

Chapter 7: Ornithology

Contents

7.1 Introduction	6
7.2 Scoping	7
7.3 Legislation	7
7.4 Planning Policy	8
7.5 Methodology	9
7.6 Impact Assessment (EclA)	13
7.7 Baseline Conditions/Results	19
7.8 Impact Assessment	24
7.9 Receptor Assessment	28
7.10 Mitigation	35
7.11 Cumulative Impacts	37
7.12 Statement of Significance and Summary	38

Tables

Table 7.1 – Approach for Evaluating the Value or Sensitivity of Ecological Receptors in Scotland

Table 7.2 – Definition of Spatial Effect Magnitude on IEFs

Table 7.3 – Definition of Temporal Effect Magnitude on IEFs

Table 7.4 - Significance Levels of Effects on Birds

Table 7.5 - Summary of Recorded Flight Activity of Target Species

Figures

Figure 7.1 – Survey Area with buffers

Figure 7.2 – Vantage Points and Viewsheds

Figure 7.3 – Flights (Curlew and Lapwing)

Figure 7.4 – Flights (Whooper Swan, Pink-footed Geese and Black Grouse)

Figure 7.5 –Breeding Waders (Curlew, Lapwing and Snipe)

Figure 7.6 – Breeding Birds (Skylark territories)

Figure 7.7 – Breeding Birds (Meadow Pipit, Wren, Dipper and Whinchat)

Appendices

Appendix 7.1 – Survey Staff Details

Appendix 7.2 – Vantage Point Data

Appendix 7.3 – Vantage Point Recording Form

Appendix 7.4 – Flights by Target 'A' Species

Appendix 7.5 – Flights by Target 'B' Species

Appendix 7.6 – Collision Risk Analysis

Appendix 7.7 – Designated Sites with Ornithological Significance

Appendix 7.8 – Desktop records

Appendix 7.9 – Breeding Bird Survey

Appendix 7.10 - Important Ecological Features (IEFs)

Appendix 7.11 – Residual Effects



Glossary

Term	Definition
Assemblage	A group of species found in the same location.
Avoidance	Prevention of impacts occurring, having regard to predictions about potentially negative environmental effects (e.g. project decisions about site location or design).
Baseline conditions	The conditions that would pertain in the absence of the proposed project at the time that the project would be constructed/operated/decommissioned. The definition of these baseline conditions should be informed by changes arising from other causes (e.g. other consented developments).
Biodiversity	The biological diversity of the Earth's living resources. The total variability among organisms and ecosystems.
Conservation status	The state of a species or habitat including for example, extent, abundance, distribution and their trends.
Cumulative effect	The combined effect of the assessed project in combination with the effects from a number of different projects, on the same single receptor/resource.
Designated site	An area afforded protection under an International Convention, European Directive or a piece of UK legislation due to its nature conservation or landscape value.
Ecological Receptor	Includes any living organisms other than humans, the habitat which supports such organisms, or natural resources which could be adversely affected by the development.
Effect	Term used to express the consequence of an impact. The significance of effect is determined by correlating the magnitude of the impact with the importance, or sensitivity of the receptor or resource in accordance with defined significance criteria.
Environmental Impact Assessment	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. Involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive, including the publication of an Environmental Statement.
Habitat	The place or type of site where an organism or population naturally occurs. Often used in the wider sense referring to major assemblages of plants and animals found together.
Impact	Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (impact).
Magnitude	A combination of the extent, duration, frequency and reversibility of an impact.
Mitigation	Measures (which may include process or design) intended to avoid, reduce and where possible, remedy significant adverse impacts of a development.

Herds Hill Wind Farm

Population	A collection of individuals (plants or animals), all of the same species and in a defined geographical area.
Scoping	The determination of the extent of an assessment (for an EclA or full EIA).
Sensitivity	The extent to which a study subject can accept a change of a particular type and scale without unacceptable adverse effects.
Significance	The significance of an effect combines the evaluation of the magnitude of an impact and the sensitivity of the receptor.
Site of Special Scientific Interest	Sites providing statutory protection for the best examples of the UK's flora, fauna, geological or physiographical features. These sites are also used to underpin other national and international nature conservation designations.
Special Area of Conservation	Protected sites designated under the EC Habitats Directive. Article 3 of the Habitats Directive requires the establishment of a European network of important high quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended).
Special Protection Area	Sites providing statutory protection for a number of rare, threatened or vulnerable bird species and also for regularly occurring migratory species.
Zone(s) of Influence	The area(s) over which ecological features may be affected by the biophysical changes caused by the proposed project and associated act.

Abbreviations

Abbreviation	Description
ASSI	Area of Special Scientific Interest
BCT	Bat Conservation Trust
BoCC	Birds of Conservation Concern
BTO	British Trust for Ornithology
CIEEM	Chartered Institute of Ecology and Environmental Management
CWL	Community Windpower Ltd
DGC	Dumfries and Galloway Council
EclA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
EIAR	<i>Environmental Impact Assessment Report</i>
FRZ	Flight Risk Zone
IEF	Important Ecological Feature
IUCN	International Union for the Conservation of Nature
LBAP	Local Biodiversity Action Plan
NHZ	Natural Heritage Zone
NNR	National Nature Reserve
NVC	National Vegetation Classification
pSAC	Proposed Special Area for Conservation
pSPA	Proposed Special Protection Area
RSPB	Royal Society for the Protection of Birds
SPA	Special Protection Area
SEPA	Scottish Environmental Protection Agency
SNCO	Statutory Nature Conservation Organisation
SPA	Special Protection Area
SPP	Scottish Planning Policy
SSSI	Site of Special Scientific Interest
VP	Vantage point
WCA	Wildlife and Countryside act 1081
ZOI	Zone of Influence



Section 7: Ornithology

7.1 Introduction

7.1.0 This chapter is the Ornithology chapter of the Ecological Impact Assessment (EclA) of the proposed Herds Hill Wind Farm development, as required by the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

7.1.1 Ornithological surveys were carried out at the proposed Herds Hill Wind Farm to establish the ornithological baseline of the site, and to assess potential impacts from the proposed development on the bird interest of the area. Starling Learning was commissioned to undertake a series of bird surveys at the site dating from September 2022 to August 2023.

7.1.2 This section describes the Ecological Impact Assessment (EclA) of the proposed wind farm development on the ornithological value of the site only. All other ecology has been covered separately in Chapter 8 of this ES. Any sensitive information relating to raptors is provided in a separate Confidential Annex.

7.1.3 This EclA is based upon:

- Existing records of important species provided through consultation;
- Bird surveys carried out by Starling Learning from 2022 to 2023; and
- Collision risk assessment.

7.1.4 The aims of this EclA are to:

- Establish a robust and accurate ornithological baseline for the site;
- Identify the risk of collision with turbines for key species;
- Identify any potential impacts arising from the development proposals (construction and operational stages);
- Establish the magnitude and significance of those identified impacts;
- Identify mitigation measures to address the significant impacts;
- Assess any residual impacts and the need for any compensation; and,
- Assess cumulative impacts from other surrounding developments.

7.1.5 The proposed Herds Hill Wind Farm is situated within an area of moorland and farmland to the south of the villages of Kirkconnel and Sanquhar in Dumfries and Galloway. It is located within an Environmentally Sensitive Area named the Western Southern Uplands, within the River Nith catchment area.

7.2 Scoping

7.2.0 During the scoping stage of the EIA process, a Scoping Report was submitted to DGC, and their Scoping Opinion was provided on 25/08/2023. However, no information was provided by DGC which related to ornithology. The Applicant has therefore been guided by their Agent and the consultants at Starling Learning in relation to the work required for this application, based on their previous experience of working on wind farms within Dumfries & Galloway and Scotland.

7.3 Legislation

7.3.0 The main relevant legislation and policy documents relating to nature conservation, which have been consulted, are detailed in the Ecology section of this EIAR (Chapter 8). However, information relating specifically to ornithology is detailed below.

7.3.1 A number of habitats and species are protected at the European level by The Conservation (Natural Habitats, &c) Regulations 2004 (as amended in Scotland). This is commonly referred to as the “Habitats Regulations” and transcribed into Scottish law 'Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora'. The Regulations also require the compilation and maintenance of a register of European sites, to include Special Areas of Conservation (SAC) and Special Protection Areas (SPA) which are classified under Council Directive 79/409/EEC on the Conservation of Wild Birds (the Birds Directive). The species listed in Annex I of the Birds Directive are, according to the Directive, those in danger of extinction, rare, vulnerable to specific changes in their habitat, and/or migratory species and member states are required to undertake special conservation measures for these species.

7.3.2 The provisions of the Birds Directive are implemented in the UK by the Wildlife and Countryside Act 1981 (as amended). All birds are protected during the nesting season and those listed on Schedule 1 receive special protection. The protection of some bird species has been amended through the Nature Conservation (Scotland) Act 2004. Taken together, these pieces of legislation make it an offence to intentionally or recklessly:

- Kill, injure or take a wild bird;
- Take, damage, destroy or interfere with a nest of any wild bird whilst it is in use or being built;
- Obstruct or prevent any wild bird from using its nest;
- Take or destroy an egg of any wild bird;
- Disturb the dependent young of any wild bird listed on Schedule 1, or disturb any wild bird listed on Schedule 1 whilst it is building a nest or is in, on, or near a nest containing eggs or young, or whilst lekking;
- Harass any wild bird listed on Schedule 1A; or

- Take, damage, destroy or interfere at any time with a nest habitually used by any bird listed in Schedule 1A.
- It is also an offence to possess or control a wild bird alive or dead, an egg of a wild bird (or any such derivatives), or to knowingly cause or permit any of the above acts to be carried out.

7.3.3 The following legislation has been considered when undertaking this assessment:

- Environmental Impact Assessment Directive 2014/52/EU;
- The Wildlife and Countryside Act (as amended) (WCA);
- The Conservation (Natural Habitats, &c) Regulations 1994 (as amended) ('The Habitats Regulations');
- The Nature Conservation (Scotland) Act 2004 (as amended);
- The Council Directive on the Conservation of Wild Birds 2009/147/EC (The EU 'Birds Directive'); and
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 ('the 2017 EIA Regulations').

7.4 Policy

National Policy

7.4.0 NPF4 is the national spatial strategy for Scotland which sets out new requirements for development to deliver positive effects, primarily under Policy 3. This states that all development will contribute to the enhancement of biodiversity, including where relevant restoring degraded habitats. Proposals for local development will include appropriate measures to conserve, restore and enhance biodiversity in accordance with national and local guidance.

Local Policy

7.4.1 Dumfries and Galloway Council Planning Policy includes the following:

NE5: Species of International Importance

Development proposals that would be likely to have an adverse effect on a European Protected Species will not be permitted unless it can be shown that:

- There is no satisfactory alternative; and
- The development is required for preserving public health or public safety or for other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment; and

- The development would not be detrimental to the maintenance of the population of the species at a favourable conservation status in its natural range.

NE6: Sites of National Importance for Biodiversity and Geodiversity

Development that affects Sites of Special Scientific Interest (SSSI), not designated as International Sites, and other national nature conservation designations will only be permitted where:

- It will not adversely affect the integrity of the area or the qualities for which it has been designated, or
- Any such adverse effects are clearly outweighed by social, environmental or economic benefits of national importance.

7.4.2 There are no statutory designated sites within the Development.

7.5 Methodology

Desk Study

7.5.0 A desktop study and consultation exercise was carried out prior to any fieldwork, to collate existing background information on the ornithological interest of the site. This included a search for statutory and non-statutory sites designated for their nature conservation value, records of protected or notable species within the site or surrounding habitats, which could be impacted by the scheme and habitats or features of interest. The search area for protected species records was determined by the particular species and ranged between 500m and 2 km from the site boundary. The following data sources were consulted:

- RSPB;
- NatureScot – Sitelink web pages (online information about designated sites);
- National Biodiversity Atlas (NBN Atlas) (only for scoping, no records from this site are included);
- SEPA;
- South West Scotland Environmental Information Centre (SWSEIC);
- The Birds of Conservation Concern (BoCC) (Eaton *et al.*, 2015);
- International Union for the Conservation of Nature (IUCN) Red list of threatened species;
- Scottish Biodiversity List (Scottish Biodiversity Forum) (2013);

- Relevant Environmental Statements, associated documents and bird monitoring reports for developments included in the Cumulative Assessment (acquired from various sources); and
 - Data on relevant scarce raptor species supplied by the local RSG.
 - Aerial photography; and
 - The UK Post 2010 Biodiversity Framework.
- 7.5.1 Results of the data search are shown in Section 7.7. The data from the Scottish Raptor Study Group is contained within the separate Confidential Annex.
- 7.5.2 Statutory designated sites up to 20 km from the site boundary were identified using the NatureScot *Sitelink* search facility.
- 7.5.3 Taking into account the potential bird issues and the generic guidance¹ on assessing effects on bird communities, the following field survey requirements were identified:
- Breeding bird surveys for species of conservation concern including black grouse (*Tetrao tetrix*), and waders;
 - Surveys of scarce breeding raptors and owls: potential species include hen harrier (*Circus cyaneus*), peregrine (*Falco peregrinus*), merlin (*Falco columbarius*), red kite (*Milvus milvus*), short-eared owl (*Asio flammeus*) and barn owl (*Tyto alba*);
 - Vantage point surveys during the breeding, non-breeding and migration seasons; and
 - Migrating wildfowl.
- 7.5.4 The primary target species for survey work are those listed in the NatureScot Guidance for wind farm developments outside of designated areas:
- All Annex 1 species or Schedule 1 breeding species (other than passerines);
 - Species with very localised UK breeding distributions; and
 - Other large species potentially vulnerable to wind farm development.
- 7.5.5 As the scheme is only three turbines, a reduced version of the survey work recommended in the guidance has been followed.

¹ Scottish Natural Heritage (2017). Recommended bird survey methods to inform Impact Assessment of onshore windfarms.

Scottish Natural Heritage (2009). Monitoring the impact of onshore wind farms on birds.

Scottish Natural Heritage (2018). Assessing Significance of Impacts from Onshore Windfarms Out With Designated Areas

Fieldwork

7.5.6 The ornithological survey work was undertaken with the following objectives:

- To determine the breeding, wintering and migrating bird populations;
- To complete a survey of breeding birds, with special reference to raptors and waders;
- To locate any nests of breeding raptors within the site or on adjacent moorland and forest edge;
- To determine the level of flight activity by birds within the proposed development area with special reference to target species; and
- To determine the impact of the proposals during construction and operation of the wind farm.

7.5.7 In order to do this, a number of different fieldwork techniques were used in this survey, paying particular attention to species of conservation concern that, by the nature of their behaviour, are particularly vulnerable to wind farm developments.

7.5.8 Surveys were all undertaken in accordance with standard methodologies with varying buffers around the Zone of Influence (ZOI) and included:

- Vantage point surveys during the breeding, non-breeding and migration seasons (500m buffer);
- Breeding bird surveys including Brown and Shepherd Wader Survey² for breeding upland waders (500m buffer);
- Black Grouse Survey (1.5km); and
- Raptor survey (2km); and
- Bird Habitat Assessment.

7.5.9 The buffers are shown on Figure 7.1.

7.5.10 Survey work was carried out by Starling Learning staff namely Liam Anton, Gerry Devaney, David Galbraith, Joseph Greenlees, Diane Lyons, Liz Parsons, and Alan Wood, all of whom are suitably qualified ornithologists. A summary of their experience and qualifications is provided in Appendix 7.1.

