes (776) was recorded at the context unit of D9 which is located at the end of a boundary corridor between two forestry plantations, with the lowest number of bat passes (0) recorded at the D15 and D18, with only 2 of the 14 deployed units recording above 50 passes over the deployment period. Unit D9 also recorded high levels of bat activity (438) and was located in heathland sheltered by forestry plantation. Comparative usage levels across the Study Area were therefore limited in variability, with only a possible lower level of activity in the most exposed part of the Study Area adjacent to the existing turbines and within heathland at D15, as shown in **Figure 7.** However, in this case, the higher level of activity in the vicinity of the D9 suggests the driver for activity may be more related to very local topographical features and feeding opportunities rather than the general exposure of the Study Area.

The one notable anomaly was the lower level of activity recorded in the vicinity of D7. This is a relatively sheltered part of the Study Area on lower altitudes within grazed heathland and close to a small stream. It may have been expected that a higher level of activity would be recorded at this site due to the presence of livestock, sheltered areas and large dung-heap close by, increasing insect quantities and thus feeding opportunities. In addition, only two common pipistrelles were recorded in the vicinity of D7.

Species-wise, the results are similar to what would normally be expected at an exposed site in the spring. Shiel *et al* (1999) highlight that Leisler's bats tend to range further from maternity roosts, often using day roosts, prior to giving birth (which occurs in June). The authors often see peaks in Leisler's bats in May (and September) in areas where roost availability is limited. In this instance, the most commonly registered species was common pipistrelle (1044 passes) followed by Leisler's bat (221 passes), soprano pipistrelle (90 passes), *Myotis* species (7 passes), unidentified pipistrelle (5) and the brown long-eared

bat (2 passes). The use of the Study Area by brown long-eared bats is interesting for such an exposed site, but not totally unusual.

As detailed in **Table 20,** all bat passes per hour species totals were considered *low*, with the exception of common pipistrelle activity at D9 Context which was considered *high* (7.20). In terms of total aggregated bat passes for all species, total bat passes per hour were considered *low* for all static detectors, with the exception of D9 and D9 Context which were both considered *medium* (4.74 and 8.40, respectively). Common pipistrelle bats use linear features and woodland to forage suggesting that the bats recorded at D9 Context may be using the boundary corridor between the two plantations to commute and forage explaining their relatively greater numbers in relation to the other bat species. Although common pipistrelle bat passes were considered *low* at D9, it was the second highest bat passes per hour species total, suggesting that the area around D9 may be important for foraging and commuting common pipistrelle bats.



Legend

2018 / 2019 Study Area

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- BLE
- Myotis spp.

Figure 8: Overview of the spring (2019) static detector deployment results within the superseded Study

Project: Owenreagh Repowering & Craignagapple Extension

Drawing Title: Spring static deployment locations (2019)

Version: 01
Page Size: A4

Drawn by: AC
Date: 06/03/2023

Reference Scale: 1:29,383

woodrow
APEMGroup

3.2.4.2.2 Summer deployment 1 (02 – 15 July 2019)

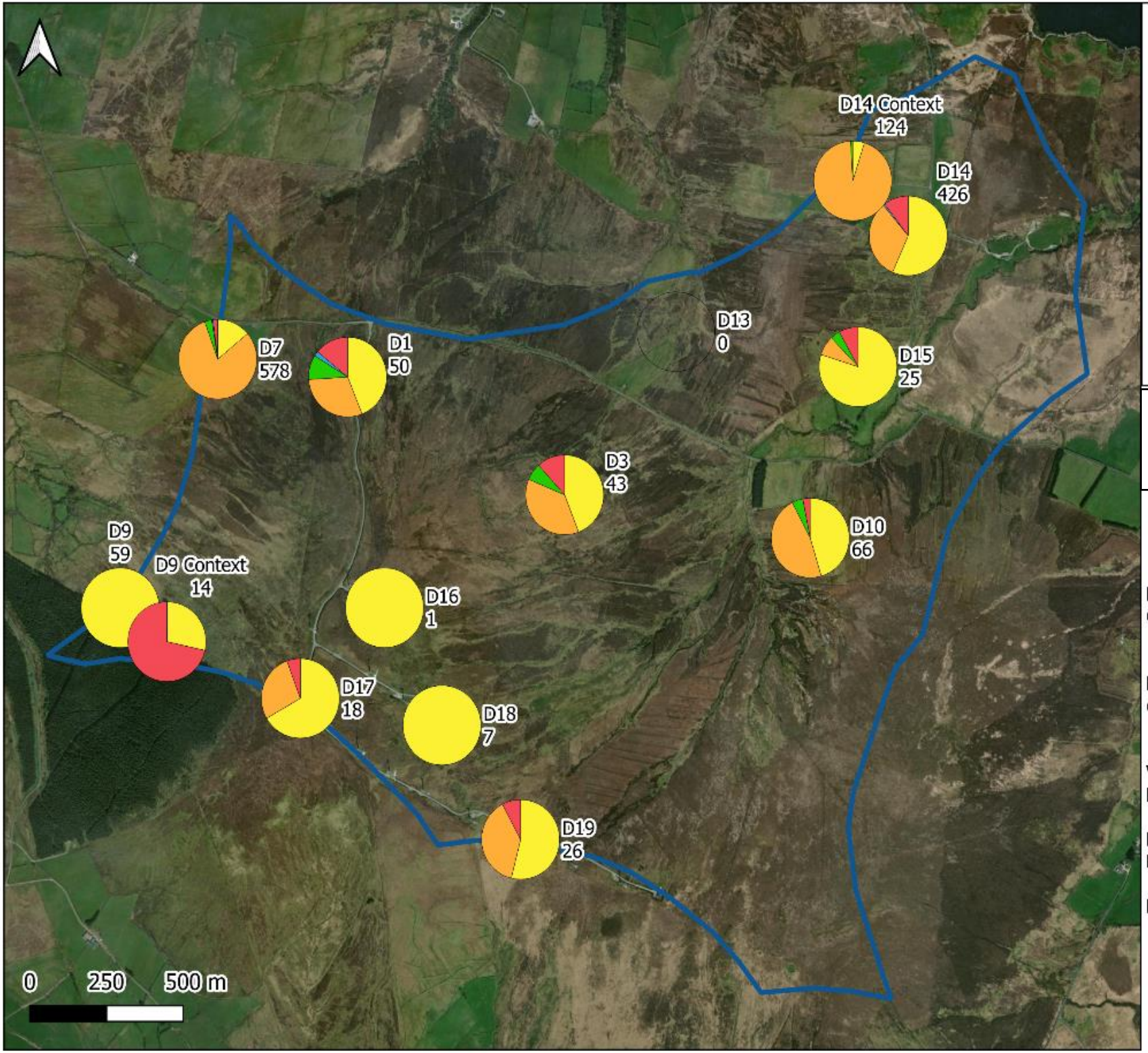
Static bat detectors were deployed for a total of 12 nights at each of the 14 locations, as shown in **Figure 7**. **Table 21** shows the number of bat passes recorded on each detector over the survey period as well as the bat passes per hour. The graphs shown in **Appendix I** illustrate the bat activity levels at the D14 context detector over the first summer deployment.

As can be seen in **Appendix I,** weather data for the first summer (July) deployment also shows compliance with SNH Guidelines of temperatures >8^{o}C at dusk and wind speeds <5m/s (11 mph) and little or no rain, on most nights. Wind speeds remained within appropriate levels, with temperatures remaining above 8^{o}C at dusk. There was relatively little significant night time rain recorded over the deployment. The static detector deployment for summer is considered to be in compliance with SNH Guidelines.

During the first summer deployment, bat registrations were a mix of common and soprano pipistrelle bats, Leisler's bat, *Myotis* species and brown long eared bats. Common pipistrelle bat registrations were the most numerous during this deployment (801), followed by Leisler's bat (515), *Myotis* species (84) and soprano pipistrelle (30), with only 7 brown long-eared registrations.

The highest number of bat passes (578) was recorded at the proposed D14 context location, with the lowest number of bat passes (0) again recorded at the proposed D15 location. Comparative usage levels across the Study Area were somewhat clearer in showing lower activity in the more exposed areas, near existing turbines, and higher activity in the more sheltered areas, such as near proposed turbine location D9.

As detailed in **Table 21**, all bat passes per hour species totals were considered *low*, with the exception of common pipistrelle bat activity at D14 context located on a fence line between semi-improved and improved grassland less than 5m from a small conifer woodland considered *medium* (5.05). In terms of total aggregated bat passes for all species, total bat passes per hour were considered *low* for all static detectors, with the exception of D9 and D14 context which were both considered *medium* (4.61 and 6.26, respectively).



Legend

2018 / 2019 Study Area

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- BLE
- Myotis spp.

Figure 9: Overview of the first summer (2019) static detector deployment results within the superseded Study Area

Project: Owenreagh Repowering & Craignagapple Extension

Drawing Title: First summer static deployment locations (2019)

Version: 01
Page Size: A4

Drawn by: AC
Date: 06/03/2023

Reference Scale: 1:29,383

woodrow
APEM Group

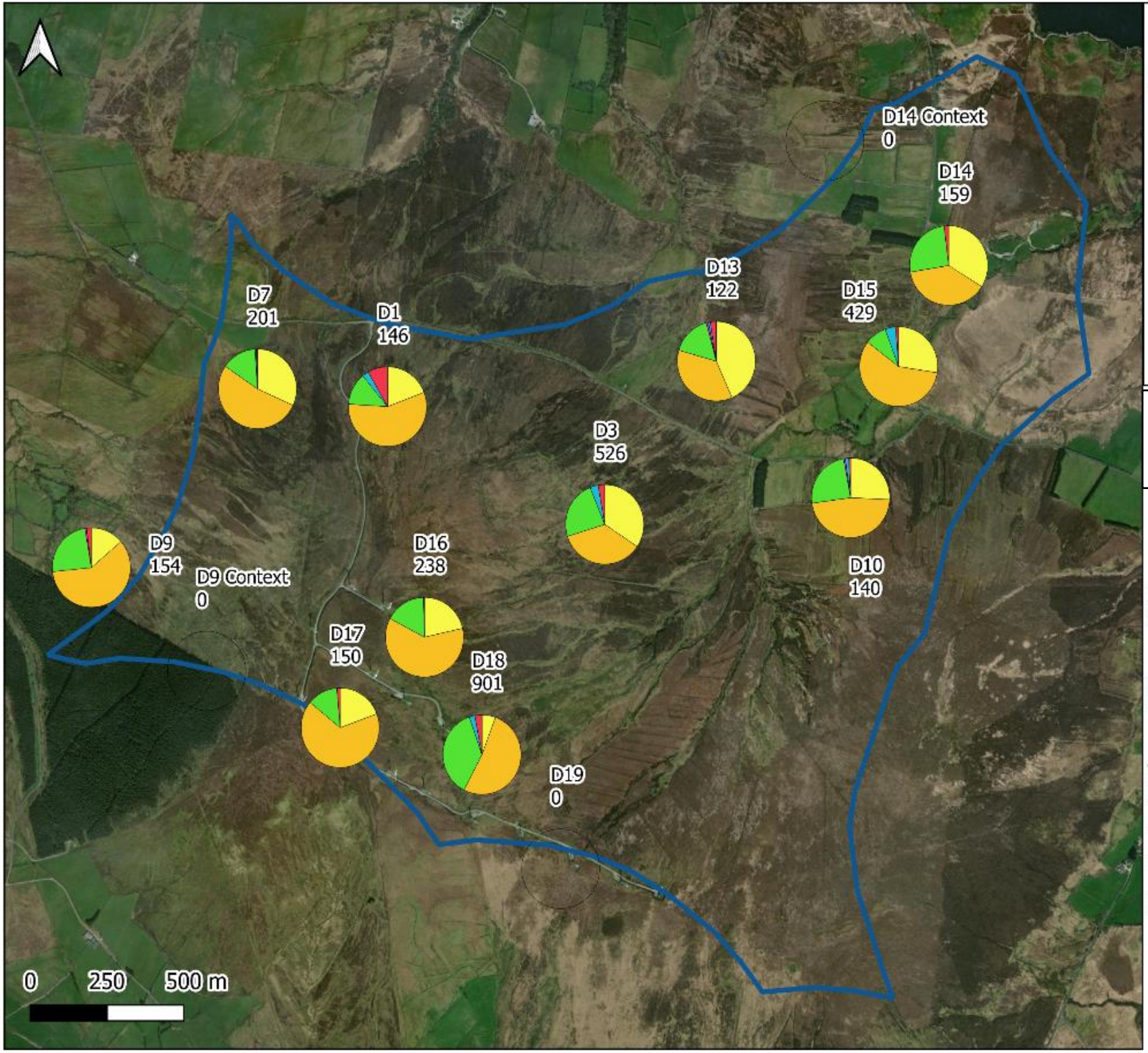
3.2.4.2.3 Second summer deployment 2 (22 August – 02 September 2019)

Static bat detectors were deployed for a total of up to 11 nights at each of the 14 locations, as shown in **Figure 7**. **Table 22** shows the number of bat passes recorded on each detector over the survey period as well as the bat passes per hour. The graphs presented in **Appendix I** illustrate bat activity levels at D18, which recorded the highest level of activity across the second summer deployment period for 2019.

As can be seen in **Appendix I**, data for the second summer (August to September) deployment also shows compliance with SNH Guidelines of temperatures >8ºC at dusk and low wind speeds and little or no rain, on most nights. Wind speeds remained below 7 m/s (approx. 16 mph) while temperatures remained above 8ºC at dusk for the entirety of the deployment. There was rain recorded on a number of occasions, but only significant night time rain on the night of 30 to 31 August. The static detectors are considered to be in compliance with SNH Guidelines, notably taking account of the time of year.

During this deployment, bat registrations were dominated by common pipistrelle bats, followed by soprano pipistrelle bats, Leisler's bats, *Myotis* species and brown long eared bats. unidentified pipistrelle bats (2) were recorded during this deployment at D1, D7 and D15. In contrast to the last two deployments, the highest number of bat passes (901) was recorded at the D18 location, with the lowest numbers of bat passes (0 in both cases) recorded at D9 context and D19 locations.

As detailed in **Table 22**, all bat passes per hour species totals were considered *low*, with the exception of common pipistrelle activity at D18 which was considered *medium* (3.99). In terms of total aggregated bat passes for all species, total bat passes per hour were considered *low* for all static detectors, with the exception of D14 and D18, both considered *medium* activity (4.48 and 7.68, respectively).



Legend

2018 / 2019 Study Area

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- BLE
- Myotis spp.

Figure 10: Overview of the second summer (2019) static detector deployment results within the superseded Study Area

Project: Owenreagh Repowering & Craignagapple Extension

Drawing Title: Second summer static deployment locations (2019)

Version: 01
Page Size: A4

Drawn by: AC
Date: 06/03/2023

Reference Scale: 1:29,383

woodrow
APEM Group

3.2.4.2.4 Autumn deployment (16 – 29 October 2019)

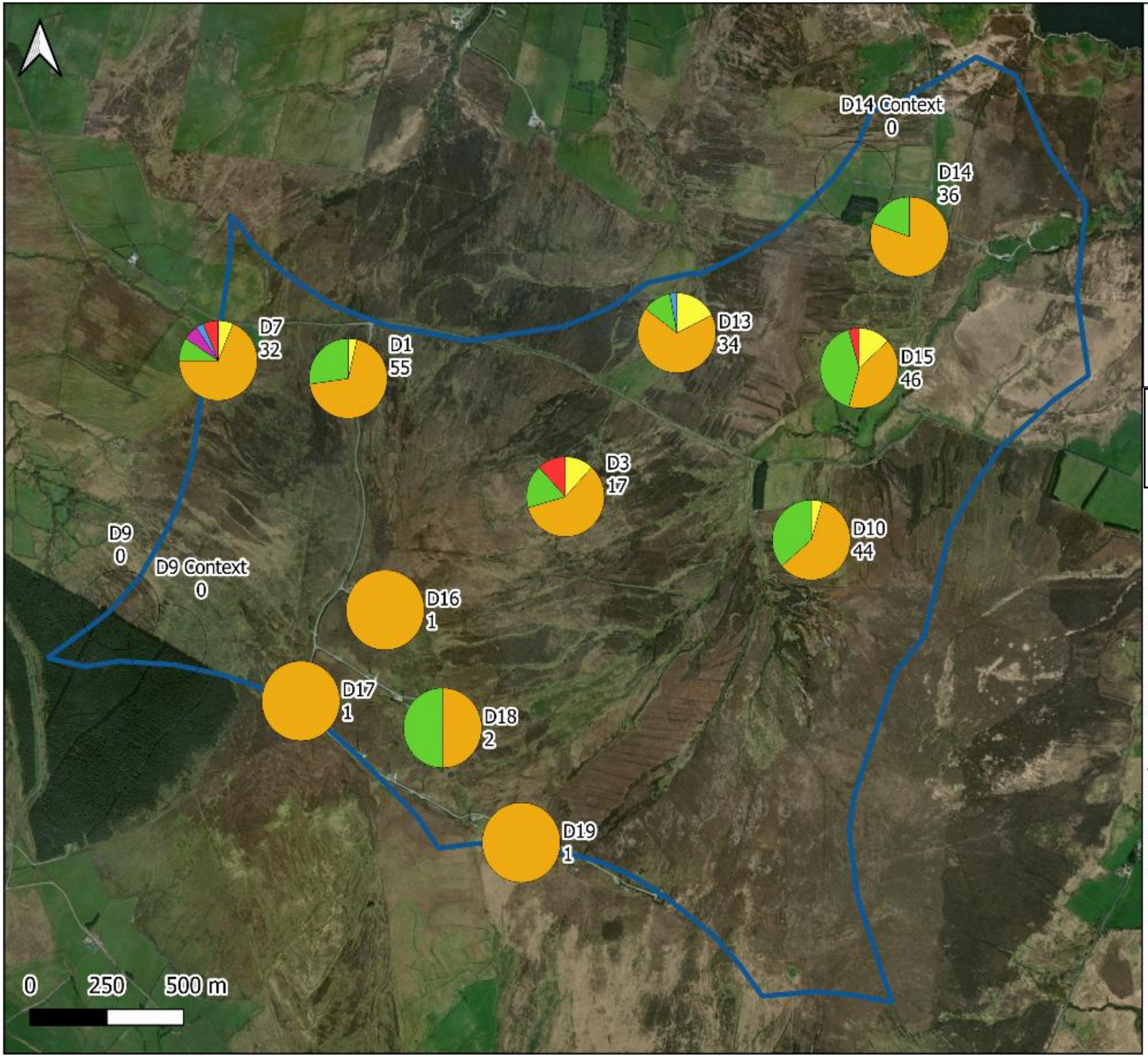
Static bat detectors were deployed for a total of up to 13 nights at each of the 14 locations, as shown in **Figure 7**. **Table 23** shows the number of bat passes recorded on each detector over the survey period as well as the bat passes per hour. **Graph 7** in **Appendix I** illustrates bat activity levels at D13, which recorded the highest number of bat passes for the autumn deployment in 2019.

As can be seen in **Graph 8** in **Appendix I**, data for the autumn (October) deployment also shows compliance with SNH Guidelines of temperatures >8^{o}C at dusk and low wind speeds and little or no rain, on most nights. Wind speeds remained below 7 m/s (approx. 16 mph) for the entirety of the deployment. No significant rain was recorded during the autumn deployment however, rain was recorded on a number of occasions. Temperatures dropped during October, with four nights recording temperatures below 8^{o}C at dusk. The static detectors are considered to be in compliance with SNH Guidelines, notably taking account of the time of year.

The highest number of bat passes (55) was recorded at D13, with the lowest numbers of bat passes (0 in all cases) recorded at D1, D3 and D9 context. As can be seen in **Table 23**, the bat passes recorded at D13 were recorded over a 5-day period, and as can be seen in **Graph 7** in **Appendix I**, this may be due to a combination of increased wind speed and rain combined with a drop in temperatures after 22 October 2019. In general terms recorded activity levels were extremely low across the entire Site, with the locations with the highest level of activity averaging less than 1 bat pass per night.

As with the last deployment, common pipistrelle bat activity dominated the bat registrations with 171 bat passes recorded across all static detectors, followed by soprano pipistrelle bats, Leisler's bat and Myotis species. During this deployment, 2 brown long eared bats (recorded at D14 context and D15) and 2 unidentified pipistrelle bats (both recorded at D14 context) were recorded. Unidentified pipistrelle bats was a classification given to pipistrelle calls within the possible echolocation range of both common and Nathusius' pipistrelles and therefore have the potential to be Nathusius' pipistrelle bats.

As detailed in **Table 23**, all bat passes per hour species totals were considered *Low*. In terms of total aggregated bat passes for all species, total bat passes per hour were considered *low* for all static detectors. In no instance did the total number of bat passes come near to the threshold for medium activity either for species groups or for all bats (3.6 for *Nyctalus* species and pipistrelle species, and 4.1 for all bats), with the highest recorded level of activity being 0.38 bat passes per hour over the deployment period. In addition, it is notable that bat passes by 'high risk' species (Leisler's bat and soprano pipistrelle) comprised less than 100 passes over the full 13-night deployment period. For the other 'high-risk' species, common pipistrelle, less than 200 passes were recorded over the duration of the deployment.



Legend

2018 / 2019 Study Area

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle
- BLE
- Myotis spp.

Figure 11: Overview of the autumn (2019) static detector deployment results within the superseded Study Area

Project: Owenreagh Repowering & Craignagapple Extension

Drawing Title: Autumn static deployment locations (2019)

Version: 01
Page Size: A4

Drawn by: AC
Date: 06/03/2023

Reference Scale: 1:29,383

woodrow
APEM Group

4. DISCUSSION

4.1 Summary of bat activity

The bat surveys undertaken at the Study Area in the form of transect surveys, roost surveys and static detector deployment across the 2018-2019 survey period provide a valuable understanding of bat usage of the Study Area. The surveys showed that there is a variable level of usage of the Study Area by bats and that bat usage of the Study Area is generally associated with habitat features such as forestry edge, treelines and hedgerows.

The table below summarises the total number of bat passes recorded at detectors that registered as being of *medium* or *high* activity (some with *low* activity overall), while **Figure 13** illustrates linear habitats present within or in the vicinity of the 2019 Study Area boundary alongside the 2019 detector deployment locations.

Table 24: Overview of the detectors across the 2018 and 2019 survey period that registered medium or high activity levels

Season / Survey Year	Detector No. (See: Figure 13)	Total bat passes recorded	Associated linear feature or Open?	Bat species with highest number of passes at the detector
2018				
August 2018	Location A	3245	Coniferous woodland	Common pipistrelle
2019				
Spring 2019	D9 (context)	776	Coniferous woodland	Common pipistrelle
	D9	438	Coniferous woodland	Common pipistrelle
Summer 2019 (1)	D14 (context)	578	Treeline / hedgerow	Common pipistrelle
	D9	426	Coniferous woodland	Leisler's bat
Summer 2019 (2)	D18	901	Open	Common pipistrelle
	D14	526	Coniferous woodland	Common pipistrelle

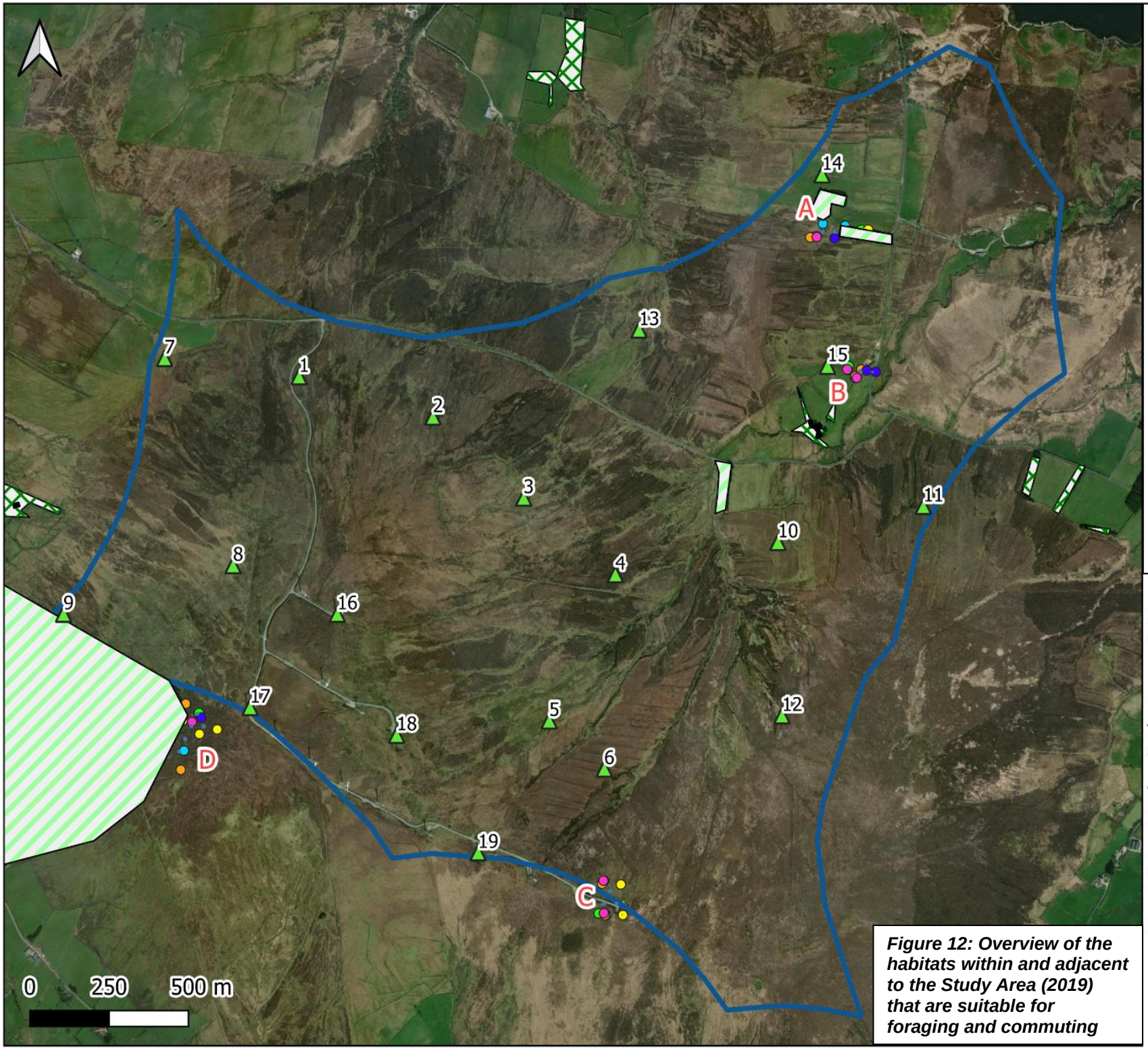


Figure 12: Overview of the habitats within and adjacent to the Study Area (2019) that are suitable for foraging and commuting

Project: Owenreagh Repowering & Craignagapple Extension

Drawing Title: Habitats suitable for foraging and commuting bats within the supersceded layout from 2018-2019

Version: 01
Page Size: A4

Drawn by: AC
Date: 05/04/2023

Reference Scale: 1:28,419

woodrow
APEM Group

Bat activity across the site in both 2018 and 2019 was generally *low* with a few outliers. In 2018 only one detector during August registered a *high* level of bat activity, related to common pipistrelle recorded between two strips of coniferous woodland (no longer within the updated 2023 Study Area boundary), while the rest were all *low* throughout the rest of the 2018 survey period. During the 2019 deployments, a few detectors registered a *medium* level of bat activity, while one registered as *high*, most likely owing to the linear features these detectors were placed next to, in the form of strips of coniferous woodland. During both survey years (2018 and 2019), common pipistrelle was the most commonly recorded species across the Study Area.

4.2 Association of bat activity with features

Association of bat activity with features is gained, with deployments including 'paired' detectors at open habitat locations as well as at features. Results reveal an association between bat passes and habitat features. Bat activity recorded during the survey season was largely associated with habitat features such as hedgerows, treelines, mature trees and forestry edge. Overall, bat activity levels differed greatly between static detectors located at features and non-features. While common and soprano pipistrelle were more likely to be found along features, Leisler's bats were more likely to forage over open habitat, particularly as the survey season progressed from spring to autumn. This behaviour is not unusual for Leisler's bat, and this species is known to be less selective with regards to the presence of linear features when foraging (Shiel *et al,* 1998; Russ *et al,* 2006; Lundy *et al,* 2011). This is supported by the literature, which outlines the preference for linear features by common and soprano pipistrelle; additionally, while common pipistrelle undertake more individual flights, soprano pipistrelle are more likely to fly further and make less journeys, suggesting an even more specific habitat preference in soprano pipistrelle than common pipistrelle (Shiel *et al*, 1998; McAney, 2006; Rachwald *et al,* 2016).

Figure 1 and **Figure 2** illustrate the generally higher level of bat activity when detectors were placed near linear features such as this, while **Figure 3** and **Figure 4** show higher levels of activity in open habitat, potentially owing to the fledging of baby bats from their roosts. Moving into the autumn deployment in 2019 and activity begins to level off; there is a Low level of activity across the entire Study Area as bats prepare for hibernation. Bat activity increased from the spring deployment to the final deployment in autumn, with an increase in range of activity coinciding with the reproductive cycle of bats[3]. While in late spring and early summer, bats will stay closer to the roost to keep warm and take care of their young, by autumn (late August – September) nursery roosts begin to break-up, baby bats are fully fledged and will forage for themselves farther afield.

Leisler's bat passes dominated in areas of open habitat, whereas other species such as common and soprano pipistrelle were more likely to dominate along linear features, such as hedgerows, treelines and woodland edges. This was true throughout the 2019 period. Common pipistrelle was the most commonly recorded species across both the 2018 and 2019 survey periods.

[3] BCT Website. Available at: https://www.bats.org.uk/about-bats/a-year-in-the-life-of-a-bat

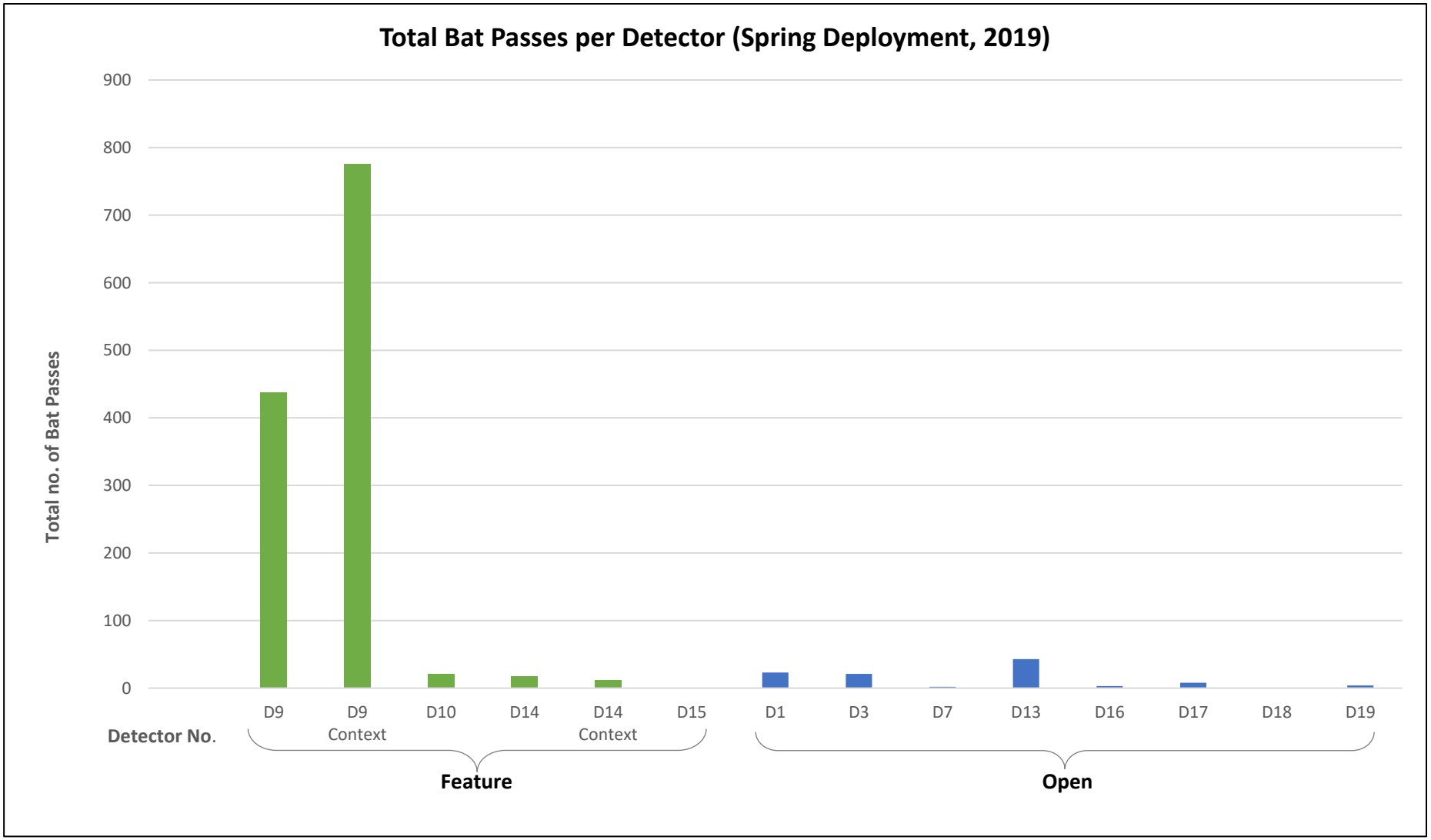


Figure 1: Overview of bat activity levels at linear features vs open habitat (Spring deployment, 2019)

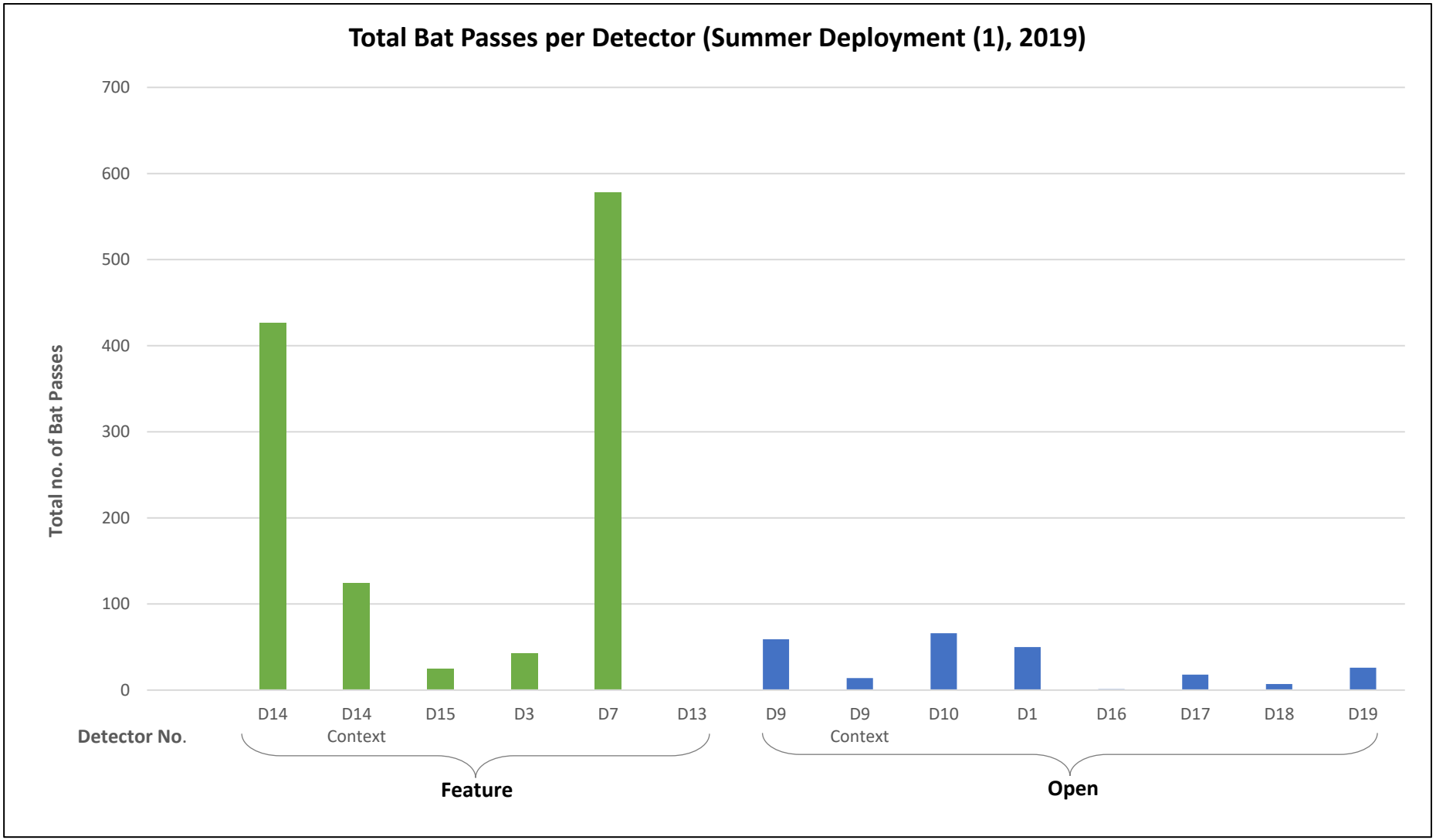


Figure 2: Overview of the level of bat activity at linear features vs open habitat (First summer deployment, 2019)

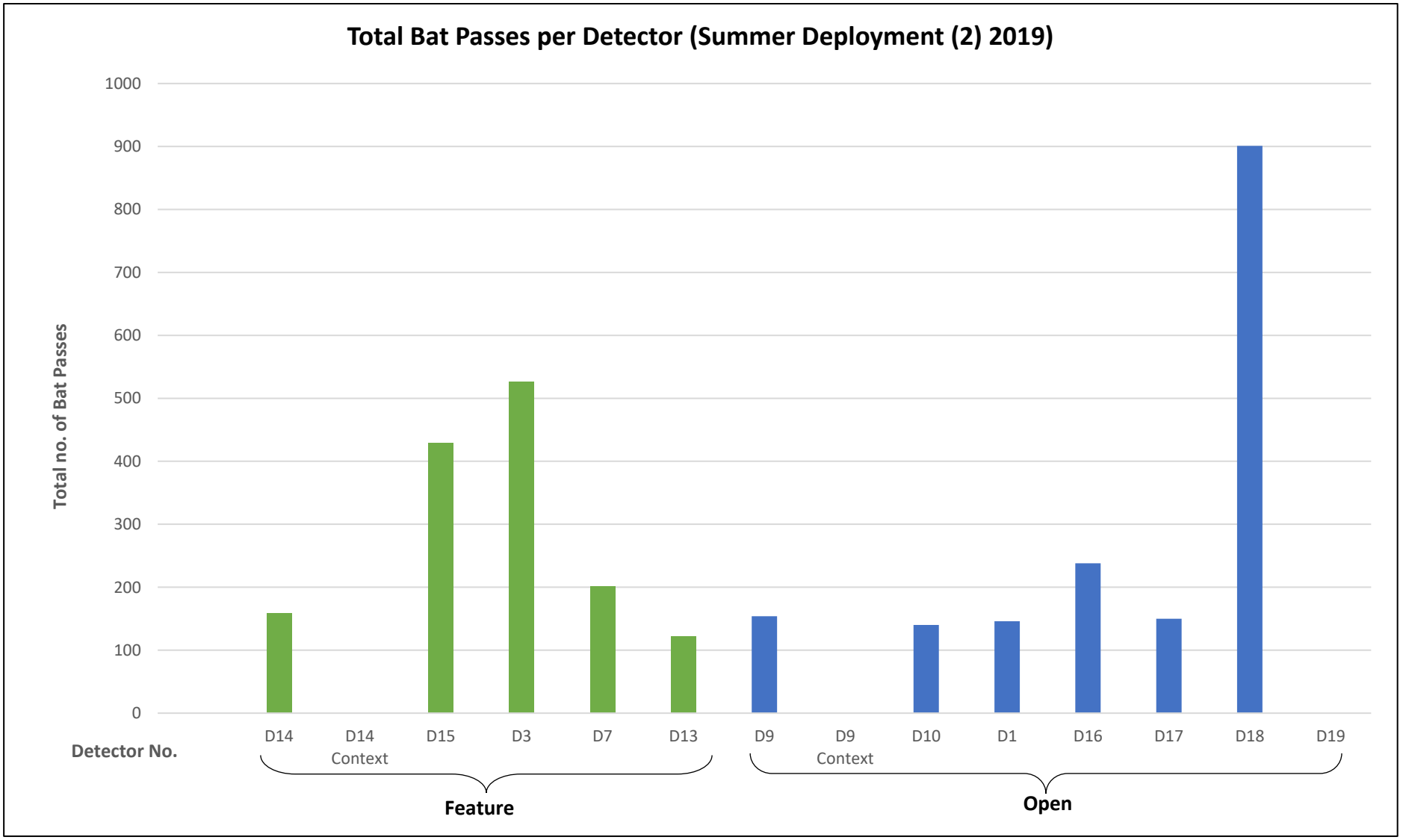


Figure 3: Overview of bat activity levels at linear features vs open habitat (Second summer deployment, 2019)

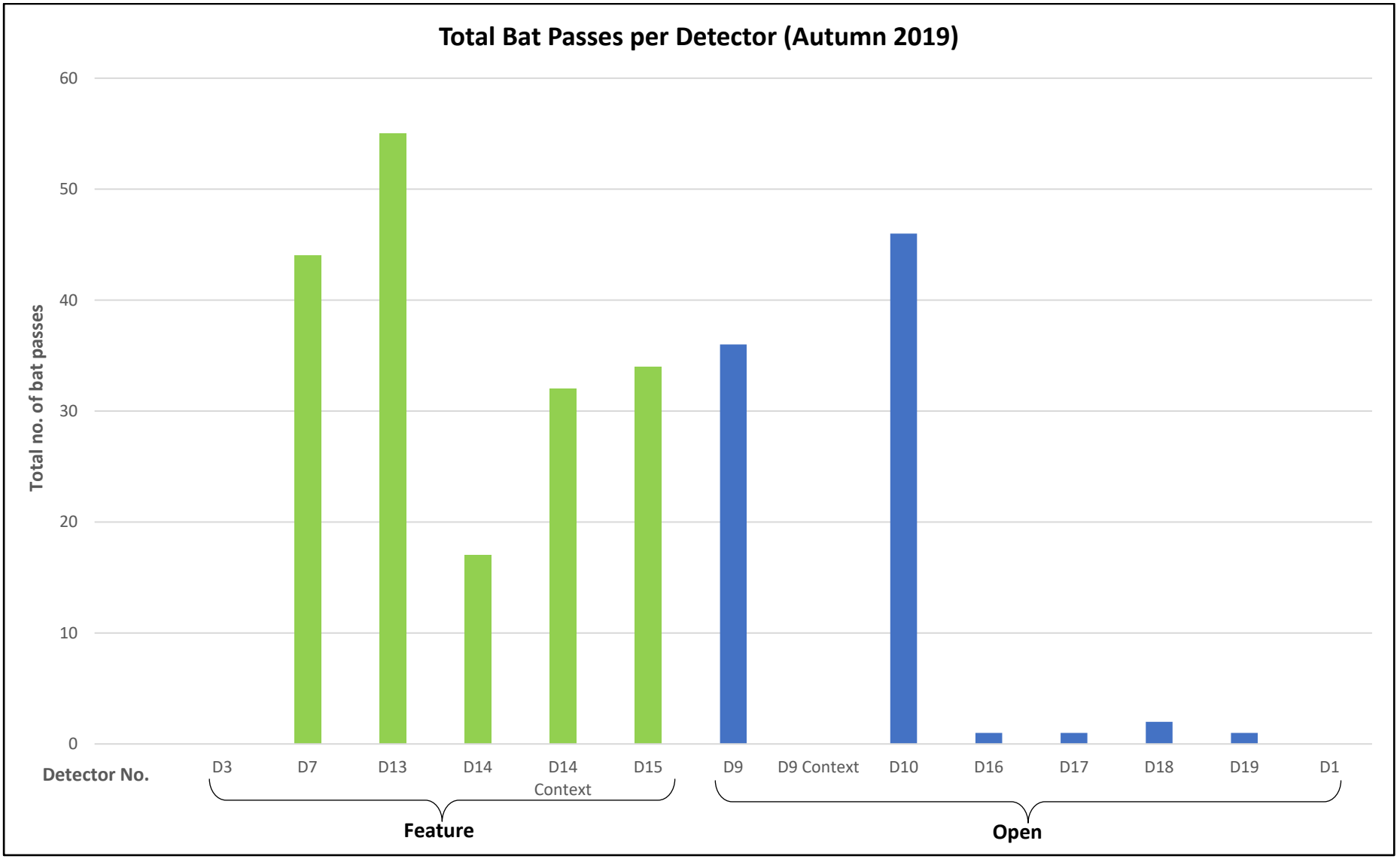


Figure 4: Overview of bat activity levels at linear features vs open habitat (Autumn deployment, 2019)

5. REFERENCES

Bat Conservation Ireland (2012). *Wind Turbine/Wind Farm Development Bat Survey Guidelines*, Version 2.8, December 2012. Bat Conservation Ireland

Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edition). The Bat Conservation Trust, London.

Hundt, L. (2012). *Bat Surveys: Good Practice Guidelines*. 2nd Edition. BCT – Bat Conservation Trust, London.

Lintott, P.R., Davison, S., van Breda, J., Kubasiewicz, L., Dowse, D., Daisley, J., Haddy, E. & Mathews, F. (2018). *Ecobat: An online resource to facilitate transparent, evidence-based interpretation of bat activity data*. Ecology and evolution, 8(2), pp.935-941

Lundy, M.G., Aughney, T., Montgomery, W.I., & Roche, N., (2011) *Landscape conservation for Irish bats*

Marnell, F., Kingston, N. & Looney, D. (2009). *Ireland Red List No. 3: Terrestrial Mammals, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.& species-specific roosting characteristics*. Bat Conservation Ireland.

Mathews, F. Richardson, S. Lintott, P. & Hosken, P. (2016). *Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management*. Final Report from University of Exeter University for RenewableUK and the UK Department of Energy & Climate Change (DECC)

McAney, K. (2006). A conservation plan for Irish vesper bats. *Irish Wildlife Manuals*, No. 20. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Middleton N., Hound A. & French K (2014). Social Calls of the Bats of Britain and Ireland.

NatureScot, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter & Bat Conservation Trust (2021). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*.

NIEA, Natural Environment Division (2022). Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland

Rachwald, A., Bradford, T., Borowski, Z. and Racey, P.A. (2016) Habitat Preferences of Soprano Pipistrelle Pipistrellus pygmaeus (Leach, 1825) and Common Pipistrelle Pipistrellus pipistrellus (Schreber, 1774) in Two Different Woodlands in North East Scotland. Zoological Studies 55(22)

Richardson, S.M., Lintott, P.R., Hosken, D.J., Economou, T. and Mathews, F. (2021) Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats. Sci Rep 11, 3636.

Roche, N., Langton, S., Aughney, T., Russ, M., Marnell, F., Lynn, D. and Catto, C. (2011) A car-based monitoring method reveals new information on bat populations and distributions in Ireland. Animal Conservation 14(6) 642-651.

Russ, J.M., Briffa, W. and Montgomery, I. (2006) Seasonal patterns in activity and habitat use by bats (Pipistrellus spp. and Nyctalus leisleri) in Northern Ireland, determined using a driven transect. Journal of Zoology. 259 (3) 289-299.

Roche, N., Aughney, T., Marnell, F. & Lundy, M. (2014). *Irish Bats in the 21st Century*. Bat Conservation Ireland. Cavan, Ireland

Russ, J.M., Hutson, A.M., Montgomery, W.I., Racey, P.A. and Speakman, J.R., (2001). The status of Nathusius' pipistrelle (Pipistrellus nathusii Keyserling & Blasius, 1839) in the British Isles. *Journal of Zoology*, 254(1), pp.91-100.

Russ, J. (2012). British Bat Calls: A Guide to Species Identification.

Rydell, J., L. Bach, M. J. Dubourg-Savage, M. Green, L. Rodrigues & A. Hedenström. (2010). Bat mortality at wind turbines in northwestern Europe. *Acta Chiropterologica* 12:261-274.

Scottish Natural Heritage (SNH) (2019). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.* Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter & Bat Conservation Trust (updated in 2021)

Shiel, C.B. and Fairley, J.S. (1998) Activity of Leisler's Bat Nyctalus leisleri (Kuhl) in the Field in South-East County Wexford, as Revealed by a Bat Detector. Biology and Environment: Proceedings of the Royal Irish Academy. 98B(2) 105-112.

Shiel, C.B., Shiel, R.E. and Fairley, J.S. (1999) Seasonal changes in the foraging behaviour of Leisler's bats (Nyctalus leisleri) in Ireland as revealed by radio-telemetry. Journal of Zoology 249(3) 347 – 358.

Wray, S., Wells, D., Long, E. & Mitchell-Jones, T. (2010). Framework for valuing bats in Ecological Impact Assessment, *CIEEM journal*, 70. Pg. 23, 25. December 2010.

APPENDIX I – GRAPHS OF WEATHER CONDITIONS DURING 2019 DEPLOYMENT

Figure 5: Recorded bat activity near T9 (context) over the spring (May 2019 – June 2019) deployment period

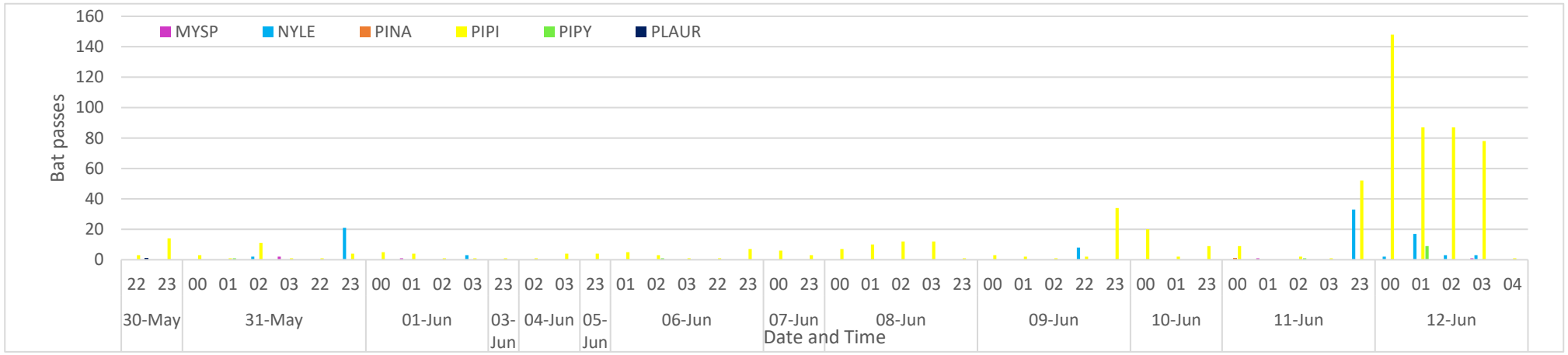


Figure 6: Weather conditions during the spring (May to June 2019) deployment period

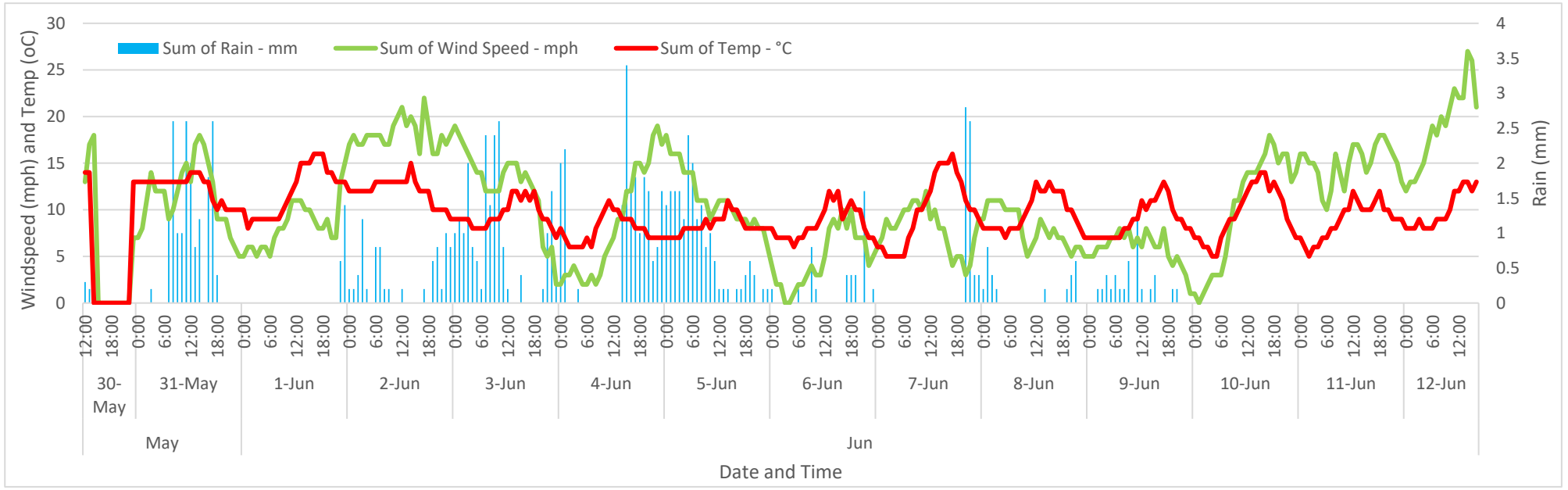


Figure 7: Recorded bat activity near T14 context over the summer 1 (July 2019) deployment period

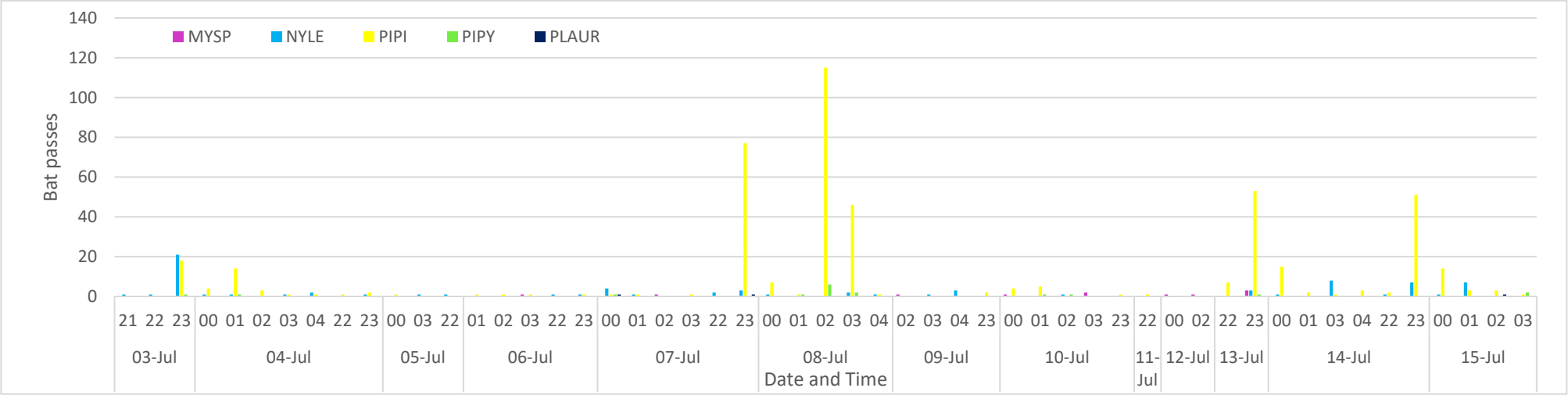


Figure 8: Weather conditions during the summer (July) deployment period

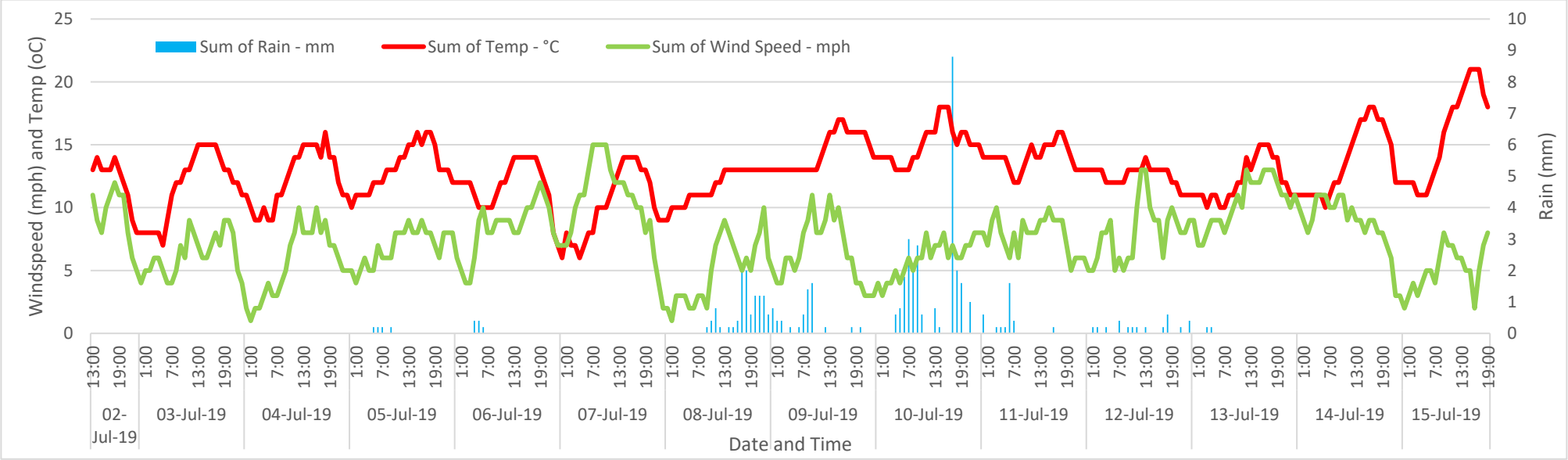


Figure 9: Recorded bat activity near T18 over the summer (2) (August – September 2019) deployment period

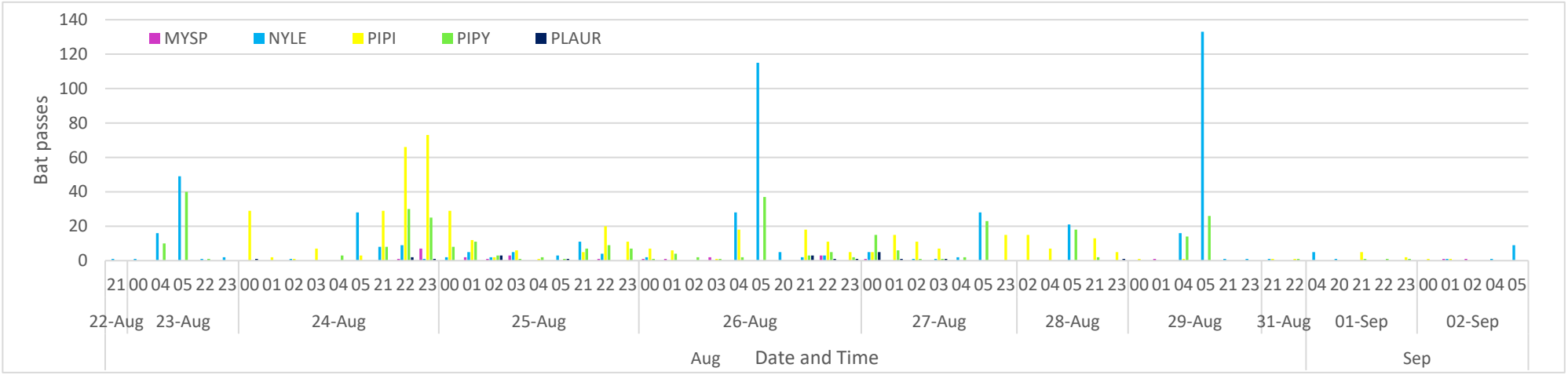


Figure 10: Weather conditions during the second summer (August to September 2019) deployment period

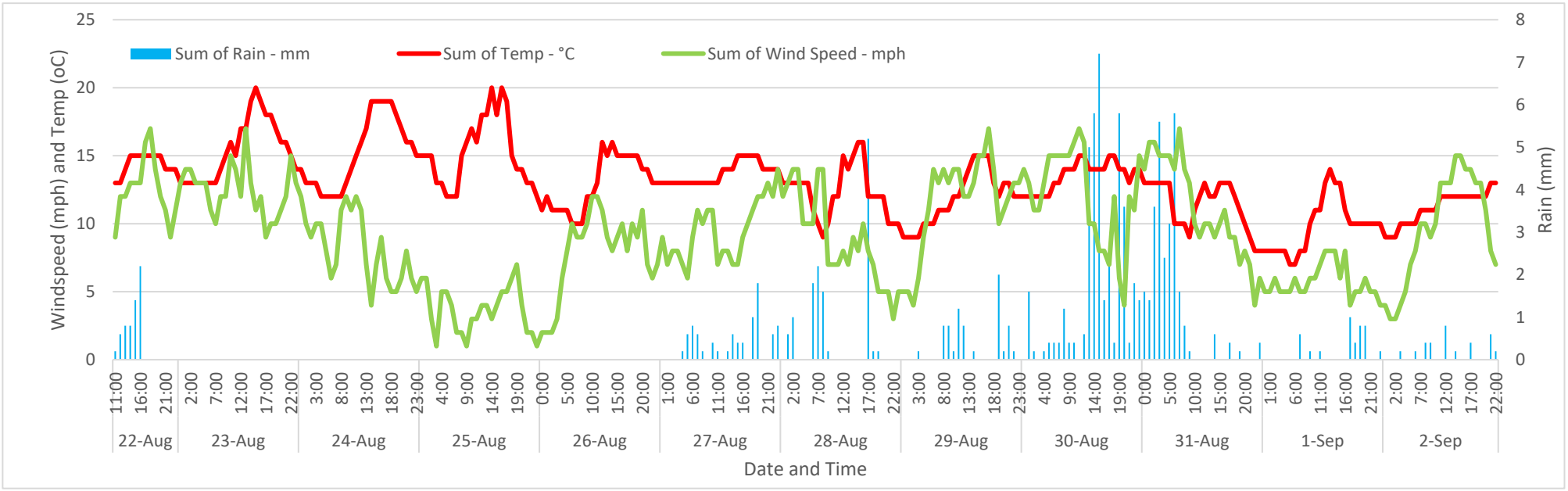


Figure 11: Recorded bat activity near T13 over the autumn (October 2019) deployment period

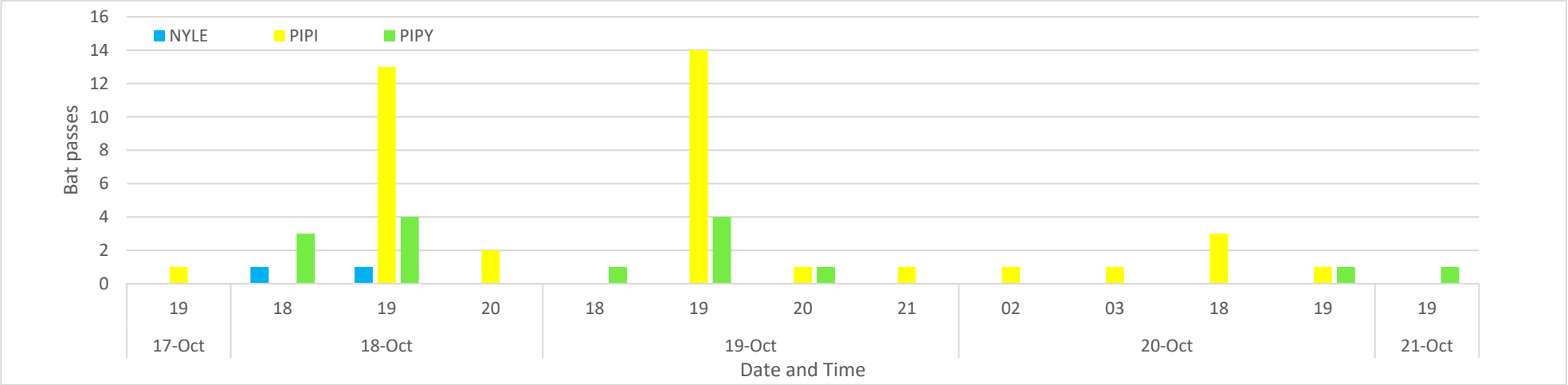
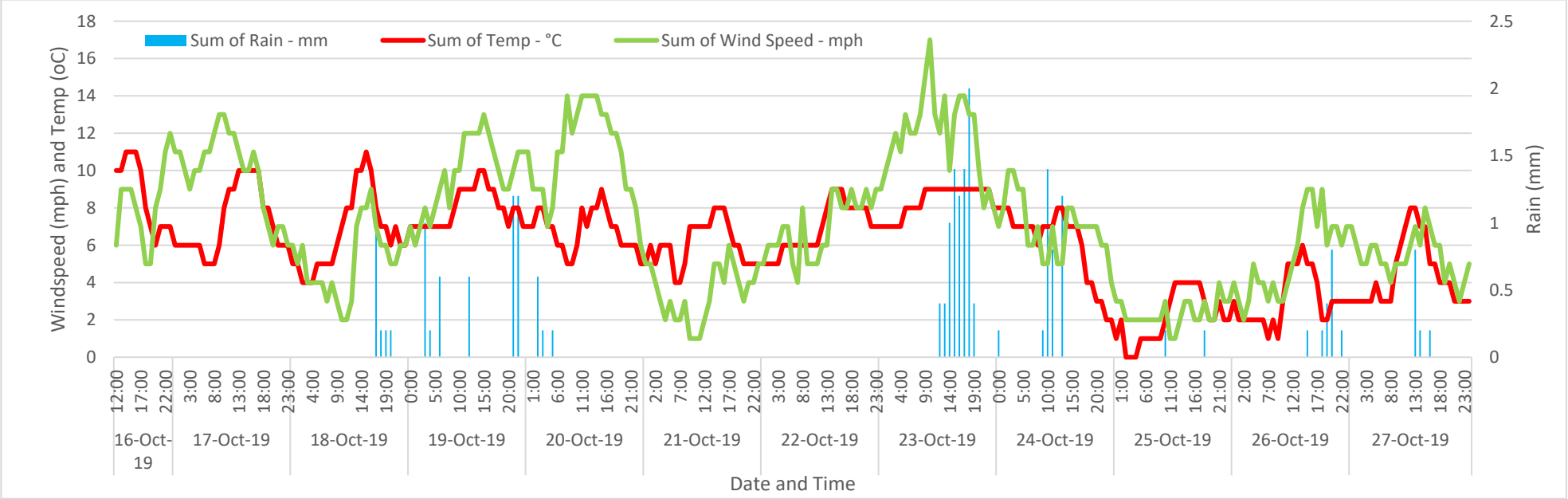


Figure 12: Weather conditions during the autumn (October 2019) deployment period



APPENDIX II – NI BAT GROUP RESULTS

NB: bat roost locations are not included for conservation reasons

Latin Name	Common Name	Irish Grid Reference	Date recorded
Chiroptera	Unidentified bat	C366016	23/07/2001
Myotis spp.	Myotis spp.	C3701	24/08/2015
Chiroptera	Unidentified bat	C3701	15/07/2011
Chiroptera	Unidentified bat	C375037	11/07/2008
Chiroptera	Unidentified bat	C375050	02/06/1994
Pipistrellus spp.	Pipistrelle spp.	C379009	24/06/1997
Myotis spp.	Unidentified bat	C379012	11/08/2015
Pipistrellus pipistrellus	Common pipistrelle	C3802	03/10/1996
Pipistrellus pygmaeus	Soprano pipistrelle	C3802	03/10/1996
Pipistrellus spp.	Pipistrelle spp.	C385031	09/07/1999
Chiroptera	Unidentified bat	C387039	09/09/2007
Myotis spp.	Myotis spp.	C4005	22/08/2014
Myotis spp.	Myotis spp.	C4104	31/07/2015
Pipistrellus pipistrellus	Common pipistrelle	C4207	05/07/1996
Pipistrellus spp.	Pipistrelle spp.	C443020	11/06/1998
Pipistrellus spp.	Pipistrelle spp.	C443020	24/06/1998
Pipistrellus pipistrellus	Common pipistrelle	C445031	08/08/2012
Chiroptera	Unidentified bat	C451017	14/07/1995
Pipistrellus spp.	Pipistrelle spp.	C455010	24/09/2007
Chiroptera	Unidentified bat	C456005	16/05/2003
Chiroptera	Unidentified bat	C456005	16/05/2003

Latin Name	Common Name	Irish Grid Reference	Date recorded
Pipistrellus spp.	Pipistrelle spp.	C461021	14/12/1994
Pipistrellus pipistrellus	Common pipistrelle	C482025	24/08/2012
Pipistrellus pipistrellus	Common pipistrelle	C484024	08/08/2012
Pipistrellus pipistrellus	Common pipistrelle	C484024	08/08/2012
Plecotus auritus	Brown long-eared bat	C485022	01/10/1997
Plecotus auritus	Brown long-eared bat	C485022	01/10/1997
Myotis daubentonii	Daubenton's bat	H3296	01/10/2010
Pipistrellus pygmaeus	Soprano pipistrelle	H3297	01/10/2010
Nyctalus leisleri	Leisler's Bat	H3297	01/10/2010
Pipistrellus nathusii	Nathusius' Pipistrelle	H3297	01/10/2010
Pipistrellus pipistrellus	Common pipistrelle	H3297	01/10/2010
Pipistrellus nathusii	Nathusius' pipistrelle	H337393	27/06/2012
Pipistrellus pygmaeus	Soprano pipistrelle	H3397	01/10/2010
Chiroptera	Unidentified bat	H339936	01/06/1990
Pipistrellus spp.	Pipistrelle spp.	H339953	01/09/1988
Pipistrellus pipistrellus	Common pipistrelle	H340396	12/08/2013
Pipistrellus pygmaeus	Soprano pipistrelle	H340964	01/09/2014
Pipistrellus pygmaeus	Soprano pipistrelle	H340964	01/09/2014
Chiroptera	Unidentified bat	H340967	21/08/1994
Chiroptera	Unidentified bat	H344967	18/05/2016
Pipistrellus spp.	Pipistrelle spp.	H347970	17/07/2018
Myotis spp.	Myotis spp.	H347988	24/08/2015
Chiroptera	Unidentified bat	H348985	26/06/1997
Pipistrellus pipistrellus	Common pipistrelle	H348986	19/06/2012

Latin Name	Common Name	Irish Grid Reference	Date recorded
Pipistrellus pipistrellus	Common pipistrelle	H348986	19/06/2012
Chiroptera	Unidentified bat	H348987	19/05/1998
Chiroptera	Unidentified bat	H3493	16/05/1997
Pipistrellus spp.	Pipistrelle spp.	H350930	23/08/2007
Pipistrellus pipistrellus	Common pipistrelle	H350981	23/08/2012
Pipistrellus pipistrellus	Common pipistrelle	H350981	23/09/2012
Pipistrellus spp.	Pipistrelle spp.	H351914	07/08/2006
Pipistrellus spp.	Pipistrelle spp.	H351914	07/08/2006
Pipistrellus spp.	Pipistrelle spp.	H352965	27/06/2016
Nyctalus leisleri	Leisler's bat	H352965	27/06/2016
Pipistrellus spp.	Pipistrelle spp.	H353975	08/10/2007
Pipistrellus spp.	Pipistrelle spp.	H353975	08/10/2007
Chiroptera	Unidentified bat	H369901	23/06/2001
Pipistrellus spp.	Pipistrelle spp.	H369902	15/08/1988
Pipistrellus spp.	Pipistrelle spp.	H369902	20/06/1991
Pipistrellus spp.	Pipistrelle spp.	H369902	21/06/1996
Pipistrellus spp.	Pipistrelle spp.	H369902	22/06/1990
Pipistrellus spp.	Pipistrelle spp.	H369902	22/06/1993
Pipistrellus spp.	Pipistrelle spp.	H369902	23/06/1992
Pipistrellus spp.	Pipistrelle spp.	H369902	23/06/1995
Pipistrellus spp.	Pipistrelle spp.	H369902	25/06/1994
Pipistrellus spp.	Pipistrelle spp.	H374900	01/07/2008
Pipistrellus spp.	Pipistrelle spp.	H374900	06/07/2007
Pipistrellus spp.	Pipistrelle spp.	H374900	17/07/2008

Latin Name	Common Name	Irish Grid Reference	Date recorded
Pipistrellus spp.	Pipistrelle spp.	H374900	21/05/2008
Pipistrellus spp.	Pipistrelle spp.	H374900	15/08/2006
Pipistrellus spp.	Pipistrelle spp.	H374900	01/07/2008
Pipistrellus spp.	Pipistrelle spp.	H374900	06/07/2007
Pipistrellus spp.	Pipistrelle spp.	H374900	17/07/2008
Pipistrellus spp.	Pipistrelle spp.	H374900	21/05/2008
Nyctalus leisleri	Leisler's bat	H381891	01/07/2011
Nyctalus leisleri	Leisler's bat	H381891	01/07/2011
Pipistrellus pipistrellus	Common pipistrelle	H381892	01/07/2011
Pipistrellus pipistrellus	Common pipistrelle	H381892	01/07/2011
Chiroptera	Unidentified bat	H39	02/08/2001
Pipistrellus spp.	Pipistrelle spp.	H393910	16/07/2001
Pipistrellus spp.	Pipistrelle spp.	H393910	23/07/1997
Pipistrellus spp.	Pipistrelle spp.	H424874	01/10/2001
Plecotus auritus	Brown long-eared bat	H453887	03/10/1986
Pipistrellus spp.	Pipistrelle spp.	H453887	15/07/1987
Plecotus auritus	Brown long-eared bat	H453887	15/07/1987
Nyctalus leisleri	Leisler's Bat	H453887	30/09/1986
Myotis spp.	Myotis spp.	H453918	08/04/2013
Chiroptera	Unidentified bat	H482993	11/06/2014
Pipistrellus spp.	Pipistrelle spp.	H484913	08/07/1999
Pipistrellus spp.	Pipistrelle spp.	H484913	08/07/1999
Pipistrellus spp.	Pipistrelle spp.	H487916	30/07/1995
Chiroptera	Unidentified bat	H494983	01/11/1985

Latin Name	Common Name	Irish Grid Reference	Date recorded
Myotis daubentonii	Daubenton's Bat	H496913	20/08/2008
Chiroptera	Unidentified bat	H496913	20/08/2008
Chiroptera	Unidentified bat	H348987	19/05/1998
Chiroptera	Unidentified bat	C374029	03/04/1997
Pipistrellus spp.	Pipistrelle spp.	H338963	04/08/1987
Chiroptera	Unidentified bat	C366011	1985 - 1986
Pipistrellus spp.	Pipistrelle spp.	H338963	31/07/1986
Pipistrellus spp.	Pipistrelle spp.	H487916	30/07/1995
Chiroptera	Unidentified bat	H348985	26/06/1997
Chiroptera	Unidentified bat	H353975	26/06/1997
Pipistrellus spp.	Pipistrelle spp.	H424874	01/10/2001
Pipistrellus spp.	Pipistrelle spp.	H393910	16/07/2001
Pipistrellus spp.	Pipistrelle spp.	H393910	23/07/1997
Pipistrellus spp.	Pipistrelle spp.	H369902	15/08/1988
Chiroptera	Unidentified bat	H369901	23/06/2001
Pipistrellus spp.	Pipistrelle spp.	H369902	25/06/1994
Chiroptera	Unidentified bat	C374029	26/03/1997
Chiroptera	Unidentified bat	H353969	30/06/1989
Chiroptera	Unidentified bat	C451017	14/07/1995
Pipistrellus spp.	Pipistrelle spp.	C461021	14/12/1994
Chiroptera	Unidentified bat	H39575926	28/06/1999
Myotis spp.	Myotis spp.	H482993	11/06/2014
Chiroptera	Unidentified bat	C379009	19/08/1996
Myotis spp.	Myotis spp.	C383014	22/07/2014

Latin Name	Common Name	Irish Grid Reference	Date recorded
Chiroptera	Unidentified bat	H348987	23/09/1996
Myotis daubentoni	Daubenton's bat	H347977	30/06/2014
Chiroptera	Unidentified bat	C383014	22/07/2014
Myotis daubentoni	Daubenton's bat	H347977	30/06/2014

Information to Inform a Habitats Regulations Assessment (Including Shadow HRA)

Owenreagh / Craignagapple Wind Farm, Co. Tyrone

Report prepared by Woodrow (APEM Group) on behalf of Ørsted Onshore Ireland Midco Limited

Woodrow Sustainable Solutions Ltd.
Upper Offices Ballisodare Centre,
Station Road,
Ballisodare,
Co. Sligo,
F91 PE04,
Ireland.