Vantage Point Surveys

² A. F. Brown & K. B. Shepherd (1993) A method for censusing upland breeding waders, *Bird Study*, 40:3, 189-195, DOI: 10.1080/00063659309477182

- 7.5.11 Vantage point (VP) watches were undertaken during the breeding, non-breeding and migration seasons and were carried out in accordance with NatureScot guidance (2017) on survey methods for use in assessing the impacts of onshore wind farms on bird communities.
- 7.5.12 One observer undertook each VP watch in conditions of good visibility, while positioned as inconspicuously as possible hidden in a small, camouflaged army tent. Surveyors were in contact using two-way radios and able to inform each other of the movements of target species. Care has been taken to avoid double counting of flights. The VP locations ensured no more than 2km from the area was viewed and it was possible to see the airspace of the three turbines.
- 7.5.13 The majority of the VP surveys were carried out soon after dawn and before dusk. Each VP watch lasted three hours, with a break between watches.
- 7.5.14 There was one year of survey with two VPs with a total of 30 hours watched from each one ensuring coverage during the breeding season, migration and winter. VPs and their viewsheds are illustrated on Figure 7.2. All dates and times of vantage point surveys are shown in Appendix 7.2.
- 7.5.15 No other ornithological or ecological surveys were carried out at times when the VP watches were taking place.
- 7.5.16 Surveys collated data over a 500 m buffer of the proposed turbine locations, and for *Target A* species, recorded flight duration and the bird's flying elevation above the ground at 15 second intervals. For other species (*Target B*), flights were mapped and elevation noted but not timed. Finally for species of lower conservation importance (*Target C*), a count of individuals present each 5 minute period was made.
- 7.5.17 Each flight was recorded on a 1:10,000 map in the field and flights of target species are shown on Figures 7.3 to 7.4. The recording forms used at vantage points are shown in Appendix 7.3. Records of all flights are given in Appendix 7.4.
- 7.5.18 The aim was to quantify the use of the proposed wind farm airspace by these birds and to collect information on the relative use of different parts of the survey area. Information on the proportion of time that target species spent flying at different elevations was also gathered. This data was then used to predict the amount of time target species would spend flying at turbine rotor blade height within the volume of the proposed wind farm. This was then used to carry out an assessment of collision risk for each target species.
- 7.5.19 Details of the secondary species recorded from VPs including buzzard, kestrel, raven and gulls are given in Appendix 7.5.
- 7.5.20 The collision risk has been calculated for the year of survey. These results are detailed in Appendix 7.6.
- 7.5.21 The overall spatial coverage is considered to provide representative flight activity levels within the development area to enable robust collision monitoring to take place.

- 7.5.22 The breeding bird survey included a wader survey to identify breeding territories of the open ground on the moorland and farmland. This was based on the Brown and Shepherd methodology (1993) for surveying upland breeding waders.
- 7.5.23 Two visits were made in April and May 2023 and fieldwork was conducted between 0830 and 1800 hours in suitable weather (i.e. wind speed not above 5 Beaufort, no persistent rain and good visibility). Dates and times are given in Appendix 7.2.
- 7.5.24 The survey area covered up to 500 m from the site boundary and all bird species visible at the time of the survey were recorded. The surveyors walked the site, scanning the area with binoculars and listening for calls at regular intervals (approximately every 100m), noting nests and broods, but focussing on evidence of breeding. Suitable cover was used to observe the birds for the majority of the survey, but raised vantage points were used for scanning for limited periods to help count vocal and highly mobile species such as curlew.
- 7.5.25 Supplementary records have been added to this survey from visits from the vantage points over the duration of the survey. All results are shown on Figures 7.5 to 7.7.

Black Grouse Survey

- 7.5.26 The RSPB monitoring method³ for black grouse was followed. Two visits were made to the survey area commencing before sunrise in April and May 2023. The known lek site, as provided by the RSPB was checked and other suitable areas were visited. Results are provided in the Confidential Annex.

Raptor Survey

- 7.5.27 Two visits were made in spring 2023 to assess the site for breeding raptors. This extended a minimum of two kilometres from the turbines.
- 7.5.28 There was liaison with the Raptor Study Group. Other raptors known to be present were considered; red kite, merlin, peregrine and hen harrier.
- 7.5.29 Methodology from the RSPB Bird Monitoring Methods manual³ was used together with the Scottish Raptor Study Group Guidelines for Surveying Raptors³. Raptors were also surveyed on all other surveys.

7.6 Impact Assessment (EclA)

General

- 7.6.0 This section explains how the significance of effects on the ornithological interests of the site was assessed.

³ Hardey, J., Crick, H.Q.P., Wernham, C.V., Riley, H.T., Etheridge, B. and Thompson, D.B.A. (2013). Raptors: A Field Guide to Survey and Monitoring. The Stationery Office, Edinburgh

- 7.6.1 This EclA is carried out in accordance with the guidance set out in the Institute of Ecology and Environmental Management (IEEM) Guidelines for Ecological Impact Assessment (2017)⁴ and Guidelines for Ecological Impact Assessment 2nd Edition (2016)⁵. This section defines the methodology used to assess the significance of effects through the process of an evaluation of the sensitivity (a combination of Nature Conservation Value and Conservation Status) and the magnitude of effect.
- 7.6.2 To accurately assess the potential impacts likely to occur from the development of the wind farm, the baseline conditions of the site need to be established, which ecological features (habitats, species, ecosystems, and their functions/processes) are likely to be affected by the proposal, both within and adjacent to the development area.

Evaluating Ornithological Interests

- 7.6.3 There are a wide range of criteria which will determine the sensitivity of each ecological feature. Examples include:
- Any site designations;
 - Naturalness;
 - Rarity of habitat, plant and animal species;
 - Habitat diversity and connectivity;
 - Habitats and species in decline; and
 - Large populations or concentrations of species considered uncommon or declining in a larger context.
- 7.6.4 The Nature Conservation Value is defined on the basis of the geographic context given in Table 7.1 below (which follows the guidance detailed in CIEEM 2016⁵).

Table 7.1 – Approach for Evaluating the Value or Sensitivity of Ecological Features in Scotland

Value of Receptor	Examples (Guidance to evaluation)
High e.g. International or National	An internationally or nationally designated site or candidate site (SPA, SSSI, NNR, Ramsar site, Biogenetic Reserve). Any regularly occurring population of an internationally or nationally important bird species, which is threatened or rare in the UK, e.g. Schedule 1.

⁴ CIEEM (2006) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Chartered Institute of Ecology and Environmental Management, Winchester

⁵ CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester



	<p>A regularly occurring, nationally significant population/number of any internationally important species.</p> <p>A site that provides critical habitat for any regularly occurring bird population of national importance which is rare in the UK.</p>
<p>Medium e.g. Regional (Southwest Scotland)</p>	<p>Viable areas of key habitat identified in the Regional BAP or smaller areas of such habitat, which are essential to maintain the viability of a larger whole.</p> <p>Viable areas of key habitat identified as being of regional value in the appropriate Natural Area profile e.g. local nature reserve.</p> <p>Any regularly occurring, locally significant population of a species listed on the current UK Red List.</p> <p>A regularly occurring, locally significant number of a regionally important species.</p> <p>An occasional occurrence of a nationally important species.</p>
<p>Low e.g. District and Local importance</p>	<p>Areas of habitat identified in a sub-county (District/Borough) BAP or in the relevant Natural Area profile.</p> <p>A population of a species that is listed in a District/Borough BAP because of its rarity in the locality or in the relevant Natural Area profile because of its regional rarity or localisation.</p> <p>A regularly occurring, locally significant number of a District/Borough important species during a critical phase of its life cycle.</p> <p>A regularly occurring but low number of locally common protected species within or adjacent to the development area.</p> <p>A population of bird species or assemblage of species which are not considered to qualify for non statutory designation but are considered locally important.</p>
<p>Very Low</p>	<p>Those habitats that have an effect of enriching and complimenting the local natural environment to a small degree.</p> <p>A population of bird species or assemblage of species which are not considered to qualify for non statutory designation but are considered locally important in the context of the immediate surrounding area.</p>
<p>Negligible</p>	<p>A commonplace species of little or no conservation importance.</p> <p>Areas of habitats considered to be of very limited ecological value.</p> <p>Those habitats that do not enrich the site for ornithology.</p>

7.6.5 Those ecological features identified to be potentially affected by the development and deemed to be of local importance or above, are termed 'Important Ecological Features' (IEFs).

7.6.6 Designated sites can be readily assigned to an appropriate level. For example, a site with a designation assigned through European legislation, such as a Special Protected Area (SPA) or a Special Area of Conservation (SAC), would be considered of International significance, a SSSI designated by UK statute would be of national significance and a site designated by a local authority would be of district importance. Where a feature has value at more than one level, its overriding value is that of the highest level. However, some sites may be designated for

different features at the European and national levels, so these features should be valued accordingly.

7.6.7 Impacts may be defined as direct (e.g. direct habitat loss or destruction of a nest) or indirect (e.g. disturbance during construction or change in habitat suitability for birds).

7.6.8 The IEEM guidelines set out the process for assessment in the following stages:

- Description of the ecological baseline i.e. results of fieldwork and desktop study;
- Identification of IEFs, i.e. the species of ecological value within the zone of influence;
- Determination of the nature conservation value of the IEFs;
- Identification of the potential impacts due to construction, operation and decommissioning of the development on the IEFs;
- Determination of the magnitude of impact on the IEFs taking into account the sensitivity of the receptor and the duration and reversibility of the impact;
- Determination of the significance of the impact based on the interaction between the magnitude/duration, the nature conservation value and the likelihood of the impact occurring;
- Identification of mitigation measures to reduce or avoid negative impacts;
- Determination of the residual impact following mitigation; and
- Identification of any monitoring requirements.

Magnitude of Effect

7.6.9 The magnitude of effect refers to the level of changes in the extent and integrity of the ecological feature.

7.6.10 Effects on IEFs can be judged in terms of magnitude in space and time. Magnitude refers to the scale of the impact. This may relate to the loss of a breeding population or the displacement of an individual bird. The effects can be adverse, neutral, or beneficial.

7.6.11 Magnitude is assessed at five levels for spatial effects as shown in Table 7.2.

7.6.12 Magnitude is also assessed at five levels for temporal effects, as shown in Table 7.3. Duration is defined as the time for which the impact is expected to last before recovery.

Table 7.2 – Definition of spatial effect magnitude on IEFs

Negative Magnitude	Effect	Description
Very high		Total or almost complete loss of the receptor. Loss or very major alteration to key elements/features of the baseline conditions

	<p>such that the post development character/composition/attributes will be fundamentally changed and may be lost from the site altogether. The conservation status of the receptor would be affected.</p> <p>Guide: <20% of population remains</p>
High	<p>Result in large scale, permanent changes in the receptor and likely to change its ecological integrity. These effects are likely to result in overall changes in the conservation status of a receptor.</p> <p>Guide: 20-80% of population lost</p>
Medium	<p>Include moderate scale, long-term changes in a receptor or larger scale temporary changes, but the integrity of the receptor is unlikely to be affected. This may mean that there are temporary changes in the conservation status of the receptor, but these are reversible and unlikely to be permanent.</p> <p>Guide: 5-20% of population lost</p>
Low	<p>Include effects that are small in magnitude, have small scale temporary changes, and where integrity is not affected. These effects are unlikely to result in overall changes to the conservation status of a receptor.</p> <p>Guide: 1-5% of population lost</p>
Negligible	<p>No perceptible change in the ecological receptor.</p> <p>Guide: 1% or less of population lost</p>

7.6.13 Effects and spatial magnitude are assessed within appropriate bio-geographic regions:

- Effects on breeding bird populations are assessed within a regional context;
- Effects on non breeding birds are assessed within a national context; and
- Any potential impacts on migrating geese of conservation value are assessed at a national level.

7.6.14 For breeding raptors, the local population is defined as all birds breeding within 2 km of the site (NatureScot 2017). For all other breeding species, the local population is defined as that being within the core survey area. For species on transit through the site, for example migrants or wintering birds, the local population is defined as the source population for the birds concerned, defined at the smallest geographical scale possible based on the available evidence.

Table 7.3 – Definition of Temporal Effect Magnitude on IEFs

Duration	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as above 26 years) except where there is likely to be substantial improvement after this period.
Long term	Between 15 and up to (and including) 25 years
Medium term	Between 5 and up to (but not including) 15 years
Short term	Up to (but not including) 5 years
Negligible	No effect

Determining Significance of Potential Effects

- 7.6.15 The significance of potential effects is determined by considering the value of the receptor and the magnitude of the effect and using professional judgement as to whether the integrity of the receptor will be affected.
- 7.6.16 Effects are more likely to be considered significant where they affect species of a high conservation value or where the magnitude of the effect is high. Effects considered not significant would apply to situations where the receptor is of a low conservation value, the integrity is not threatened, or the magnitude is low.
- 7.6.17 In accordance with the EIA Regulations, each likely effect is evaluated and classified as either significant or not significant. The significance levels of effect on bird populations are described in Table 7.4. Effects resulting in detectable changes in the conservation status of regional populations of Nature Conservation Importance are automatically considered to be significant effects for the purposes of the EIA Regulations (i.e. no distinction is made between effects of “major” or “moderate” significance). Non-significant effects include all those which are likely to result in small to barely detectable (minor) or non-detectable (negligible) changes in conservation status of regional (and therefore national) populations.

Table 7.4 - Significance Levels of Effects on Birds

Significance Level of Effect	Description
Major	Detectable changes in regional populations of Nature Conservation Importance that would have a severe impact on conservation status.
Moderate	Detectable changes in regional populations of Nature Conservation Importance that would likely have an impact on their conservation status.
Minor	Small or barely discernible changes that would be unlikely to have an impact on the conservation status of regional populations of Nature Conservation Importance
Negligible	No or non-detectable changes in the conservation status of regional populations of Nature Conservation Importance.

Frequency and Timing

- 7.6.18 The number of times an activity occurs will have an impact on ornithological features. The timing is also significant if the activity takes place during a critical period e.g. when birds are nesting.

Reversibility

- 7.6.19 An irreversible effect is one from which recovery is not possible within a reasonable timescale or if there is no possibility of action being taken to repair it. A reversible effect is one where recovery can take place or can be reversed by mitigation.

Assessment of Cumulative Impacts and Effects

- 7.6.20 NatureScot (2012) Cumulative Assessment is used to inform the cumulative assessment and the assessment of effects from surrounding developments will be taken into consideration.

Assessment of residual impacts

- 7.6.21 If a potential impact is determined to be significant, mitigation measures to avoid, reduce or prevent the impact are suggested wherever possible. Remaining residual impacts will then be discussed.
- 7.6.22 The available information on bird populations at the NHZ level is limited and available information on the results of monitoring, mitigation and enhancement work at existing wind farm developments is sparse. Therefore, the best use is made of the available literature and professional judgement to inform the assessment.

7.7 Baseline Conditions/Results

- 7.7.0 This section summarises the baseline bird populations and flight activity within and surrounding the Proposed Development based on surveys undertaken in the period 2022 to June 2023 by Starling Learning.
- 7.7.1 The Zone of Influence (ZOI) is identified as the area and resources that may be influenced by the development. It includes a radius around turbines, ancillary structures, borrow pits and access tracks of between 500m to 2km.
- 7.7.2 The Proposed Development site comprises an area of upland moor and farmland.

7.7.3 Desk Study

7.7.4 Natural Heritage Zone

- 7.7.5 Natural Heritage Zones are a system devised by NatureScot. It comprises of subdivisions of Scotland based on wildlife, natural features, landforms, geology, land use and human impact. The proposed Herds Hill Wind Farm is within the Western Southern Uplands and adjacent to the Border Hills NHZ.

Designated Sites

- 7.7.6 There are no statutory designations on the site. All statutory and non-statutory designated sites within 20km of the site boundary are described in Appendix 8.6 of the Ecology Chapter. Designated areas surrounding the site with significance to birds are outlined in Appendix 7.7. There are several statutory sites relating to birds within 20km namely the Muirkirk and North Lowther Uplands SPA, Airds Moss SAC, Merrick Kells SAC and SSSI and the North Lowther Uplands SSSI, Mennock Water SSSI, Muirkirk Uplands SSSI, and Bogton Loch SSSI. There are no direct links to the development.
- 7.7.7 There are no non-statutory sites of significance to birds within or adjacent to the development.
- 7.7.8 Data from other sources is outlined in Appendix 7.8.
- 7.7.9 Data from the Scottish Raptor Study Group (SRSG) is provided in a separate Confidential Annex, which accompanies this ES. Data from the SRSG and from site surveys identified the following raptors and owls within 2km of the development:
- Hen Harrier roost in 2019;
 - Golden eagle flights in 2019 just south of Barr Moor;
 - There is a known breeding site for goshawk within 2.5km of the development. A tree used for nesting in 2015 was later cut down as part of forestry operations and the pair moved to a new location.

Species (Site Survey)

Bird Habitats

- 7.7.10 A range of bird habitats exist within the development site. These are:
- Acid and marshy grassland;
 - Blanket bog;
 - Wet and dry modified bog; and
 - Running water.

Vantage Point Surveys

- 7.7.11 During the surveys, the flight activity of all target species was recorded from the vantage points. The Flight Risk Zone (FRZ) is given by the lower and upper limits of the recorded flight height bands which encompass the heights swept by the rotating turbine blades (i.e. 35 m to 149 m).
- 7.7.12 Flight records for target species are summarised below in Table 7.5. This details the total number of flights, and flights within the FRZ.

Curlew

7.7.13 Curlews were recorded in this transitional habitat from moorland to farmland with a total of six curlew flights recorded and a total flight time of 79 seconds within the FRZ.

Lapwing

7.7.14 Two flocks of lapwing were recorded in flight, one of 17 birds, and one of five birds with a total flight time of 809 seconds in the FRZ.

Black grouse

7.7.15 A total of three flights were recorded with no flights within the FRZ.

Whooper Swan

7.7.16 One small flock of whooper swans was recorded flying over the site with no flight time within the FRZ. As there was only one flock recorded and there is lack of suitable whooper swan habitat for feeding or roosting, a detailed assessment of potential effects on this species arising from the Proposed Development is not required under the EIA Regulations. Hence, whooper swans despite their high Nature Conservation Importance are not considered further in this EIA.

Pink-footed Geese

7.7.17 A flock of 110 birds was recorded but with no flight time within the FRZ. Pink-footed goose is considered to be of low Nature Conservation Importance in relation to the Proposed Development since there are no wintering areas in the vicinity and very little migratory traffic was recorded relative to the known volume of movements by this species. Therefore, there is no requirement for a more detailed assessment and this species is not considered further in this EIA.

Table 7.5 - Summary of Recorded Flight Activity of Target A Species

Species	Total flights	Total flights within the FRZ	Total time recorded (secs)	Within FRZ
Curlew	6	5	187	79
Lapwing	22	22	1,062	809
Black Grouse	3	0	95	0
Whooper Swan	6	0	96	0
Pink-footed Geese	110	0	1,760	0

Secondary Species

7.7.18 Flights of seven Target B species were recorded namely buzzard, herring gull, lesser black-backed gull, kestrel, raven, cormorant, and mallard. A summary of the observed flights on non-target species is given in Table 7.6.

Buzzard

7.7.19 Recorded frequently with a total of 35 flights of which 32 were within the FRZ.

Herring Gull

7.7.20 Recorded flying over the site occasionally. Due to infrequent recording and there being no significant habitat for this species, herring gull has been scoped out and will not be considered further within this EclA.

Lesser Black-backed Gull

7.7.21 Recorded occasionally over the site in small numbers. As with herring gull, lesser black-backed gulls will not be considered further with this EclA.

Kestrel

7.7.22 Recorded fairly frequently with five flights, all of which were within the FRZ.

Raven

Recorded fairly frequently but due to its low conservation value, raven will not be considered further within this EclA.

Cormorant

7.7.23 One flight recorded, outside the FRZ. Due to infrequent recording and there being no significant habitat for this species, cormorant has been scoped out and will not be considered further within this EclA.

Mallard

7.7.24 One flight recorded within the FRZ. Mallard too has been scoped out.

Table 7.6 - Summary of Recorded Flight Activity of Target B Species

Species	Total flights	Total flights within the FRZ	Total flight time in FRZ (secs)
Buzzard	35	32	1,410
Kestrel	5	5	229
Herring Gull	4	4	45
Lesser black-backed Gull	13	13	87
Raven	9	7	24
Cormorant	1	0	0
Mallard	1	1	10

7.7.25 Eight other species were recorded flying over the survey areas, seen or heard from the vantage points or during the point counts. This included regular flights by skylark and meadow

pipit in the moorland areas and occasional stonechats. Several woodland species were recorded flying over or foraging on site including woodpigeon, mistle thrush and song thrush. Records are included in Appendix 7.2. As numbers of woodland species foraging on site were low, they will no longer be considered within the EclA.

Breeding Bird Survey

- 7.7.26 This section includes the results from the wader survey, moorland breeding bird survey and the raptor survey. Results are given in Appendix 7.10.

Breeding Target Species Recorded and their Status

- 7.7.27 Within the 500 m buffer of the entire proposed site, a total of 13 species have been recorded breeding at Herds Hill. However, a number of these species have not been included in the results in Appendix 7.10 as they are not species of conservation concern.

Waders

- 7.7.28 Waders were present, breeding in quite low numbers on the moorland areas. Two to three pairs of curlew were recorded with another pair on the periphery to the east. Nine pairs of snipe were recorded breeding, and one pair of lapwing was recorded in the lower lying agricultural land.

Black Grouse Survey

- 7.7.29 A lek was recorded and details are provided in the Confidential Annex.

Raptor Survey

- 7.7.30 Due to the sensitivity of many of these species, a summary is provided below with further details provided in the Confidential Annex. In conjunction with data from the SRSG, the following raptors have been recorded.

- 7.7.31 Merlin feathers beside a kill of a meadow pipit was recorded during the breeding season indicating a possible territory, however no nest was confirmed.

- 7.7.32 A barn owl nest was recorded just over 2km distant.

- 7.7.33 Three buzzard and two kestrel territories were recorded within the 2km search area.

- 7.7.34 Other species

- 7.7.35 Skylark was the most common species on the moorland with 48 pairs and meadow pipit was also present in high densities with 39 territories recorded. Whinchat, wren, and dipper were localised and present in low numbers.

Determining Ornithological Importance

- 7.7.36 The assessment applies to species that have been identified as Important Ecological Features (IEFs). These are the species considered to be important and potentially affected by the

development. Appendix 7.10 outlines birds of conservation importance relating to species rarity, to the extent to which they are threatened throughout their range, or to their rate of decline. The species identified as IEFs due to being of high or medium conservation importance are outlined below.

- 7.7.37 The following are considered to be of high or medium conservation importance with high nature value at Herds Hill: hen harrier, merlin, goshawk, kestrel, curlew, lapwing, snipe, barn owl, and black grouse.
- 7.7.38 There are a number of other species, mainly passerines, considered to have low conservation value for the site.
- 7.7.39 Species of high, medium and low nature conservation value will be considered further within this EclA.

7.8 Impact Assessment

7.8.0 Within this section, the ways in which birds may be affected by the wind farm development are discussed and a description is given of possible impacts of the scheme on the bird populations in the area and their significance.

7.8.1 The key issues relating to birds are as follows:

- Effect on hunting and foraging grounds, shelter and roost sites, breeding sites, corridors for migration and dispersal and stop over sites; and
- Effect on population cycles, survival rates, reproduction rates, and seasonal behaviour.

7.8.2 These could be affected by:

- The effects of direct habitat loss due to land-take from the access tracks, the turbine bases, and the ancillary structures.
- The effects of indirect habitat loss. Birds may be disturbed and displaced from the proximity of the wind turbines. Such disturbance may occur because of construction work, maintenance, and visitors or due to the presence of the wind farm close to nesting or feeding sites or on habitual flight routes.
- The potential killing or injury of birds due to the effects of collision with rotating turbine blades, overhead wires, guy lines and fencing.

7.8.3 The effects of habitat loss, construction of the wind farm and the operational wind farm on individual birds or groups of birds are discussed. Decommissioning may result in disturbance to birds breeding and hunting in the area. This is difficult to judge at this time and will depend upon the levels of use of the site by birds at the time of decommissioning and will be dependent upon whether a decision is made to remove the track or not. However, it is unlikely to affect more than one breeding season and is likely to be less of a disturbance than construction of the wind farm.

Direct Habitat Loss

- 7.8.4 The development would lead to a very minimal loss of habitat from the site. The construction of turbines, access tracks and ancillary structures would lead to small losses of bog and grassland habitats.
- 7.8.5 This would mean a small loss of nesting habitat for some species including black grouse, curlew, lapwing, snipe, skylark and meadow pipit, a loss of foraging habitat for raptors such as kestrel. No Schedule 1 or Annex I bird species will lose any significant amount of habitat for foraging or for nesting. The loss of habitat is considered **negligible**.

Disturbance and Displacement during Construction

- 7.8.6 During the construction phase is the time when there is most potential for impacts on bird populations. The amount of disturbance is dependent on the time of year that construction takes place, with the breeding season having the biggest potential for loss of bird populations. It would be difficult to avoid disturbing nesting birds if construction took place from mid-March until early August although this can be mitigated by good management. Ground clearance would be especially disruptive to ground nesting species if carried out at the wrong time. Nests in the moorland vegetation would be difficult to locate making avoidance challenging. These works should be done in advance.
- 7.8.7 This disturbance and displacement is likely to occur over just one breeding season. If ground clearance takes place out with the breeding season, disturbance and displacement will be **short term**, of low magnitude and minor significance. However, if ground clearance is during the nesting season it is considered to be of **medium magnitude** and of **moderate significance**.
- 7.8.8 The effects of disturbance and displacement on individual species are discussed later in Section 7.9, Receptor Assessment.

Displacement during Operation

- 7.8.9 Operational turbines have the potential to displace both nesting and foraging birds.
- 7.8.10 Various studies have shown that at some sites waders can be displaced from up to 500 m away and in some cases, 800 m (Pearce-Higgins *et al.*, 2009).⁶ However a study by Natural Research⁷ has suggested that curlew are not displaced by turbines. Therefore, the studies are inconclusive. At Herds Hill, up to three pairs of curlew and nine pairs of snipe could have the potential to be displaced.

⁶ Pearce-Higgins, J.W., Stephen, L., Langston, R.W., Bainbridge, I.P. and Bullman, R. (2009) The distribution of breeding birds around upland wind farms. *Journal of Applied ecology*, 46: 1323-1331

⁷ Whitfield, D.P., Green, M & Fielding, A.H. (2010). Are breeding Eurasian curlew *Numenius arquata* displaced by wind energy developments? Natural Research Projects Ltd, Banchory, Scotland.

- 7.8.11 Raptors will lose foraging areas and can be displaced up to 200 to 300m from turbines (Whitfield & Madders, 2006⁸). Flight activity of many raptors have been shown to be reduced significantly within 500m of wind turbines⁸ however as it is only three turbines the loss of foraging habitat is low and so it is likely that they will continue to hunt close to and within the wind farm area.
- 7.8.12 The risk of birds colliding with the rotating turbine blades has been assessed using the model developed by Band et al. This estimates the number of bird collisions with the turbine rotors during the specified time period. It is calculated in two stages:
- Estimating the number of birds passing through the area or volume swept by the rotors;
 - Estimating the probability that a bird will be struck by a rotor blade when passing through the area swept by the rotors.
- 7.8.13 The model is different for two different situations:
- Predictable flights by waterfowl;
 - Less predictable and generally more local movements by birds such as foraging by raptors and waders.
- 7.8.14 Data for both scenarios were collected by observing and recording bird flight activity in and around the site during timed watches from the vantage points.

Effects Scoped Out

- 7.8.15 On the basis of the field survey work undertaken, the professional judgement of the ornithology team, experience from other relevant projects and taking account of policy guidance and standards, the following topic areas have been scoped out of the current assessment:
- Effects on all bird species classified as of Low Nature Conservation Importance.
 - As discussed previously, effects on the following bird populations: whooper swan, pink-footed goose, herring gull, lesser black-backed gull, and mallard. Baseline field studies have recorded very infrequent use of the area within the proposed development by these species of high and moderate Nature Conservation Importance. Although these species were present, their reliance on habitats and airspace in the vicinity of the Proposed Development is so low that there is no potential for an adverse effect on regional or national populations as a result of the construction, operation, or decommissioning activities (see Baseline Conditions).

⁸ Whitfield P., Madders M.2006. Upland raptors and the assessment of wind farm impacts. Ibis Vol 148

Effects Assessed

- 7.8.16 Potential effects are evaluated in respect of species of high or moderate Nature Conservation Importance whose regional populations could be potentially affected by the Proposed Development. Emphasis is given to species identified as sensitive receptors. In considering the Nature Conservation Importance of potentially affected species, consideration has been given to the criteria in Table 7.2.
- 7.8.17 Potential Effects are assessed in respect of the following species of high Nature Conservation Importance, as follows:
- Black grouse
 - Merlin
 - Hen harrier;
 - Goshawk;
 - Golden eagle;
 - Red kite;
 - Barn owl;
 - Lapwing;
 - Snipe;
 - Curlew;
 - Kestrel;
 - Ground nesting passerines – skylark, meadow pipit, whinchat and wren.
- 7.8.18 Based on consultations and survey work, collision risk modelling has been carried out to predict the wind farm's impact on curlew and lapwing as they are considered to be at risk from the turbine rotors.
- 7.8.19 However, no flights were recorded by black grouse and snipe. Although known to be present in the area, no flights were recorded during the survey for merlin, golden eagle, goshawk, hen harrier, and barn owl, so no collision risk modelling has been carried out for these species.
- 7.8.20 The risk window for the area was calculated using the data shown in Appendix 7.6.
- 7.8.21 The total area surveyed was 235.5 ha with the entire airspace visible (A) from all the vantage points.
- 7.8.22 All calculations for collision risk are shown in Appendix 7.6. In this case the less predictable model has been used. The results are given in Section 7.9 below.

7.9 Receptor Assessment

7.9.0 For each species taken to be an IEF, an assessment is made of the impacts on the Scottish population and the population of the NHZ. Population figures for Scotland are from The Birds of Scotland, Forrester et al, 2007⁹. Population figures for the NHZ are taken from Wilson M.W. et al, 2015.¹⁰

7.9.1 The assessment will identify whether the impact is likely to adversely affect the conservation status of each of the species, without any consideration of mitigation.

Black Grouse

Baseline

7.9.2 There is a black grouse lek were located on site. The lek has moved in recent years. The lek is approximately 180m from the nearest turbine.

7.9.3 The Scottish breeding population is estimated to be 3,500 to 5,750 lekking males and the wintering population is 7,500 to 19,000. The NHZ population of lekking males in 2019 was estimated to be 50 lekking males¹¹.

7.9.4 Black grouse is a UK BAP priority species, red listed and a Dumfries and Galloway species.

7.9.5 This species is considered to be of high nature conservation importance at this site.

Potential Construction Effects

7.9.6 There is potential for disturbance and displacement to this species during construction. The magnitude of the impact will be higher if construction takes place during the breeding season, however, would only affect the lek for one breeding season. If construction is during the breeding season, the impact is considered to be of a **medium magnitude, short term** and of **moderate significance**. If out with the breeding season, the impact is considered to be of **low magnitude, short term and of negligible significance**.

Potential Operational Effects

7.9.7 Black grouse have been known to collide with turbines (Zeiler & Grunschachner-Berger, 2009 and Council of Europe Publishing, 2004). No birds were recorded in flight however this is a regular lek and collision is a possibility. The risk is deemed to be of **low magnitude** and **minor significance**.

⁹ Forrester R. & Andrews I. et al. 2007. The Birds of Scotland. The Scottish Ornithologists Club.

¹⁰ Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned report number SWBSG_1504.pp72. Available from:www.swbsg.org

¹¹ <https://swseic.org.uk/2019/05/black-grouse/>

- 7.9.8 Black Grouse leks can be displaced by operating turbines. Some studies show abandonment of lek sites, others show tolerance. Recent studies have shown seasonality where winter birds are undeterred however breeding birds sometimes avoid wind farms¹². There is the possibility of displacement of this lek of two birds due to the close proximity of the turbine; this is a loss of 4% of the lekking males in the region. This is considered to be of **low magnitude, long term and minor significance**.

Hen Harrier

Baseline

- 7.9.9 Hen harrier is an Annex 1 and Schedule I species, red listed and an LBAP species in Dumfries and Galloway as it is a scarce species due to a serious decline owing to persecution. Numbers have recovered slightly however this species still suffers from persecution. A survey in 2004 recorded the population as 633 pairs in Scotland and only about 400 in the early 1980s. The NHZ population of breeding hen harriers in 2011 was approximately 18 pairs.
- 7.9.10 No flights were recorded during the survey and no nests located. However, desk study data does show use by this species in this area with previous roost and flight records.
- 7.9.11 Hen harrier is considered to be of medium nature conservation value at this site.

Potential Construction Effects

- 7.9.12 There is some potential for disturbance and displacement during construction. Displacement distance is estimated to be 500 m from the construction of turbines (Ruddock and Whitfield, 2007)¹³. However this is temporary and the current use of the site is not by breeding birds. The impact is considered to be of a **low magnitude, short term** and of **minor significance**.

Potential Operational Effects

- 7.9.13 There is potential for some displacement from the operating wind farm. Madders and Whitfield concluded that the majority of upland raptors are displaced slightly from turbines whilst foraging. However, hen harriers are known to continue to hunt at wind farms, so they are unlikely to be displaced entirely.
- 7.9.14 Both the collision risk and displacement of hen harrier from the proposed Herds Hill Wind Farm is considered to be of a **low magnitude** and considered to be of **minor significance**.