Tel: +353 (0) 719140542
Email: info@woodrow.ie

August 2023

DOCUMENT CONTROL

Document	Information to Inform a Habitats Regulations Assessment (including Shadow HRA) at Owenreagh/Craignagapple Wind Farm, Co. Tyrone.
Client	Ørsted Onshore Ireland Midco Limited.
Prepared by	Woodrow Sustainable Solutions Ltd., (Part of the APEM Group) Upper Offices, Ballisodare Centre, Station Road, Ballisodare, Co. Sligo, F91 PE04 Ireland.
Author(S)	Aoife Moroney MSc Giulia Mazzotti MSc Rachel Irwin BSc
Checked Internally	Emmeline Cosnett BSc Maeve Maher-McWilliams MSc ACIEEM
Approved by	Róisín NigFhloinn MSc MCIEEM
Checked by Client	15/06/2023
Status/ Version/ Date	R01 17 August 2023

STATEMENT OF AUTHORITY

This report has been written by Aoife Moroney with assistance from Giulia Mazzotti and Rachel Irwin. Aoife is an Ecologist – Ornithologist with Woodrow. She has completed a B.Sc. in Engineering at University College Dublin and M.Sc. in Environmental Engineering (specialising in Environmental Management) at the Technical University of Denmark and the Royal Institute of Technology, Sweden. She has also recently completed a Post-graduate Certificate in Ecological Survey Techniques at the University of Oxford. Aoife is highly proficient in data analysis and management as well as mapping using ArcGIS and QGIS. Aoife regularly carries out ornithological surveys and compiles ornithological reports, including carrying out Collision Risk Modelling to inform wind farm planning.

Giulia Mazzotti is an Assistant Ecologist and Data Co-Ordinator with Woodrow. She has completed a B.Sc. in Biological Sciences at University of Bologna and obtained full marks with honours (110/110 Cum Laude) in Ecology and Nature Conservation M.Sc. from University of Parma. During her studies she learnt to use R for data analysis and became proficient in the use of ArcGIS and QGIS for mapping. Since joining Woodrow Giulia developed experience undertaking ecological surveys including habitat mapping using Fossitt 2000 in Republic of Ireland (RoI) and Joint Nature Conservation Committee (JNCC) Phase 1 classifications in Northern Ireland (NI), mammal, bat and invertebrate surveys. She also assists Senior members of staff with GIS mapping activity and reporting for Ornithology Reports, Ecological Impact Assessment (EcIA) and Biodiversity Chapters for Environmental Impact Assessment Reports (EIAR). Furthermore, Giulia has taken a lead Health & Safety role for the Woodrow Division, producing risk assessments and Risk Assessment Method Statements (RAMS), keeping track of all the new hazards, near misses and incidents related to fieldwork, and linking in with HSQE in the wider Group. She is in the process of applying for membership of the Chartered Institute of Ecology and Environmental Management (CIEEM).

Rachel Irwin is an Agri-Ecologist with Woodrow. She has completed a B.Sc. in Zoology and Conservation at Bangor University and is currently undertaking her PhD with University College Dublin in collaboration with Teagasc. She has more than three years' professional experience working within the environmental sector in both Ireland and the United Kingdom (UK). During this time, Rachel has carried out protected species surveys including for bats (preliminary roost assessment, emergence/re-entry and activity surveys), otter, badger, red squirrel and herpetofauna (smooth newts and reptiles). Rachel's experience also includes undertaking environmental monitoring and assessments in soil, air, water, waste and energy, working for a wide range of schemes and developments including windfarms, quarries, hydro-schemes, gas lines and commercial and residential developments. Rachel has strong report writing skills, having been published in peer-reviewed scientific journals. She is in the process of applying for membership of the CIEEM.

This report has been reviewed and checked by Emmeline Cosnett and approved by Róisín NigFhloinn.

Emmeline Cosnett (Qualifying member of CIEEM) is an Ecologist with Woodrow. She has worked in a variety of terrestrial and aquatic environments and has carried out independent published research on botany/pollination ecology and has worked on agri-environmental schemes and botanical habitat surveys across Ireland. Emmeline has excellent habitat classification skills using several classification systems including Fossitt 2000, JNCC Phase 1 and Irish Vegetation Classification (IVC), UK National

Vegetation Classification (NVC). Emmeline is also experienced in undertaking mammal, bird and bat surveys. She has experience carrying out site monitoring to assess compliance with Habitat Management Plans and planning conditions and has worked on a wide variety of reports for clients, including those to inform Appropriate Assessment / Habitat Regulations Assessment, Habitat Management Plans and Ecological Impact Assessment reports.

Maeve Maher-McWilliams is a Principal Ecologist with Woodrow. Maeve has completed a BSc (Hons) in Biological Sciences and a MSc in Evolutionary and Behavioural Ecology. Maeve is an experienced ecologist and has worked for over twelve years on complex environmental impact assessments and mitigation strategies for development projects across Ireland, Northern Ireland and Scotland. Maeve has been involved in projects across several sectors such as renewable energy; linear infrastructure; flood relief schemes and port developments; tourism and recreation; residential, pharmaceutical and data centre developments. She is proficient in Ecological Impact Assessment and Appropriate Assessment.

Róisín is an Associate Director with Woodrow. She has completed an honours B.Sc. specialising in Botany, and a M.Sc. in Ecology and Management of the Natural Environment. She is a full member of the CIEEM. She regularly carries out reporting on Ecological Impact Assessment, and to inform the Appropriate Assessment process. Furthermore, the author has over 13 years' experience in habitat surveys, mammal surveys, and bird and bat surveys for a number of large infrastructure schemes, commercial and residential projects. She is experienced in the implementation of Habitat Management Plans for Wind Farm sites and has worked as an Ecological Clerk of Works for National Grid Schemes, Wind Farms, Rail and Road schemes throughout her career.

Ornithological surveys were carried out by Mike Trewby (MT), Hazel Doyle (HD), Hugh Delaney (HPD), Ken Westman (KW), Kate Bismilla (KB), Robert Vaughan (RV) and Jamie Bliss (JB).

QUALIFICATIONS:

Aoife Moroney:

B.Sc. – Engineering, University College Dublin, 2015
M.Sc. – Environmental Engineering (specialising in Environmental Management), Technical University of Denmark/Royal Institute of Technology Sweden, 2018
PGCert – Ecological Survey Techniques, University of Oxford, 2022

Giulia Mazzotti:

B.Sc. – Biological Sciences, University of Bologna, 2016
M.Sc. – Ecology and Nature Conservation, University of Parma, 2019

Emmeline Cosnett:

BSc (1.1 Hons) – Environmental Science, National University of Ireland, Galway, 2018.
MSc – Wildlife Biology and Conservation, Edinburgh Napier University, 2020-2023 (in progress).

Maeve Maher-McWilliams:

B.Sc. (Hons) – Biological Sciences, Queens University Belfast, 2008.
MSc – Evolutionary and Behavioural Ecology, University of Exeter, 2010.

Róisín NigFhloinn:
B.A. Mod (Hons) – Natural Sciences (specialising in Botany), Trinity College Dublin, 2008.
MSc – Ecology and Management of the Natural Environment, University of Bristol, 2011.

Mike Trewby:
B.Sc.- Zoology & Botany, University of Namibia, 1997
PGDip - Environmental Studies, University of Strathclyde, 2002
Ornithological survey experience: 20 years
Member of Birdwatch Ireland and contributes to BWI studies.

Hazel Doyle:
B.Sc. – Wildlife Biology & Environmental Science, IT Tralee, 2012
Ornithological survey experience: 4 years
Member of Birdwatch Ireland (BWI) and contributes to BWI studies.

Hugh Delaney:
B.Sc. – Wildlife Biology & Environmental Science, IT Tralee, 2012
Ornithological survey experience: 30 years
Member of BWI and contributes to BWI studies.

Ken Westman – Qualifications:
Diploma – Field Ecology, University College Cork, 2017
Ornithological survey experience: 5 years

Kate Bismilla:
B.Sc. – Wildlife Biology & Environmental Science, IT Tralee, 2014
Ornithological survey experience: 7 years

Jamie Bliss:
Providing ornithological consultancy experience for 5 years.
Ornithological survey experience: 7 years.
Member of BWI and contributes to BWI studies.

Robert Vaughan:
Ornithological surveyor and wildlife illustrator based in Donegal.
Providing ornithological consultancy experience for 4 years.
Ornithological survey experience: 25 years.
Member of BWI and contributes to BWI studies.

Table of Contents

1 Introduction

1.1 Background

Woodrow APEM Group ('Woodrow') was commissioned by the applicant, Ørsted Onshore Ireland Midco Limited, to collate information to inform a Habitats Regulations Assessment (HRA) for the proposed Owenreagh / Craignagapple Wind Farm (the 'Development'). The intention of this report is to provide additional information to assist the Planning Authority in its determination regarding the potential for the proposal to have significant adverse impacts upon the integrity of any European Sites / UK National Sites /Ramsar Sites[1] due to any identified Source-Pathway-Receptor (S-P-R) linkages to the Development.

The planning application is being made with reference to The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017. It is the planning authority, in this case DfI Planning, (as the Competent Authority) who are required to assess whether or not a plan or project is likely to have any significant effects upon any European (and/or Ramsar) Sites. If, as in this case, the likelihood of a significant effect is identified – then the project requires a full Habitats Regulation Assessment to identify if the project may adversely affect the integrity of any European Sites. DfI will be consult and be advised by Shared Environmental Services ("SES") in respect of the Habitat Regulations Assessment. The intention of this document is to provide clear and concise information to assist this process.

For the purposes of this report the term 'European Sites' refers to Special Areas of Conservation (SACs), Special Protection Areas (SPAs) (both within the UK and Europe) and also includes Ramsar Sites (the need for including which was interpreted within Belfast City Council's Report on Habitats Regulations Assessment Requirement in Accordance with The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended) for The Belfast Agenda (2017)), in line with NI Planning Policy Statement - PPS2: Natural Heritage)[2,3]. European Sites within the UK now make up part of the UK National Sites Network, while European Sites within RoI still fall within the Natura 2000 Sites Network. Where these exist in proximity to Northern Ireland and have S-P-R linkages with a Development, they continue to be considered within the HRA process post Brexit.

Field surveys have been carried out within the defined Ecological Study Area (ESA) encompassing the Development site and existing wind farm infrastructure (the operational Owenreagh I and II Wind Farms) from 2017 - 2022. The results from these surveys, in combination with the desk study and the assessment contained within the Environmental Impact Statement that accompanied the consented 2010 Craignagapple Wind Farm (Planning Ref: J/2010/0481/F), have informed the Ecological Impact Assessment (EcIA) (held within Technical Appendix 10.1 of the Environmental Statement for the Development) and Environmental Statement (ES) (Woodrow, 2023b) reports. During these surveys, an

[1]Although Ramsar Sites are not a UK national site network Site, and cover a wider international designation than Europe, it is policy in Northern Ireland to include these sites within Habitats Regulations Assessments. There are 21 Ramsar Sites within NI.
[2] https://www.eplani.org/cmsfiles/library/draft-planning-policy/Draft-PPS2-Natural-Heritage-2011-DOE.pdf (Accessed December 2022)

extended Phase 1 survey to assess the ESA's potential to support notable or protected species was undertaken.

This report provides the information necessary to inform a HRA by the Competent Authority, which would fulfil the requirements of Article 6(3) and 6(4) of the EU Habitats Directive 1992[4] and Regulation 43 of the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995, in determining the potential impacts of the proposal on UK national site network (and/or Ramsar) Sites. The Study Area for this HRA can be seen in **Appendix I, Figure 1** (which aligns with the ESA for the EcIA and **ES Chapter 10: Ecology**).

1.2 Site location and environs

The Development is located on Owenreagh Hill within the townlands of Craignagapple, Ballykeery, Knockinarvoe, Owenreagh, Ligfordrum and Lagavadder, Co. Tyrone. An existing regional road "Glenmornan Road" runs through the ESA with the wind turbines and associated infrastructure of 'the Operational Owenreagh I Wind farm (Planning Ref: J/93/0286)', "Owenreagh I Wind farm" and 'the Operational Owenreagh II Wind Farm (Planning Ref: J/2004/1015/F)' "Owenreagh II Wind farm" incorporated into the extent of the ESA.

The ESA is located in a typical upland site in Northern Ireland, and includes grassland, heath, and mire habitats. No part of the ESA lies within a designated area. The closest internationally designated site to the ESA is the River Foyle and Tributaries SAC (UK0030320) which lies *c.* 5.5km west by direct distance. Four European Sites are in the potential Zone of Influence, although all are distant from the Development site (further information on these is provided in **Section 4**).

1.3 Requirement to identify potential for impacts upon European Sites and/or Ramsar Sites

It is the Northern Ireland Environment Agency (NIEA), an agency within the Department of Agriculture, Environment and Rural Affairs (DAERA) which has the principal responsibility for the designation of a hierarchy of sites that are of nature conservation importance. It is the role of the planning authority, in this case DfI Planning as the responsible authority, to ensure the protection of these sites through the use of relevant planning policy i.e., Planning Policy Statement 2 – Natural Heritage (PPS2). DfI will be consult and be advised by Shared Environmental Services ("SES") in respect of the Habitat Regulations Assessment.

As of 1st January 2021, the SACs and SPAs of the UK no longer contribute to the EU's Natura 2000 Network, instead being referred to as 'UK National Site Network'. However, in Northern Ireland, regulations that were implemented as the Habitats Directive through the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995, still apply after 1st January 2021. Therefore, the

[4]Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitat and of wild fauna and flora (as codified) (the 'Habitats Directive').

same regulations apply in Northern Ireland, under a different naming convention[5]. European Designated Sites (UK National Site Network) include SACs and SPAs.

It is government policy in Northern Ireland to apply the procedures under the Habitats Regulations in respect of Ramsar sites (NI Planning Policy Statement - PPS2: Natural Heritage)[6].

Within Northern Ireland Planning Policy, 'Policy NH 1 - European and Ramsar Sites' 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:

- *A European Site (Special Protection Area, proposed Special Protection Area, Special Areas of Conservation, candidate Special Areas of Conservation and Sites of Community Importance); or,*
- *A listed or proposed Ramsar Site.*

Where a development proposal is likely to have a significant effect (either alone or in combination) or reasonable scientific doubt remains, the Department shall make an appropriate assessment of the implications for the site in view of the site's conservation objectives. Appropriate mitigation measures in the form of planning conditions may be imposed. In light of the conclusions of the assessment, the Department shall agree to the development only after having ascertained that it will not adversely affect the integrity of the site.

In exceptional circumstances, a development proposal which could adversely affect the integrity of a European or Ramsar Site may only be permitted where:

- *There are no alternative solutions; and,*
- *The proposed development is required for imperative reasons of overriding public interest; and,*
- *Compensatory measures are agreed and fully secured.*

As part of the consideration of exceptional circumstances, where a European or Ramsar site hosts a priority habitat or priority species listed in Annex I or II of the Habitats Directive, a development proposal will only be permitted when:

- *It is necessary for reasons of human health or public safety or there is a beneficial consequence of primary importance to the environment; or,*
- *Agreed in advance with the European Commission."*

According to 'Planning Policy Statement 2' (PPS2), *"the Habitats Directive requires the protection of certain natural habitat through the designation of SACs. It also requires the establishment of a system of strict protection for a list of species (other than birds) who's resting and breeding places and whose habitats must be protected to secure their survival, whenever they occur in the member state's territory."* In addition, *"the Birds Directive provides for the selection of sites for their importance as areas for breeding, over wintering and migrating birds known as SPAs. The Directive also requires Member States*

[5] Department of Agriculture, Environment and Rural Affairs. Available at: https://www.daera-ni.gov.uk/articles/european-marine-sites-marine-special-areas-conservation-and-special-protection-areas (Accessed December 2022)
[6] https://www.eplani.org/cmsfiles/library/draft-planning-policy/Draft-PPS2-Natural-Heritage-2011-DOE.pdf (Accessed December 2022)

to strive to avoid the deterioration of habitats for wild birds outside designated sites" (Department of the Environment, 2013).

The European Directive 92/43/EEC (The Habitats Directive) was transposed into law in Northern Ireland by the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended). In Northern Ireland, this piece of legislation is known as the Habitats Regulations, which came into force on 30th October 1994, and has subsequently been amended on several occasions. The Regulations specify the roles and responsibilities of public bodies (Competent Authorities), owners and occupiers, and the statutory advisors for nature conservation in meeting the obligations of the Habitats Directive. It places a general duty upon all public bodies in the exercise of their functions to have regard to the requirements of the Directive (Regulation 3(4)).

1.4 Requirement to identify potential for adverse effects upon the integrity of European Sites, UK national site network and/or Ramsar sites

Regulation 43 requires that if, after consultation, the council considers that a development is likely to have a significant effect on a European Site, UK National Sites and/or Ramsar sites, and the development is not directly connected with or necessary to the management of the site, the council shall make an appropriate assessment of the implication of the development for the site in view of its conservation objectives, and in light of the conclusions of the assessment, the council shall only approve the commencement of the development after it has ascertained that it will not adversely affect the integrity of the site[7].

The precautionary approach is a fundamental principle underpinning the Directive. In the clarification document 'Guidance document on Article 6(4) of the 'Habitats Directive' is states that *"any uncertainty over the precise nature and/or magnitude of the adverse effects should be thoroughly tested. Where appropriate, a precautionary approach should be adopted, and the assessment of adverse effect based on a worse-case scenario."*[8]

A Habitats Regulations Assessment is required in order to determine the potential for impact on the integrity of a European Site as a result of a proposed plan or project. In the event of a negative assessment in terms of an adverse effect on site integrity, a proposal can only be consented in the absence of feasible alternatives and for 'Imperative Reasons of Overriding Public Interest' (IROPI). This includes those of a social or economic nature. In the case of rarer habitats and species (priority habitats and species) the only considerations permitted are those relating to public health or safety or of beneficial consequences to the environment. Where such plans and project are permitted under IROPI, Member States in the EU must take compensatory measures to ensure the overall coherence of Natura 2000 is protected (Article 6(3) and 6(4) and Regulation 44 of the Habitats Regulations).

[7] Statutory Rules of Northern Ireland (2015) No. 182 European Communities – Nature Conservation. *The Conservation (Natural Habitats, etc.) (Amendment) Regulations (Northern Ireland) 2015.* Available at: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/doe/natural-legislation-conservation-natural-habitats-etc-amendment-regulations-Northern-Ireland-2015.pdf (Accessed February 2022)

[8] (European Commission, 2007) http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/guidance_art6_4_en.pdf (Accessed February 2022)

Case law[9] has demonstrated that measures which are intended to avoid or reduce the harmful effects of a development on any relevant European Site, i.e., mitigation (such as pollution control measures), cannot be considered at the screening stage of the Habitats Regulations Assessment process and where this arises, the plan or project must be screened and assessed through an HRA. However, the recent decision of the European Court of Justice in Case C-721/21[10] (delivered 15 June 2023) states that it is permissible to take into account embedded mitigation at the screening stage. Notwithstanding this decision of the European Court, the UK position at the date of this report remains in accordance with prevailing practice established as a result of the *People over Wind* judgment, that all mitigation is only to be considered at the HRA stage and not the screening stage. For this reason, a full HRA has been undertaken in this document, applying a Precautionary Approach to the assessment in this report.

1.5 Zone of Influence (ZoI)

Potential impacts on designated sites are dependent on their locations, the type of development proposed, the topography and environment at the Development site, the nature of impacts arising, the sensitivity of receptors, and the causal links and conduits. In many cases the potential Zone of Influence (ZoI) could be relatively small (for example when considering noise and airborne pollution), while in other cases the potential Zone of Influence could be extensive, for example if there is a hydrological connection.

As such the ZoI may extend beyond the boundaries of the Development due to the presence of ecological connections with a Qualifying Interest (QI) or a Special Conservation Interest (SCI) of a European Site. Similarly, the QI/SCI of a European Site which is geographically close to the Development, but which has no ecological connection with the Development, and as such no pathway for impacts, are not within the ZoI regardless of their proximity to the Development. Any such ecological/ hydrological connections which provide pathways for impacts are identified and described. Any designated sites with Source-Pathway-Receptor (S-P-R) linkages are considered further.

1.6 Screening Matrix

Table 1 details European Sites and Ramsar Sites within the ZoI of the Development with the potential for significant effects using a number of specific terms to conclude on the potential for significant effects. The term 'likely significant effect' (LSE) is used where a plan or project is likely to undermine any of the Site's conservation objectives. The term 'potential significant effect' (PSE) is used where a plan or project has an indicated potential to undermine any of the Site's conservation objectives, but where doubt exists about the risk of a significant effect in the current context. Nevertheless, where doubt exists about the risk of a significant effect, use of the 'Precautionary Principle' requires this effect to be considered appropriately within the screening process. The term 'No Potential Significant Effect' is used where it can be concluded, with confidence, that there is no potential causal link (or source-pathway-receptor linkage) between a development and a European Site.

[9] People Over Wind and Peter Sweetman v Coillte Teoranta (C-323/17); and, Heather Hill Management Company clg v An Bord Pleanála [2019] IEHC 450.
[10] Case C-721/21 Eco Advocacy v An Bord Pleanala and others 15 June 2023

Table 1 – Significance of potential effects matrix for European Sites.

Designated Site	Qualifying Interests (QIs are in bold if they potentially exist within the Zone of Influence) * denotes a priority habitat	Distance from Development site	Potential Site- Pathway-Receptor Linkage via proximity of site, and/or surface water connectivity?	Potential Direct, Indirect and In-Combination Effects	Potential for Significant Effects?
Special Area of Conservation (SAC)					
River Foyle & Tributaries (NI) UK0030320	• **Atlantic Salmon (*Salmo salar*)** • **Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitricho-Batrachion* vegetation** • **Otter (*Lutra lutra*)** • **Sea lamprey (*Petromyzon marinus*)** • **River lamprey (*Lampetra fluviatilis*)** • **Brook lamprey (*Lampetra planeri*)** • **Freshwater pearl mussel (*Margaritifera margaritifera*)**	*c.* 5.5 km west (direct distance) and 12.8 km via watercourse.	Potential site-pathway-receptor linkage identified via surface water connectivity. Potential for hydrological connectivity to the south of Owenreagh Hill: Douglas Burn > Mourne River > River Foyle SAC To the north of Owenreagh Hill: Dunnyboe Burn > Burn Dennett > River Foyle SAC	Sediment and/or hydrocarbons pollution within the Development during the construction and operational stages of the Development. Secondary and in-Combination impacts	Potential significant effect
River Finn (ROI) IE0002301	• **Salmon (*Salmo salar*)** • **Otter (*Lutra lutra*)** • **Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)** • Northern Atlantic wet heaths with *Eric tetralix* • Blanket bogs (*if active bog)	*c.* 6.5 km west (direct distance) and 13 km via watercourse.	Potential site-pathway-receptor linkage identified via surface water connectivity	Sediment and/or hydrocarbons pollution within the Development during the construction and operational stages of the Development.	Potential significant effect

	• Transition mires and quaking bogs			Secondary and in-combination impacts	
River Faughan & Tributaries (NI) UK003036	• Otter (*Lutra lutra*) • Salmon (*Salmo salar*) • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	*c.* 9 km north-east (direct distance) No connection via watercourse.	No potential connectivity (no hydrological/ ecological connection).	No potential direct, indirect and in-combination effects identified.	No potential for significant effect.
Special Protection Area (SPA)					
Lough Foyle (NI) UK9020031	• **Whooper Swan (*Cygnus cygnus*)** • **Light-bellied Brent Goose (*Branta bernicla hrota*)** • **Bar-tailed Godwit (*Limosa lapponica*)** • **The site also qualifies under Article 4.2 of the Directive by supporting over 20,000 migratory waterfowl**	*c.* 22.7 km north-west (direct distance) and 40 km via watercourse	Potential site-pathway-receptor linkage identified via surface water connectivity. No potential for direct impacts to migratory and wintering QI species associated with the SPA. Ornithological surveys undertaken for the Development found, within the impact assessment, that no QI bird species of any Designated Site are in any way reliant upon the Development site or its environs (e.g., the ESA or HMEP lands).	Secondary and in-combination impacts	Potential significant effect

Lough Foyle (ROI) IE0004087	• **Red-throated Diver (*Gavia stellata*) [A001]** • **Great Crested Grebe (*Podiceps cristatus)* [A005]** • **Bewick's Swan (*Cygnus columbianus bewickii*) [A037]** • **Whooper Swan (*Cygnus cygnus*) [A038]** • **Greylag Goose (*Anser anser*) [A043]** • **Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]** • **Shelduck (*Tadorna tadorna*) [A048]** • **Wigeon (*Anas penelope*) [A050]** • **Teal (*Anas crecca*) [A052]** • **Mallard (*Anas platyrhynchos*) [A053]** • **Eider (*Somateria mollissima*) [A063]** • **Red-breasted Merganser (*Mergus serrator)* [A069]** • **Oystercatcher (*Haematopus ostralegus*) [A130]** • **Golden Plover (*Pluvialis apricaria*) [A140]** • **Lapwing (*Vanellus vanellus*) [A142]** • **Knot (*Calidris canutus*) [A143]** • **Dunlin (*Calidris alpina*) [A149]** • **Bar-tailed Godwit (*Limosa lapponica*) [A157]**	*c.* 27 km north-west (direct distance) and 40 km via watercourse	Potential site-pathway-receptor linkage identified via surface water connectivity. No potential for direct impacts to migratory and wintering QI species associated with the SPA. Ornithological surveys undertaken for the Development found, within the impact assessment, that no QI bird species of any Designated Site are in any way reliant upon the Development site or its environs (e.g., the ESA or HMEP lands).	Secondary and in-combination impacts	Potential significant effect

	• **Curlew (*Numenius arquata*) [A160]** • **Redshank (*Tringa totanus*) [A162]** • **Black-headed Gull (*Chroicocephalus ridibundus*) [A179]** • **Common Gull (*Larus canus*) [A182]** • **Herring Gull (*Larus argentatus*) [A184]** • **Wetlands [A999]**				
Ramsar Site					
Lough Foyle UK12014	• **Ramsar criterion 1a: this is a particularly good representative example of a wetland complex including intertidal sand and mudflats with extensive seagrass beds, saltmarsh, estuaries and associated brackish ditches.** • **Ramsar criterion 1c: this is a good representative example of a wetland, which plays a substantial hydrological, biological and ecological system role in the natural functioning of a major river basin which is located in a trans-border position.** • **Ramsar criterion 2a: the site supports an appreciable assemblage of rare, vulnerable**	*c.* 22.7 km north-west (direct distance) and 40 km via watercourse	Potential site-pathway-receptor linkage identified via surface water connectivity. No potential for direct impacts to migratory and wintering waterfowl species associated with the Ramsar. Ornithological surveys undertaken for the Development found, within the impact assessment, that no QI bird species of any Designated Site are in any way reliant upon the Development site or its environs (e.g., the ESA or HMEP lands).	Secondary and in-combination impacts	Potential for significant effect

	or endangered species or sub-species of plant and animal. • **Ramsar criterion 3: the site supports a diverse assemblage of wintering waterfowl which are indicative of wetland values, productivity and diversity.** • **Ramsar criterion 5: the site supports about 29000 migrating birds.** • **Ramsar criterion 6: species/populations occurring at levels of international importance**				

The Screening for Habitats Regulations Assessment in **Table 1** established that the likelihood of significant effects on four European Sites and one Ramsar Site could not be excluded on the basis of objective scientific information. These are sites with potential ecological/hydrological connections with the Development and as such are considered to be within the potential ZoI of the Development. These European Sites are:

- UK0030320 - River Foyle and Tributaries SAC (NI);
- IE0002301 - River Finn SAC (ROI);
- UK9020031 - Lough Foyle SPA (NI);
- IE0004087 - Lough Foyle SPA (ROI);
- UK12014 - Lough Foyle Ramsar Site (NI).

1.7 Conclusions of the Shadow Habitats Regulations Assessment

The screening process for Habitats Regulations Assessment (Shadow HRA) identified five sites which are considered to be within the ZoI of the Development. It is considered that, in the absence of mitigation, there is some potential for water quality impacts caused during the construction stage and/ or the operational stage of the Development within the Development Site to negatively affect those QIs within the River Foyle and Tributaries SAC, River Finn SAC, Lough Foyle SPA (NI), Lough Foyle SPA (ROI) and Foyle Ramsar Site, which are, to varying degrees, sensitive to water quality issues. Potential impacts may result from unmitigated mobilisation of sediments during the construction stage, with potential impact sources including excavation and construction of new areas of infrastructure as well as upgrading of access tracks and removal of old infrastructure/ site restoration. In addition, there is potential for pollution from hydrocarbons or other chemical pollutants, with potential impact sources comprising uncontained spillages or pollution events during the construction stage in particular.

In the case of the River Foyle and Tributaries SAC and the River Finn SAC, PSE on QIs are concluded as possibly resulting from water quality changes. In the case of the Lough Foyle SPA (NI, ROI, RAMSAR), it is concluded that, although a PSE is unlikely due to the distance, LSEs on QIs resulting from water quality changes cannot be ruled out at this stage.

1.8 Structure/ layout of the report

Following the structure of the requirements for Article 6(3) of the Habitats Directive, **Section 2 to 9** of the HRA provide a description of the project and an assessment of potential effects of aspects of the Development on European Sites and their conservation interests. **Section 2** describes the methodology for the study; **Section 3** describes the details of the proposal; **Section 4** describes those European Sites which are within the ZoI of the proposal, **Section 5** presents a summary survey results relevant to the HRA and Section 6 assesses the potential effects on those European Sites. **Section 7** assesses the potential for in-combination effects on those European Sites. Mitigation for such effects is identified in **Section 8**. **Section 9** provides a conclusion which will determine whether the proposal is likely to have, either alone or in-combination with other plans or projects, an adverse effect on the integrity of any European or Ramsar Sites.

2 Methodology

2.1 Desk Study Methodology

The following information sources were consulted:

- Department of Environment Northern Ireland (Department of the Environment, July 2013). *Planning Policy Statement 2 Natural Heritage*;
- European Community Habitats Directive (92/43/EEC) – The Habitats Directive;
- Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended);
- European Commission (2001) Assessment of plans and projects significantly affecting European Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC;
- European Commission (2018) Managing European Sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC;
- The Department of the Environment website[11];
- The Department of Agricultural, Environment and Rural Affairs (DAERA) and Northern Ireland Environment Agency (NIEA) website[12];
- NIEA Natural Environment Map Viewer[13]; and,
- NI River Basin Viewer[14].

2.2 Field survey methodology

Table 2 details the surveys, investigation and monitoring undertaken at the Development which are considered relevant to this HRA (for full details of relevant surveys undertaken, see **ES Chapter 8: Hydrology and Hydrogeology**, **ES Chapter 10: Ecology** and **ES Chapter 11: Ornithology**).

[11] Available at: https://www.doeni.gov.uk/ (Accessed December 2020)
[12] Available at: https://www.daera-ni.gov.uk/northern-ireland-environment-agency (Accessed December 2020)
[13] Available at: https://appsd.daera-ni.gov.uk/nedmapviewer/ (Accessed December 2020)
[14] Available at: https://appsd.daera-ni.gov.uk/RiverBasinViewer/ (Accessed December 2020)

Table 2 – Details of surveys undertaken for the Development. Those which are in bold are particularly relevant to the HRA.

Description	Coverage	Dates and Company
Ecological, Aquatic and Bird Surveys	Active peat assessment (APA) NVC Quadrat survey and active peat assessment (APA) Extended Phase 1 Survey **Surveys to inform a Habitat Management and Enhancement Plan (HMEP)[15]** **Otter Survey** **Electrofishing** **Chemical Aquatic Survey** **Salmonid Suitability Survey** **Biological Aquatic Survey** Non-Breeding Bird Surveys Vantage Point Watches Breeding Bird Survey	2017 - 2022 Woodrow Apem Group
Hydrology and Hydrogeology survey	**Hydrological and Hydrogeological Survey of site.**	November 2021 ERM
Ecohydrological survey	**Hydrological and Hydrogeological Survey of site.**	Summer and autumn 2022 Ecohydrological Analysis Ltd. (EHA)

[15] For further details see **Technical Appendix A10.3: National Vegetation Classification (NVC) Assessment, Technical Appendix A3.2: Owenreagh / Craignagapple Habitat Management and Enhancement Pan (HMEP)** and **Technical Appendix A10.4: Active Peat Assessment (APA).**

3 Description and Features of the Project

3.1 Location of the Development Site

The Development Site is located approximately 5 km east of the town of Strabane. The proposed Development Site, including the operational Owenreagh I and II Wind Farms, is located within a typical upland rural landscape, mainly comprising of bog/ heath with occasional improved and semi-improved pastures, and is mainly used for agricultural grazing by both sheep and cattle. The approximate site centre is located at UK Grid Reference NV 57868 59842 (Irish Grid Reference H 43239 96678). The geographic location of the site can be seen in **Appendix I, Figure 1**. Within the heath and mire habitats, the presence of drainage ditches and peat hags suggests that these habitats were subject to historic peat cutting. Natural and/or artificial watercourse within these areas support flushes and marshy grassland as parts of the mire complex. The Development does not lie within any European or International designated sites.

3.2 Description of the Project

The development proposes a decommissioning of the operational Owenreagh I and II Wind Farms and construction and operation of a wind farm comprising of up to 14 wind turbines, anticipated to be a minimum of 50 MW. The proposed works will comprise of the erection of 14 three-bladed horizontal axis wind turbines of up to 156.5 m tip height and the construction of a substation compound including control building and other electrical infrastructure. It will also include an upgrading of existing site access tracks and the construction of new access tracks, crane hardstanding's and onsite power collection system (turbine transformers and underground cables). The operational Owenreagh I and II Wind Farms will be decommissioned, and the site will undergo restoration. The ESA for this application occupies an area of *c.* 596 ha with a footprint of approximately 22 ha (see **Appendix I, Figure 2**). **Figure 3** in **Appendix I** provides an aerial overview of the ESA.

The Development will comprise of the following main components:

- Decommissioning and removal of the existing turbines;
- Two temporary construction compound/laydown areas (some areas may be reinstated temporarily if required for future operational and decommissioning purposes);
- Removal and restoration of the existing crane hardstanding's, access tracks and any other above-ground infrastructure in accordance with the Outline DCEMP and Draft HMEP;
- Construction and/or upgrading of seven Site access points onto the public highway;
- Construction of approximately 3,947 m of new access tracks;
- Upgrade of approximately 382 m of existing access tracks;
- Construction of turning heads and passing places on the access tracks;
- The erection of up to 14 three bladed horizontal axis wind turbines of up to 156.5 m tip height;
- Construction of temporary and permanent hardstanding areas for each turbine to accommodate turbine component laydown areas, crane hardstanding areas and internal or external transformers and/or switchgear;
- Construction of turbine foundations;

- There are no upgraded water crossings and two new water crossings;
- Installation of buried underground electrical and communication cables;
- Construction of a substation and control building, and associated compound, including windfarm and grid connection operating equipment; and
- Associated ancillary works.

In addition to the above, there is a requirement for minor works along the abnormal load route. These minor works largely include vegetation removal along the existing road network.

4 European Sites within the Zone of Influence of the Proposal

The potential for LSE on European Sites has been assessed based on the likely impacts of the Development, the QI of each European Site and the identification of ecological/ hydrological pathways. The sites considered in the screening for Habitats Regulations Assessment that are considered to be within the ZoI are shown in **Table 3**. The following section provides information on European Sites which are considered to be within the ZoI of the proposal.

Table 3 – European Sites with potential Ecological/ Hydrological Connections with the Development Site.

European Site	Qualifying Interest The QI potentially affected is written in bold (QIs with potential source – receptor pathway)	Distance from the Development	Potential Ecological/ Hydrological Connection
River Foyle and tributaries SAC (Site Code: UK0030320)	• Atlantic Salmon (*Salmo salar*) • Otter (*Lutra lutra*) • Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitricho-Batrachion* vegetation • Sea lamprey (*Petromyzon marinus*) • River lamprey (*Lampetra fluviatilis*) • Brook lamprey (*Lampetra planeri*) • Freshwater pearl mussel (*Margaritifera margaritifera*)	*c.* 5.5 km west by distance 12.8 km via watercourse connection	Hydrological Connection
River Finn SAC (Site Code: 002301)	• Salmon (*Salmo salar*) • Otter (*Lutra lutra*) • Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) • Northern Atlantic wet heaths with *Eric tetralix* • Blanket bogs (*if active bog) • Transition mires and quaking bogs	*c.* 6.5 km west by distance 13 km via watercourse connection	Hydrological Connection
Lough Foyle SPA (NI) (Site Code: UK9020031	• Whooper Swan (*Cygnus cygnus*) • Light-bellied Brent Goose (*Branta bernicla hrota*) • Bar-tailed Godwit (*Limosa lapponica*) • The site also qualifies under Article 4.2 of the Directive by supporting over 20,000 migratory waterfowl	*c.* 22.7 km north-west by distance 40 km via watercourse connection	Hydrological Connection

European Site	Qualifying Interest **The QI potentially affected is written in bold (QIs with potential source – receptor pathway)**	Distance from the Development	Potential Ecological/ Hydrological Connection
Lough Foyle SPA (ROI) (Site Code: IE0004087)	• Red-throated Diver (*Gavia stellata*) [A001] • Great Crested Grebe (*Podiceps cristatus)* [A005] • Bewick's Swan (*Cygnus columbianus bewickii*) [A037] • Whooper Swan (*Cygnus cygnus*) [A038] • Greylag Goose (*17ave17u 17ave17u*) [A043] • Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] • Shelduck (*Tadorna tadorna*) [A048] • Wigeon (*Anas 17ave17us17*) [A050] • Teal (*Anas crecca*) [A052] • Mallard (*Anas platyrhynchos*) [A053] • Eider (*Somateria mollissima*) [A063] • Red-breasted Merganser (*Mergus serrator)* [A069] • Oystercatcher (*Haematopus ostralegus*) [A130] • Golden Plover (*Pluvialis apricaria*) [A140] • Lapwing (*Vanellus vanellus*) [A142] • Knot (*Calidris canutus*) [A143] • Dunlin (*Calidris alpina*) [A149] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa 17ave17us*) [A162] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Common Gull (*Larus canus*) [A182] • Herring Gull (*Larus argentatus*) [A184] • Wetlands [A999]	*c.* 27 km north-west by distance 40 km via watercourse connection	Hydrological Connection
Lough Foyle (NI) (Site Code: UK12014)	• Ramsar criterion 1a: this is a particularly good representative example of a wetland complex including intertidal sand and mudflats with extensive seagrass beds, saltmarsh, estuaries and associated brackish ditches. • Ramsar criterion 1c: this is a good representative example of a wetland, which	*c.* 22.7 km north-west by distance	Hydrological Connection

European Site	Qualifying Interest **The QI potentially affected is written in bold (QIs with potential source – receptor pathway)**	Distance from the Development	Potential Ecological/ Hydrological Connection
	plays a substantial hydrological, biological, and ecological system role in the natural functioning of a major river basin which is located in a trans-border position. • Ramsar criterion 2a: the site supports an appreciable assemblage of rare, vulnerable, or endangered species or sub-species of plant and animal. • Ramsar criterion 3: the site supports a diverse assemblage of wintering waterfowl which are indicative of wetland values, productivity, and diversity. • Ramsar criterion 5: the site supports about 29000 migrating birds. • Ramsar criterion 6: species/populations occurring at levels of international importance	40 km via watercourse connection	

4.1 Description of European Sites within the Zone of Influence

4.1.1 River Foyle and tributaries SAC

4.1.1.1 Qualifying Interests within the Zone of Influence

The Qis for this European Site are listed in **Table 3**. The potential source – receptor pathway between the Development and this European Site is by surface watercourse, with potential impacts considered to be limited to those associated with water quality changes. The following QI of the River Foyle and tributaries SAC are considered to be sensitive to water quality impacts downstream of the Development site:

- Atlantic Salmon (*Salmo salar*)
- Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitricho-Batrachion* vegetation
- Otter (*Lutra lutra*)
- Sea lamprey (*Petromyzon marinus*)
- River lamprey (*Lampetra fluviatilis*)
- Brook lamprey (*Lampetra planeri*)
- Freshwater pearl mussel (*Margaritifera margaritifera*)

4.1.1.2 Conservation Objectives of the Qualifying Interests within the Zone of Influence

The Conservation Objectives of those QI in the River Foyle and tributaries SAC are outlined in the document *R Foyle and tributaries SAC (UK0030320) Conservation Objectives (McKeown 2017).* These are summarised in **Table 4** below, with the relevant Attributes/ Targets that the Development has the potential to affect, highlighted in amber.

Table 4 – Conservation Objectives for River Foyle and Tributaries SAC

Feature	Grade[16]	Objective
Atlantic Salmon *Salmo salar*	B	Maintain and, if possible, expand existing population numbers and distribution (preferably through natural recruitment), and improve age structure of population.
		Maintain and, if possible, enhance the extent and quality of suitable Salmon habitat – particularly the chemical and biological quality of the water and the condition of the river channel and substrate.
Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitricho-Batrachion* vegetation	B	Maintain and, if possible, enhance extent and composition of community.
		Improve water quality
		Improve channel substrate quality by reducing siltation.
		Maintain and if feasible enhance the river morphology
Otter *Lutra lutra*	C	Maintain and, if possible, increase population numbers and distribution.
		Maintain the extent and quality of suitable Otter habitat, in particular the chemical and biological quality of the water and all associated wetland habitats
Sea lamprey *Petromyzon marinus*	D	-
River lamprey *Lampetra fluviatilis*	D	-

[16] Grades (Source: McKeown 2017[a]) A – Sites holding outstanding examples of the habitat in a European Context. B – Sites holding excellent stands of the habitat, significantly above the threshold for SSSI/ASSI notifications but of somewhat lower value than grade A sites. C – Examples of the habitat which are of at least national interest (i.e., usually above the threshold for SSSI/ ASSI notifications on terrestrial sites) but not significantly above this. These habitats are not the primary reason for SACs being selected. This is a useful distinction, but it is important to note that all three grades are qualifying SAC interest features. D-Habitat present but not of sufficient extent or quality to merit listing as SAC feature.

Feature	Grade[16]	Objective
Brook Lamprey *Lampetra planeri*	D	-
Freshwater Pearl Mussel *Margaritifera margaritifera*	D	-

4.1.2 River Finn SAC

4.1.2.1 Qualifying Interests within the Zone of Influence

The QIs for this European Site are listed in **Table 3**. The potential source – receptor pathway between the Development and this European Site is by surface watercourse, with potential impacts considered to be limited to those associated with water quality changes. The following QIs of the River Finn SAC are considered to be sensitive to water quality impacts downstream of the Development site:

- [3110] Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)
- [1106] Atlantic salmon (*Salmo salar*)
- [1355] Otter (*Lutra lutra*)

4.1.2.2 Conservation Objectives of the Qualifying Interests within the Zone of Influence

The Conservation Objectives of those QI in the River Finn SAC are outlined in the document *Conservation Objectives: River Finn SAC 002301. Version 1* (NPWS 2017). These are summarised below, with the relevant Attributes/ Targets that the Development has the potential to affect, highlighted in amber.

- [3110] Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)

The Conservation Objective for this QI is, to restore the favourable conservation condition of Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) in River Finn SAC, which is defined the list of attributes and targets set out in **Table 55**.

Table 5 – Attributes and Targets for Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) habitat within River Finn SAC

Attribute	Measure	Target
Habitat area	Hectares	Area stable or increasing, subject to natural processes
Habitat distribution	Occurrence	No decline, subject to natural processes
Typical species	Occurrence	Typical species present, in good condition, and demonstrating typical abundances and distribution

Attribute	Measure	Target
Vegetation composition: characteristic zonation	Occurrence	All characteristic zones should be present, correctly distributed and in good condition
Vegetation distribution: maximum depth	Metres	Maintain maximum depth of vegetation, subject to natural processes
Hydrological regime: water level fluctuations	Metres	Maintain appropriate natural hydrological regime necessary to support the habitat
Lake substratum quality	Various	Maintain appropriate substratum type, extent and chemistry to support the vegetation
Water quality: transparency	Metres	Maintain appropriate Secchi transparency. There should be no decline in Secchi depth/transparency
Water quality: nutrients	µg/l P; mg/l N	Maintain the concentration of nutrients in the water column at sufficiently low levels to support the habitat and its typical species
Water quality: phytoplankton biomass	µg/l Chlorophyll *a*	Maintain appropriate water quality to support the habitat, including high chlorophyll a status
Water quality: phytoplankton composition	EPA phytoplankton composition metric	Maintain appropriate water quality to support the habitat, including high phytoplankton composition status
Water quality: attached algal biomass	Algal cover and EPA phytobenthos metric Maintain trace/absent attached algal biomass	
Water quality: macrophyte status	EPA macrophyte metric (The Free Index)	Maintain high macrophyte status
Acidification status	pH units; mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to

Attribute	Measure	Target
		support the habitat, subject to natural processes
Water colour	mg/l PtCo	Maintain appropriate water colour to support the habitat
Dissolved organic carbon (DOC)	mg/l	Maintain appropriate organic carbon levels to support the habitat
Turbidity	Nephelometric turbidity units/ mg/l SS/ other appropriate units	Maintain appropriate turbidity to support the habitat
Fringing habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3110

- [1106] Atlantic Salmon *Salmo salar*

The Conservation Objective for this QI is, to maintain the favourable conservation condition of Atlantic Salmon in River Finn SAC, which is defined by the list of attributes and targets as set out in **Table 6**.

Table 6 – Attributes and Targets for Atlantic salmon within River Finn SAC

Attribute	Measure	Target
Distribution: extent of anadromy	Percentage of river accessible	100% of river channels down to second order accessible from estuary
Adult spawning fish	Number	Conservation limit (CL) for each system consistently exceeded
Salmon fry abundance	Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 minutes sampling
Out-migrating smolt abundance	Number	No significant decline
Number and distribution of redds	Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes
Water quality	EPA Q value	At least Q4 at all sites sampled by EPA

- [1355] Otter *Lutra lutra*

The Conservation Objective for this QI is, to maintain the favourable conservation condition of Otter in River Finn SAC, which is defined by the list of attributes and targets as set out in **Table** .

Table 7 – Attributes and Targets for Otter within River Finn SAC

Attribute	Measure	Target
Distribution	Percentage positive survey sites	No significant decline
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 390ha along river banks/lake shoreline/ around ponds
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 182.2km
Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as 354ha
Couching sites and holts	Number	No significant decline
Fish biomass available	Kilograms	No significant decline
Barriers to connectivity	Number	No significant increase.

4.1.3 Lough Foyle SPA (NI)

4.1.3.1 Special Conservation Interests within the Zone of Influence

The SCIs for this European Site are listed in **Table 3**. The potential source – receptor pathway between the Development and this European Site is by surface watercourse, with potential impacts considered to be limited to those associated with water quality changes. These include wetland habitats within the SPA which occur downstream of the Development, and the associated SCI species that utilise these habitats occurring downstream of the Development for feeding and/or roosting. The following SCIs of the Lough Foyle SPA (NI) are considered to be sensitive to water quality impacts downstream of the Development site:

- Whooper Swan (*Cygnus cygnus*)
- Light-bellied Brent Goose (*Branta bernicla hrota*)
- Bar-tailed Godwit (*Limosa lapponica*)
- Over 20,000 internationally and nationally important migratory waterfowl including whooper swan, light-bellied brent goose, bar-tailed godwit, red-throated diver, great crested grebe, mute swan, Bewick's swan, greylag geese, shelduck, teal, mallard, wigeon, eider, red-breasted merganser,

oystercatcher, golden plover, grey plover, lapwing, knot, dunlin, curlew, redshank and greenshank. Also supports a small wintering population of Slavonian grebe.

4.1.3.2 Conservation Objectives of the Special Conservation Interests within the Zone of Influence

The Conservation Objectives of those SCI in the Lough Foyle SPA (NI) are outlined in the document *Lough Foyle SPA (UK9020031) Conservation Objectives* (Enlander 2015). These are summarised in **Table 8** below, with the relevant Attributes/ Targets that the Development has the potential to affect have been highlighted in amber.

Table 8 – Conservation Objectives Lough Foyle SPA (NI)

Feature	Conservation Objective
Bewick's Swan wintering population	To maintain or enhance the population of the qualifying species
	To maintain or enhance the range of habitats utilised by the qualifying species
	To ensure that the integrity of the site is maintained
	To ensure there is no significant disturbance of the species
	To ensure that the following are maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species
Golden Plover wintering population	As above
Bar-tailed Godwit wintering population	As above
Light-bellied Brent Goose wintering population	As above
Great Crested Grebe wintering population	As above
Cormorant wintering population	As above
Greylag Goose wintering population	As above
Shelduck wintering population	As above
Wigeon wintering population	As above

Feature	Conservation Objective
Teal wintering population	As above
Mallard wintering population	As above
Eider wintering population	As above
Red-breasted Merganser wintering population	As above
Oystercatcher wintering population	As above
Lapwing wintering population	As above
Knot wintering population	As above
Dunlin wintering population	As above
Curlew wintering population	As above
Redshank wintering population	As above
Waterfowl Assemblage wintering population	As above
Waterfowl Assemblage wintering population	Maintain species diversity contributing to the Waterfowl Assemblage
Habitat Extent	Maintain or enhance the area of natural and semi-natural habitats used or potentially usable by Feature bird species. (2056.13 ha intertidal area) subject to natural processes
Habitat Extent	Maintain the extent of main habitat components subject to natural processes
Roost sites wintering population	Maintain or enhance sites utilised as roosts

4.1.4 Lough Foyle SPA (ROI)

4.1.4.1 Special Conservation Interests within the Zone of Influence

The SCIs for this European Site are listed in **Table 3**. The potential source – receptor pathway between the Development and this European Site is by surface watercourse, with potential impacts considered to be limited to those associated with water quality changes. These include wetland habitats within the SPA which occur downstream of the Development, and the associated SCI species that utilise these habitats occurring downstream of the Development for feeding and/or roosting. The following SCIs of the Lough Foyle SPA (ROI) are considered to be sensitive to water quality impacts downstream of the Development site:

- Red-throated Diver (*Gavia stellata*) [A001]
- Great Crested Grebe (*Podiceps cristatus*) [A005]
- Bewick's Swan (*Cygnus columbianus bewickii*) [A037]
- Whooper Swan (*Cygnus cygnus*) [A038]
- Greylag Goose (*26ave26u 26ave26u*) [A043]
- Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]
- Shelduck (*Tadorna tadorna*) [A048]
- Wigeon (*Anas 26ave26us26*) [A050]
- Teal (*Anas crecca*) [A052]
- Mallard (*Anas platyrhynchos*) [A053]
- Eider (*Somateria mollissima*) [A063]
- Red-breasted Merganser (*Mergus serrator*) [A069]
- Oystercatcher (*Haematopus ostralegus*) [A130]
- Golden Plover (*Pluvialis apricaria*) [A140]
- Lapwing (*Vanellus vanellus*) [A142]
- Knot (*Calidris canutus*) [A143]
- Dunlin (*Calidris alpina*) [A149]
- Bar-tailed Godwit (*Limosa lapponica*) [A157]
- Curlew (*Numenius arquata*) [A160]
- Redshank (*Tringa 26ave26us*) [A162]
- Black-headed Gull (*Chroicocephalus ridibundus*) [A179]
- Common Gull (*Larus canus*) [A182]
- Herring Gull (*Larus argentatus*) [A184]
- Wetlands [A999]

4.1.4.2 Conservation Objectives of the Special Conservation Interests within the Zone of Influence

The Conservation Objectives of those SCI in the Lough Foyle SPA (ROI) are outlined in the document *Conservation Objectives: Lough Foyle SPA 004087. Version 1* (NPWS 2014). These are summarised in **Table 9** below.

Table 9 – Conservation Objectives for the waterbird Special Conservation Interests of Lough Foyle SPA

Objective 1: **To maintain the favourable conservation condition of the waterbird Special Conservation Interest species listed for Lough Foyle SPA, which is defined by the following list of attributes and targets:**		
Attribute	**Measure**	**Target**
Population trend	Percentage change	Long term population trend stable or increasing
Distribution	Range, timing, or intensity of use of areas used by waterbirds, as determined by regular low tide and other waterbird surveys.	There should be no significant decrease in the range, timing, or intensity of use of areas by the waterbird species of Special Conservation Interest other than that occurring from natural patterns of variation
Objective 2: **To maintain the favourable conservation condition of the wetland habitat at Lough Foyle SPA as a resource for the regularly occurring migratory waterbirds that utilise it. This is defined by the following attributes and targets:**		
Attribute	**Measure**	**Target**
Wetland habitat	Area (ha)	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 588 ha, other than that occurring from natural patterns of variation.

4.1.5 Lough Foyle Ramsar Site

Lough Foyle Ramsar site is situated in County Derry and includes the Lough Foyle SPA (NI). As for the above SPAs, the potential source – receptor pathway between the Development and the Ramsar Site is by surface water, with potential impacts considered to be limited to those associated with water quality changes. These include wetland habitats that occur downstream of the Development, the associated vegetative communities, and invertebrate and wintering waterfowl assemblages that utilise these habitats occurring downstream of the Development.

The following extracts from the DAERA site description[17] summarise the site's important ecological features.

"The site is comprised of a large shallow sea lough which includes the estuaries of the rivers Foyle, Faughan and Roe and contains extensive intertidal mudflats and sandflats and associated brackish ditches."

"The littoral communities found in Lough Foyle reflect the dominance of intertidal sands and muds. While rocky substrate is very limited, the extensive beds of common mussel provide a stable surface for acorn barnacle and edible periwinkle. The polychaete green leaf worm is a common associate and the soft mud shores hold a range of typical invertebrates, with a number of species, such as the polychaete worm Hediste diversicolor, indicative of reduced salinity conditions. Balls Point has the highest diversity of sediment and community types in Lough Foyle and holds large populations of the bivalve sand gaper and peppery furrow shell."

"The extensive mudflats support large beds of both common mussel and eelgrass. The latter are amongst the largest colonies of this vegetation type in Northern Ireland and include two species, Narrow-leaved eelgrass and dwarf eelgrass. Large stands of saltmarsh vegetation occur along the foreshore, displaying a transitional sequence of community types."

"The lower colonising saltmarsh consists of a community dominated by common saltmarsh-grass. As tidal influence declines up the shore, this is replaced by a "middle-marsh" community, characterised by red fescue and mud rush. Localised stands of sea club-rush and common reed also occur and the uppermost saltmarsh features a community dominated by common couch."

"Just west of the Ballykelly Bank, on the large intertidal mudflats, which form part of a larger creek network, the lower saltmarsh communities are replaced by extensive stands of common cord-grass. Brackish dykes behind the shore support a maritime aquatic and swamp vegetation, including reflexed saltmarsh-grass and spiral tasselweed."

[17] Foyle Ramsar Site. https://www.daera-ni.gov.uk/protected-areas/lough-foyle-ramsar#:~:text=Lough%20Foyle%20Ramsar%20site%20is,of%20the%20city%20of%20Derry.

5 Summary of Relevant Survey Results

Full details of all ecological surveys carried out to inform this document are provided in:

- **ES Chapter 10: Ecology**,
- **ES Chapter 11: Ornithology**,
- **ES TA A10.1 Ecological Impact Assessment (EcIA)**,
- **ES TA A11.1 Ornithological Synopsis Report**.

The site was visited on a regular basis by Woodrow Ecologists to inform the planning application from 2017 – 2022 and underwent the full suite of required ecological surveys to provide robust data on which a determination within a HRA could be based. This was completed to inform this HRA report as well as the ES for the Development.

Subsequently, there were no direct linkages found between the Development and any Special Conservation Interest / Qualifying Interest birds of the Lough Foyle SPA / Ramsar site which lies *c.* 22.7 km north-east by distance. It was found, within the impact assessment, that no QI bird species of any Designated Site are in any way reliant upon the Development site or its environs (e.g., the ESA or HMEP lands). However, there is a direct hydrological connection through a stretch of 40 km via downstream watercourses and as such, there is some low potential for indirect impacts upon bird species using areas which lie downstream of the Development. This must still be considered within this HRA (albeit there being negligible potential for a significant impact as a result of the distances involved and the potential for mixing within the catchment before reaching areas where QI species might exist, or where QI habitats lie, even in advance of considering mitigation).

During the electrofishing surveys in the ESA, there was no evidence found of Salmonids at the Development site, and the watercourses within the ESA were considered to be unsuitable for critically endangered freshwater pearl mussel *(Margaritifera margaritifera).* Consultation with the Loughs Agency in respect of salmonids supports these findings, with them noting that the Development site lies *'very high up in the catchment'* for salmonids (Pers. Comm. Email 16/08/2021). However, they also noted that surveys should still be carried out to inform any impact assessments. This advice was followed, applying the 'Precautionary Approach', and full details are available in the EcIA and **ES Chapter 10: Ecology**.

Mammal surveys undertaken within the ESA demonstrated that otter exist in the ESA (foraging and commuting), however, no otter holts were recorded at or near the Development site. Subsequently, following on from the surveys, there is no possibility for otter resting sites to be significantly affected by the Development. However, otter commuting and foraging habitat should be considered for potential impacts given their presence within the ESA (confirmed by wildlife camera footage during the surveys).

In addition, ERM hydrologists surveyed the site in 2022 and their survey results are provided in:

- **ES Chapter 8: Hydrology and Hydrogeology**,
- **ES TA A8.1: Hydrological Unit Assessment (HUA)**,
- **ES TA A8.5: Outline Drainage Strategy**.

6 Assessment of Impacts and Effects on European Sites within the Zone of Influence

Article 6(3) of the EU Habitats Directive (EC, 1992) requires that any plan or project that is likely to have a significant effect on a European Site must undergo an Appropriate Assessment/ Habitats Regulations Assessment of *"its implications for the site in view of the site's conservation objectives"*. Such a project can only be consented if it can be demonstrated that the proposal *"will not adversely affect the integrity of the site concerned"* via the undertaking of a HRA. EU guidance on Article 6[18] states, with respect to 'integrity' *"the 'integrity of the site' has been usefully defined as 'the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified"*.

Case law also infers that features of interest which lie outside of a European Site, but which are functionally linked to, and an integral part of that site, should be considered within the appropriate assessment process[19].

This section outlines the impacts (both direct and indirect) which are likely to have an effect on those European Sites with QIs/SCIs within the ZoI. An assessment of the likely effects which these impacts could have on these QIs/SCIs is then undertaken.

The potential for effects on each European Site is assessed in terms of those impacts have the potential to affect the QIs/SCIs of each European Site. In this report, direct impacts constitute direct or primary impacts to European Sites, for example habitat loss or mortality of QI/SCI species. Indirect or secondary impacts constitute pollution of watercourses which may flow into a European Site or sedimentation of a watercourse also upstream of a site which is designated for pollution/sedimentation sensitive QIs.

6.1 Assessment of direct impacts affecting the European Sites

As outlined in the previous sections of this HRA (see **Table 1; Appendix I, Figure 4;** and **Section 5**), the distance between the Development and the closest European Sites prevents any direct or primary impacts such as habitat loss or mortality of QI/SCI species.

6.2 Assessment of indirect impacts affecting the European Sites

As outlined in the **ES Chapter 10: Ecology** (Woodrow, 2023) and **ES Chapter 8: Hydrology and Hydrogeology** (ERM, 2023), there is potential for water quality impacts to occur during the initial decommissioning and construction phase, operational phase and final decommissioning phase of the Development, these are described further in **Section 6.3**. The Designated Sites in the ZoI share the same pathway for connectivity with the Development. Indirect impacts on QI of the Designated Sites in the ZoI are therefore assessed together with those in NI.

[18] European Commission (2018). Managing European Sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. Available at: https://ec.europa.eu/environment/nature/natura2000/management/docs/art6/Provisions_Art_._nov_2018_endocx.pdf [Accessed December 2022]
[19] See the Court of Justice of the European Union (CJEU): C-461/17 Holohan v. An Bord Pleanála ECLI:EU:C:2018:649.

6.3 Description of European Sites within the Zone of influence and their potentially affected Features of Interest

The proposed Development has a direct link to the aforementioned European Sites via hydrological connectivity. Of these, it is considered that the River Foyle & Tributaries SAC (UK0030320), the River Finn SAC (IE002301), Lough Foyle SPA (UK9020031 & IE0004097) and Lough Foyle Ramsar Site (UK12014) may have a potential significant impact (PSE), although this is only likely in the event of a major pollution event during construction. In these circumstances, the qualifying interests for these designated areas could be affected.

6.3.1 Assessment of Water Quality Impacts

6.3.1.1 Construction Stage Water Quality Impacts

During the construction stage, there is potential for the following impacts to occur:

- Contamination of surface water from hydrocarbons and/or other chemicals stored onsite; and
- Contamination of surface waters from sediment as a result of excavation and disturbance works onsite, or from a potential peat slide event.

6.3.1.2 Operational Stage Water Quality Impacts

During the operational stage, there is potential for the following impacts to occur:

- An increase of impermeable surfaces at the Development may result an increased rate of surface water run-off and erosion resulting in sediment pollution of drainage ditches.

Peatland restoration is an important element of the Development. During the operational phase, peatland restoration works will improve existing peatland conditions in defined restoration areas. Overall, during the operational phase of the Development water quality in the receiving environment is expected to improve as a result of the proposed peatland restoration (pers. comm. Dr Raymond Flynn, 2023).

6.3.2 Potential impacts on Atlantic salmon

High suspended solid concentrations in rivers can affect the feeding and health of individual species through increased turbidity (inhibiting respiration through gills) and increased siltation affecting composition of riverbed substrate (reducing fry survival) and affecting spawning beds (Hendry *et al.* 2003). Suspended solids often hold nutrients such as phosphorus or hydrocarbons that can result in eutrophication and reduced oxygen levels (with high oxygen levels being important for all life stages of Atlantic salmon for example).

Densities of different life stages of salmon, particularly fry and parr, vary within a river catchment, limited often by the availability of suitable substrates. Young parr are territorial and defend small sections of the river channel used for intercepting edible particles in the current (Kalleberg, 1958). Habitat availability and quality is intrinsically linked with survival rates and recruitment to smolt stages.

Therefore, small amounts of debris entering a section of river important for vulnerable life stages of salmon can have deleterious impacts, even in the short-term, on juvenile survival and habitat utility.

In summary, it is considered that, although unlikely – due to the lack of these species at the ESA and the unsuitability of the watercourses here for salmonids in their current condition, in the absence of mitigation there is low potential for downstream water quality impacts resulting from the construction and operational stages of the Development on Atlantic salmon. The potential impacts are those largely related to sediment release and pollution events. Such issues can be controlled by standard mitigation practices well-established as effective in these circumstances. Effective mitigation is proposed in **Section 8**.

6.3.3 Potential impacts on Freshwater pearl mussel

A decline of freshwater pearl mussel has been strongly linked to increased suspension of sediments in rivers and its settlement onto the riverbed. Each time siltation of gravel occurs the juvenile mussels below the age of 5 are killed (Buddensiek, 2001). Direct ingestion of silt by adult mussels can also lead to rapid death, as can continuous turbidity over several days (particularly from fine peat) (Buddensiek *et al.,* 1993, Buddensiek, 1995). During the glochidia stage freshwater pearl mussels rely on salmonid fish as a host (Bauer and Vogel 1987), and it is considered that any adverse effects on host fish (see section above on Atlantic salmon) also further the decline of freshwater pearl mussel populations. These hosts are mobile and therefore within the ZoI). While the potential to affect downstream freshwater pearl mussels is considered to be low due to the lack of suitable habitat and lack of salmonid species recorded within the ESA during surveys, the potential for indirect effects on water quality to affect salmonids downstream of the Development, and therefore to influence the freshwater pearl mussel population, has still been considered in this HRA. Any adverse effects on host fish (see **Section 6.3.2** Potential impacts on Atlantic salmon) also further the decline of freshwater pearl mussel populations.

In summary, it is considered that, although unlikely – given the unsuitable conditions for this species at the Development site, in the absence of mitigation there is potential for downstream water quality impacts resulting from the construction and operational stages of the Development on host fish of freshwater pearl mussel. The potential impacts are those largely related to sediment release and pollution events. Such issues can be controlled by standard mitigation practices well-established as effective in these circumstances. Effective mitigation is proposed in **Section 8**.

6.3.4 Potential impacts on Otter

Although otters can be impacted by habitat degradation, accidental death/ persecution and water pollution, the only realistic potential impact from the Development is as a result of water pollution. Pollution can impact otters either indirectly or directly. Indirect effects include damage to food supply or habitat thus lowering the carrying capacity of an affected area. Direct effects impact of the animal itself, resulting in either rapid death (acute toxicity) or in lowered fitness (sub-lethal toxicity), reducing the animal's ability to reproduce successfully or to survive in inclement conditions (Macdonald & Mason, 1990).

Being large mammalian predators, otters are tolerant of a wide range of habitat conditions, but where deterioration in water quality leads to deterioration in food supply, there will clearly be an indirect effect.

In summary, it is considered that, although unlikely given the lack of any local resting sites within the ESA of the Development, in the absence of mitigation there is some low potential for water quality impacts resulting from the Development on otter. The potential impacts are those largely related to sediment release and pollution events. Such issues can be controlled by standard mitigation practices well-established as effective in these circumstances. Effective mitigation is proposed in **Section 8**.

6.3.5 Potential impacts on Oligotrophic Waters containing very few minerals

Oligotrophic waters usually have low primary productivity (they have a high-water quality and few algae) and are nutrient poor. The primary potential impact on these habitats comes from the potential for sediments and nutrients entering the system. Increases in sediment can lead to excess nutrients available which increases primary production and decreases water quality and can ultimately lead to eutrophication of these waters.

In summary, it is considered that, although unlikely given that River Finn SAC lies 13 km via a watercourse connection to the Development, in the absence of mitigation there is low potential for water quality impacts resulting from the construction and operational stages of the Development on Oligotrophic Waters containing very few minerals. The potential impacts are those largely related to sediment release. Such issues can be controlled by standard mitigation practices well-established as effective in these circumstances. Effective mitigation is proposed in **Section 8**.

6.3.6 Potential impacts on watercourses of plain to montane levels with the *Ranunculus fluitans* and *Callitricho-Batrachion* vegetation

In general terms, floating river vegetation habitat occurs on rivers in areas with clean substrate and swift to moderate flow. Substrate generally needs to be largely free of silt (except for channel margins and localised deposits associated with macrophytes (Hatton-Ellis TW *et al.* 2003). Increases in sediment loading can reduce the available light and, if nutrient rich, can provide ideal conditions for the growth of benthic algae, which can hinder the spring growth of channel plants (Mainstone *et al.* 2000). Mainstone (1999) states that plants growing in nutrient-rich sediments tend to have shorter shoots and weaker roots, and are therefore, prone to washout during spates and that the seeds of *Ranunculus* spp. (the main floating river vegetation species of this QI habitat), do not survive in the anoxic conditions that develop within organic sediments, or are lost when the silt is flushed out by high flows.

In summary, it is considered that, although unlikely given the River Foyle SAC lies 12.8 km away from the Development via a watercourse connection, in the absence of mitigation there is low potential for water quality impacts resulting from the construction and operational stages of the proposal on floating river vegetation. The potential impacts are those largely related to sediment release and pollution events. Such issues can be controlled effectively and with a high degree of certainty by appropriate standard mitigation. Appropriate mitigation is proposed in **Section 8**.