Goshawk

Baseline

¹² Zwart, M.C. & McKenzie, Ailsa & Minderman, Jeroen & Whittingham, Mark. (2016). Conflicts Between Birds and On-Shore Wind Farms. 10.1007/978-3-319-22246-2_23.

¹³ Ruddock M. & Whitfield P. (2007). A review of disturbance distances in selected bird species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage

- 7.9.15 No flights were recorded during the survey; however, this species is known to nest in the area.
- 7.9.16 Goshawks were reintroduced to Britain in the 1960s following extinction in the 19th century. The Scottish breeding population is now at least 150 pairs with 350 to 450 birds in winter. Breeding birds in the NHZ is estimated at 31 pairs however this figure is out of date and likely to be higher. The British Trust for Ornithology (BTO) has stated that Goshawks have increased significantly in recent years.¹⁴
- 7.9.17 Goshawk is listed as a Schedule 1 species and is considered to be of medium nature conservation value for this site.

Potential Construction Effects

- 7.9.18 No nest will be disturbed, and no birds were recorded during the survey. There may be some disturbance and displacement to foraging habitats during the construction phase. The impact is considered to be of **low magnitude, short term and of no significance**.

Potential Operational Effects

- 7.9.19 No disturbance or displacement to nesting birds is likely. Birds are likely to continue to hunt in the area. The impact is considered to be of **low magnitude, long term and of no significance**.

Barn Owl

Baseline

- 7.9.20 Barn owl was recorded nesting just over 2km distant of the development.
- 7.9.21 The Scottish breeding population was estimated to be between 545 and 1,000 pairs in 2004. The NHZ population in 2014 was estimated to be between 165 and 400 pairs.
- 7.9.22 Barn Owl is listed as an EC Annex 1 species, amber listed, and a Dumfries and Galloway LBAP species and on the Scottish Biodiversity list and is considered to be of medium nature conservation value for this site.

Potential Construction Effects

- 7.9.23 The nest will not be disturbed and as hunting generally takes place at night, foraging is unlikely to be disturbed. The impact is considered to be **negligible**.

Potential Operational Effects

- 7.9.24 No flights of barn owl were recorded. The impact of the development on risk of collision and displacement is considered to be **negligible**.

¹⁴ <https://www.bto.org/understanding-birds/birdfacts/goshawk>

Merlin

Baseline

- 7.9.25 Evidence of merlin using the site was recorded.
- 7.9.26 Merlin is an Annex 1 and Schedule I species, amber listed and a Dumfries and Galloway LBAP species. The Scottish population is estimated to be 800 pairs with 3,000 birds present in winter. The NHZ population is estimated to be 12 breeding pairs.
- 7.9.27 Merlin is considered to be of medium nature conservation value for this site.

Potential Construction Effects

- 7.9.28 There is potential for disturbance and displacement to hunting birds during construction. The impact is considered to be of **low magnitude, short term and of minor significance**.

Potential Operational Effects

- 7.9.29 No birds were recorded in flight, the collision risk is considered to be **negligible**.
- 7.9.30 There is some potential for foraging birds to be displaced, however this is considered to be of a **low** magnitude and of **minor significance**.

Golden Eagle

Baseline

- 7.9.31 Golden eagle was not recorded during the survey, but desktop records show flights within the vicinity.
- 7.9.32 It is a Schedule 1 species. It is considered to have low conservation value at this site.
- 7.9.33 It is estimated that there are approximately 440 pairs breeding in Scotland. The NHZ population has been counted in 2022 by the SoSGEP as 39 birds¹⁵.

Potential Construction Effects

- 7.9.34 There is some potential for disturbance and displacement to foraging eagles and during construction, however this is considered to be **negligible**.

Potential Operational Effects

- 7.9.35 Lots of research has been undertaken relating to the impacts of wind turbines on golden eagles. In 2021, a report by Fielding et al.¹⁶ determined that eagles were eight times less likely to be within a rotor diameters distance of a hub location after turbine operation. It was noted

¹⁵ <https://www.goldeneaglessouthofscotland.co.uk/media/uploads/cat-27/august-2022-eagle-release-final.pdf>

¹⁶ Fielding et al. (2021). Responses of dispersing GPS-tagged Golden Eagles (*Aquila chrysaetos*) to multiple wind farms across Scotland

that the substantial response of the GPS-tagged birds was avoidance, with functional habitat loss and not collision risk, as being the predominant adverse effect for the monitored golden eagles.

- 7.9.36 The impacts are considered to be **negligible**.

Red Kite

Baseline

- 7.9.37 Red kite have not been recorded on site however are known to be present in the area.
- 7.9.38 Red kite is an Annex 1 and Schedule I species, amber listed and a Dumfries and Galloway LBAP species.
- 7.9.39 In 2018 the Scottish population was estimated to be at least 350 breeding pairs¹⁷. The NHZ population of red kites is estimated to be between 360 to 390 birds in 2013 and the number of breeding pairs in 2017 was estimated at over 105 pairs¹⁸.

Potential Construction Effects

- 7.9.40 There is potential for disturbance and displacement from foraging habitats during construction. The impact is considered to be of a **low magnitude, short term** and of **negligible significance**.

Potential Operational Effects

- 7.9.41 No collision risk has been calculated as no birds were recorded, however there is potential for some risk of collision and displacement. The impact is considered to be of **low magnitude, long term** and of **minor significance**.

Lapwing

Baseline

- 7.9.42 Flocks of lapwing use the area for winter roosting and feeding and a total of 23 flights were recorded from the vantage points. Birds also nest on site.
- 7.9.43 Lapwing is a Priority UK BAP species, on the Scottish Biodiversity List and Red listed. The site is considered to be of medium conservation value to this species.
- 7.9.44 The Scottish wintering population is estimated to be approximately 67,000 birds.

¹⁷ The history and future of red kite conservation. RSPB Posts. 2018.
<https://community.rspb.org.uk/ourwork/b/scotland/posts/red-kite-conservation>

¹⁸ RSPB, January 2017. <http://www.gallowaykitetrail.com/>

7.9.45 The Scottish breeding population was estimated at 91,200 pairs.

Potential Construction Effects

7.9.46 If ground clearance takes place during winter months, there is the risk of some disturbance and displacement to this species. Birds may still be able to utilise the site for some of the time depending on patterns of night or daytime feeding. The disruption is temporary and therefore the impact is considered to be of **low magnitude, short term** and of **minor significance**.

Potential Operational Effects

7.9.47 The collision risk was calculated to be 1 bird every 6.34 years. This is an estimated 6.31 birds during the 40 year lifetime of the wind farm. In relation to the Scottish wintering population of approximately 67,000 birds this is 0.009% of a loss of the wintering population. The impact of collision is considered to be **negligible**.

7.9.48 Nesting lapwing have the potential to be displaced. However as only one pair was recorded, the impact is considered to be **negligible**.

Curlew

Baseline

7.9.49 Vantage point surveys recorded 37 flights by curlew. Six breeding territories were recorded.

7.9.50 The Scottish breeding population is estimated to be around 58,800 pairs. Approximately 4,284 (8,568 birds) of these are in the NHZ.

7.9.51 Curlew is red listed, a priority UK BAP species and a Dumfries and Galloway LBAP species.

7.9.52 Curlew is considered to be of high nature conservation importance at this site.

Potential Construction Effects

7.9.53 There is potential for disturbance and displacement to nesting birds during construction. As with other species the magnitude of the impact will be higher if ground clearance and construction takes place during the breeding season, however it would only affect the birds for one breeding season. If construction is during the breeding season, the impact is considered to be of a **medium magnitude, short term** and of **moderate significance**. If this work is undertaken out with the breeding season, the impact is considered to be of **low magnitude, short term** and of **negligible significance**.

Potential Operational Effects

7.9.54 Pearce Higgins *et al* (2009) suggested a 42.4% decline in breeding curlews within 500 m of turbines⁸. Some of the curlew territories are closer to turbines than 500 m. There is therefore a possibility that three pairs of breeding curlew could be displaced during construction.

Herds Hill Wind Farm

- 7.9.55 There is a possibility that curlews will collide with turbines. Collision risk has calculated that 1 bird will collide every 126 years, a loss of 0.31 birds over 40 years. This equates to 0.003% of the regional population.
- 7.9.56 Curlews do have a tendency to continue to be displaced by operating wind farms. An estimated displacement of three breeding birds is 0.07% of the local population.
- 7.9.57 The adverse effects of the operating wind farm on curlew is considered to be **negligible**.

Snipe

Baseline

- 7.9.58 Nine breeding territories in total were recorded with no flights recorded from vantage points.
- 7.9.59 Snipe is amber listed and a Scottish Biodiversity List priority species.
- 7.9.60 The breeding population within the NHZ was estimated at 1,252 birds from 1985 to 1995.
- 7.9.61 Snipe is considered to be of medium nature conservation importance at this site.

Potential Construction Effects

- 7.9.62 As with curlew, the effects will be greater if ground clearance takes place during the nesting season. The impact is considered to be of a **medium magnitude, short term** and of **moderate significance**. If this work is undertaken out with the breeding season, the impact is considered to be of **low magnitude, short term and of negligible significance**.

Potential Operational Effects

- 7.9.63 A few snipe may be deterred from nesting close to the turbines, however this is considered to be of **negligible** magnitude and **not significant**.

Other Raptors

- 7.9.64 For other raptors it is possible that several buzzards and kestrels may be displaced as a result of the construction. Birds will continue to hunt through the site during operation of the wind farm, therefore there is some risk of collision, although the impact is considered to be of **low magnitude** and of **minor significance**.

Moorland passerines

- 7.9.65 There are a number of species of conservation concern on the moorland that have the potential to be affected by the development.
- 7.9.66 All breeding birds are likely to lose a small amount of foraging and nesting habitat and there is a slight risk of collision, however this is likely to make little difference to the population of most of these species. The main impacts are during ground clearance for construction when nests have the potential to be destroyed. If construction is during the breeding season, the

impact is considered to be of a **medium magnitude, short term** and of **moderate significance**. If out with the breeding season, the impact is considered to be of **low magnitude, short term and of negligible significance**.

7.10 Mitigation

- 7.10.0 A Habitat Management and Enhancement Plan (HMEP) including a Species and Habitat Protection Plan (SPP) will be written post planning consent as part of a programme of mitigation measures associated with the construction and operation of the wind farm. This will be designed to minimise any negative impacts on habitats and species. There is also the possibility of gaining a positive impact for bird populations on the site through careful mitigation design to enhance existing retained habitats for notable species recorded on the site, which would assist the Council in discharging its biodiversity duty.
- 7.10.1 It is proposed that this HMEP will be a working document which will evolve following discussions between the Applicant, the landowners, the ECoW and organisations with responsibility for and an interest in key wildlife species such as the Biodiversity Officer, NatureScot and the RSPB to develop an effective and workable plan for the site. The priority will be to:
- Examine ways to minimise disturbance and potential problems for key species;
 - Examine how the value might be improved by changes in land management; and
 - Increase overall biodiversity through management targeted at specific species.
- 7.10.2 An Ecological Clerk of Works (ECoW) will be appointed to oversee all construction work and ensure that the HMEP is implemented.
- 7.10.3 A brief outline of habitat mitigation and habitat enhancement measures are provided below, but will be covered in further detail in the HMEP and SPP.

Pre-construction

- 7.10.4 Prior to construction commencing, ornithological surveys will be carried out. The lek sites of black grouse will also be surveyed each year leading up to construction.

Construction Phase

- 7.10.5 Although the construction phase is considered to have the most potential for impacts on bird populations, the amount of disturbance is dependent on the time of year that construction takes place, with the breeding season having the highest potential for significant disturbance of bird populations. Due to the scale of the site and the habitats present, it would be difficult to locate and thus avoid nests during construction works. Therefore, to minimise the potential for impacts on breeding birds during construction, all ground clearance will be undertaken outside the bird breeding season, which is generally accepted to be from March to August.
- 7.10.6 Any ground clearance required during the breeding season will be kept to a minimum and will be checked by a competent ornithologist prior to works commencing with a maximum of five days to clear each stage after each nest check before checking is required again.

- 7.10.7 The ECoW will ensure that measures are put in place should nests be discovered to ensure no further disturbance to nesting birds. For example, the area with the nest will be avoided till after birds have fledged, this will be monitored by the ECoW. Buffer zones will be set up around the nest, the size of which will be determined by the bird species.
- 7.10.8 A buffer zone will be set up around the black grouse lek. No work will take place within 750m during April and May before 9 a.m. to avoid disturbing lekking birds.
- 7.10.9 Displacement to breeding birds will be mainly temporary and outside the breeding season. Improvements suggested within the HMEP will ensure any permanent displacement is insignificant.
- 7.10.10 Flocks of lapwing have the potential to be displaced in winter during construction. These will be carefully monitored by the ECoW, their roost locations noted, and disturbance will be minimised.
- 7.10.11 The turbines, access tracks and ancillary structures will avoid habitats of bird significance as far as possible. Any micro-siting will be agreed with the ECoW.
- 7.10.12 There will be several habitat enhancement measures proposed within the HMP to improve the site for many bird species including creation of wader scrapes in areas distant from the turbines, planting of woodland for black grouse and erection of nestboxes.

Operational Phase

- 7.10.13 Post-construction monitoring to determine the effectiveness of the mitigation measures implemented is a crucial element in assessing the true extent of impacts on birds from wind farm developments. Ornithological surveys will be carried out in the year following the completion of the works and again in years five and ten. A report will be made to the relevant bodies regarding bird status post-construction. The status of important bird species will be discussed and, if monitoring results suggest a change in management methods is required; these will be agreed and implemented through a revised management plan. Reports will be produced after each year of monitoring and will be made available to all relevant parties.
- 7.10.14 The methods used for post-construction monitoring will be in accordance with those detailed in Guidance on Methods for Monitoring Bird Populations at Onshore Wind Farms (NatureScot 2017) for those species identified as potentially at risk from the wind farm development. It will include monitoring of breeding birds and vantage point watches for comparison with pre-construction data. It will also include carcass searches to estimate the actual number of collisions. This data can then be used to inform future collision risk analysis and potential alterations to the HMP.

Decommissioning Phase

- 7.10.15 As with the construction phase, the greatest potential for impacts on birds during the decommissioning phase is during the nesting season, assuming that birds are breeding on site at that time. It is therefore recommended that decommissioning of the site is also undertaken outside the bird breeding season.

Implementation of Mitigation Measures

7.10.16 Various enhancements will take place on site to increase the value of the site to bird populations. These are described in detail in the HMP, and are summarised below:

- Woodland and scrub enhancement will take place within the cleughs to benefit black grouse and passerines;
- Bog enhancement measures out with the wind farm area will enhance the site for species such as curlew and snipe; and
- A variety of nest boxes will be erected at adjacent farms and maintained for the duration of the wind farm including nest boxes specifically for kestrel and barn owl.

Residual Effects

7.10.17 If the species protection and mitigation measures detailed above are implemented, this will contribute to reducing significant negative impacts to occur on the ornithological value of the site and surrounding area. Residual effects following mitigation are summarised in Appendix 7.11

7.10.18 Avoiding ground clearance during the breeding bird season reduces adverse impacts on all breeding bird species and reduces construction impacts to low magnitude, short term and of minor or negligible significance.

7.10.19 With good practice and mitigation and some positive impacts, the overall residual impact of the development of a wind farm will be reduced.

7.11 Cumulative Impacts

7.11.0 NatureScot has published guidance on assessing cumulative impacts on birds in relation to wind farm developments (NatureScot 2012)¹⁹. These impacts may result from collision with turbines; displacement of birds due to loss of suitable feeding and/or breeding/wintering habitat; disturbance within and around the turbine envelope or a barrier effect on dispersal, regular movements, or migration.

7.11.1 There are several other developments in the area, which need to be considered in terms of cumulative impacts. These include operational, consented/under construction and wind farm applications currently going through the planning process, as well as other types of developments such as mining.

Cumulative Effect on IEFs

¹⁹ Scottish Natural Heritage (2012). Guidance. Assessing the Cumulative Impact of Onshore Wind Energy Developments

- 7.11.2 The IEFs considered within this cumulative assessment are those whose impact was considered to be of a moderate or high magnitude and moderate or high significance following mitigation. However, no species meet these criteria.
- 7.11.3 Nonetheless, all loss of birds will have some minor cumulative effect on the regional population.
- 7.11.4 For instance, as black grouse are decreasing in the region, the potential loss of the lek at Herds Hill may be of significance. Black grouse were recorded on 11 wind farms within the NHZ and within 30km. At these sites a total of nine leks were predicted to potentially be disturbed or displaced (Sanquhar II, Afton, Hare Hill extension, Sandy Knowe, and North Lowther). The cumulative effect is considered to be of **medium magnitude** and **moderate significance**.

7.12 Statement of Significance and Summary

- 7.12.0 The scope of the ornithological assessment was determined through a combination of desk study, fieldwork, consultation, and analysis of data. Fieldwork included a breeding bird survey, vantage point watches, black grouse surveys and raptor survey.
- 7.12.1 It is considered that the development of the wind farm will not have an adverse effect on areas of conservation significance in the surrounding area.
- 7.12.2 If good practice is followed and species protection and mitigation put in place, most negative impacts have been reduced. Overall, it is assessed that the majority of the predicted impacts on birds, with the exception of black grouse, are not significant in terms of the EIA Regulations.



Appendix 7.1 – Survey Staff

Starling Learning is an ecological consultancy, habitat management and environmental education agency. Established in June 1996 and has six full time and several contract staff.

Liz Parsons and Joe Greenlees have worked with the company since 1996, Alan Wood since 1998, Diane Lyons and Davy Galbraith since 2004. The others have worked with the company for at least five years.

Ornithological survey experience includes Common Bird Census, Breeding Bird Survey, vantage point watches for windfarms, Black Grouse survey, Brown and Shepherd survey, raptor surveys, wetland bird surveys and nest searches.

Our clients are wide ranging and include wind farm companies, local authorities, conservation organisations, golf courses and other consultancies. A few examples are shown below:

Community Windpower

Spango 2012, 2013, 2016

Sanquhar, 2011, 2013, 2015, 2016, 2017 to 2018

Scoop Hill 2017 to 2020

Millour Hill, Dalry 2010 to 2011, 2015 to 2016, 2023

Aikengall, Dunbar. Spring 2004 and 2011 and 2013, 2015, 2016, 2018

We have acted as Ecological Clerk of Works at Aikengall I, Sanquhar, Sneddon Law, Dalry and Calder Water wind farms.

Clean Earth Energy

Merkland – 2022 to 2023

South Brownhill – 2022-2023

Low Drumclog – 2021

Rigmuir – 2021

ECoW for Rigmuir -2023

East Dunbartonshire Council

Wide range of ecological surveys including update of LNCSs

North Ayrshire Council

Update of LNCSs

Glasgow City Council

Glasgow Farmland Bird Surveys

NatureScot

Various surveys including Muirkirk and North Lowther Uplands breeding wader survey

AMEC

Dalry by- pass 2011, breeding bird survey

Greengairs Tip, 2012, breeding bird survey

Various windfarm ornithological surveys, 2013

Herds Hill Wind Farm

Survey staff	Occupation	Relevant qualifications and main experience
Liz Parsons	Director of Starling Learning	Has co-ordinated and assisted with many wind farm surveys since 2004. BSc (Hons) Geography/Geology 2.1, Strathclyde University
Alan Wood	Senior Ecologist and Ecological Clerk of Works	Very experienced ornithologist, fieldwork experience includes many surveys for the Scottish Ornithologists Club and British Trust for Ornithology as well as 16 years of experience with Starling Learning
Joe Greenlees	Senior Ecologist and Ecological Clerk of Works, Starling Learning	Has assisted with many wind farm surveys since 2004. Main experience includes ecological survey work of birds, and protected species. HNC Countryside Management, Barony College
David Galbraith	Ecological Surveyor, Starling Learning	Has assisted with many of the bird survey projects listed above. Carries out all habitat surveys for Starling Learning. GIS technician
Diane Lyons	Ecological surveyor, lead field teacher	Has assisted with many of the survey projects listed above. Main experience includes ornithological and mammal survey. BSc Countryside Management, Auchincruive.
Liam Anton	Ecological Surveyor, Starling Learning	Ecological surveyor since 2018
Gerry Devaney	Ecological Surveyor, Starling Learning	Ecological surveyor since 2018

Herds Hill Wind Farm

APPENDIX 7.2 – Dates and Times of Ornithological Surveys and Target C species

VP Data

Date	VP number	Surveyor	No. of hours	start time	Wind speed	Wind direction	Weather and visibility	Target C species
29/09/2022	1	DL	3	08.10	0-1	NE	Cloud 4-6/8, dry, very good	MP, C., S., RN
29/09/2022	1	DL	3	11.40	1	NE		S., MP
29/09/2022	2	JG	3	08.10	0-1	NE	Cloud 4-6/8, dry, very good	MP, WP, C., S., RN
29/09/2022	2	JG	3	11.40	1	NE		S., MP, SC
14/12/2022	1	LA	3	09.00	3-4	NW	Cloud 0, dry, very good	SC, RN
14/12/2022	1	LA	3	12.30	3	NW		MP
14/12/2022	2	GD	3	09.05	3-4	NW	Cloud 0, dry, very good	C.
14/12/2022	2	GD	3	12.30	4	NNW		MP
01/03/2023	1	LA	3	08.05	4	NE	Cloud 7-8, showers, good	MP, S., RN
01/03/2023	1	LA	3	11.35	4	NE		MP, S.
01/03/2023	2	GD	3	08.00	4	NE	Cloud 7-8, showers, good	C.
01/03/2023	2	GD	3	11.30	4	NE		MP, S.
14/04/2023	1	GD	3	13.10	3	SW	Cloud 7-8, showers, good	S., MP, RN
14/04/2023	1	GD	3	16.40	3	SW		MP, S. WP, C, M.
14/04/2023	2	LA	3	13.10	2	SW	Cloud 7-8, showers, good	MP, S., C.
14/04/2023	2	LA	3	16.40	3	SW		S., MP, RN
21/05/2023	1	LA	3	06.30	1	SE	Cloud 8/8, light rain, good	S., MP, C., ST, SL, RN
21/05/2023	1	LA	3	10.10	1	SE		S., MP, M., SL
21/05/2023	2	DL	3	06.25	1	SE	Cloud 8/8, light rain, good	S., ST, C., LB, WP
21/05/2023	2	DL	3	10.00	1	SE		M., WP, C., SL

Herds Hill Wind Farm

All other surveys

Survey type	Survey type and dates	Surveyor
Black Grouse	29 th April 2023	AW
	18 th May 2023	LP
Raptors	18 th March 2023	AW, DG
	14 th May 2023	LP, LA
Breeding Birds <i>Brown and Shepherd</i>	15 th May 2023	LP
	10 th June 2023	AW
Barn Owl nest check	29 th April 2023	AW

Appendix 7.4 – Flights by Target A Species

Target Species	No. on map	Date	VP	Total time recorded (secs)	Within FRZ
Curlew					
1 bird	1	14-April-23	1	60	0
1 bird	2	14-April-23	1	25	25
1 bird	3	11-May-23	1	14	8
2 birds	4	11-May-23	1	28 x 2	15 x 2
1 bird	5	11-May-23	1	32	16
			Total	187	79
Lapwing					
17 birds	1	14-Dec-22	1	36 x 17	17 x 27
5 birds	2	11-May-23	1	90 x 5	70 x 5
			Total	1,062	809
Black Grouse					
2 birds	1	11-May-23	1	30 x 2	0
1 bird	2	11-May-23	1	35	0
			Total	95	0
Whooper Swan					
Six birds	1	14-Dec-22	2	16 x 6	0
			Total	96	0
Pink-footed Goose					
110 birds	1	11-May-23	1	16 x 110	0
			Total	1,760	0

Appendix 7.5 - Flights of Target B (secondary species)

Species	Total flight time	Total within the FRZ
Buzzard		
2 flights	85	40
1 flight	37	15
13 flights	1500	915
7 flights	402	250
1 flight	50	40
5 flights	105	85
2 flights	16	0
1 flight	11	0
1 flight	82	45
2 flights	34	20
Total	2322	1410
Kestrel		
1 flight	135	135
1 flight	93	35
1 flight	28	16
1 flight	34	25
1 flight	18	18
Total	308	229
Herring Gull		
1 flight	21	18
3 flights	45	27
Total	66	45
Lesser Black-backed Gull		
4 flights	64	16
3 flights	44	36
6 flights	60	35
Total	168	87
Raven		
1 flight	11	0
2 flights	13	2
2 flights	8	8
1 flight	12	4
2 flights	28	10
1 flight	14	0
Total	86	24
Cormorant		
1 flight	15	0
Mallard		
1 flight	10	10

Appendix 7.6 – Collision Risk Analysis

Turbine Variables	Details
Hub height	93 m
Depth of blade	3
No. of blades	3
Maximum chord	3.8 m
Pitch (average)	11.5°
Rotor diameter	112 m
Rotation period average	6.87 s
Number of turbines	3

Table 1 - The total area surveyed:

Total area surveyed (ha)	Total airspace visible from vantage points (ha) A
235.5	235.5

Table 2 below summarises the flight activity over the site for species at risk from collision.

Table 2 – Summary of Flight Activity by Target Species at Risk of Collision

Species	Total flight time in FRZ
Lapwing	809
Curlew	79

The following tables describe the calculations for collision risk.

Total observation time was 30 hrs (108,000 seconds).

The proportion of observation time (t) that birds were observed flying at turbine m height was calculated.

The table below shows t= total recorded time/total observation time for each species at each site.

Table 3 – Calculation of t

Species	t
Lapwing	7.49E-03
Curlew	7.31E-04

Flight activity per hectare of visible area, (F) is calculated by t divided by A

Herds Hill Wind Farm

Table 3 – Calculation of F

Species	F
Lapwing	3.18E-05
Curlew	3.11E-06

The flight risk zone (FRZ) was calculated. This was taken as the envelope bounded by the outermost turbines with a buffer applied around the turbine envelope, the total area surveyed, see Table 1. This is the proportion of time that the birds were predicted to spend at turbine height within the wind farm area. Flight activity per hectare of visible area multiplied by the turbine envelope:

Table 4 – Flight Risk Area

Species	FRZ
Lapwing	7.49E-03
Curlew	7.31E-04

The size of the flight risk volume (Vw) was calculated by multiplying the area of the buffer zones of the three turbines, shown in Table 5, by the diameter of the blades 112m.

Table 5 – Calculation of Vw

Area of wind farm (ha)	Area of wind farm m ²	Vw
235.5	2,355,000	263,760,000

The combined volume swept out by the wind farm rotors (Vr) was determined by multiplying the number of turbines by $\pi R^2 \times (d + l)$ where d is the maximum depth of blade from back to front (3 m) and R is the rotor radius of the turbine (56 m) and l is the bird length.

Table 6 – Calculation of Vr

Species	Vr
Lapwing	97485.70
Curlew	104870.98

The occupancy within the flight risk volume n was estimated.

Lapwing breed on site and there are winter flocks present and therefore has the possibility of being present all year (365 days). During this period, they are considered active for 12 hours over the day and night. Lapwing occupancy of the wind farm area over one year is estimated to be 4,380 hours (15,768,000 seconds).

Curlew is a summer visitor. It has the possibility of being present from mid March until the end of August (168 days). During this period, they are estimated to be active 12 hours per day. Curlew occupation of the wind farm in one year was therefore estimated to be 2,016 hours (7,257,600 seconds).

Bird occupancy of the flight risk area is n , occupancy x flight risk area.

Table 7 – Calculation of n.

Species	n
Lapwing	118114.000
Curlew	5308.800

Herds Hill Wind Farm

The bird occupancy of the volume swept by the rotors (b) is then $n \times (V_r/V_w)$.

Table 8 – Calculation of b .

Species	b
Lapwing	4.37E+01
Curlew	2.11E+00

The time taken for a bird to make transit through the rotor and completely clear the rotors (t) is $(d + l)/v$, where d is the depth of the blades, l is the length of the bird and v ms⁻¹ is the speed of the bird through the rotor. Average speeds have been sourced from a variety of sources (Madders and Whitfield, 2006).

Table 9 – Calculation of t

Species	t
Lapwing	0.22
Curlew	0.24

The number of bird transits through the rotors is therefore b/t .

Table 10 – Bird Transits

Species	b/t
Lapwing	1.98E+02
Curlew	8.92E+00

The likelihood of birds flying through the disc swept by the rotor blades and being hit by one of the blades was estimated using the Band Collision Model.

Collision likelihood was calculated for both upwind and downwind situations and the mean of these two values taken. Flapping and not gliding flight was assumed.

Assuming no avoidance by birds, the model predicts the average percentage of birds that will collide each year with the turbines as shown in Table 10.

Table 11 – Percentage of birds estimated to collide with turbines

Species	% collision
Lapwing	5.3%
Curlew	5.9%

The number of collisions per year is calculated by the probability of a collision multiplied by the number of bird transits through the rotors each year.

The table below shows the number of transits through the rotors each year by each species.

Herds Hill Wind Farm

The turbine blades do not turn in very low winds and are shut down in very strong winds. It is predicted that turbines will not turn for approximately 25% of the time. Therefore, the number of flights at risk from collision is reduced.

Table 12 – Bird Transits

Species	No. of transits	At 75% operation
Lapwing	1.05E+01	7.89E+00
Curlew	5.26E-01	3.95E-01

The estimated collision rate does not take account of an avoidance factor by birds, but in practise the proportion of birds taking likely action to avoid collision with blades is very high. Waders are manoeuvrable and agile in flight and the likelihood of any of them flying into a turbine is considered to be fairly low.

The NatureScot precautionary avoidance rates 98% with 2% taking no avoiding action²⁰. The collision risk analysis is summarised in the table below.

Table 13 – Birds per year

Species	Avoidance %	Collision rate	Collision rate 1 bird every (years)
Lapwing	98.00	1.58E-01	6.34
Curlew	98.00	7.89E-03	126.69

Over the duration of the wind farm, 40 years, there is potential for the following collision rates shown below.

Table 14 – Collision risk for the duration of the wind farm

Species	Collision risk over 40 years (number of birds)
Lapwing	6.31
Curlew	0.32

²⁰ Scottish Natural Heritage. Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model

Herds Hill Wind Farm

Lapwing

Calculation of collision risk for bird passing through the rotor

K: [1D or [3D] (0 or 1)		1		Calculation of alpha and p(collision) as a function of radius										
NoBlades		3							Upwind:			Downwind:		
MaxChord	3.8	m	r/R	c/C	α	collide	contribution		collide	contribution				
Pitch (degrees)	11.5		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r			
BirdLength	0.3	m	0.025	0.575	11.71	33.72	0.98	0.00123	32.85	0.96	0.00120			
Wingspan	0.7	m	0.075	0.575	3.90	11.53	0.34	0.00252	10.66	0.31	0.00233			
F: Flapping (0) or gliding (+1)	0		0.125	0.702	2.34	8.29	0.24	0.00302	7.23	0.21	0.00263			
			0.175	0.860	1.67	7.18	0.21	0.00366	5.88	0.17	0.00300			
Bird speed	15	m/sec	0.225	0.994	1.30	6.48	0.19	0.00425	4.98	0.14	0.00326			
RotorDiam	112	m	0.275	0.947	1.06	5.22	0.15	0.00418	3.78	0.11	0.00303			
RotationPeriod	6.87	sec	0.325	0.899	0.90	4.33	0.13	0.00410	2.97	0.09	0.00281			
			0.375	0.851	0.78	3.67	0.11	0.00400	2.38	0.07	0.00260			
			0.425	0.804	0.69	3.15	0.09	0.00390	1.94	0.06	0.00239			
			0.475	0.756	0.62	2.74	0.08	0.00379	1.59	0.05	0.00220			
Bird aspect ratio: b (length/wingspan)	0.43		0.525	0.708	0.56	2.40	0.07	0.00367	1.33	0.04	0.00203			
			0.575	0.660	0.51	2.11	0.06	0.00353	1.11	0.03	0.00186			
			0.625	0.613	0.47	1.86	0.05	0.00339	0.93	0.03	0.00170			
			0.675	0.565	0.43	1.64	0.05	0.00323	0.79	0.02	0.00155			
			0.725	0.517	0.40	1.47	0.04	0.00310	0.69	0.02	0.00145			
			0.775	0.470	0.38	1.32	0.04	0.00297	0.61	0.02	0.00137			
			0.825	0.422	0.35	1.18	0.03	0.00283	0.54	0.02	0.00129			
			0.875	0.374	0.33	1.05	0.03	0.00267	0.48	0.01	0.00123			
			0.925	0.327	0.32	0.93	0.03	0.00251	0.44	0.01	0.00118			
			0.975	0.279	0.30	0.82	0.02	0.00234	0.40	0.01	0.00114			
Overall p(collision) =						Upwind			Downwind					
						6.5%			4.0%					
						Average			5.3%					