7 Consideration of 'in-combination' impacts

Article 6 of the EU Habitats Directive states that any plan or project that may, either alone or in combination with other plans or projects, significantly affect a European Site should be the subject of a Habitats Regulations Assessment / Appropriate Assessment. The assessment of in-combination impacts is therefore an important part of the assessment process.

In-combination impacts can be an issue when a proposal has a small impact on European Sites as a result of factors such as disturbance or pollution. If other proposals also have a further small impact, the combined result can be a significant impact on the Natura site.

Different types of actions can cause cumulative impacts and effects. As such, these types of impacts may be characterised as:

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

It has been established that any potential for significant impacts related to European Sites is linked to hydrological connectivity of the Development to these Designated Sites. Direct impacts from the Development (on its own) upon QI/SCI species or QI habitats as a result of killing or injuring / or direct habitat loss due to the Development footprint, can be ruled out.

7.1 Additive/Incremental Impacts

The following proposed, consented, under construction and operational wind farms have been identified within 10 km of the Development.

- Ballykeery Road (operational) approximately 1.5 km south of the Development, located within the Doulas Burn catchment;
- Ballykeery Road 2 (proposed) approximately 1.5 km south of the Development, located within the Douglas Burn catchment (planning ref. LA11/2022/1099/F);
- Dunnyboe Road (proposed) approximately 3.0 km northeast of the Development, located within Burn Dennet River catchment (planning ref. LA11/2022/0938/F);
- Curlyhill Road (consented) approximately 3.0 km west of the Development, located within the Glenmornan River catchment (planning ref. LA11/2022/0731/F);
- Ballylaw Road (operational) approximately 4.5 km northwest of the Development, located within the Burn Dennet River catchment (planning ref. LA11/2022/1045/F);
- Loughan Road (under construction) approximately 5.5 km north of the Development, located within the Altinaghrea Burn catchment (planning ref. LA11/2019/0379/F);

- Carrickatane (operational) approximately 10.0 km north of the Development, located within the Sandville Burn catchment (planning ref. J/2005/0211/F);
- Eglish Mountain (operational) approximately 9.0 km northeast of the Development, located within the Faughan River catchment (planning ref. A/2005/0223/F); and
- Slieve Kirk (operational) approximately 10.0 km northeast of the Development, located within the Faughan River catchment (planning ref. A/2004/1130/F).

As Ligford Road Wind Farm (planning ref. LA11/2022/0205/F) is located outside the hydrological catchments of the Development, there is no potential for cumulative effects on downstream receptors from this project.

The proposed Dalradian Gold Mine grid connection application (planning ref. LA11/2019/1000/F) lies within the hydrological catchment of the Development. The proposed grid connection application supports the Curraghinalt mine application (LA10/2017/1249/F) which lies outside the hydrological catchment of the Development. Both applications are subject to public inquiry by the Planning Appeals Commission (PAC), and at the time of writing, the date for the public inquiry hearings have not been scheduled. As noted earlier in **Section 7**, direct impacts from the Development (on its own) on QI/SCI species as a result of killing or injuring through e.g. collision with overground infrastructure, or, direct habitat loss due to the Development footprint, can be ruled out. As such, there is no potential for impacts arising from the Dalradian Gold Mine grid connection application in-combination with the Development.

It has been established that any potential for significant impacts related to European Sites is linked to hydrological connectivity of the Development to these Designated Sites. Outside of the projects listed and discussed above, there are limited planning applications that could have the potential to result in in-combination impacts with the Development. These may include the construction of single residential dwellings or agricultural buildings, or operational quarries that occur within the hydrological catchment of the Development, have the potential to have hydrological impacts on the receiving environment, and are either in construction or operation at the same time as the Development. While hydrological impacts arising from the Development have the potential to reach downstream European Sites, as described in **Section 6.3** the impact on any downstream QI/SCI species and habitat has been assessed as low potential. Furthermore, any in-combination impacts are also considered to present a low potential impact due to the small scale of the projects, and the requirement of any planning application to be in compliance with Habitats Regulations Assessment/Appropriate Assessment.

It is anticipated that, in the absence of mitigation, the key cumulative effects upon ecology during the operation of the Development are largely as a result of augmentation of existing drainage within the Ecological ESA which could exacerbate peatland erosion within the vicinity of the proposed infrastructure, particularly if the current and future drainage scenarios are not maintained appropriately and in a sensitive manner, taking careful consideration of the peatland habitats here.

If similar effects resulted from equivalent actions on other wind farms in the area, this could result in downstream aquatic impacts on the QIs/SCIs of European and Ramsar Sites as discussed in **Section 6**.

These impacts would be caused by factors such as sedimentation in watercourses, nutrient pollution and spillage/leakage of hydrocarbons or other chemicals, as described in **Section 6.3**.

Mitigation will be required to negate such potential impacts. Proposed mitigation is discussed in **Section 8**.

7.2 Associated/Connected Impacts

Associated/Connected developments in the case of the Development would include the turbine delivery haul route (which encompasses the Abnormal Load Route (ALR)) and the electrical grid connection associated with the Development. The haul route for the Development has been assessed as part of HRA, as set out in **Section 3.2**. For further details refer to **Technical Appendix A2.3: Abnormal Load Route Works (ALRW)** and Technical **Appendix A13.1: Abnormal Load Route Assessment**. Any works associated with the haul route include minor works comprising vegetation removal along the existing road network. There is no potential for the haul route to contribute to LSEs associated with the Development.

The grid connection associated with the Development will be subject to a separate planning application, which will be accompanied by its own ES. This will either be done by SONI (Northern Ireland's transmission system operator) or by the Applicant. In initial discussions with SONI, they identified two potential grid connection points: Strabane 110kV substation and Killymallaght 110kV substation. Once an application is made, SONI will conduct studies post consent to determine which is the best point of connection. The windfarm will connect to the substation via either an overhead line (OHL) or underground cable along the public road system. The substation building, for which the grid connection will connect to, is included in the Development planning application.

The substation which forms part of the Development has been assessed as part of this HRA. The grid connection impacts will be assessed as part of the separate planning application and will consider in-combination impacts with the Development. While regard has been given to the associated grid connection, at this stage given the details of the gird connection are unknown, it is not possible to fully consider these in any in-combination assessment for the Development in this HRA.

As such, no associated/connected impacts have been identified as a result of additional/connected works or development activity that 'enables' the consent or operation of the Development.

8 Mitigation of Potential Effects

8.1 Avoidance Measures and Design Best Practice

Impacts resulting from the Development can be considerably reduced in their significance and severity or eliminated through the implementation of a proactive design approach avoiding baseline receptors, in particular water quality.

The design of the Development was amended to provide the most feasible avoidance of conflict with environmental receptors.

Avoidance measures implemented in the design of the Development are outlined in this section as well as additional mitigation to reduce or eliminate remaining effects.

8.1.1 Design Evolution & Embedded Mitigation

A process of "mitigation by avoidance" was undertaken by the EIA team during the design of the turbine and associated infrastructure layout. Environmental considerations influencing the design evolution are presented in **ES Chapter 3: Development Description** and **ES Chapter 4: Site Selection and Design**.

A detailed overview of mitigation measures embedded in the design to avoid impacts on the water environment is also provided in the mitigation section of **ES Chapter 8: Hydrology and Hydrogeology**. These measures are outlined in the following sections.

8.1.1.1 Water features

Buffer zones are applied to valuable water features as a precautionary measure following NIEA guidance. The implementation of the embedded mitigation and avoidance of impacts are intended to prevent a degradation of the water quality. Buffer zones which support intact vegetation between construction site and water features facilitate:

- Filtering of runoff within the vegetated buffer to protect water quality;
- Spatial demands for fluvial ecosystems;
- Bank stabilisation and reduced erosion with colonisation from the surrounding vegetation;
- Vital part of a habitat network; and,
- Access to water quality sampling points.

The degree of protection afforded to each water feature depends on the sensitivity of the features which is determined by:

- Environmental designation (incl. downstream features);
- Ecological potential;
- Morphology;
- Feature and catchment size; and,
- Topography and environmental surroundings.

Additional industry guidance taken into consideration includes:

- Guidance for Pollution Prevention (GPPs): GPP5-Works and Maintenance in or near water[20];
- 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[21]; and,
- 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.

8.1.1.2 Significance of watercourses

Watercourses with a catchment > 0.3 km^2 which indicates constant baseflow, natural morphological processes and a potential habitat value were considered significant and applied a 50 m buffer.

A catchment < 0.3 km^2 indicates a lack of the qualities outlined for significant watercourses, however, these minor watercourses are potential hydrological links between impacts and significant watercourses so that a 10 m buffer was applied to them. Minor drainage features (dry or partially dry agricultural ditches, ephemeral drains, peat cuttings etc.) are considered insignificant regarding hydrology and habitat potential so a management of diversion and temporary blocking can be applied to them during and after construction to prevent downstream impacts.

8.1.1.3 Adopted Surface Water Construction Constraint Buffers

The minimum hydrological buffer zones applied to the Development are dependent on the significance of the watercourse outlined in above. The minimum width for the water features is shown in **Table 5 – Width of buffer zones for different water features according to the ES Chapter 8: Hydrology and Hydrogeology**

Type/ Width of Water feature	Width of Buffer
Surface watercourse	50 m
Drainage ditch	5 m
Groundwater feature	250 m
Active peat	5-15 m

.

Table 5 – Width of buffer zones for different water features according to the ES Chapter 8: Hydrology and Hydrogeology

Type/ Width of Water feature	Width of Buffer
Surface watercourse	50 m

[20] https://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf?utm_source=website&utm_medium=social&utm_campaign=GPP5%2027112017
[21] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290293/stsps202-e-e.pdf

Drainage ditch	5 m
Groundwater feature	250 m
Active peat[22]	5-15 m

The buffers outlined in **Table 5 – Width of buffer zones for different water features according to the ES Chapter 8: Hydrology and Hydrogeology**

Type/ Width of Water feature	Width of Buffer
Surface watercourse	50 m
Drainage ditch	5 m
Groundwater feature	250 m
Active peat	5-15 m

10 were applied to the consented layout of the project with the exception of the watercourse crossings, and the access track and crane hardstanding between T8 and T9 according to the following principles:

- Infrastructure of the project is designed to lie outside the hydrological buffer zones (especially those elements with significant earthworks and high potential for pollution); and,
- Access tracks are designed to limit the crossing of watercourses and lie outside the hydrological buffer zone where possible.

In order to avoid areas of active peat, specific areas of the consented Development would fail the mitigation of siting infrastructure outside the buffer strips. These include:

- In the area proposed to be constructed as an access track to T1 and T2;
- A small section of the access track to T13 In order to enable access from the Napple Road;
- The access track and auxiliary crane pad located between the proposed T8 and T9; and,
- Small areas of the access track between T1 and T2, T4 and T5 and along the access track between T8, T11 and T12.

Minor breaches of the buffer zones set out in **Table 10** include:

- At the west construction compound;
- Earthworks at T3;
- The auxiliary crane pad at T5;
- Earthworks at T7;
- The access track entrance to the substation;
- The crane pad of T9;

[22] For further details on Active Peat across the site, see ES **Technical Appendix A10.4: Active Peat Assessment (APA).**

- The auxiliary crane pad of T10;
- The crane pad of T12; and,
- The crane pad for T13.

For further details, see **ES Chapter 8: Hydrology and Hydrogeology**.

8.2 Mitigation Measures – Initial Decommissioning and Construction Phase

The avoidance approach guiding the design evolution outlined previously in this report, in **Section 8.1**, is applied to the Development as best practice regardless of potentially significant adverse effects. Additional mitigation measures to reduce or prevent any adverse effects during the initial decommissioning and construction phase that are not mitigated by the embedded mitigation are outlined in this section of the report.

8.2.1 Outline Decommissioning and Construction Environmental Management Plan

The Outline Decommissioning and Construction Environmental Management Plan (oDCEMP) prepared for this application, sets out the measures that will be used during the decommissioning and construction phase of the Development to adequately protect the receiving environment. The oDCEMP contains mitigation measures as set out in this HRA and describes in detail how the Contractor will achieve these measures. A copy of the oDCEMP and related files and reports will be kept in the site offices of the Contractor for the duration of the site works and will be made available for review at any time.

The oDCEMP is included as **Appendix II** of the HRA, and is an integral part of how the mitigation measures set out below will be implemented on site during the decommissioning and the construction phase of the Development.

8.2.2 Environmental Site Inspections

Environmental site inspections will be undertaken by the Contractor's Onsite Environmental and Consents Manager supported by the wider site team. In addition, throughout construction at a frequency to be agreed as appropriate to the construction activity underway at the time, inspections and audits will be carried out by the Employer's Environmental Manager. Health and Safety inspections will be undertaken by the Employer's H&S Manager.

The results of these inspections will be fed back to both the Principal Contractor and the Employer. Evidence of good practices are highlighted and where issues are identified, remedial actions will be put in place.

8.2.2.1 Ecological Clerk of Works

There is a requirement for an Ecological Clerk of Works (ECoW) to be appointed for certain periods of times in areas of sensitivity from commencement of decommissioning/construction to final commissioning of the Development, or end of the construction period, whichever is the latter. The scope of the work of the ECoW will be decided in consultation with NIEA-DAERA and in relation to the HRA specifically shall include, but not be limited to:

- Ensuring visual checks on surrounding watercourses are carried out regularly to identify possible construction effects; and
- To ensure sediment and chemical pollution prevention measures are employed correctly and replaced when required.

8.2.2.2 Project Hydrologist

A project hydrologist will be required for certain periods of time in areas of sensitivity during pre-construction and construction phases of the proposed project in order to monitor water quality and drainage associated with proposed project activities. The project hydrologist will be responsible for managing a programme of inspection and maintenance detailed in the water quality monitoring section of this HRA. Should any adverse change be noted, an investigation will be undertaken as to whether the change could have been caused by the Development, and appropriate remedial action will be taken.

8.2.3 Pollution Prevention

The oDCEMP will integrate a detailed Pollution Prevention Plan (PPP) to be implemented and monitored by the site manager. The PPP will include guidance and best practice, as well as site-specific measures and a Pollution Incident Plan for emergencies.

The following are of relevance to surface water groundwater, and soil resources at the Site:

- PPG1: Understanding Your Environmental Responsibilities[23];
- PPG2: Above ground oil storage tanks[24];
- PPG3: Use and design of oil separators in surface water drainage systems[25];
- PPG4: Disposal of sewage where no mains drainage is available[26];
- PPG5: Works and maintenance in or near water[27];
- PPG6: Working at construction and demolition sites[28];
- PPG7: Safe storage: The safe operation of refuelling facilities[29]
- PPG18: Managing fire water and major spillages[30]; and
- PPG21: Pollution incident response planning[31].

[23] Environment Agency (2007) PPG 1: Understanding Your Environmental Responsibilities [online] available at: Title (publishing.service.gov.uk)(accessed 12/07/2023)
[24] Environment Agency (2011): PPG 2: Above Ground Oil Storage Tanks [online] available at: Title (nationalarchives.gov.uk) Accessed: 12/07/2023
[25] Environment Agency (2006): PPG 3: Use and design of oil separators in surface water drainage systems [online] available at: Layout 1 (nationalarchives.gov.uk) Accessed: 12/07/2023
[26] Environment Agency (2006): PPG 4: Disposal of sewage where no mains drainage is available [online] available at: New EnvAgency PPG4 (nationalarchives.gov.uk) Accessed 12/07/2023
[27] Environment Agency (2007): PPG 5: Works and maintenance in or near water [online] available at: pmho1107bnkg-e-e.pdf (nationalarchives.gov.uk) Accessed 12/07/2023
[28] Environment Agency (2010): PPG 6: Working at construction and demolition sites [online] available at: pmho0412bwfe-e-e.pdf (nationalarchives.gov.uk) Accessed 12/07/2023
[29] Environment Agency (2011): PPG 7: Safe storage: The safe operation of refuelling facilities [online] available at: Title (nationalarchives.gov.uk) Accessed 12/07/2023
[30] Environment Agency: PPG 18: Managing fire, water and major spillages [online] available at: EnvAgency PPG18_6pp (nationalarchives.gov.uk) Accessed 12/07/2023
[31] Environment Agency (2011): PPG 21: Pollution Incident response planning [online] available at: [ARCHIVED CONTENT] (nationalarchives.gov.uk) Accessed 12/07/2023

A review plan for the PPGs is currently underway, replacing them with a replacement guidance series, Guidance for Pollution Prevention (GPPs)[32]. GPPs provide environmental good practice guidance for the whole UK and environmental regulatory guidance directly to Northern Ireland. The following GPPs are of relevance:

- GPP2: Above ground oil storage tanks[33];
- GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer[34];
- GPP5: Works and maintenance in or near water[35];
- GPP13: Vehicle washing and cleaning[36];
- GPP21: Pollution incident response planning[37]; and
- GPP26: Safe storage – drums and intermediate bulk containers[38].

DAERA-NIEA have produced a series of standing advice notes which detail the measures that must be implemented in order to meet legislative and policy requirements. The following standing advice notes apply to potential effects on the water environment as a result of the Development:

- Discharges to the water environment[39];
- Pollution Prevention Guidance[40];
- Sustainable Drainage Systems[41]; and
- Culverting.[42]

The works will be planned and carried out in line with the PPGs and GPPs and standing notes. The following other principles will be applied:

- All works will comply with Control of Water Pollution from Construction Sites – A Guide to Good Practice, CIRIA (SP156 – 2002);
- Appropriate spill and leak containment systems will be incorporated into the construction procedures to ensure no uncontrolled releases of contaminants occur;

[32] NetRegs (2021): Guidance for Pollution Prevention (GPP) [Online]. Available at: Guidance for Pollution Prevention (GPP) documents | NetRegs | Environmental guidance for your business in Northern Ireland & Scotland (Accessed 12/07/2023)
[33] NIEA et al (2018): GPP 2: Above ground oil storage tanks [online] available at: guidance-for-pollution-prevention-2-2022-update.pdf (netregs.org.uk) Accessed 12/07/2023
[34] NIEA et al (2021): GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul water [online] available at: guidance-for-pollution-prevention-4-2022-update.pdf (netregs.org.uk) Accessed 12/07/2023
[35] NIEA et al (2018): GPP 5: works and maintenance in or near water [online] available at: GPP 5: Works and maintenance in or near water | NetRegs | Environmental guidance for your business in Northern Ireland & ScotlandAccessed 12/07/2023
[36] NIEA et al (2021): GPP 13: vehicle washing and cleaning [online] available at: guidance-for-pollution-prevention-13-2022-update-v2.pdf (netregs.org.uk) Accessed 12/07/2023
[37] NIEA et al (2021): GPP 21: Pollution incident response planning [online[available at: gpp-21-final.pdf (netregs.org.uk) Accessed 12/07/2023
[38] NIEA et al (2021): GPP 26: safe storage – drums and intermediate bulk containers [online] available at: guidance-for-pollution-prevention-26-2022-updated.pdf (netregs.org.uk) Accessed 12/07/2023
[39] DAERA-NIEA (2017): Standing Advice – Discharges to the water environment [online] available at: DAERA Standing Advice – WTR – Discharge to the water environment – November 2017.pdf (daera-ni.gov.uk) (Accessed 12/07/2023)
[40] DAERA-NIEA (2022): Standing Advice – Pollution Prevention Guidance [online] available at: DAERA Standing Advice – WTR – Pollution Prevention Guidance – Sept 2022 Final.pdf (daera-ni.gov.uk) Accessed 12/07/2023
[41] DAERA-NIEA (2020): Standing Advice – Sustainable Drainage Systems [online] available at: DAERA Standing Advice - WTR - Sustainable Drainage Systems - November 2017.pdf (daera-ni.gov.uk) Accessed 12/07/2023
[42] DAERA-NIEA (2017): Standing Advice – Culverting [online] available at: DAERA Standing Advice - WTR - Culverting - November 2017.pdf (daera-ni.gov.uk) Accessed 12/07/2023

- Storage of fuels, oils and chemicals will be in appropriately bunded static tanks within the site of the relative works. This storage will be in compliance with the respective Control of Substances Hazardous to Health (COSHH) assessments; and
- Refuelling will take place within dedicated refuelling areas within the site. Where applicable, fuel systems will have automatic shut-off pistol grip nozzles.

Oil and fuel storage containers will meet the following requirements:

- Bunded to at least 110% of the volume stored;
- Associated pipework to be stored within the bund;
- Located at least 10 m from any existing surface water drainage systems;
- Mobile bowsers will be locked when not in use; and
- Mobile bowsers will be double-bunded.
- Using appropriate measures e.g. drip trays when refuelling at all locations and providing spill kits with these at all working areas; and
- If required, construction plant will only be washed in designated areas.

8.2.3.1 Pollution Incident Procedure

Measures have been taken in the design to prevent pollution incidents, such as the use of a sump at each transformer bund within the substation. The purpose of the sump is to collect any oily water and divert it through a separate drainage system where the oil will be separated from the water before the water is discharged into the Site water drainage, soakaway or to surface water. In the event of an incident resulting in pollution, e.g. spillage of fuel or other chemicals, the following additional responses will be made:

- All incidents will be immediately reported to the Site Manager and Health and Safety (H&S) Manager and logged;
- Appropriate spill kits will be available at all times and employed during any such instances in order to try and limit and contain the affected area; and
- Compliance with the Emergency Response Procedures, as set out in the oDCEMP.

The NIEA's guidance on pollution prevention encourages the reporting of all spillages, particularly under the following circumstances:

- Incidents that the operator cannot deal with, or does not know how to deal with;
- Spills that reach surface water drains or flow into the ground;
- Spills that run over hard surfaces and leave the site or run into surface waters; and
- Fires where the fire service has been called out.

If any of these criteria are met, the pollution incident will be reported to the NIEA as soon as possible.

The excavation of turbine foundations, access tracks and other infrastructure elements has the potential to have a direct impact upon geological features.

A range of mitigation measures exist to reduce the impacts on underlying geology and aquifer. This includes measures for avoiding the likelihood of spills and leakages, such as:

- The implementation of properly designed shoring systems to avoid unstable excavations;
- The removal of superficial deposits should be minimised wherever possible;
- Limiting of refuelling activities to designated, impermeably surfaced areas and use drip traps where possible;
- Checking and maintain equipment regularly to ensure that leakages do not occur; and

Ensuring site inductions are completed for all staff including the Principal Contractor and sub-contractors; include the above procedures and the locations of spill kits.

8.2.4 Sediment Pollution Prevention

Mitigation measures should minimise mobilisation and release of sediments to the water environment. Water polluted by sediments are not allowed to leave the site untreated and the final discharge from the site must have acceptable levels of sediment (in line with baseline levels).

The contractor will work under a wet weather working policy during construction. Works that could mobilise sediments and impact the water environment would be stopped during heavy precipitation events.

8.2.4.1 Silt Traps and Silt Matting

Silt traps may be utilised to trap and filter sediment-laden run-off from excavation works at the Site, including foundations for the sub-station, temporary construction compounds and temporary access tracks.

Silt traps and matting are to be installed at the following locations:

- Within drainage ditches but will be sited to avoid slopes with a gradient greater than 1 in 20;
- At the inlet (sump) or outlet side of culverts; and
- At the outfall of settlement lagoons to filter sediment during times of heavy rainfall.

The silt traps and silt matting will be monitored by the ECoW and should be cleared regularly and replaced when necessary.

8.2.4.2 Silt Fencing

Silt fences are a semi-permeable geotextile fabric arranged in the form of a fence (attached to timber posts). Silt fences are to be used as perimeter controls on the site at the downslope end of earthworks or disturbed soils. They should be used in conjunction with other sediment and water treatment solutions, such as settlement lagoons, where required.

To comply with best practice, they should be installed as follows:

- Installed perpendicular to the gradient of the slope;
- Construct a trench on the up-gradient side;
- Install stakes on the down-gradient side; and

- Position with a curve to the end of the fence in the up-gradient direction to help capture surface run-off.

Silt fences should not be installed in the following:

- Within drainage ditches or channels; and / or
- Running parallel to the direction of slope.

Silt fencing will be monitored by the ECoW and should be cleared regularly of sediment and silt build-up, and after heavy rainfall and storm events. Silt fencing will should be replaced, when necessary, as monitored by the ECoW.

8.2.4.3 Check Dams

Check dams will be utilised to facilitate the settlement of suspended solids by slowing the flow of water within the drainage ditches. Appropriately sized stone pitching will be used and installed at regular intervals within ditches.

8.2.4.4 Settlement Lagoons

Settlement lagoons allow for contaminated water to be retained to allow for the settlement of silt and sediments to an acceptable level prior to discharge to the water environment. They will be implemented where appropriate and take the form of large trenches dug into the ground and are often bunded.

Settlement lagoons should be installed so as to retain water long enough for silt to settle out. The length of time required will depend on the type of silt with finer silts and clays taking longer to settle.

Further guidance on the required dimension of settlement lagoons is provided in GPP5: Works and maintenance in or near water[43].

To comply with best practice, they should be installed as follows:

- Install energy dissipation methods (e.g. rip-rap) at the inlet to minimise flow;
- Install inlet pipe work vertically to dissipate energy of flow in;
- Install a lined inlet chamber and outlet weir with materials such as geotextiles;
- Install a long outlet weir; and
- Install two or three lagoons in a series to increase silt retention and storage.

Settlement lagoons should be inspected regularly by the ECoW to ascertain the functionality of the system. Settlement lagoon outflow discharge may be pumped, when required, for maintenance purposes. A ‘Siltbuster’ is a method of pumping excess silt-laden water and treated prior to discharge. Any pumping activities will be supervised and authorised by the Contractor’s Project Manager.

8.2.4.5 Natural Peat Slide

The potential exists for a natural peat slide to occur after heavy rainfall events. To avoid the potential for injury or damage from natural peat slide works should be postponed during and for a period after heavy

[43] NIEA et al (2018): GPP 5: works and maintenance in or near water [online] available at: gpp-5-works-and-maintenance-in-or-near-water.pdf (netregs.org.uk)Accessed 12/07/2023

rainfall events. This is defined by the Met Office as 4mm per hour or greater; however, the parameters for the project should be agreed prior to construction based on weather averages for the area.

8.2.5 Chemical Pollution Prevention

8.2.5.1 Storage of Chemicals and Oil

Potentially contaminating chemicals stored on site will be kept within a secure bunded area to prevent any accidental spills from affecting hydrological resources. The bunded area will be within the construction compound and will be underlain by an impermeable ground membrane layer to reduce the potential pathways for contaminants to enter watercourses and groundwater.

Oil storage areas will be covered in order to prevent rainwater collecting within the bunded area.

The chemicals storage area would be kept secure to prevent theft or vandalism. A safe system for accessing the storage area would be implemented by the Construction Contractor.

The following measures should be employed under best practice guidance for storage of chemicals and oils:

- Storage tanks (above or below ground) should have sufficient strength and structural integrity to hold without leak or burst and bunded in accordance with guidance;
- Storage containers should have a minimum design life of 20 years; and
- All storage containers are closed and locked when not in use.

Chemical storage areas are to be removed from Site as part of decommissioning, any remnant in-situ storage facilities must be appropriately maintained and monitored for degradation and release of oils or chemicals.

8.2.5.2 Spillage of Chemicals and Oil

The construction compound will have a bunded area and this area will be underlain by an impermeable ground membrane layer. The bund will have a capacity of 110% of the stored liquid containers (including fresh concrete). This will reduce the potential for accidental spillages to contaminate surface water or groundwater.

Best practice guidance on the prevention of spillages of chemical outlines the following measures:

- Areas where transfer and handling of chemicals is to occur should have impermeable surface;
- Drainage systems onsite should be designed to enable the containment of spillages and appropriate disposal and treatment;
- Emergency procedures are implemented for a spillage incident and leak detection measures (if appropriate);
- Regular maintenance and inspection of chemical storage facilities to be conducted (may be carried out by onsite ECoW); and
- Provision and training in the use of spill kits, as outlined below.

Appropriately sized spill kit(s) will be provided, maintained and located at strategic points across the Site. It is also recommended that all vehicles on-site have spill kits in the event of a spillage from a

vehicle. This will contain materials, such as absorbent granules and pads, absorbent booms and collection bags. These are designed to halt the spread of spillages and will be deployed, as necessary, should a spillage occur elsewhere within the construction compound.

8.2.5.3 Concrete, Cement and Grout

To comply with best practice, concrete, cement and grout mixing and washing areas should:

- Be sited in an impermeable hardstanding or geotextile within a designated area;
- Be sited at least 10 m from any watercourse or surface water drain, rock outcrop or sinkhole;
- Install settlement and re-circulation systems for water re-use in the batching process to minimise water use, treatment requirements and risk of pollution;
- Designated and contained washing areas for batching plant and vehicles; and
- Collect contaminated wash waters which cannot be reused and discharge to foul sewer or tanker off-site. Contaminated water should never be released to the water environment.

To prevent pollution, it is important that all concrete pours are planned and that specific procedures are adopted where there may be a risk of surface water or groundwater contamination, in accordance with CIRIA C532. These procedures will include:

- Ensuring that all excavations are sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system; and
- Ensuring that covers are available for freshly placed concrete to avoid the surface of the concrete washing away during heavy precipitation.

8.2.6 Management of sediment and surface water

This section addresses the management of sediment and surface water run-off generated during the construction phase of the Development, through good practice construction techniques.

Drainage from the Site will include elements of Sustainable Drainage Systems (SuDS) design, where appropriate. SuDS replicate natural drainage patterns and have a number of benefits:

- SuDS will attenuate run-off, thus reducing peak flow and any flooding issues that might arise downstream;
- SuDS will treat run-off, which can reduce sediment and pollutant volumes in run-off before discharging back into natural drainage network; and
- In addition, any installed drainage management system, where necessary, will be implemented to avoid any surface water run-off to public roads.

8.2.6.1 Pre-Earthworks drainage

Pre-earthworks drainage relates to the required drainage measures to be installed prior to earthwork activities such as access track and other infrastructure construction.

Best practice pre-earthworks drainage measures include:

- Cut-off/ diversion ditches;

- Temporary interception bunds;
- Swales; and
- Retention ponds.

Pre-earthwork drainage should be installed immediately prior to earthworks and construction works commencing. Final details of the pre-earthworks drainage system design will be provided by the contractor in accordance with the requirements at the specific location within the site.

8.2.6.2 Earthworks drainage

Drainage for permanent or semi-permanent earthworks is required to control surface water run-off and discharge to appropriate outlets.

Best practice earthworks drainage measures include:

- Drainage ditches;
- Sumps; and
- Culverts.

8.2.6.3 Management of Drainage from Surplus and Loose Materials

Careful consideration will be given to the location of topsoil and subsoil storage areas for all areas of the Development during construction. Storage areas will be either in a flat dry area away from watercourses or be protected by the addition of cut off drains above the storage areas to minimise the ingress of water. Temporary peat storage areas have been sited to avoid areas of active peat.

The use of soil stockpiles will be minimised by earthworks planning. However, where stockpiles are used, silt fences and silt mats will be employed to minimise sediment levels in run-off.

All stockpiled material will be stored at least 50 m from watercourses in order to reduce the potential for sediment to be transferred into the wider surface water system and will be regularly inspected to ensure that erosion of the material is not taking place.

8.2.7 Activities Within the Water Environment

Construction phase works within the water environment include the construction of temporary and permanent watercourse crossings.

8.2.7.1 Watercourse Diversions

Temporary watercourse diversions will be required for construction works to be conducted on the banks of a watercourse, within wetlands or a watercourse channel. This will only be undertaken in artificial drains and ditches; no watercourse diversions will occur in natural watercourses.

Where required, watercourse diversions are to be installed in line with best practice guidance. In-lieu of any relevant Northern Irish best practice guidance on diverting watercourses, the following Scottish guidance should be followed:

- SEPA WAT-SG-29: Temporary Construction Methods[44].

Isolation of a watercourse to allow works may be in the following good practice methods:

- Partial isolation (cofferdam);
- Partial isolation (caisson);
- Full isolation (temporary diversion);
- Full isolation (gravity/flume pipe); or
- Full isolation (over-pumping/siphon).

Over pumping/siphon allows for a whole section of the channel to be isolated, and water is diverted downstream using a pump or siphon in order to retain hydrological continuity. This temporary diversion may be utilised prior to establishing a long-term watercourse diversion for permanent infrastructure within watercourses.

The section of the watercourse requiring diversion will be isolated using barriers that span the full width of the existing watercourse. This keeps a stretch of the watercourse dry and the water is transferred downstream of the works area by mechanical assistance (pumping), until a long-term diversion is operational. It may be necessary to pump water from upstream of the barrier to downstream of the works area, i.e., maintain 'normal' flow in the watercourse either side of the isolated reach. Depending on the gradient of the watercourse, it may also be necessary to install a full width barrier downstream of the work area to prevent ingress of water.

Pumps will be kept at least 10 m from the edge of the channel and on drip trays or within bunds that have a capacity 110 % of that of the fuel tank.

8.2.7.2 Watercourse Crossings

Where required to be installed, watercourse crossings should be designed in order to minimise effects of developments on the natural integrity and continuity of watercourses. In-lieu of any relevant Northern Irish guidance on watercourse crossings, the following Scottish best practice guidance should be used:

- SEPA WAT-SG-25 River Crossing – Good Practice Guide45;
- SEPA WAT-PS-06-02: Culverting watercourses46; and
- CIRIA C689: Culvert design and operation guide47.

[44] SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition* [Online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ (Accessed: 12/07/2023)
[45] SEPA (2010) *WAT-SG-25 Engineering in the water environment: good practice guide. River Crossings.* [Online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ https://www.sepa.org.uk/media/151036/wat-sg-25.pdf (Accessed: 12/07/2023).
[46] SEPA (2015) *WAT-PS-06-02: Culverting of Water courses - Position Statement and Supporting Guidance* [online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ (Accessed: 12/07/2023).
[47] CIRIA (2010) *C689: Culvert design and operation guide* [Online] Available at: https://www.ciria.org/Resources/Free_publications/C689.aspx?WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91 (Accessed: 12/07/2023)

8.2.7.3 Pre-installation Checks

Identification of ecological requirements and limiting factors (e.g. breeding birds and fish spawning) should be conducted prior to installation of a watercourse crossing. The ECoW should be consulted before watercourse crossing construction can commence.

The hydraulic capacity of the crossing is to be assessed and constructed peak river flow plus a climate change allowance of 20% in Northern Ireland. Watercourse crossings should not be installed in 'active' areas of a watercourse e.g. meandering bends and depositional areas.

Consideration should be given to the type of watercourse crossing acknowledging that hard engineering structures, such as concrete culverts, can make it more difficult to restore a site or decommission temporary structures e.g. access tracks. Bottomless arched culverts will be used for the small scale crossings.

8.2.7.4 Installation

The use of in-situ fresh concrete in the construction of watercourse crossings will be avoided by the use of pre-cast elements. Watercourse crossings will be installed perpendicular to the direction of flow.

In total two new watercourse crossings are required for the Development. It is anticipated that ready-made bottomless arched concrete or plastic culverts watercourse crossings are to be installed on site:

However, in accordance with best practice guidance, each watercourse crossing shall be designed on a case-by-case basis to be appropriate for the width of watercourse being crossed, and the prevailing ecological and hydrological situation (i.e. the sensitivity of the watercourse). A number of factors, both environmental and engineering will influence the selection of structure type and the design of the crossing.

All watercourse crossings should be installed in line with SEPA WAT-SG-25 River Crossing good practice guide. General good practice in watercourse crossing design and construction will ensure that site conditions are taken into account. Good practice measures include:

- The use of appropriate structures to carry access tracks across watercourses taking into account the scale of the watercourse, ecological value, sensitivity to construction activities, topography and construction methodology;
- There is a preference to avoid construction in watercourses altogether through the use of arch culverts appropriately designed not to impede the flow of water and allow safe passage for wildlife, such as fish, water voles, otters etc;
- When installing culverts, care will be taken to ensure that the construction does not pose a permanent obstruction to migrating species of fish, or riparian mammals (i.e. the crossings will make provision for fish and wildlife migration);
- Culverts should be sized so that they do not interfere with the bed of the stream post construction, (i.e. the crossings will leave the watercourse in as natural condition as possible or permit re-establishment of substrate post construction);
- Single culverts will be used in preference to a series of smaller culverts that may be more likely to become blocked with flotsam and create erosion (i.e. the crossings will not constrict the channel);

- To minimise impacts on the breeding of any fish found, any in-stream works in these areas will be conducted during months which have less impact on their breeding and development, where possible;
- Ease and speed of construction are important to minimise disruption to the watercourse and surrounding habitat;
- Culverts and headwalls should be designed to last the operational life of the Development;
- Designs should be low maintenance and where possible self-cleansing; and
- Structures should be visually in keeping with the surroundings.

8.2.7.5 Maintenance

Erosion to the bed and banks at a watercourse crossing as a result of scouring during high rainfall and storm events. Erosion can expose span structure foundations and/ or cause a drop forming at the outlet of the watercourse crossing.

If this occurs, the inclusion of erosion protection measures may be required, such as baffles. The crossing should be reinstated and reinforced to allow for scour during higher flows. The crossing should be reinstated to allow for fish passage and continuity of the watercourse bed. If this is not possible, inclusion of a fish pass may be required.

If maintenance works are required within the watercourse bed then isolation of the watercourse is required, and authorisation from SEPA may be required.

Culverts are prone to blockage by debris and may require routine clearing.

8.2.7.6 Culverts

Culverts are used to create artificial channels and allow for the continuity of water drainage and balance upstream and downstream of infrastructure associated with the Development e.g., access tracks.

Closed culverts are sufficient for cross-drainage under an onsite access track. Bottomless arch culverts should be used for all culverts over watercourses.

Culverts will be installed and designed in line with best practice guidance, including CIRIA C689, and incorporate the following criteria:

- Culverts will be well bedded to avoid settlement and protected by an adequate cover of road material;
- The substrate and side/ head walls will be reinforced in order to prevent erosion;
- The culverts will be designed such that it does not cause a barrier to movement of fish or other aquatic fauna;
- Culvert floors will have the same gradient (not exceeding a slope of 3 %) and level, and carry similar bed material and flow, as the original stream;
- There shall be no hydraulic drop at the culvert inlet or outlet;
- The width of the culvert will be greater than the active channel width of the watercourse;
- The culvert must not exacerbate or create flooding;
- Culverts will be used to conduct water under the wind farm tracks;

- Any fences or screens fitted on the inlet or outlet of the culvert will be designed to allow at least 230 mm of space between the bars of the screen of fence, up to the high-water level;
- A natural stone headwall will be provided upstream and downstream of culverts to protect the road embankment. Further protection will be provided to the banks using soft engineering techniques as much as possible; and
- Where there is risk of bed erosion upstream or downstream of culverts, natural stone rip-rap will be provided.

8.2.7.7 Dewatering

Dewatering may be required for excavations or construction of foundations.

In-lieu of relevant Northern Irish guidance in relation to dewatering, the following Scottish best practice guidance should be followed during dewatering activities:

- SEPA WAT-SG-29: Temporary Construction Methods;
- SEPA Good Practice Guide WAT-SG-28: Intakes and Outfalls[48]; and
- SEPA Regulatory Method WAT-RM-11: Licensing Groundwater Abstractions including Dewatering[49].

Discharge of water as a result of dewatering must not cause further erosion and energy dissipation measures should be put in place as outlined in SEPA WAT-SG-28 guidance. Drop pipe structures can be used to lower the height at which the water is discharged in areas with particularly high banks. These act as energy dissipaters if the lower outfall pipe is placed slightly above the bottom of the drop structure. Stilling basins are also effective energy dissipaters, these must be appropriately designed to suit the discharge rate and existing hydrological conditions at the Site.

Dewatering must consider the impact on other groundwater abstractions and groundwater dependent terrestrial ecosystems (GWDTE).

Settlement lagoons may also be constructed with a composting layer also allow for the treatment of any ochre water before being discharged into the hydrological system.

8.2.8 Chemical Storage

Potentially contaminating chemicals stored on-site will be kept within the construction compound and will each be bunded to prevent any accidental spills from affecting hydrological resources by removing a potential pathway for contaminants to enter watercourses and groundwater.

Oil storage areas will be covered in order to prevent rainwater collecting within bunded areas.

The chemicals storage area would be kept secure to prevent theft or vandalism. A safe system for accessing the storage area would be implemented by the Contractor.

[48] SEPA (2019) *WAT-SG-28: Engineering in the Water Environment Good Practice Guide: Intakes and outfalls Second Edition* [Online] Available at: https://www.sepa.org.uk/media/150984/wat_sg_28.pdf (Accessed: 12/07/2023)
[49] SEPA (2017) *WAT-RM-11: Regulatory Method: Licensing Groundwater Abstractions including Dewatering* [Online] Available at: https://www.sepa.org.uk/media/151997/wat-rm-11.pdf (Accessed: 12/07/2023)

8.2.9 Dust Suppression and Control

Water will be needed for dust suppression on the haul roads during periods of dry weather and the compound vehicle wash will be clean water. Clean water may be obtained from re-circulated clean or treated drainage waters.

Where required, water may be extracted from local watercourses or groundwater. In these instances, the Contractor will liaise with the NIEA beforehand to agree abstraction locations, rates and licencing requirements.

Good practice measures will be adopted during construction to control the generation and dispersion of dust such that significant impacts on neighbouring habitats will not occur. The hierarchy for mitigation will be prevention, suppression then containment.

The following mitigation measures will be implemented to control the movement of dust within the Site:

- Excavation and earthworks areas will be stripped as required in order to minimise exposed areas;
- During excavation works, drop heights from buckets will be minimised to control the fall of materials reducing dust escape;
- Completed earthworks and other exposed areas will be covered with topsoil and re-vegetated as soon as it is practical in order to stabilise surfaces;
- During stockpiling of loose materials, stockpiles shall exist for the shortest possible time;
- Material stockpiles will be low mounds without steep sides or sharp changes in shape;
- Material stockpiles will be located away from the site boundary, sensitive receptors, watercourses and surface drains;
- Material stockpiles will be sited to account for the predominant wind direction and the location of sensitive receptors;
- Water bowsers will be available on site and utilised for dust suppression during roadworks/ vehicle movements when and where required;
- Daily visual inspections will be undertaken to assess need for use of water bowsers, with increased frequency when activities with high potential to generate dust are carried out during prolonged dry or windy conditions;
- Shielding of dust-generating activities;
- Use of enclosed chutes, conveyors and covered skips;
- Covering vehicles carrying dry spoil and other wastes to prevent escape of materials;
- Cutting, grinding and sawing equipment will only be used in conjunction with suitable dust suppression techniques; and
- A wheel washing system will be sited close to the site entrance to avoid getting dust on the public road.

8.2.10Installation of Underground Cabling

Underground electrical cabling will be required to import and export electricity on-site.

The installation of underground cabling could lead to sedimentation of near-surface water should the cabling be buried in trenches. Chemical pollutants and sedimentation could, therefore, have the potential to adversely affect subsurface water quality, surface water quality, and groundwater.

The position of the cable route will be marked out and the line stripped of turfs and soils and set aside for reinstatement. Ecologically sensitive areas will be avoided by construction plant and vehicles. In the first instance, the cable run installation will be undertaken adjacent to and within the access track, to minimise intrusion into the surrounding areas, although it may be required to divert to the shortest possible routes locally. The siting and laying of the cables will be supervised by the ECoW(s) where possible.

Sand will be imported to the Site and will be placed around the cables as protection. Suitable duct marker tape shall be installed in the trench prior to backfilling.

The following mitigation measures will aim to minimise soil compaction:

- The position of trenches will be marked out and the line stripped of turfs and soils and set aside for reinstatement; and
- Vehicles using the track/undertaking the cable laying must be the lightest vehicle required for that job and must use either wider tires, dual tires, or tracks.

8.2.11Water Quality Monitoring

The outline Decommissioning and Construction Environmental Management Plan (oDCEMP) provided in **Appendix II** of this HRA prescribes a water quality monitoring program to:

- monitor the effectiveness of mitigation measures; and,
- indicate a need for additional mitigation.

A surface water monitoring programme will be established prior to the construction phase of the Development. An indicative monitoring programme is set out below.

Visual inspections of any drainage or nearby surface watercourses will be regularly carried out by the Project Hydrologist, especially during major excavation works. This will allow rapid identification of changes to water quantity or water quality that could indicate construction related effects are occurring. Potential effects will then be investigated, and remedial action taken to prevent further effects, if necessary.

To supplement the visual inspections, it is anticipated that there would be a number of surface water monitoring points for extractive sampling and analysis. Details will be agreed with the NIEA prior to construction.

The following sampling frequency is proposed in order to establish baseline hydro-chemical conditions of surface water constituents:

- Once every month for 12 months prior to the construction phase.

The following sampling frequencies are proposed in order to monitor surface water conditions against baseline conditions:

- Once a month in-situ monitoring and sampling throughout the duration of the construction phase; and
- Once a month in-situ monitoring and sampling for 3 months post construction.

Establishing baseline conditions for surface waters will enable any trends in levels of critical parameters to be assessed and deviations from the norm identified and rectified through water management measures, such as the use of silt fencing and settlement lagoons. Surface water management measures are discussed in **Section 8.2.7** of this HRA.

8.3 Mitigation Measures - Operational Phase

Additional mitigation of the effects of the operational windfarm development include:

- Compliance with best practice and Pollution Prevention Guidance (PPG), these have been in-built into the design through the implementation of the oDCEMP, see **Appendix II** of the HRA.

8.4 Mitigation for potential impacts during the decommissioning phase

Mitigation for potential impacts during the decommissioning phase will adhere to the mitigation measures outlined for the construction phase.

9 CONCLUSIONS

This report has examined whether, in view of best scientific knowledge and applying the precautionary principle, the Development either individually, or in combination with other plans or projects, may have an adverse effect on the integrity of any European Sites. In line with NI policy (PPS2), the potential for impacts upon Ramsar sites has also been taken into consideration.

The Screening stage identified five European Sites that could be significantly impacted. As a result of European Case Law[50] and its adoption in the UK on a precautionary basis, measures which are *intended to avoid or reduce* the harmful effects of the proposed development on any relevant European Site, such as pollution control measures, currently are not, as a matter of practice, considered at the screening stage of the HRA process. Given that significant impacts on European and Ramsar Sites could not be ruled out, it was carried forward for assessment in line with the HRA procedure. The potential impacts identified were for adverse effects on Qualifying Interests/Special Conservation Interests due to a decline in water quality as a result of contamination from hydrocarbons or sediments during construction or sediment during the operational stage.

Mitigation measures to avoid and reduce the potential impacts of the Development on European and Ramsar sites are fully described in **Section 8**. These mitigation measures are based on best practice, tried and tested, and effective control measures to protect water quality in the receiving environment, and will be fully implemented to the specifications set out in this HRA.

Therefore, it is considered that the full implementation of the mitigation and guidance referred to in this document will, in view of best scientific knowledge and in view of the conservation objectives of the aforementioned European and Ramsar Sites, the proposed Owenreagh / Craignagapple Wind Farm will not have any adverse effects on the integrity of any European or Ramsar Sites, either alone or in-combination with other plans or projects.

[50] People Over Wind and Peter Sweetman v Coillte Teoranta (C-323/17); and, Heather Hill Management Company clg v An Bord Pleanála [2019] IEHC 450.

10 REFERENCES

Balkham, M. *et al.* (2010): Culvert design and operation guide (C689F). Available at: https://www.ciria.org/ItemDetail?iProductCode=C689F&Category=FREEPUBS

Bauer, G. and Vogel, C. (1987). The parasitic stage of the freshwater pearl mussel *Margaritifera margaritifera*. I. Host response to Glochidiosis. Arch. Hydrobiol. 76, 393-402.

Belfast City Council (2017) Report on Habitats Regulations Assessment Requirement In accordance with The Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended) for The Belfast Agenda. December 2017.

Buddensiek, V. (1995). The culture of juvenile freshwater pearl mussels *Margaritifera margaritifera* L. in cages: a contribution to conservation programmes and the knowledge of habitat requirements. Biol. Conserv. 74, 33-40.

Buddensiek, V. (2001). Okologie der jungen Flussperlmusschel. In: Böttig, E. (Ed.) "The Freshwater pearl mussel in Europe: Population status and conservation strategies". Wasserwirtschaftsamt, Hof.

Buddensiek, V., Engel, H., Fleischauer-Rossing, S. and Wachtler, K. (1993). Studies on the chemistry of interstitial water taken from defined horizons in the fine sediments of bivalve habitats in several northern German lowland waters. II: Microhabitats of *Margaritifera margaritifera L.*, *Unio crassus* (Philipson) and *Unio tumidus* Philipsson. Arch. Hydrobiol. 127, 151-166.

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater, and Coastal. 2nd Edition. Updated September 2019). Available at: https://www.cieem.net/data/files/Publications/EcIA_Guidelines_Terrestrial_Freshwater_and_Coastal_Jan_2016.pdf

CIRIA (2006). Control of water pollution from linear construction projects. Technical guidance (C648)

DOE (1999) Ramsar Convention. Lough Foyle Ramsar Site. Available at: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004087.pdf

DOENI (Department of the Environment) (2014): Revised Planning Policy Statement 15 'Planning and Flood Risk'. Available at: https://www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/PPS15%20Planning%20and%20Flood%20Risk.pdf

Enlander, I. (2015) Lough Foyle – Special Protection Area (SPA) UK9020031. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/lough-foyle-spa-conservation-objectives-2015.pdf

European Community Habitats Directive (92/43/EEC) – The Habitats Directive.

European Commission (2001) Assessment of plans and projects significantly affecting European Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.

Hatton-Ellis T. W. & Grieve N. (2003). Ecology of Watercourses Characterised by *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation. Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough.

Hendry, A. P., Letcher, B. H., & Gries, G. (2003). Estimating natural selection acting on stream-dwelling Atlantic salmon: implications for the restoration of extirpated populations. Conservation Biology, 17(3), 795-805.

Kalleberg H (1958). Observations in a stream tank of territoriality and competition in juvenile salmon and trout (Salmo salar L and S. trutta). Report of the Institute of Freshwater Research, Drottningholm 39, 55–98.

Macdonald SM & Mason CF (1990). Action plan for European Otters. In Foster-Turley P., Macdonald SM, and Mason CF (eds) Otters: and action plan for their conservation. IUCN Species Survival Commission, Gland. Pp 29-40.

Mainstone CP (1999). Chalk rivers – nature conservation and management. Water Research Centre. English Nature, Peterborough.

Mainstone CP, Parr W & Day M. (2000). Phosphorus and River Ecology – tackling sewage inputs. English Nature/Environment Agency, Peterborough.

McKeown, R (2017a) River Foyle & Tributaries SAC Conservation Objectives. DOENI. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Conservation%20Objectives%20%282017%29.%20%20River%20Foyle%20%26%20Tributaries%20SAC.%20%20Version....pdf

https://www.daera-ni.gov.uk/publications/reasons-designation-special-area-conservation-river-foyle-and-tributaries

NPWS (2014) Conservation Objectives: Lough Foyle SPA 004087. Available at: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004087.pdf

NPWS (2017) Conservation Objectives: River Finn SAC 002301. Available at: https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002301.pdf

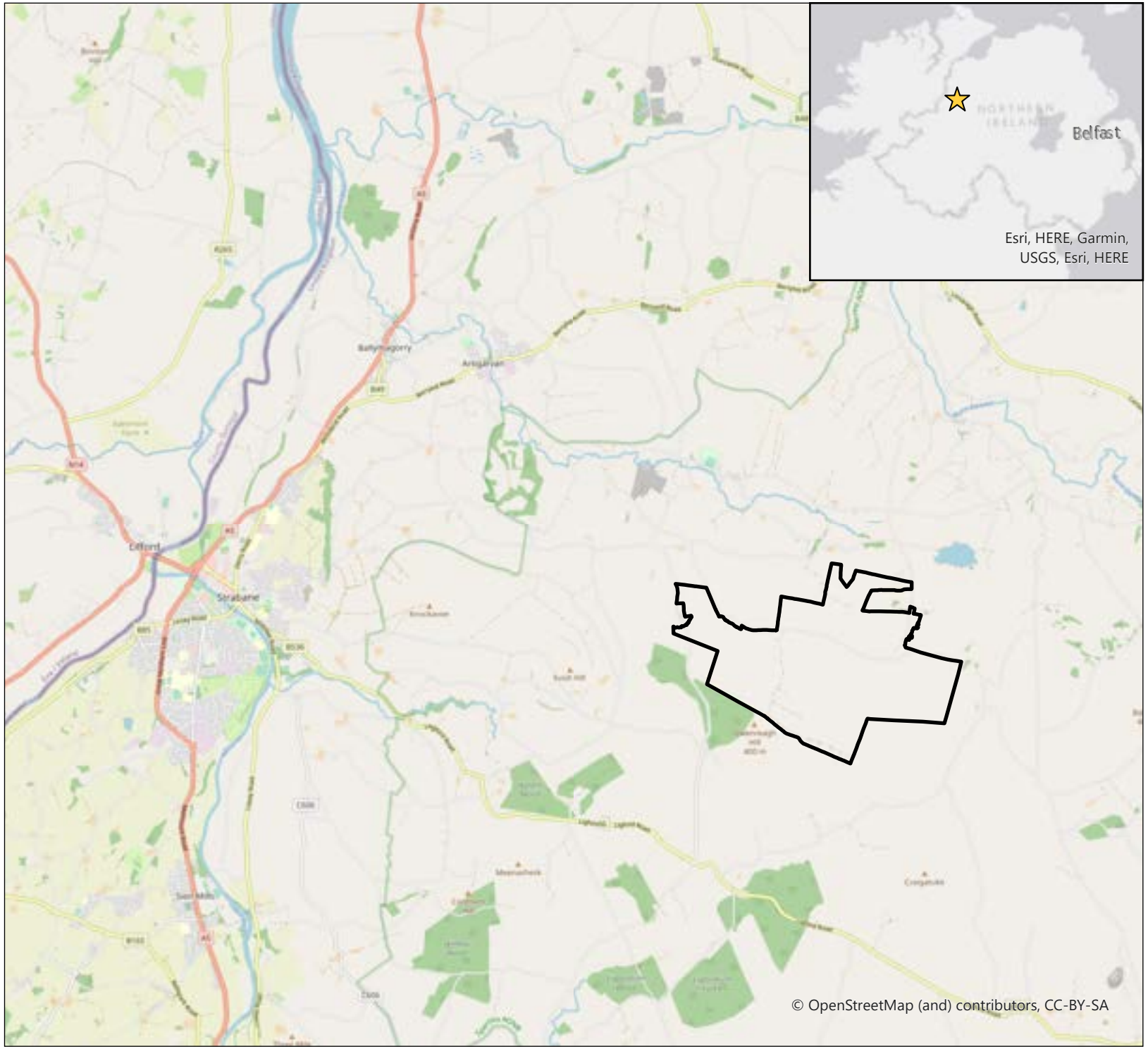
SEPA (2010) Engineering in the water environment good practice guide sediment management.

SEPA (2009) Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First edition, March 2009. https://www.sepa.org.uk/media/150997/wat_sg_29.pdf (Accessed September 2019).

Skinner, A., Young, M. and Hastie, L. (2003) Ecology of the Freshwater Pearl Mussel. Conserving Natura 2000 Rivers Ecology Series No. 2 English Nature, Peterborough.

Woodrow (2023) Chapter 10: Ecology. In Owenreagh-Craignagapple Environmental Statement.

11 Appendix I – Figures



woodrow APEMGroup

Owenreagh / Craignagapple Wind Farm

Internationally Designated Sites

Legend

Ecological Study Area

0 1.5 3 Km

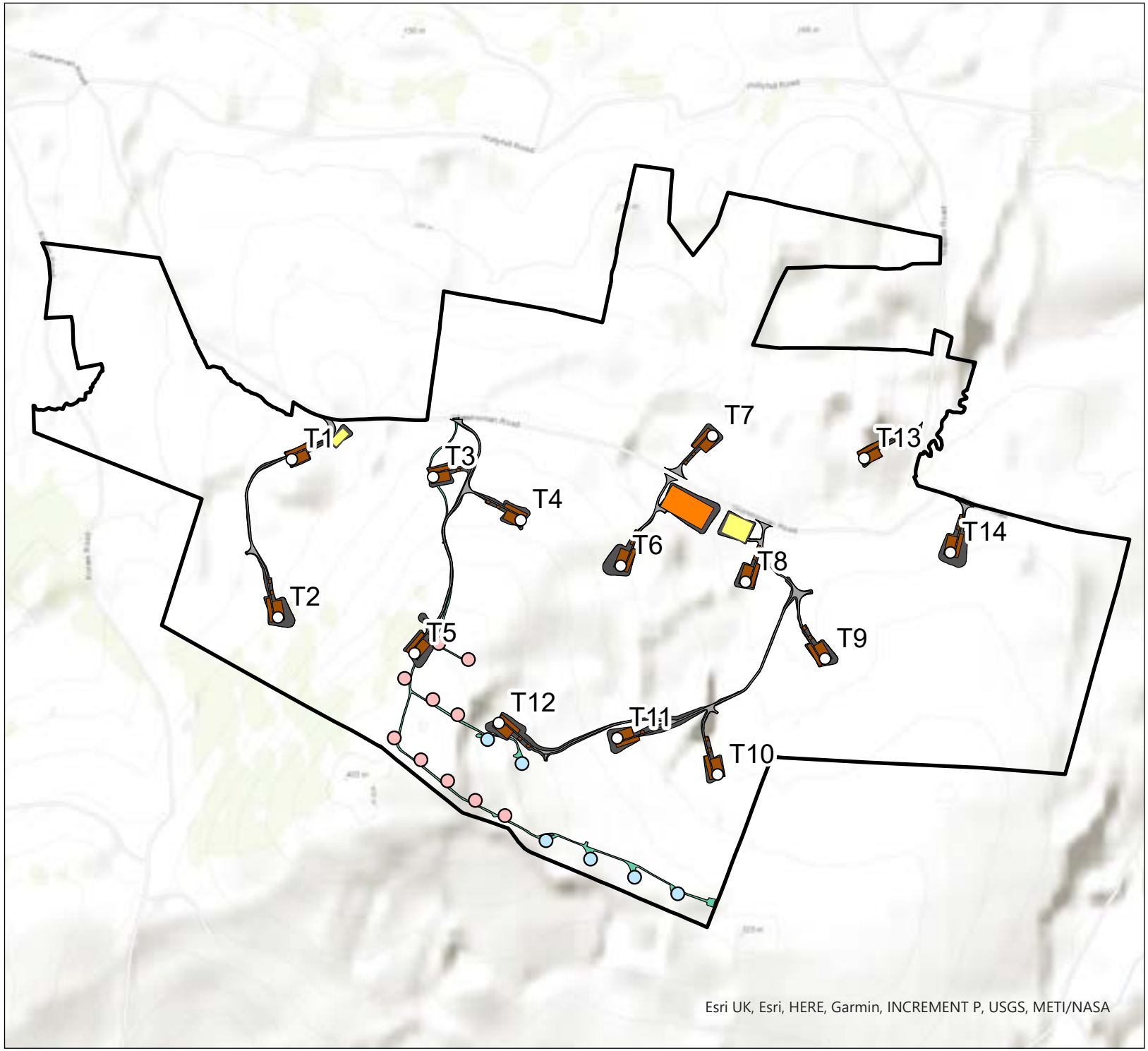
N

Scale	Date	Drawn by	Approved by
1:76,000@A4	21/08/2023	EC	RNF

Woodrow APEM Group.,
Upper Offices,
Ballisodare Centre,
Station Road, Ballisodare,
Co Sligo, F91 PE04, Ireland.
Tel: +353 71 914 0542
Email: info@woodrow.ie

woodrow APEMGroup

Figure Reference: Owenreagh / Craignagapple Wind Farm



woodrow
APEM Group

Owenreagh / Craignagapple
Wind Farm

Development Layout

Legend

- Ecological Study Area
- Proposed Turbine Locations
- Owenreagh 1
- Owenreagh 2
- As Built Site Roads & Hardstands

Proposed Infrastructure

- hardstanding
- access tracks
- construction compounds
- substation
- earthworks

0 410 820 m

N

Scale	Date	Drawn by	Approved by
1:20,000@A4	21/08/2023	EC	RNF

Woodrow APEM Group.,
Upper Offices,
Ballisodare Centre,
Station Road, Ballisodare,
Co Sligo, F91 PE04, Ireland.
Tel: +353 71 914 0542
Email: info@woodrow.ie

woodrow
APEM Group

Figure Reference: Owenreagh / Craignagapple Wind Farm

woodrow
APEM Group

Owenreagh / Craignagapple
Wind Farm

Aerial Overview

Legend

- Ecological Study Area
- Proposed Turbine Locations
- Owenreagh 1
- Owenreagh 2
- As Built Site Roads & Hardstands

Proposed Infrastructure

- hardstanding
- access tracks
- construction compounds
- substation
- earthworks

0 410 820 m

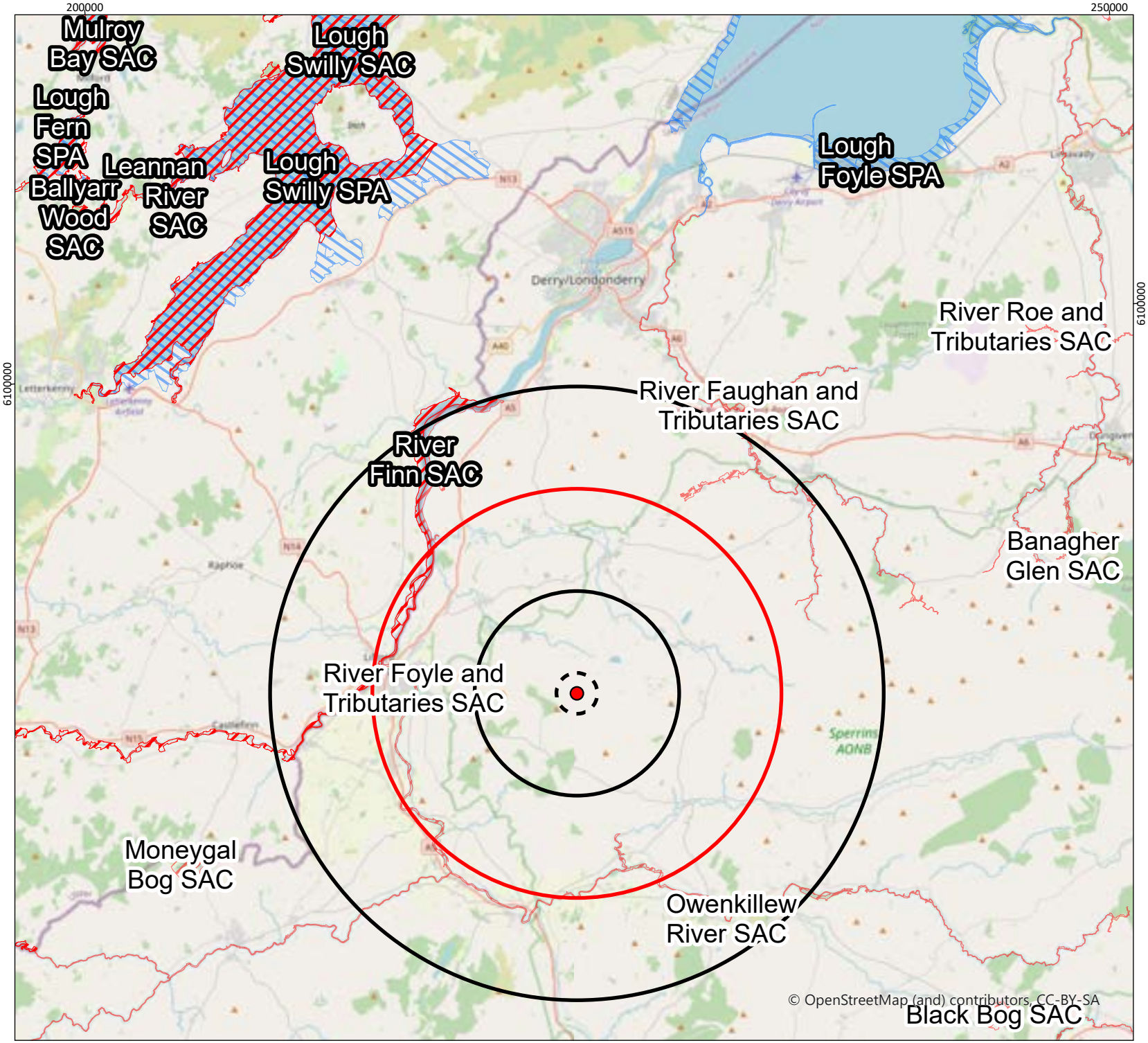
N

Scale	Date	Drawn by	Approved by
1:20,000@A4	21/08/2023	EC	RNF

Woodrow APEM Group.,
Upper Offices,
Ballisodare Centre,
Station Road, Ballisodare,
Co Sligo, F91 PE04, Ireland.
Tel: +353 71 914 0542
Email: info@woodrow.ie

woodrow
APEM Group

Figure Reference: Owenreagh / Craignagapple Wind Farm



Owenreagh / Craignagapple Wind Farm

Internationally Designated Sites

Legend

- Site Centre

Buffers of Site Centre

- 1km
- 5km
- 10km
- 15km

ROI Designated Sites

- ROI SAC
- ROI SPA

NI Designated Sites

- NI SAC
- NI SPA

0 5 10 km

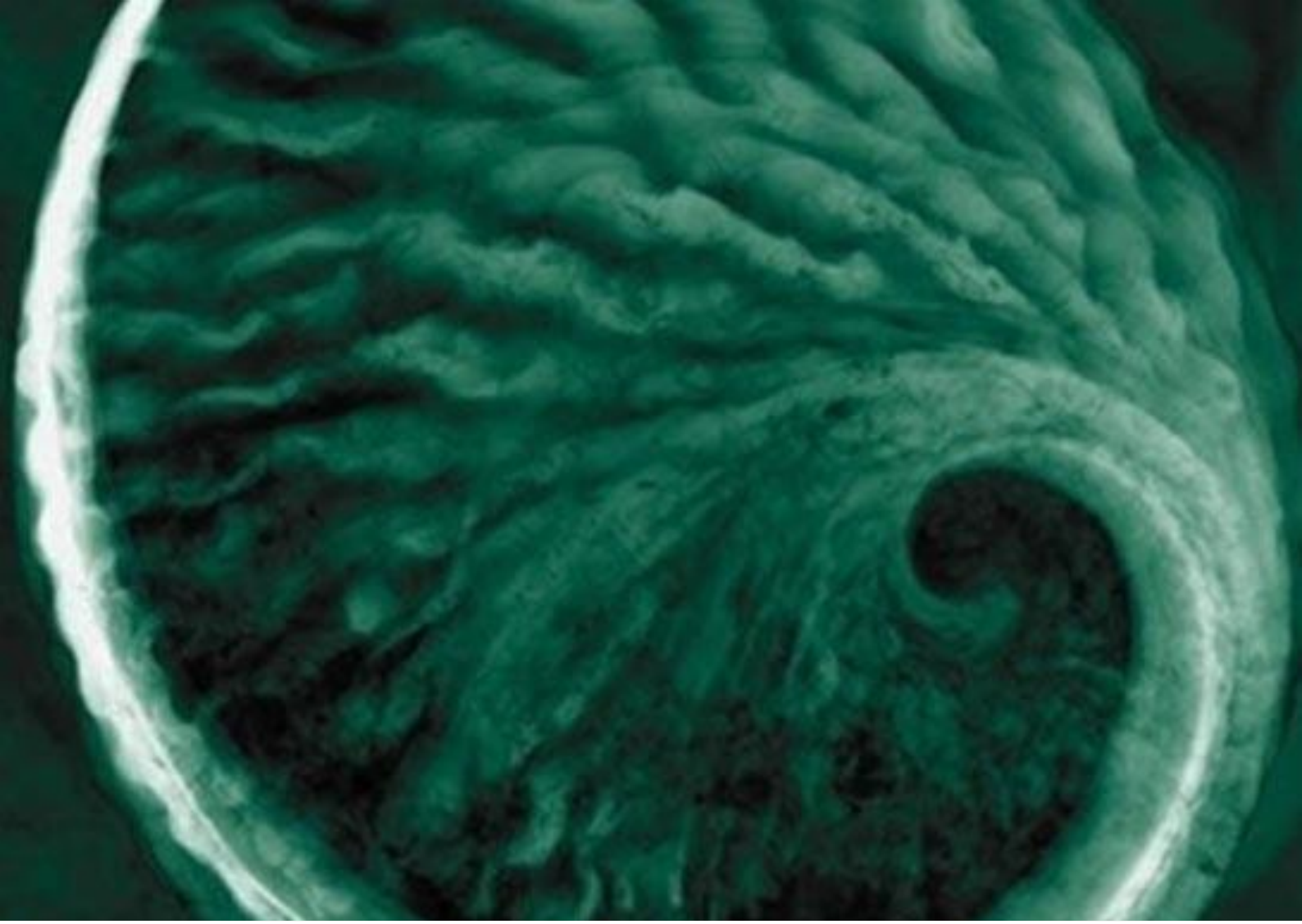
N

Scale	Date	Drawn by	Approved by
1:256,000@A4	21/08/2023	EC	RNF

Woodrow APEM Group.,
Upper Offices,
Ballisodare Centre,
Station Road, Ballisodare,
Co Sligo, F91 PE04, Ireland.
Tel: +353 71 914 0542
Email: info@woodrow.ie

Figure Reference: Owenreagh / Craignagapple Wind Farm

12 Appendix II – Outline Decommissioning and Construction Environmental Management Plan (oDCEMP)



Owenreagh/Craignapple Wind Farm

Ørsted Onshore Ireland Midco Limited

Environmental Statement - Technical Appendix A3.1: Outline Decommisioning and Construction Environmental Management Plan

06 September 2023

Project No.: 0696177

The business of sustainability

ERM

Signature Page

06 September 2023

Owenreagh/Craignagapple Wind Farm

Environmental Statement- Technical Appendix A3.1: Outline Decommisioning and Construction Environmental Management Plan

Magnus Woods
Consultant

Ian Grant
Senior Consultant

Tomos Ap Tomos
Operational Director

Peter Rodgers
Partner

Environmental Resources Management Ireland Limited

D5 Nutgrove Office Park

Dublin 14

D14 X343

Ireland

CONTENTS

Acronyms and Abbreviations

Name	Description
ACoW	Archaeological Clerk of Works
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
BoP	Balance of Plant
BPEO	Best Practicable Environmental Option
CDM	Construction (Design and Management)
CIRIA	Construction Industry Research and Information Association
CoCP	Code of Construction Practice
COSHH	Control of Substances Hazardous to Health
CPP	Construction Phase Plan
CTMP	Construction Traffic Management Plan
dB	Decibels
DfC	Department for Communities
DfI	Department for Infrastructure
oDCEMP	Outline Decommissioning and Construction Environmental Management Plan
DHEMP	Draft Habitat Management Plan
EcMP	Ecological Management Plan

ECoW	Ecological Clerk of Works
EA	Environmental Agency
EIA	Environmental Impact Assessment
EIERP	Environmental Incident and Emergency Response Procedures
ERM	Environmental Resources Management Limited
ES	Environmental Statement
EWC	European Waste Catalogue
GCoW	Geological Clerk of Works
GPP	Guidance for Pollution Prevention
GWDTE	Groundwater Dependent Terrestrial Ecosystem
HED	Historic Environment Division
HGV	Heavy Goods Vehicle
H&S	Health and Safety
HSE	Health, Safety and Environment
IEMA	Institute of Environmental Management and Assessment
NGR	National Grid Reference
NI	Northern Ireland
NIEA	Northern Ireland Environment Agency
NIFRS	Northern Ireland Fire and Rescue Service
NRMM	Non-Road Mobile Machinery
oPMP	Outline Peat Management Plan
PPE	Personal Protective Equipment
PPG	Pollution Prevention Guideline
PSRA	Peat Slide Risk Assessment
SuDS	Sustainable Drainage System
SWMP	Site Waste Management Plan
TDV	Turbine Delivery Vehicle
UKAS	United Kingdom Accreditation Scheme
WTN	Waste Transfer Note
WCI	Watercourse Crossing Inventory
WRAP	Waste and Resources Action Programme
WTG	Wind Turbine Generator
WTSC	Wind Turbine Supply Contractor

1 INTRODUCTION

Environmental Resources Management Inc. (ERM) was commissioned by Ørsted Onshore Ireland Midco Limited ('the Applicant') to prepare an Outline Decommissioning and Construction Environmental Management Plan (oDCEMP) to support an application for planning consent for the Owenreagh / Craignagapple Wind Farm ('the Development'), located approximately 5 kilometres (km) east of Strabane, in County Tyrone ('the Site') and centred on Irish NGR 242862, 396786.

The layout and technical details of the Development are provided In the associated **Chapter 3: Development Description** of the Environmental Statement (ES) and accompanying figures indicated below:

- **Figure 1.1: Site Location Plan**;
- **Figure A3.1.1: Development Layout & Existing Infrastructure;**
- **Figure A3.3.2: Temporary Peat Storage Areas;**
- **Figure 8.4: Watercourse Crossings; and,**
- **Figure 8.5: Groundwater Dependent Terrestrial Ecosystems**

The oDCEMP takes into account specific activities during the construction phase of the Development, including:

- Decommissioning of the existing turbines;
- Removal and restoration of other redundant infrastructure (access tracks, existing substation, and crane hardstandings);
- Excavation and construction of access tracks;
- Excavation and construction of turbine foundations;
- Excavation and construction of hardstanding areas, including crane hardstandings, substation and construction compounds);
- Watercourse crossings;
- Drainage;
- Use of plant on site;
- Storage of materials including Control of Substances Hazardous to Health (COSHH);
- Dust suppression and control; and,
- Management of sediment and surface water.

Appropriate methodologies for the mitigation of environmental effects, including any water-related effects and pollution prevention measures are described in the following sections.

This oDCEMP includes the following appendices:

- Appendix A – Outline Site Waste Management Plan (oSWMP);
- Appendix B – Pollution Incident Response Plan;
- Appendix C – Schedule of Monitoring Proposals;
- Appendix D – Figures.

2 AIMS AND OBJECTIVES

The oDCEMP is intended to demonstrate measures that could be used during the decommissioning and construction phase of the Development to adequately protect environmental resources. Detailed proposals for such measures will be documented prior to construction and will provide the same or greater protection for the environment as those described in this oDCEMP. The measures are proportionate to the risk and, where greater risk is highlighted at specific locations prior to construction, specific measures would be agreed for those locations. Currently, the oDCEMP is sufficiently detailed to enable impacts resulting from the Development and proposed mitigation to be assessed in the ES and meet the requirements of the EIA Regulations.

2.1 Project Environmental Policy

The Development should be delivered in accordance with good construction practice, both in its approach to the management of effects on the environment and its support of local communities.

In doing so, the following approach has been developed and is delivered through the implementation of the oDCEMP and associated plans and reports:

- The Developer, along with the Contractor, the Designers and other parties to the construction process (once appointed) will act collaboratively and cooperatively to achieve the best environmental outcomes;
- The works will progress in accordance with the requirements of the environmental reporting and methods agreed with the Planning Authority and Consultees;
- The Developer undertakes the appointment of a contractor that is competent;
- The Developer undertakes the appointment of a contractor that is experienced in delivering works in environments similar to those at the Site and in implementing mitigation works of a similar nature to those defined in this oDCEMP and environmental reporting within the ES;
- The Contractor plans the work integrating from the outset the objectives of the Development and the environmental requirements defined in this oDCEMP and environmental reporting within the ES;
- The Contractor programmes the work in a manner that is safe and that the work and mitigation measures have the greatest opportunity to be effective;
- The Contractor develops contingency plans for reasonably foreseeable events. The Developer, Designer and other parties take reasonable steps to support the development of the Contractor's plans taking into account responsibilities;
- The Contractor shall take reasonable steps to notify local communities of operations during the Development that may impact on domestic or business activity and will use appropriate methods to manage the impact; and,
- In all operations, management of the environment and control of effects will be an integral part of the design, management and construction process.

2.2 oDCEMP Objectives

The objective of the oDCEMP is to contribute to the successful delivery of the Development, achieved through a structured approach to good construction management taking into account information and research documented in the environmental reporting, whilst incorporating flexibility to accommodate unforeseen conditions and innovation.

A copy of the oDCEMP and related files and reports will be kept in the site offices of the Contractor for the duration of the site works and will be made available for review at any time.

Upon completion of the works, the Contractor will submit a complete copy of the final set of information to the Developer for their records. This information will include electronic scans of all hard copy reports, data, field records and correspondence which are gathered over the course of the construction works, and all updates to the oDCEMP.

It is intended that the oDCEMP will be a live document that is regularly reviewed and updated to reflect conditions experienced onsite.

2.3 oDCEMP Review Process

Where the Contractor has standard documents within their own Company or Corporate Environmental Management Plan which might cover a particular requirement of this oDCEMP, this will be provided to the Developer and the relevant corresponding documents will be made available.

A checklist will be issued providing the Contractor with a summary of the minimum information to be provided to the Developer pre, during and post-construction.

The Developer will undertake review and acceptance of the Contractor's provided information prior to commencement of construction works.

2.4 Guidance and Legislation

The methods set out in this oDCEMP are based on legislation and good practice, including measures agreed with the Northern Ireland Environment Agency (NIEA) for several constructed wind farms. The following guidance is applicable:

- The Construction Industry Research and Information Association (CIRIA), 'Environmental Good Practice On Site (C741)' (2015)[1];
- Environmental Protection Act 1990[2];
- The Pollution Prevention and Control Regulations (Northern Ireland) (2003)[3];
- The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013[4];
- Groundwater Regulations (Northern Ireland) (2009)[5];
- Groundwater Protection Technical Guidance[6];
- CIRIA, 'Control of Water Pollution from Construction Sites (C532)' (2001)[7]; and,
- CIRIA, 'The SuDS Manual (C753F)' (2015)[8].

[1] The Construction Industry Research and Information Association (CIRIA), (2015), Environmental Good Practice on Site Guide (C741), CIRIA: London

[2] UK Government 1990: Environmental Protection Act, 1990 [Online] Available at: Environmental Protection Act 1990 (legislation.gov.uk) Accessed 12/07/2023

[3] UK Government 2003: The Pollution Prevention and Control Regulations (Northern Ireland) (2003) [online] available at: The Pollution Prevention and Control Regulations (Northern Ireland) 2003 (legislation.gov.uk) (accessed 12/07/2023)

[4] UK Government 2013: Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 [online] available at: The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 (legislation.gov.uk) (Accessed 12/07/2023)

[5] UK Government 2009: Groundwater Regulations (Northern Ireland), 2009 [online] available at: Groundwater Regulations (Northern Ireland) 2009 (legislation.gov.uk) (accessed 12/07/2023)

[6] Environment Agency 2017: Groundwater Protection Technical Guidance [Online] Available at: Groundwater protection technical guidance - GOV.UK (www.gov.uk) Accessed 12/07/2023.

[7] CIRIA, (2001), Control of Water Pollution from Construction Sites (C532), CIRIA: London.

[8] CIRIA (2015), The SuDS Manual (C753F), CIRIA, London.

3 DESCRIPTION OF THE DEVELOPMENT

3.1 Site Description

The Site is located approximately 5 km east of Strabane and 6 km south-east of Antigarvan, in County Tyrone. The Site is centred on Irish NGR 242862, 396786. The Site is located entirely within the Sperrin Area of Outstanding Natural Beauty (AONB). The proposed infrastructure is shown in **Figure 3.1: Development Layout**.

The topography of the Site and immediate vicinity is complex and habitats largely consist of improved acid grassland, acid grassland, improved grassland and modified blanket bog. The Site itself varies significantly in elevation ranging from approximately 150 m above Ordnance Survey Datum (AOD, approximately equivalent to sea level) in the west of the Site, to approximately 400 m AOD in the south of the Site. There are a number of hilltops bordering the Site boundary, with no summits located within the Site; Owenreagh Hill to the south (453 m AOD), and Evish Hill to the west (249 m AOD).

The newly proposed turbines and their infrastructure are located adjacent to the operational Owenreagh I and II Wind Farms, which consist of 15 turbines and their associated infrastructure and access tracks. The scope of the Development includes the decommissioning of these wind farms.

3.2 Development Description

The Development comprises the decommissioning and repowering of the operational Owenreagh I and II Wind Farms.

The Development will comprise of the following main components:

- Decommissioning and removal of the existing turbines and substation (pending approval by the relevant authorities);
- Two temporary construction compound/laydown areas (some areas may be reinstated temporarily if required for future operational and decommissioning purposes);
- Removal and restoration of the existing crane hardstandings, access tracks and any other above-ground infrastructure in accordance with the oDCEMP and **Technical Appendix A3.2: Draft Habitat Management Enhancement Plan (DHMEP)**;
- Construction and/or upgrading of seven Site access points onto the public highway;
- Construction of approximately 3,947 m of new access tracks;
- Upgrade of approximately 382 m of existing access tracks;
- Construction of turning heads and passing places on the access tracks;
- The erection of 14 three bladed horizontal axis wind turbines of up to 156.5 m tip height;
- Construction of temporary and permanent hardstanding areas for each turbine to accommodate turbine component laydown areas, crane hardstanding areas and internal or external transformers and/or switchgear;
- Construction of turbine foundations;
- There are no upgraded water crossings and two new watercourse crossings;
- Installation of buried underground electrical and communication cables;
- Construction of a substation and control building, and associated compound, including windfarm and grid connection operating equipment; and,
- Associated ancillary works.

The layout of the Development, existing operational turbines and is shown in **Figure A3.1.1: Development Layout and Existing Infrastructure**.

4 GENERAL POINTS

4.1 Working Hours

Core working hours are proposed to be between 07:00 until 19:00, Monday to Friday with reduced working hours on weekends (unless in exceptional circumstances where need arises to protect plant, personnel or the environment). No works would be undertaken on Sundays and Public Holidays unless continuous operations need to be completed in exceptional circumstances. This will be confirmed in writing by the Planning Authority.

It is anticipated that work will only be undertaken during daylight hours in order to prevent disturbance to local wildlife, such as badgers. The only possible exception to this is the delivery of turbine components, which may take place at night in order to limit disturbance to public road users. In addition to this, a start-up and close down period for up to an hour before and after the core working hours is proposed. This does not include the operation of plant or machinery that may cause a disturbance. Any changes to the construction hours would be agreed in writing with the Planning Authority in consultation with the Environmental Health Officer.

If work is to be undertaken outside of daylight hours, lighting will be used for the works areas only and shall not to be allowed to spill onto neighbouring wildlife habitats. Any lighting required during works will be shielded or fitted with hoods to reduce light spill. Quieter construction activities at this time would be undertaken to reduce disturbance.

Application of the above working hours to manage construction noise and vibration will ensure that effects are minimised as far as reasonably practicable.

Exceptional circumstances in the above context are defined as reasonably unforeseeable circumstances which would result in the curtailment of construction activity, causing an increase in health and safety risk to humans (determined by the construction site manager and/or the Geological Clerk of Works (gCoW)), a risk to wildlife (determined by the Ecological Clerk of Works (eCoW)), or risk to unknown cultural heritage assets uncovered during construction activities (determined by the Archaeological Clerk of Works (aCoW). Examples of this would be ensuring work areas in proximity to public areas are fully secure outside of working hours, or to close up trenches to protect wildlife.

The Applicant, or the Contractors appointed by the Applicant, will notify the Planning Authority of any exceptional situations to the approved working hours 48 hours before these occur.

4.2 Site Induction

The Principal Contractor will ensure that personnel working on and accessing the works are made aware of the content of the oDCEMP relevant to their work via a site induction on any personnel's first visit to the site. This will include an introduction to all health and safety measures applicable on site, as well as any stage-specific environmental considerations. As a minimum, the following information will be provided to all inductees:

Identification of environmental risks associated with the works specific to the work undertaken by the inductee. For example:

- Health, Safety and Environment (HSE) Policy;
- Significant environmental aspects and potential effects of their work;
- Objectives and Targets;
- Submission of environmental improvement ideas, near misses and incidents;
- The implications of not complying with environmental consent requirements;
- Environmental site rules and requirements;
- Species and / or habitat protection requirements;
- Protocol for archaeological discoveries and watching brief;
- Pollution prevention (e.g. silt mitigation and protection of the water environment);
- Waste management practices; and,
- Environmental Incident and Emergency Response Procedures (EIERP).

Stage-specific environmental constraints will be presented in the induction. This will include known sensitive areas, restricted working zones, watercourses and buffer zones, refuelling (or refuelling exclusion) areas, location of skips, etc. Where updates occur, all site personnel will be informed of the change via a Toolbox Talk (see Section 4.3 of this oDCEMP).

4.3 Training and Toolbox Talks

During construction, in order to provide on-going reinforcement and awareness training, Toolbox Talks will be given on environmental issues. Toolbox Talks and training are arranged by the Principal Contractor and delivered by specialist personnel on site as required. The Principal Contractor submits a schedule for Toolbox Talks to the Projects at least one week prior to commencement of construction. The proposed schedule, to be considered as a live document, is consistent with the programme; i.e. toolbox talks for specific environmental issues are scheduled in advance of when those issues are anticipated to be encountered during the construction programme, if possible.

Additional Toolbox Talks are added as required, based on circumstances such as unforeseen risks, repeated observation of bad practices, perceived lack of awareness, pollution events, etc. Specifically, the Principal Contractor provides, as a minimum, environmental training on the following topics:

- Training on the use of spill kits (on ground and in surface waters), provided on a regular basis (to account for staff/sub-contractor changes etc.);
- Training on silt mitigation e.g. installation of silt fencing etc., silt mitigation measures to relevant construction / site staff;
- Contaminated land;
- Archaeology;
- Buried infrastructure; and,
- Ecology.

A record of all training and Toolbox Talks, their content and the attendees will be maintained by the Principal Contractor.

4.4 Control of Lighting

The majority of construction activities will be undertaken during daylight hours. In winter, the short daylight hours may require some temporary lighting to be deployed during construction however, this will be avoided as far as practicable, and lights will not be used outside of core working hours outlined in Section 4.1.

All construction lighting will be deployed in accordance with the following recommendations to reduce or remove impacts on human and ecological receptors:

- The use of lighting will be minimised to that required for safe site operations;
- Lighting will utilise directional fittings to minimise outward light spill and glare (e.g., via the use of light hoods/cowls which direct light below the horizontal plane, preferably at an angle greater than 20° from horizontal); and,
- Lighting will be directed towards the centre of the Site rather than towards the boundaries.

4.5 Control of Noise

The Principal Contractor will prepare a scheme of noise control and mitigation measures based on the final detailed construction plan. This can be submitted for approval in advance of works commencing, if required by the Planning Authority. As the Principal Contractor is yet to be appointed, the detailed construction plan has not been finalised at this stage.

The Principal Contractor will observe BS 5228:2009+A1:2014+A1:2019 Code of Practice for Noise and Vibration Control on Construction and Open Sites[9] (BS 5228) to inform noise control measures during the construction of the Development, with an awareness of noise pollution legislation.

[9] British Standards (2008): BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites.

In accordance with BS 5228 best practice; the Principal Contractor will establish a process for handling any noise-related complaints during the construction period. These will be recorded, and a log will be maintained that will include details of the response and any action taken. This will be available upon request for inspection to the Planning Authority. All enquires whether a query or a complaint will be dealt with in a timely manner. Any complaints with regards to noise will be investigated as soon as practicable, and will be logged, along with the action taken to prevent further exceedances.

Any complaints received are to be recorded into the register within 24 hours. The interested party will be notified what action is being taken to address the enquiry/ complaint as required.

The good practice measures detailed below will be implemented to manage the effects of noise during construction operations, and will be required of all contractors:

- Operations shall be limited as set out in section 4.1;
- Deliveries of plant and materials by heavy goods vehicles (HGV) or boat to Site shall only take place by designated routes and shall be limited to the working hours detailed in Section 4.1 or such other times as agreed with the Planning Authority;
- The site contractors shall be required to employ the best practicable means of reducing noise emissions from plant, machinery and construction activities, as advocated in BS 5228;
- Non-tonal and / or directional reversing alarms should be used;
- Where practicable, the work programme will be phased, which would help to reduce the combined effects arising from several noisy operations;
- Where necessary and practicable, noise from fixed plant and equipment will be contained within suitable acoustic enclosures or behind acoustic screens;
- The main contractor and all sub-contractors will be required through their contract to comply with all environmental noise conditions, as listed within any future planning permission(s);
- Where practicable, night-time working will not be carried out. Local residents shall be notified in advance of construction activities likely to take place outside of the normal working hours, and noise activities will be kept to minimum during such times; and,
- Any plant and equipment required for operation at night (23:00–- 07:00), e.g. generators or dewatering pumps, shall be silenced or suitably shielded to ensure that the night-time lower threshold of 30 decibels (dB) shall not be exceeded at the nearest noise-sensitive receptors.

4.6 Invasive Species Management

A pre-construction invasive/non-native species survey shall be conducted in the year prior to the commencement of construction along the Abnormal Load Route within and immediately adjacent to the red line boundary. Chemical control will be implemented throughout the area by either a contracted invasive species control Specialist or by the relevant Competent Authority. A targeted and detailed invasive species management plan will be drawn up to ensure the appropriate treatment of invasive species to avoid their spread further afield in the areas where encountered. Further details on invasive species management is detailed in **Technical Appendix A2.3: Abnormal Load Route Works** and **Technical Appendix A10.1: Ecological Impact Assessment**.

4.7 Pollution Prevention

Produced historically by the Environment Agency (EA), archived Pollution Prevention Guidelines (PPGs)[10] outline previous advice statutory responsibilities and good environmental practice. Each PPG addresses a specific industrial sector or activity. Whilst the PPG documents have now been archived by the EA, they still provide a useful resource for managing on site activities.

The following are of relevance to surface water groundwater, and soil resources at the Site:

- PPG1: Understanding Your Environmental Responsibilities[11];

[10] Environment Agency (2007) Pollution prevention advice and guidance [online] available at: [ARCHIVED CONTENT] Environment Agency - Pollution prevention advice and guidance (PPG) (nationalarchives.gov.uk) (Accessed 12/07/2023)
[11] Environment Agency (2007) PPG 1: Understanding Your Environmental Responsibilities [online] available at: Title (publishing.service.gov.uk)(accessed 12/07/2023)

- PPG2: Above ground oil storage tanks[12];
- PPG3: Use and design of oil separators in surface water drainage systems[13];
- PPG4: Disposal of sewage where no mains drainage is available[14];
- PPG5: Works and maintenance in or near water[15];
- PPG6: Working at construction and demolition sites[16];
- PPG7: Safe storage: The safe operation of refuelling facilities[17]
- PPG18: Managing fire water and major spillages[18]; and,
- PPG21: Pollution incident response planning[19].

A review plan for the PPGs is currently underway, replacing them with a replacement guidance series, Guidance for Pollution Prevention (GPPs) [20]. GPPs provide environmental good practice guidance for the whole UK and environmental regulatory guidance directly to Northern Ireland. The following GPPs are of relevance:

- GPP2: Above ground oil storage tanks[21];
- GPP4: Treatment and disposal of wastewater where there is no connection to the public foul sewer[22];
- GPP5: Works and maintenance in or near water[23];
- GPP13: Vehicle washing and cleaning[24];
- GPP21: Pollution incident response planning[25]; and
- GPP26: Safe storage – drums and intermediate bulk containers[26].

DAERA-NIEA have produced a series of standing advice notes which detail the measures that must be implemented in order to meet legislative and policy requirements. The following standing advice notes apply to potential effects on the water environment as a result of the Development:

[12] Environment Agency (2011): PPG 2: Above Ground Oil Storage Tanks [online] available at: Title (nationalarchives.gov.uk) Accessed: 12/07/2023
[13] Environment Agency (2006): PPG 3: Use and design of oil separators in surface water drainage systems [online] available at: Layout 1 (nationalarchives.gov.uk) Accessed: 12/07/2023
[14] Environment Agency (2006): PPG 4: Disposal of sewage where no mains drainage is available [online] available at: New EnvAgency PPG4 (nationalarchives.gov.uk) Accessed 12/07/2023
[15] Environment Agency (2007): PPG 5: Works and maintenance in or near water [online] available at: pmho1107bnkg-e-e.pdf (nationalarchives.gov.uk) Accessed 12/07/2023
[16] Environment Agency (2010): PPG 6: Working at construction and demolition sites [online] available at: pmho0412bwfe-e-e.pdf (nationalarchives.gov.uk) Accessed 12/07/2023
[17] Environment Agency (2011): PPG 7: Safe storage: The safe operation of refuelling facilities [online] available at: Title (nationalarchives.gov.uk) Accessed 12/07/2023
[18] Environment Agency: PPG 18: Managing fire, water and major spillages [online] available at: EnvAgency PPG18_6pp (nationalarchives.gov.uk) Accessed 12/07/2023
[19] Environment Agency (2011): PPG 21: Pollution Incident response planning [online] available at: [ARCHIVED CONTENT] (nationalarchives.gov.uk) Accessed 12/07/2023
[20] NetRegs (2021): Guidance for Pollution Prevention (GPP) [Online]. Available at: Guidance for Pollution Prevention (GPP) documents | NetRegs | Environmental guidance for your business in Northern Ireland & Scotland (Accessed 12/07/2023)
[21] NIEA et al (2018): GPP 2: Above ground oil storage tanks [online] available at: guidance-for-pollution-prevention-2-2022-update.pdf (netregs.org.uk) Accessed 12/07/2023
[22] NIEA et al (2021): GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul water [online] available at: guidance-for-pollution-prevention-4-2022-update.pdf (netregs.org.uk) Accessed 12/07/2023
[23] NIEA et al (2018): GPP 5: works and maintenance in or near water [online] available at: GPP 5: Works and maintenance in or near water | NetRegs | Environmental guidance for your business in Northern Ireland & Scotland Accessed 12/07/2023
[24] NIEA et al (2021): GPP 13: vehicle washing and cleaning [online] available at: guidance-for-pollution-prevention-13-2022-update-v2.pdf (netregs.org.uk) Accessed 12/07/2023
[25] NIEA et al (2021): GPP 21: Pollution incident response planning [online[available at: gpp-21-final.pdf (netregs.org.uk) Accessed 12/07/2023
[26] NIEA et al (2021): GPP 26: safe storage – drums and intermediate bulk containers [online] available at: guidance-for-pollution-prevention-26-2022-updated.pdf (netregs.org.uk) Accessed 12/07/2023

- Discharges to the water environment[27];
- Pollution Prevention Guidance[28];
- Sustainable Drainage Systems[29]; and,
- Culverting.[30]

The works will be planned and carried out in line with the PPGs and GPPs and standing notes. The following other principles will be applied:

- All works will comply with Control of Water Pollution from Construction Sites – A Guide to Good Practice, CIRIA (SP156 – 2002);
- Appropriate spill and leak containment systems will be incorporated into the construction procedures to ensure no uncontrolled releases of contaminants occur;
- Storage of fuels, oils and chemicals will be in appropriately bunded static tanks within the site of the relative works. This storage will be in compliance with the respective Control of Substances Hazardous to Health (COSHH)[31] assessments; and,
- Refuelling will take place within dedicated refuelling areas within the site. Where applicable, fuel systems will have automatic shut-off pistol grip nozzles.

Oil and fuel storage containers will meet the following requirements:

- Bunded to at least 110% of the volume stored;
- Associated pipework to be stored within the bund;
- Located at least 10 m from any existing surface water drainage systems;
- Mobile bowsers will be locked when not in use;
- Mobile bowsers will be double-bunded.
- Using appropriate measures e.g. drip trays when refuelling at all locations and providing spill kits with these at all working areas; and,
- If required, construction plant will only be washed in designated areas.

4.7.1 Water Quality Monitoring

A surface water monitoring programme will be established prior to the construction phase of the Development. An indicative monitoring programme is set out below.

Visual inspections of any drainage or nearby surface watercourses will be regularly carried out by the Project Hydrologist, especially during major excavation works. This will allow rapid identification of changes to water quantity or water quality that could indicate construction related effects are occurring. Potential effects will then be investigated, and remedial action taken to prevent further effects, if necessary.

To supplement the visual inspections, it is anticipated that there would be a number of surface water monitoring points for extractive sampling and analysis. Details will be agreed with the NIEA prior to construction.

The following sampling frequency is proposed in order to establish baseline hydro-chemical conditions of surface water constituents:

- Once every month for 12 months prior to the construction phase.

[27] DAERA-NIEA (2017): Standing Advice – Discharges to the water environment [online] available at: DAERA Standing Advice – WTR – Discharge to the water environment – November 2017.pdf (daera-ni.gov.uk) (Accessed 12/07/2023)
[28] DAERA-NIEA (2022): Standing Advice – Pollution Prevention Guidance [online] available at: DAERA Standing Advice – WTR – Pollution Prevention Guidance – Sept 2022 Final.pdf (daera-ni.gov.uk) Accessed 12/07/2023
[29] DAERA-NIEA (2020): Standing Advice – Sustainable Drainage Systems [online] available at: DAERA Standing Advice - WTR - Sustainable Drainage Systems - November 2017.pdf (daera-ni.gov.uk) Accessed 12/07/2023
[30] DAERA-NIEA (2017): Standing Advice – Culverting [online] available at: DAERA Standing Advice - WTR - Culverting - November 2017.pdf (daera-ni.gov.uk) Accessed 12/07/2023
[31] Health and Safety Executive: Control Of Substances Hazardous to Health (COSHH) [online] Available at: Control of Substances Hazardous to Health (COSHH) - COSHH (hse.gov.uk) Accessed 12/07/2023

The following sampling frequencies are proposed in order to monitor surface water conditions against baseline conditions:

- Once a month in-situ monitoring and sampling throughout the duration of the construction phase; and,
- Once a month in-situ monitoring and sampling for 3 months post construction.

Establishing baseline conditions for surface waters will enable any trends in levels of critical parameters to be assessed and deviations from the norm identified and rectified through water management measures, such as the use of silt fencing and settlement lagoons. Surface water management measures are discussed in Section 6 of this oDCEMP

4.7.2 Pollution Incident Procedure

Measures have been taken in the design to prevent pollution incidents, such as the use of a sump at each transformer bund within the substation. The purpose of the sump is to collect any oily water and divert it through a separate drainage system where the oil will be separated from the water before the water is discharged into the Site water drainage, soakaway or to surface water. In the event of an incident resulting in pollution, e.g. spillage of fuel or other chemicals, the following additional responses will be made:

- All incidents will be immediately reported to the Site Manager and Health and Safety (H&S) Manager and logged;
- Appropriate spill kits will be available at all times and employed during any such instances in order to try and limit and contain the affected area; and,
- Compliance with the Emergency Response Procedures, detailed further in Section 4.8.

The NIEA's guidance on pollution prevention encourages the reporting of all spillages, particularly under the following circumstances:

- Incidents that the operator cannot deal with, or does not know how to deal with;
- Spills that reach surface water drains or flow into the ground;
- Spills that run over hard surfaces and leave the site or run into surface waters; and,
- Fires where the fire service has been called out.

If any of these criteria are met, the pollution incident will be reported to the NIEA as soon as possible.

The excavation of turbine foundations, access tracks and other infrastructure elements has the potential to have a direct impact upon geological features.

A range of mitigation measures exist to reduce the effects on underlying geology and aquifer. This includes measures for avoiding the likelihood of spills and leakages, such as:

- The implementation of properly designed shoring systems to avoid unstable excavations;
- The removal of superficial deposits should be minimised wherever possible;
- Limiting of refuelling activities to designated, impermeably surfaced areas and use drip traps where possible;
- Checking and maintain equipment regularly to ensure that leakages do not occur; and,
- Ensuring site inductions are completed for all staff including the Principal Contractor and sub-contractors; include the above procedures and the locations of spill kits.

4.8 Emergency Response Procedures

Emergency Response Procedures will be contained within the Construction Phase Plan (CPP) written by the Principal Contractor. This includes evacuation procedures, emergency access and egress, muster points, location of first aid facilities and a list of emergency contact telephone numbers for key personnel and emergency services. Emergency arrangements will be documented on all site notice boards, and would include details of:

- A map with route to nearest medical facilities (Altnagelvin Area Hospital, Derry, Londonderry);
- Emergency contact number (Police, Fire and Rescue and Ambulance);

- On-site team contacts;
- Incident Notification;
- First Aid Arrangements;
- Fire Emergency Arrangements;
- Environmental Incidents; and,
- Security Arrangements.

All personnel will be made aware of and required to follow Site Emergency Protocols. This will form part of their induction process.

Should an incident involving injury or damage to vehicles or plant take place, the Site should be left undisturbed as far as is reasonably practicable (in accordance with personal health and safety). Where it is necessary to move equipment, materials or people to prevent or reduce environmental impact, photographs will be taken, wherever reasonably practicable (in accordance with personal health and safety), to allow easy reconstruction of the incident layout for any required investigative purposes. Both the Principal Contractor and Employer will be immediately notified of any incidents and contact will be made with the relevant emergency services, if required. Section 4.7 of this document details pollution prevention measures that will be followed in the event of an environmental incident.

Consultation with the Northern Ireland Fire & Rescue Service (NIFRS) will be sought by the Applicant to develop an adequate emergency response in the event of a fire. The Applicant will provide the fire services with all of the necessary information and will provide updates during operation as required.

4.9 Site Inspections

Environmental site inspections will be undertaken by the Principal Contractor's onsite Environmental and Consents Manager supported by the wider site team. In addition, throughout construction at a frequency to be agreed as appropriate to the construction activity underway at the time, inspections and audits will be carried out by the Employer's Environmental Manager. Health and Safety inspections will be undertaken by the Employer's H&S Manager.

The results of these inspections will be fed back to both the Principal Contractor and the Employer. Evidence of good practices are highlighted and where issues are identified, remedial actions will be put in place.

4.10 Fire Prevention and Control

The office and welfare facilities associated with the Site will have in place appropriate plans and management controls to prevent fires in line with the Joint Code of Practice on the Protection from Fire on Construction Sites (^{9t}h ed.)[32]. A response plan, in the event of a fire breaking out, will be explained to personnel during site inductions. The Plan will be prepared by the Principal Contractor and will be specific to the works being undertaken.

4.11 Natural Peat Slide

The potential exists for a natural peat slide to occur after heavy rainfall events. As detailed in Table 16 of **Technical Appendix A9.1: Peat Slide Risk Assessment**, to avoid the potential for injury or damage from natural peat slide works should be postposed during and for a period after heavy rainfall events. This is defined by the Met Office as 4mm per hour or greater; however, the parameters for the project should be agreed prior to construction based on weather averages for the area.

4.12 Ecological Clerk of Works

There is a requirement for an Ecological Clerk of Works (eCoW) to be appointed for certain periods of times in areas of sensitivity from commencement of decommissioning/construction to final commissioning of the Development, or end of the construction period, whichever is the latter. The

[32] Construction Industry Publications and Fire Protection Association (1992): "Fire Prevention on Construction Sites – The joint code of practice on the Protection from Fire of Construction Sites and Buildings Undergoing Renovation – 9th Edition"

scope of the work of the eCoW will be decided in consultation with NIEA-DAERA and shall include, but not be limited to:

- Monitoring compliance with the ecological mitigation works – including measures for the protection of water vole, nesting birds, bats, badger, invertebrates and common amphibians, plus mitigation measures for reptiles following the detailed presence/absence surveys;
- Providing advice on adequate protection of nature conservation interests onsite;
- Providing contractor tool-box briefings about legally protected species and their habitats;
- Ensuring any required protected species licences are in place and providing advice and monitoring compliance with the licence conditions;
- Ensuring visual checks on surrounding watercourses are carried out regularly to identify possible construction effects; and,
- To ensure sediment and chemical pollution prevention measures are employed correctly and replaced when required.

Further details regarding the role of the eCoW are provided in **Technical Appendix A3.2: DHMEP** and **Chapter 11: Ornithology**.

4.13 Project Hydrologist

A project hydrologist will be required for certain periods of time in areas of sensitivity during pre-construction and construction phases of the proposed project in order to monitor water quality and drainage associated with proposed project activities. The project hydrologist will be responsible for managing a programme of inspection and maintenance detailed in section 4.6.1. Should any adverse change be noted, an investigation will be undertaken as to whether the change could have been caused by the Development, and appropriate remedial action will be taken.

4.14 Geotechnical Clerk of Works

A Geotechnical Clerk of Works (gCoW) will be appointed to monitor slope stability during pre-construction and construction phases of work, including for both peat stability and non-peat related stability.

4.15 Archaeological Clerk of Works

An Archaeology Clerk of Works (aCoW) will be required to monitor any activities which require ground-breaking within 25 m of WS1 and to implement a watching brief during groundworks associated with construction of turbines 1, 3, 4, 6, 7, 8, 9, 13 and 14 and their associated infrastructure, including groundworks for hardstanding, construction compounds, substations, access tracks and cable trenching. The aCoW will also monitor any groundworks associated with the construction of the off-road section of the Abnormal Load Route within 25 m of the farmstead buildings, which were identified as a non-designated cultural heritage asset during the walk over survey that was conducted as part of **Technical Appendix A2.3: Abnormal Load Route Works**.

4.16 Housekeeping

A good housekeeping policy will be applied at all times. The following principles will be applied:

- All working areas will be kept in a clean and tidy condition;
- Construction sites and working areas will be secured to prevent unauthorised access;
- Open fires and the burning of rubbish will be prohibited at all times;
- All necessary measures will be taken to minimise the risk of fire and the Principal Contractor will comply with the requirements of the local fire authority;
- Adequate welfare facilities will be provided for site and construction staff;
- Site waste will be stored securely to prevent wind blow;
- Rubbish will be removed at frequent intervals; and,

- All reasonable steps will be taken to ensure mud, water and other loose material does not encroach onto the public highway, and if it does, steps will be taken to immediately address the concern.

4.17 Public Liaison, General Enquiries and Complaints

The Principal Contractor has in place a plan covering community liaison, enquiries and complaints which will be contained within the CPP. Measures that will be adopted by the Principal Contractor as part of the construction works include:

- The Communications Manager will establish a system for dealing with enquiries or complaints from the public, local authorities or statutory consultees;
- Displaying an information board containing contact names, telephone numbers and addresses, and the helpline number at appropriate locations on the boundaries of the Site will be in place to inform the local community;
- Prior to commencing main construction activities, occupiers of premises in the vicinity of the works will be notified by the Contractor of the nature of the works, access restrictions, and provided with contact details to which any enquiries should be directed;
- Any complaints that may arise will be logged, reported and addressed. The system will include measures to keep all relevant parties informed about the progress of complaints;
- Complaints will be investigated and where required, mitigation implemented; and,
- A complaint close-out report will be provided, as appropriate. Discussions will be undertaken to agree a timescale for this.

During construction, any external enquiries or complaints relating to an environmental and consents matter shall be reported to the Principal Contractor's Communications Manager, as well as the Environmental/Consents Manager, eCoW and the H&S Manager.

The Communications Manager will then work with the onsite team to investigate, address, and respond to the complaint accordingly. Environmental complaints will be recorded on the Principal Contractor's HSE system in accordance with HSE management procedures.

Records of complaints are regularly monitored by the Principal Contractor and Employer to check that an appropriate and timely response has been made, and to identify emergent trends which may require further investigation. Roles and responsibilities are defined further in Section 4.13 of this document.

4.18 Environmental Roles and Responsibilities

Environmental roles and responsibilities vary between different stages of the Projects. Information regarding roles specific to the works can be found below.

Employer: The Employer fulfils the role of the commercial client, and as such has oversight of all construction work packages. The Employer ensures that project requirements are properly implemented, controlled, and effectively documented. It is the Employer's responsibility to ensure that suitable processes and resources are in place to ensure the Principal Contractor complies with the health, safety, and environmental obligations.

Principal Contractor: The Principal Contractor will lead responsibility for practical construction of the Development, including the appointment of a competent Site Manager, Health and Safety (H&S) Manager, and sub-contractors, agreeing and setting construction environmental targets with the Employer, and ensuring all activities are in compliance with the requirements of documents and management plans such as a Code of Construction Practice (CoCP) and detailed Construction Environmental Management Plan and other associated reports and appendices. This contractor will be deemed to be the Principal Contractor for the purposes of the Construction (Design and Management) Regulations (Northern Ireland) 2016 (CDM Regulations)[33].

Site Manager: The Site Manager will have the overall day to day responsibility for the delivery of the Works and will oversee all operational aspects of the construction programmes.

[33] UK Government 2016: The Construction (Design and Management) Regulations (Northern Ireland) 2016 [online] available at: The Construction (Design and Management) Regulations (Northern Ireland) 2016 (legislation.gov.uk) Accessed 12/07/2023

H&S Manager: The Health and Safety (H&S) Manager role is to oversee and enforce the implementation and adherence to all relevant health & safety provisions within the site. This role will have overall responsibility for maintaining and updating H&S provisions, and be on site to advise, guide, support and promote awareness of the onsite requirements to all personnel. The H&S role will be filled by an appropriately qualified and experienced staff member of the Principal Contractor.

Environment and Consents Manager: The Employer will appoint an appropriately competent person or persons (the Environment and Consents Manager) to undertake relevant environmental tasks and supervision as detailed in this document, prior to, during and upon completion of the Works. Together with the Principal Contractor and their Designated Onsite Environment and Consents Manager and the eCoW, the Environment and Consents Manager will monitor and report CoCP and oDCEMP implementation through liaison with the H&S Manager, Site Manager, and other parties as appropriate.

Designated Onsite Environment and Consents Manager: The Principal Contractor will appoint an appropriately competent person or persons (the designated onsite Environment and Consents Manager) to undertake relevant environmental tasks and supervision as detailed in this document, prior to, during and upon completion of the Works. Together with the Employer's Environment and Consents Manager, the Principal Contractor and their eCoW, the designated onsite Environment and Consents Manager will monitor and report CoCP and oDCEMP implementation through liaison with the H&S Manager, Site Manager, and other parties as appropriate.

eCoW: A suitably qualified and experienced eCoW will be appointed and will be responsible for providing advice about ecological issues and helping to ensure that the measures specified in an Ecological Management Plan (EcMP) are implemented correctly and in line with industry guidance.

Project Hydrologist: A Project Hydrologist will be required to monitor water quality and drainage associated with the Development, particularly in hydrologically sensitive areas. The project hydrologist will be responsible for overseeing a programme of inspection and maintenance as detailed in Section 4.7.1 of this oDCEMP

gCoW: A gCoW will be appointed to monitor slope stability in-line with the mitigation measures set out in **Technical Appendix A9.1: Peat Slide Risk Assessment (PSRA)**. The gCoW will be responsible for monitoring areas of both peat related stability and non-peat related stability.

aCoW: An aCoW will be appointed to oversee any activities which require ground-breaking within 25 m of WS1 and to implement an observation programme for groundworks associated with the construction of turbines 1, 3, 4, 6, 7, 8, 9, 13 and 14 as well as their associated infrastructure. The aCoW will also oversee any activities which require ground-breaking within 25 m of non-designated cultural heritage asset that was identified in the vicinity of the off-road section of the Abnormal Load Route.

Communications Manager: A Communications Manager will be appointed and will establish a system for dealing with enquiries or complaints from the public, local authorities, or statutory consultees. Any complaints that may arise will be logged, reported, and addressed and complaint close-out reports will be produced and submitted.

5 DECOMMISSIONING AND CONSTRUCTION METHODOLOGY

This section of the oDCEMP is provided to outline the methods to be employed during the decommissioning and construction phases of the Development. These methods will inform the Balance of Plant (BoP) Principal Contractor's detailed method statements produced as the Development progresses to reflect conditions, programme and requirements of the CDM Regulations.

5.1 Decommissioning of Operational Owenreagh I & II

5.1.1 Background

The first phase of the Development will comprise the decommissioning and removal of the existing turbines from the Owenreagh I and II Wind Farms. It is anticipated that the turbines and external transformers will be carefully dismantled and exported offsite, possibly for resale in the second-hand market or recycling, with landfilling of turbine components only to be used as an option of last resort. It is anticipated that this will run in parallel with the construction phase of the Development.

The decommissioning phase is expected to last approximately three months following an initial period of four weeks, during which the temporary construction compounds will be constructed and existing access tracks and hardstanding areas will be cleared of any vegetation and upgraded for use by decommissioning plant as required.

Significant environmental risks are not anticipated as a result of decommissioning, however risks need to be addressed in order to ensure that minimal, if any, effects on the environment occur. Best practice methods as well as mitigation measures outlined for construction in the ES and Technical Appendices also apply to the decommissioning phase.

5.1.2 Decommissioning Details

Following initial track construction and upgrade, cranes will be used to split the turbines into suitable sections, which will then be transported offsite by HGVs. Following removal of the blades, cables will be disconnected and lowered with control cables left in place, before the tower sections are lowered.

Concrete broken out from existing infrastructure will be reused if possible. Where this is not possible, materials will be assessed for reuse offsite or recycled.

Landfilling of turbine components or other materials generated during the decommissioning will be a last resort and will be undertaken in accordance with current Waste Regulations by the appointed Principal Contractor. All wastes will be dealt with in accordance with the SWMP, contained in Appendix A of this oDCEMP.

The existing substation building will be demolished, and all interior and exterior components taken off site for reuse or recycling wherever possible. The footprint from the demolished substation will be cut to 1 m below the surface and backfilled with suitable topsoil, generated from the construction activities elsewhere in the Site.

In locations where the areas of the turbine and transformer bases will not form part of the new crane hardstanding and laydown areas, they will be cut to 1 m below the surface and backfilled with suitable topsoil, generated from the construction activities elsewhere in the Site. Areas of hardstanding and access track which are being reused will be retained, whilst unaffected areas of hardstanding and access track that have already naturally regenerated will either be left in-situ, or removed and reinstated, with materials reused in construction materials elsewhere on the Site in accordance with **Technical Appendix A3.2: DHMEP.**

Redundant tracks will be broken out and stone removed or reused on site if a suitable use can be identified. Reinstatement of tracks, turbine foundations, the existing substation, and hardstandings will be undertaken by use of either:

- Soil material retained on site during the original construction; or
- Imported soil and topsoil.

The reinstatement of any areas disturbed during the decommissioning works will be undertaken by the Principal Contractor. The Principal Contractor will be required to record excavated volumes and storage areas, as well as volumes and types of material used for reinstatement and relevant areas.

Should the import of materials be required, they will be accompanied by either a Declaration of Analysis, written confirmation that material was produced under a quality control procedure in accordance with the Waste & Resources Action Programme (WRAP) quality protocol, or other applicable procedures in place at the time of the decommissioning works.

Seeding may be required if suitable vegetation turves are unavailable. Seed mixes will be selected to match with existing habitats in the surrounding areas, following advice from the eCoW.

5.2 Access Tracks

5.2.1 Introduction

The extent of construction disturbance is limited to areas along and adjacent to access tracks and hardstanding areas. These works shall be monitored on an ongoing basis by the eCoW. All proposed infrastructure has been sited at least 50 m from any watercourse, where practicable. Areas where this buffer from watercourses is encroached is detailed further in Section 8.5.1.1 of **Chapter 8: Hydrology and Hydrogeology**.

It is anticipated that all access"trac's will be constructed from graded stone aggregate won from cut activities, re-use of existing materials from redundant infrastructure and stone imported from local quarries. An appropriate sample ratio based on volume will be obtained and tested by a suitably United Kingdom Accreditation Scheme (UKAS) accredited laboratory to confirm the material is not contaminated and is adequate for the construction works.

5.2.2 Design Basis

The outline design of tracks and hardstanding areas has been developed in accordance with the relevant turbine manufacturer specifications, which determines the minimum and maximum geometric requirements.

Access tracks shall be constructed to a minimum running width of 5 m, plus a minimum shoulder or verge width of approximately 0.5 m on either side, to accommodate the maximum transport requirements and specifications of the Turbine Delivery Vehicles (TDVs). Existing tracks will be widened where required as detailed in **Technical Appendix A13.1: Abnormal Load Risk Assessment** to accommodate component deliveries and vehicle movements forming any passing places and turning heads.

Track shoulders may increase up to a width of 2 m to accommodate cabling along the access track alignment as required.

To minimise any disturbance, tracks will generally follow existing contours where possible for routes used by TDVs.

5.2.3 Onsite Track Design

The route of the new tracks will be surveyed, pegged out and agreed with the eCoW ahead of construction operations. Micro-siting, as approved by the eCoW, is permitted up to 50 m, distances beyond this will require approval from the Planning Authority.

5.2.4 Upgraded Existing Tracks

Approximately 382 m of existing access tracks will require localised widening. This may involve the re-routing of drainage ditches on whichever side of the track is being widened, which will likely involve the excavation of a cut-off ditch.

The verge will be excavated on the widened side of the track and the road will be constructed to the design level, tying-in to the existing track at a running width of at least 5 m.

5.2.5 New Access Tracks

Access tracks will be formed on suitable underlying material (soil or rock with sufficient bearing capacity) in the following manner:

- Stripping of surface vegetation (turves) and careful stockpiling of this material (where not floating tracks);

- Excavating the remaining superficial soil materials (overburden) and stockpiling this material;
- Where different overburden materials are present these will be stored according to type. This material shall be monitored and watered (as appropriate) to be retained for reinstatement purposes;
- The exposed suitable track formation shall have rock fill material tipped from dumper trucks directly onto the proposed access track alignment and spread by dozer or track machine; and,
- This material shall then be either; spread by a dozer or placed by a hydraulic excavator and compacted in layers, typically using vibratory rollers.

Access tracks shall be formed from a sub-base of general fill and finished off with a capping stone/wearing course of graded crushed rock to provide a finish to a specification appropriate for the design loading. Wearing course stone shall be of a suitable material that is not susceptible to breaking down/weathering to a high fines content material. In a number of areas, access tracks will be formed in large cuttings which will also maximise the sourcing of rock material for re-use as fill and structural materials.

Maintenance of the running surface will be carried out on a regular basis, as required, to prevent undue deterioration. Loose track material generated during the use of access tracks will be prevented from reaching watercourses by maintaining an adequate cross fall on the tracks. Periodic maintenance of tracks by way of brushing or scraping will be carried out to minimise the generation of wheel ruts, which could lead to some road material being washed away.

In dry weather, dust suppression methods may be required for track and hardstanding areas. The Site access tracks, hardstandings and trackside drains will be inspected regularly by the BoP Contractor. Records of such inspections will be held on-site for review by the eCoW.

5.2.6 Cut Roads and Drainage

In areas where peat is shallow (i.e. generally less than approximately 1 m below ground surface), the road formation will be created by a cut and fill operation. A lateral drain will be established on the uphill side of the road to drain water from the slopes and cross drains will be established at regular intervals as determined by site conditions.

Peat and topsoil, where present, will be stored beside the road for use in re-instatement of road shoulders. Consideration will be given to the potential for entrapment of snow and water in their placement. The management of peat and excavated materials is discussed further in **Technical Appendix A3.3: Outline Peat Management Plan (oPMP).**

Where the peat layer is typically of 1 m thickness or greater and side slope is significant or where failure of the peat could result in landslip, the peat may require to be excavated down to rockhead or suitable sub-soil horizon, leaving batters on each side with angles sufficient to ensure stability of the peat batter. Similarly, for excavations typically less than 1 m, but where the local gradient gives concern with regards to the stability of the peat, suitable slopes shall be adopted for stability.

A cut-off ditch will be established uphill of the batter to avoid significant water flow over it, thereby minimising erosion. The running surface of the road will have a cross-fall in order to drain run-off into the ditches. A lateral drain will be made on the uphill side of the road with cross drainpipes at appropriate locations where necessary. The diameter of the cross drains will be calculated taking account of the catchment for each pipe. A ditch will be constructed on the low side of the track as necessary. The outlet of the drain will be at appropriate locations, with hessian/copra mats placed at the outfalls (where appropriate) in order to minimise erosion during periods of heavy rainfall or snow melt.

5.2.7 Floating Roads

The final alignment of tracks will be as per the approved planning drawings and will avoid, as far as micrositing allows, track sections through areas of deep peat (depths greater than 1 m). However, where this is not possible, and where the existing ground gradient is relatively flat and the peat layer is typically of 1 m thickness or more, a floating road design may be required, ensuring that the risk of failure due to landslip is mitigated.

Floating road construction comprises the laying of a geosynthetics (geotextile mat or geogrid reinforcement) across the peat prior to construction of the road. A layer of crushed stone would then

be laid upon the geosynthetics resulting in a raised track with a verge of approximately 1 m. Where necessary, risk from run-off will be mitigated by directing drainage to settlement areas. Erosion processes on roadside embankments and cuttings will be mitigated by ensuring that gradients are below stability thresholds, which will also enable effective regeneration of vegetation. Sediment traps will be required in the early years following construction until natural regeneration is established. Should unexpected, significant erosion or sedimentation take place at any location it will be addressed by the re-grading and re-vegetating of slopes by hydro-seeding with heavy mulch. Seeding mixes will be determined in consultation with the eCoW.

By developing both the existing ground model and peat depth models, the construction methods will be determined based on topography, watercourses, risk sensitivity and peat depths.

Further information on floating tracks in included in **Technical Appendix A3.3: oPMP**.

5.2.8 Onsite Vehicle Movements

As noted above, access roads will be designed to be single track, approximately 5 m wide. The provision of intermittent passing places at appropriate locations taking account of horizontal and vertical track alignments may be required. These are likely to be approximately 5 m wide and 80 m long to accommodate the longest anticipated TDV (blade delivery vehicle will be an articulated vehicle which consists of a tractor unit and an extendible trailer measuring 58.7 m long and 3.09m wide for the transportation of the blades. The blades will overhang the back end of the trailer by 10.5m). The passing places will be constructed, where required by turbine supplier, alongside the access track to facilitate safe traffic movement on-site, unless existing hardstandings and/or turning heads are available. The tracks have been designed to allow circular vehicular movement to reduce the requirement for vehicles turning on-site.

Additional widening will be provided on bends to facilitate the movement of the large delivery vehicles associated with turbine tower and blade delivery.

During the periods of delivery of the large components, the BoP Contractor will use appropriate site communications and access control techniques to enable safe operation of the roads.

The presence of crane pads and laydown areas will facilitate traffic movement on-site. Internal track junctions will also be locally widened to facilitate multiple options for construction traffic movement. This will allow vehicles to move more directly between construction locations and double as passing places. The crane hardstand will include a turning area large enough for an HGV.

5.2.9 Unstable Ground

Unstable ground is considered to be any ground conditions encountered along the proposed alignment, or within the immediate vicinity and influence, of the access tracks that:

- Has insufficient strength in its existing state to support the proposed load conditions or to remain in situ for the duration of the construction works; and
- Has experienced natural failure (i.e. not as a consequence of the Development construction works) prior to, but along the alignment of, or within the immediate vicinity and influence of, the proposed access track alignment such as to require re-alignment of the works, or major civil engineering solution to maintain the proposed alignment.

Should any unstable ground be encountered during access track construction, the following procedure shall be adopted:

- Access track construction in the immediate area of the unstable ground shall cease with immediate effect;
- The BoP Contractor shall immediately consult a suitably qualified and experienced geotechnical engineer;
- If relocation lies within the approved micrositing allowances of the proposed access track alignment is possible and acceptable to the eCoW/ACoW (as appropriate) without potential for further ground instability to occur, then construction may recommence along the newly agreed alignment, and any mitigation measures that may be required of the unstable ground shall occur in parallel; and,

- Any alteration to the proposed track alignment or infrastructure which falls outwith the 50 m micrositing limits will be agreed with the Planning Authority prior to any works in such areas commencing onsite.

If required, the risk from unstable ground will be assessed by a specialist gCoW and implemented through **Technical Appendix A9.1: PSRA.**

5.3 Crane Hardstandings

The Development consists of 14 crane hardstandings, each extending to a maximum working area of 173.75 m x 62.8 m. These dimensions may change following confirmation from the turbine supplier. This is required to accommodate all permanent and temporary laydown areas for installation of the turbine components. Locations and orientations are optimised to make best use of the existing topography, prevailing wind conditions (to enable safe lifting) and the chosen erection procedure. Additionally, the crane hardstanding orientation takes into account ecological or other environmental constraints. As with access tracks, turfs topsoil and subsoil will be removed wherever possible and stored separately adjacent to the removal area for later reinstatement up to the edge of the hardstanding.

The area will be set out to the required dimensions (typically a main crane and a tail crane hardstanding will be required) and excavated to a suitable formation. Construction of the crane hardstanding will be similar to the construction of the site tracks. Surplus excavated material will be stored adjacently until the opportunity of reuse, or utilised in reinstatement and track maintenance during construction, as appropriate. Surplus topsoil will be used to restore track edges after construction or removed from the Site. Standard fill will then be placed and compacted in layers using compaction equipment. Geotextile may be used depending on the suitability of the underlying strata. The final surface will be formed from selected granular material and trimmed to allow surface water run-off to drainage ditches. The crane pad will remain in situ for the operational life of the Development, although may be partially covered with excavated materials and seeded with a local seed mix.

Typical crane hardstanding details are shown in Figure 3.6 and their proposed locations are shown in Figure 3.1: Site Layout Plan, both in **Chapter 3: Development Description**.

Upon final decommissioning of the Development, the crane hardstandings will be covered with local peat/topsoil and seeded with a local seed mix as agreed with the eCoW and detailed within the Decommissioning Statement. The final ground level will be profiled to suit the surrounding ground.

5.4 Turbine Foundations and Erection

The limits of each of the foundation excavations will be surveyed and pegged out in advance of any proposed works, and the eCoW (and ACoW where required) shall be consulted to ensure all necessary pre-construction checks have been completed.

Each turbine foundation will require steel reinforcement which will be delivered to Site on a flat-bed vehicle and then connected together to provide the reinforcing cage.

Each turbine foundation will be excavated at a larger area up to 35 m diameter and generally at approximately 3 m depth, although this will vary locally based on ground conditions whilst accounting for any cut slopes to be profiled to a stable gradient (measurements depend on final turbine model). This will allow safe batter slopes to be excavated, and sufficient space to allow shuttering for concrete, placement of steel reinforcement and concrete teams to gain access.

The construction activities assoc”ated’lith the turbine foundation are detailed below:

- Stripping of surface vegetation (turves) and careful stockpiling of this material as detailed in Section **Error! Reference source not found.**;
- Excavating the remaining superficial soil and rock materials and stockpiling of this material as detailed in Section **Error! Reference source not found.**;
- The stockpiled materials are to be retained for restoration purposes;
- Soil will be excavated until a suitable formation can be achieved. Where rock is encountered this will most likely be removed by mechanical excavation to the required depth and material stockpiled as described above. The potential impacts associated with the use of hydraulic

breakers or other such vibratory equipment in the vicinity of sensitive ecological receptors or watercourses shall be assessed and appropriate mitigation measures implemented where required in consultation with the ECoW;

- The foundation design is based on the most efficient use of materials and local ground conditions;
- Temporary barriers and fencing shall be erected at locations where there are safety implications for any persons likely to be present on the Site e.g. around open excavations. Signage will be displayed clearly to indicate deep excavations and any other relevant hazards associated with the foundation excavation works;
- Cut off ditches will be used where necessary at the perimeter of foundation excavations to divert the clean water away from the work areas thereby reducing the volume of water potentially requiring pumping/treatment in silt traps/settlement lagoons. It is not anticipated that large scale dewatering will be required during the excavations. Any sump pumping of excavations shall be via surface silt traps to minimise and avoid where possible any sediment entering surrounding watercourses. Settlement lagoons will be employed in areas where the level of runoff is likely to exceed levels normally contained within a silt trap, however it is considered unlikely that these will be required. Wash-out areas at each base, (if required) will be lined and contained to prevent wash-out water entering drainage/surface waters. The material from the wash-out will be disposed of appropriately onsite;
- Following excavation, levels will be set to allow the blinding concrete to be placed and finished to the required line and level;
- The steel reinforcement shall then be finished to the required design specification. Most of the steel reinforcement will have been fabricated off site, and then delivered to Site and stockpiled adjacent to the respective turbine base;
- The formwork will be pre-fabricated of sufficient quality and robustness to allow repeated use. Formwork will be cleaned after each use and re-sprayed or painted with mould oil within the blinded foundation excavation prior to being fixed in place. The placement of containers with mould oil will be strictly monitored to ensure that storage is only in bunded areas (e.g. in the Temporary Construction Compound) on sealed hardstanding. Spraying of mould oil and storage of such sprayed materials will be undertaken in such a way as to avoid pollution;
- Sulphate resistant concrete or other suitable concrete, as appropriate for the prevailing ground conditions, will be used in the turbine base. Prior to pouring the base concrete, the overall quality of the steel fixing will be checked to ensure there is sufficient rigidity to cope with the weight of personnel and small plant during the pour. The quantity, size and spacing of the reinforcement bars will be checked against the construction drawings to ensure compliance with the design detail. The position of the foundation insert and/or bolt ring, or other appropriately designed foundation mechanism supplied by the turbine manufacturer will be checked to ensure that the level is within the prescribed tolerances. A check will also be carried out to make sure the correct cover from edge of reinforcement to edge of concrete is maintained throughout the structure. A splay will be formed on all external corners;
- The line of ducts will be checked so as not to leave sharp corners that will cause cable snagging and that all bend radiuses comply with the design illustrated on the construction drawing. All earthing cable or strip connections will also be examined to prove their adequacy to withstand the rigors of the concrete placing process;
- Concrete will be supplied to the foundation location through an on-site batching plant or through concrete deliveries. As with all concrete deliveries, a record shall be kept against each turbine to indicate the source of supply, type and consistency of the mix. A record will also be kept of the personnel involved, and the time and date the pour commenced and finished;
- The concrete pour will commence after the blinding concrete has been cleaned of debris and other loose material. Vibrating pokers will have been checked to ensure they are fuelled by compressed air and are in good working order. The pour will proceed under the control of the BoP Contractor. Pouring will follow best working practice procedures and fresh concrete will be protected from hot and cold weather as required;
- Shutters will be carefully loosened, removed and cleaned no earlier than 24 hours from the finish of the pour; and
- Backfilling to the turbine base will proceed in layers of approximately 0.3 m with compaction as necessary. Further layers of material will be laid until the original till level is attained. Peat or soil will be replaced from storage until the original ground level is reached. In the event that there is

limited on-site material to compact above the turbine foundation, then imported material may be required. This will typically be a well graded granular product that should be available from the onsite borrow pits.

A checklist for each foundation will be prepared to show compliance with the documents of each step of the installation process. These lists, once completed, will be stored in the BoP Contractor's Quality Assurance file along with relevant cube test results, and be available for inspection at all times.

Following the completion of all construction activities, the area surrounding the base shall be reinstated. Figure 3.5 in **Chapter 3: Development Description** of the ES shows typical turbine foundation details.

On completion of foundation curing, the Wind Turbine Supply Contractor (WTSC) will be responsible for the supply and installation of the Wind Turbine Generators (WTGs) and ancillary components. This will likely consist of the following operations:

- Site installation and unloading of WTSC equipment, WTGs and other materials;
- Preassembly of turbine components onsite;
- Preassembly of towers onsite;
- Installation of the steel tower segments and of the turbine component nacelle, hub and rotor;
- Cabling works inside the nacelle and tower (preparation for grid connection); and,
- Clearing the Site and appropriate disposal of waste.

5.5 Substation and Control Building

The substation compound will measure up to 90 m x 180 m including a control building measuring. The structure will have a concrete floor, and the switchgear within a hardstanding area.

Welfare facilities including a toilet will be provided for the duration of the operation of the Development. Sewage waste will be collected in a temporary septic tank, managed on-site and will be taken by road going tanker off site by a licensed approved waste contractor.

A rainwater collection and purification system or borehole may be installed to service the welfare room, and electricity will be provided from a local electricity connection or a back-up diesel generator.

As detailed in Section 5.1.2, the existing substation will be removed and the area reinstated, pending approval from NIE.

5.6 Cable Laying

WTGs will be connected to the national grid via the onsite substation. Onsite underground power cables will be run in covered trenches between the turbines, and adjacent to the access track before entering the substation building. The cables will be laid in a trenching operation with sufficient lengths opened up, laid and reinstated sequentially.

On-site cable trenches will be typically up to 1.5 m wide and the cables laid at a depth of approximately 1 m.

The position of trenches will be marked out and the line stripped of turves and soils, which will be set aside for reinstatement. Ecologically sensitive areas will be avoided by construction plant or vehicles. The majority of cable installation will be undertaken adjacent to and within the track construction zone to minimise intrusion into the surrounding areas.

Where topography or ecological constraints dictate (over limited sections of the Site), the cables will be installed in ducts within the existing track corridor.

In areas of trenching, the vegetation layer and peat/topsoil will be removed and segregated from the removed subsoil for use in reinstatement. If necessary, where depth allows, further segregation of the vegetation layer and peat/topsoil will be undertaken to prevent burying of the upper vegetation layers in deeper soil on replacement.

Sand will be imported to the Site and will be placed around the cables as protection. Suitable duct marker tape shall be installed in the trench prior to backfilling.

Following testing of the cables, the trench will be backfilled and compacted in layers with suitable material and reinstated with previously excavated surface soils. The method of reseeding, should it be required, will be agreed with the ECoW.

All backfilling and re-instatement will be completed as soon as practical after excavation.

Where cables are laid in wetland areas or other zones that would negatively be impacted by dewatering as advised by the ECoW, backfill to cable trenches will include clay bunds at a maximum of 50 m intervals. The purpose of these is to ensure cable trenches do not act as a drainage pathway with the potential to impact on these sensitive areas.

Where cables cross open gullies and ditches, they will be installed in ducts and incorporated in the access road crossing points. During installation operations, cable trenches will be temporarily dammed uphill of the watercourse and a filter placed downstream to avoid silt migration along the trench into the watercourse.

5.7 Watercourse Crossings

The avoidance, where possible, of works in the vicinity of mapped watercourses and minimisation of new water crossings was a key consideration during the design of the Development in order to reduce the likelihood of pollution and damage to the receiving environment.

Two new watercourse crossings are proposed and there will be no upgraded watercourse crossings. Utilising existing watercourse crossings as much as possible minimises the potential for impediment to flow as a result of new crossings being installed.

It is possible that crossing locations may change as a result of more detailed ground investigation works and micrositing during construction. The BoP Contractor is responsible for liaising with the NIEA and the Department for Infrastructure (DfI) Rivers, and obtaining all relevant consents, licences and authorisations relating to the construction of watercourse crossings at the Site.

All construction works at the Site, and specifically construction works to be undertaken within and in the vicinity of any watercourses, shall be completed in compliance with current legislation and best practice as detailed within the oDCEMP.

As part of design mitigation, all turbine locations, site compounds, and other permanent and temporary structures (with the exception of access tracks) have been sited with a minimum separation of 50 m from watercourses and drainage runs where possible. Access tracks have also been routed 50 m away from watercourses, where possible. At select locations this buffer will be encroached and the potential effects from this encroachment are further assessed in Section 8.5.1.1 of **Chapter 8: Hydrology and Hydrogeology**.

However, as tracks are required to cross watercourses at certain locations, appropriate design and construction of watercourse crossings is required.

The ECoW shall be consulted on all watercourse crossing works. Surveys by the ECoW will be carried out immediately prior to construction of the watercourse crossings to identify areas of ecological interest and more specifically, mammal activity to ensure that adequate mitigation is built into the design.

Watercourse crossings are discussed in greater detail in Section 6.8 of the oDCEMP.

A Watercourse Crossing Inventory (WCI) is included in **Technical Appendix A8.4: WCI** of the ES.

5.8 Temporary Construction Compounds

Two temporary construction compounds are proposed, the compound adjacent to T8 will measure 100 m x 80 m, while the compound in the west of the Site will have dimensions of 70 m x 35 m. It is proposed that the compounds will include the following:

- Portacabins for site office and staff welfare facilities with provision for sealed waste storage and removal;
- Areas for storing materials;
- Parking for project related vehicles; and,
- Containerised storage for tools and spares.

Indicative compound arrangements are shown in Figures 3.12a and 3.12b in **Chapter 3: Development Description** respectively.

All areas of the Site, including construction compound areas, shall be kept clean and tidy with a regime of good housekeeping established to facilitate mobility of personnel and plant/equipment around the site and eliminate potential hazards and environmental pollution.

If necessary, the Construction Compounds would be microsited to use flatter ground following detailed ground investigations. The compound areas will be built by stripping turves/peat/topsoil and re-graded. A geotextile or geo-grid may be laid across the area to spread loading if required, and a crushed rock/sub-base layer would be placed to form a hardstanding. All crushed rock used will have a reduced fines content to reduce the risk of sediment contamination.

The stripped turves/peat/topsoil will be stored adjacent to the compounds in a linear bund typically no greater than 2 m in elevation for future restoration purposes.

Any uncontaminated surface run-off from the compounds will be accommodated in a shallow swale or soakaway which will be constructed as a perimeter ditch to avoid contamination of watercourses should there be a spillage.

A facility will be provided to shut off drainage run-off from the temporary construction compounds to contain any contaminants in the event of spillage for subsequent remediation. Details on oil storage is discussed further in Appendix A of this oDCEMP.

All other run-off from the Site will follow natural drainage patterns and newly installed drainage routes.

The compound and laydown areas will be reinstated at the end of the construction period. Reinstatement will involve removal of the imported material and underlying geotextile. The exposed substrate will be gently ripped and the stored subsoil and topsoil replaced. The surface will be re-seeded as required using the same seed mix or naturally re-generated as agreed with the ECoW.

5.9 Access to the Development

Turbine delivery vehicles and other construction vehicles will access the Site via the local road network. The proposed haul route is shown in Figure 13.1 in **Chapter 13: Traffic and Transport.**

5.10 Post-Construction Restoration

The BOP's Principal Contractor will provide detailed methods for reinstatement, landscaping and re-profiling at the detailed design stage which will be included in updated versions of the oDCEMP. This will include restoration of track verges, turbine bases, construction compounds, cable trenches, other disturbed areas and redundant construction features (such as drainage mitigation measures, concrete wash-out areas and other features which may not be required as part of the permanent works).

Excavated material from the access tracks will be used for dressing the side slopes of track sections.

Where practicable, reinstatement and re-profiling of, and around, infrastructure will be carried out as the work front progresses, or as soon as is practical after the substantial completion of the works in a particular area. Early reinstatement and re-profiling are required to minimise visual impact and temporary storage/stockpiling of soils.

The preferred method for restoration of excavated or disturbed areas is to replicate the principal habitat communities found within the area. Reinstatement will be undertaken by re-use of onsite vegetation and soil using turf/clodding methods. Vegetation monitoring carried out by the ECoW who will determine if re-seeding is required. Should re-seeding be required, species appropriate to the surrounding vegetation will be selected.

Following construction, the temporary construction compound will be restored by removing the stone material and underlying geotextile and replacing with the stored soils/subsoils.

Similarly, on completion of the access tracks, the peat materials previously excavated from the tracks and stored adjacent to the tracks, will be used to dress off the verges of the new track as part of an on-going reinstatement process. Any turves should be re-instated as soon as is practicable.

The backfilling of the bases will involve a similar process to the reinstatement of tracks, with peat excavated from the area being stored separately in acrotelmic and catotelmic layers and then being replaced using the same methods. All peat, including acrotelmic and catotelmic, will be re-used in the

works within track verges, hardstandings, reinstatement of borrow pits and material extraction areas. No peat will be deposited off-site. Details of peat re-use and reinstatement principles are included in **Technical Appendix A3.3: oPMP**.

Restoration activities will be overseen by the ECoW to ensure methods are properly adhered to.

6 MANAGEMENT OF SEDIMENT AND SURFACE WATER

This section addresses the management of sediment and surface water run-off generated during the construction phase of the Development, through good practice construction techniques.

Drainage from the Site will include elements of Sustainable Drainage Systems (SuDS) design, where appropriate. SuDS replicate natural drainage patterns and have a number of benefits:

- SuDS will attenuate run-off, thus reducing peak flow and any flooding issues that might arise downstream;
- SuDS will treat run-off, which can reduce sediment and pollutant volumes in run-off before discharging back into natural drainage network; and,
- In addition, any installed drainage management system, where necessary, will be implemented to avoid any surface water run-off to public roads.

All works within watercourses and discharges to watercourses require a Schedule 6 consent to be gained in advance of works commencing and shall be implemented in accordance with the Schedule 6 consent.

6.1 Pre-Earthworks drainage

Pre-earthworks drainage relates to the required drainage measures to be installed prior to earthwork activities such as access track and other infrastructure construction.

Best practice pre-earthworks drainage measures include:

- Cut-off/ diversion ditches;
- Temporary interception bunds;
- Swales; and,
- Retention ponds.

Pre-earthwork drainage should be installed immediately prior to earthworks and construction works commencing. Final details of the pre-earthworks drainage system design will be provided by the contractor in accordance with the requirements at the specific location within the site.

The appointed contractor is to ensure appropriate drainage infrastructure is put in place. This could include for temporary interception bunds and cut-off drainage ditches (‘clean water drains’) being constructed on the ‘high-side’ boundary of the earthwork operations to prevent surface water run-off entering excavations. Run-off collected in the drainage ditches will be diverted along a channel which follows the natural gradient of the ground, avoiding steep gradients.

The profile of the ditch can vary from a ‘v’ shape to a ‘u’ shape but should have a constant uniform depth. The profile of cut-off ditches is generally a 1 in 4 slope but will depend on the soil type and stability at the Site.

If appropriate, the use of ‘u’-shaped vegetated ditches is preferential, these are also known as swales. The dimensions and gradient of swales will be kept to a minimum to prevent rapid flow of water. Swales to collect runoff will be placed on the downslope of earthworks and stockpiles and will be designed to treat potentially silty runoff before discharging back into the drainage system. This may include constructing check dams within the channel and employing silt management measures. The use of retention ponds allows for additional storage capacity during heavier rainfall events.

All pre-earthworks drainage channels should be re-instated unless required for long-term drainage on the site. No exposed soils should remain, and turves should be emplaced to prevent erosion.

Where exposed soil is to be left for a long period before reinstatement or re-seeding, other measure to prevent erosion may be required:

- Geotextiles (biodegradable and non-biodegradable);
- Mulching/ binders/ hydro-seeding;
- Turf cut from other areas on site; and,
- Surface roughening.

6.2 Earthworks drainage

Drainage for permanent or semi-permanent earthworks is required to control surface water run-off and discharge to appropriate outlets.

Best practice earthworks drainage measures include:

- Drainage ditches;
- Sumps; and,
- Culverts.

6.2.1 Purpose / Aim

To manage surface water run-off from earthworks and manage and allow for continuity of the natural drainage of surface water and groundwater from higher elevations to lower.

6.2.2 Pre-Installation

Prior to temporary access track and earthwork construction, site operatives will identify flush areas, depressions or zones which may concentrate water flow so that site drainage design will maintain hydrological connectivity. Detailed site drainage design will be produced in advance of construction. **Technical Appendix A8.5: Outline Surface Water Drainage Strategy** and **Chapter 8: Hydrology and Hydrogeology** of the ES provides additional details regarding flush areas, drainage design, and hydrological connectivity.

6.2.3 Installation

All earthworks will have a gravity drainage system and all water will drain to an adequately sized sump. If dewatering of excavations is necessary, wastewater will be treated using the aggregate sub-base, further details are provided in Appendix A: Outline Site Waste Management Plan. Trackside drainage ditches are to be constructed parallel to the access track and follow the same gradient as the access track.

Plate 5.1 Example of a trackside drainage ditch and cross-drainage culvert

Water within channels shall be allowed to flow and shall not be stagnant, and tracks shall be free from standing water through inclusion of camber or cross-fall. Sustainable drainage systems such as

swales with vegetated channels are preferential and will be designed to intercept, filtrate and convey run-off.