Herds Hill Wind Farm

Curlew

Calculation of collision risk for bird passing through the rotor

K: [1D or [3D] (0 or 1)		1		Calculation of alpha and p(collision) as a function of radius									
NoBlades		3							Upwind:		Downwind:		
MaxChord		3.8 m		r/R	c/C	α	collide	contribution		collide	contribution		
Pitch (degrees)		11.5		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r	
BirdLength	0.55	m	0.025	0.575	11.71	36.06	1.00	0.00125		35.19	1.00	0.00125	
Wingspan	0.9	m	0.075	0.575	3.90	12.31	0.36	0.00269		11.44	0.33	0.00250	
F: Flapping (0) or gliding (+1)	0		0.125	0.702	2.34	8.76	0.26	0.00319		7.70	0.22	0.00280	
			0.175	0.860	1.67	7.52	0.22	0.00383		6.21	0.18	0.00317	
Bird speed	15	m/sec	0.225	0.994	1.30	6.74	0.20	0.00442		5.24	0.15	0.00343	
RotorDiam	112	m	0.275	0.947	1.06	5.43	0.16	0.00435		4.00	0.12	0.00320	
RotationPeriod	6.87	sec	0.325	0.899	0.90	4.51	0.13	0.00427		3.15	0.09	0.00298	
			0.375	0.851	0.78	3.82	0.11	0.00417		2.53	0.07	0.00277	
			0.425	0.804	0.69	3.29	0.10	0.00407		2.07	0.06	0.00257	
			0.475	0.756	0.62	2.86	0.08	0.00396		1.72	0.05	0.00238	
Bird aspect ratio: $\frac{\text{length}}{\text{wingspan}}$	0.61		0.525	0.708	0.56	2.56	0.07	0.00391		1.48	0.04	0.00227	
			0.575	0.660	0.51	2.30	0.07	0.00386		1.30	0.04	0.00218	
			0.625	0.613	0.47	2.08	0.06	0.00379		1.15	0.03	0.00210	
			0.675	0.565	0.43	1.89	0.06	0.00372		1.03	0.03	0.00203	
			0.725	0.517	0.40	1.72	0.05	0.00363		0.94	0.03	0.00198	
			0.775	0.470	0.38	1.57	0.05	0.00353		0.86	0.02	0.00193	
			0.825	0.422	0.35	1.43	0.04	0.00343		0.79	0.02	0.00189	
			0.875	0.374	0.33	1.30	0.04	0.00331		0.73	0.02	0.00187	
			0.925	0.327	0.32	1.18	0.03	0.00318		0.69	0.02	0.00185	
			0.975	0.279	0.30	1.07	0.03	0.00305		0.65	0.02	0.00185	
Overall p(collision) =							Upwind	7.2%		Downwind	4.7%		
							Average		5.9%				

Appendix 7.7 – Designated Sites with Ornithological Significance within 20 km of Herd’s Hill

Site Name and Designation	Distance from Site	Reasons for Designation	Potential for Impacts
European Designated Sites			
Muirkirk and North Lowther Uplands SPA	7 km	Aggregations of breeding and wintering upland birds.	No direct habitat connections No potential for impacts.
Airds Moss SAC	16 km	Blanket Bog	No direct habitat connections No potential for impacts.
Merrick Kells SAC	19km	Upland assemblage with blanket bog, breeding bird assemblage, beetle assemblage, <i>Aeschna caerulea</i> , geology	No direct habitat connections No potential for impacts.
National Designated Sites			
North Lowther Uplands SSSI (subsumed within Muirkirk and North Lowther Uplands SAC)	6.5 km	Aggregations of breeding and wintering upland birds.	No direct habitat connections No potential for impacts.
Mennock Water SSSI	10 km	Aggregations of breeding birds.	No direct habitat connections No potential for impacts.
Muirkirk Uplands SSSI	10 km	Aggregations of breeding birds.	No direct habitat connections No potential for impacts.
Bogton Loch SSSI	15.4 km	Open water transition fen and breeding bird assemblage	No direct habitat connections No potential for impacts.
Merrick Kells SSSI	19 km	Upland assemblage with blanket bog, breeding bird assemblage, beetle assemblage, <i>Aeschna caerulea</i> , geology	No direct habitat connections No potential for impacts.

Herds Hill Wind Farm

Appendix 7.8 – Desktop - Bird Records

Bird records within 5km of the proposed development from the Scottish Ornithologists Club, Lorg Wind Farm EIA, Whiteside Hill Wind Farm EIA, Ecological Clerk of Works post by Liz Parsons at Glenglass 2017, bird records during construction of Sanquhar Community Wind Farm, and the Sanquhar II EIA.

Species	Species	Details
Barn Owl	<i>Tyto alba</i>	2011 and 2014 Pair nesting and roosting in barn near Drumbuie
Black Grouse	<i>Tetrao tetrix</i>	2016 Male on track at Glengap 2005 1 male Whiteside Hill 2006 4 males at lek Hare Hill 17/05/2005 1 male, 1 female Whiteside Wind Farm 12/12/2005 1 male, 1 female Whiteside Wind Farm 5 leks at North Lowther Wind Farm Lek at Afton Wind Farm Hare Hill and Hare Hill extension Wind Farms Windy Standard and Windy Standard III Wind Farms Twentyshilling Hill Wind Farm Sunnyside Wind Farm Sandy Knowe Wind Farm Lorg Wind Farm South Kyle Wind Farm
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	20/05/2017 3 pairs nesting in borrow pit at Drumbuie Moorhead
Bullfinch	<i>Pyrrhula pyrrhula</i>	10/12/2017 Three males feeding on heather Hog Hill
Common Gull	<i>Larus canus</i>	24/04/2017 3 pairs nesting in borrow pit Drumbuie Moorhead
Common Sandpiper	<i>Actitis hypoleucos</i>	20/05/2017 nested by Euchar Water
Curlew	<i>Numenius arquata</i>	14/04/2017 two pairs displaying Drumbuie 2011 5 breeding pairs Sanquhar wind farm 2005 pair Whiteside Hill Twentyshilling Hill Wind Farm Sandy Knowe Wind Farm Enoch Hill Wind Farm
Fieldfare	<i>Turdus pilaris</i>	18/10/2017 400 Fieldfares at Glengap Burn culvert NS 703 082 area 02/11/2006 150 Ulzieside
Golden Eagle		Afton Wind Farm – flights recorded Sanquhar II 2017 – flights recorded
Golden Plover	<i>Pluvialis apricaria</i>	15/11/2017 150 birds on Bank Hill 24/01/17 11 birds over Hog Hill 13/03/17 90 Golden Plover over Black Hill, still present 14/04/2017 2006 1 breeding pair Hare Hill 2006 600+ on Hare Hill 2005 pair Whiteside Hill 13/11/2005 43 birds NS 7004 15/11/2005 75 birds NS7004

Herds Hill Wind Farm

Goshawk	<i>Accipiter gentilis</i>	2006 Whiteside Hill Sanquhar I Wind Farm Whiteside Hill Wind Farm Shepherd's Rig Wind Farm North Lowther Wind Farm
Greylag Geese	<i>Anser anser</i>	26/01/2011 45 birds over Lorg Hill 2005 37 birds over Whiteside Hill
Grey Heron	<i>Ardea cinerea</i>	16/11/2017 Euchan Water
Grey Wagtail	<i>Motacilla cinerea</i>	16/11/2017 Euchan Water
Hen Harrier	<i>Circus cyaneus</i>	24/10/2017 male hunting at Glengap Burn at Hog Hill 11/10/10 High Countam 07/08/2005 Foraging, Ulzieside NS 7004 Whiteside Hill Wind Farm Twentyshilling Hill Wind Farm Shepherd's Rig Wind Farm North Lowther Wind Farm
Lapwing	<i>Vanellus vanellus</i>	18/10/2017 45 Lapwing at Herds Hill NS 738 088 2011 2 breeding pairs Drumbuie 12/10/2017 22 Lapwing on Barr Moor NS 753 085 area Twentyshilling Hill Wind Farm North Lowther Wind Farm
Marsh Harrier	<i>Circus aeruginosus</i>	09/08/2005 Ulzieside NS 7004
Meadow Pipit	<i>Anthus pratensis</i>	2011 81 pairs Sanquhar wind farm 26/04/2006 50 at Ulzieside
Merlin	<i>Falco columbarius</i>	04/09/2005 and 06/12/2005 NS 7004 2006 Whiteside Hill Afton wind Farm Windy Standard and Windy Standard II Wind Farms Twentyshilling Hill Wind Farm Shepherd's Rig Wind Farm Enoch Hill Wind Farm North Lowther Wind Farm Penbreck/Carmacoup Wind Farm
Osprey	<i>Pandion haliaetus</i>	09/08/2005 Ulzieside NS 7004 2006 Whiteside Hill
Oystercatcher	<i>Haematopus ostralegus</i>	2017 1 breeding pair at attenuation pond Sanquhar wind farm 2011 1 breeding pair Drumbuie
Peregrine	<i>Falco peregrinus</i>	01/11/10 Lorg House area 06/12/2005 NS 7004 2006 Whiteside Hill Afton Wind Farm Wether Hill extension Twentyshilling Hill Wind Farm Lorg Wind Farm North Lowther Wind Farm Penbreck/Carmacoup Wind Farm
Pink-footed Geese	<i>Anser brachyrhynchus</i>	10/02/2011 flock of 270 over Lorg Hill 2005 42 over Whiteside Hill

Herds Hill Wind Farm

Raven	<i>Corvus corax</i>	20/02/2017 one Raven Black Hill
Red Grouse	<i>Lagopus lagopus</i>	14/122016 1 male near Mid Hill
Redstart	<i>Phoenicurus phoenicurus</i>	10/05/2006 Glenmaddie
Redwing	<i>Turdus iliacus</i>	20/11/2017 85 Euchan Water
Short-eared Owl	<i>Asio flammeus</i>	03/08/2006, 10/10/2006, 03/11/2006 Ulzieside Sanquhar II Afton Wind Farm Twentyshilling Hill Wind Farm Sandy Knowe Wind Farm North Lowther Wind Farm Penbreck/Carmacoup Wind Farm
Skylark	<i>Alauda arvensis</i>	2011 49 breeding pairs Sanquhar wind farm
Snipe	<i>Gallinago gallinago</i>	2011 1 breeding pair Drumbuie Moor 2006 3-4 breeding pairs Hare Hill
Snow Bunting	<i>Plectrophenax nivalis</i>	20/02/17 A Snow Bunting on Mid Hill 09/02/2006 Euchan Forest NS 673 032 25/01/2006 30 at Ulzieside 09/02/2006 32 at Ulzieside
Stonechat	<i>Saxicola torquata</i>	01/06/2006 2 at Ulzieside
Wheatear	<i>Oenanthe oenanthe</i>	24/04/2017 1 male Mid Hill 02/07/2006 8 at Ulzieside
Whinchat	<i>Saxicola rubetra</i>	05/05/2006 Ulzieside
Whooper Swan	<i>Cygnus cygnus</i>	05/11/2010 6 birds over Lorg Hill

Appendix 7.9 – Breeding Birds 2023

In British List Order

Species	Breeding pairs	Description
<i>Black Grouse</i> <i>Tetrao tetrix</i>	1	See Confidential Annex
Lapwing <i>Vanellus vanellus</i>	1	One breeding territory and two more just outside the survey area.
Curlew <i>Numenius arquata</i>	2 - 3	Two to three pairs have their territory within the development area.
Snipe <i>Gallinago gallinago</i>	9	Nine breeding territories in the marshy grassland and blanket bog areas.
Buzzard <i>Buteo buteo</i>	3	Part of one breeding territory within the development area and another two within the 2km survey area.
Barn Owl <i>Tyto alba</i>	1	See Confidential Annex
Kestrel <i>Falco tinnunculus</i>	2	One part territory recorded and another within the 2km survey area.
Merlin <i>Falco columbarius</i>	1	Possibly one breeding territory
Skylark <i>Alauda arvensis</i>	48	The most common species on site with 48 breeding territories recorded.
Wren <i>Troglodytes troglodytes</i>	2	Two Wren territories.
Whinchat <i>Saxicola rubetra</i>	4	Four territories recorded.
Dipper <i>Cinclus cinclus</i>	1	One pair recorded on the March Burn.
Meadow Pipit <i>Anthus pratensis</i>	39	A high breeding density with 39 territories.

Appendix 7.10 – Important Ecological Features

Nature Conservation Value at Herd's Hill	Species	Status	Population/distribution on site
High	Black Grouse	Priority species, UK BAP Red listed Scottish Biodiversity List D & G LBAP	Lek
Medium	Goshawk	Schedule 1	Nests adjacent to site.
Medium	Hen Harrier	Schedule 1 EC Annex 1 Scottish Biodiversity List Red listed D & G LBAP	Desktop records only
Medium	Barn Owl	EC Annex I Scottish Biodiversity List Amber listed D & G LBAP	Nests adjacent to site
Medium	Golden Eagle	Schedule 1 D & G LBAP	Desktop records, foraging occasionally near site
Medium	Curlew	Priority species, UK BAP Red listed D & G LBAP	Breeding in low numbers.
Medium	Lapwing	Priority species, UK BAP Scottish Biodiversity List Red listed D & G LBAP	Winter flocks and one pair nesting
Medium	Snipe	Amber listed	Nesting
Medium	Merlin	Schedule 1 EC Annex 1 Amber listed Scottish Biodiversity List D & G LBAP	Possibly nests on site.
Low	Kestrel	Amber listed Scottish Biodiversity List D & G LBAP	Breeding on site and in surrounding area.
Low	Red Kite	Schedule 1 EC Annex 1 Scottish Biodiversity List Amber listed D & G LBAP	Desktop records of birds foraging in the area
Low	Skylark	UK BAP Scottish Biodiversity List Red-listed D & G LBAP	Common breeding bird

Herds Hill Wind Farm

		Ayrshire LBAP	
Low	Meadow Pipit	Amber listed	Localised breeding territories
Low	Whinchat	Amber listed	Localised, breeding
Very low	Wren	Amber listed	Localised, breeding
Very low	Dipper	Amber listed	Localised, breeding
Negligible	Pink-footed Goose	Amber listed	Only one winter flock recorded flying over survey site.
Negligible	Whooper Swan	Schedule 1 Scottish Biodiversity List Amber listed	Flying over, non breeding
Negligible	Lesser Black-backed Gull	Amber listed	Flying over, non breeding
Negligible	Herring Gull	UK BAP Scottish Biodiversity List Red listed D & G LBAP	Flying over, feeding in fields, non breeding

Appendix 7.11 – Residual Effects

Species	Significance of negative impact without mitigation	Residual significance of impact following mitigation
Black Grouse	<p>If construction is during the breeding season, the impact is considered to be of a medium magnitude, short term and of moderate significance.</p> <p>Collision risk is deemed to be of low magnitude and minor significance.</p> <p>Displacement of lek low magnitude, long term and minor significance.</p>	<p>Construction out with breeding season. Low magnitude, short term and of minor significance for construction.</p> <p>Collision risk of low magnitude and minor significance.</p> <p>Displacement of lek low magnitude, long term and minor significance.</p>
Goshawk	<p>Construction - low magnitude, short term and of no significance</p> <p>Operation - low magnitude, long term and of no significance.</p>	<p>Construction - low magnitude, short term and of no significance</p> <p>Operation - low magnitude, long term and of no significance.</p>
Hen Harrier	<p>Construction - low magnitude, short term and of minor significance.</p> <p>Operation – low magnitude and minor significance for the operation of wind farm.</p>	<p>Construction - low magnitude, short term and of minor significance.</p> <p>Operation – low magnitude and minor significance for the operation of wind farm.</p>
Barn Owl	<p>Both construction and operation considered to be negligible.</p>	<p>Negligible.</p>
Golden Eagle	<p>Both construction and operation considered to be negligible.</p>	<p>Negligible.</p>
Curlew	<p>If construction is during the breeding season, the impact is considered to be of a medium magnitude, short term and of moderate significance.</p> <p>Operation – negligible.</p>	<p>Construction undertaken out with the breeding season, the impact is of low magnitude, short term and of negligible significance.</p> <p>Operation – negligible.</p>
Lapwing	<p>Construction - low magnitude, short term and of minor significance.</p> <p>Operation – collision risk negligible, displacement, low magnitude and of minor significance.</p>	<p>Construction - low magnitude, short term and of minor significance.</p> <p>Operation – collision risk negligible, displacement, low magnitude and of minor significance.</p>
Snipe	<p>If construction is during the breeding season, the impact is considered to be of a medium magnitude, short term and of moderate significance.</p> <p>Operation – negligible.</p>	<p>Construction undertaken out with the breeding season, the impact is of low magnitude, short term and of negligible significance.</p> <p>Operation – negligible.</p>
Merlin	<p>Construction - low magnitude, short term and of minor significance.</p>	<p>Construction - low magnitude, short term and of minor significance.</p>

Herds Hill Wind Farm

	Operation – negligible.	Operation – negligible.
Kestrel	Construction and operation - low magnitude and of minor significance.	Construction and operation - low magnitude and of minor significance.
Red Kite	Construction - low magnitude, short term and of negligible significance. Operation - low magnitude, long term and of minor significance.	Construction - low magnitude, short term and of negligible significance. Operation - low magnitude, long term and of minor significance.
Moorland passerines	Construction – if during the breeding season then the impacts is considered to be medium magnitude, short term and of moderate significance. Operation - negligible	Construction - if out with the breeding season, the impact is of low magnitude, short term and of negligible significance. Operation - negligible

397 Herds Hill

Legend

- Site Boundary
- Wind Turbine (149m to Tip)
- Existing Access Tracks
- Cable Route
- New Access Tracks
- Substation & Control Room
- Temporary Construction Compound
- Existing Borrow Pit
- Breeding Bird Survey and Vantage Point Survey Area
- Black Grouse Survey Area
- Raptor Survey Area

Notes: N/A
 Revisions: N/A
 Layout: 397-220905-9005-C

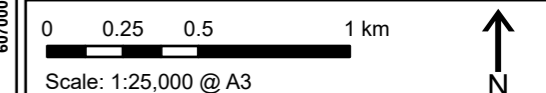
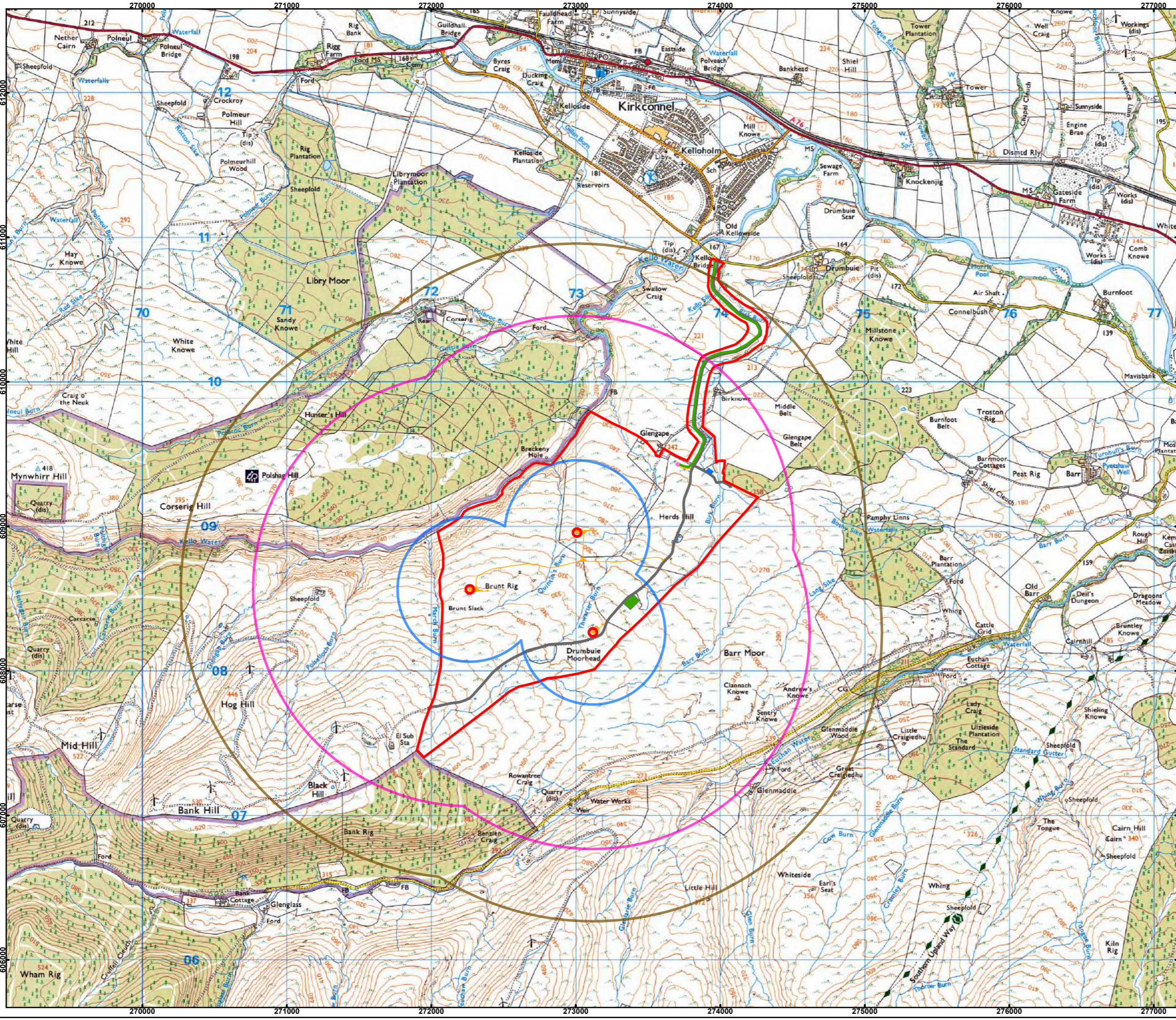


Figure 7.1 - Survey Areas

Date: 21/11/2023 Ref: 397-231010-7086
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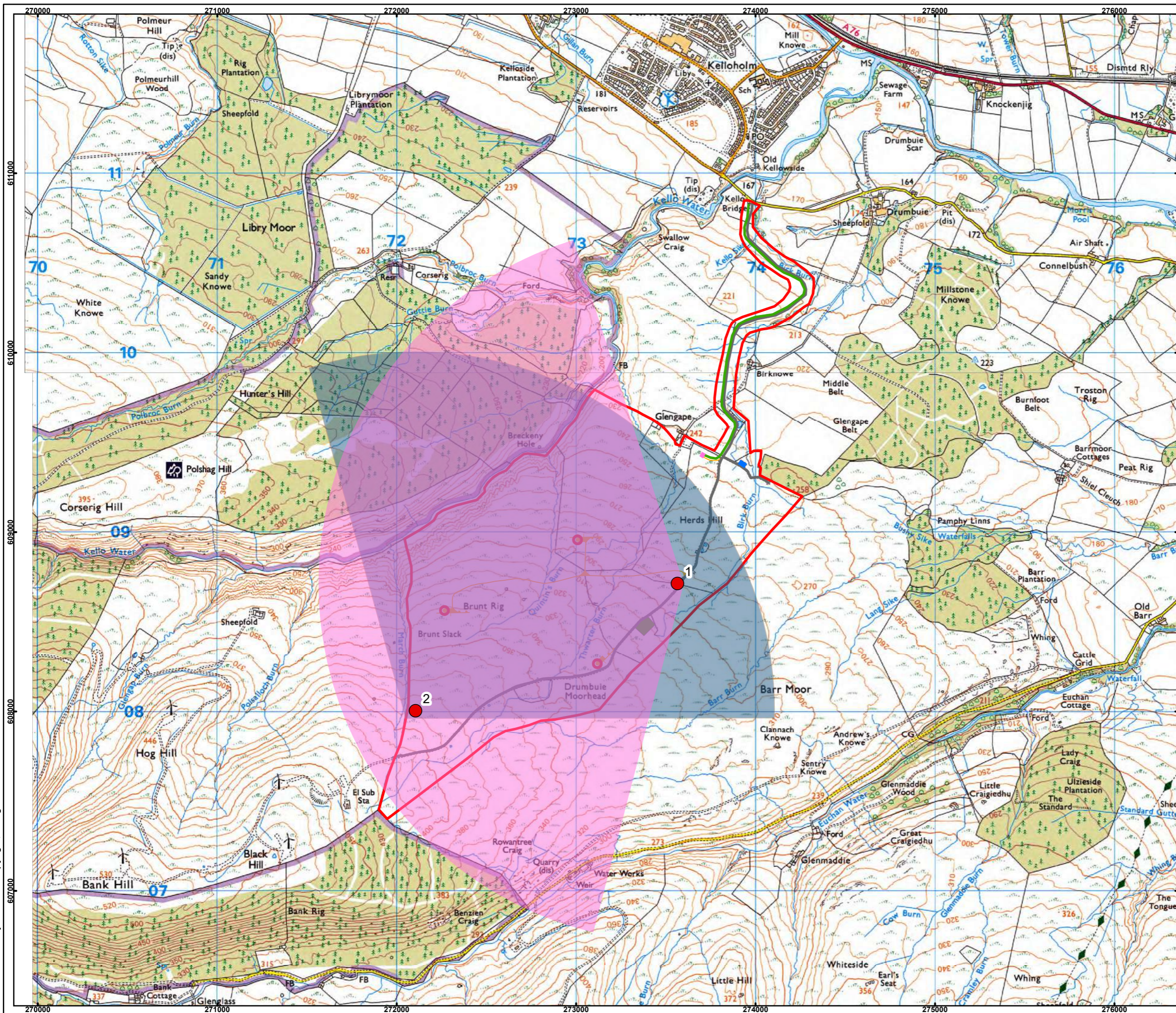


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397 Herds Hill

Legend

- Site Boundary
- Wind Turbine (149m to Tip)
- Existing Access Tracks
- Cable Route
- New Access Tracks
- Substation & Control Room
- Temporary Construction Compound
- Existing Borrow Pit
- Vantage Points
- VP1 Viewshed
- VP2 Viewshed



Notes: N/A
 Revisions: N/A
 Layout: 397-220905-9005-C

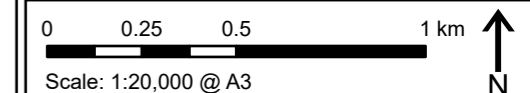


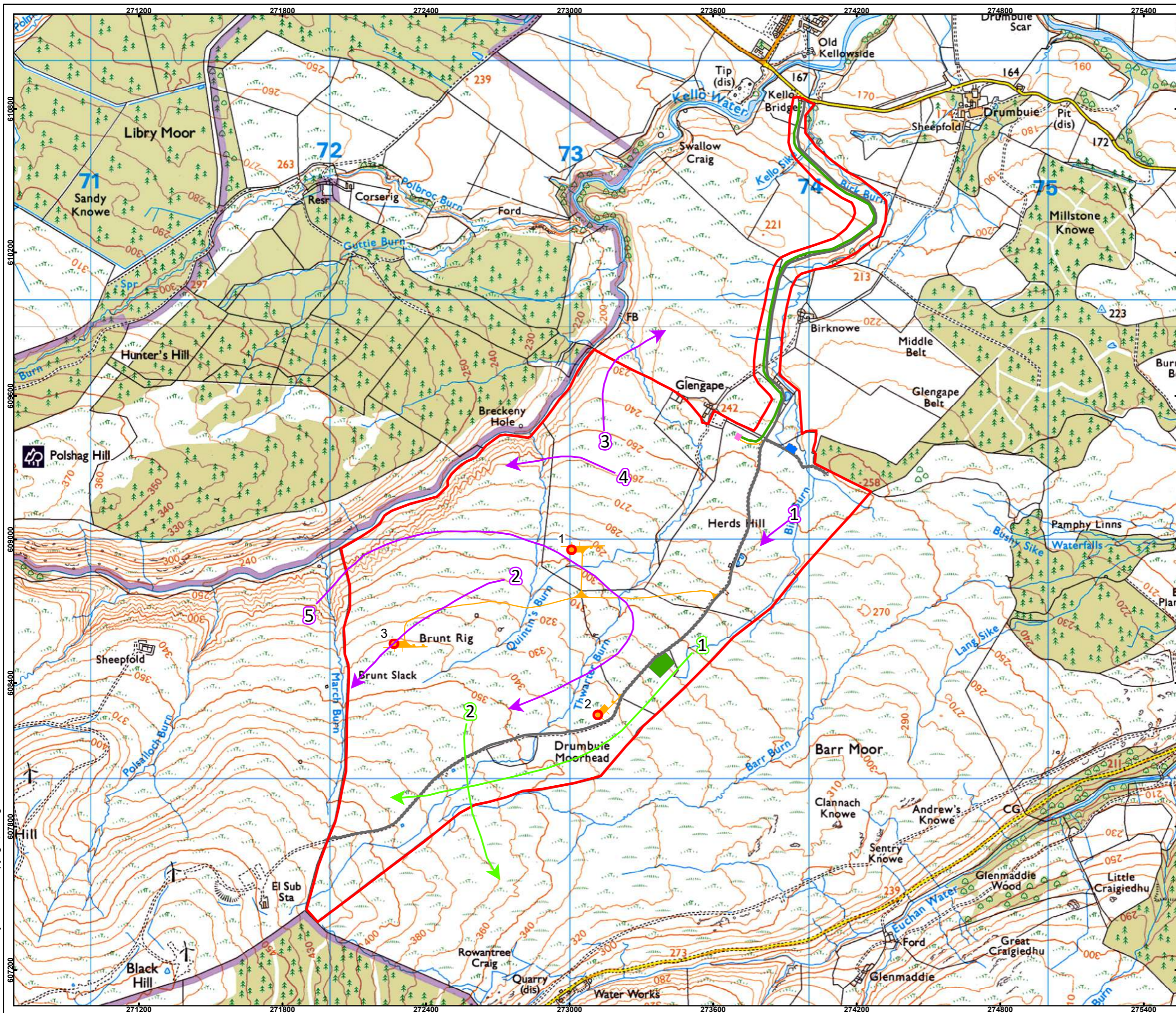
Figure 7.2 - Vantage Points and Viewsheds

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397 Herds Hill

Legend

- Site Boundary
 - Wind Turbine (149m to Tip)
 - Existing Access Tracks
 - Cable Route
 - New Access Tracks
 - Substation & Control Room
 - Temporary Construction Compound
 - Existing Borrow Pit
- Flight Lines
- Curlew
 - Lapwing



Notes: N/A
 Revisions: N/A
 Layout: 397-220905-9005-C

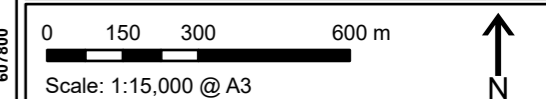


Figure 7.3 - Flights (Curlew and Lapwing)

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 Produced: GW Reviewed: DW Approved: GC