The ditches surrounding the site are managed by DfIRivers, therefore any discharge or works within a watercourse would require a Schedule 6 consent from the DfI. Discharge approval will be sought through DfI consultations during the pre-construction phase of the Development. Settlement lagoons should be installed at drainage ditch outlets, prior to discharge to watercourse. They will be constructed to allow for adequate attenuation of water and settlement of sediments to peak river flow plus a climate change allowance. Silt mats should be used at the outfalls of settlement lagoons and retention ponds to further aid the settlement of sediment from earthworks drainage. The use of retention ponds will allow for additional storage capacity during heavier rainfall and storm events.

6.2.4 Management of Drainage from Surplus and Loose Materials

Careful consideration will be given to the location of topsoil and subsoil storage areas for all areas of the Development during construction, in accordance with the **Technical Appendix A3.3: oPMP**. Storage areas will be either in a flat dry area away from watercourses or be protected by the addition of cut off drains above the storage areas to minimise the ingress of water. Temporary peat storage areas have been sited to avoid areas of active peat, as shown on Figure A3.3.2: Temporary Peat Storage Areas.

The use of soil stockpiles will be minimised by earthworks planning. However, where stockpiles are used, silt fences and silt mats will be employed to minimise sediment levels in run-off.

All stockpiled material will be stored at least 50 m from watercourses in order to reduce the potential for sediment to be transferred into the wider surface water system and will be regularly inspected to ensure that erosion of the material is not taking place. Stockpiles must be regularly monitored for holes, and they should also be fenced to ensure that they do not attract badger activity.

An example of a stockpile / overburden and the installation of drainage ditch to divert run-off from the stockpile material is shown in Plate 5.1.

Plate 5.1: Example stockpile and drainage ditch (under construction)

6.3 Discharge of water

Discharge of water from the Site will follow the methods outlined within **Technical Appendix A8.5: Outline Drainage Strategy**[34]. This section considers the discharge of surface water drainage to the water environment and does not consider foul drainage from welfare facilities.

[34] ERM (2023) *Outline Surface Water Drainage Strategy*

6.4 Provision For Storm Events

Flood Maps (NI)[35] produced by DfI Rivers show areas of Northern Ireland with a 0.5% (1:200) or greater chance of flooding. These areas are known as medium to high risk areas for flooding.

These flood maps indicate that although several waterbodies at the Site and surrounding areas are at medium to high risk of flooding, this is restricted to the waterbodies themselves. The flood maps do not indicate that widespread flooding across the Site is likely.

During flood events the welfare facility will be utilised as a point of refuge should excavation of the Site not be feasible.

The Development will have a remote shut down system to allow electrical infrastructure to be isolated during times of flooding with staff having to attend the Site.

6.5 Foul Drainage

This is described in Appendix A of this oDCEMP.

6.6 Sediment pollution prevention

Mitigation measures should minimise mobilisation and release of sediments to the water environment. Water polluted by sediments are not allowed to leave the site untreated and the final discharge from the site must have acceptable levels of sediment (in line with baseline levels).

The contractor will work under a wet weather working policy during construction. Works that could mobilise sediments and impact the water environment would be stopped during heavy precipitation events.

6.6.1 Silt Traps and Silt Matting

Silt traps may be utilised to trap and filter sediment-laden run-off from excavation works at the Site, including foundations for the sub-station, temporary construction compounds and temporary access tracks.

Silt traps and matting are to be installed at the following locations:

- Within drainage ditches but will be sited to avoid slopes with a gradient greater than 1 in 20;
- At the inlet (sump) or outlet side of culverts; and,
- At the outfall of settlement lagoons to filter sediment during times of heavy rainfall as shown in Plate 5.3.

[35] DfI Rivers: Flood Maps (NI) [online] available at: Flood Maps NI | Department for Infrastructure (infrastructure-ni.gov.uk) (Accessed 12/07/2023)

Plate 5.2: Example silt matting (combined with silt fencing)

The silt traps and silt matting will be monitored by the ECoW and should be cleared regularly and replaced when necessary.

6.6.2 Silt Fencing

Silt fences are a semi-permeable geotextile fabric arranged in the form of a fence (attached to timber posts) as shown in Plate 5.4.

Silt fences are to be used as perimeter controls on the site at the downslope end of earthworks or disturbed soils. They should be used in conjunction with other sediment and water treatment solutions, such as settlement lagoons, where required.

To comply with best practice, they should be installed as follows:

- Installed perpendicular to the gradient of the slope;
- Construct a trench on the up-gradient side;
- Install stakes on the down-gradient side; and,
- Position with a curve to the end of the fence in the up-gradient direction to help capture surface run-off as shown in **Error! Reference source not found.**.

Silt fences should not be installed in the following:

- Within drainage ditches or channels; and / or,
- Running parallel to the direction of slope.

Plate 5.4: Typical Silt Fencing

Silt fencing will be monitored by the ECoW and should be cleared regularly of sediment and silt build-up, and after heavy rainfall and storm events. Silt fencing will should be replaced, when necessary, as monitored by the ECoW.

6.6.3 Check Dams

Check dams will be utilised to facilitate the settlement of suspended solids by slowing the flow of water within the drainage ditches. Appropriately sized stone pitching will be used and installed at regular intervals within ditches, as shown in Plate 5.5.

Plate 5.5: Check dam example

6.6.4 Settlement Lagoons

Settlement lagoons allow for contaminated water to be retained to allow for the settlement of silt and sediments to an acceptable level prior to discharge to the water environment. They will be implemented where appropriate and take the form of large trenches dug into the ground and are often bunded, as shown in Plate 5.6.

To avoid harm to wildlife, strong, badger-proof, fencing must be used around any lagoons to prevent animals from entering and drowning.

Plate 5.6: Settlement Lagoon Series

Settlement lagoons should be installed so as to retain water long enough for silt to settle out. The length of time required will depend on the type of silt with finer silts and clays taking longer to settle.

Further guidance on the required dimension of settlement lagoons is provided in GPP5: Works and maintenance in or near water[36].

To comply with best practice, they should be installed as follows:

- Install energy dissipation methods (e.g. rip-rap) at the inlet to minimise flow;
- Install inlet pipe work vertically to dissipate energy of flow in;
- Install a lined inlet chamber and outlet weir with materials such as geotextiles;
- Install a long outlet weir; and,
- Install two or three lagoons in a series to increase silt retention and storage as shown in Plate 5.6.

Settlement lagoons should be inspected regularly by the ECoW to ascertain the functionality of the system. Settlement lagoon outflow discharge may be pumped, when required, for maintenance purposes. A ‘Siltbuster’ is a method of pumping excess silt-laden water and treated prior to discharge. Any pumping activities will be supervised and authorised by the Principal Contractor’s Project Manager.

[36] NIEA et al (2018): GPP 5: works and maintenance in or near water [online] available at: gpp-5-works-and-maintenance-in-or-near-water.pdf (netregs.org.uk)Accessed 12/07/2023

6.7 Chemical pollution prevention

6.7.1 Storage of Chemicals and Oil

Potentially contaminating chemicals stored on site will be kept within a secure bunded area to prevent any accidental spills from affecting hydrological receptors. The bunded area will be within the construction compound and will be underlain by an impermeable ground membrane layer to reduce the potential pathways for contaminants to enter watercourses and groundwater.

Oil storage areas will be covered in order to prevent rainwater collecting within the bunded area.

The chemicals storage area would be kept secure to prevent theft or vandalism. A safe system for accessing the storage area would be implemented by the Construction Contractor.

The following measures should be employed under best practice guidance for storage of chemicals and oils:

- Storage tanks (above or below ground) should have sufficient strength and structural integrity to hold without leak or burst and bunded in accordance with guidance;
- Storage containers should have a minimum design life of 20 years; and,
- All storage containers are closed and locked when not in use.

Chemical storage areas are to be removed from Site as part of decommissioning, any remnant in-situ storage facilities must be appropriately maintained and monitored for degradation and release of oils or chemicals.

6.7.2 Spillage of Chemicals and Oil

The construction compound will have a bunded area and this area will be underlain by an impermeable ground membrane layer. The bund will have a capacity of 110% of the stored liquid containers (including fresh concrete). This will reduce the potential for accidental spillages to contaminate surface water or groundwater.

Best practice guidance on the prevention of spillages of chemical outlines the following measures:

- Areas where transfer and handling of chemicals is to occur should have impermeable surface;
- Drainage systems onsite should be designed to enable the containment of spillages and appropriate disposal and treatment;
- Emergency procedures are implemented for a spillage incident and leak detection measures (if appropriate);
- Regular maintenance and inspection of chemical storage facilities to be conducted (may be carried out by onsite ECoW); and,
- Provision and training in the use of spill kits, as outlined below.

Appropriately sized spill kit(s) will be provided, maintained and located at strategic points across the Site, as shown in Plate 5.7. It is also recommended that all vehicles on-site have spill kits in the event of a spillage from a vehicle. This will contain materials, such as absorbent granules and pads, absorbent booms and collection bags. These are designed to halt the spread of spillages and will be deployed, as necessary, should a spillage occur elsewhere within the construction compound.

Plate5.7: Example Spill Kit Provision on Site

6.7.3 Concrete, Cement and Grout

Concrete, cement and grouts which are to be stored or transported on site will be subject to the same requirements as outlined in Section 5.7.1.

To comply with best practice, concrete, cement and grout mixing and washing areas should:

- Be sited in an impermeable hardstanding or geotextile within a designated area;
- Be sited at least 10 m from any watercourse or surface water drain, rock outcrop or sinkhole;
- Install settlement and re-circulation systems for water re-use in the batching process to minimise water use, treatment requirements and risk of pollution;
- Designated and contained washing areas for batching plant and vehicles; and,
- Collect contaminated wash waters which cannot be reused and discharge to foul sewer or tanker off-site. Contaminated water should never be released to the water environment.

To prevent pollution, it is important that all concrete pours are planned and that specific procedures are adopted where there may be a risk of surface water or groundwater contamination, in accordance with CIRIA C532. These procedures will include:

- Ensuring that all excavations are sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system; and,
- Ensuring that covers are available for freshly placed concrete to avoid the surface of the concrete washing away during heavy precipitation.

6.8 Activities Within the Water Environment

Construction phase works within the water environment include the construction of temporary and permanent watercourse crossings.

6.8.1 Authorisation

Engineering activities within the water environment, including construction of watercourse crossings, culverting, diversions and dewatering requires authorisation from the DfI via a 'Schedule 6 application'[37]. The draft application form is included with **Technical Appendix A8.5: Outline Drainage Strategy**.

6.8.2 Watercourse Diversions

Temporary watercourse diversions will be required for construction works to be conducted on the banks of a watercourse, within wetlands or a watercourse channel. This will only be undertaken in artificial drains and ditches; no watercourse diversions will occur in natural watercourses.

Where required, watercourse diversions are to be installed in line with best practice guidance. In-lieu of any relevant Northern Irish best practice guidance on diverting watercourses, the following Scottish guidance should be followed:

- SEPA WAT-SG-29: Temporary Construction Methods[38].

Isolation of a watercourse to allow works may be in the following good practice methods:

- Partial isolation (cofferdam);
- Partial isolation (caisson);
- Full isolation (temporary diversion);
- Full isolation (gravity/flume pipe); or,
- Full isolation (over-pumping/siphon).

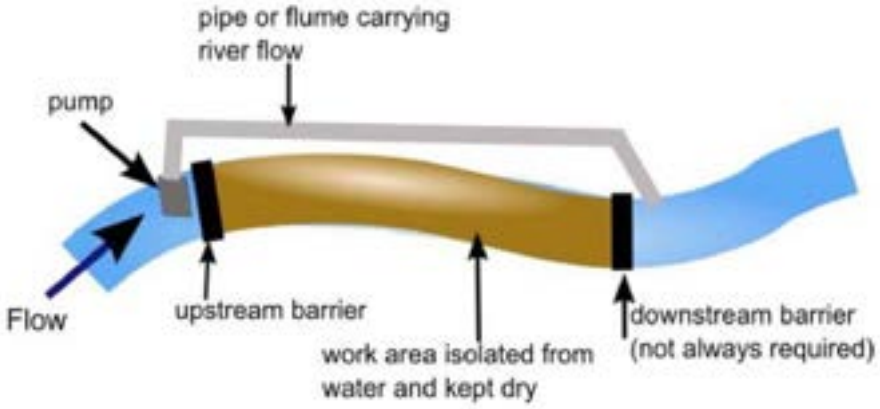
Over pumping/siphon allows for a whole section of the channel to be isolated, and water is diverted downstream using a pump or siphon in order to retain hydrological continuity. This temporary diversion may be utilised prior to establishing a long-term watercourse diversion for permanent infrastructure within watercourses.

The section of the watercourse requiring diversion will be isolated using barriers that span the full width of the existing watercourse. This keeps a stretch of the watercourse dry and the water is transferred downstream of the works area by mechanical assistance (pumping), until a long-term diversion is operational.

The pump and associated pipework need not be located in the isolated area, as shown in Plate 5.8.

[37] DfI: Schedule 6 application for consent to undertake works to a watercourse [online] available at: Schedule 6 application for consent to undertake works to a watercourse | Department for Infrastructure (infrastructure-ni.gov.uk) (Accessed 12/07/2023)
[38] SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition* [Online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ (Accessed: 12/07/2023)

Plate 5.8: Typical over-pumping arrangement



SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition*

It may be necessary to pump water from upstream of the barrier to downstream of the works area, i.e., maintain 'normal' flow in the watercourse either side of the isolated reach. Depending on the gradient of the watercourse, it may also be necessary to install a full width barrier downstream of the work area to prevent ingress of water, as shown in Plate 5.9.

Plate 5.9: Watercourse Diversion (Full isolation – over pumping)

SEPA (2009) WAT-SG-29: *Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods First Edition*

Pumps will be kept at least 10 m from the edge of the channel and on drip trays or within bunds that have a capacity 110 % of that of the fuel tank.

6.8.3 Watercourse Crossings

The crossing of watercourses has been avoided in the design where possible. Existing culverts and watercourse crossings may be upgraded and anticipated to be replaced with suitable pre-cast culvert

designs. To inform the design, a watercourse crossings inventory was completed and is detailed in **Technical Appendix A8.4: WCI**.

Where required to be installed, watercourse crossings should be designed in order to minimise effects of developments on the natural integrity and continuity of watercourses. In-lieu of any relevant Northern Irish guidance on watercourse crossings, the following Scottish best practice guidance should be used:

- SEPA WAT-SG-25 River Crossing – Good Practice Guide[39];
- SEPA WAT-PS-06-02: Culverting watercourses[40]; and,
- CIRIA C689: Culvert design and operation guide[41].

6.8.3.1 Pre-installation

Identification of ecological requirements and limiting factors (e.g. breeding birds and fish spawning) should be conducted prior to installation of a watercourse crossing. The ECoW should be consulted before watercourse crossing construction can commence.

The hydraulic capacity of the crossing is to be assessed and constructed peak river flow plus a climate change allowance of 20% in Northern Ireland.

Watercourse crossings should not be installed in 'active' areas of a watercourse e.g. meandering bends and depositional areas.

Consideration should be given to the type of watercourse crossing acknowledging that hard engineering structures, such as concrete culverts, can make it more difficult to restore a site or decommission temporary structures e.g. access tracks. Bottomless arched culverts will be used for the small scale crossings. Further details on the type of culvert to use is provided in Section 6.8.4.

6.8.3.2 Installation

The use of in-situ fresh concrete in the construction of watercourse crossings will be avoided by the use of pre-cast elements. Watercourse crossings will be installed perpendicular to the direction of flow.

In total two new watercourse crossings are required for the Development, as shown in **Figure 8.4: Watercourse Crossings** and detailed in **Chapter 8: Hydrology and Hydrogeology** of the ES. It is anticipated that ready-made bottomless arched concrete or plastic culverts watercourse crossings are to be installed on site:

However, in accordance with best practice guidance, each watercourse crossing shall be designed on a case-by-case basis to be appropriate for the width of watercourse being crossed, and the prevailing ecological and hydrological situation (i.e. the sensitivity of the watercourse). A number of factors, both environmental and engineering will influence the selection of structure type and the design of the crossing.

All watercourse crossings should be installed in line with SEPA WAT-SG-25 River Crossing good practice guide. General good practice in watercourse crossing design and construction will ensure that site conditions are taken into account. Good practice measures include:

- The use of appropriate structures to carry access tracks across watercourses taking into account the scale of the watercourse, ecological value, sensitivity to construction activities, topography and construction methodology;

[39] SEPA (2010) *WAT-SG-25 Engineering in the water environment: good practice guide. River Crossings.* [Online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ https://www.sepa.org.uk/media/151036/wat-sg-25.pdf (Accessed: 12/07/2023).
[40] SEPA (2015) *WAT-PS-06-02: Culverting of Water courses - Position Statement and Supporting Guidance* [online] Available at: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/ (Accessed: 12/07/2023).
[41] CIRIA (2010) *C689: Culvert design and operation guide* [Online] Available at: https://www.ciria.org/Resources/Free_publications/C689.aspx?WebsiteKey=3f18c87a-d62b-4eca-8ef4-9b09309c1c91 (Accessed: 12/07/2023)

- There is a preference to avoid construction in watercourses altogether through the use of arch culverts appropriately designed not to impede the flow of water and allow safe passage for wildlife, such as fish, water voles, otters etc;
- When installing culverts, care will be taken to ensure that the construction does not pose a permanent obstruction to migrating species of fish, or riparian mammals (i.e. the crossings will make provision for fish and wildlife migration);
- Culverts should be sized so that they do not interfere with the bed of the stream post construction, (i.e. the crossings will leave the watercourse in as natural condition as possible or permit re-establishment of substrate post construction);
- Single culverts will be used in preference to a series of smaller culverts that may be more likely to become blocked with flotsam and create erosion (i.e. the crossings will not constrict the channel);
- To minimise impacts on the breeding of any fish found, any in-stream works in these areas will be conducted during months which have less impact on their breeding and development, where possible;
- Ease and speed of construction are important to minimise disruption to the watercourse and surrounding habitat;
- Culverts and headwalls should be designed to last the operational life of the Development;
- Designs should be low maintenance and where possible self-cleansing; and,
- Structures should be visually in keeping with the surroundings.

6.8.3.3 Maintenance

Erosion to the bed and banks at a watercourse crossing as a result of scouring during high rainfall and storm events. Erosion can expose span structure foundations and/ or cause a drop forming at the outlet of the watercourse crossing.

If this occurs, the inclusion of erosion protection measures may be required, such as baffles. The crossing should be reinstated and reinforced to allow for scour during higher flows. The crossing should be reinstated to allow for fish passage and continuity of the watercourse bed. If this is not possible, inclusion of a fish pass may be required.

If maintenance works are required within the watercourse bed then isolation of the watercourse is required, as detailed in Section 6.8.2, and authorisation from SEPA may be required.

Culverts are prone to blockage by debris and may require routine clearing.

6.8.4 Culverts

Culverts are used to create artificial channels and allow for the continuity of water drainage and balance upstream and downstream of infrastructure associated with the Development e.g., access tracks.

Closed culverts are sufficient for cross-drainage under an onsite access track, as outlined in Section 6.2.

Bottomless arch culverts should be used for all culverts over watercourses. An indicative design of these types of culverts is provided in Figure 3.13.

Culverts will be installed and designed in line with best practice guidance, including *CIRIA C689,* and incorporate the following criteria:

- Culverts will be well bedded to avoid settlement and protected by an adequate cover of road material;
- The substrate and side/ head walls will be reinforced in order to prevent erosion;
- The culverts will be designed such that it does not cause a barrier to movement of fish or other aquatic fauna;
- Culvert floors will have the same gradient (not exceeding a slope of 3 %) and level, and carry similar bed material and flow, as the original stream;
- There shall be no hydraulic drop at the culvert inlet or outlet;
- The width of the culvert will be greater than the active channel width of the watercourse;

- The culvert must not exacerbate or create flooding;
- Culverts will be used to conduct water under the wind farm tracks;
- Any fences or screens fitted on the inlet or outlet of the culvert will be designed to allow at least 230 mm of space between the bars of the screen of fence, up to the high-water level;
- A natural stone headwall will be provided upstream and downstream of culverts to protect the road embankment. Further protection will be provided to the banks using soft engineering techniques as much as possible; and,
- Where there is risk of bed erosion upstream or downstream of culverts, natural stone rip-rap will be provided.

6.8.5 Dewatering

Dewatering may be required for excavations or construction of foundations.

In-lieu of relevant Northern Irish guidance in relation to dewatering, the following Scottish best practice guidance should be followed during dewatering activities:

- SEPA WAT-SG-29: Temporary Construction Methods;
- SEPA Good Practice Guide WAT-SG-28: Intakes and Outfalls[42]; and
- SEPA Regulatory Method WAT-RM-11: Licensing Groundwater Abstractions including Dewatering[43].

Discharge of water as a result of dewatering must not cause further erosion and energy dissipation measures should be put in place as outlined in SEPA WAT-SG-28 guidance. Drop pipe structures can be used to lower the height at which the water is discharged in areas with particularly high banks. These act as energy dissipaters if the lower outfall pipe is placed slightly above the bottom of the drop structure. Stilling basins are also effective energy dissipaters, these must be appropriately designed to suit the discharge rate and existing hydrological conditions at the Site.

Dewatering must consider the impact on other groundwater abstractions and wetland habitats. Further information on the protection of these receptors are provided in Section 6.9.

Settlement lagoons may also be constructed with a composting layer to allow for the treatment of any ochre water before being discharged into the hydrological system. A schematic diagram is displayed below:

[42] SEPA (2019) *WAT-SG-28: Engineering in the Water Environment Good Practice Guide: Intakes and outfalls Second Edition* [Online] Available at: https://www.sepa.org.uk/media/150984/wat_sg_28.pdf (Accessed: 12/07/2023)
[43] SEPA (2017) *WAT-RM-11: Regulatory Method: Licensing Groundwater Abstractions including Dewatering* [Online] Available at: https://www.sepa.org.uk/media/151997/wat-rm-11.pdf (Accessed: 12/07/2023)

Plate 5.10: Settlement Lagoon

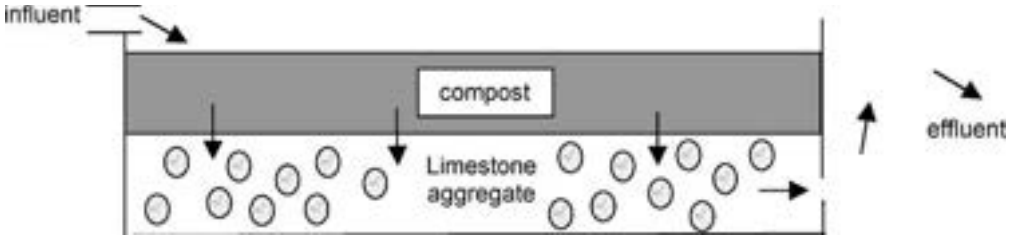


Diagram taken from Johnson & Hallberg 2005[44].

6.9 Measures to Protect Groundwater Dependent Terrestrial Ecosystems (GWDTE)

During the NVC survey, several communities were determined to have a Moderate groundwater dependency according to UKTAG guidance. Communities of U2b/M6c and M6c were found throughout the Site and a conservative approach was taken to assess all potential wetland habitats as outlined in **Chapter 8: Hydrology and Hydrogeology,** Section 8.5.3. These communities have been found within the proposed infrastructure footprint which will result in direct loss of wetland habitats. The locations of these habitats are represented on Figure 8.5 of **Chapter 8: Hydrology and Hydrogeology** of this ES. Additionally, some habitats are subject to indirect effects as detailed in **Technical Appendix A8.3: Note on Indirect Effects of Dewatering**. In a worst case scenario, this would affect the integrity of wetland habitats although they will still be functional.

Foundations and linear infrastructure such as roads, tracks and trenches can disrupt groundwater flow. If carried out in close proximity to wetland habitats, construction activities can have adverse effects on these receptors.

Measures to protect wetland habitats are based on mitigation and good practice, similar to those outlined already in this document, as well as avoidance of wetland habitats during design. In the absence of comprehensive guidance for the mitigation of potential effects on wetland habitats within Northern Ireland, the following guidance document(s) are used to inform protection of wetland habitats:

- SEPA LUPS-GU-31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems[45].

The following measures will ensure that water quality and the flow supply of groundwater and near-surface water are maintained during the construction and operational phase of the Development.

Key measures include:

- Silt traps shall be deployed to trap and filter sediment-laden run-off throughout the construction phase of the Development;
- Settlement lagoons shall be constructed and actively managed to control water levels and ensure that any runoff is contained, especially during times of rainfall. The location and management of the settlement lagoons is essential and will not be sited within vulnerable wetland areas where they may cause drying out and direct loss of habitat;
- Flush areas, depressions or zones which may concentrate water flow, will be identified in advance of construction and a suitable drainage design shall be developed to address each location, to ensure hydraulic connectivity;
- Site drainage design will avoid any severance of saturated areas to ensure hydrological connectivity is maintained. Site drainage design will be produced in advance of construction;
- The length of time excavations are kept open and the duration of any dewatering will be minimised;

[44] Johnson & Hallberg 2005. "*Acid mine drainage remediation options: a review*" [online] Available at: https://www.sciencedirect.com/science/article/abs/pii/S0048969704006199 (Accessed 12/07/2023).

[45] SEPA (2017) Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (LUPS-GU-31) [Online] Available at: sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions.pdf(Accessed: 12/07/2023)

- All excavations will be sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system; and,
- Water from dewatering activities is generally treated by settlement lagoons and will be discharged onto vegetated surfaces, ensuring no net loss of water from the hydrological system. If ponding of water is observed during the discharge onto vegetated surfaces, additional measures may be employed.

The restoration and improvement in quality of existing active peat and wetland habitats is discussed further in Section 4 of **Technical Appendix A3.2: DHMEP** of the ES.

7 MANAGEMENT OF SOIL AND LAND

7.1 Degradation of Soils

There is the potential for soils to be compacted and soil structure to deteriorate especially in areas where heavy materials or equipment is stored.

To minimise the risk of damage to soil structure, the following rules must be observed during all soil handling tasks:

- No trafficking of vehicles/plant or materials storage to occur outside demarcated working areas;
- No trafficking of vehicles/plant on reinstated soil (topsoil or subsoil);
- Only direct movement of soil from donor to receptor areas (no triple handling and/or ad hoc storage);
- Soil handling is to be determined based upon soil moisture content. Where practicable soil handling when soil moisture content is above the lower plastic limit (the moisture content at which soil begins to behave as a plastic material and the soil is deemed too wet to handle without causing damage to the soil structure), should be avoided;
- Where soils are wet or damp, to minimise compaction, soils should be handled using excavators rather than dozers;
- No mixing of topsoil with subsoil, or of soil with other materials;
- Soil is only to be stored in designated soil storage areas;
- All soil storage areas (stockpiles) must be planned appropriately and must have clear signage accordingly by the appropriate contractors to ensure no cross contamination occurs and ease of identification for reinstatement;
- Stockpiles should be bunded and sealed to prevent the ingress of water resulting in the loss of soils due to erosion;
- Topsoil stockpiles should not exceed 4 m in height and subsoil stockpiles should not exceed 5 m in height. However, if the soil to be stockpiled is dry, formation of higher stockpiles may be permissible, if required, as the soil is likely to remain dry in the core of the stockpile for the entire storage period. However, the appropriateness of higher stockpiles will need to be established on a location by location basis;
- Upon the placement of soils into stockpiles has been completed, rainfall and soil moisture conditions are of lesser importance, providing they do not lead to erosion resulting in a loss of the soil resource and potentially a change in soil composition if fine material is lost leaving a greater proportion of stones. Stockpile erosion can also result in significant environmental impacts, such as discharges of sediment laden for pathways that could be susceptible to local receptors (roads, drainage systems and surrounding land);
- Locations and footprints of each stockpile will be accurately recorded on a plan of appropriate scale by the Contractor(s). Marker posts will need to be provided in locations which have been surveyed and recorded (this should also occur if further soil surveys are required);
- Plant and machinery only work when ground or soil surface conditions enable their maximum operating efficiency (i.e. when machinery is not at risk of being bogged down or skidding causing compaction or smearing);
- All plant and machinery must always be maintained in good working condition to ensure that the soil is stripped correctly, for example to ensure that the depth of the strip can be accurately controlled, and to minimise the risk of contamination through spillages;
- The size of the earthmoving plant to be used should be tailored to the size of the area to be stripped and the space available within the working area. The use of a long reach excavator, which will minimise the need for movement across the soil surface and the use of tracked vehicles, will further reduce soil compaction;
- Given the wide spacing of exploratory locations in some area, if any critical buried concrete infrastructure is planned to be constructed as part of the project, it would be prudent to undertake targeted sampling and analysis of soil and groundwater in the location of critical infrastructure to confirm the risk associated to buried concrete attack. The process should be documented; and,

- If any soil or aggregate materials are imported as part of the construction, the materials should be subject to sampling and analysis to ensure it is suitable for its intended use from an environmental risk and waste management perspective. This process should be fully documented.

7.2 Land Quality (Contamination)

No known areas of soil contamination were identified within the site during the site walkovers and desk studies. It is therefore considered that the presence of contaminated land either as defined within Part IIA of the Environmental Protection Act 1990, or which may otherwise impact the Development is very unlikely.

7.2.1 Unexpected Contamination

In the event that previously unidentified contamination is found at any time during the works, the Principal Contractor shall report it as per the principles set out in Part III of The Waste and Contaminated Land (Northern Ireland) Order 1997[46].

All assessments of contaminated land at the Site will adhere to the Environment Agency guidance: Land contamination risk management[47].

[46] UK Government, 1997: The Waste and Contaminated Land (Northern Ireland) Order 1997 [online] available at: The Waste and Contaminated Land (Northern Ireland) Order 1997 (legislation.gov.uk) (Accessed 18/07/2023)
[47] Environment Agency, 2020: Land contamination risk management [online] available at: Land contamination risk management (LCRM) - GOV.UK (www.gov.uk) (Accessed 18/07/2023)

8 OTHER POLLUTION PREVENTION MEASURES

8.1 Vehicle Maintenance

8.1.1 Potential Hydrocarbon Contamination

During construction, machinery will be regularly maintained to reduce the likelihood of fuel or oil leaks / spillages to occur. All maintenance will be conducted on suitable absorbent spill pads to minimise the potential for groundwater and surface water pollution. All machinery will be bunded and equipped with drip pans to contain fuel spillage or equipment leakages.

Appointed refuelling personnel will be trained in the correct methods of refuelling on-site to ensure that pollution incidents are prevented. Should a spill occur, a quick response plan will be implemented to minimise the impact of spills (see Appendix B).

Fuel delivery vehicles servicing the Site will only be allowed as far as the construction compound. Equipment within the construction compound will be bunded to mitigate any spillage during refuelling and operations will only be permitted where they comply with the Contractor's method statement/ requirements.

Fuel pipes on plant, outlets at fuel tanks, etc., will be regularly checked and maintained to ensure that no drips or leaks to ground occur. The following precautions will also be installed on fuel delivery pipes:

- Any flexible pipe, tap or valve must be fitted with a lock where it leaves the container and be locked when not in use;
- Flexible delivery pipes must be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use;
- The pump or valve must have a lock and be locked when not in use;
- Warning notices including “No smoking” and “Close valves when not in use” shall also be displayed; and,
- Spill kits will be available within each plant/ vehicle on site and also located close to identified pollution sources or sensitive receptors (fuel storage areas, water course crossings, etc.).

Irrespective of the buffer distances to watercourses and location of refuelling points, interceptor drip trays or similar (open metal drip trays are not acceptable) will be available in accordance with standard good practice across the construction industry. Interceptor drip trays will be positioned under any stationary mobile plant to prevent oil contamination of the ground surface or water. Plant and site vehicles are to be well maintained and any vehicles leaking fluids must be repaired or removed from the Site immediately. Any servicing operations shall take place over drip trays.

8.1.2 Non-Road Mobile Machinery

Recommended mitigation measures in relation to Non-Road Mobile Machinery (NRMM) are detailed below:

- All NRMM should use fuel equivalent to ultra-low sulphur diesel (fuel meeting the specification within EN590:2013[48]);
- All NRMM should comply with the previous EU Directive Staged Emission Standards (97/68/EC, 2002/88/EC, 2004/26/EC) or new emission standards as they are introduced in the UK. Acceptable standards will be updated to the most current standard as appropriate;
- All NRMM should be fitted with Diesel Particulate Filters conforming to defined and demonstrated filtration efficiency (load/duty cycle permitting);
- The on-going conformity of plant retrofitted with Diesel Particulate Filters, to a defined performance standard, should be ensured through a programme of on-site checks;
- Implementation of energy conservation measures including instructions to throttle down or switch off idle construction equipment; switch off the engines of trucks while they are waiting to access the site and while they are being loaded or unloaded;

[48] British Standards (2013) BS EN 590:2013+A1:2017 Automotive fuels. Diesel. Requirements and test methods

- Ensure equipment is properly maintained to ensure efficient energy consumption; and,
- NRMM and plant should be well maintained. If any emissions of dark smoke occur, then the relevant machinery will stop immediately and any problem will be rectified.

8.2 Chemical Storage

Potentially contaminating chemicals stored on-site will be kept within the construction compound and will each be bunded to prevent any accidental spills from affecting hydrological resources by removing a potential pathway for contaminants to enter watercourses and groundwater.

Oil storage areas will be covered in order to prevent rainwater collecting within bunded areas.

The chemicals storage area would be kept secure to prevent theft or vandalism. A safe system for accessing the storage area would be implemented by the Principal Contractor.

8.3 Management of Drainage from Surplus Materials

Careful consideration will be given to the location of topsoil and subsoil storage areas for all areas of the Site during construction. Storage areas will be either in a flat dry area away from existing land drains or be protected by the addition of cut off drains above the storage areas to minimise the ingress of water.

Mineral soils will not be allowed to dry out and silt fences and mats will be employed to minimise sediment levels in run-off.

All stockpiled material will be stored at least 50 m from drainage ditches in order to reduce the potential for sediment to be transferred into the wider surface water system and will be regularly inspected to ensure that erosion of the material is not taking place.

8.4 Dust Suppression and Control

Water will be needed for dust suppression on the haul roads during periods of dry weather and the compound vehicle wash will be clean water. Clean water may be obtained from re-circulated clean or treated drainage waters.

Where required, water may be extracted from local watercourses or groundwater. In these instances, the Contractor will liaise with the NIEA beforehand to agree abstraction locations, rates and licencing requirements.

Good practice measures will be adopted during construction to control the generation and dispersion of dust such that significant impacts on neighbouring habitats will not occur. The hierarchy for mitigation will be prevention, suppression then containment.

The following mitigation measures will be implemented to control the movement of dust within the Site:

- Excavation and earthworks areas will be stripped as required in order to minimise exposed areas;
- During excavation works, drop heights from buckets will be minimised to control the fall of materials reducing dust escape;
- Completed earthworks and other exposed areas will be covered with topsoil and re-vegetated as soon as it is practical in order to stabilise surfaces;
- During stockpiling of loose materials, stockpiles shall exist for the shortest possible time;
- Material stockpiles will be low mounds without steep sides or sharp changes in shape;
- Material stockpiles will be located away from the site boundary, sensitive receptors, watercourses and surface drains;
- Material stockpiles will be sited to account for the predominant wind direction and the location of sensitive receptors;
- Water bowsers will be available on site and utilised for dust suppression during roadworks/ vehicle movements when and where required;
- Daily visual inspections will be undertaken to assess need for use of water bowsers, with increased frequency when activities with high potential to generate dust are carried out during prolonged dry or windy conditions;

- Shielding of dust-generating activities;
- Use of enclosed chutes, conveyors and covered skips;
- Covering vehicles carrying dry spoil and other wastes to prevent escape of materials;
- Cutting, grinding and sawing equipment will only be used in conjunction with suitable dust suppression techniques; and,
- A wheel washing system will be sited close to the site entrance to avoid getting dust on the public road.

Further considerations of air quality and dust management are set out in the Air Quality Assessment.

8.5 Installation of Underground Cabling

Underground electrical cabling will be required to import and export electricity onsite.

The installation of underground cabling could lead to sedimentation of near-surface water should the cabling be buried in trenches. Chemical pollutants and sedimentation could, therefore, have the potential to adversely affect subsurface water quality, surface water quality, and groundwater. Mitigation measures to reduce the likelihood of sedimentation of surface and subsurface water are discussed in Section 6.

The position of the cable route will be marked out and the line stripped of turfs and soils and set aside for reinstatement. Ecologically sensitive areas will be avoided by construction plant and vehicles. In the first instance, the cable run installation will be undertaken adjacent to and within the access track, to minimise intrusion into the surrounding areas, although it may be required to divert to the shortest possible routes locally. The siting and laying of the cables will be supervised by the ECoW(s) where possible.

Sand will be imported to the Site and will be placed around the cables as protection. Suitable duct marker tape shall be installed in the trench prior to backfilling.

The following mitigation measures will aim to minimise soil compaction:

- The position of trenches will be marked out and the line stripped of turfs and soils and set aside for reinstatement; and,
- Vehicles using the track/undertaking the cable laying must be the lightest vehicle required for that job and must use either wider tires, dual tires, or tracks.

9 TRAFFIC MANAGEMENT

9.1 Overview

During construction there may be a need to alter or manage the current state of traffic operations on the Site and the surrounding areas. Potential traffic management strategies are outlined in **Chapter 13: Traffic and Transport** of the ES.

9.2 Traffic

Measures to be adopted as part of the Works:

- Any road closures will occur temporarily during daylight hours but outside of local peak periods;
- Local residents and business users will have unrestricted access to the route throughout construction;
- Residents will be notified of proposed timings for deliveries and predicted days of elevated construction traffic;
- The main access roads will be regularly maintained and cleaned;
- Alternative traffic routes will be arranged locally to avoid the works where necessary;
- Steel plates will be used to enable traffic to pass over trenches where works take place in the vicinity of a property entrance;
- Full permanent reinstatement of the road surface and/or verges will take place at the end of construction works if any damage occurred as a result of the Development;
- Contractors will follow a set route for construction vehicles;
- Temporary warning signage will be installed;
- Delivery times will be restricted to those outlined in Section 41;
- Wheel washing facilities will be used to prevent the deposit of mud on public roads; and,
- Measures will be taken to minimise noise, vibration and dust.

A detailed Construction Traffic Management Plan (CTMP) shall be produced by the appointed Principal Contractor and agreed with the Local Authority prior to decommissioning and construction commencing.

10 MATERIALS MANAGEMENT

10.1 General Good Practice Measures

Import, export (not anticipated) and reuse of material generated on-site will be undertaken in line with the requirements of the CL:AIRE Definition of Waste: Development Industry Code of Practice (version 2)[49].

No soils are expected to be generated that cannot be reused on the Site. Any soils that cannot be re-used will be taken off site and disposed of in line with current waste disposal guidance. Further details will be included in the detailed DCEMP produced by the appointed Principal Contractor. Refer to Appendix A for the Outline SWMP.

Soils will be stored in accordance with the Peat Management Plan, which is to be produced by the Principal Contractor and will accord with **Technical Appendix A3.3: oPMP** of the ES.

10.2 Other Waste Materials

Waste such as timber, metal, general waste, etc., will be segregated on-site, and disposed of off-site in a licenced waste facility.

[49] Contaminated Land: Applications in Real Environments (2011): The Definition of Waste: Development Industry Code of Practice (Version 2)

11 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this oDCEMP is to outline how the Development will avoid, minimise and/or mitigate any effects on the environment and surrounding area. It further details appropriate soil and water management measures to control surface water run-off, drainage infrastructure and soil quality during the construction of the Development.

The measures proposed in this oDCEMP will ensure that any effects on the surface and groundwater environment are minimised.

If required, this oDCEMP will be adapted to meet the additional requirements of the Contractor and ECoW, to ensure that all measures implemented are effective and site-specific.

The oDCEMP is considered to be a 'live' document, such that modifications can be made following additional information and advice from consultees.

APPENDIX A OUTLINE SITE WASTE MANAGEMENT PLAN

06 September 2023

Introduction

The aim of this Outline SWMP is to protect the environment through implementation of effective management plans which relate to the management of waste throughout the life cycle of the Development.

Prior to construction of the Development, the Contractor will update this Outline SWMP to ensure it is a suitably detailed document. The Contractor will take ownership of the Detailed SWMP and will adhere to the principles presented within it.

The Detailed SWMP is a key tool which is used to plan, implement, monitor and review waste minimisation and management during the construction, operation and decommissioning phases of the Development.

This Outline SWMP provides guidelines and details of the minimum requirements which the Contractor shall include in their detailed SWMP. The Detailed SWMP will be put in place by the appointed Contractor prior to commencement of the construction phase of the Development and will be implemented in conjunction with the oDCEMP to ensure environmental effects onsite are reduced.

It is anticipated that all excavated materials will be utilised onsite as part of the permanent works and site restoration process resulting in no waste arising from these elements of the Development.

Any import, export (not anticipated) and reuse of material generated onsite will be undertaken in line with the requirements of the CL:AIRE Definition of Waste: Development Industry Code of Practice (version 2)[50]. As such, this Outline SWMP considers only the management of the waste arising from other imported construction materials.

The Waste Hierarchy

The 'Waste Hierarchy' provides an outline approach of how waste management should be assessed within the Outline SWMP, see Plate A.1. The Waste Regulations (Northern Ireland) 2011 and 2019[51] place a duty on all persons who produce, keep or manage waste to apply the 'Waste Hierarchy' in order to minimise waste production at every stage of the Development.

Plate A.1: Waste Hierarchy[52]

[50] Contaminated Land: Applications in Real Environments (2011): The Definition of Waste: Development Industry Code of Practice (Version 2)
[51] Uk Government 2019: The Waste Regulations (Northern Ireland) 2019 [online] Available at: The Waste Regulations (Northern Ireland) 2019 (legislation.gov.uk) Accessed 12/07/2023
[52] Defra (2011) Guidance on applying the Waste Hierarchy [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69403/pb13530-waste-hierarchy-guidance.pdf (Accessed 12/07/2023)

The 'Waste Hierarchy' promotes selection of the Best Practicable Environmental Option (BPEO) and preferred option for management of waste.The core waste management principles of reduce, reuse, recycle, recover and disposal as defined in the 'Waste Hierarchy', are embedded within this Outline SWMP.

Waste Prevention

Minimisation of waste generation is achieved through careful design and creating a 'waste aware' culture on-site. All reasonable actions will be taken by the Contractor to avoid the production of and/or minimise the volume of waste produced as a result of the Development. This can be through reducing consumption, using resources efficiently, and designing for longevity.

Waste Separation for Reuse and Recycle

Where possible, the separation of waste will be carried out at the source in order to maximise opportunities for reuse and recycling. Segregation of waste will require training, monitoring and enforcement.

Waste Storage, Disposal and Transportation

All areas used for temporary storage of waste on-site will comply with DAERA-NIEA guidelines and will be clearly signed. Waste storage facilities will be provided at source using the best environmental options available. Any hazardous or special waste will be stored in separate, secure containers and clearly identified as such.

Technical Appendix A3.3: oPMP demonstrates that all peat excavated during construction will be reused in reinstatement and restoration activities and therefore, there will be no waste peat as a result of the Development.

Disposal activities will also be carried out in accordance with the NIEA, Pollution Prevention Guidelines (PPGs[53]) and Guidance for Pollution Prevention (GPPs[54]) in order to ensure compliance with current waste legislation.

As the Site is within Northern Ireland, the activities will also be carried out in accordance with both PPGs and GPPs to demonstrate environmental good practice.

Waste transportation will take place at regular intervals to avoid the accrual of waste. Where possible, delivery vehicles will aim to remove waste materials on return trips.

Only registered waste carriers will be authorised to transport waste and a Waste Transfer Note (WTN) will be completed for each load of waste, which must contain a record of their waste carrier registration number. Copies of each WTN will be filed as an appendix to the SWMP and held for at least two years. The appropriate European Waste Catalogue (EWC) code will be established using updated Technical Guidance (WM3)[55] and will be noted on the WTN, in addition to how it is contained. All sites receiving waste must have an appropriate permit, licence or registration exemption, the details of which should also be recoded.

If required, the NIEA will be advised in advance of any hazardous waste movements and Waste Consignment Notes (WCNs) will be purchased in advance for this type of waste transportation. These consignment notes will be held for at least three years.

[53] Environment Agency (2014): Pollution prevention guidance (PPG) [Withdrawn] Available at: https://webarchive.nationalarchives.gov.uk/20140328090931/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx (Achieved material accessed 12/07/2023)
[54] NetRegs (2021): Guidance for Pollution Prevention (GPP) [Online]. Available at: https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/ (Accessed 12/07/2023)
[55] DAERA, NIEA: Guidance on the classification and assessment of waste (1st edition, v1.2 NI) Technical Guidance WM3 [online] available at: Waste Classification - Guidance on the classification and assessment of waste (Edition 1.1) Technical Guidance WM3 (daera-ni.gov.uk) (accessed 12/07/2023)

Policy Context and Legislation

As of 2013, the production and implementation of a SWMP is no longer a legal requirement, however it is regarded as best practice[56]. Policy and legislation do dictate the management of waste and therefore, the following items have been considered when developing the SWMP:

- The Environmental Protection Act 1990
- The Waste and Contaminated Land (Northern Ireland) Order 1997[57]
- The Hazardous Waste (Northern Ireland) Regulations 2005[58];
- The Waste Regulations (Northern Ireland) 2011 and 2019;
- The Waste Framework Directive[59]; and,
- The Waste Management Plan for Northern Ireland 2019.[60]

Should any surplus waste remain which cannot be reused or recycled, then the Landfill Directive 1999[61], as implemented by the Waste Management Licencing Regulations (Northern Ireland) 2003[62], will apply.

Guidance

Several guidance documents were also used to develop the SWMP and include:

- Environment Agency, 2015, Manage Water on Land: Guidance for Land Managers[63];
- British Standards Institution, 2015, BS 5930:2015, Code of practice for ground investigations[64];
- Construction Industry Research and Information Association (CIRIA), 2015, Environmental Good Practice on Site (C741), 4th edition[65];
- NIEA, 2016: Waste Management, The Duty of Care. A Code of Practice for Northern Ireland[66];
- Defra and Environmental Agency, 2019, Pollution Prevention for Businesses[67];
- Defra and Environmental Agency, 2021, Discharges to Surface water and groundwater: environmental permits[68];
- Defra and Environmental Agency, 2020, Oil Storage Regulations for Businesses[69];

[56] IEMA (2008) Practitioner Series No. 11, Waste Management: A Guide for Business in the UK. Institute of Environmental Management and Assessment.
[57] UK Government, 1997: The Waste and Contaminated Land (Northern Ireland) Order 1997 [online] available at: The Waste and Contaminated Land (Northern Ireland) Order 1997 (legislation.gov.uk) Accessed 12/07/2023
[58] Legislation (Northern Ireland)) (2005) The Hazardous Waste (Northern Ireland) Regulations 2005 [Online] Available at: The Hazardous Waste Regulations (Northern Ireland) 2005 (legislation.gov.uk) (Accessed 12/07/2023)
[59] European Commission (2008) The Waste Framework Directive - DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008L0098-20180705 (Accessed 12/07/2023)
[60] DAERA, NIEA (2019): The Waste Management Plan for Northern Ireland, 2019 [online] available at: Waste Management Plan for Northern Ireland 2019.pdf (daera-ni.gov.uk) (accessed 12/07/2023)
[61] European Commission (1999) Landfill of waste - Directive 1999/31/EC on the landfill of waste [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Al21208 (Accessed 12/07/2023)
[62] UK Government, 2003: The Waste Management Licencing Regulations (Northern Ireland) 2003 [online] available at: The Waste Management Licensing Regulations (Northern Ireland) 2003 (legislation.gov.uk) (Accessed 12/07/2023)
[63] Environment Agency (2015) Manage Water on Land: Guidance for Land Managers [Online] Available at: https://www.gov.uk/guidance/manage-water-on-land-guidance-for-land-managers (Accessed 12/07/2023)
[64] British Standards Institution (2015) Code of practice for ground investigations - BS 5930:2015+A1:2020
[65] Construction Industry Research and Information Association (2015): Environmental Good Practice on Site (C741), 4th edition
[66] NIEA (2016): Waste Management, The Duty of Care. A Code of Practice for Northern Ireland [online] available at: duty-of-care-code-of-practice-june2016.pdf (daera-ni.gov.uk) accessed 12/07/2023
[67] Defra and Environmental Agency (2016) Pollution Prevention for Businesses [Online] Available at: https://www.gov.uk/guidance/pollution-prevention-for-businesses (Accessed 12/07/2023)
[68] Defra and Environmental Agency (2021) Discharges to Surface water and groundwater: environmental permits [Online] Available at: https://www.gov.uk/guidance/discharges-to-surface-water-and-groundwater-environmental-permits (Accessed 12/07/2023)
[69] Defra and Environmental Agency (2020) Oil Storage Regulations for Businesses [Online] Available at: https://www.gov.uk/guidance/storing-oil-at-a-home-or-business (Accessed 12/07/2023)

- Institute of Environmental Management and Assessment (IEMA), 2008, Practitioner Vol. 11 Waste Management: a guide for businesses in the UK[70]; and,
- Wrap[71].

The above guidance on waste management will be used to ensure the following objectives are met through the Outline SWMP:

- Legal obligations of the Development;
- Waste production is minimised;
- Waste is recognised as a resource;
- Project build costs are minimised;
- A framework for continuous improvement and best practice is implemented and maintained; and ,
- Adverse environmental impacts associated with the production and management of waste materials are minimised.

Anticipated Waste Streams

The list below provides an indication of the expected waste streams, however this list is not exhaustive and additional streams may be added as the works progress:

- Waste from welfare and domestic facilities;
- Waste chemicals, fuels and oils;
- Packaging;
- Waste metals; and,
- Waste water.

Waste from Welfare and Domestic Facilities

During the construction phase, 'Porta-loo' type facilities, or equivalent, will be used and emptied by a waste contractor, therefore minimising potential effects on drainage ditches and watercourses.

It is anticipated that presence on site during the operational phase will be infrequent. Visits will mainly be restricted to maintenance personnel and will only be for short periods of time. A cesspit will be used for foul waste during the operational phase, which will be emptied by a licenced waste contractor.

Other Domestic Refuse

Collection facilities for refuse will be provided to segregate waste. These facilities will be clearly marked, positioned in appropriate locations and protected from the weather and animals.

Waste Chemicals, Fuels and Oils

All fuel and oil will be stored within a designated area and contained by a small bund constructed from material sourced on site and lined with an impermeable membrane in order to prevent any contamination of the surrounding soils, vegetation and water table, in accordance with the Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010[72]Any contaminated run-off within the bund will be disposed of at an appropriate waste management facility.

[70] IEMA (2008) Practitioner Series No. 11, Waste Management: A Guide for Business in the UK. Institute of Environmental Management and Assessment.
[71] Waste and Resources Action Programme (WRAP) [Online] Available at: https://wrap.org.uk/ (Accessed 12/07/2023)
[72] UK Government, 2010: Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010 [online] available at: Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010 (legislation.gov.uk) (Accessed 12/07/2023)

Any used (contaminated) spill kits, absorbent granules, sheets or fibres must be disposed of in accordance with the COSHH Regulations (Northern Ireland) 2003[73]and amended workplace limits for exposure to COSHH materials[74] and in accordance with the spill management plan.

Packaging

Construction waste generated is expected to be restricted to general construction waste (e.g., off cuts of timber, timber pallets, cardboard, wire, cleaning cloths, paper, etc.) which will be sorted and either recycled or disposed of off-site to an appropriately licenced landfill by the Contractor.

Packaging will be separated at the source of generation on-site. This approach uses the Waste Hierarchy by encouraging reuse and recycling of materials, such as plastic, wood and paper.

Waste Metals

It is likely that this will be produced from excess steel (e.g., cuttings from underground cabling). Any waste metals would be recycled as appropriate.

[73] UK Government 2003: Control of Substances Hazardous to Health Regulations (Northern Ireland) 2003 [online] available at: Control of Substances Hazardous to Health Regulations (Northern Ireland) 2003 (legislation.gov.uk) (Accessed 12/07/2023)
[74] Health and Safety Executive (2020) EH40/2005 Workplace exposure limits. Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002 (as amended) – also approved for use in Northern Ireland

APPENDIX B POLLUTION INCIDENT RESPONSE PLAN

06 September 2023

Introduction

A Pollution Incident Response Plan will be implemented throughout the construction and operation of the Development.

Prior to the commencement of construction, the lead construction contractor shall set up an emergency response plan/procedure in liaison with Northern Ireland Environment Agency in order to ensure that this plan is adequate for the nature and lifetime of the project and the environment in which works are being undertaken.

The Pollution Incident Response Plan will include emergency contacts who will coordinate response activities in the event of a pollution incident.

This Pollution Incident Response Plan will include an outline procedure similar to that set out below:

1. Make the situation safe: Do not compromise the health and safety of site personnel in controlling a pollution incident. Ensure that appropriate Personal Protective Equipment (PPE) is available to use where necessary.

2. Stop the source of the pollution incident: Identify the cause of the emergency or incident and act immediately to prevent further pollution.

3. Contain the pollution incident: Once the source of the pollution has been stopped, act to prevent the pollution that has already taken place from spreading. Ensure that appropriate materials are available in appropriate quantities to use where necessary. For example, absorbent materials and booms to soak up the pollution are required to deal with spillages of liquid contaminants. For example, an excavator may be used to dig containment facilities or bunds where containing large volumes of pollutants.

4. Notify the pollution incident: Any emergency or incident will be reported as soon as possible after the above initial control measures have been implemented detailing the nature, cause and location to ensure that appropriate action is taken. Where appropriate, the site team should refer the incident to a specialist clean up Contractor. Where pollution is serious, or containment has failed, it may be necessary to contact the Local Authority, the NIEA as relevant to the incident.

5. Monitor the pollution incident: Once the pollutants are contained, the site of the pollution should be monitored on an ongoing basis until the pollutants and contaminated materials are successfully removed and if necessary, further action taken to contain the pollutants. Where it is possible that pollution has spread, the surrounding water bodies and watercourses should be inspected and monitored on an ongoing basis to identify the extents of the pollution. In the event of pollution due to sedimentation of watercourses, those watercourses should be checked during periods of high rainfall or during construction activities with the potential for significant run-off.

6. Clean up the pollution incident: Once the pollution incident has been stopped, contained and the full extents defined, a strategy for cleaning up should be developed. All waste generated by clean-up activities should be disposed of in accordance with current legislative requirements and the site waste management plan and copies of all transfer notes retained.

7. Learn from the pollution incident: Ensure that any lessons from the incident are communicated to all relevant staff and appropriate action taken elsewhere on site if necessary. Update all relevant Method Statements and Toolbox Talks, and ensure new information is communicated to site staff.

Environmental Incident Protocol

In the event of an environmental incident occurring, the following protocol (or similar) will be adopted:

The appropriate notification protocols shall be implemented immediately following a planning or environmental spillage or incident, followed by immediate notification of the Site Manager. Should a serious environmental incident occur, the NIEA should also be notified;

The Site Manager will investigate the incident, with inputs from specialist advice as to appropriate measures to remedy or mitigate any potential pollution arising from the incident;

Assuming the issue arose from the failure of a control system, the issue shall be rectified at the earliest opportunity;

The response action shall be recorded on the Environmental Complaints/ Spills/ Incidents Report by the Site Manager, Lead Contractor or ECoW;

A log of all environmental spills/ incidents and follow-up actions should be kept and made available for inspection; and

All complaints received from the public or other interested parties as a result of the installation works must be recorded on the Environmental Complaints/ Spills/ Incident Form.

Reporting of Environmental Incidents

All accidents, incidents and near misses (including spills, dust, noise pollution etc) will be reported to the Site Manager immediately, these will be recorded and investigated by the Site Manager and ECoW as appropriate.

Details which will be recorded on the report will include:

- A description of the incident;
- Contributory causes;
- Adverse effects;
- Measures implemented to mitigate adverse effects; and,
- Effectiveness of measures implemented to prevent pollution incidents.

Emergency Contact Details

A notice displaying emergency contact details will be displayed in a prominent location within the site accommodation / office, including emergency spill response team details.

Internal Emergency Pollution Response Team

The details of at least two lead members of staff with responsibility for emergency pollution response will be included in this section, as well as the details of the ECoW during construction:

- Primary emergency contact;
- Secondary emergency contact; and,
- ECoW.

External Organisations

This section will be populated with contact telephone numbers for organisations to be contacted following a pollution incident (contact details are specifically excluded to ensure that the final version of the oDCEMP includes the most up to date details). Examples of the types of organisations/call lines to be included are:

- EA Incident Hotline; and,
- NIEA.

APPENDIX C SCHEDULE OF MONITORING PROPOSALS

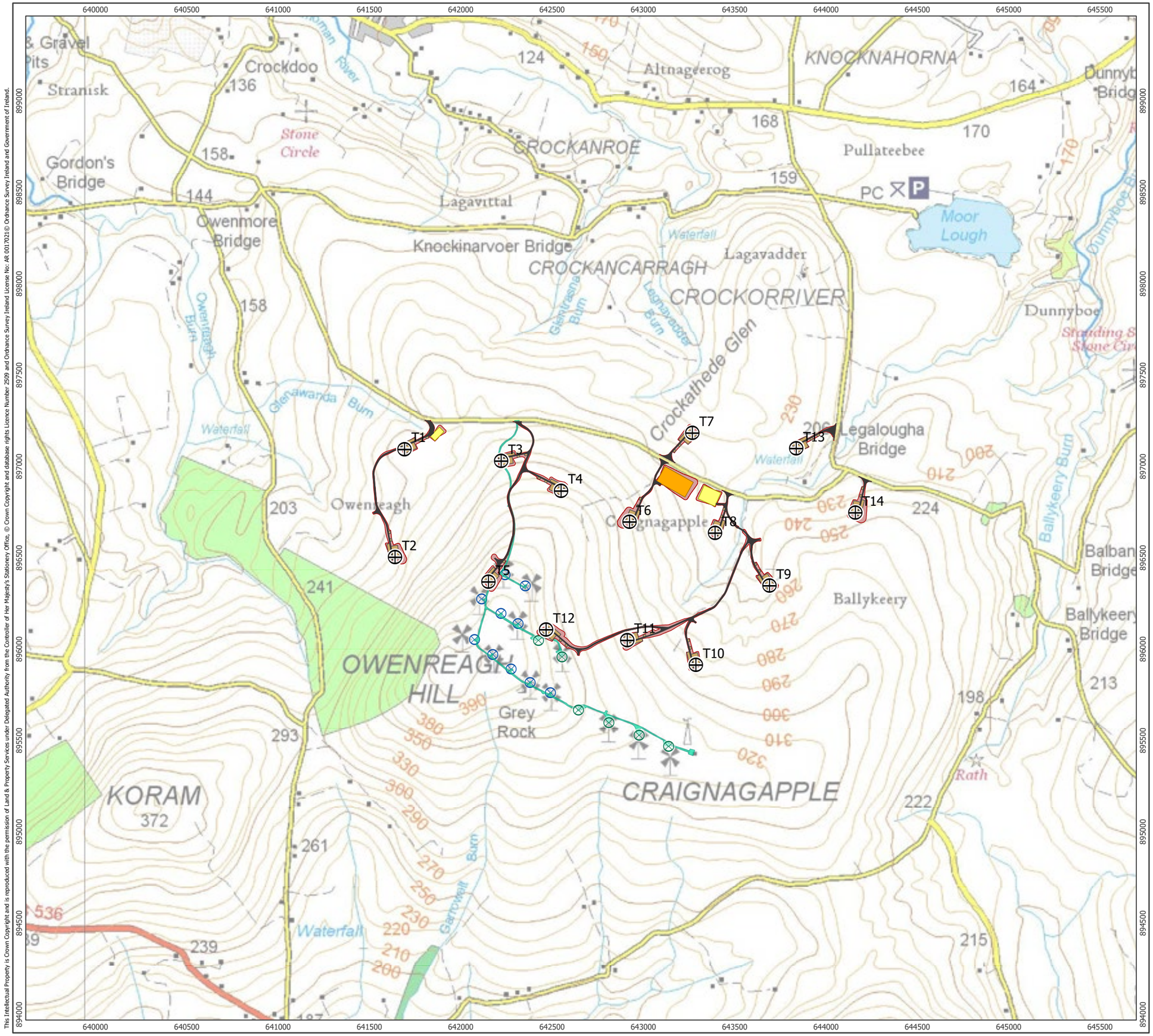
06 September 2023

	Related to	Location in Report	Monitoring Measure
	Pre-construction Phase		
	Water Quality	ES Chapter 8	It is proposed that water quality monitoring is undertaken to monitor any changes to the quantity or quality of water in local water sources.
	Ecology	ES Chapter 10	An ECoW will be appointed, whose responsibilities will include, but will not be limited to: ■ Monitoring compliance with the ecological mitigation works – including measures for the protection of water vole, nesting birds, bats, badger, invertebrates and common amphibians, plus mitigation measures for reptiles following the detailed presence/absence surveys; ■ Providing advice on adequate protection of nature conservation interests on-site; ■ Providing contractor tool-box briefings about legally protected species and their habitats; and, ■ Ensuring any required protected species licences are in place and providing advice and monitoring compliance with the licence conditions.
	Slope-stability Monitoring	ES Chapter 9	A GCoW will be appointed. Slope stability monitoring will occur during pre-construction and construction phases of work, including for both peat stability and non-peat related stability.
	Decommissioning/Construction Phase		
	Floating New Road	ES Chapter 9	Monitoring posts will be installed prior to construction to monitor movement of soils in the area around the construction, managed by a GCoW.
	Dust	ES Chapter 8	Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.
	Water Quality	ES Chapter 10	It is proposed that water quality monitoring is undertaken at PWS at 31 Koram Road and 60 Glenmornan Road, identified as the closest water sources, and hydrologically connected, to the Development. This will monitor any changes to the quantity or quality of water at these PWS. Should any adverse change be noted, an investigation will be undertaken as to whether the change could have been caused by the Development, and appropriate remedial action will be taken. This could include provision of a water bowser as a temporary measure.
	Archaeological Monitoring	ES Chapter 7	Excavations associated with construction works, including topsoil stripping, will be monitored by an ACoW. The ACoW will be appointed to oversee the effective implementation of the archaeological mitigation measures prescribed in this chapter. In the event that archaeological deposits are discovered, work in the area will cease immediately and the ACoW will liaise with the Department for Communities (DfC) Historic Environment Division (HED) to determine an appropriate and proportionate mitigation strategy.

Excavation Works	ES Chapter 7 and 9	Excavation works will be monitored by a suitably qualified and experienced GCoW, and an ACoW if the work occurs within 25 m of WS1 or non-designated asset identified along the Abnormal Load Route. The earthworks will not be scheduled to be carried out during severe weather conditions.
Settlement Lagoons	ES Chapter 8	The settlement lagoons will be monitored closely over the construction timeframe to ensure that they are operating effectively.
Surface Water Management System	ES Chapter 8 and 10	The surface water management system will be visually inspected on a daily basis during construction works to ensure that it is working optimally. Where issues arise, construction works will be stopped immediately, and the source of the issue will be investigated. Records of all maintenance and monitoring activities associated with the surface water network will be retained by the Project Hydrologist, including results of any discharge testing requirements.
Substation Foundations		All works will be monitored by a suitably qualified and experienced engineer.
Directional Drilling		Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. The drilling process / pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse. This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur, then drilling will be immediately stopped.
Noise	ES Chapter 12	Monitoring activity in relation to noise and vibration will include: ■ Monitoring typical levels of noise and vibration during critical periods and at sensitive properties; ■ The use of independent monitoring by external bodies for verification of results; and ■ Blast monitoring to enable adjustment of subsequent charges.
Slope-stability Monitoring	ES Chapter 9	Slope stability monitoring will occur during pre-construction and construction phases of work, including for both peat stability and non-peat related stability.

APPENDIX D FIGURES

06 September 2023



Ørsted

ERM

- ⊕ Proposed Turbine Locations

Site Infrastructure

- Access Tracks
- Substation
- Crane hardstanding
- Construction Compound
- Earthworks

Existing Wind Farm Infrastructure

- ⊗ Operational Owenreagh I
- ⊗ Operational Owenreagh II
- As Built Site Roads & Hardstands

1:20,000 Scale @ A3

0 0.35 0.7 km

NORTH

Produced By: CS	Ref: 4172-REP-062
Checked By: GH	Date: 17/07/2023

Development Layout and Existing Infrastructure

Figure A3.1.1

Owenreagh/Craignagapple Wind Farm Technical Appendix A3.1: Outline Decommissioning and Construction Environmental Management Plan

Y:\GIS\Engineering\Projects\4172 Owenreagh Repowering\4172 Owenreagh 2.aprx\4172-REP-062 Fig9.3.1 Development Layout

The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Singapore
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
Tanzania
Thailand
UK
US
Vietnam

ERM's Dublin Office

D5 Nutgrove Office Park

Dublin 14

D14 X343

Ireland

T: +353 (01) 653 2151
www.erm.com

ERM's Dublin Office

D5 Nutgrove Office Park

Dublin 14

D14 X343

Ireland

T: +353 (01) 653 2151
www.erm.com

OWENREAGH / CRAIGNAGAPPLE WIND FARM

ENVIRONMENTAL STATEMENT VOLUME 4: TECHNICAL APPENDICES

TECHNICAL APPENDIX A10.3: NATIONAL VEGETATION CLASSIFICATION (NVC) SURVEY AND PEATLAND ASSESSMENT

AUGUST 2023

Prepared By:

Woodrow APEM Group,
Upper Offices,
Ballisodare Centre,
Station Road,
Ballisodare,
Co. Sligo.
Ireland.
F91 PE04.

Contents

DOCUMENT CONTROL

Document	Proposed Owenreagh / Craignagapple Wind Farm Development, east of Strabane, Co. Tyrone. National Vegetation Classification (NVC) Survey and Peatland Assessment
Client	Ørsted Onshore Ireland Midco Limited
Prepared by	Woodrow APEM Group, Upper Offices, Ballisodare Centre, Station Road, Ballisodare, Co. Sligo, F91 PE04, Ireland. T: +353 719140542
Lead Author	Bridget Keehan
Checked by	Róisín NigFhloinn
Approved by	Will Woodrow
Checked by client	27.03.2023
Status / Version / Date	R01 / 08.08.2023

Statement of Authority

This report was authored by Bridget Keehan ACIEEM and Róisín NigFhloinn MCIEEM and approved by Will Woodrow CEcol MCIEEM.

This report is written by Bridget Keehan BSc ACIEEM. Bridget is a Senior Ecologist with Woodrow and a professional field botanist with more than 30 years of experience in plant identification including bryophytes. She has excellent habitat classification skills, with extensive experience in JNCC Phase 1, Fossitt 2000 and National Vegetation Classification (NVC) surveys and is proficient in developing strategies and providing advice based on information collated. Bridget is also experienced in undertaking mammal, raptor, invertebrate and invasive species surveys to inform reports and impact assessments. Bridget is proficient in the preparation of habitat maps, ecology chapters of Environmental Impact Assessments, Screening Reports and inputting into Appropriate Assessments, including provision of mitigation recommendations, and has wide experience in editing and analysing reports and journals. Bridget maintains an up-to-date practical knowledge of both European and National (Northern Ireland and Republic of Ireland) environmental legislation and is an Associate Member of the Chartered Institute of Ecology and Environmental Management (ACIEEM).

Róisín NigFhloinn, is an Associate Director with Woodrow, and a project manager for several large infrastructure schemes, as well as for smaller Development projects. She has completed an honours degree, specialising in Botany, and holds a masters in Ecology and Management of the Natural Environment. She is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). She regularly carries out reporting for EcIA, EIAR Biodiversity Chapters / ES Ecology Chapters, and reporting to inform Appropriate Assessment / Habitat Regulations Assessment carried out by statutory authorities. Furthermore, she has more than 13 years' experience in habitat surveys, mammal surveys, bird and bat surveys for a number of large infrastructure schemes, commercial and residential projects. Róisín is also an experienced Ecological Clerk of Works (ECoW).

This report has been reviewed and approved by Will Woodrow. Will is a Director at Woodrow APEM Group. He is a Chartered Ecologist, and a full member of CIEEM, with over 30 years of experience in ecological surveys and assessment. He has particular expertise in ornithological assessment, invertebrate identification and habitat management, particularly when working within peatland environments.

Bridget Keehan – Qualifications:

BSc (Hons) – Botany, University College of North Wales, 1992.

Róisín NigFhloinn – Qualifications:

B.A. Mod (Hons) – Natural Sciences (specialising in Botany), Trinity College, Dublin, 2008.
M. Sc. – Ecology and Management of the Natural Environment, University of Bristol, England, 2011.

Will Woodrow – Qualifications:

M.Sc. – European Environmental Policy and Regulation, Lancaster University, 1994.
M.Sc. (Arch) – Advanced Environmental and Energy Studies. University of East London, 2006

1. Introduction and survey methodology

Woodrow APEM Group ('Woodrow') were commissioned by Ørsted in 2020 to provide ecological services to inform the preparation of an ES for the proposed repowering and extension of the existing Owenreagh I and II Wind Farms, Co Tyrone, henceforth referred to as 'Owenreagh / Craignagapple Wind Farm' ('the Development'). The Ecological Study Area (ESA) can be seen in Appendix I.

A full suite of extended Phase 1 habitat surveys and specialist vegetation surveys have been undertaken by Woodrow at the Craignagapple/Owenreagh Study Area since 2015, both for the previously consented Craignagapple Wind Farm, which was granted permission in 2018 but has not yet been constructed, and for the current proposal (for which Woodrow was contracted to undertake surveys from 2017 to 2022). Habitat surveys undertaken within the Study Area during this period are summarised in Table 2.

Table 1 – Habitat surveys undertaken by Woodrow for the current proposal

Description of surveys undertaken within the Study Area		Dates
Habitat surveys	• Preliminary Extended Phase 1 Habitat Surveys to JNCC specifications. [This included assessment of quadrats to NVC level at selected locations].	2017-2019
	• Further extended Phase 1 Habitat Survey to JNCC specifications, concentrating on highlighting areas of conservation importance. • Initial Active Peat Assessment.	31 May 2021 11 August 2021 19 August 2021 04 October 2021
	• NVC Quadrat survey and active peat assessment.	26-28 October 2021
	• Further Active Peat Assessment.	20-21 July 2022

An active peat assessment ('APA') was undertaken by Woodrow in 2021 and 2022 across the entire Craignagapple/Owenreagh Study Area, focussing particularly on locations highlighted by previous habitat mapping and the indicative site layout at that time. This was undertaken by assessing potential for active peat at georeferenced point locations, by examining parameters such as peat depth, ground conditions and presence of peat forming species. The Active Peat Assessment is reported upon separately (see **Technical Appendix 10.4** of the ES for this proposal); however, standard survey forms used for the APA are provided in **Appendix 2** of this report, with the results summarised In Section 3.

As part of the ongoing habitat assessment for this proposal, to inform the final site layout, a further, more detailed active peat assessment involving a survey of 68 No. standard 2x2 metre vegetation quadrats (relevés) were carried out across the full extent of the proposed Owenreagh 1 Repowering/ Craignagapple Extension area during the period 26-28 October 2021. The locations of the quadrats assessed can be seen on the map in Appendix I.

This survey was intended to inform the final siting of turbines, hardstands and access roads for this proposal. Therefore, a suggested layout of turbine locations and proposed access routes (informed by various factors, including existing and previously consented infrastructure, previous habitat assessments and extended Phase 1 surveys, and optimum wind farm layout) was used as the basis of this survey, quadrat locations being selected within representative habitat in the vicinity of this provisional infrastructure layout.

This quadrat survey was undertaken by a team of five ecologists, all of whom are experienced field botanists with experience in undertaking this type of assessment at a range of wind farm sites across Northern Ireland:

- Róisín NigFhloinn BA Mod. MSc MCIEEM – Associate Director at Woodrow
- Bridget Keehan BSc ACIEEM – Senior Ecologist and Botany Lead at Woodrow
- Philip Doddy PhD BSc (Hons) – Senior Ecologist at Woodrow
- Emmeline Cosnett MSc QCIEEM – Ecologist at Woodrow
- Aoife Hughes MSc GradCIEEM – Ecologist at Woodrow

The assessment of quadrats followed standard National Vegetation Classification guidance (Rodwell, 1996). The information gathered was used to update both the existing JNCC Phase 1 and Constraints site mapping (see TA 10.4 Active Peat Assessment), using ArcPro GIS Software.

For each quadrat, all plant species present, including bryophytes, were recorded, and coverage of each species was assessed in terms of both % cover and score on the DOMIN scale (see Table 2). General observations were recorded for each quadrat location, including notes on slope, aspect, ground condition, substrate, land management and other factors that may influence the vegetation (e.g., nearby drainage; evidence of historic peat cutting).

Table 2 – Coverage of vegetation represented by DOMIN scores (*sensu.* Dahl and Hadač, 1941; reproduced in Rodwell, 1991 and 1992)

DOMIN score	% cover of vegetation
1	Few individuals (<4%)
2	Several individuals (<4%)
3	Many individuals (<4%)
4	4-10%
5	11-25%
6	26-33%
7	34-50%
8	51-75%
9	76-90%
10	91-100%

The information gathered was used to assign a NVC vegetation category to the local vegetation and to determine whether the habitat was likely to represent Northern Ireland Priority Habitat. For each quadrat, an assessment was also made on the suitability of the local area to support active peat accumulation, considering facts such as hydrology and the presence of peat forming species.
The results of the NVC quadrat survey are presented in the tables in Section 2. Each quadrat is colour coded to reflect the status of its vegetation in the Constraints site mapping. A red circle indicated high potential for habitat constraints, such as the likely potential for active peat. A green circle indicates that the quadrat lies within an area of poorer quality/significantly degraded habitat that is not considered likely to represent a constraint to development.

The quadrat survey identified a number of areas of relatively intact peatland habitat where it was considered that there could be potential for active peat accumulation. As a result, it was necessary to make some amendments to the preliminary site layout. In order to further inform such changes, on 21 and 22 July 2022, an additional assessment was made of the potential for active peat focussing on the areas in the vicinity of Turbines 6, 7, 8, 9 and 14. Rather than assessing quadrats, in order to achieve rapid coverage of a relatively large area, individual points were assessed for their likely correspondence to active peat, at a large number of locations, as per the assessment undertaken in summer 2021. Results were recorded in the field using the ArcGIS online field application, Survey 123, in order to achieve a standardised collection of data and to georeference the observations. At each monitoring location, photographs were taken and parameters such as peat depth, surface characteristics, vegetation coverage and presence of peat-building species such as *Sphagnum* were recorded, enabling an assessment of the likelihood of active peat at each point. The combined results

of the two active peat point assessments are provided in Section 3, and the recording forms used for this assessment are reproduced in Appendix 2.
The Hydrological Assessment was also considered when assessing the potential for active peat to occur. This is reported on in detail within **Technical Appendix 8.1** – Hydrological Unit Assessment (HUA) of the Environmental Statement.

1.1 Habitats occurring in the Craignagapple / Owenreagh Area

The majority of the area surveyed is originally derived from blanket bog habitat, as would be expected given the climate, topography and altitude. The peat underlying this area tends to exceed one metre in depth and is much deeper than this in many areas. The exception to this is the western part of the survey area (the proposed locations for Turbines 1 and 2) where the peat, where present, is shallower and the vegetation tends towards semi-improved or improved grassland habitats with some flush.

The Craignagapple / Owenreagh area has been extensively modified in the past as a result of various land management practices. The area has been extensively cut over for peat, and many exposed haggs and cuttings can be seen in the landscape. In addition, many drains run through the area and there are a number of historic access tracks cut deep into the substate, which are now acting as large drains. These are frequently characterised by a luxuriant growth of flat-topped bog-moss (*Sphagnum fallax*), common haircap-moss (*Polytrichum commune*) and rushes (*Juncus* spp.) indicating movement of water and nutrients.

In addition, the general area has been both heavily grazed and burnt in the past, which has continued in localised areas until recently. Surveys undertaken in the area by Woodrow throughout the period 2016-present have noted evidence of degradation caused by overgrazing, as well as direct evidence of burning.

Much of the vegetation in the Survey Area now appears transitional between blanket bog and acid grassland, with heather (*Calluna vulgaris*), hare's-tail cottongrass (*Eriophorum vaginatum*), wavy hair-grass (*Deschampsia flexuosa*) and bilberry (*Vaccinium myrtillus*) tending to dominate the vegetation. Hypnoid mosses are generally abundant throughout, while bog mosses (*Sphagnum* spp.) are present in many areas but are patchy in their distribution. Pockets of relatively intact blanket bog remain in localised areas where the hydrology has not been too compromised. Areas of species-poor flush, likely to result from water movement arising from the damaged hydrology, intersect the areas of modified bog.

It is likely that most of the vegetation communities present are originally derived from M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire. Where the hydrology has become compromised, the vegetation is considered to correspond to the M19b *Empetrum nigrum ssp. nigrum* sub-community (where *Calluna vulgaris* is the dominant species). Where the vegetation appears to be transitional to acid grassland, this has been classified as a mosaic between this community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community. M20 mire communities can develop from M19 blanket mire as a result of drainage, intensive grazing and burning (Rodwell, 1992).

1.1.1 Correspondence to Northern Ireland Priority Habitat and EU Annex I habitats

It is acknowledged that, given the nature of this area, there is potential for correspondence to Northern Ireland Priority moorland habitats and EU Annex I habitats – in particular, considering the deep peat that predominates in this area, to the Northern Ireland Priority Habitat 'Blanket Bog' and EU Annex I Habitat '7130 Blanket Bogs' (a Priority Annex I Habitat when the peat is active).

Blanket bog in Northern Ireland is defined as peatland covering extensive areas in the uplands (and at lower altitudes in the north and west) including hill slopes, valley bottoms and summits. Blanket bog usually occurs on peat which exceeds 0.5m in depth, and its vegetation is generally dominated by peat-forming plants, notably bog-mosses (*Sphagnum* spp.) and cotton-grasses (*Eriophorum* spp.),

with a limited range of other characteristic species including heather (*Calluna vulgaris*), cross-leaved heath (*Erica tetralix*), deergrass (*Trichophorum germanicum*) and purple moor-grass (*Molinia caerulea*) (DAERA, 2018).

As stated by Priority Habitat guidance issued by DAERA, the target for high-quality blanket bog habitat is a coverage of at least 25% *Sphagnum* species and 33% dwarf shrub species, and less than 50% graminoid species (except where purple moor-grass dominates the vegetation). Bare ground cover should be less than 2% and the optimum vegetation height is 15-30cm. The habitat should form an even (not tussocky) sward (DAERA, 2018).

However, in identifying areas of Northern Ireland Priority Habitat, consideration is also given to the wider habitat assemblage, and to the potential for recovery given appropriate management.
In assessing the potential for areas within the Study Area to support Active Peat, NIEA's Advice Note *Active Peatland and PPS18* (DAERA, 2012) was consulted, and consideration given to the following factors:

- The presence of *Sphagnum* species;
- The ground surface – whether wet and/or spongy underfoot;
- The presence of deep peat (>0.5m);
- Whether intact peat is present;
- The hydrology of the area;
- The presence and abundance of the peat forming species *Eriophorum vaginatum* and/or *E. angustifolium*;
- The presence of typical blanket bog indicator species; and
- The presence of hummock and pool topography.

In addition, the EU Habitats Directive defines 'active' bog as a system which supports a significant area of vegetation which is normally peat forming because the presence of such vegetation is readily determined. Any areas identified as supporting active peat are considered likely to correspond to both Northern Ireland Priority Habitat 'Blanket Bog' and the EU Annex I Priority Habitat type '*7130 Blanket Bogs'.

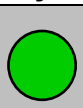
Given the other habitats recorded within the Study Area, consideration was also given to the possible occurrence of other Northern Ireland Priority Habitats and EU Annex I habitat types listed in Table 3.

Table 3 – Northern Ireland Priority Habitats and EU Annex I habitats taken into consideration during the habitat and vegetation surveys undertaken within the Study Area

Northern Ireland Priority Habitats	EU Annex I habitats
Blanket Bog	'*7130 Blanket Bogs'
	7150 Depressions on peat substrates of the Rhynchosporion
Purple Moor Grass and Rush Pastures	6410 *Molinia* meadows
Upland Heathland	4010 Northern Atlantic wet heaths with *Erica tetralix.*
	4030 European dry heaths
Upland Flushes, Fens and Swamps	7140 Transition mires and quaking bogs

2. Results of the Quadrat Survey

2.1 Quadrats assessed in the vicinity of proposed turbine T1

Quadrat T1.1 **Surveyor: EC** 	**Location (X,Y):** **-7.35140, 54.81977**	
This quadrat is located in the vicinity of the proposed hardstand to Turbine 1, within an area that is less improved than the field to the north, however, it is still heavily grazed. Soft-rush (*Juncus effusus*), bent grasses (*Agrostis* spp.) and Yorkshire-fog (*Holcus lanatus*) dominate the vegetation, with abundant springy turf-moss (*Rhytidiadelphus squarrosus*) and other hypnoid mosses. This area has been classified as the JNCC Phase 1 habitat Acid Grassland / Flush (B1.2 / E2.1) – U2b/M6c		
		
Date	28.10.21	
Size (m)	2x2	
Aspect / slope	none	
Altitude (m)	257	
Height of vegetation (cm)	5-10cm with rushes 30cm	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	55	
Bryophyte cover %	45	
No. plant species in quadrat	9	
Species	**% cover**	**DOMIN**
Juncus effusus	25	5-6
Agrostis capillaris	10	4
Agrostis stolonifera	10	4
Holcus lanatus	10	4
Cirsium palustre	<4	1
Rhytidiadelphus squarrosus	25	5-6
Pleurozium schreberi	15	5
Kindbergia praelonga	<4	2
Cerastium fontanum	<4	2
Evaluation - Quadrat T1.1: **NVC classification**: Mosaic between M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire – *Juncus effusus* subcommunity and U2b *Deschampsia flexuosa* grassland, *Vaccinium myrtillus sub-community*. This area is **unlikely to comprise active peat** due its extensive modification with evidence of degraded peat.		

Quadrat T1.2 **Surveyor: EC**	**Location (X,Y):** **-7.35007, 54.81964**

This quadrat is located *c*. 40m southwest of the proposed T1 hardstand, having been initially located on the access route for the turbine, the layout of which has since been modified to avoid impacts upon sensitive habitats. The vegetation supports typical blanket bog species, with abundant bog-mosses (*Sphagnum* spp.), and is in an area of deep peat (>0.5m). There appears to be potential for this area to support active peat.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past – M19.

Date	28.10.21	
Size (m)	2x2	
Aspect / slope	north-facing slope	
Altitude (m)	256	
Height of vegetation (cm)	Mean 5-15cm (*Molinia caerulea* 1.5m+)	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	20	
Herbaceous/Graminoid cover %	60	
Bryophyte cover %	55	
No. plant species in quadrat	24	
Species	**% cover**	**DOMIN**
Calluna vulgaris	15	5
Erica tetralix	5	4
Vaccinium myrtillus	<4	2
Juncus effusus	10	4-5
Eriophorum vaginatum	5	4
Eriophorum angustifolium	5	4
Agrostis stolonifera	5	4
Molinia caerulea	<4	1
Juncus squarrosus	10	4-5
Potentilla erecta	<4	3
Narthecium ossifragum	15	5
Juncus bulbosus	5	4
Galium saxatile	<4	3
Rhytidiadelphus loreus	5	4
Plagiothecium undulatum	10	4-5
Aulacomnium palustre	<4	3
Sphagnum capillifolium	5	4
Sphagnum fallax	<4	3
Sphagnum palustre	5	4
Sphagnum papillosum	<4	2
Sphagnum tenellum	<4	1

Sphagnum subnitens	5	4
Hypnum jutlandicum	5	4
Polytrichum commune	15	5

Evaluation - Quadrat T1.2:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but **still has the potential for active peat.** This area has been identified as having a comprised hydrological within the Hydrological Assessment.

Quadrat T1.3 **Surveyor: EC**	**Location (X,Y):** **-7.34932, 54.81908**

This quadrat is located *c.* 100m southeast of the proposed T1 hardstand, having been initially placed on the access route for the turbine, which has since been modified to avoid impact on active peat. Therefore, this quadrat is now at a significant distance from the proposed T1 infrastructure, which now lies within acid grassland and species-poor flush habitat.
The vegetation in the vicinity of the quadrat is composed of blanket bog on deep peat (>0.5m), which appears to have been cutover in the past but is now recovering. It is wet and spongy underfoot, being fed by a flush to east and receiving water from upslope. Bog-mosses (*Sphagnum* spp.) and ericoid species dominate the vegetation, with cottongrasses (*Eriophorum vaginantum* and *E. angustifolium*) and some deergrass (*Trichophorum germanicum*).

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past – M19

Date	28.10.21	
Size (m)	2x2	
Aspect / slope	none	
Altitude (m)	254	
Height of vegetation (cm)	30-40	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	40	
Herbaceous/Graminoid cover %	40	
Bryophyte cover %	80	
No. plant species in quadrat	15	
Species	**% cover**	**DOMIN**
Calluna vulgaris	30	6
Erica tetralix	10	4-5
Trichophorum germanicum	10	4-5
Eriophorum angustifolium	10	4-5
Eriophorum vaginatum	20	5
Cladonia portentosa	10	4-5
Sphagnum cuspidatum (in wetter patch)	10	4-5
Sphagnum subnitens	15	5
Sphagnum fallax	10	4-5
Rhytidiadelphus loreus	10	4-5
Plagiothecium undulatum	5	4
Pleurozium schreberi	10	4-5
Hypnum jutlandicum	10	4-5
Sphagnum capillifolium	<4	2
Campylopus introflexus	<4	2

Evaluation - Quadrat T5.3:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but **still has the potential for active peat.** However, the Hydrological Assessment indicates that this quadrat lies within a 'non-intact' hydrological unit.

2.2 Quadrats assessed in the vicinity of proposed turbine T2

Quadrat T2.1 **Surveyor: PD**	**Location (X,Y):** **-7.345668012276292, 54.81376416049898,**

This quadrat is located between Turbine 2 and Turbine 5, on a steep hillside area, originally placed in order to assess this area's suitability for a potential alternative access track to Turbine 2. The ground here was firm underfoot with many hummocks. The vegetation was dominated by graminoid species, such as wavy hair-grass (*Deschampsia flexuosa*), and heather (*Calluna vulgaris*). There is a considerable moss layer, with a variety of species noted. There were no signs of recent grazing.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8) - the wider area transitions between Dry Modified Bog and an Acid Grassland/Flush (B1.2 / E2.1).

Date	27.10.21	
Size (m)	2x2	
Aspect / Slope (degrees)	Steep west-facing slope	
Height of vegetation (cm)	45 cm	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	18	
Herbaceous/Graminoid cover %	38	
Bryophyte cover %	65	
No. plant species in quadrat	15	
Substrate	Peat	
Species	**% cover**	**DOMIN**
Calluna vulgaris	18	5
Galium saxatile	<4	3
Molinia caerulea	<4	2
Eriophorum angustifolium	7	4
Juncus effusus	9	4
Eriophorum vaginatum	7	4
Deschampsia flexuosa	11	5
Potentilla erecta	<4	1
Rhytidiadelphus squarrosus	5	4
Polytrichum commune	17	5
Sphagnum fallax	10	4
Sphagnum palustre	10	4
Sphagnum papillosum	5	4
Rhytidiadelphus loreus	12	5
Hylocomium splendens	7	4

Evaluation – Quadrat T2.1:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing the *Empetrum nigrum* ssp. *nigrum* sub-community, transitioning to a mosaic of M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire – *Juncus effusus* subcommunity and U2b *Deschampsia flexuosa* grassland*, Vaccinium myrtillus* sub-community.

Although there are some bog-mosses (*Sphagnum* spp.) present, the area **is unlikely to comprise active peat** due its extensive modification and dry surface.

Quadrat T2.2 **Surveyor: PD**	**Location (XY)** **-7.348357178270817, 54.8142827488482**

This quadrat is located in between Turbines 2 and 5, approximately 180m from the T2 hardstand. At the time, its placement was to enable assessment of this area for a potential alternative access track to Turbine 2. The quadrat lies within a wet area dominated by graminoids, of which most were rushes, *Juncus* spp.). The most abundant graminoid species was sharp-flowered rush (*Juncus articulatus*). There was a substantial bryophyte layer present with an abundance of flat-topped bog-moss (*Sphagnum fallax*). No evidence of recent grazing was noted.

This area has been classified as the JNCC Phase 1 habitat Flush & Spring - acid/neutral flush (E2.1), although it is considered to be a species poor example.

Date	27.10.2021	
Size (m)	2x2	
Aspect / Slope (degrees)	Gentle west-facing slope	
Height of vegetation (cm)	82	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	72	
Bryophyte cover %	46	
No. plant species in quadrat	7	
Substrate	Peat	
Species	**% cover**	**DOMIN**
Juncus acutiflorus	38	7
Agrostis stolonifera	11	5
Molinia caerulea	5	4
Juncus effusus	12	5
Deschampsia flexuosa	5	4
Polytrichum commune	8	4

Evaluation – Quadrat T2.2:

NVC classification: M6d *Carex echinata – Sphagnum recurvum/auriculatum* mire - *Juncus acutiflorus* subcommunity

This location does not support peat-forming vegetation and as such **it is not considered to represent active peat.**

Quadrat T2.3 **Surveyor: PD**	**Location** **(XY)-7.350387694314122, 54.81460813432932**

This quadrat is located c. 50m east of the T2 proposed hardstand. It was originally placed along a potential alternative access route for T2 although this was not ultimately adopted. The ground in the area of the quadrat was very uneven with large hummocks, deep holes and channels. The general area appears to be composed of cutaway bog. The vegetation was dominated by dwarf shrubs and graminoids. Dominant species were heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*). No signs of grazing were noted. The general area also has large patches of rushes, mainly soft rush (*Juncus effusus*).

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8), although like the other quadrats in the vicinity of T9, it lies adjacent to an area of *Juncus*- dominated acid-neutral flush (E2.1)

Date	27.10.2021	
Size (m)	2x2	
Aspect / Slope (degrees)	Moderate west-facing slope	
Height of vegetation (cm)	55	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	32	
Herbaceous/Graminoid cover %	45	
Bryophyte cover %	40	
No. plant species in quadrat	12	
Substrate	Peat	
Species	**% cover**	**DOMIN**
Calluna vulgaris	24	5
Galium saxatile	<4	3
Eriophorum vaginatum	16	5
Vaccinium myrtillus	8	4
Potentilla erecta	< 4	2
Deschampsia flexuosa	11	5
Eriophorum angustifolium	9	4
Molinia caerulea	<4	2
Rhytidiadelphus squarrosus	12	5
Pseudoscleropodium purum	14	5
Pleurozium schreberi	14	5
Dryopteris dilatata	<4	1

Evaluation – Quadrat T2.3:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat composed of the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community.

This area has been highly modified in the past, and is dry and firm underfoot, with *Sphagnum* notably absent, therefore **is not considered to support active peat.**

Quadrat T2.4 **Surveyor: PD**	**Location** **(XY) 54.81486340519041, -7.350831516087055**

This quadrat is located a short distance east of the proposed hardstand area of Turbine T2. The area around the quadrat is rushy and dominated by graminoids, particularly hare's-tail cottongrass (*Eriophorum vaginatum*) and rushes (*Juncus* spp.). The ground was damp and soft underfoot. Some mosses were found in the quadrat, mainly common haircap-moss (*Polytrichum commune*) and flat-topped bog-moss (*Sphagnum fallax*). No signs of grazing were noted. The area is likely to be a previously-cutaway bog.

This area has been classified as the JNCC Phase 1 habitat Flush & Spring - acid/neutral flush (E2.1), although it is considered to be a species poor example. The area transitions into Dry Modified Bog (E1.8) nearby.

Date	27.10.2021	
Size (m)	2x2	
Aspect / Slope (degrees)	Moderate west-facing slope	
Height of vegetation (cm)	64	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	60	
Bryophyte cover %	65	
No. plant species in quadrat	10	
Substrate	Peat	
Species	**% cover**	**DOMIN**
Eriophorum vaginatum	22	5
Juncus articulatus	6	4
Juncus effusus	5	4
Molinia caerulea	7	4
Deschampsia flexuosa	8	4
Eriophorum angustifolium	12	5
Galium saxatile	< 4	2
Sphagnum fallax	27	6
*Polytrichum ccommune*38	7	
Potentilla erecta	< 4	2

Evaluation - Quadrat T2.4:

NVC classification: M6c *Carex echinata* – *Sphagnum recurvum/auriculatum* mire – *Juncus effusus* subcommunity.

This location contains some inundated *Sphagnum* but supports little peat-forming vegetation and the conditions are suggestive of water flux; as such **it is not considered to represent active peat.**

Quadrat T2.5 **Surveyor: PD**	**Location (XY):** **-7.351302746683359, 54.814922623336315**

This quadrat is located within a rushy area close to the potential turbine hardstand for Turbine 8. This area appears to have been derived from a previously-cutaway boy, the vegetation dominated by rushes (*Juncus* spp.) and other graminoid species, particularly wavy hair-grass (*Deschampsia flexuosa*), sharp-flowered rush (*Juncus articulatus*), purple moor-grass (*Molinia caerulea*) and creeping bent (*Agrostis stolonifera*). There were also occasional clumps of heather (*Calluna vulgaris*). No signs of grazing were noted.

This area has been classified as the JNCC Phase 1 habitat Acid Grassland / Flush (B1.2 / E2.1).

Date	27.10.2021	
Size (m)	2x2	
Aspect / Slope (degrees)	Moderate west-facing slope	
Height of vegetation (cm)	48	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	30	
Herbaceous/Graminoid cover %	62	
Bryophyte cover %	15	
No. plant species in quadrat	12	
Substrate	Peaty	
Species	**%DOMIN**	
Calluna vulgaris	28	6
Deschampsia flexuosa	14	5
Potentilla erecta	< 4	3
Juncus articulatus	16	5
Molinia caerulea	14	5
Agrostis stolonifera	18	5
Galium saxatile	<4	2
Vaccinium myrtillus	< 4	1
Rhytidiadelphus squarrosus	8	4
Pleurozium scheberi	7	4
Nardus stricta	4	4
Eriophorum angustifolium	4	4

Evaluation - Quadrat T2.5:

NVC classification: Mosaic between the M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* subcommunity and U2b *Deschampsia flexuosa* grassland, *Vaccinium myrtillus* sub-community.

This area has been highly modified in the past, and while it contains some peat forming species these are not dominant. Its surface is not excessively wet or spongy. Therefore**, it is not considered to support active peat.**

Quadrat T2.6 **Surveyor: PD**	**Location (X,Y):** **-7.352246632799506, 54.81519566383213**

This quadrat is located within the area of the proposed hardstand for Turbine 2. This area contained some heathy habitat and appeared to be a previously cutaway bog. The ground was quite firm and dry underfoot although some channels and holes were also present. The vegetation was dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*). No signs of grazing were noted. A single hard fern (*Blechnum spicant*) was noted just outside the quadrat boundary.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	27.10.2021	
Size (m)	2x2	
Aspect / Slope (degrees)	Moderate west-facing slope	
Height of vegetation (cm)	32	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	48	
Herbaceous/Graminoid cover %	4 2	
Bryophyte cover %	35	
No. plant species in quadrat	12	
Substrate	Peat	
Species	**% cover**	**DOMIN**
Calluna vulgaris	45	7
Erica tetralix	<4	1
Eriophorum vaginatum	24	5
Potentilla erecta	<4	3
Vaccinium myrtillus	< 4	1
Molinia caerulea	5	4
Rhytidiadelphus squarrosus	8	4
Rhytidiadelphus loreus	10	4
Polytrichum commune	8	4
Hylocomium splendens	5	4
Sphagnum fallax	4	4
Eriophorum angustifolium	4	4
Deschampsia flexuosa	9	4

Evaluation - Quadrat T2.6:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community.

This area has been highly modified in the past, and is dry and firm underfoot, with little *Sphagnum* present, therefore **is not considered to support active peat.**

Quadrat T2.7 **Surveyor: PD**	**Location** **(XY)-7.350969733670354,** **54.81473193503916**

This quadrat is located a short distance east of the proposed hardstand area for Turbine 2. It previously lay within the hardstand area, but this has since been relocated. The area appears to be a cutover bog, and supports hummocky vegetation, with tall heather (*Calluna vulgaris*). The ground was quite firm and dry underfoot. The vegetation was dominated by heather (*Calluna vulgaris*) and some graminoid species, particularly hare's-tail cottongrass (*Eriophorum vaginatum*) and purple moor-grass (*Molinia caerulea*). Bog-mosses (*Sphagnum* spp.) were absent although a range of hypnoid mosses were represented. No signs of grazing were noted.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8).

Date	27.10.2021	
Size (m)	2x2	
Aspect / Slope (degrees)	moderate west-facing slope	
Height of vegetation (cm)	65	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	62	
Herbaceous/Graminoid cover %	33	
Bryophyte cover %	35	
No. plant species in quadrat	9	
Substrate	Peat	
Species	**% cover**	**DOMIN**
Calluna vulgaris	60	8
Molinia caerulea	12	5
Eriophorum vaginatum	13	5
Deschampsia flexuosa	8	4
Vaccinium myrtillus	<4	1
Pleurozium schreberi	7	4
Hylocomium splendens	7	4
Rhytidiadelphus loreus	16	5
Hypnum jutlandicum	5	4

Evaluation - Quadrat T2.7:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community.

This area has been highly modified in the past, and is dry and firm underfoot, with little *Sphagnum* present, therefore **is not considered to support active peat.**

2.2.1 Quadrats assessed along the access route to proposed turbine T2

Quadrat X.1 **Surveyor: AH**	**Location (X,Y):** **-7.355189351, 54.81716839**

This quadrat is located *c*. 80m to the west of the proposed access road between T1 and T2. [At the time of the survey, this was located on the potential hardstand for an additional turbine, which has since been dropped from the design.]

The vegetation at this location is dominated by sharp-flowered rush (*Juncus acutiflorus*) and hare's-tail cottongrass (*Eriophorum vaginatum*). Evidence of grazing was noted in the quadrat (dung and trails) and access by sheep to the wider area was also noted.
No invasive species were noted in the vicinity and there was no evidence of recent turf cutting. The ground in this area is damp underfoot.

This area has been classified as a mosaic of the JNCC Phase 1 habitats Acid Grassland (B1.2) and Acid/neutral flush (E2.1)

Date	28.10.2021	
Size (m)	2x2	
Slope (degrees)	5° - gentle	
Aspect	West facing	
Altitude (m)	231	
Height of vegetation	30	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	76	
Bryophyte cover %	80	
No. plant species in quadrat	12	
Substrate	Peat	
Species	**% cover**	**DOMIN**
Juncus acutiflorus	40	7
Juncus effusus	3	1
Eriophorum vaginatum	15	5
Potentilla erecta	9	4
Galium saxatile	6	4
Deschampsia flexuosa	3	2
Polytrichum commune	35	7
Pleurozium schreberi	30	6
Sphagnum fallax	10	4

Sphagnum palustre	10	4
Rhytidiadelphus squarrosus	5	4

Evaluation - Quadrat X.1:

NVC classification M6d/U2b - a mosaic of M6d *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus acutiflorus* sub-community and U2b *Deschampsia flexuosa* grassland - *Vaccinium myrtillus* sub-community grassland).

This area has been highly modified in the past, and while it contains some peat forming species these are not dominant. Its surface is not excessively wet or spongy.
Therefore, it is **not considered to support active peat.**

Quadrat X.2 **Surveyor: AH**	**Location (X,Y):** **-7.353669712 54.81792506**

This quadrat is located adjacent to the proposed access road between T1 and T2. At the time of the survey, this was located on the proposed access road to an additional turbine location between T1 and T2, which has since been dropped from the design.

The vegetation in this area is damp underfoot, dominated by soft rush (*Juncus effusus*). There was no evidence of grazing in the quadrat at the time of survey; however, sheep were noted to have access to the wider area. No invasive species were noted in the vicinity and there was no evidence of recent turf cutting.

This area has been classified as the JNCC Phase 1 habitat Acid/neutral flush (E2.1), although it is considered to be a species poor example.

Date	28.10.2021	
Size (m)	2x2	
Slope (degrees)	3° - gentle slope	
Aspect	West facing	
Altitude (m)	240	
Height of vegetation	1m +	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	100	
Bryophyte cover %	30	
No. plant species in quadrat	4	
Substrate	Peat	
Species	**% cover**	**DOMIN**
Juncus effusus	95	10
Holcus lanatus	3	2
Deschampsia flexuosa	2	1
Feather-moss	30	6

Evaluation - Quadrat X.2:

NVC classification: M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* subcommunity.

This location does not support peat-forming vegetation and as such **it is not considered to represent active peat.**

2.3 Quadrats assessed in the vicinity of proposed turbine T3

Quadrat T3.1 **Surveyor: AH**	**Location (X,Y):** **-7.343547745, 54.81907803**
This quadrat is located close to the proposed Turbine 3 hardstand, having been initially placed on the proposed access route for a different location for this turbine, the location of which has since been modified. The vegetation in the quadrat is dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*) with abundant *Sphagnum* hummocks. There was no evidence of grazing or recent turf cutting at the time of surveying, and no invasive species were noted in the vicinity. This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past.	
	

Date	28.10.2021	
Size (m)	2x2	
Slope (degrees)	3° - gentle slope	
Aspect	West facing	
Altitude (m)	296	
Height of vegetation	30cm mean	
Vegetation cover %	97	
Bare rock cover %	0	
Bare peat cover %	3 % (degraded *Sphagnum* on bare ground)	
Shrub/ericoid cover %	40	
Herbaceous/Graminoid cover %	30	
Bryophyte cover %	90	
No. plant species in quadrat	11	
Substrate	Peat (<1m)	
Species	**% cover**	**DOMIN**
Calluna vulgaris	39	7
Vaccinium myrtillus	1	1
Eriophorum vaginatum	28	6
Eriophorum angustifolium	1	1
Carex echinata	1	2
Sphagnum papillosum	2	3
Sphagnum capillifolium	35	7

Sphagnum fallax	30	6
Rhytidiadelphus loreus	20	5
Polytrichum commune	4	4
Sphagnum palustre	1	1

Evaluation - Quadrat T3.1:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but **still has the potential to support areas of active peat**, however the Hydrological Assessment has assessed this as a non-intact hydrological unit and as such, active peat recovery is unlikely to occur at this location in the future.

Quadrat T3.2 **Surveyor: AH**	**Location (X,Y):** **-7.345037703, 54.81834931**

This quadrat is located *c.* 140m southwest of the proposed hardstand of Turbine 3. It was initially placed on the proposed turbine hardstand, but this has since been moved to the current location, due to its original proximity to modified bog habitat considered to have potential for restoration to active peat. The vegetation is dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*). Evidence of grazing (dung and tracks) was noted within the quadrat. There was no evidence of recent tuft cutting and there were no invasive or non-native species noted in the vicinity.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8).

Date	28.10.2021	
Size (m)	2x2	
Slope (degrees)	7° – gentle slope	
Aspect	North facing	
Altitude (m)	296	
Height of vegetation	50+ cm mean height	
Vegetation cover %	98	
Bare rock cover %	0	
Bare peat cover %	2	
Shrub/ericoid cover %	52	
Herbaceous/Graminoid cover %	43	
Bryophyte cover %	80	
No. plant species in quadrat	9	
Substrate	Peat (1+ m deep)	
Species	**% cover**	**DOMIN**
Calluna vulgaris	50	7
Vaccinium myrtillus	2	1
Eriophorum vaginatum	38	7
Eriophorum angustifolium	1	1
Potentilla erecta	3	3
Galium saxatile	1	1
Rhytidiadelphus loreus	70	8
Sphagnum palustre	10	4

Evaluation - Quadrat T3.2:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat comprising the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community.

This area has been highly modified in the past, and is dry and firm underfoot, with little *Sphagnum* present, therefore **is not considered to support active peat.**

Quadrat T3.3 **Surveyor: AH**	**Location (X,Y):** **-7.344987104, 54.81859163**

This quadrat is located *c.* 120m southwest of the proposed hardstand of Turbine 3. It was initially placed on the proposed turbine hardstand, but this has since been relocated out of this habitat type due to its moderate to high contraint (see also Quadrat 3.2). The vegetation is dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*), with a good coverage of bog-moss (*Sphagnum* spp.). Evidence of grazing was noted within the general area. There was no evidence of recent turf cutting and there were no invasive or non-native species noted in the vicinity.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past – M19

Date	28.10.2021	
Size (m)	2x2	
Slope (degrees)	6° – gentle slope	
Aspect	North facing	
Altitude (m)	293	
Height of vegetation	60	
Vegetation cover %	98	
Bare rock cover %	0	
Bare peat cover %	2	
Shrub/ericoid cover %	55	
Herbaceous/Graminoid cover %	45	
Bryophyte cover %	85	
No. plant species in quadrat	11	
Substrate	Peat (>1m)	
Species	**% cover**	**DOMIN**
Calluna vulgaris	50	7
Vaccinium myrtillus	5	4
Potentilla erecta	4	4
Eriophorum vaginatum	40	7
Eriophorum angustifolium	<1.	1
Galium saxatile	<1	1
Rhytidiadelphus loreus	40	7
Polytrichum commune	25	5
Sphagnum subnitens	5	4
Sphagnum palustre	10	1
Sphagnum fallax	5	4

Evaluation - Quadrat T3.3:

NVC Classification: M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire.

This area has been modified in the past but **still has the potential to support areas of active peat**, however the Hydrological Assessment has assessed this as a non-intact hydrological unit and as such, active peat recovery is unlikely to occur at this location in the future.

Quadrat T3.4 **Surveyor: AH**	**Location (X,Y):** **-7.344032818, 54.81890994**

This quadrat is located *c.* 50m southwest of the proposed hardstand of Turbine 3. It was initially placed on the proposed turbine hardstand, but this has since been relocated (see Quadrat 3.2). The vegetation is dominated by heather (*Calluna vulgaris*), with some soft rush (*Juncus effusus*) also present. Flat-topped bog-moss (*Sphagnum fallax*) was quite abundant beneath the heather layer, possibly suggesting some localised flushing. There was no evidence of grazing noted within the quadrat, nor any evidence of recent tuft cutting. No invasive/non-native species were noted in the vicinity.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8).

Date	28.10.2021	
Size (m)	2x2	
Slope (degrees)	5° – gentle slope	
Aspect	North facing	
Altitude (m)	293	
Height of vegetation	80+	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	80	
Herbaceous/Graminoid cover %	7	
Bryophyte cover %	65	
No. plant species in quadrat	11	
Substrate	Peat <1m	
Species	**% cover**	**DOMIN**
Calluna vulgaris	80	9
Vaccinium myrtillus	2	1
Juncus effusus	6	4
Galium saxatile	1	2
Sphagnum fallax	40	7
Polytrichum commune	2	2
Sphagnum papillosum	3	2
Rhytidiadelphus loreus	10	4
Feather moss (unknown)	10	4

Evaluation – Quadrat T3.4:

NVC Classification: degraded M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past and now most closely corresponds to the M19b *Empetrum nigrum* ssp. *nigrum* sub-community.

This area has been highly modified in the past, and is dry and firm underfoot, with little peat-forming *Sphagnum* present, therefore **is not considered to support active peat.**

2.4 Quadrats assessed in the vicinity of proposed turbine T4

Quadrat T4.1 **Surveyor: BK**	**Location (X,Y):** **-7.337888433, 54.8178516** **IG: H 42616 96874**

This quadrat, which lies within the proposed T4 hardstand footprint, is located on deep peat (>1m) within an area of modified blanket bog, which has been extensively cutover in the past; a number of old cut banks are visible in the surrounding area, the closest lying 3-4 m from the quadrat. The quadrat lies *c.* 5m from a dip which is slightly flushed in places, evidenced by the present of soft rush (*Juncus effusus*).

The ground at this location is quite uneven underfoot, the surface firm and relatively dry. The vegetation is dominated by hare's-tail cottongrass (*Eriophorum vaginatum*) with heath (*Calluna vulgaris*); bilberry (*Vaccinium myrtillus*), tormentil (*Potentilla erecta*) and wavy hair-grass (*Deschampsia flexuosa*) are also quite abundant, with scattered cross-leaved heath (*Erica tetralix*). Hypnoid mosses are abundant beneath the heather layer; bog-mosses (*Sphagnum* spp.) are also present but are quite sparse. No evidence of recent management was observed but past cutting and draining were apparent.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8).

Right: Overview of proposed hardstand location (photographed at 54.81759871, -7.338177608). This general area is composed of modified blanket bog vegetation with a central lower channel supporting species-poor flush. There is generally a peat depth of over 1m at this location.

		
Date	27.10.2021	
Size (m)	2x2	
Aspect / slope (degrees)	Moderate west-facing slope	
Altitude (m)	313	
Height of vegetation (cm)	35-40	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	45	
Herbaceous/Graminoid cover %	80	
Bryophyte cover %	20	
No. plant species in quadrat	12	
Substrate	deep peat (>1m)	
Species	**% cover**	**DOMIN**
Eriophorum vaginatum	75	8-9
Vaccinium myrtillus	10	4
Potentilla erecta	10	1
Deschampsia flexuosa	4-5	3-4
Erica tetralix	1	1
Potentilla erecta	10	4
Sphagnum subnitens	2	2
Rhytidiadelphus loreus	15	5
Hypnum jutlandicum	2	2
Polytrichum commune	<1	1
Kindbergia praelonga	<1	1

Evaluation – Quadrat T4.1:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire, that has been modified by drainage and cutting in the past, and now most closely corresponds to the M19b *Empetrum nigrum* ssp. *nigrum* sub-community.

This area is **unlikely to comprise active peat** due its extensive modification and dry surface, with evidence of degraded peat.

Quadrat T4.2 **Surveyor: BK**	**Location (X,Y):** **-7.33783856, 54.81826269** **IG: H42616 92921**

This quadrat is located in the vicinity of the proposed T4 hardstand footprint, on moderately sloping land, within a dip between two spurs, just above (and west of) the lowest part which forms a flushed channel. The ground here is wetter than at Quadrat T4.1, with more *Sphagnum* moss and some patches of bog asphodel (*Narthecium ossifragum*) and is softer underfoot. There are small patches of bare and degraded peat, and some holes are present suggesting past poaching.

The vegetation is dominated by hare's-tail cottongrass (*Eriophorum vaginatum*) with heather (*Calluna vulgaris*), but deergrass (*Trichophorum germanicum*) is also quite abundant. bog-mosses (*Sphagnum palustre, S. capillifolium, S subnitens* and *S. papillosum*) are all present and together make up about 15% of the vegetation. Similar vegetation extends upslope (i.e., to the south).

In spite of the presence of deergrass, the spongy surface and the abundance of the peat-forming species hare's-tail cottongrass (*Eriophorum vaginatum*) and bog-mosses (*Sphagnum* spp.) at this location, it is questionable whether this area would constitute active peat as it appears that the hydrology must be compromised by adjacent channel.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8).




Date	27.10.2021
Size (m)	2x2
Aspect / slope (degrees)	Moderate north-facing slope
Altitude (m)	309
Height of vegetation (cm)	20-35
Vegetation cover %	97
Bare rock cover %	0
Bare peat cover %	3
Shrub/ericoid cover %	18

Herbaceous/Graminoid cover %	75	
Bryophyte cover %	20	
No. plant species in quadrat	14	
Substrate	deep peat (>1m)	
Species	**% cover**	**DOMIN**
Eriophorum vaginatum	60	8
Calluna vulgaris	15	5
Trichophorum germanicum	7-8	4
Sphagnum palustre	7	4
Sphagnum capillifolium	6	4
Sphagnum papillosum	7	4
Sphagnum fallax	<1	1
Sphagnum subnitens? (Quite degraded so exact species unclear)	2	2
Eriophorum angustifolium	4-5	3-4
Erica tetralix	2	2
Potentilla erecta	<1	1
Vaccinium myrtillus	<1	1
Narthecium ossifragum	<1	1
Hypnum jutlandicum	<1	3

Evaluation – Quadrat T4.2:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire, that has been modified by drainage and cutting in the past, and now most closely corresponds to the M19b *Empetrum nigrum* ssp. *nigrum* sub-community.

This area is **unlikely to comprise active peat** due its extensive modification and evidence of degraded peat.

Quadrat T4.3 **Surveyor: BK**	**Location** **(IG): H42627 96923** **(XY): -7.33769522979855, 54.8183093313127**

This quadrat is located in the vicinity of the proposed hardstand for Turbine 4, just above a drainage channel, in a disturbed-looking area of flushed acid grassland vegetation on shallow peat. The ground at this location is very uneven, with tussocks of wavy-hair grass (*Deschampsia flexuosa*) and patches of soft-rush (*Juncus effusus*). Overall, the vegetation is dominated by wavy hair-grass with heather (*Calluna vulgaris*) and bilberry (*Vaccinium myrtillus*). Dead heather stems are visible and there are some deep holes where water is present.

No evidence of recent grazing or other management was observed.

This area has been classified as a mosaic of the JNCC Phase 1 habitat Flush & Spring - acid/neutral flush (E2.1) with Dry Modified Bog (E1.8), into which it grades at the margins.




Date	27.10.2021
GPS reading	9 42627 96923
Size (m)	2x2
Aspect / slope (degrees)	Moderate, North facing
Altitude (m)	305
Height of vegetation (cm)	15-50
Vegetation cover %	100
Bare rock cover %	0
Bare peat cover %	0
Shrub/ericoid cover %	25
Herbaceous/Graminoid cover %	60
Bryophyte cover %	15
No. plant species in quadrat	16
Substrate	shallow peat (*c*. 0.5m)

Species	% cover	DOMIN
Eriophorum vaginatum	7-8	4
Deschampsia flexuosa	40	7
Carex sp. (*C. 35chinate?*)	10	4
Juncus effusus	3	1
Vaccinium myrtillus	15	5
Potentilla erecta	5-6	4
Galium saxatile	3	2-3
Calluna vulgaris	10	4
Erica tetralix	<1	1
Molinia caerulea	2	1
Rhytidiadelphus squarrosus	10-12	4-5
Hypnum jutlandicum	2	2
Rhytidiadelphus loreus	3	3
Sphagnum palustre	At margin only	1
Polytrichum commune	2-3	2
Kindbergia praelonga	1	2

Evaluation – Quadrat T4.3:

NVC Classification: This area has been classified as a mosaic of the communities M19b *Calluna vulgaris – Eriophorum vaginatum* blanket mire, *Empetrum nigrum* ssp. *nigrum* sub-community and M6c *Carex 35chinate – Sphagnum recurvum/auriculatum* mire – *Juncus effusus* subcommunity. It is likely to be derived from a M19 blanket mire that has experienced drainage and cutting in the past.

This area is **unlikely to comprise active peat** due its extensive modification and dry surface, with evidence of degraded peat.

Quadrat T4.4 **Surveyor: BK**	**Location (X,Y):** **-7.33741879463195, 54.81904518** **IG: H42649 97048**

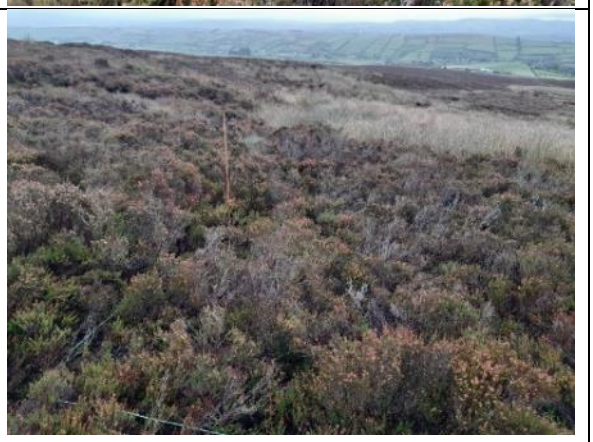
This quadrat is located *c*. 80m downslope of the proposed T4 hardstand and was originally located along the proposed access track for this turbine, which has since been rerouted.

The vegetation is composed of modified bog dominated by tall, leggy heather (*Calluna vulgaris*). The heather is dense and is underlain by mosses: heath plait-moss (*Hypnum jutlandicum*) and either red bog-moss or lustrous bog-moss (*Sphagnum capillifolium* or *Sphagnum subnitens*) – identification is uncertain as the plants are very shaded and therefore lacking their usual colour and other species are present in the wider area. There is a small quantity of hare's-tail cottongrass-tail cottongrass (*Eriophorum vaginatum*) present but otherwise no other species were recorded within the quadrat.

There was no evidence of grazing observed in this general area.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)



Date	27.10.2021
GPS reading	H42649 97048
Size (m)	2x2
Aspect / slope (degrees)	Moderate, north-facing
Altitude (m)	292
Height of vegetation (cm)	35-40, max. 70
Vegetation cover %	100
Bare rock cover %	-
Bare peat cover %	-
Shrub/ericoid cover %	95
Herbaceous/Graminoid cover %	3

Bryophyte cover %	75	
No. plant species in quadrat	4	
Substrate	*c*. 1m peat (very firm in character)	
Species	**% cover**	**DOMIN**
Calluna vulgaris	95	10
Eriophorum vaginatum	3	2
Vaccinium myrtillus	not recorded in the quadrat but occurs nearby	
Sphagnum subnitens	55-60	8
Hypnum jutlandicum	15-20	5

Evaluation – Quadrat T4.4:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat comprising the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community.

Although *Sphagnum* mosses are present here, they appear degraded, shaded and drying out. This area is **unlikely to comprise active peat** due its extensive modification, with evidence of degraded peat.

Quadrat T4.5 **Surveyor: BK**	**Location (X,Y):** **-7.33737990260124, 54.8194501921534** **IG:** H 42649 97048

This quadrat is located *c*. 120m downslope of the proposed T4 hardstand, and was originally located along the proposed access track for this turbine, which has since been rerouted. It lies within an area of acid grassland and flush which is dominated by soft-rush (*Juncus effusus*) and wavy hair-grass (*Deschampsia flexuosa*) with hypnoid mosses (e.g. little shaggy-moss *Rhytidiadelphus loreus* and glittering wood-moss *Hylocomium splendens*) and some flat-topped bog-moss (*Sphagnum fallax*). The ground at this location was noted to be relatively dry underfoot with tussocky vegetation.

No heather is present within the quadrat, but some bilberry (*Vaccinium myrtillus*) was observed. Heath bedstraw (*Galium saxatile*) was abundant, and some fungi were noted. No grazing was noted in the area.

This area has been classified as the JNCC Phase 1 habitat Acid Grassland / Flush (B1.2 / E2.1).

Date	27.10.2021
Size (m)	2x2
GPS reading	H 42649 97048
Aspect / slope (degrees)	Moderate, N-facing
Altitude (m)	287
Height of vegetation (cm)	30-40, 80m
Vegetation cover %	100
Bare rock cover %	-
Bare peat cover %	-
Shrub/ericoid cover %	2-3
Herbaceous/Graminoid cover %	80
Bryophyte cover %	50

No. plant species in quadrat	12	
Substrate	>1m peat	
Species	**% cover**	**DOMIN**
Juncus effusus	40	7
Deschampsia flexuosa	40	7
Agrostis capillaris	1-2	2
Galium saxatile	5-10	4
Vaccinium myrtillus	2-3	2
Rhytidiadelphus loreus	10	4
Hylocomium splendens	5-6	4
Sphagnum fallax	15	5
Polytrichum commune	1	1
Pseudoscleropodium purum	2	2
Pleurozium schreberi	1	1
Rhytidiadelphus squarrosus	15	5

Evaluation: Quadrat T4.5:

NVC classification: Mosaic between the mire community M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire – *Juncus effusus* subcommunity and U2b *Deschampsia flexuosa* grassland, *Vaccinium myrtillus sub-community*

This area has been highly modified in the past, and while it contains some peat forming species these are not dominant. Its surface is not excessively wet or spongy. Therefore**, it is not considered to support active peat.**

Additional Notes **General observation between existing Owenreagh access track and T4** **Surveyor: BK**	**Location (X,Y):** **-7.33961451798677, 54.8175794351845**
At this location, the land in between the existing Owenreagh access track and the proposed location of turbine T4 has been highly modified. This panorama shows the extent of past cutting, with many cut banks and drains. The ground at this location is uneven, quite dry and firm underfoot. The present proposed access track to Turbine T4 runs through this area.	
	
	
	
	

2.5 Quadrats assessed in the vicinity of proposed turbine T5

Quadrat T5.1 **Surveyor: RNF**	**Location (X, Y):** **-7.34424821839066, 54.8134030527741**

This quadrat is located within the proposed hardstand area for Turbine 5.
Graminoid species, notably wavy hair-grass (*Deschampsia flexuosa*) are prominent in the vegetation and the ground is drier than in nearby areas, with a firm, not spongy, surface

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	26. 10. 2021	
Size (m)	2x2	
Aspect / slope (degrees)	West / moderate	
Altitude (m)	375m	
Height of vegetation (cm)	30 cm	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	30	
Herbaceous/Graminoid cover %	65	
Bryophyte cover %	10	
No. plant species in quadrat	11	
Substrate	Shallower peat (0.51 – 1m depth)	
Species	**% cover**	**DOMIN**
Calluna vulgaris	20	5
Vaccinium myrtillus	7	4
Juncus squarrosus	7	4
Deschampsia flexuosa	45	7
Molinia caerulea	5	4
Galium saxatile	<4	2
Polytrichum commune	10	4
Rhytidiadelphus loreus	10	4
Sphagnum palustre	5	4
Rhytidaidelphus squarrosus	10	4
Eriophorum vaginatum	10	4

Evaluation - Quadrat T5.1

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past; it now consists predominantly of M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area is **unlikely to comprise active peat** due its extensive modification and dry, firm surface, with evidence of degraded peat.

Quadrat T5.2 **Surveyor: RNF**	**Location (X,Y):** **-7.34442087970056, 54.813613503232**

This quadrat is located within the proposed hardstand area for Turbine 5, in an area of extensively modified bog habitat, in which ericoid species are prominent, in particular bilberry (*Vaccinium myrtillus*). The ground is relatively dry and firm and is not spongy underfoot.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	26.10.2021	
Size (m)	2x2	
Aspect / slope (degrees)	West	
Altitude (m)	375m	
Height of vegetation (cm)	30cm	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	45	
Herbaceous/Graminoid cover %	45	
Bryophyte cover %	10	
No. plant species in quadrat	8	
Substrate	Shallower Peat, 0.5 – 1m depth.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	15	5
Vaccinium myrtillus	45	7
Galium saxatile	5	4
Eriophorum vaginatum	25	5-6
Deschampsia flexuosa	25	5-6
Rhytidiadelphus squarrosus	20	5
Pleurozium schreberi	20	5
Rumex acetosa	<4	1

Evaluation - Quadrat T5.2

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past, as well as through its proximity to existing site infrastructure. It now consists predominantly of M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area is unlikely to comprise active peat due its extensive modification and dry surface, with evidence of degraded peat.

Quadrat T5.3 **Surveyor: RNF**	**Location (X,Y):** **-7.34385781652211, 54.8137721387062,**

This quadrat is located within the proposed Turbine 5 hardstand area, within an area that appears transitional between bog and acid grassland. It is dominated mainly by heather (*Calluna vulgaris*) and wavy hair-grass (*Deschampsia flexuosa*), with some hare's-tail cottongrass (*Eriophorum vaginatum*) and bilberry (*Vaccinium myrtillus*). Common haircap-moss (*Polytrichum commune*) is quite abundant, but bog-mosses (*Sphagnum* spp.) were absent from the quadrat area.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	26.10. 2021	
Size (m)	2x2	
Aspect / slope (degrees)	West	
Altitude (m)	376m	
Height of vegetation (cm)	30m	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	50	
Herbaceous/Graminoid cover %	40	
Bryophyte cover %	10	
No. plant species in quadrat	11	
Substrate	Shallower peat, 0.5 – 1m depth.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	40	7
Vaccinium myrtillus	10	4
Potentilla erecta	<4	3
Erica tetralix	5	4
Deschampsia flexuosa	30	6
Eriophorum vaginatum	10	4
Pleurozium schreberi	10	4
Polytrichum commune	30	6
Galium saxatile	<4	2

Sphagnum palustre	<4	1
Rhytidiadelphus loreus	5	4

Evaluation - Quadrat T5.3

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past as well as the proximity to existing site infrastructure, it now consists predominantly of M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area has been highly modified in the past, and is dry and firm underfoot, with little *Sphagnum* present, therefore **is not considered to support active peat**.

Quadrat T5.4 **Surveyor: RNF**	**Location (X,Y):** **-7.34354113409781, 54.8141296534846**

This quadrat is located in the vicinity of the proposed access road for Turbine 5, close to the hardstand area, in an area composed of vegetation that appears transitional between bog and acid grassland, dominated by heather (*Calluna vulgaris*), wavy hair-grass (*Deschampsia flexuosa*) and soft-rush (*Juncus effusus*). Some flushing is occurring (evidenced by the abundant soft-rush, and some flat-topped bog-moss, *Sphagnum fallax*) as a result of run-off from the existing hardstand to the east, and the existing site road. The ground in this area is firm and dry underfoot.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	26. 10. 2021	
Size (m)	2x2	
Aspect / slope (degrees)	Shallower slope, facing North-east	
Altitude (m)	370	
Height of vegetation (cm)	60	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	30	
Herbaceous/Graminoid cover %	60	
Bryophyte cover %	20	
No. plant species in quadrat	13	
Substrate	1.0 – 1.5 m depth of peat.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	35	7
Vaccinium myrtillus	5	4
Juncus effusus	30	6
Deschampsia flexuosa	40	7
Agrostis stolonifera	<4	2
Eriophorum vaginatum	5	4
Empetrum nigrum	<4	3
Polytrichum commune	15	5
Rhytidiadelphus loreus	5	4
Sphagnum fallax	10	4
Pleurozium schreberi	<4	3
Rhytidiadelphus squarrosus	5	4
Molinia caerulea	<4	3

Evaluation – Quadrat T5.4:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past as well as the proximity to existing site infrastructure, it now consists predominantly of M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area is unlikely to comprise active peat due its extensive modification and dry surface, with evidence of degraded peat.

Quadrat T5.5 **Surveyor: RNF**	**Location (XY):** **-7.34345436605562, 54.8143704172458**

This quadrat is located in the vicinity of the proposed access road for Turbine 5, in an area composed of modified bog. The ground is firm, not spongy underfoot, and there are signs of past burning here. The vegetation is dominated by heather (*Calluna vulgaris*) and wavy hair-grass (*Deschampsia flexuosa*) with bilberry (*Vaccinium myrtillus*) and hypnoid mosses; bog-mosses (*Sphagnum* spp.) were absent from the quadrat area.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	26.10. 2021	
Size (m)	2x2	
Aspect / slope (degrees)	North West	
Altitude (m)	366m	
Height of vegetation (cm)	40 cm	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	70	
Herbaceous/Graminoid cover %	30	
Bryophyte cover %	20	
No. plant species in quadrat	9	
Substrate	1.01 – 1.5 m depth of peat.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	50	7-8
Vaccinium myrtillus	15	5
Deschampsia flexuosa	30	6
Eriophorum vaginatum	<4	2
Hypnum jutlandicum	10	4
Pleurozium schreberi	10	4
Rhytidiadelphus loreus	<4	2
Erica tetralix	<4	3
Empetrum nigrum	<4	3

Evaluation – Quadrat T5.5

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past as well as the proximity to existing site infrastructure. It now consists predominantly of M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area is unlikely to comprise active peat due its extensive modification and dry surface, with evidence of degraded peat.

Quadrat T5.6 **Surveyor: RNF**	**Location (X,Y):** **-7.34324301075672, 54.8145808653691**

This quadrat is located in the vicinity of the proposed access road for Turbine 5, in an area composed of degrading bog, in which the ground is very firm underfoot, not spongy, and there is evidence of past burning. Some of the mosses are obviously degrading and dying back, and the vegetation is not in good condition. The vegetation is dominated by heather (*Calluna vulgaris*) with some bilberry (*Vaccinium myrtillus*) and hare's-tail cottongrass-tail cottongrass (*Eriophorum vaginatum*). Hypnoid mosses feature in the vegetation, but bog-mosses (*Sphagnum* spp) are absent.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	26. 10. 2021	
Size (m)	2x2	
Aspect / slope (degrees)	North West	
Altitude (m)	365	
Height of vegetation (cm)	40 cm	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	80	
Herbaceous/Graminoid cover %	20	
Bryophyte cover %	20	
No. plant species in quadrat	9	
Substrate	1.01 – 1.5 m depth of peat.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	60	8
Vaccinium myrtillus	10	4
Eriophorum vaginatum	10	4
Erica tetralix	<4	3
Empetrum nigrum	<4	3
Pleurozium schreberi	5	4
Rhytidiadelphus loreus	5	4
Kindbergia praelonga	5	4
Hypnum jutlandicum	5	4

Evalu–tion - Quadrat T5.6

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past as well as the proximity to existing site infrastructure. It now consists predominantly of M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area is **unlikely to comprise active peat** due its extensive modification and dry surface, with evidence of degraded peat.

Quadrat T5.7 **Surveyor: EC**	**Location (X,Y):** **-7.34039801, 54.81493252,**

This quadrat is located close to the proposed access route for Turbine T5, within an area of blanket bog on deep peat (>0.5m) which has been modified by the existing site access road nearby. The ground at this location is wet and spongy and supports a variety of typical blanket bog species, including peat forming species; bog-mosses (*Sphagnum* spp.) are abundant in the vegetation. In spite of modification the area still retains many of the characteristics of NI Priority Habitat Blanket Bog and is likely to support active peat.
The access track for Turbine 5 lies c. 22m to the east, avoiding recovering bog habitat (which could potentially comprise active peat), instead passing through an area of dry modified bog not considered to have potential to support active peat.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)- Modified in past.

Date	27.10.21	
Size (m^2)	2x2	
Aspect / slope (degrees)	north-facing slope	
Altitude (m)	362m	
Height of vegetation (cm)	50 cm	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	55	
Herbaceous/Graminoid cover %	30	
Bryophyte cover %	85	
No. plant species in quadrat	14	
Substrate	1.5 – 2 m depth of peat.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	30	6
Erica tetralix	10	4-5
Vaccinium myrtillus	15	5
Potentilla erecta agg	5	4
Deschampsia flexuosa	10	4-5
Eriophorum vaginatum	15	5
Eriophorum angustifolium	5	4
Potentilla erecta	5	4
Rhytidiadelphus loreus	15	5
Hypnum jutlandicum	5	4
Pleurozium schreberi	15	5
Sphagnum fallax	5	4
Sphagnum capillifolium	5	4
Polytrichum commune	<4	3

Evaluation - Quadrat T5.7

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but still has the **potential for active peat.** The Hydrological Assessment identified this as an area of 'compromised' hydrology, however this quadrat lies within a unit of recovering blanket bog.

Quadrat T5.8 **Surveyor: RNF**	**Location (X,Y):** **-7.3423046060137, 54.81528917974**

This quadrat is located close to the proposed access route for Turbine T5, within an area of degraded bog. Drainage effects from the existing adjacent road are visible here. The vegetation is dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*). Bog-mosses (*Sphagnum* spp.) are absent and there is a significant quantity of bare peat, being colonised by heath star-moss (*Campylopus introflexus*), a species indicative of degraded peatland, and bulbous rush (*Juncus bulbosus*).

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	27.10.2021	
Size (m)	2x2	
Aspect / slope (degrees)	North West	
Altitude (m)	360m	
Height of vegetation (cm)	30 cm	
Vegetation cover %	90	
Bare rock cover %	0	
Bare peat cover %	10	
Shrub/ericoid cover %	25	
Herbaceous/Graminoid cover %	20	
Bryophyte cover %	50	
No. plant species in quadrat	11	
Substrate	1.51 – 2 m depth of peat.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	25	5-6
Eriophorum vaginatum	20	5
Eriophorum angustifolium	5	4
Desc–ampsia flexuosa	5	4
Vaccinium myrtillus	5	4
Juncus bulbosus	15 (on bare peat)	5
Campylopus introflexus	20	5
Cladonia floerkeana	5	4
Hypnum jutlandicum	5	4
Rhytidiadelphus loreus	<4	3

Evaluation - Quadrat T5.8

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past as well as the proximity to existing site infrastructure. It now consists predominantly of M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area is unlikely to comprise active peat due its extensive modification and dry surface, with evidence of degraded peat. It is not considered to meet the characteristics to fall under EU Annex I '7130 Blanket bogs'. The Hydrological Assessment has identified this area as having 'Compromised' hydrology.

2.6 Quadrats assessed in the vicinity of proposed turbine T6

Quadrat T6.1 **Surveyor: EC**	**Location (X,Y):** **-7.33085709, 54.81790689**

This quadrat is located a short distance west of the access route for Turbine 6 (*c*. 20m). It is located on deep peat (greater than 0.5m depth), approximately 10m from an existing access track. Bog-mosses (*Sphagnum* spp.) are abundant with many species represented, and a good range of typical blanket bog species are present. Heather (*Calluna vulgaris*) and bog-mosses (*Sphagnum* spp.) dominated the vegetation. Although this area has been modified in the past, it still appears to have potential to support active peat.

The access track for Turbine 6 has been routed so as to avoid recovering bog habitat (which could potentially comprise active peat), instead passing through an area of dry modified bog not considered to have potential to support active peat.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1) - Modified in past.

Date	28.10.21	
Size (m)	2x2	
Aspect / slope	none	
Altitude (m)	266	
Height of vegetation (cm)	50	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	40	
Herbaceous/Graminoid cover %	55	
Bryophyte cover %	60	
No. plant species in quadrat	13	
Species	**% cover**	**DOMIN**
Calluna vulgaris	40	7
Juncus squarrosus	15	5
Eriophorum angustifolium	15	5
Eriophorum vaginatum	15	5
Trichophorum germanicum	10	4-5
Sphagnum capillifolium	5	4
Sphagnum subnitens	25	5-6
Sphagnum fallax	10	4-5
Sphagnum palustre	5	4
Sphagnum tenellum	<4	2
Sphagnum papillosum	<4	2
Rhytidiadelphus squarrosus	5	4
Hypnum jutlandicum	5	4

Evaluation - Quadrat T6.1:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

The abundance of *Sphagnum* spp. and the wet spongy nature of the ground surface suggests that this area **supports active peat.** This quadrat is located on the edge of a wider moderate to high constraint habitat (orange constraint in TA 10.4 APA).

Quadrat T6.2 **Surveyor: EC**	**Location (X,Y):** **-7.33165, 54.81684**

This quadrat is located at the location of the proposed hardstand for Turbine 6. The vegetation is composed of a mosaic of acid grassland and blanket bog mosaic, in which grasses and ericoids are co-dominant. The ground is spongy underfoot, but still quite dry and uneven, overlying deep peat (>0.5m). Several species of bog-moss (*Sphagnum* spp.) are present although these are not abundant. Hypnoid mosses are more abundant. The heather (*Calluna vulgaris*) in this area is tall and leggy. There is evidence of modification and degraded peat in the surrounding area.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	28.10.21	
Size (m)	2x2	
Aspect / slope	north-facing slope	
Altitude (m)	277	
Height of vegetation (cm)	60	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	50	
Herbaceous/Graminoid cover %	45	
Bryophyte cover %	75	
No. plant species in quadrat	16	
Species	**% cover**	**DOMIN**
Calluna vulgaris	40	7
Vaccinium myrtillus	5	4
Erica tetralix	5	4
Deschampsia flexuosa	20	5
Eriophorum angustifolium	5	4
Eriophorum vaginatum	10	4-5
Molinia caerulea	5	4
Potentilla erecta	5	4
Polytrichum commune	10	4-5
Rhytidiadelphus loreus	25	5-6
Hypnum jutlandicum	10	4-5
Kindbergia praelonga	<4	3
Sphagnum fimbriatum	<4	3
Sphagnum subnitens	10	4-5
Sphagnum fallax	5	4
Pleurozium schreberi– 10	4-5	

Evaluation - Quadrat T6.2:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It is now a mosaic habitat comprising the M19b *Empetrum nigrum* ssp. *nigrum* sub-community, along with M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community.

This area is **unlikely to comprise active peat** due its extensive modification with evidence of degraded peat.

Quadrat T6.3 **Surveyor: EC**	**Location (X,Y):** **-7.33226, 54.81627**

This quadrat is located at the location of the proposed hardstand for Turbine 6. The ground is drier at this location and is not spongy underfoot. The vegetation resembles an acid grassland/blanket bog mosaic and does contain some typical blanket bog species, although the peat forming species bog-mosses (*Sphagnum* spp.) are absent and cottongrasses (*Eriophorum* spp.) are sparse. This area appears to be drying out and the hydrology is severely affected by the nearby track and drains. An area of flush is located to the southeast.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	28.10.21	
Size (m)	2x2	
Aspect / slope	north-facing slope	
Altitude (m)	291	
Height of vegetation (cm)	20-50	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	30	
Herbaceous/Graminoid cover %	45	
Bryophyte cover %	50	
No. plant species in quadrat	12	
Species	**% cover**	**DOMIN**
Calluna vulgaris	15	5
Vaccinium myrtillus	15	5
Galium saxatile	<4	3
Potentilla erecta	5	4
Molinia caerulea	5	4
Deschampsia flexuosa	15	5
Eriophorum vaginatum	10	4-5
Agrostis sp.	5	4
Rhytidiadelphus squarrosus	15	5
Rhytidiadelphus loreus	15	5
Pleurozium schreberi	15	5
Kindbergia praelonga	<4	3

Evaluation - Quadrat T6.3:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat comprising the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community.

This area has been highly modified in the past, and the hydrology has been severely compromised through drainage. As a result, the ground is dry and firm underfoot, and little *Sphagnum* is present, Therefore, this area **is not considered to support active peat.**

2.7 Quadrats assessed in the vicinity of proposed turbine T7

Quadrat T7.1 **Surveyor EC**	**Location (X,Y):** **-7.32745312, 54.82015639**
This quadrat is located along the proposed access track to T7, within an area of species-poor improved grassland, currently grazed by cattle. This area has been classified as the JNCC Phase 1 habitat Improved Grassland (B4).	
	

Date	28.10.21	
Size (m)	2x2	
Aspect / slope	none	
Altitude (m)	245	
Height of vegetation (cm)	10 (max)	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	100	
Bryophyte cover %	25	
No. plant species in quadrat	9	
Species	**% cover**	**DOMIN**
Juncus effusus	5	4
Lolium perenne	10	4-5
Holcus lanatus	10	4-5
Agrostis capillaris	10	4-5
Agrostis stolonifera	10	4-5
Dactylis glomerata	5	4
Cirsium palustre	<4	2
Trifolium repens	15	5
Stellaria media	15	5
Cerastium fontanum	15	5
Rhytidiadelphus squarrosus	25	5-6
Campylopus introflexus	<4	3

Evaluation - Quadrat T7.1

NVC classification: MG10 *Holcus lanatus* – *Juncus effusus* rush pasture grassland – now heavily grazed.

No potential for active peat.

Quadrat T7.2 **Surveyor: EC**	**Location (X,Y):** **-7.32661862, 54.820684**

This quadrat is located adjacent to proposed hardstand area for Turbine 7.

This area is improved in character, with abundant white clover (*Trifolium repens*). Hypnoid mosses such as springy-turf-moss (*Rhytidiadelphus squarrosus*) are also very abundant. No bog-mosses (*Sphagnum* spp.) were present in the vegetation. The ground was very wet underfoot at the time of the survey, and soft rush (*Juncus effusus*) is prominent in the vegetation.

This area has been classified as the JNCC Phase 1 habitat Improved Grassland (B4) – This is a transitional area where the improved grassland becomes dominated by a dense rushy sward as the area transitions into a poor flush.

Date	28.10.21	
Size (m)	2x2	
Aspect / slope	none	
Altitude (m)	241m	
Height of vegetation (cm)	*Juncus* 1.5m, average 15cm	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	55	
Bryophyte cover %	50	
No. plant species in quadrat	10	
Species	**% cover**	**DOMIN**
Juncus effusus	10	4-5
Juncus conglomeratus	5	4
Agrostis stolonifera	5	4
Anthoxanthum oderatum	<4	3
Agrostis capillaris	5	4
Cirsium pallustre	<4	1
Myrica galeifolium repens	25	5-6
Pleurozium schreberi	10	4-5
Rhytidiadelphus squarrosus	40	7
Polytrichum commune	<4	2

Evaluation - Quadrat T7.2

NVC classification: MG10 *Holcus lanatus* – *Juncus effusus* rush pasture grassland – now heavily grazed.

No potential for active peat.

2.8 Quadrats assessed in the vicinity of proposed turbine T8

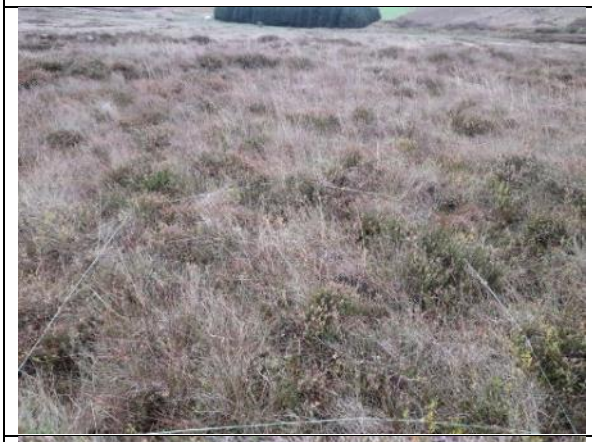
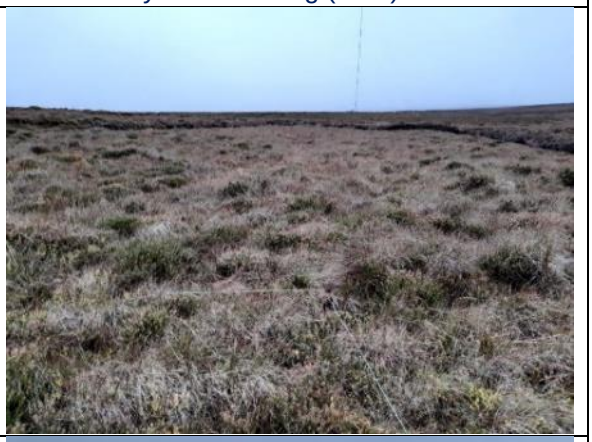
Quadrat T8.1 **Surveyor: BK**	**Location (X,Y):** **-7.32574716210365, 54.8149643652141** **IG: H43397 96556**

This quadrat is located a short distance upslope of the proposed T8 hardstand location, which lies within a rectangular plot (dimensions of approximately 60x30m) composed of cutover blanket bog. The quadrat lies within a previously suggested location for the turbine handstand, but this was since modified to avoid impacts upon active peat.

The ground at this location is dry and uneven, and the peat surface appears disturbed, with some degraded bog-moss (*Sphagnum* spp.) apparent.

The vegetation is dominated by hare's-tail cottongrass (*Eriophorum vaginatum*), bilberry (*Vaccinium myrtillus*) and heather (*Calluna vulgaris*). Some algal mats and bare peat were seen and some dead heather stems were visible.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	27.10.2021
Size (m)	2x2
GPS reading	H 43397 96556
Aspect / slope (degrees)	Moderate, north-facing slope
Altitude (m)	244
Height of vegetation (cm)	30
Vegetation cover %	95
Bare rock cover %	-
Bare peat cover %	5
Shrub/ericoid cover %	40
Herbaceous/Graminoid cover %	55
Bryophyte cover %	10

No. plant species in quadrat	12	
Substrate	>1m peat	
Species	**% cover**	**DOMIN**
Eriophorum vaginatum	40	7
Eriophorum angustifolium	5	4
Deschampsia flexuosa	10	4
Calluna vulgaris	20	5
Erica tetralix	4	2
Vaccinium myrtillus (some overlap)	15	5
Pleurozium schreberi (some degraded)	3	3
Hypnum jutlandicum	3	3
Sphagnum capillifolium	3	3
Sphagnum palustre (appears degraded)	–	3
Aulacomnium palustre	<1 - individual shoots only	2
Plagiothecium undulatum	<1 - individual shoots only	2

Evaluation - Quadrat T8.1:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past, it now consists of a mosaic habitat containing M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community.