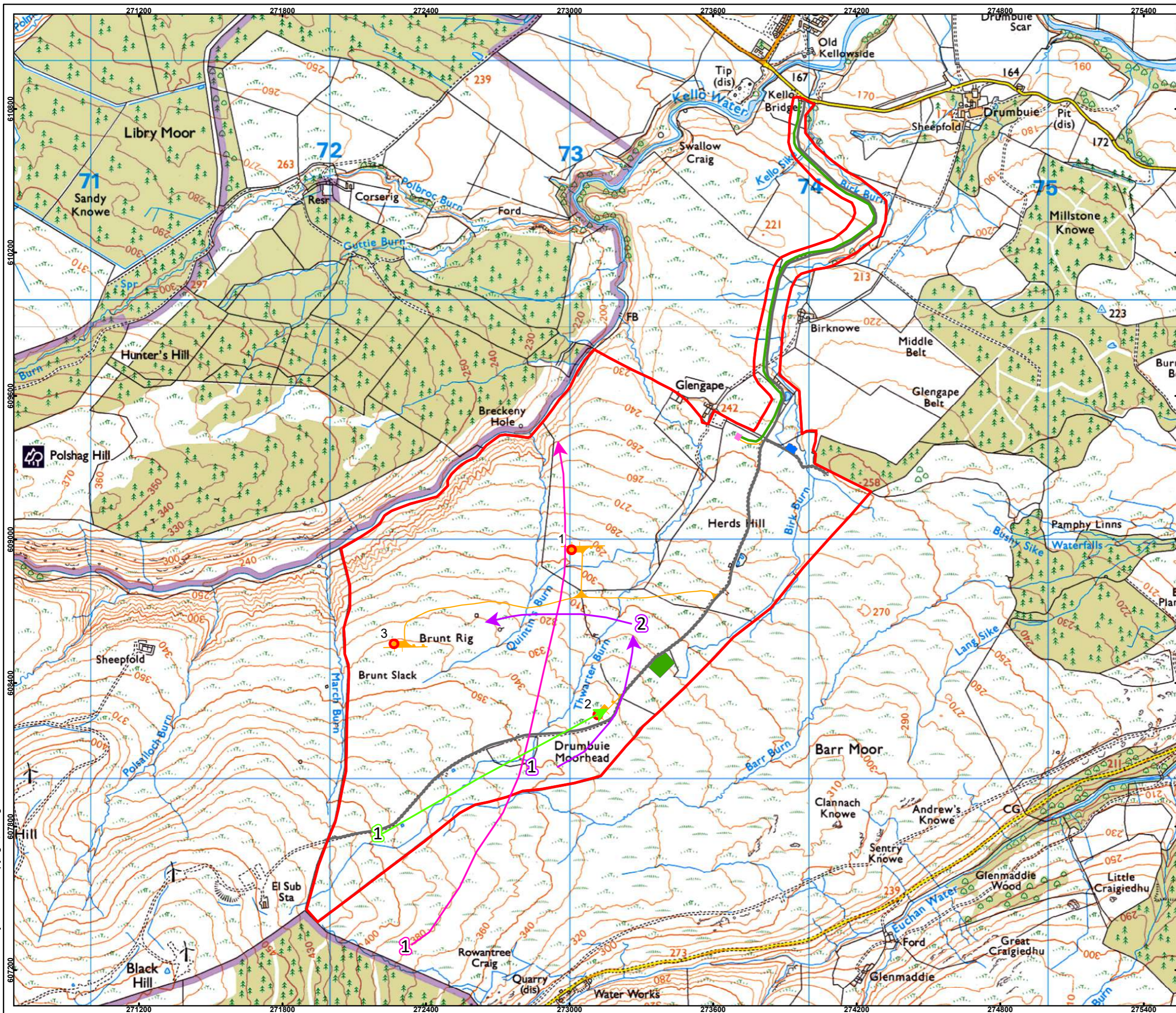
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397 Herds Hill

Legend

- Site Boundary
 - Wind Turbine (149m to Tip)
 - Existing Access Tracks
 - Cable Route
 - New Access Tracks
 - Substation & Control Room
 - Temporary Construction Compound
 - Existing Borrow Pit
- Flight Lines
- Whooper Swan
 - Pink-footed Goose
 - Black Grouse



Notes: N/A
 Revisions: N/A
 Layout: 397-220905-9005-C

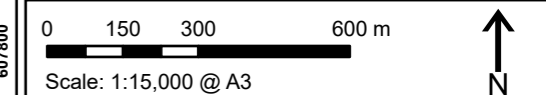


Figure 7.4 - Flights (Whooper Swan, Pink-footed Goose, Black Grouse)

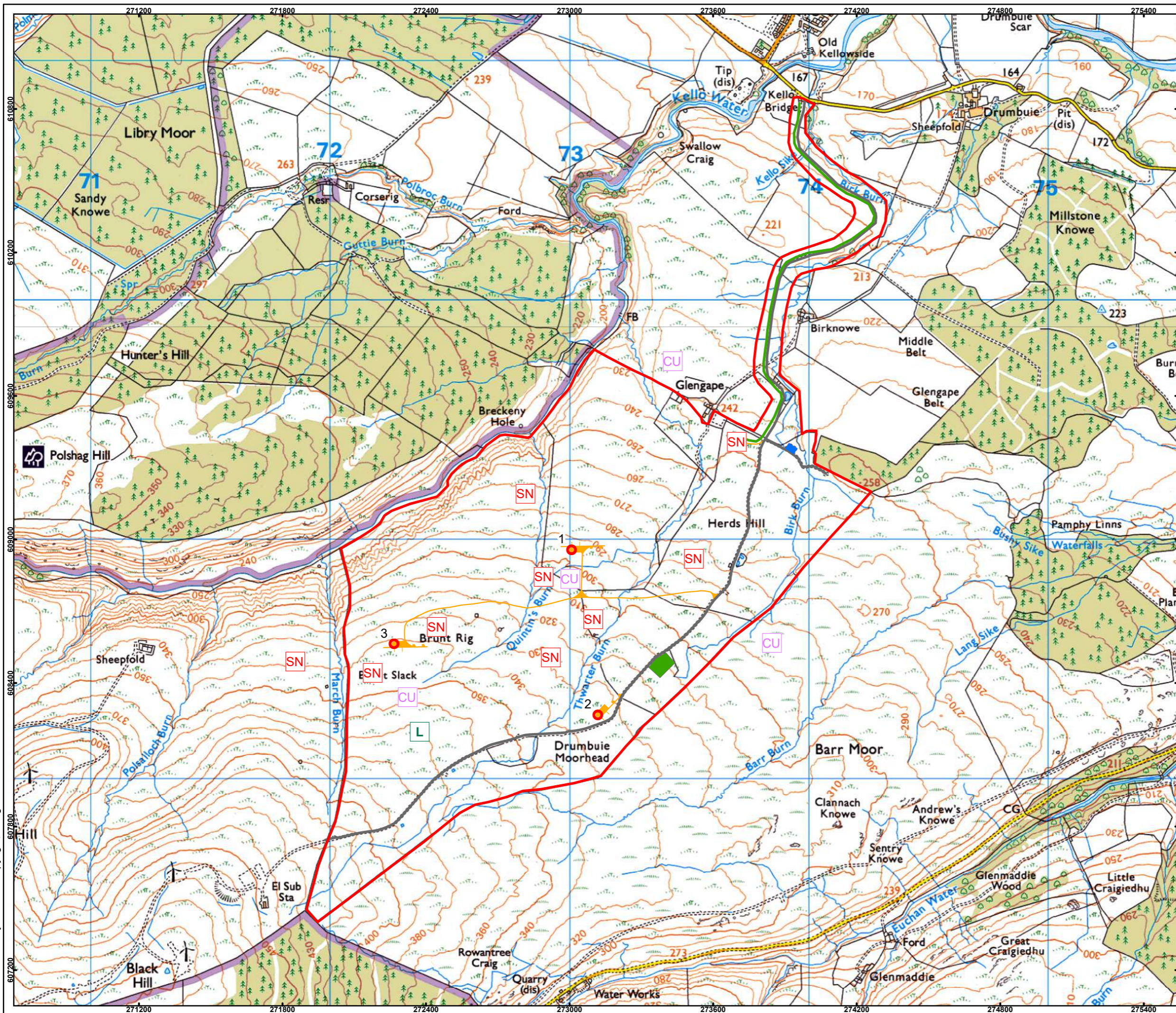
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397 Herds Hill

Legend

- Site Boundary
 - Wind Turbine (149m to Tip)
 - Existing Access Tracks
 - Cable Route
 - New Access Tracks
 - Substation & Control Room
 - Temporary Construction Compound
 - Existing Borrow Pit
- Breeding Waders**
- CU Curlew
 - L Lapwing
 - SN Snipe



Notes: N/A
 Revisions: N/A
 Layout: 397-220905-9005-C

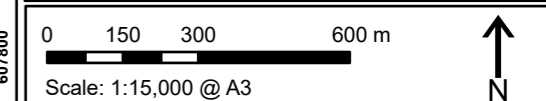


Figure 7.5 - Breeding Waders (Curlew, Lapwing, Snipe)

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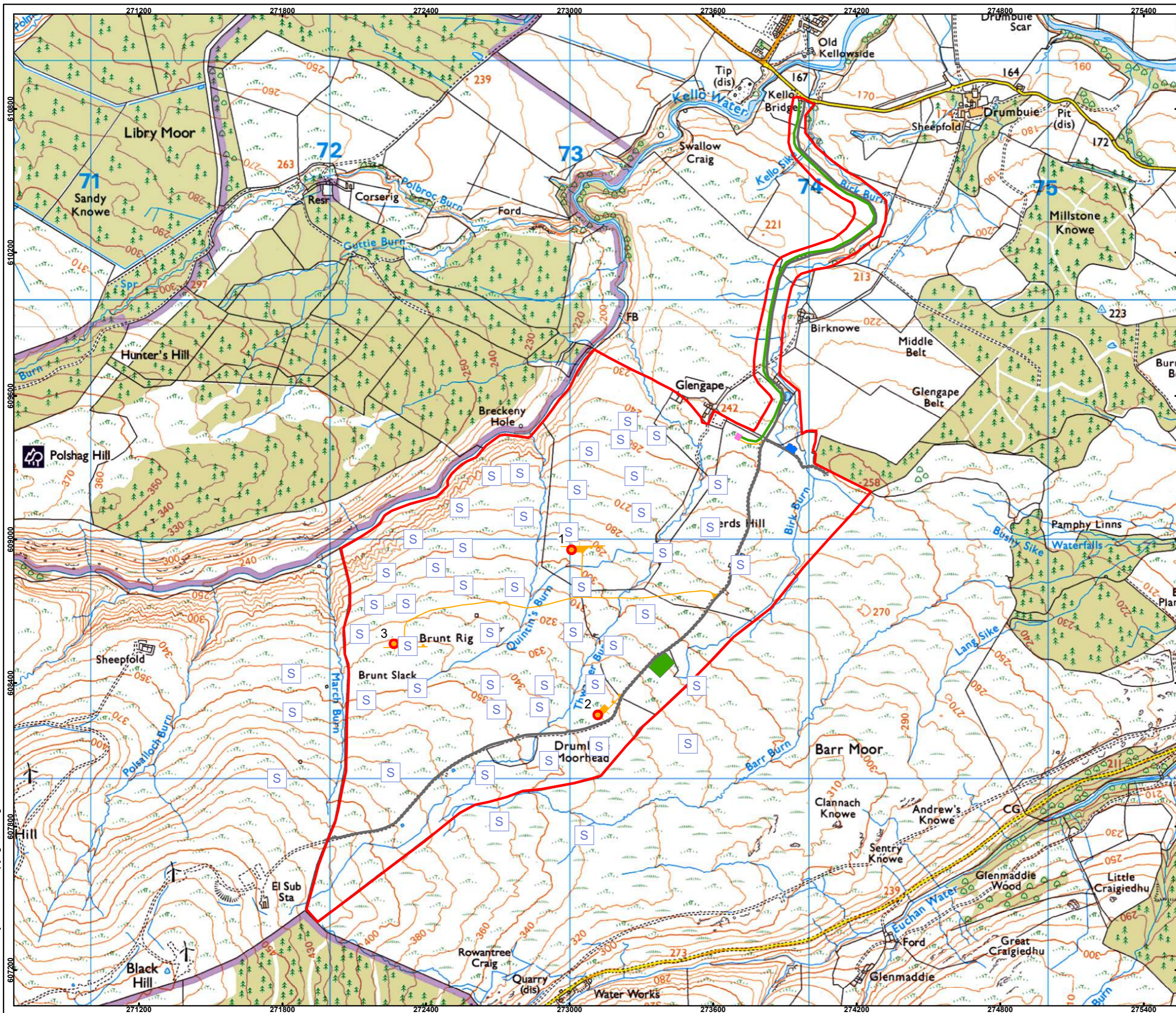
397 Herds Hill

Legend

- Site Boundary
- Wind Turbine (149m to Tip)
- Existing Access Tracks
- Cable Route
- New Access Tracks
- Substation & Control Room
- Temporary Construction Compound
- Existing Borrow Pit

Breeding Birds

- S Skylark



Notes: N/A
 Revisions: N/A
 Layout: 397-220905-9005-C

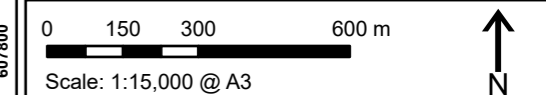


Figure 7.6 - Breeding Birds (Skylark territories)

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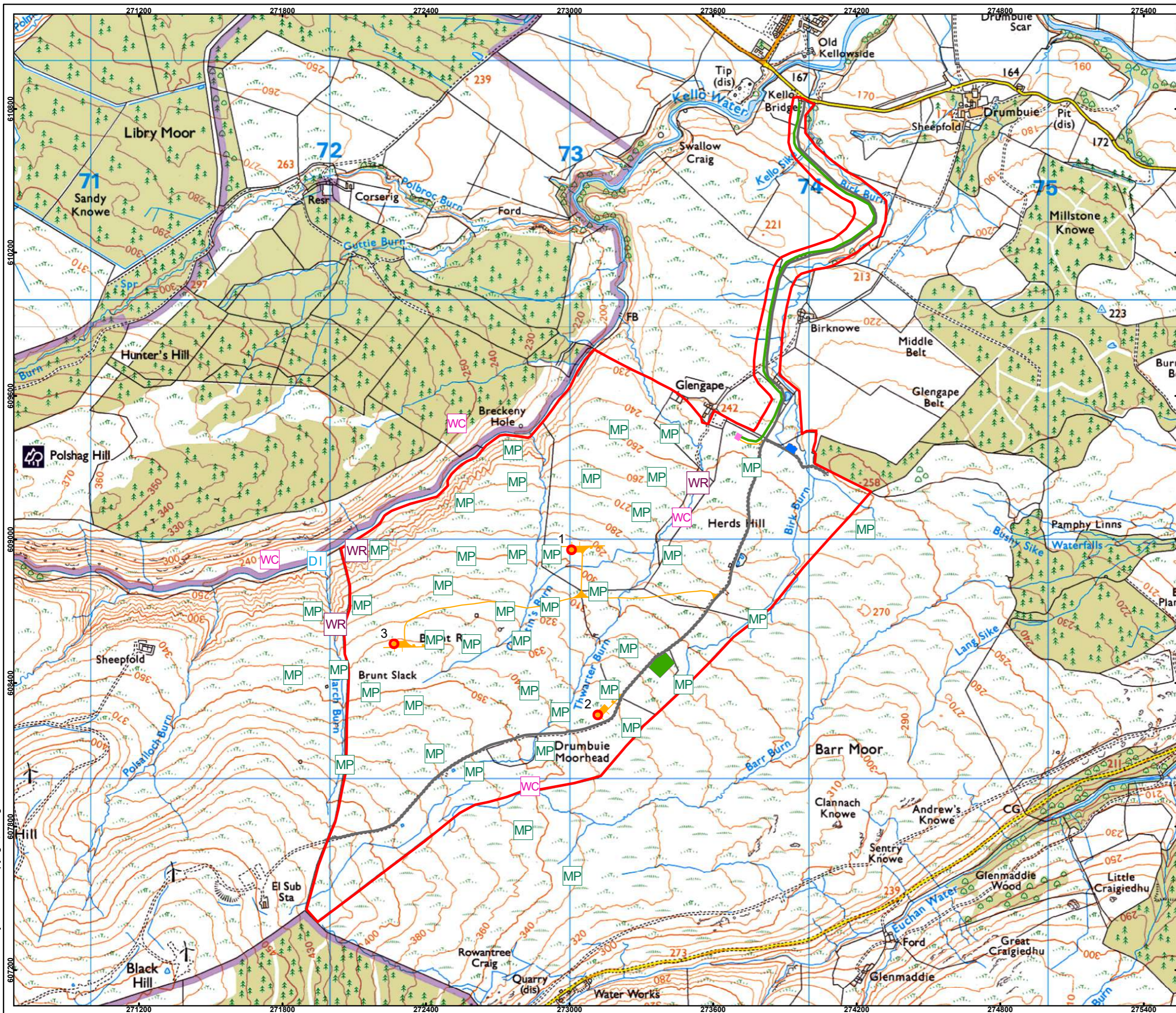
397 Herds Hill

Legend

- Site Boundary
- Wind Turbine (149m to Tip)
- Existing Access Tracks
- Cable Route
- New Access Tracks
- Substation & Control Room
- Temporary Construction Compound
- Existing Borrow Pit

Breeding Birds

- MP Meadow Pipit
- WR Wren
- DI Dipper
- WC Whinchat



Notes: N/A
 Revisions: N/A
 Layout: 397-220905-9005-C

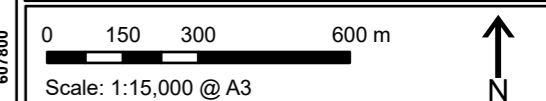


Figure 7.7 – Breeding Birds (Meadow Pipit, Wren, Dipper and Whinchat)

Date: 10/10/2023 Ref: 397-231010-7084
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