This area is **unlikely to comprise active peat** due its extensive modification and dry surface, with evidence of degraded peat.

Quadrat T8.2 **Surveyor: BK**	**Location (X,Y):** **-7.32487376779317, 54.8150501959025** **IG: H43456 96567**

This quadrat is located *c*. 50m upslope of the proposed T8 hardstand location, on a moderate slope within an area of modified blanket bog vegetation. The quadrat lies within a previously suggested location for the turbine handstand, but this was since modified in the light of the Active Peat assessment of the Study Area, to avoid impacts upon active peat.

The ground here is uneven underfoot, mostly firm and dry but with some wetter patches. The vegetation is dominated by hare's-tail cottongrass (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*), with some wavy hair-grass (*Deschampsia flexuosa*) and bilberry (*Vaccinium myrtillus*). There are patches of *Sphagnum palustre* and some *Polytrichum commune,* suggesting that this area may be somewhat flushed. Some degraded moss was seen.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)




Date	27.10.2021
GPS reading	H43456 96567
Size (m)	2x2
Aspect / Slope (degrees)	Moderate, north-facing
Altitude (m)	230
Height of vegetation (cm)	25-30
Vegetation cover %	100
Bare rock cover %	-
Bare peat cover %	-
Shrub/ericoid cover %	25
Herbaceous/Graminoid cover %	65
Bryophyte cover %	15
No. plant species in quadrat	12
Substrate	>1m peat

Species	% cover	DOMIN
Calluna vulgaris	15	4
Erica tetralix	3	3
Vaccinium myrtillus	7	4
Sphagnum palustre	6	4
Sphagnum subnitens	1-2	2
Polytrichum commune	3	3
Sphagnum fallax	3-4	3-4
Hypnum jutlandicum	2	2
Eriophorum vaginatum	35	7
Eriophorum angustifolium	10	4
Deschampsia flexuosa	20	5
Potentilla erecta	2-3	3

Evaluation - Quadrat T8.2:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia* spp. sub-community

This area **is unlikely to comprise active peat** due its extensive modification with evidence of degraded peat.

2.9 Quadrats assessed in the vicinity of proposed turbine T9

Quadrat T9.1 **Surveyor: EC**	**Location (X,Y):** **-7.32108275, 54.81415477**

This area has been cutover in the past but the surface remains spongy underfoot, with good quantities of *Sphagnum* spp. The peat depth exceeds 0.5m. It is considered that this area has potential to support active peat.
The access route has since been relocated *c*. 25m to the west, into an area of acid grassland and flush, in order to avoid impacts on active peat.

JNCC Phase 1 habitat: Recovering Blanket Bog (E1.6.1) – Modified in past

Date	27.10.21	
Size (m)	2x2	
Aspect / slope	west-facing slope	
Altitude (m)	242	
Height of vegetation (cm)	40-50	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	30	
Herbaceous/Graminoid cover %	50	
Bryophyte cover %	60	
No. plant species in quadrat	16	
Species	**% cover**	**DOMIN**
Vaccinium myrtillus	<4	2
Erica tetralix	5	4
Calluna vulgaris	25	5-6
Agrostis capillaris	5	4
Eriophorum angustifolium	15	5
Eriophorum vaginatum	20	5
Deschampsia flexuosa	10	4-5
Sphagnum subnitens	10	4-5
Sphagnum capillifolium	25	5-6
Sphagnum fallax	10	4-5
Rhytidiadelphus loreus	5	4
Ryhtidiadelphus squarrosus	<4	2
Rhytidiadelphus squarrosus	<4	3
Aulacomnium palustre	<4	2
Hypnum jutlandicum	5	4
Plagiothecium undulatum	<4	2

Evaluation - Quadrat T9.1:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area is considered **likely to support active peat**, although it has been cutover in the past.

Meets criteria for Northern Ireland Priority habitat 'Blanket Bog' and is considered to support Active Peat. However, this area has a 'compromised' hydrology according to the Hydrological Assessment.

Quadrat T9.2 **Surveyor: EC**	**Location (X,Y):** **-7.32093589, 54.81371353**

This quadrat is located within the proposed T9 hardstand area. The vegetation is drier underfoot than in the previous quadrat, and is derived from modified blanket bog, as a result of past cutting, drainage, grazing and/or burning.
Tall, leggy heathers dominate the vegetation and although the bryophyte cover is relatively high, this is composed mainly of hypnoid species with very little *Sphagnum* spp. present.

The quadrat is located within an area which has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	27.10.21	
Size (m)	2x2	
Aspect / slope	north-west facing slope	
Altitude (m)	242	
Height of vegetation (cm)	1.5m (leggy heather)	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	90	
Herbaceous/Graminoid cover %	10	
Bryophyte cover %	55	
No. plant species in quadrat	12	
Species	**% cover**	**DOMIN**
Calluna vulgaris	85	9
Deschampsia flexuosa	<4	2
Potentilla erecta	<4	2
Eriophorum vaginatum	10	4-5
Molinia caerulea	<4	2
Hypnum jutlandicum	15	5
Rhytidiadelphus loreus	10	4-5
Aulacomnium palustre	<4	1
Sphagnum fallax	10	4-5
Pleurozium schreberi	10	4-5
Sphagnum subnitens	<4	3
Vaccinium myrtillus	<4	1

Evaluation - Quadrat T9.2:

NVC community: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists predominantly of the M19b *Empetrum nigrum* ssp. *nigrum* sub-community where *Calluna vulgaris* is the dominant species

This area has been highly modified in the past, and is dry and firm underfoot, with little *Sphagnum* present, therefore is **not considered to support active peat.**

Quadrat T9.3 **Surveyor: EC**	**Location (X,Y):** **-7.32067452, 54.81360174**

This quadrat is located within the Proposed T9 Hardstand area. The vegetation at this location is very wet, with a floating mat of vegetation. Soft-rush (*Juncus effusus*) dominates the vegetation with a layer of flat-topped bog-moss (*Sphagnum fallax*) and common haircap moss (*Polytrichum commune*) beneath.

This area has been classified as the JNCC Phase 1 habitat Acid/neutral flush (E2.1), although it is considered to be a species poor example.

Date	27.10.21	
Size (m)	2x2	
Aspect / slope	west-facing slope	
Altitude (m)	242	
Height of vegetation (cm)	1.75m (rushes)	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	100	
Bryophyte cover %	10	
No. plant species in quadrat	5	
Species	**% cover**	**DOMIN**
Juncus effusus	75	8-9
Agrostis stolonifera	15	5
Molinia caerulea	10	4-5
Sphagnum fallax	5	4

Evaluation - Quadrat T9.3:

NVC Classification: *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* subcommunity

This location does not support peat-forming vegetation. As such it is **not considered to represent active peat.**

2.10 Quadrats assessed in the vicinity of proposed turbine T10

Quadrat T10.1 **Surveyor: EC**	**Location (X,Y):** **-7.32702565, 54.80917783**

This quadrat is located within the proposed hardstand area for Turbine 10. The vegetation is characteristic of wet modified bog, with bare peat, algal growth and pooling water. The ground was very wet underfoot at the time of surveying but was not spongy. A range of peatland species were present, but the ground conditions and habitat structure were not indicative of good-quality peatland habitat.

This area has been classified as the JNCC Phase 1 habitat Wet Modified Bog (E1.7).

Date	27.10.21	
Size (m^2)	2x2	
Aspect / slope	north-facing slope	
Altitude (m)	302m	
Height of vegetation (cm)	30cm	
Vegetation cover %	90	
Bare peat cover %	15	
Shrub/ericoid cover %	10	
Herbaceous/Graminoid cover %	50	
Bryophyte cover %	25	
No. plant species in quadrat	11	
Species	**% cover**	**DOMIN**
Calluna vulgaris	10	4-5
Erica tetralix	<4	3
Narthecium ossifragum	10	4-5
Trichophorum cespitosus	15	5
Eriophorum vaginatum	10	4-5
Eriophorum angustifolium	15	5
Campylopus introflexus	5	4
Sphagnum palustre (some degraded)	10	4-5
Sphagnum subnitens	5	4
Sphagnum capillifolium (degraded)	5	4
Hypnum jutlandicum	<4	2

Evaluation - Quadrat T10.1:

NVC Classification: M20a *Eriophorum vaginatum* blanket and raised mire, species poor sub-community. Bare peat and sparse vegetation are characteristic features. This is derived from blanket bog that has been highly modified by cutting and draining.

Conditions at this location are no longer suitable for the formation of peat, evidenced by signs of degradation such as bare peat and algal mats. As such **it is not considered to represent active peat.**

Quadrat T10.2 **Surveyor: EC**	**Location (X,Y):** **-7.32653352, 54.80936584**

This quadrat is located within the proposed hardstand area for Turbine 10. The vegetation is composed of cutover wet modified bog, with significant quantities of bare peat which is being colonised by common cottongrass (*Eriophorum angustifolium*). The hydrology has clearly been affected. Algal mats were observed, with bare peat and pooling water.

This area has been classified as the JNCC Phase 1 habitat Wet Modified Bog (E1.7)

Date	27.10.21	
Size (m^2)	2x2	
Aspect / slope	none	
Altitude (m)	301	
Height of vegetation (cm)	30	
Vegetation cover %	75	
Bare peat cover %	25	
Shrub/ericoid cover %	5	
Herbaceous/Graminoid cover %	70	
Bryophyte cover %	5	
No. plant species in quadrat	5	
Substrate	Bare peat, pooling water & algal mats	
Species	**% cover**	**DOMIN**
Calluna vulgaris	5	4
Eriophorum vaginatum	5	4
Eriophorum angustifolium	60	8
Trichophorum germanicum	5	4
Campylopus introflexus	5	4

Evaluation - Quadrat T10.2:

NVC Classification: M20a *Eriophorum vaginatum* blanket and raised mire, species poor sub-community. Bare peat and sparse vegetation are characteristic features. This is derived from blanket bog that has been highly modified by cutting and draining.

Conditions at this location are no longer suitable for the formation of peat, evidenced by signs of degradation such as bare peat and algal mats. As such **it is not considered to represent active peat.**

Quadrat T10.3 **Surveyor: EC**	**Location (X,Y):** **-7.32471886, 54.81277794**

This quadrat is located in the vicinity of the proposed access route for Turbine 10, *c*. 300m north-northeast of the proposed T10 hardstand, and c. 20m northwest of the proposed access rouite to this turbine. The ground at this location is spongy, with many typical bog species on the area between the existing cut-out road and the nearby area of species-poor *Juncus* flush. This is considered to be recovering blanket bog.

The access route to T10 has been located to the southeast of this area of habitat, so as to avoid impacting upon potentially active peat.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past – M19.

Date	27. 10. 21	
Size (m^2)	2x2	
Aspect / slope	north-facing slope	
Altitude (m)	282	
Height of vegetation (cm)	30-40	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	40	
Herbaceous/Graminoid cover %	55	
Bryophyte cover %	40	
No. plant species in quadrat	14	
Species	**% cover**	**DOMIN**
Calluna vulgaris	20	5
Erica tetralix	20	5
Juncus squarrosus	5	4
Narthecium ossifragum	10	4-5
Potentilla erecta	10	4-5
Eriophorum vaginatum	10	4-5
Trichophorum germanicum	10	4-5
Eriophorum angustifolium	5	4
Molinia caerulea	<4	3
Sphagnum capillifolium	15	5
Sphagnum tenellum	<4	2
Sphagnum subnitens	5	4
Sphagnum palustre	15	5
Sphagnum fallax	5	4

Evaluation - Quadrat T10.3

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but still **has the potential for active peat.** The hydrology at this location is considered to be relatively intact according to the Hydrological Assessment.

2.11 Quadrats assessed in the vicinity of proposed turbine T11

Quadrat T4.1 **Surveyor: EC**	**Location (X,Y):** **-7.33215124, 54.81033733**

This quadrat is located within the proposed T11 hardstand area. The ground at this location is very wet underfoot and the vegetation is indicative of a species-poor flush, dominated by soft-rush (*Juncus effusus*), common haircap-moss (*Polytrichum commune*) and flat-topped bog-moss (*Sphagnum fallax*).

This area has been classified as the JNCC Phase 1 habitat Flush & Spring - acid/neutral flush (E2.1), although it is considered to be a species-poor example.

Date	27.10.11	
Size (m)	2x2	
Aspect / slope	north-facing slope	
Altitude (m)	302	
Height of vegetation (cm)	1.5m (*Juncus effusus*)	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	95	
Bryophyte cover %	95	
No. plant species in quadrat	13	
Species	**% cover**	**DOMIN**
Juncus effusus	15	5
Deschampsia flexuosa	15	5
Agrostis stolonifera	15	5
Juncus acutiflorus	10	4-5
Galium saxatile	15	5
Rumex acetosa	10	4-5
Potentilla erecta	5	4
Juncus conglomeratus	10	4-5
Polytrichum commune	25	5-6
Sphagnum subnitens	5	4
Sphagnum palustre	10	4-5
Sphagnum fallax	30	6
Rhytidiadelphus squarrosus	25	5-6
Evaluation - Quadrat T11.1:		

NVC classification: M6c *Carex echinata – Sphagnum recurvum/auriculatum – Juncus effusus* subcommunity.

This location does not support peat-forming vegetation and as such it is **not considered to represent active peat.**

Quadrat T11.2 **Surveyor: EC**	**Location (X,Y):** **-7.33243397, 54.8104859**

This quadrat is located upon the proposed hardstand area of Turbine 11, on a degraded peat hag, on deep peat (>0.5m), which is situated on the edge of a *Juncus* spp. dominated flush. Some ericoid species were present in the vegetation but there very few bog-mosses (*Sphagnum* spp.) were observed.

The wider area has been mapped as the JNCC Phase 1 habitat Acid/Neutral flush (E2.1), although it is considered to be a species poor example, with prominent soft rush (*Juncus effusus*). However, the quadrat is located on a hagg of degraded dry Modified Bog (E1.8) within this area.

Date	27.10.21	
Size (m)	2x2	
Aspect / slope	north-facing slope	
Altitude (m)	304	
Height of vegetation (cm)	30-60	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	45	
Herbaceous/Graminoid cover %	50	
Bryophyte cover %	45	
No. plant species in quadrat	12	
Species	**% cover**	**DOMIN**
Calluna vulgaris	20	5
Vaccinium myrtillus	25	5-6
Molinia caerulea	5	4
Deschampsia flexuosa	10	4-5
Agrostis stolonifera	5	4
Carex hirta	20	5
Potentilla erecta	5	4
Galium saxatile	5	4
Rhytidiadelphus loreus	20	5
Pleurozium schreberi	15	5
Rhytidiadelphus squarrosus	5	4–
Eriophorum vaginatum	5	4
Evaluation - Quadrat T11.2:		

NVC Classification: The wider area is composed predominantly of M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* subcommunity; however this quadrat is located on a hagg of degraded M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past, now corresponding predominantly to the M19b *Empetrum nigrum* ssp. *nigrum* sub-community.

This location does not support peat-forming vegetation and as such it is **not considered to represent active peat.**

Quadrat T11.3 **Surveyor: EC**	**Location (X,Y):** **-7.33077853, 54.81074863**
This quadrat is located on the proposed access route for Turbine 11, within an area of species-poor flush, dominated by soft rush (*Juncus effusus*) and bryophytes. This area has been classified as the JNCC Phase 1 habitat Flush & Spring - acid/neutral flush (E2.1), although it is considered to be a species poor example.	
	

Date	27.10.21	
Size (m)	2x2	
Aspect / slope	north-facing slope	
Altitude (m)	306	
Height of vegetation (cm)	80c	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	60	
Bryophyte cover %	55	
No. plant species in quadrat	11	
Species	**% cover**	**DOMIN**
Juncus effusus	15	5
Juncus acutiflorus	10	4-5
Deschampsia flexuosa	15	5
Potentilla erecta	10	4-5
Galium saxatile	5	4
Polytrichum commune	25	5-6
Rhytidiadelphus squarrosus	15	5
Rumex acetosa	5	4
Pleurozium schreberi	5	4
Rhytidiadelphus loreus	5	4
Sphagnum fallax	5	4
Evaluation - Quadrat 11.3:		

NVC classification: M6c *Carex echinata* – *Sphagnum recurvum/auriculatum* mire – *Juncus effusus* subcommunity

This location does not support peat-forming vegetation and as such **it is not considered to represent active peat.**

2.12 Quadrats assessed in the vicinity of proposed turbine T12

Quadrat T12.1 **Surveyor: RNF**	**Location (X,Y):** **-7.339584274, 54.81085962**

This quadrat is located some distance northwest of the proposed hardstand area for Turbine 12, close to a previous proposed location of Turbine 12. It lies within acid grassland and flush habitat below the existing track edge, that are likely to have developed due to drainage effects here.

This area is mapped as the JNCC Phase 1 habitats Acid/neutral Flush (E2.1) and Dry Modified Bog (E1.8) but there are also elements of acid grassland B2.1.

Date	26.10. 21	
Size (m)	2x2	
Altitude (m)	371m	
Height of vegetation (cm)	Max. 1.5m (soft-rush); mean 5cm (*Sphagnum*)	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	80	
Bryophyte cover %	40	
No. plant species in quadrat	12	
Substrate	Peat 50cm deep (shallow peat)	
Species	**% cover**	**DOMIN**
Juncus effusus	25	5-6
Deschampsia flexuosa	10	4
Agrostis stolonifera	10	4
Galium saxatile	<4	2
Polytrichum commune	15	5
Rhytidiadelphus loreus	10	4
Rhytidiadelphus squarrosus	5	4
Pleurozium schreberi	<4	3–
Sphagnum fallax	5	4
Sphagnum palustre	<4	2
Kindbergia praelonga	<4	2
Calluna vulgaris	<4	2

Evaluation – Quadrat T12.1:

NVC Classification: Predominantly a mosaic between M6c *Carex 76chinate – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* subcommunity and U2b *Deschampsia flexuosa* grassland, *Vaccinium myrtillus sub-community*. The quadrat is located on the edge of an area of M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire, modified by drainage and cutting in the past and now aligning to the M19b *Empetrum nigrum* ssp. *Nigrum* sub-community.

The habitat here is considered likely to exist as a result of surface water runoff and drainage from the track edge. It does not correspond to any EU Annex I or NI Priority habitat. This area is **unlikely to comprise active peat** due its extensive modification, with evidence of degraded peat. The Hydrological Assessment has identified this area as having a 'compromised' hydrology.

Quadrat T12.2 **Surveyor: RNF**	**Location (X, Y):** **-7.339510067, 54.8111069**

This quadrat is located at the margin of the proposed hardstand area for Turbine 12. Overall, the habitat appears to represent active peat, and is predominantly blanket bog, with some acid grassland mosaic. Hare's-tail cottongrass (*Eriophorum vaginatum*) and heather (*Calluna vulgaris*) are dominant species here. Some signs of degradation are evident, e.g., signs of drainage and lack of typical good quality bog *Sphagnum* species.

The modified bog habitat is quite fragmented at this location and comprises only a small part of the hardstand area, the remainder of which is located upon species-poor flush habitat.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past.

Date	26.10.2021	
Size (m)	2x2	
Aspect / slope (degrees)	North East slope running into poor flush	
Altitude (m)	364 m	
Height of vegetation (cm)	50 cm	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	50	
Herbaceous/Graminoid cover %	40	
Bryophyte cover %	65	
No. plant species in quadrat	14	
Substrate	Peat >1m deep, Active peat	
Species	**% cover**	**DOMIN**
Calluna vulgaris	35	7
Vaccinium myrtillus	5	4
Erica tetralix	5	4
Empetrum nigrum	5	4
Eriophorum vaginatum	30	6
Deschampsia flexuosa	10	4
Leafy liverwort sp.	<4	2
Plagiothecium undulatum	<4	2
Rhytidiadelphus loreus	20	5
Sphagnum subnitens	10	4
Pleurozium schreberi	10	4
Sphagnum tenellum	<4	2
Cladonia portentosa	<4	1

Evaluation - Quadrat T12.2:
NVC Classification: M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire.
EU Annex I Priority Habitat '7130 Blanket Bog'.
Northern Ireland Priority Habitat 'Blanket Bog'.

This area has been modified in the past but still **has the potential for active peat within pockets.** However, the Hydrological Assessment has identified this location as having an overall 'compromised' hydrology.

Quadrat T12.3 **Surveyor: EC**	**Location** **(XY): -7.33977579, 54.81121739** **IG: H 42493 96112**

This quadrat is situated on the proposed hardstand location for Turbine 12. The ground at this location is uneven, but spongy underfoot. The vegetation is dominated by heather (*Calluna vulgaris*), crowberry (*Empetrum nigrum),* bilberry *(Vaccinium myrtillus)* and hypnoid mosses. There was no evidence of grazing; however, evidence of previous past turf cutting in some areas was noted nearby (cutover hags are still visible in the topography).

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8).

Date	26.10.21	
Size (m^2)	2x2	
Aspect / Slope	East-facing slope	
Altitude (m)	370m	
Height of vegetation (cm)	1m max, average 30cm	
Vegetation cover %	100	
Bare peat cover %	0	
Herbaceous/Graminoid cover %	40	
Bryophyte cover %	55	
No. plant species in quadrat	13	
Species	**% cover**	**DOMIN**
Calluna vulgaris	20	5
Vaccinium myrtillus	10	4
Empetrum nigrum	10	4
Galium saxatile	<4	2
Eriophorum vaginatum	15	5
Molinia caerulea	15	5
Deschampsia flexuosa	10	4
Pleurozium schreberi	20	5
Sphagnum subnitens	<4	2
Sphagnum fallax	5	4
Rhytidiadelphus loreus	20	5
Rhytidiadelphus squarrosus	5	4
Sphagnum fimbriatum	<4	2

Evaluation - Quadrat T12.3:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing the

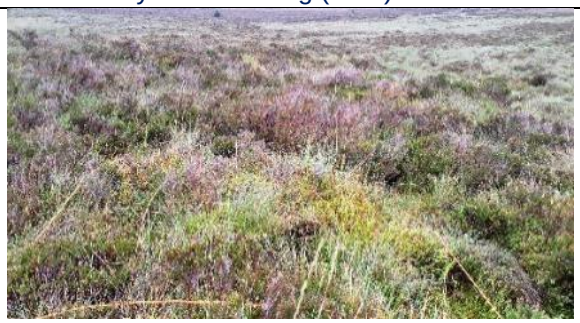
M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area has been highly modified in the past and is dry and firm underfoot with little *Sphagnum* present, therefore is **not considered to support active peat.**

Quadrat T12.4 **Surveyor: EC**	**Location (X,Y):** **-7.33953897, 54.81131199** **IG: H 42508 96123**

This quadrat is located in the vicinity of the proposed hardstand area for Turbine 12. The vegetation in this area is dominated by bryophytes and heather (C*alluna vulgaris*). The ground remains relatively dry underfoot but there are pockets of bog-moss (*Sphagnum* spp.) throughout the area in damper hollows. The surface is very uneven, with drains and hags nearby. The hydrology has been affected and active peat is considered unlikely.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8).



Date	26. 10. 21	
Size (m²)	2x2	
Aspect / slope	east-facing slope	
Altitude (m)	433	
Height of vegetation (cm)	40-50	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	30	
Herbaceous/Graminoid cover %	25	
Bryophyte cover %	75	
No. plant species in quadrat	13	
Species	**% cover**	**DOMIN**
Calluna vulgaris	15	5
Erica tetralix	5	4
Vaccinium myrtillus	10	5
Molinia caerulea	10	5
Eriophorum vaginatum	10	5
Deschampsia flexuosa	5	4
Galium saxatile	<4	2
Rhytidiadelphus loreus	20	5
Pleurozium schreberi	20	5
Sphagnum fallax	5	4
Sphagnum subnitens	20	5
Hypnum jutlandicum	5	4
Sphagnum tenellum	5	4

Evaluation - Quadrat T12.4:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community

This area is unlikely to comprise active peat due its extensive modification, with evidence of degraded peat.

Quadrat T12.5 **Surveyor: EC**	**Location (X,Y):** **-7.34024551, 54.81178725** **IG: H 42462 96175**

This quadrat is located *c.* 50m NNW of the handstand location for T12, along a previously proposed access track for Turbine 12 (since relocated). The ground in this area is very uneven and dry in places with hypnoid mosses. Heather (*Calluna vulgaris)* and hare's-tail cottongrass (*Eriophorum vaginatum*) are dominant. The substrate is deep peat (>0.5m), and the vegetation has some characteristics of both bog habitat and acid grassland. There are no signs of grazing or recent turf cutting. Active peat is unlikely due to the extent of habitat modification in the area.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8).

Date	26.10.21	
Size (m^2)	2x2	
Aspect / slope	north-east facing slope	
Altitude (m)	433	
Height of vegetation (cm)	40-50	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	45	
Herbaceous/Graminoid cover %	40	
Bryophyte cover %	65	
No. plant species in quadrat	15	
Species	**% cover**	**DOMIN**
Calluna vulgaris	25	5-6
Erica tetralix	<4	3
Empetrum nigrum	10	4
Vaccinium myrtillus	10	4
Deschampsia flexuosa	10	4
Eriophorum vaginatum	25	5-6
Galium saxatile	5	4
Rhytidiadelphus loreus	30	6
Pleurozium schreberi–10 | 4		
Polytrichum commune	<4	2
Sphagnum fallax	10	4-5
Sphagnum subnitens	5	4
Rhytidiadelphus squarrosus	5	4

Evaluation - Quadrat T12.5:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area has been highly modified in the past, and is dry and firm underfoot, with little *Sphagnum* present, therefore **is not considered to support active peat.**

Quadrat T12.6 **Surveyor: EC**	**Location (X,Y):** **-7.33961731, 54.81169204** **IG: H 42503 96165**

This quadrat is located a short distance northwest of the proposed T12 hardstand and was originally located close to an alternative proposed access track for this turbine, but this has since been relocated. This area is on deep peat (>0.5m); although the surface remains somewhat spongy, it is very uneven and grassy and appears to support some mineral soil. It grades into a section of species-poor flush.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (B2.1) located at the edge of an area of acid/neutral flush (E2.1). There is an area of recovering Blanket Bog (E1.6.1) nearby.

Date	26.10.21	
Size (m²)	2x2	
Aspect / slope	north-east facing slope	
Altitude (m)	430	
Height of vegetation (cm)	50	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	45	
Herbaceous/Graminoid cover %	40	
Bryophyte cover %	50	
No. plant species in quadrat	14	
Species	**% cover**	**DOMIN**
Calluna vulgaris	20	5
Empetrum nigrum	10	4-5
Vaccinium myrtillus	15	5
Deschampsia flexuosa	15	5
Molinia caerulea	5	4
Empetrum vaginatum	15	5
Galium saxatile	5	4
Polytrichum commune	10	4-5
Sphagnum fallax	5	4
Pleurozium schreberi	2–	5
Sphagnum subnitens	<4	3
Rhytidiadelphus loreus	5	4
Rhytidiadelphus squarrosus	5	4
Hypnum jutlandicum	<4	2

Evaluation - Quadrat T12.6:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat that includes M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* subcommunity and U2b *Deschampsia flexuosa* grassland, *Vaccinium myrtillus sub-community.*

This area has been highly modified and **active peat is considered unlikely in this immediate area**. However, this part of the Study Area has an extremely mosaic nature. This quadrat lies within a 'non-intact' hydrological unit, next to a 'compromised' hydrological unit according to the Hydrological Assessment.

Quadrat T12.7 **Surveyor: EC**	**Location (X,Y):** **-7.3404287, 54.8122775**

This quadrat is located some distance northwest of the proposed T12 hardstand and was originally located near the location of the proposed access track for this turbine, but this has since been relocated to avoid impacts upon active peat. The vegetation in this area is considered to have active blanket bog potential and lies within an area of deep peat (>0.5m). Typical blanket bog species dominate the vegetation, including abundant bog-moss (*Sphagnum* spp.). The ground remains wet and spongy underfoot.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past.

Date	26.10.21	
Size (m^2)	2x2	
Aspect / slope	north-east facing slope	
Altitude (m)	430	
Height of vegetation (cm)	50	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	50	
Herbaceous/Graminoid cover %	40	
Bryophyte cover %	75	
No. plant species in quadrat	13	
Species	**% cover**	**DOMIN**
Calluna vulgaris	30	6
Empetrum nigrum	10	4-5
Vaccinium myrtillus	10	4-5
Eriophorum vaginatum	25	5-6
Molinia caerulea	<4	3
Deschampsia flexuosa	10	4-5
Sphagnum subnitens	25	5-6
Sphagnum fallax	15	5
Sphagnum tenellum	–	4
Sphagnum fimbriatum	5	4
Pleurozium schreberi	10	4-5
Rhytidiadelphus loreus	10	4-5
Kindbergia praelonga	<4	2

Evaluation - Quadrat T12.7:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

Although this area has been modified in the past, it still **has potential for active peat** formation. However, the Hydrological Assessment has identified this as lying within a 'non-intact' hydrological unit.

Quadrat T12.8 **Surveyor: EC**	**Location (X,Y):** **-7.34051489, 54.81254402**

This quadrat is located some distance north/northwest of the proposed T12 hardstand and was originally located near an alternative proposed access track for this turbine, which was since rerouted to avoid impacts upon active peat. The ground remains wet and spongy underfoot at this location, which is situated on an area of deep peat (>0.5m). The vegetation is dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*) with some crowberry (*Empetrum nigrum*) and bilberry (*Vaccinium myrtillus*). Hypnoid mosses are abundant, and some bog-mosses (*Sphagnum* spp.) are also present. There is considered to be active blanket bog potential. No signs of grazing or cutting were observed.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)- Modified in past.

Date	26.10.21	
Size (m²)	2x2	
Aspect	East-facing slope	
Altitude (m)	374	
Height of vegetation (cm)	mean 50cm	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	45	
Herbaceous/Graminoid cover %	30	
Bryophyte cover %	70	
No. plant species in quadrat	14	
Species	**% cover**	**DOMIN**
Calluna vulgaris	20	5
Erica tetralix	5	4
Empetrum nigrum	10	4-5
Vaccinium myrtillus	10	4-5
Eriophorum vaginatum	20	5
Potentilla erecta	5	4
Deschampsia flexuosa	5	4
Rhytidiadelphus loreus	30	6
Pleurozium schreberi	15	5
Hypnum jutlandicum	10	4-5
Sphagnum subnitens	10	4-5
Sphagnum fallax	5	4
Sphagnum capillifolium	<4	2
Polytrichum commune	5	4

Evaluation - Quadrat T12.8:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but still **has the potential for active peat.** However, the Hydrological Assessment has identified this as lying within a 'non-intact' hydrological unit.

Quadrat T12.9 **Surveyor: EC**	**Location (X,Y):** **-7.34097058, 54.81292062**

This quadrat is located on an area of deep peat (>0.5m), some distance northwest of the proposed T12 hardstand. It was originally located near an alternative proposed access track for this turbine, which has since been rerouted to avoid impacts upon active peat. The ground remains wet and spongy underfoot, and bog-mosses (*Sphagnum* spp.) are abundant, as well as other peat-forming species such as cottongrasses (*Eriophorum* spp.). There is active blanket bog/peat potential here. The hydrology appears reasonably intact with no signs of cutting or grazing noted.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)- Modified in past.

Date	26.10.21	
Size (m^2)	2x2	
Aspect / slope (degrees)	east-facing slope	
Altitude (m)	375	
Height of vegetation (cm)	30-40	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	35	
Herbaceous/Graminoid cover %	35	
Bryophyte cover %	80	
No. plant species in quadrat	14	
Species	**% cover**	**DOMIN**
Calluna vulgaris	20	5
Vaccinium myrtillus	5	4
Empetrum nigrum	10	4-5
Eriophorum angustifolium	10	4-5
Eriophorum vaginatum	15	5
Deschampsia flexuosa	10	4-5
Polytrichum commune	15	5
Sphagnum palustre	10	4-5
Sphagnum capillifolium	10	4-5
Sphagnum subnitens	15	5
Sphagnum fallax	10	4-5
Sphagnum cuspidatum	5	4
Sphagnum papillosum	10	4-5
Kindbergia praelonga	<4	2
Evaluation - Quadrat T12.9:		

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area is considered to have **potential for active peat.** However, the Hydrological Assessment has identified this as lying within a 'non-intact' hydrological unit.

Quadrat T12.10 **Surveyor: RNF**	**Location (X,Y):** **-7.34084553705392, 54.8112244682162**

This quadrat is located within an area of deep peat, but this has been affected by the existing wind farm infrastructure. It is located in the vicinity of the proposed T12 hardstand. Acid grassland is dominant, due to the influence of run-off from the existing turbine infrastructure.

This general area has been mapped as the JNCC Phase 1 habitat Dry Modified Bog (E1.8) but at this location there are elements of a heathy acid grassland (B2.1, corresponding to the NVC community U2b).

Date	27.10. 2021	
Size (m)	2x2	
Aspect / slope (degrees)	North East	
Altitude (m)	383m	
Height of vegetation (cm)	60cm	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	55	
Herbaceous/Graminoid cover %	40	
Bryophyte cover %	10	
No. plant species in quadrat	12	
Substrate	1.01 – 1.5 m depth of peat.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	25	5-6
Deschampsia flexuosa	15	5
Eriophorum vaginatum	10	4
Juncus effusus	<4	2
Agrostis stolonifera	5	4
Vaccinium myrtillus	20	5
Galium saxatile	<–	3
Empetrum nigrum	10	4
Pleurozium schreberi	30	6
Rhytidiadelphus loreus	15	5
Potentilla erecta	7	4
Rumex acetosa	<4	3

Evaluation - Quadrat T12.10:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and U2b *Deschampsia flexuosa* grassland, *Vaccinium myrtillus* sub-community.

Active peat is unlikely due to the extent of the modifications observed in this area

Quadrat T12.11 **Surveyor: RNF**	**Location (X,Y):** **-7.34042488768586, 54.811056832562**

This quadrat is located a short distance west of the proposed T12 hardstand, close to a previously suggested location for this turbine. The quadrat is dominated by acid grassland which lies on the edge of a large section of dry modified bog. The ground remains firm and dry underfoot with a soil-peat substrate. No signs of grazing were noted. Heath rush (*Juncus squarrosus*) and creeping bent (*Agrostis stolonifera*) were the dominant species.

This general area has been mapped as the JNCC Phase 1 habitat Dry Modified Bog (E1.8) but at this location there are elements of a heathy acid grassland (B2.1, corresponding to the NVC community U2b).

Date	27. 10.2021	
Size (m)	2x2	
Aspect / slope (degrees)	East/ North East	
Altitude (m)	380m	
Height of vegetation (cm)	50	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	10	
Herbaceous/Graminoid cover %	80	
Bryophyte cover %	65	
No. plant species in quadrat	14	
Substrate	1.01 – 1.5 m depth of peat.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	7	4
Vaccinium myrtillus	3	5
Juncus squarrosus	25	5-6
Juncus bulbosus	<4	2
Eriophorum vaginatum	15	5
Eriophorum angustifolium	<4	2
Agrostis stolonifera	20	5
Deschampsia flexuosa	5	4
Potentilla erecta	6	4
Galium saxatile	5	4
Polytrichum commune	10	4
Campylopus introflexus	10	4
Rhytidiadelphus loreus	5	4
Pleurozium schreberi	10	4

Evaluation - Quadrat T12.11:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic of the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and U2b *Deschampsia flexuosa* grassland, *Vaccinium myrtillus* subcommunity.

Active peat is unlikely.

Quadrat T12.12 **Surveyor: EC**	**Location (X,Y):** **54.81020257, -7.34039801**

This quadrat is in an area of intact blanket bog southwest of the proposed T12 hardstand, separated from it by the existing Owenreagh wind farm infrastructure. While some drainage effects of the existing site infrastructure are evident within this area of peatland to the north of this quadrat location, overall, the ground remains wet and spongy underfoot. *Sphagnum* species are abundant (*S. palustre* is dominant) with other peat-forming species such as hare's tail cotton grass (*Eriophorum vaginatum*). The quadrat is located within an area of active, deep peat >0.5m. No signs of grazing or modification were noted, however there are drains further north.

This area has been classified as the JNCC Phase 1 habitat Intact Blanket Bog (E1.6.1).

Date	27.10.21	
Size (m^2)	2x2	
Aspect / slope	north-facing slope	
Altitude (m)	430	
Height of vegetation (cm)	50	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	30	
Herbaceous/Graminoid cover %	45	
Bryophyte cover %	75	
No. plant species in quadrat	11	
Species	**% cover**	**DOMIN**
Calluna vulgaris	25	5-6
Vaccinium myrtillus	5	4
Eriophorum vaginatum	25	5-6
Deschampsia flexuosa	10	4-5
Potentilla erecta	10	4-5
Polytrichum commune	10	4-5
Rhytidiadelphus squarrosus	10	4-5
Rhytidiadelphus loreus	10	4-5
Sphagnum subnitens	10	4-5
Sphagnum palustre	25	5-6
Sphagnum papillosum	5	4
Pleurozium schreberi	5	4

Evaluation - Quadrat T12.12:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire

This area has potential to support **active peat**.

This area corresponds to the **EU Annex I Priority Habitat '7130 Blanket Bog'** and the **Northern Ireland Priority Habitat 'Blanket Bog'.**

Quadrat T12.13 **Surveyor: EC**	**Location (X,Y):** **-7.33930886, 54.80998987**

The area is located a short distance from 12.12, separated from the proposed T12 hardstand by the existing wind farm access road. It is drier underfoot than the location of Quadrat T12.12 but is still located on deep peat (>0.5m), however bog-mosses (*Sphagnum* spp.) are very sparse to absent. Shrubs, ericoid species and grasses dominate the vegetation. Hypnoid mosses also abundant. The hydrology appears severely affected by nearby drains. The lies at the edge of existing site infrastructure which appears to have affected the vegetation.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8).

Date	27.10.21	
Size (m^2)	2x2	
Aspect / slope	north-eastern slope	
Altitude (m)	428	
Height of vegetation (cm)	50	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	40	
Herbaceous/Graminoid cover %	40	
Bryophyte cover %	60	
No. plant species in quadrat	13	
Species	**% cover**	**DOMIN**
Calluna vulgaris	20	5
Vaccinium myrtillus	15	5
Erica tetralix	5	4
Potentilla erecta	10	4-5
Eriophorum vaginatum	15	5
Eriophorum angustifolium	5	4
Deschampsia flexuosa	10	4-5
Pleurozium schreberi	15	5
Rhytidiadelphus loreus	20	5
Polytrichum commune	5	4
Kindbergia praelonga	5	4
Hypnum jutlandicum	10	4-5
Rhytidiadelphus squarrosus	5	4

Evaluation - Quadrat T12.13:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing the M19b *Empetrum nigrum* ssp. *nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire*, Calluna vulgaris – Cladonia* spp. sub-community.

This area has been highly modified in the past, and is dry and firm underfoot, with no *Sphagnum* present, therefore **is not considered to support active peat.**

2.13 Quadrats assessed in the vicinity of proposed turbine T13

Quadrat T13.1 **Surveyor: EC**	**Location (X,Y):** **-7.31794, 54.81995**

This quadrat is located within the proposed hardstand area for Turbine 13. The vegetation is composed of improved grassland, heavily grazed by sheep at the time of survey. Soft-rush (*Juncus effusus*) and grasses such as bents (*Agrostis* spp.) and Yorkshire-fog (*Holcus lanatus*) dominate the vegetation, and white clover (*Trifolium repens*) is also abundant.

This area has been classified as the JNCC Phase 1 habitat Improved Grassland (B4).

Date	28.10.21	
Size m²	2X2	
Aspect / slope	none	
Altitude (m)	226m	
Height of vegetation (cm)	*Juncus* 1m, mean 10cm	
Vegetation cover %	90	
Bare rock cover %	10	
Bare peat cover %	0	
Shrub/ericoid cover %	0	
Herbaceous/Graminoid cover %	90	
Bryophyte cover %	0	
No. plant species in quadrat	11	
Species	**% cover**	**DOMIN**
Juncus effusus	30	6
Agrostis capillaris	5	4
Agrostis stolonifera	10	4-5
Trifolium repens	20	5
Holcus lanatus	5	4
Cardamine flexuosa	5	4
Ranunculus repens	10	4-5
Cirsium palustre	<4	2
Stellaria media	<4	2
Cerastium fontanum	<4	2
Rumex sp.	<4	1

Evaluation - Quadrat T13.1

NVC classification: MG10 *Holcus lanatus* – *Juncus effusus* rush pasture grassland – now heavily grazed.

No potential for active peat.

Quadrat T13.2 **Surveyor: EC**	**Location** **(X,Y): -7.31866, 54.81971**

This quadrat is located a short distance from the proposed hardstand for Turbine T13, within an area of blanket bog located at the edge of a species-poor improved field which is dominated by soft-rush (*Juncus effusus*). The area supports many typical bog species, including heather (*Calluna vulgaris*) and cross-leaved heath (*Erica tetralix*), cottongrasses (*Eriophorum* spp.) and a range of both hypnoid mosses and bog-mosses (*Sphagnum* spp.). Grazing was evident in this area.

The T13 hardstand was formerly planned to occupy this area, however, it was relocated eastwards to an area of improved grassland and acid grassland/flush habitat, in response to the findings of the habitat survey and active peat assessment.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past.

Date	28.10.21	
Size m²	2x2	
Aspect / slope	slight eastern slope	
Altitude (m)	221	
Height of vegetation (cm)	15-40	
Vegetation cover %	100	
Bare peat cover %	0	
Shrub/ericoid cover %	20	
Herbaceous/Graminoid cover %	50	
Bryophyte cover %	65	
No. plant species in quadrat	17	
Species	**% cover**	**DOMIN**
Calluna vulgaris	17	5
Erica tetralix	<4	2
Vaccinium myrtillus	<4	1
Juncus squarrosus	15	5
Molinia caerulea	15	5
Deschampsia flexuosa	10	5
Eriophorum vaginatum	5	4
Narthecium ossifragum	<4	1
Potentilla erecta	5	4
Plagiothecium undulatum	5	4
Rhytidiadelphus squarrosus	15	5
Pleurozium–schreberi	10	4-5
Rhytidia–elphus loreus	5	4
Sphagnum fallax	15	5
Sphagnum subnitens	10	4-5
Sphagnum capillifolium	<4	2

Polytrichum commune	5	4

Evaluation - Quadrat T13.2

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but still **has the potential for active peat.** However, the Hydrological Assessment has indicated that this quadrat lies within an area of 'compromised' hydrology.

Quadrat T13.3 **Surveyor: AH**	**Location** **(X,Y):-7.320058364, 54.8193183**

This quadrat is located c. 130m from the T13 hardstand, along a previously suggested route for the access road to this turbine (since relocated to avoid sensitive habitats). The vegetation in the quadrat was dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*). The ground was wet underfoot. and a peat depth of >1m was recorded in the quadrat. Some bog asphodel (*Narthecium ossifragum*) was noted in the vicinity but was not present within the quadrat. No evidence of grazing or recent turf cutting was noted in the quadrat area and no invasive or non-native species were noted in the vicinity.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past

Date	28.10.2021	
Size (m)	2x2	
Slope (degrees)	Level	
Aspect	n/a	
Altitude (m)	226	
Height of vegetation (cm)	30	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	60	
Herbaceous/Graminoid cover %	35	
Bryophyte cover %	88	
No. plant species in quadrat	11	
Substrate	Peat > 1m	
Species	**% cover**	**DOMIN**
Calluna vulgaris	56	8
Erica tetralix	4	4
Eriophorum angustifolium	5	4
Eriophorum vaginatum	20	5
Trichophorum germanicum	10	4
Sphagnum subnitens	15	5
Sphagnum cuspidatum	3	3
Sphagnum palustre	5	4
Sphagnum fallax	40	7
Hypnum jutlandicum	20	5
Cladonia portentosa	<1	1

Evaluation - Quadrat T13.3
NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but stil**l has the potential for active peat.** However, the Hydrological Assessment has indicated that this quadrat lies within an area of 'compromised' hydrology.

Quadrat T13.4 **Surveyor: AH**	**Location** **(X,Y):-7.321837256, 54.8188811**

This quadrat is located on the previously-suggested route of the proposed access road to T13 (since relocated to avoid sensitive habitats), within an area of previous cutover bog between peat banks. The quadrat area is very wet underfoot and the ground is generally wet in the vicinity. The peat depth within the quadrat was >1m. The vegetation is dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum angustifolium*). No evidence of grazing or recent turf cutting was noted within the quadrat and no invasive or non-native species were observed in the vicinity.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past.

Date	28.10.2021	
Size (m)	2x2	
Slope (degrees)	3°	
Aspect	South facing	
Altitude (m)	228	
Height of vegetation (cm)	30	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	30	
Herbaceous/Graminoid cover %	60	
Bryophyte cover %	85	
No. plant species in quadrat	9	
Substrate	peat	
Species	**% cover**	**DOMIN**
Calluna vulgaris	28	6
Erica tetralix	2	2
Eriophorum angustifolium–22	5	
Eriophorum vaginatum	8	4
Hypnum jutlandicum	40	7
Sphagnum palustre	10	4
Sphagnum denticulatum	2	2
Sphagnum fallax	30	6
Campylopus introflexus	3	3

Evaluation - Quadrat T13.4

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but still **has the potential for active peat.** However, the Hydrological Assessment has indicated that this quadrat lies within an area of 'compromised' hydrology.

2.14 Quadrats assessed in the vicinity of proposed turbine T14

Quadrat T14.1 **Surveyor: RNF**	**Location (XY):** **-7.3128907970465, 54.8168002401101**

The quadrat is located within the proposed hardstand location for Turbine 14. This habitat here is revegetating cutover bog, dominated by heather (*Calluna vulgaris*), with little *Sphagnum* present. It is not considered to meet the criteria for EU Annex I '7130 Blanket Bog' or Northern Ireland Priority Habitat 'Blanket Bog'.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8)

Date	27. 10. 2021	
Size (m)	2x2	
Aspect / Slope (degrees)	North West	
Altitude (m)	239	
Height of vegetation (cm)	40	
Vegetation cover %	99	
Bare rock cover %	0	
Bare peat cover %	1	
Shrub/ericoid cover %	70	
Herbaceous/Graminoid cover %	20	
Bryophyte cover %	70	
No. plant species in quadrat	8	
Substrate	shallower peat, 70cm in depth	
Species	**% cover**	**DOMIN**
Calluna vulgaris	55	8
Vaccinium myrtillus	10	4
Erica tetralix	5	4
Deschampsia flexuosa	10	4
Eriophorum vaginatum	5	4
Pleurozium schreberi	40	7
Rhytidiadelphus loreus	25	5-6
Sphagnum capillifolium	5	4

Evaluation - Quadrat T14.1:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past. It now consists predominantly of the M19b *Empetrum nigrum* ssp. *nigrum* sub-community

This area has been highly modified in the past, and is dry and firm underfoot, with little *Sphagnum* present, therefor**e is not considered to support active peat.**

Quadrat T14.2 **Surveyor: RNF**	**Location (XY):** **-7.31328744781753, 54.8165899843984**

This quadrat is located within the proposed hardstand location for Turbine 14, in an area that has been previously cutover. The peat is shallow at this proposed turbine location. The vegetation is dominated by heather (*Calluna vulgaris*) and hare's-tail cottongrass (*Eriophorum vaginatum*) with wavy hair-grass (*Deschampsia flexuosa*) and some bilberry (*Vaccinium myrtillus*). Some bog-mosses (*Sphagnum* spp) are present, but the main peat-forming species are poorly represented. Some hypnoid mosses and common haircap-moss (*Polytrichum commune*), often an indicator of habitat degradation, were also present and some bare peat was evident. This area has been highly modified in the past and is dry and firm underfoot.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8) - M19b

Date	27.10.2021	
Size (m)	2x2	
Aspect / slope (degrees)	North	
Altitude (m)	240	
Height of vegetation (cm)	40	
Vegetation cover %	90	
Bare rock cover %	0	
Bare peat cover %	10	
Shrub/ericoid cover %	35	
Herbaceous/Graminoid cover %	50	
Bryophyte cover %	50	
No. plant species in quadrat	12	
Substrate	Shallow peat, 40 cm in depth	
Species	**% cover**	**DOMIN**
Calluna vulgaris	25	5-6
Erica tetralix	5	4
Vaccinium myrtillus	5	4
Eriophorum vaginatum	20	5
Deschampsia flexuosa	15	5
Carex echinata	<4	1
Sphagnum fallax	15	5
Sphagnum capillifolium	5	4
Rhytidiadelphus loreus	10	4
Polytrichum commune	10	4
Cladonia portentosa	<4	1
Pleurozium schreberi	5	4

Evaluation - Quadrat T14.2

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past, it now consists predominantly of the M19b *Empetrum nigrum* ssp. *nigrum* sub-community

Owing to its modified nature, and firm, dry surface, this area is **not considered to support active peat.**

Quadrat T14.3 **Surveyor: RNF**	**Location (XY):** **-7.31361030598733, 54.8164379937614**

This quadrat is located within the proposed hardstand location for Turbine 14, within an area of cutover bog, on deeper peat. This habitat is revegetating cutover bog that is dry and firm underfoot, dominated by heather (*Calluna vulgaris*). It is not considered to meet the–criteria for EU Annex I '7130 Blanket Bog' or Northern Ireland Priority Habitat 'Blanket Bog'.

This area has been classified as the JNCC Phase 1 habitat Dry Modified Bog (E1.8) - M19b

Date	27.10.2021	
Size (m^2)	2x2	
Aspect / slope (degrees)	North / North West	
Altitude (m)	241	
Height of vegetation (cm)	50	
Vegetation cover %	95	
Bare rock cover %	0	
Bare peat cover %	5	
Shrub/ericoid cover %	60	
Herbaceous/Graminoid cover %	35	
Bryophyte cover %	45	
No. plant species in quadrat	9	
Substrate	0.51 – 1 m depth of peat.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	40	7
Vaccinium myrtillus	5	4
Erica tetralix	54	
Eriophorum vaginatum	35	7
Eriophorum angustifolium	5	4
Sphagnum fallax	10	4
Sphagnum capillifolium	20	5
Rhytidiadelphus loreus	10	4
Polytrichum commune	5	4

Evaluation - Quadrat T14.3:

NVC Classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire that has been modified by drainage and cutting in the past; it now consists predominantly of the M19b *Empetrum nigrum* ssp. *nigrum* sub-community

This area has been highly modified in the past, and is dry and firm underfoot, therefore **is not considered to support active peat.**

Quadrat T14.4 **Surveyor: RNF**	**Location (XY):** **-7.31496716878721, 54.8163334986464**

This quadrat is located *c*. 75m west of the proposed T14 hardstand, in the vicinity of a previously considered access road to this turbine, since re-routed to avoid sensitive habitat. The quadrat lies within an area of modified but potentially active blanket bog on deep peat that is wet and spongy underfoot. This area is likely to correspond to the EU Annex I Priority Habitat '7130 Blanket Bog'. Northern Ireland Priority Habitat 'Blanket Bog'. The vegetation is dominated by bog-asphodel (*Narthecium ossifragum*); heather (*Calluna vulgaris*) and bog-mosses (*Sphagnum* spp.) also feature in the vegetation.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)- Modified in past.

Date	27.10.2021	
Size (m)	2x2	
Aspect / slope (degrees)	North	
Altitude (m)	237	
Height of vegetation (cm)	30	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	15	
Herbaceous/Graminoid cover %	80	
Bryophyte cover %	35	
No. plant species in quadrat	7	
Substrate	2.01 – 2.5 m deep peat	
Species	**% cover**	**DOMIN**
Calluna vulgaris	10	4
Erica tetralix	5	4
Narthecium ossifragum	70	8
Sphagnum capillifolium	15	5
Sphagnum palustre	15	5
Pleurozium schreberi	5	4
Vaccinium myrtillus	<4	2

Evaluation - Quadrat T14.4:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but still **has the potential for active peat** and forms part of a wider moderate to high constraint (see orange constraint in TA 10.4 APA).

Quadrat T14.5 **Surveyor: RNF**	**Location (X,Y):** **-7.315623454, 54.81652525,**

This quadrat is located in the vicinity of a previously considered access route to Turbine 14, since re-routed to avoid sensitive habitat. The quadrat lies within an area of modified but active blanket bog on deep peat, that is wet and spongy underfoot. The vegetation is dominated by hare's-tail cottongrass (*Eriophorum vaginatum*) with some heather (*Calluna vulgaris*), bilberry (*Vaccinium myrtillus*), hypnoid mosses and bog-mosses (*Sphagnum* spp.). This area corresponds to the Annex I Priority Habitat '7130 Blanket Bog'. Northern Ireland Priority Habitat 'Blanket Bog'.

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)-Modified in past – M19

Date	27.10.2021	
Size (m)	2x2	
Aspect / slope (degrees)	North	
Altitude (m)	232	
Height of vegetation (cm)	40	
Vegetation cover %	100	
Bare rock cover %	0	
Bare peat cover %	0	
Shrub/ericoid cover %	30	
Herbaceous/Graminoid cover %	55	
Bryophyte cover %	50	
No. plant species in quadrat	8	
Substrate	1.01 – 1.5 m depth of peat.	
Species	**% cover**	**DOMIN**
Calluna vulgaris	20	5
Eriophorum vaginatum	55	8
Vaccinium myrtillus	10	4
Hypnum jutlandicum	5	4
Dicranum scoparium	5	4
Rhytidiadelphus loreus	20	5
Sphagnum subnitens	10	4
Sphagnum capillifolium	10	4

Evaluation - Quadrat T14.5:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

This area has been modified in the past but still **has the potential for active peat** and forms part of a wider moderate to high constraint (see orange constraint in TA 10.4 APA).

Quadrat T14.6 **Surveyor: RNF**	**Location (X,Y):** **-7.31746418110152, 54.8169707315162**

This quadrat is located in the vicinity of a previously considered access route to Turbine 14, since re-routed to avoid sensitive habitat. The quadrat lies within an area of somewhat degraded, cutover bog on deep peat. However, the surface remains spongy underfoot and peat forming species are frequent. Dominant species include heather (*Calluna vulgaris*), cottongrasses (*Eriophorum* spp.) and bog-mosses (*Sphagnum* spp.)

This area has been classified as the JNCC Phase 1 habitat Recovering Blanket Bog (E1.6.1)- Modified in past.

Date	27.10 .2021	
Size (m)	2x2	
Aspect / slope (degrees)	North West	
Altitude (m)	228	
Height of vegetation (cm)	45	
Vegetation cover %	95	
Bare rock cover %	0	
Bare peat cover %	5	
Shrub/ericoid cover %	45	
Herbaceous/Graminoid cover %	50	
Bryophyte cover %	25	
No. plant species in quadrat	9	
Substrate	60 cm depth of peat here	
Species	**% cover**	**DOMIN**
Calluna vulgaris	25	5-6
Erica tetralix	10	4
Vaccinium myrtillus	10	4
Eriophorum vaginatum	35	7
Eriophorum angustifolium	10	4
Dicranium scoparium	5	4
Sphagnum subnitens	30	6
Sphagnum capillifolium	5	4
Hypnum jutlandicum	5	4

Evaluation - Quadrat T14.6:

NVC classification: M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

EU Annex I Priority Habitat '7130 Blanket Bog'.

Northern Ireland Priority Habitat 'Blanket Bog'.

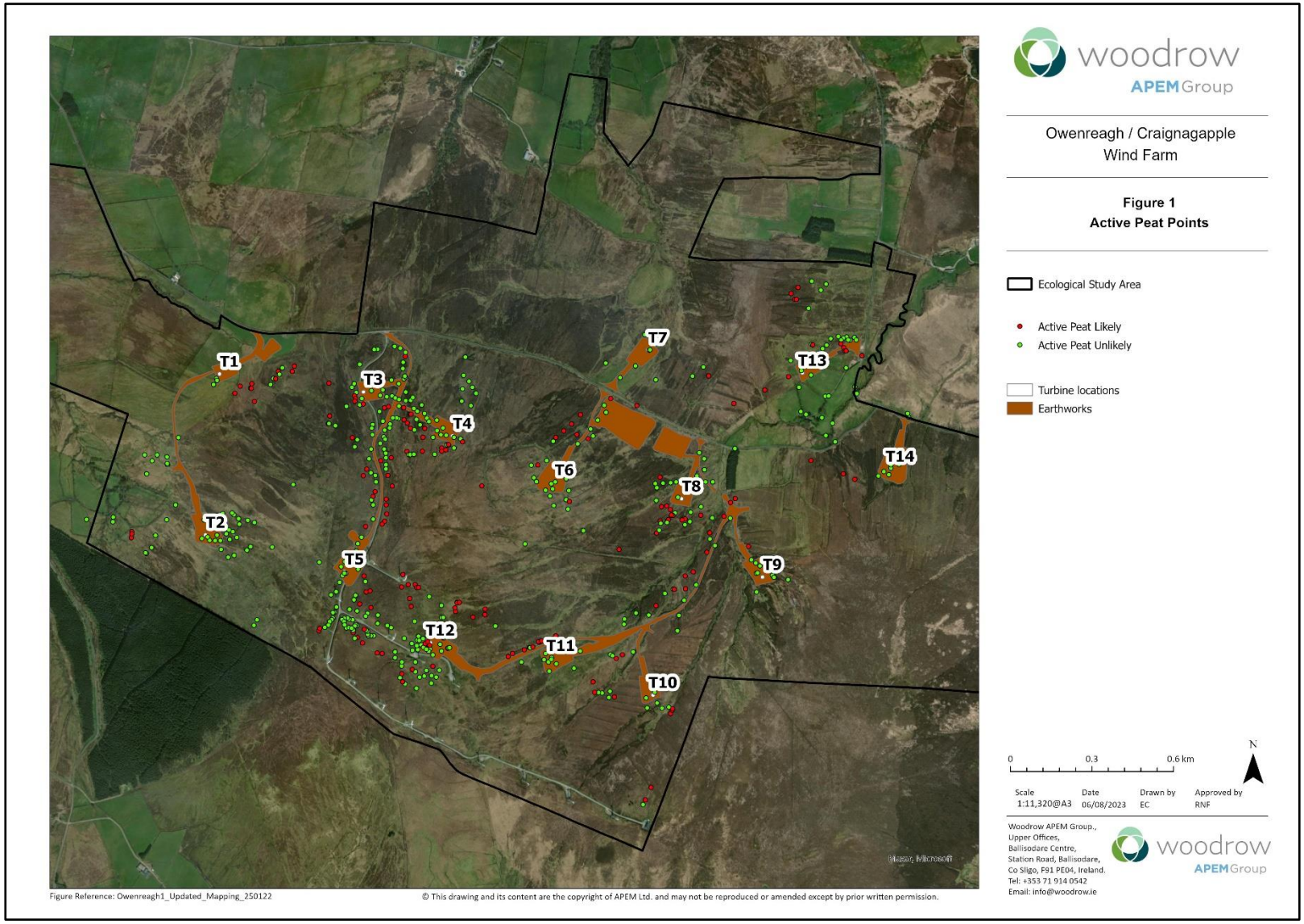
This area has been modified in the past but still **has the potential for active peat** and forms part of a wider moderate to high constraint (see orange constraint in TA 10.4 APA).

3. Results of the active peat assessment undertaken in July 2022

This additional active peat assessment allowed for refinement of the preliminary turbine layout. As described in Section 1, peat points were taken within areas known to support patches of active peat allowing locations of active peat to be presented on a map.

The results of the additional active peat survey are reproduced in Figure 1.

Figure 1 – Results of the active peat point assessments undertaken during 2021 and 2022



4. References

Averis, A., Averis, B., Birks, J., Horsfield, D., Thompson, D. & Yeo, M. (2004) An Illustrated Guide to British Upland Vegetation, JNCC, Peterborough, ISBN 1 86107 553 7. Available to download at: https://data.jncc.gov.uk/data/a17ab353-f5be-49ea-98f1-8633229779a1/IllustratedGuideBritishUplandVegetation-2004.pdf

DAERA (2012). NIEA, Natural Heritage, Development Management Team Advice Note: Active Peatland and PPS18. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-guidance-NIEA-natural-heritage-development-management-team-advice-note-2012.pdf

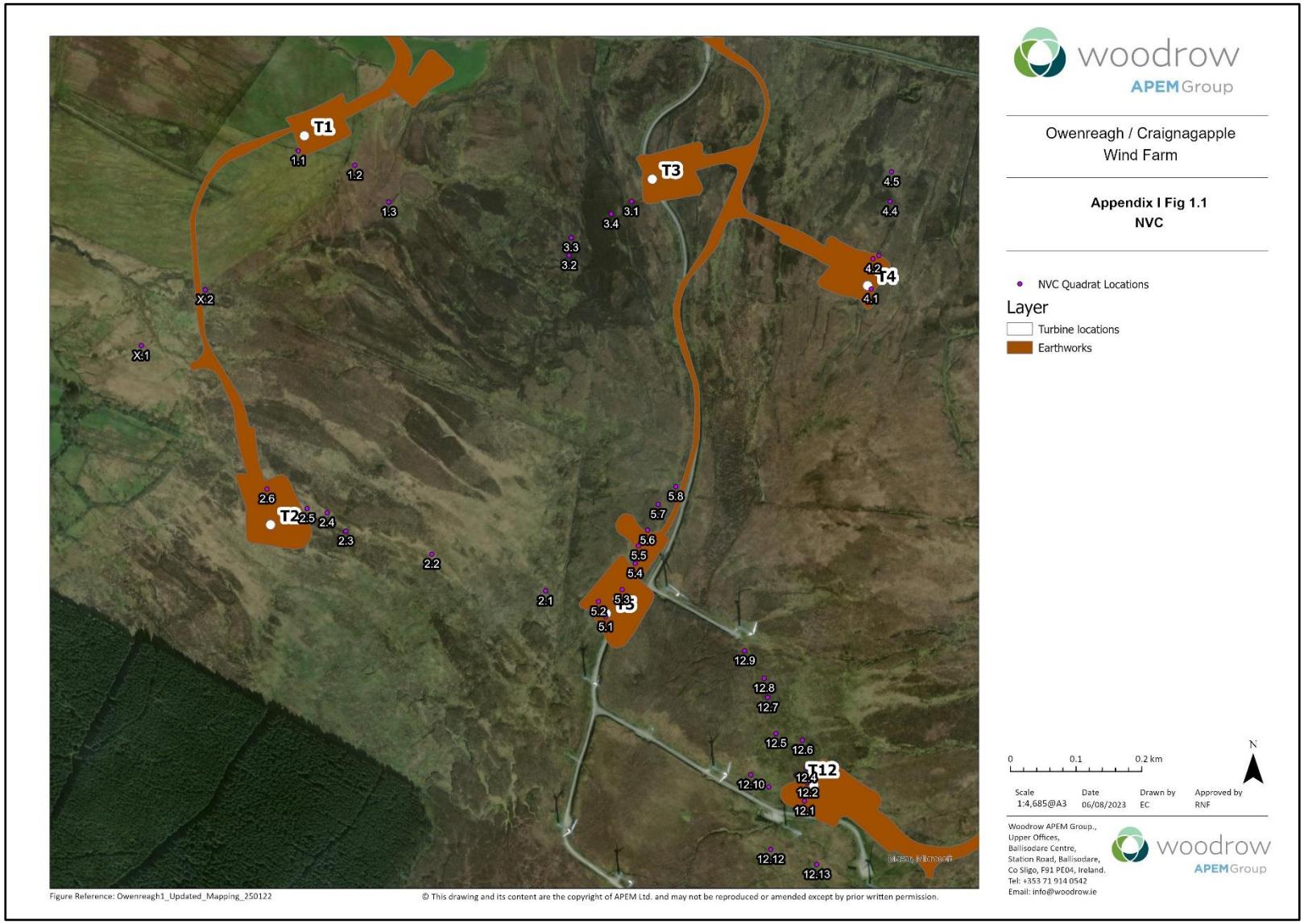
DAERA (2018). Habitat Guide – Blanket Bog. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Priority%20Habitat%20Guide%20-%20Blanket%20bog.PDF

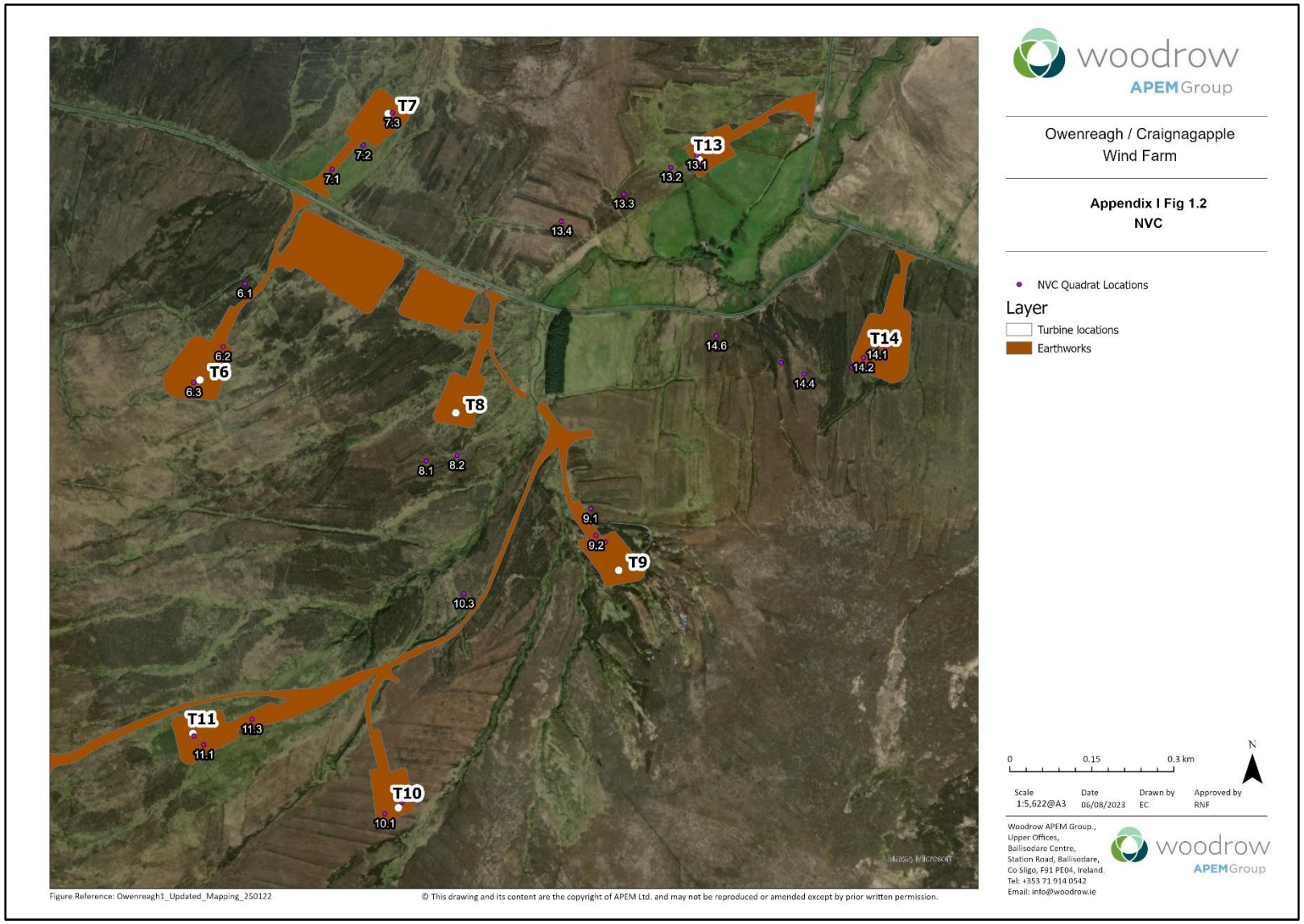
DAERA (n.d.). Northern Ireland Priority Habitat Rapid Condition Assessments. Rapid Condition Assessment: Moorland. Tranche 2. Habitat determination/ habitat ID assessment for moorland

Elkington, T., Dayton, N., Jackson, D.L. & Strachan, I.M. (2002) National Vegetation Classification field guide to mires and heaths, JNCC, Peterborough, ISBN 1 86107 526 X. Available to download at: https://data.jncc.gov.uk/data/1d0037bd-6c77-4677-8040-2f6e1d852eb1/JNCC-NVC-MiresHeaths-2002.pdf

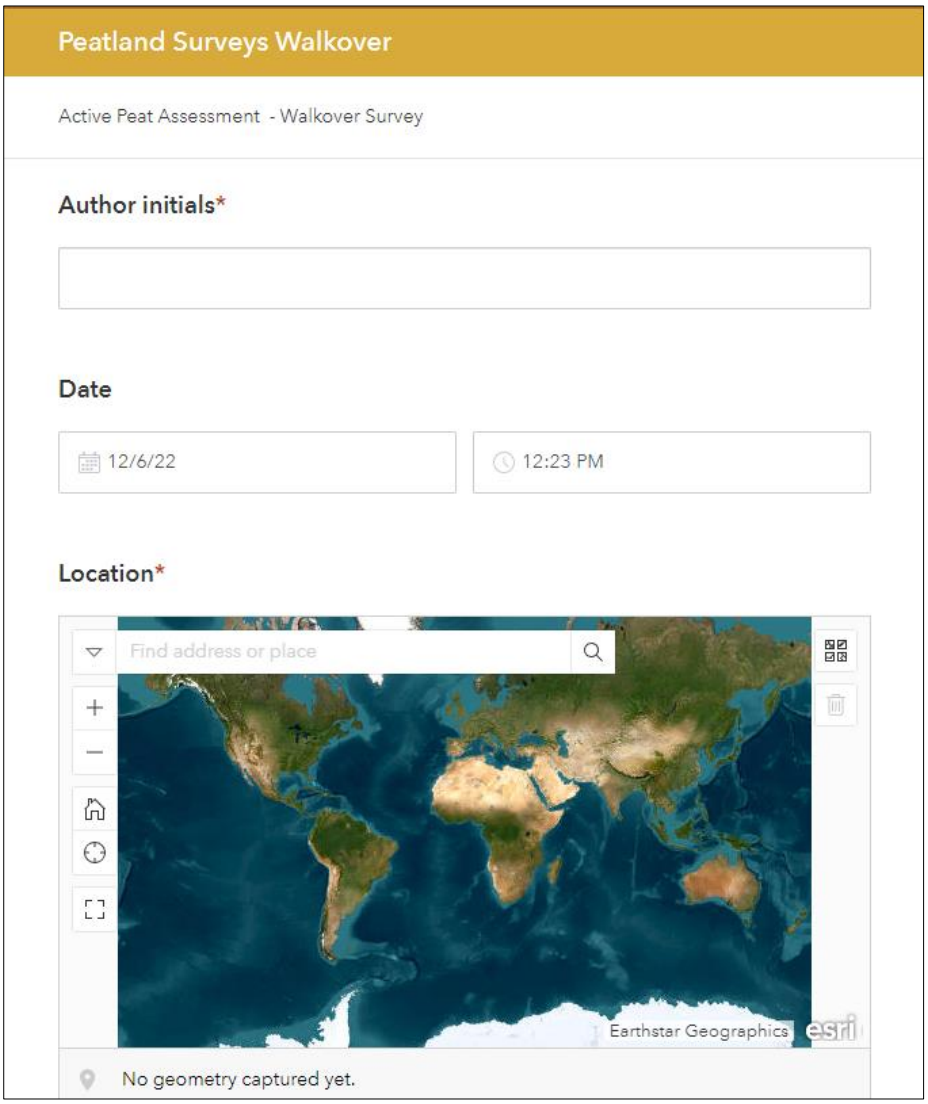
Rodwell, J.S. (2006) NVC Users' Handbook, JNCC, Peterborough, ISBN 978 1 86107 574 1. Available to download at: https://data.jncc.gov.uk/data/a407ebfc-2859-49cf-9710-1bde9c8e28c7/JNCC-NVC-UsersHandbook-2006.pdf

Appendix 1 - NVC Quadrat Locations – October 2021




T7
7.3
7.2
7.1
T13
13.1
13.2
13.3
13.4
6.1
6.2
T6
6.3
T8
8.1
8.2
9.1
9.2
T9
10.3
T11
11.3
11.1
T10
10.1
14.6
T14
14.1
14.2
14.4
Owenreagh / Craignagapple Wind Farm
Appendix I Fig 1.2
NVC
NVC Quadrat Locations
Layer
Turbine locations
Earthworks
0
0.15
0.3 km
N
Scale
1:5,622@A3
Date
06/08/2023
Drawn by
EC
Approved by
RNF
Woodrow APEM Group.,
Upper Offices,
Ballisodare Centre,
Station Road, Ballisodare,
Co Sligo, F91 PE04, Ireland.
Tel: +353 71 914 0542
Email: info@woodrow.ie
Figure Reference: Owenreagh1_Updated_Mapping_250122
© This drawing and its content are the copyright of APEM Ltd. and may not be reproduced or amended except by prior written permission.

Appendix 2 – Active peat recording form (Survey 123)



Active Peat Decision

- [ ] Active Peat Likely
- [ ] Active Peat Unlikely
- [ ] Other

Notes

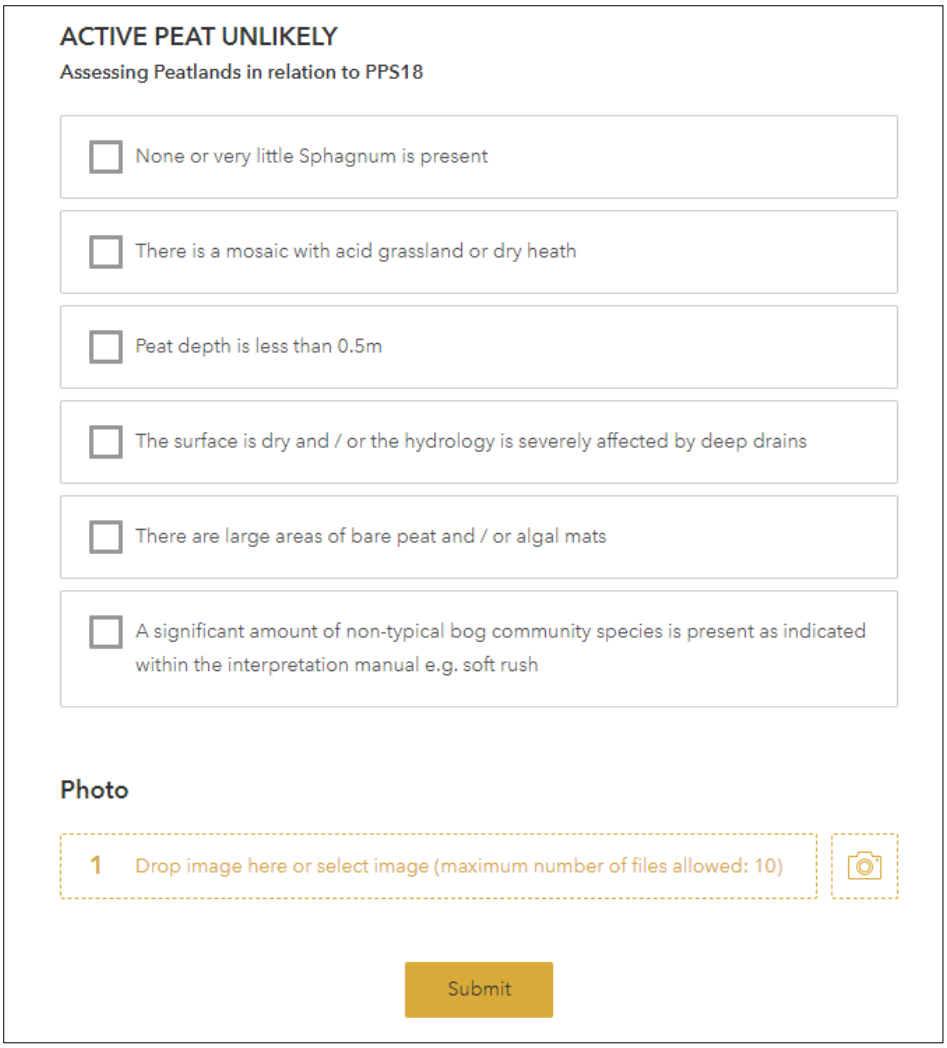
Species, topography, ground conditions, slope, any other info deemed relevant

Please input 1,000 characters at most

ACTIVE PEAT LIKELY

Assessing Peatlands in relation to PPS18

- [ ] Sphagnum is present
- [ ] 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



ACTIVE PEAT UNLIKELY

Assessing Peatlands in relation to PPS18

- ☐ None or very little Sphagnum is present
- ☐ There is a mosaic with acid grassland or dry heath
- ☐ Peat depth is less than 0.5m
- ☐ The surface is dry and / or the hydrology is severely affected by deep drains
- ☐ There are large areas of bare peat and / or algal mats
- ☐ A significant amount of non-typical bog community species is present as indicated within the interpretation manual e.g. soft rush

Photo

1 Drop image here or select image (maximum number of files allowed: 10)

Submit

PROPOSED OWENREAGH / CRAIGNAGAPPLE WIND FARM

ENVIRONMENTAL STATEMENT VOLUME 4: TECHNICAL APPENDICES

TECHNICAL APPENDIX A10.4: ACTIVE PEAT ASSESSMENT (APA)

AUGUST 2023

Prepared By:

Woodrow APEM Group,
Upper Offices,
Ballisodare Centre,
Station Road,
Ballisodare,
Co. Sligo,
Ireland.
F91 PE04

Contents

DOCUMENT CONTROL

Document	Proposed Owenreagh / Craignagapple Wind Farm Development, east of Strabane, Co. Tyrone. Active Peat Assessment (APA)
Client	Ørsted Onshore Ireland Midco Limited
Prepared by	Woodrow APEM Group, Upper Offices, Ballisodare Centre, Station Road, Ballisodare, Co. Sligo, F91 PE04, Ireland. T: +353 719140542
Lead Author	Bridget Keehan
Checked by	Róisín NigFhloinn
Approved by	Will Woodrow
Checked by client	27.03.2023
Status / Version / Date	R01 / 17.08.2023

Statement of Authority

This Active Peat assessment report was authored by Bridget Keehan ACIEEM and Róisín NigFhloinn MCIEEM and approved by Will Woodrow CEcol MCIEEM.

This report is written by Bridget Keehan BSc ACIEEM. Bridget is a Senior Ecologist with Woodrow and a professional field botanist with more than 30 years of experience in plant identification including bryophytes. She has excellent habitat classification skills, with extensive experience in JNCC Phase 1, Fossitt 2000 and National Vegetation Classification (NVC) surveys and is proficient in developing strategies and providing advice based on information collated. Bridget is also experienced in undertaking mammal, raptor, invertebrate and invasive species surveys to inform reports and impact assessments. Bridget is proficient in the preparation of habitat maps, ecology chapters of Environmental Impact Assessments, Screening Reports and inputting into Appropriate Assessments, including provision of mitigation recommendations, and has wide experience in editing and analysing reports and journals. Bridget maintains an up-to-date practical knowledge of both European and National (Northern Ireland and Republic of Ireland) environmental legislation and is an Associate Member of the Chartered Institute of Ecology and Environmental Management (ACIEEM).

Róisín NigFhloinn, is an Associate Director with Woodrow, and a project manager for several large infrastructure schemes, as well as for smaller Development projects. She has completed an honours degree, specialising in Botany, and holds a masters in Ecology and Management of the Natural Environment. She is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). She regularly carries out reporting for EcIA, EIAR Biodiversity Chapters / ES Ecology Chapters, and reporting to inform Appropriate Assessment / Habitat Regulations Assessment carried out by statutory authorities. Furthermore, she has more than 13 years' experience in habitat surveys, mammal surveys, bird and bat surveys for a number of large infrastructure schemes, commercial and residential projects. Róisín is also an experienced Ecological Clerk of Works (ECoW).

This report has been reviewed and approved by Will Woodrow. Will is a Director at Woodrow APEM Group. He is a Chartered Ecologist, and a full member of CIEEM, with over 30 years of experience in ecological surveys and assessment. He has particular expertise in ornithological assessment, invertebrate identification and habitat management, particularly when working within peatland environments.

Bridget Keehan – Qualifications:

BSc (Hons) – Botany, University College of North Wales, 1992.

Róisín NigFhloinn – Qualifications:

B.A. Mod (Hons) – Natural Sciences (specialising in Botany), Trinity College, Dublin, 2008.
M. Sc. – Ecology and Management of the Natural Environment, University of Bristol, England, 2011.

Will Woodrow – Qualifications:

M.Sc. – European Environmental Policy and Regulation, Lancaster University, 1994.
M.Sc. (Arch) – Advanced Environmental and Energy Studies. University of East London, 2006

1 INTRODUCTION

Woodrow APEM Group ('Woodrow') were commissioned on behalf of Ørsted Onshore Ireland Midco Limited ('the Applicant') to provide ecological services to inform the preparation of Ecology and Ornithology Chapters for incorporation into the Environmental Statement (ES) for the proposed repowering and extension of the existing Owenreagh I and II Wind Farm, Co. Tyrone, henceforth referred to as 'Owenreagh / Craignagapple Wind Farm' ('the Development').

This Technical Appendix of the Environmental Statement outlines the results of the Active Peat Assessment (APA) carried out at the Development.

In recognition of the high importance afforded to active peatland by the *Department of the Environment's Planning Policy Statement 18: Renewable Energy (2009)* and the *Strategic Planning Policy Statement for Northern Ireland: Planning for Sustainable Development (2015)*, and following various scoping and consultation exercises carried out during 2021 for the Development, it was determined that an Active Peat Assessment (APA) would be required to determine the extent of areas of active peat and to ensure that the design would seek to avoid and minimise detrimental impact on areas of active peat.

'Active' blanket bog is defined as supporting a significant area of vegetation that is normally peat-forming. Typical species include the important peat-forming species, such as bog-mosses *(Sphagnum spp.)* and cotton grasses *(Eriophorum spp.)*, or purple moor-grass *(Molinia caerulea)* in certain circumstances, together with ling heather *(Calluna vulgaris)* and other ericaceous species.

In accordance with the NIEA Guidance Note on Active Peat[1], active peat is likely to occur where certain indicator species are present, such as *Sphagnum* mosses and/or cottongrass species (*Eriophorum* spp.); on deep peat (>0.5m), with the correct moisture-rich ground conditions; and in areas where the hydrology remains intact (i.e., the unit is not hydrologically degraded for example by the presence of artificial features such as drains or cuttings). A number of factors need to be considered in combination to provide an indication of likely areas of active peat, or areas which are inactive, but which could become active in future with the implementation of successful restoration practices (see Section 4 of this Technical Appendix).

A review of existing information from the historic planning applications at this site were also used to inform baseline information. The planning history of the Ecological Study Area (ESA) is as follows:

- Owenreagh I (J/93/0286 - 10 no. 500 kW Z40 Zond turbines);
- Owenreagh II (J/2004/1015/F - 6 no. 850 kW Vestas V52 turbines); and
- Consented Craignagapple Wind Farm (J/2010/0481/F - 6 no. 111m turbines) (consented but not constructed).

The Hydrological Unit Assessment (HUA) which informed this APA is provided within **ES Technical Appendix A8.1**. The purpose of the HUA was to determine the spatial extent of intact hydrological units across the Study Area, and to determine whether they are intact or non-intact in the light of site observations and monitoring.

The definition of an intact unit, for the purposes of the Hydrological Unit Assessment, is *"a hydrological unit that is not damaged or impaired in any way"*, i.e., that has not been artificially modified, for example though drainage or turbary.

[1] Northern Ireland Environment Agency (NIEA) (2018) Guidance Note on Active Peat [Online]. Available at: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-guidance-NIEA-natural-heritage-development-management-team-advice-note-2012.pdf (Accessed 28/01/2021)

During specific workshops with the Project Team Ecologists and Hydrologists, the HUA assessment was reviewed alongside the vegetation classifications (Phase 1 Habitat Assessment, National Vegetation Classification and the active peat assessment surveys) in order to classify areas as being of Low to High constraint for Active Peat.

2 METHODOLOGY

2.1 Introduction

This section outlines the methodology for the Active Peat Assessment (APA) undertaken for the Development.

'Active' peat supports the typical range of blanket bog species which are capable of peat formation coupled with an intact hydrological unit. 'Active' is defined as supporting a significant area of vegetation that is normally peat-forming. Typical species include the important peat-forming species, such as bog-mosses *(Sphagnum spp.)* and cottongrasses *(Eriophorum spp.)*, or purple moor-grass *(Molinia caerulea)* in certain circumstances, together with ling heather *(Calluna vulgaris)* and other ericaceous species. The peat depth within these areas typically exceeds 0.5 m and the substrate remains wet and spongy underfoot.

The classification of peat types for the APA is illustrated on the Constraints Map provided in **Figure A10.4.1** (**Appendix I** of this report). This highlights the:

- Areas where active peat has been identified;
- Areas of inactive peat which have the potential to become active upon the successful implementation of restoration practices (but are unable to regenerate on their own due to existing land management), which investigated further in the draft Habitat Management and Enhancement Plan (draft HMEP) report;
- Areas of non-intact inactive peat, for which restoration practices would be unlikely to successfully recover the peatland habitat to an active status; and
- Areas which are not actively peat forming such as flush or acid grassland.

As well as identifying areas unsuitable for development due to the presence of, or proximity to, areas of active peat, the APA has also been used to select areas for Habitat Restoration (also considering topography, hydrology and peat slide risk, and drawing on further detailed analysis carried out as part of the draft HMEP (**ES Technical Appendix A3.2**) and Peat Slide Risk Assessment (**ES Technical Appendix A9.1**)). Information on these areas, as well as proposed management prescriptions designed to restore, maintain and enhance these areas, and the species associated with them, are provided within the draft HMEP, prepared for this Development (see **ES Technical Appendix A3.2**)]. This will be carefully monitored as per the prescriptions outlined in the HMEP.

Further details on the habitat ecology of the Ecological Study Area (ESA) are provided within the ES (**Chapter 10: Ecology**), which includes a review of its ecological baseline. Reporting on the National Vegetation Classification (NVC) relevé (quadrat) survey undertaken in the ESA in 2021, and a summary of the NVC survey data collected form the ESA in 2019, are provided in **ES Technical Appendix A10.3** – the National Vegetation Classification (NVC) survey.

2.2 Habitat Surveys of the Ecological Study Area

The habitat assessment input for the APA has been informed by Joint Nature Conservation Committee (JNCC)[2] Phase 1 habitat walkover surveys undertaken within the ESA during

[2] JNCC, (2010), Handbook for Phase 1 habitat survey – a technique for environmental audit, JNCC, Peterborough. Available at: https://hub.jncc.gov.uk/assets/9578d07b-e018-4c66-9c1b-47110f14df2a (Accessed 28/01/2021)

summer and autumn in 2018 and 2021. JNCC habitat classification was supplemented by the collation of peat status points during these walkovers (see Appendix III).

Peat status points were undertaken to provide fine-scale mapping of areas of 'active peat'. This assessment was based on the presence of indicator plant species, the depth of the underlying peat layer and the hydrological condition of the peatland unit; based on NIEA-NED Guidance note on Active Peat (NIEA, 2012).

Subsequently, habitat classifications were confirmed and refined using relevé data collected according to National Vegetation Classification (NVC) standard guidance[3] during October 2019 and October 2021 (see **ES Technical Appendix A10.3**: NVC Assessment for summary information). Additional point locations for active peat were conducted in July 2022.

The following surveys were completed within the ESA as part of this APA by Woodrow's team of ecologists specialising in botanical surveys:

- JNCC Phase 1 Habitat Walkover Survey (conducted in July 2018);
- NVC Survey (conducted in October 2019);
- JNCC Phase 1 Habitat Walkover Survey, including assessment of point locations for active peat (conducted in June, July, August, and September 2021);
- NVC Survey (conducted in October 2021);
- Assessment of additional point locations for active peat (conducted in July 2022); and
- An assessment of the proposed substation location (conducted in October 2022) – see Appendix II of this report.

2.3 Relevant Surveys within the Study Area

Hydrology surveys are reported on in **ES Chapter 8: Hydrology and Hydrogeology**; Geology and Peat studies are dealt with in **ES Chapter 9: Geology and Peat**.

2.4 Survey limitations

There were no limitations on access during the botanical or the hydrology surveys which inform this APA.

Full details regarding the ecological surveys undertaken at this site are provided within **Technical Appendix A10.1: Ecological Impact Assessment** (EcIA) and **ES Chapter 10 - Ecology**.

3 JOINT NATURE CONSERVATION COMMITTEE (JNCC) PHASE 1 HABITAT SURVEY METHODOLOGY

Baseline information from habitat surveys undertaken by Woodrow for previously consented planning application at this location were reviewed by Woodrow (Planning Ref: J/2010/0481/F). These informed the production of a draft habitat map for the ESA. This information was then updated by extensive habitat walkovers undertaken in 2019 and 2021 to provide information to inform the design of the Development.

A Joint Nature Conservation Committee (JNCC) Phase 1 habitat survey was carried out across the entire ESA during July 2019 and updated during the period May-September 2021.

Survey methods followed the standard approach specified by the JNCC for habitat mapping. For the Phase 1 survey, the ESA was walked, ecological features of interest were noted,

[3] National Vegetation Classification (NVC) [Online]. Available at: https://jncc.gov.uk/our-work/nvc/ (Accessed 28/01/2021)

and habitats were classified into recognised communities as outlined by the JNCC (JNCC, 2010). The habitat survey gave cognisance to the potential presence of any habitats which had the potential to correspond to Northern Ireland Priority Habitats and EU Habitats Directive Annex I Habitats.

The location of habitat types was noted, and, during the survey, consideration was given to identifying important or protected habitats, and habitats that could be used by protected species. Post-survey analysis was then carried out by cross-referencing habitat and plant community types to Habitats Directive habitats (Annex I habitat types[4]) and Northern Ireland Priority Habitats, using JNCC's correspondence rules (JNCC, 2010) and NIEA Priority Habitat guidance. This information was used to inform a 'Design Chill' workshop which was held with the project team on 13 October 2021. Further information regarding the conservation status of various habitat types found in this area is available within **Technical Appendix A10.1: Ecological Impact Assessment** (EcIA) and **ES Chapter 10 - Ecology**.

This APA focuses on the identification of existing 'Active Peat' within the ESA (as defined within the EcIA). An Active Peat Workshop for this Development was conducted across the ESA on 2 December 2021 between the Woodrow Ecology team and an hydrology team from ERM (formerly Arcus). This was undertaken specifically to inform the design of the Development and was intended to ensure an informed discussion of vegetation classification, active peat, hydrological units and the intrinsic links between these. Subsequently, a design workshop, involving a collaboration of the entire project team, was held on 18 August 2022 to further develop the design, with specific reference to ecological and hydrological considerations as well as other design factors.

During the JNCC Habitat surveys in 2019, a series of peat status points were assessed across the ESA which, in conjunction with the results of the NVC survey, were used to inform 'constraints mapping' of the ESA. This assessment is described in more detail in Section 4.

4 CONSTRAINTS MAPPING – PEAT STATUS POINTS

During walkovers of the ESA in May 2019, initial notes were made regarding the indicators for 'Active Peat' throughout this area. These walkover surveys highlighted the highly mosaic nature of the general area and identified areas where land management practices were influencing the peatland conservation status, as well as locations where existing infrastructure has affected these habitats.

Follow-up surveys in autumn/winter 2021 and summer 2022 were undertaken in order to assess potential for active peat at a series of points across the ESA, focussing on areas proposed for Development infrastructure at that time. At each point assessed, the following parameters were recorded, in line with the NIEA Guidance Note on Active Peat (NIEA 2018):

- % cover of Sphagnum and Eriophorum spp.;
- Approximate peat depth (measured using a peat probe);
- General surface hydrology and the presence or absence of drains;
- % cover of bare peat and/or algal mats;
- Presence of typical or non-typical bog community species/ positive and negative indicator species; and
- Any obvious management/grazing observations.

[4] JNCC (n.d.) Habitat List [Online]. Available at: https://sac.jncc.gov.uk/habitat/ (Accessed 28/01/2021)

With reference to NIEA active peat guidance, each assessment point was then initially classified as either 'Active Peat Likely' or 'Active Peat Unlikely' (indicating whether the vegetation was assessed as being potentially peat-forming or not, at that specific point location; allowing for a later classification of Active Peat or otherwise depending on whether a unit comprised a "significant area" of peat forming vegetation). Observations at each assessment point were recorded in the field using the ArcGIS application 'Survey 123' in order to provide a georeferenced record of each point assessed.

The Active Peat Assessment, coupled with Phase 1 and NVC habitat survey data (see Sections 3 and 5), and supported by the interpolated peat depth analysis (see **ES Chapter 9: Geology and Peat**) and the Hydrological Unit Assessment undertaken by ERM (**ES Technical Appendix A8.1**), were used to inform the final constraints mapping of the ESA, which classifies habitat status at the site and identifies areas of low to high constraint (see **Figure A10.4.1** in **Appendix I** of this report). Areas of active peat were identified and the footprint of the design was located outside of this habitat.

5 NATIONAL VEGETATION CLASSIFICATION (NVC) SURVEY METHODOLOGY

During the NVC surveys (see **Technical Appendix A10.3**), placement of relevés focused on areas where infrastructure might potentially be proposed. JNCC habitat classification was supported by baseline information using aerial photography through consistent checks against ArcGIS world imagery orthophotography base mapping. Overall JNCC habitat classifications for the various polygons illustrated on **Figure A10.4.1** were ground-truthed during the wider habitat surveys to gain a higher degree of accuracy when classifying Phase 1 habitat types across the ESA.

A survey of 68 No. standard 2x2 metre vegetation relevés was carried out across the ESA during the period 26-28 October 2021 as part of the habitat assessment.

This survey was intended to inform the final siting of turbines, hardstands, and access roads for the Development. Therefore, the turbine locations and preliminary associated access routes proposed at that time were prioritised during this survey.

The assessment of relevés followed standard National Vegetation Classification survey guidance[5]. The information gathered was used to update both the existing JNCC Phase 1 and preliminary constraints mapping, using ArcPro GIS Software.

In assessing each relevé, all plant species present, including bryophytes, were recorded, and coverage of each species was assessed in terms of both % cover and score on the DOMIN scale (see Table A.8.1.1). General observations were recorded for each relevé location, including notes on slope, aspect, ground condition, substrate, land management and other factors that may influence the vegetation (e.g., nearby drainage; evidence of historic peat cutting).

Table A8.1.1: Coverage of vegetation represented by DOMIN scores.

DOMIN score	% Cover of vegetation
1	Few individuals (<4%)
2	Several individuals (<4%)
3	Many individuals (<4%)
4	4-10%
5	11-25%
6	26-33%

[5] Rodwell, J.S. (2006) NVC Users' Handbook, JNCC, Peterborough. Available at: https://data.jncc.gov.uk/data/a407ebfc-2859-49cf-9710-1bde9c8e28c7/JNCC-NVC-UsersHandbook-2006.pdf (Accessed 28/01/2021)

DOMIN score	% Cover of vegetation
7	34-50%
8	51-75%
9	76-90%
10	91-100%

The information gathered was used to assign NVC plant communities to the local vegetation and to determine whether the habitat present was likely to represent Northern Ireland Priority Habitat. For each relevé, an assessment was also made on the suitability of the local area to support active peat accumulation, considering factors such as hydrology and the presence of peat forming plant species.

Further details on the NVC surveys undertaken for this Development are provided in **ES Chapter 10: Ecology** and **Technical Appendix A10.3: NVC Assessment**.

The final constraints mapping, informed by the Active Peat Assessment, the JNCC Phase 1 habitat survey and the NVC relevé survey, is provided in **Figure A10.4.1** in **Appendix I** of this report.

6 RESULTS OF ACTIVE PEAT ASSESSMENT

The results of the Active Peat Assessment conducted across the ESA were used to compile a constraints map, highlighting areas where active peat was more likely to be present. This is provided in **Figure A10.4.1** within **Appendix I** of this report.

It should be noted that the area has undergone much historic modification, with extensive evidence of turbary, drainage, burning and overgrazing, as well as some evidence of historic peat slippage, and thus most of the habitats present are highly fragmented and mosaic in nature. Although much of the area is underlain by deep peat (typically 1-2 m, see **ES Technical Appendix A9.1: Peat Slide Risk Assessment**), the peat has become degraded in many areas though impaired hydrology, desiccation and oxidation.

The rationale for each category of mapped constraint is as follows:

- Areas of **High Constraint** are indicated in red. These are significant areas of relatively intact blanket bog where peat-forming vegetation was evident or was considered likely in the light of the field assessments and, based on the NIEA description, are considered to be Active Peat. The vegetation in these areas corresponds principally to the NVC community M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire.

- Areas of **Moderate-High Constraint** are indicated in orange. These encompass areas that have clearly been modified in the past, resulting in development of a modified vegetation type, but where the overall hydrology remains relatively intact, and pockets of recovering blanket bog vegetation are evident. These areas support both active (M19 *Calluna vulgaris – Eriophorum vaginatum*) blanket mire and inactive (M19 *Calluna vulgaris – Eriophorum vaginatum*) blanket mire that has been modified by drainage and cutting in the past. It now consists of a mosaic habitat containing M19b *Empetrum nigrum ssp. nigrum* sub-community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia spp.* sub-community peatland habitats, and has drains which have been cut into the peatland throughout these areas. If management practices in these areas changed appropriately, it might be possible for these areas to become Active Peat, however, these areas do not currently meet the requirement to be classified as Active Peat. Where this

blanket bog is potentially affected (following site-specific surveys of the vegetation at that time) the ECoW will seek to agree to microsite infrastructure with the aim of avoiding any peat-forming vegetation pockets within this habitat type

- Areas of **Moderate-Low Constraint** are indicated in yellow. These are areas that, although underlain by peat, are generally quite dry underfoot, where turbary, overgrazing, burning and drainage have given rise to a modified vegetation community that contains peatland species such as heather (*Calluna vulgaris*), bilberry (*Vaccinium myrtillus*) and hypnoid mosses, often with a high proportion of graminoid species, but where the hydrology has been significantly compromised, and peat forming species such as *Sphagnum* spp. are very sparse or absent. These areas do not currently meet the requirements to classified as Active Peat. They include:
  - Where the vegetation remains heather dominated, but the hydrology is clearly compromised, the vegetation is considered to correspond to the NVC community M19b *Calluna vulgaris – Eriophorum vaginatum* blanket mire, *Empetrum nigrum ssp. nigrum* sub-community; and
  - Where the vegetation appears to be transitional to acid grassland, this has been classified as a mosaic between this community and M20b *Eriophorum vaginatum* blanket mire, *Calluna vulgaris – Cladonia spp.* sub-community. As stated in Rodwell (1991), M20 mire communities can develop from M19 blanket mire as a result of drainage, intensive grazing and burning.
- Areas of **Low Constraint** are indicated in green. These encompass non-peat habitats, such as improved and semi-improved grassland, scrub and conifer plantation. This category also includes habitats that may be underlain by peat, such as flush, which by its nature does not retain water and as such would not support significant accumulation of peat. These areas are not Active Peat.

JNCC Phase 1 habitats and NVC communities that were found to correspond to each category of active peat status most typically are listed in Table A8.1.2 during the surveys of the ESA. These are illustrated in **Appendix I Figure A10.4.1**.

Areas where peatland restoration and enhancement parcels have been identified within the ESA by EHA are dealt with further within the Technical Appendix A3.2: Habitat Management and Enhancement Plan.

Table A8.1.2: JNCC habitats and NVC vegetation communities occurring in areas covered by the Active Peat Assessment

JNCC habitat	NVC community	Total area of this habitat within ESA (ha)	APA Assessment (Colour Coded)
Intact Blanket Bog (E.1.6.1)	M19	22.413	High Constraint
Recovering blanket bog (E1.6.1) – modified in past	M19	188.199	Moderate-High Constraint
Dry modified bog (E1.8)	M19b / M20b	208.479	Moderate-Low Constraint
Wet modified bog (E1.7) – very degraded	M20a	19.356	Low Constraint
Acid grassland / Flush (B1.2 / E2.1)	U2b / M6c	88.445	

Species-poor flush and spring (E2.1)	M6c	34.398	
Improved grassland / poor semi-improved grassland mosaic (B4 / B2.2)	MG10	24.763	
Hedgerows and scrub (J2.2 / A2.2)	n/a	5.702	
Dry ditch (J2.6 / E2.1)	n/a	4.580	
Coniferous plantation (A1.2.2)	n/a	0.482	

6.1 Existing and Future Ecohydrological Baseline at the site

Extensive surveys across the ESA have highlighted the degraded nature of peatland here. This is largely due to historic land management practices for peat cutting and land management. If no action is taken peatland degradation, and associated wider environmental impacts will continue.

These consist of the following (pers. comm. Dr Raymond Flynn, 2023):

1. Reduced water tables will lead to continued decomposition of peat, most notably above the water table, where presence of oxygen accelerates the decomposition rate. This gives rise to increase emissions both in gaseous form (Evans *et al.* 2021), and aquatic form. The latter is less well characterised, although Queens University Belfast are researching this further. Swenson *et al.* (2019) examined this issue for raised bogs and noted that losses from aqueous pathways can be an important, and sometime dominant route for loss. The availability of data from blanket bogs is less common. The QUBBES report (Flynn *et al.* 2021) illustrates some data which is consistent with Swenson's findings.

2. From an ecohydrological perspective, lowered water tables will prevent the re-establishment of peat accumulating plant communities, while the continued presence of drains will continue to affect the hydrology by keeping water tables low, leading to further loss of remaining active blanket bog, most notably in the vicinity of more recent drains (past 10-15 years), where the effects of consolidation may still prove significant (Best and Flynn, 2016).

3. Reduced water levels will result in continued degraded peatland water quality, while restoration will result in improvements on the current baseline (Wilson *et al.* 2011).

4. Increased flood risk/reduced baseflow. The sustained presence of drains will continue to remove water at a more rapid rate than would naturally occur. This affects the flow regime in receiving natural water bodies by increasing peat flows and reducing baseflow. The change in flow regime serves to make conditions more stressful for aquatic ecological receptors (Flynn *et al.,* 2022). By contrast restoration measures serve to stabilise flow to conditions more closely resembling those encountered in areas not affected by artificial drainage.

5. Less variable water quality in aquatic receptors. Ongoing degradation of peatlands will result in less oligotrophic peatland water flowing to aquatic receptors during drier periods, leading to more mineralised water during low flow (as is apparent in the Iron-oxide rich stream within the eastern side of ESA, which is currently draining into the Legnahone Burn). By contrast flood waters will remain dominated by oligotrophic waters. Overall, this leads to greater variation in water quality than during natural conditions (again noted in Flynn *et al.,* 2022).

6. Consistent degradation of peatland can occur where drains have been infilled but not been blocked (Mackin *et al.,* 2017), e.g., this has occurred at Clare Island Raised Bog SAC. Comparable responses would be anticipated on blanket bog (pers. comm. Dr Raymond Flynn, 2023).

6.2 Integration of Constraints into the Development Design

Following several design workshops undertaken in collaboration between the ecology, hydrology and engineering consultants for this project the Development layout responds strongly to the identified areas of High (red) and Moderate-High (orange) Constraints – these areas are almost entirely avoided (see **Figure A.10.4.1** in **Appendix I**). This was in contrast with earlier iterations of the layout, before the Active Peat distribution was sufficiently understood, and in contrast with the consented (but not built) Craignagapple Wind Farm layout.

ES Chapter 4: Site Selection and Design summarises the main design iterations and the environmental rationale and implications of each.

Table A8.1.3 outlines the turbine and track locations and the habitats in which they sit, and this is correlated to the results of the NVC surveys.

Table A8.1.3: Areas potentially affected by the Development.

JNCC habitat	Total area of this habitat within ESA (ha)	NVC community (Associated relevé Numbers within this habitat type)	Infrastructure located within this habitat type within the ESA* (NVC relevé Numbers closest to that infrastructure**)	Total area potentially affected (ha) within the ESA		Total maximum area potentially affected (ha)	Description of affected Peatland habitat *Information supported by ES Technical Appendix A10.3 – the National Vegetation Classification (NVC) survey*	APA Assessment (Colour Coded)
				directly	indirectly			
Intact Blanket Bog (E.1.6.1)	22.413	M19 (12.12)	None (immediately adjacent to T12 embankment earthworks) (12.12 & 12.13)	0	0.017	**0.017**	This is an edge habitat. The location potentially affected by **indirect** effects is an area of blanket bog that juts out from a wider unit (the wider unit is as per NVC relevé 12.12) and is surrounded by recovering blanket bog (E1.6.1) – modified in the past (e.g., relevés 12.4/12.3/12.11/12.10). This location supports compromised peat forming habitat, albeit within an intact hydrological unit supporting peat forming vegetation. The proposed footprint has been designed to avoid any direct impact on Active Peat – albeit some minor indirect effects are possible due to the potential for dewatering as a result of new hardstands being placed on the site in close proximity to this habitat type.	High Constraint
Recovering blanket bog (E1.6.1) – modified in past	188.199	M19 (9.1; 6.1; 1.2; 1.3; 3.1; 3.3; 12.2; 12.7; 12.8; 12.9; 10.3; 13.2; 13.3; 13.4; 14.4; 14.5; 14.6)	**T1** (construction compound) (1.1 and 1.2); **T3** (earthworks) (3.1); **T6** (entrance track earthwork) (6.1);	0.0022	0.011	**0.0132**	Minor direct impacts (and indirect impacts) are anticipated upon this habitat type in the following locations: southern corner of construction compound, south-western corner of T3 earthworks; and at the entrance track to T6. Where this blanket bog habitat type is potentially affected (following site-specific surveys of the vegetation at that time) the ECoW will seek to agree to microsite infrastructure with the aim of avoiding any isolated pockets of active peat within non-active wider units in this habitat type.	Moderate-High Constraint

Dry modified bog (E1.8)	208.479	M19b / M20b (9.2; 6.2; 6.3; 8.1; 8.2; 11.2; 3.2; 3.4; 4.1; 4.2; 4.4; 2.1; 2.3; 2.6; 2.7; 12.1; 12.3; 12.4; 12.5; 12.6; 12.10; 12.11; 12.13; 14.1; 14.2; 14.3; 5.1; 5.2; 5.3; 5.4; 5.5; 5.6; 5.8)	**T2** (2.5; 2.6) and T2 access (X.1; X.2); **T3** (3.4) and T3 access (3.4); **T4** (4.1; 4.2) and T4 access (4.2); **T5** (5.1; 5.2; 5.3) and T5 access (5.4; 5.5; 5.6; 5.8); **T6** (6.2; 6.3) and T6 access (6.2); Substation (See **Appendix II**); eastern temporary works compound (See **Appendix II**); **T8** (8.1; 8.2) and T8 access (8.1; 8.2); **T9** (9.2; 9.3) and T9 access (9.2; 9.3); T10 (10.1; 10.2) access (10.1; 10.2); **T11** (11.1; 11.2; 11.3); T11 access (10.1; 10.2; 11.3); **T12** (12.1; 12.2; 12.3; 12.4); T12 embankment (12.12) and T12 access and turning circle (11.2; 11.1; 12.13); T13 access (13.1); **T14** (14.1; 14.2; 14.3).	10.783	3.908	**14.691**	These habitats have all undergone changes in land use including cutting, drainage, grazing and in some locations burning in the past. The areas affected are transitional between this habitat type, Acid grassland / Flush (B1.2 / E2.1) and Species-poor flush and spring (E2.1). Bog mosses were sparse or absent, with hypnoid mosses becoming more evident. These habitats had compromised hydrology (drains were present), with the ground being firmer and not spongey underfoot within this habitat type. Shrubs and ericoid species dominate the vegetation, with low cover of bog cotton species. The affected habitats did not support intact active peat.	Moderate-Low Constraint
Wet modified bog (E1.7) – very degraded	19.356	M20a (10.1; 10.2)	**T10** (10.1; 10.2) and T10 access (10.1; 10.2; 11.3).	0.970	0.580	**1.478**	The vegetation is composed of cutover wet modified bog, with significant quantities of bare peat which is being colonised by common cottongrass *(Eriophorum angustifolium)*. The hydrology has clearly been affected. Algal mats were observed, with bare peat and pooling water. This habitat does not support intact active peat.	Low Constraint

Acid grassland / Flush (B1.2 / E2.1)	88.445	U2b / M6c (X.1; 1.1; 4.5; 2.5)	**T1** (1.1) and T1 access (1.1); **T2** (2.5) and T2 access (X.1); **T5** (4.5) and T5 turning circle (4.5); **T8** (-); **T9** (-) and T9 access and T9 turning circle (-); **T11** (11.1; 11.2; 11.3); **T13** (13.1) and T13 access (13.1); **T14** (14.1) and T14 access (14.1).	5.304	1.952	**7.256**	These habitats were dominated by soft rush and graminoid species, with a low species diversity. Sphagnum mosses were absent (apart from *Sphagnum fallax* being present in one relevérelevé). These habitats were highly modified in the past. Their surface was not excessively wet or spongy. They didn't support suitable floral assemblages, or the intact hydrology required to constitute peat forming habitats. Therefore, it is not considered to support active peat.	
Species-poor flush and spring (E2.1)	34.398	M6c (9.3; X.2; 11.1; 11.2; 11.3; 4.3; 2.2; 24)	**T2** (2.4) and T2 access (X.2); **T4** (4.3); **T6** (-) and T6 access (-); **T7** (7.3); **T9** (9.3) and T9 access (9.3); T10 access (-); **T11** (11.1; 11.2; 11.3) and T11 access (11.1; 11.2; 11.3); **T12** (11.1; 11.2; 11.3) and T12 access and turning circle (11.1; 11.2; 11.3).	3.063	1.041	**4.104**	These areas of species poor habitat are dominated by dominated by soft-rush (*Juncus effusus*), common haircap-moss (*Polytrichum commune*) and flat-topped bog-moss (*Sphagnum fallax*) and are likely to have resulted from water movement arising from damaged hydrology across the site. They generally intersect the areas of modified bog.	
Improved grassland / poor semi-improved grassland mosaic (B4 / B2.2)	24.763	MG10 (49; 50; 51; 52)	**T1** access (-); western temporary works compound (-); **T7** (7.1; 7.2; 7.3) and T7 access (7.1; 7.2; 7.3); **T13** (13.1).	1.457	0.457	**1.914**	N/A	
Hedgerows and scrub (J2.2 / A2.2)	5.702	n/a	100m Loss proposed as mitigation for bats at T13.	100m	100m	**100m**	N/A	
Dry ditch (J2.6 / E2.1)	4.580	n/a	**T14** (-) and T14 embankment (-).	0.211	0.054	**0.265**	N/A	

Coniferous plantation (A1.2.2)	0.482	n/a	-	0	0	**0**	N/A	

*Note: The potential for significant effects on ecological receptors from works required along the Haul Route have been scoped out of the EIA, as documented in **ES Technical Appendix A2.3: Abnormal Load Route Works (ALRW)**, and hence are not included in the ES Chapter 10 - Ecology. However, any ecological survey and assessments aspects relevant to those works are included within **Technical Appendix A10.1: Ecological Impact Assessment** (EcIA) and **Appendix IV** of that report. There is no peatland habitat affected by the Haul Route, and as such it has not been included within this report.

**Note: Given the mosaic nature of the site, relevés were aimed within homogenous stands in the locations where infrastructure was likely to be located, particularly within peatland habitats. As such, where vegetation was considered to be more uniform across a unit; or was not peatland, less relevés may have been required in those locations. In addition, the infrastructure often traverses a variety of different habitat types as a result of the patchy distribution of habitats across the Development site as can be seen in the maps illustrating the habitat types occurring across the site. Close communication with the ecologists during the design process has ensure that infrastructure was purposely located away from areas where the NVC survey picked up better quality peatland habitats, which explains the spread of NVC relevés taken across the Development site.

6.2.1 Location of Turbines

In designing the site layout, ecological and hydrological considerations have been taken into account, in particular with regard to the presence of, and potential connectivity to, areas of Active Peat. Specifically, there is no development proposed on Active Peat. This has been integrated with other considerations such as landscape and archaeology, peat slide risk and optimum turbine placement.

No turbines have been sited within areas of Active Peat, or in areas of modified bog habitat where it is considered there is potential for active peat.

- Turbines 1, 2, 5, 7, 8, 9, 10, 11, 13 and 14 have been either wholly or substantially located within areas identified as being of Low Constraint (largely acid grassland, improved grassland or species-poor flush). In some cases, portions of these turbines' hardstands or access routes fall within dry modified bog habitat identified of being of Low-Moderate Constraint, where it is considered that there is no reasonable potential for restoration to active peat status.
- Turbines 3, 4, 6 and 12 have been located within areas of dry modified bog habitat identified as being of Low or Moderate–Low Constraint (i.e., within areas not considered to support, or have potential to support, active peat). Locations of these turbines have been carefully considered and have been located to avoid areas of High, or Moderate to High, Constraint, as well as any pockets of higher-quality habitat identified within dry modified bog areas. During the design process for T12 it became apparent that c. 0.01717 ha of degraded but largely intact blanket bog would be indirectly impacted by the embankment for this proposed turbine. This is an edge habitat. The location affected is an area of blanket bog that juts out from a wider unit (the wider unit is as per NVC relevé 12.12, supporting relatively intact peat) and this area is surrounded by Recovering blanket bog (E1.6.1) – modified in past (e.g., relevés 12.4/12.3/12.11/12.10). The affected area adjacent to works for T12 supports compromised peat forming habitat albeit within a unit which has an intact hydrology. Due to design changes prior to design freeze, there is no development proposed on Active Peat.

6.2.2 Location of Access Roads and Construction Compounds

As well as appropriate siting of turbines to avoid impacts upon areas of Active Peat and other valuable habitat (Moderate-High Constraint), the final design layout has also avoided routing access tracks and construction compounds through these areas. No access tracks impinge upon areas classified as being of High Constraint.

- The construction compound at T1 is largely located within an area of Acid Grassland / Flush (B1.2 / E2.1) and Improved / Poor Semi-Improved Grassland (B4 / B2.2). The southern corner of construction compound is in the Moderate-High Constraint. Where this blanket bog is potentially affected (following site-specific surveys of the vegetation at that time) the ECoW will seek to agree to microsite infrastructure with the aim of avoiding any peat-forming vegetation pockets within this habitat type.
- The access tracks to T1 and T2 have been specifically routed so as to avoid areas of Active Peat (High Constraint) and also, as far as possible, areas of modified bog (Moderate-High Constraint). At this location, one turbine from an earlier iteration of the layout was removed, in order to avoid potential impacts upon Active Peat.
- The access road from T3 to T5 has as far as possible utilised the operational Owenreagh I and II Wind Farms existing site road to avoid impacts upon peatland habitat of Moderate-High Constraint identified on either side of the road.
- The access road to T6 partially utilises an existing track, then passes through an area of dry modified bog and species-poor Juncus effusus flush identified as being

of Low/ Moderate–Low Constraint, thereby avoiding impacts upon areas of Active Peat or modified bog. A section of the earthwork for a new track at the entrance to T6 does infringe onto an area of Moderate-High Constraint. Where this blanket bog is potentially affected (following site-specific surveys of the vegetation at that time) the ECoW will seek to agree to microsite infrastructure with the aim of avoiding any peat-forming vegetation pockets within this habitat type.

- The access roads to T7, T8, T9, T10, T11 and T14 are virtually restricted to areas identified as being of Low Constraint, largely acid grassland and flush habitats, with only occasional short stretches passing through dry modified bog habitat (Moderate–Low Constraint). The route of the access road from the Glenmornan road to T12 (which has branches to Turbines 8, 9, 10 and 11) has been changed from the original design, to be re-located eastwards in order to avoid areas of recovering modified bog habitat.
- The habitat around T10, through which the access road to this turbine runs, has been classified as wet modified bog, originally derived from blanket bog that has been highly modified by cutting and draining, to the extent that the active peat assessment identified no correlation with active peat. Bare peat, algal mats and sparse vegetation are characteristic features here.
- The proposed access route to T12 has been moved to avoid potential for impacts upon active peat. This turbine was originally to have been accessed from T3 to the northwest but will now be accessed from T11. In this way, the access road avoids areas of High or Moderate to High Constraint, also thus avoiding impacts on an area that it is considered may be fundamental to maintaining hydrological regimes within intact and recovering blanket bog habitat located downslope of this area. Instead, the road to T12 now passes through a small area of dry modified bog identified as being of Moderate–Low Constraint. As already stated, the remainder of the access road to T12 from the Glenmornan road largely passes though habitats of Low Constraint.
- The proposed access road to T13 has been changed to avoid potential for impacts upon Active Peat. This turbine was originally to have been accessed from the Glenmornan road to the southwest but will now be accessed from the Napple road to the east, the access road passing mainly through an area of acid grassland and flush habitat identified as being of Low Constraint, also partially skirting an area of dry modified bog for a short distance, identified as being of Moderate–Low Constraint.
- The proposed access road to T14 has been changed to avoid potential for impacts upon Active Peat. This turbine was originally to have been accessed from the Glenmornan road, via an access road constructed to head eastwards from the conifer plantation but will now be accessed directly from the Napple road to the east. This represents a significantly reduced length of road, which now passes through acid grassland/flush habitat (identified as being of Low Constraint) rather than recovering blanket bog (Moderate-High Constraint).

Table A8.14 illustrates Moderate-High Constraint peat habitats which are **directly** affected by the Development. Where blanket bog in these areas is potentially affected (following site-specific surveys of the vegetation at that time) the ECoW will seek to agree to microsite infrastructure with the aim of avoiding any peat-forming vegetation pockets within this habitat type.

Table A8.1.4: Peat Directly Affected by the Development

Turbine	**Peatland constraint** *(Colour indicates highest constraint directly affected in that area)*	**Peatland Constraint - Track Notes**	**Moderate-High Constraint Area Directly Affected in ha**	**Nearest Relevé**	**Distance to Relevé from edge of Infrastructure /Embankment**	**Relevés indicated Active Peat Likely (Needs Micro-siting by ECoW)?**
T1 (and construction compound)	Southern corner of construction compound is in the Moderate-High Peatland constraint (orange)	Low	0.0004 (Edge habitat)	1.2 (Recovering Blanket Bog (E1.6.1)- Modified in past)	***c. 125m to SW***	**Yes**
T2	Largely in low constraint area, some northern corners of the earthworks lie within Moderate - Low area	Low and Low - Moderate habitat affected	N/A	N/A	-	No
T3	Majority is in Moderate - Low habitat, south-westerns corner of earth work impacts on Moderate-High Peatland constraint (orange)	Low - Moderate habitat affected	0.0005 (Edge habitat)	3.1 (Recovering Blanket Bog (E1.6.1)- Modified in past)	***c. 20m to W***	**Yes**
T4	Low - Moderate habitat affected	Low - Moderate habitat affected	N/A	N/A	-	No
T5	Low - Moderate habitat affected	Low - Moderate habitat affected	N/A	N/A	-	No
T6	Majority is in Moderate - Low habitat, earth work at start of entrance track impacts on Moderate-High Peatland constraint (orange)	Low - Moderate habitat affected	0.0013 (Edge habitat)	6.1 (Recovering Blanket Bog (E1.6.1)- Modified in past)	***c. 160m to SW***	**Yes**
Substation	Low - Moderate habitat affected	Low - Moderate habitat affected	N/A	N/A	-	N/A

T7	Low	Low	N/A	N/A	-	N/A
T8 (and construction compound)	Low and Low - Moderate habitat affected	Low	N/A	N/A	-	N/A
T9	Majority is Low, some Low - Moderate affected	Low	N/A	N/A	-	N/A
T10	Low	Low and Low - Moderate habitat affected	N/A	N/A	-	N/A
T11	Majority is Low, some Low - Moderate affected	Majority is Low, some Low - Moderate affected	N/A	N/A	-	N/A
T12	Earthwork lies immediately adjacent to High Peat Constraint	Low and Low - Moderate habitat affected	N/A	12.12 (Intact Blanket Bog (E1.6.1))	***c. 100m to SW***	**Yes**
T13	Low and Low - Moderate habitat affected	Low and Low - Moderate habitat affected	N/A	N/A	-	N/A
T14	Low and Low - Moderate habitat affected	Low and Low - Moderate habitat affected	N/A	N/A	-	N/A
TOTAL	**-**	**-**	**0.0022 (Edge habitats)**	**-**		**Yes** *Where blanket bog in these areas is potentially affected (following site-specific surveys of the vegetation at that time) the ECoW will seek to agree to microsite infrastructure with the aim of avoiding any peat-forming vegetation pockets within this habitat type.*

6.3 Consideration in the Development Design of Other Habitats Potentially Influencing Peat Integrity

Although flush habitat at the site represents a Low Constraint and tends to be species-poor (dominated largely by soft-rush *Juncus effusus,* sometimes underlain by flat-topped bog moss *Sphagnum fallax* and common haircap moss *Polytrichum commune*), it is recognised that flushes may be instrumental in maintaining hydrological regimes which support active peat or feeding areas which could become active in future through the implementation of habitat restoration measures. This has been considered in the project design to ensure continuity of peatland of higher quality.

7 CONCLUSION

The Development layout was developed with the aim of avoiding identified areas of High (red) and Moderate-High (orange) Constraints. No development is proposed on areas of High (red) Constraint (see **Figure A.10.4.1** in **Appendix I**). A total area of *c.* 22m^2 of Moderate-High (orange) Constraint is directly impacted by the required embankments of the Development. These have been identified as edge habitats as shown in **Figure A.10.4.1.** The Moderate-High (orange) Constraint areas do not constitute Active Peat as units, and where these areas are potentially affected by proposed infrastructure (following site-specific surveys of the vegetation at that time) the ECoW will seek to agree to microsite infrastructure with the aim of avoiding any peat-forming vegetation pockets within the wider unit of non-Active peat.

ES Chapter 4: Site Selection and Design summarises the main design iterations and the environmental rationale and implications of each.

Following review of the data sources, 'Active Peat' and other high-quality habitats (shown as red and orange on **Figure A10.4.1**, corresponding to 'High' and 'Moderate-High' Constraint) is known to occupy a total area of 210.612 ha within the ESA.

Precautionary measures have been incorporated into the development design in order to avoid or minimise impacts upon Active Peat arising from the Development, with the main aim of the design being to avoid any direct impacts on Active Peat. The turbine locations have been chosen to avoid direct and indirect impacts to areas of intact or recovering peat (including impacts upon hydrology) in so far as possible. Similarly, turbine access roads and turbine hardstand embankments have been modified to avoid passing through areas of potential active or recovering peat, and to avoid impacting upon the hydrology of connecting intact/recovering peatland areas. A walkover of areas where identified edge habitats are potentially affected (*c.* 22m^2) by an experienced ECoW alongside the Appointed Contractor will seek to agree to microsite infrastructure with the aim of avoiding any peat-forming vegetation pockets within this habitat type.

Development has been restricted as far as possible to areas of habitat identified as having no or very low potential to support peat-forming vegetation (such as grassland, flush and extremely degraded bog habitats) and, where necessary, to areas of modified bog habitat where it is considered that the hydrology and peat substrate have been compromised to such an extent that the area is not Active Peat. Flushed areas have been considered for development only where it has been ascertained (by both ecologists and hydrologists) that these are not instrumental to the continued functioning of connecting intact or recovering blanket bog areas.

Other factors that have also been taken into consideration in the final development design (as well as in selecting areas for restoration and enhancement) are as follows:

- The extremely steep slopes occurring in some parts of the ESA;
- Substantial existing land drainage features;
- The potential for peat slide risk; and
- Past peat cutting practices.

It can be seen that by siting turbines and access roads in such a way as to avoid areas that comprise (or are connected to) active peat, habitat having potential for restoration to active peat, and other hydrologically strategic habitats, potential impacts on peatland habitats have been minimised, as illustrated in Table A8.1.3 (data reproduced from **ES Chapter 10: Ecology**).

With the layout provided, no Active Peat (High Constraint) will be directly affected, as there is no development proposed on Active Peat. 0.017 ha may be **indirectly** affected as a

result of localised changes in the water table within the peat resulting from development close to Active Peat.

The maximum area of habitat identified as being of Moderate High Constraint, that is expected to be **directly** affected by the Development is 0.0022ha (22m^2), with0.94ha (9,400m^2) having potential to be **indirectly** affected by the Development.

The Habitat Management and Restoration Plan (**Technical Appendix A3.2** to the ES) outlines proposals to restore and/or enhance *c.* 38.313 ha of modified blanket bog habitat with the aim of re-establishing active peat status in these areas, in addition to an area of *c.* 35.047ha of drain blocking (within red grouse management areas).

With the layout provided, no High Constraint habitat will be directly affected. Potential indirect effects on High active peat are estimated to be 0.017 ha (170 m^2). The maximum area of habitat identified as being of Moderate-High Constraint that is expected to be directly affected by the Development is 0.0022ha (22 m^2), with 0.011 ha (110 m^2) having potential to be indirectly affected by the Development. This constitutes a total maximum area of approximately 0.03 ha (300 m^2) of intact and recovering blanket bog habitats that could be indirectly affected by the Development through dewatering (as well as direct impacts on edge habitats within the High-Moderate Constraint areas. By comparison, the Habitat Management and Restoration Plan prepared for this Development (**Technical Appendix A3.2** to the ES) outlines proposals to restore and/or enhance c. 42.719 ha (427,190 m^2) of modified blanket bog habitat with the aim of re-establishing active peat status in these areas, in addition to an area of c. 35.047 ha (350,470 m^2) of drain blocking (within red grouse management area 3A).

8 REFERENCES

BEST, A. FLYNN, R. (2016) MODELLING THE IMPACT OF MARGINAL CUTTING ON RAISED BOG TOPOGRAPHY AND CONSERVATION, ABSTRACT A-092, 15TH INTERNATIONAL PEAT CONGRESS, PULLMAN-KUCHING MALAYSIA.

EVANS, C. D., PEACOCK, M., BAIRD, A. J., ARTZ, R. R. E., BURDEN, A., CALLAGHAN, N., ... & MORRISON, R. (2021). OVERRIDING WATER TABLE CONTROL ON MANAGED PEATLAND GREENHOUSE GAS EMISSIONS. NATURE, 593(7860), 548-552.

FLYNN, RAYMOND, FRANCIS MACKIN, AND FLORENCE RENOU-WILSON. TOWARDS THE QUANTIFICATION OF BLANKET BOG ECOSYSTEM SERVICES TO WATER. NO. 378. EPA RESEARCH REPORT, 2021.

FLYNN, RAYMOND, FRANCIS MACKIN, CLAIRE MCVEIGH, AND FLORENCE RENOU-WILSON. "IMPACTS OF A MATURE FORESTRY PLANTATION ON BLANKET PEATLAND RUNOFF REGIME AND WATER QUALITY." HYDROLOGICAL PROCESSES 36, NO. 2 (2022): E14494.

JNCC. (2010) HANDBOOK FOR PHASE 1 HABITAT SURVEY – A TECHNIQUE FOR ENVIRONMENTAL AUDIT. JOINT NATURE CONSERVATION COMMITTEE, PETERBOROUGH.

MACKIN, FRANCIS, RAYMOND FLYNN, ALAN BARR, AND FERNANDO FERNANDEZ-VALVERDE. "USE OF GEOGRAPHICAL INFORMATION SYSTEM-BASED HYDROLOGICAL MODELLING FOR DEVELOPMENT OF A RAISED BOG CONSERVATION AND RESTORATION PROGRAMME." ECOLOGICAL ENGINEERING 106 (2017): 242-252.

NIEA (2012) GUIDANCE NOTE ON ACTIVE PEAT. AVAILABLE AT: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/natural-guidance-niea-natural-heritage-development-management-team-advice-note-2012.pdf (AS ACCESSED APRIL 2023).

RODWELL, J. (ED.). (1992). BRITISH PLANT COMMUNITIES: VOLUME 2: MIRES AND HEATHS. CAMBRIDGE UNIVERSITY PRESS.

RODWELL, J.S. (2006) NVC USERS' HANDBOOK, JNCC, PETERBOROUGH, ISBN 978 1 86107 574 1.

SWENSON, MICHAEL M., SHANE REGAN, DIRK TH BREMMERS, JENNA LAWLESS, MATTHEW SAUNDERS, AND LAURENCE W. GILL. "CARBON BALANCE OF A RESTORED AND CUTOVER RAISED BOG: IMPLICATIONS FOR RESTORATION AND COMPARISON TO GLOBAL TRENDS." BIOGEOSCIENCES 16, NO. 3 (2019): 713-731.

WILSON, L., WILSON, J., HOLDEN, J., JOHNSTONE, I., ARMSTRONG, A. AND MORRIS, M., 2011. DITCH BLOCKING, WATER CHEMISTRY AND ORGANIC CARBON FLUX: EVIDENCE THAT BLANKET BOG RESTORATION REDUCES EROSION AND FLUVIAL CARBON LOSS. SCIENCE OF THE TOTAL ENVIRONMENT, 409(11), PP.2010-2018.

APPENDIX I – ACTIVE PEAT ASSESSMENT MAPPING

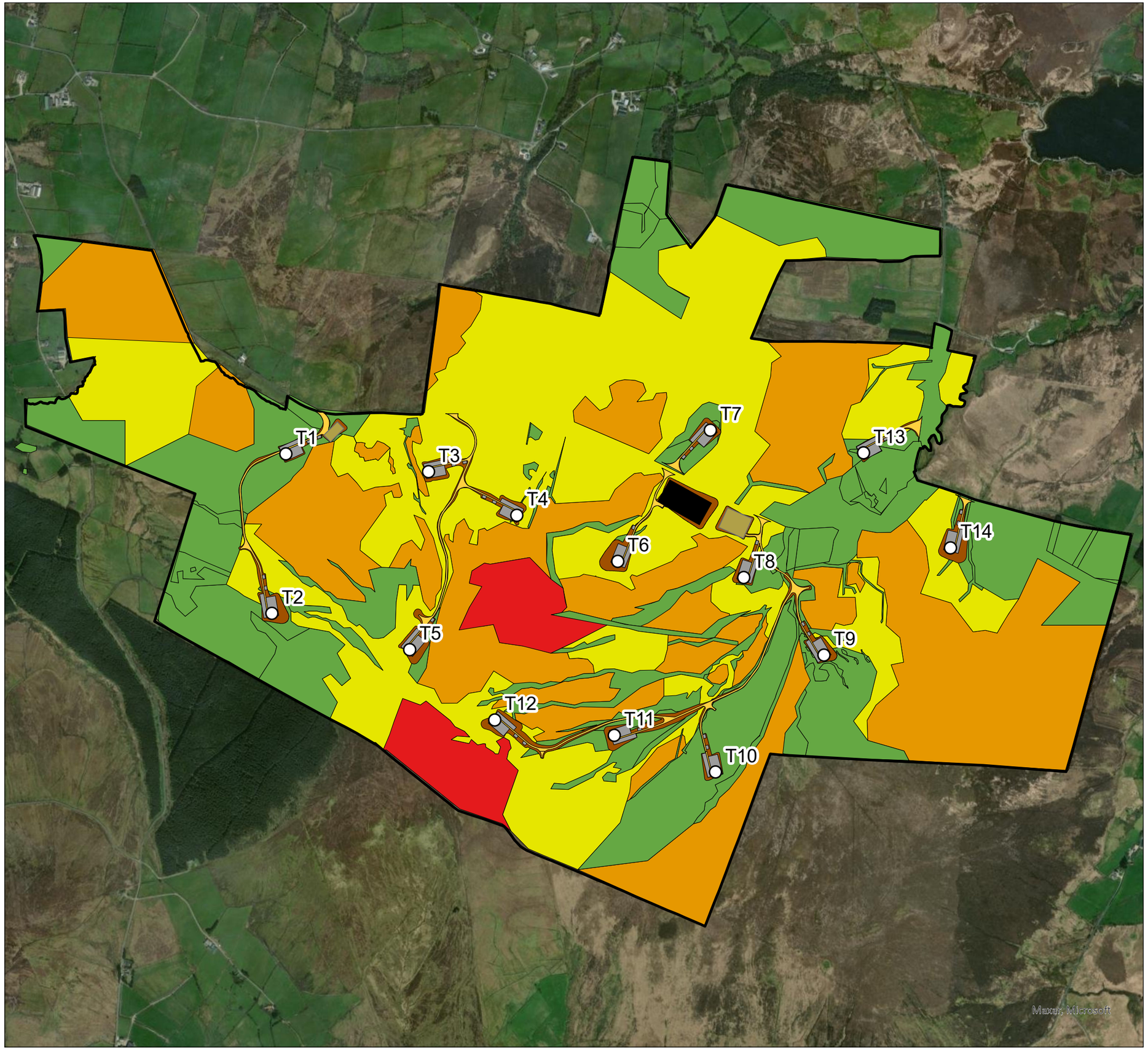


Figure Reference: Owenreagh1_Updated_Mapping_250122

woodrow
APEM Group

Owenreagh / Craignagapple
Wind Farm

Figure A10.4.1
Habitat Constraints

Layout

- Proposed Turbine Locations
- Hardstanding
- Construction compounds
- Access tracks
- Substation
- Earthworks

Study Area

- Ecological Study Area

Habitat Constraint Level

- High
- Moderate - High
- Moderate - Low
- Low

0 0.4 0.8 km

N

Scale	Date	Drawn by	Approved by
1:14,000@A3	06/07/2023	EC	RNF

Woodrow APEM Group.,
Upper Offices,
Ballisodare Centre,
Station Road, Ballisodare,
Co Sligo, F91 PE04, Ireland.
Tel: +353 71 914 0542
Email: info@woodrow.ie

woodrow
APEM Group

APPENDIX II – SUBSTATION SURVEY

Owenreagh Substation – Additional Habitat Assessment: 04.10.2022

The location of the substation was not available during the initial habitat and National Vegetation Classification (NVC) surveys for the proposed Development. Subsequently, once the proposed location of the substation was identified, this area required an additional habitat assessment.

It was noted during the preliminary surveys that *Sphagnum* mosses were present in the peatland unit where the substation was proposed. As such, a more detailed survey was carried out to assess the habitat type and condition of the peatland here.

During the survey on 4.10.2022, it was noted that localised patches of abundant *Sphagnum* mosses existed within wetter hollows within a north-western corner of the proposed location. The slope and the position of the existing farm access tracks here, as well as the proximity to Glemnmornan road have had a significant impact on the hydrology of this area and have resulted in localised patches of pooling water here. The survey was also conducted after a period of heavy rainfall.

The localised area of pooling which was identified is *c*. 0.27ha in size and falls under the footprint of the proposed substation (which itself is *c.* 2.2 ha in total). The patch of *Sphagnum mosses* is located *c*. 10m to the southwest of and running parallel to Glenmornan road and to the east of an existing farm access track to the proposed T6. The substation footprint is situated at the bottom of a steep slope, which further uphill contains numerous drains and water runoff from historically cutover areas of bog which is likely being funnelled by the existing farm access track to this location. The extent of the habitat being assessed was subsequently mapped on site (**Figure A10.4.2**).

Habitat condition as assessed within the substation footprint:

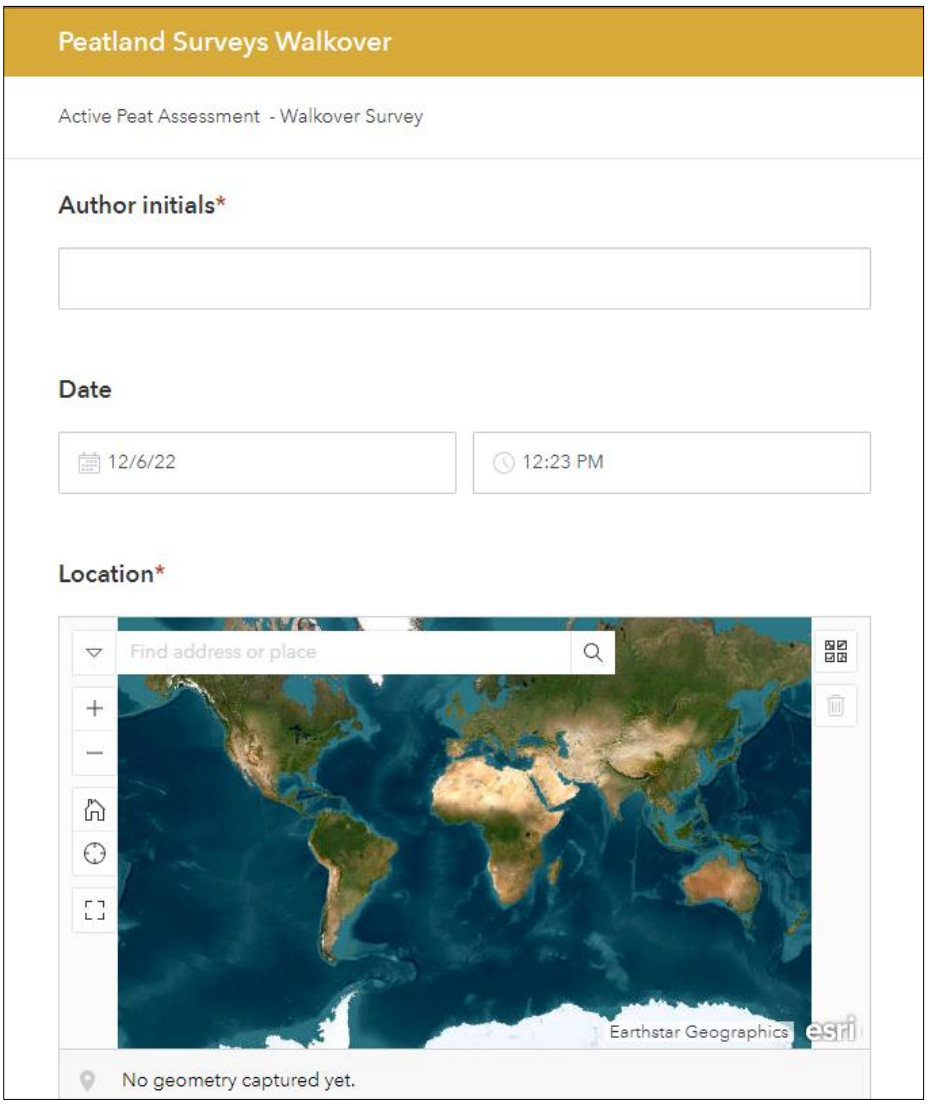
- Deep peat >0.5m; Surface is predominantly dry throughout the wider substation unit; however, in localised hollows the substrate remains spongy and wet underfoot with pooling water.
- *Sphagnum* layer where present, contained good species diversity; *S.papillosum, S.capillofolium, S.rubellum, S.tenellum, and some S.cuspidatum* and *S.fallax* in localised waterlogged hollows, in the north-west of the substation footprint.
- Typical, but limited, range of Blanket Bog species; *N. ossifragum, C. vulgaris, E. tetralix, P. erecta, A.palustre, P. commune, C. portentosa, E. nigrum* (this species was noted as locally frequent in small patches throughout the drier areas here as well), *E. vaginatum, E. angustifolium,* (bog cottons were sparse throughout this unit).
- A border of species-poor flush habitat dominated by *J. effusus with Gallium saxatile and Polytrichum commune* provided a buffer to the farm access track.

It was concluded that the localised area assessed presents as a species-poor flushed habitat (E2.1) within a wider habitat unit of 'Dry modified bog (E1.8)' consisting of cutover peat habitat that remains dry underfoot with few/no *Sphagnum* species and is dominated by rank ling heather (*Calluna vulgaris*). The localised corner of species-poor, flushed and waterlogged conditions is likely due to the channelised water runoff from further upslope. This habitat unit has therefore been assessed as holding no current 'Active Peat Potential' due to the proximity of the existing roads on site coupled with the historical damage to the hydrology within the area through cutting and draining. The construction compound adjacent lies within the same habitat unit.

BLANK PAGE FOR FIGURE

Figure A10.4.2 - Substation Habitat Assessment

APPENDIX III – ACTIVE PEAT RECORDING FORM (SURVEY 123)



Active Peat Decision

- [ ] Active Peat Likely
- [ ] Active Peat Unlikely
- [ ] Other

Notes

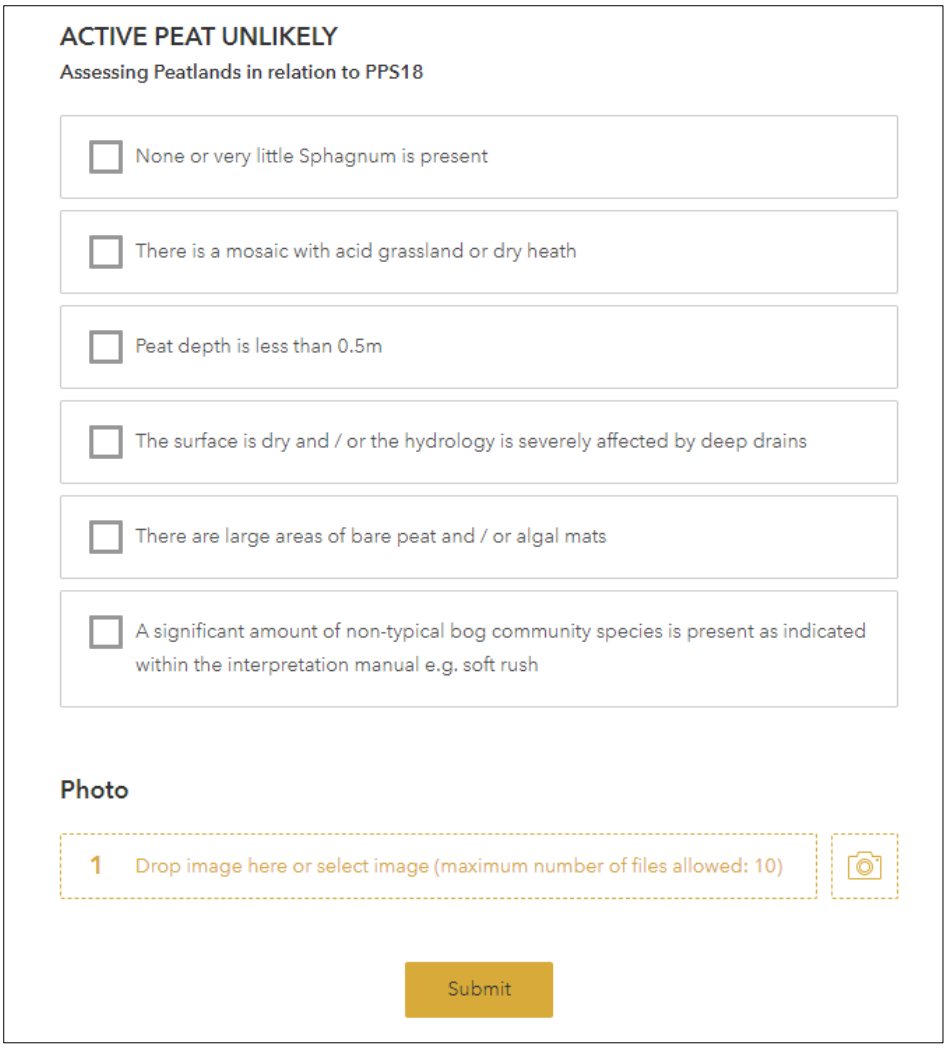
Species, topography, ground conditions, slope, any other info deemed relevant

Please input 1,000 characters at most

ACTIVE PEAT LIKELY

Assessing Peatlands in relation to PPS18

- [ ] Sphagnum is present
- [ ] 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


ACTIVE PEAT UNLIKELY
Assessing Peatlands in relation to PPS18
None or very little Sphagnum is present
There is a mosaic with acid grassland or dry heath
Peat depth is less than 0.5m
The surface is dry and / or the hydrology is severely affected by deep drains
There are large areas of bare peat and / or algal mats
A significant amount of non-typical bog community species is present as indicated within the interpretation manual e.g. soft rush
Photo
1
Drop image here or select image (maximum number of files allowed: 10)
Submit