

Technical Appendix 6-1

Woolfords Wind Farm

Ecology and Ornithology Appraisal

Wind 2 Ltd

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Contents

6 Ecology and Ornithology	2
6.1 Introduction	2
6.2 Methodology and Approach	2
6.2.1 Legislation, Planning Policy and Guidance	2
6.2.2 Consultation	2
6.3 Assessment Methodology	3
6.4 The Study Area	3
6.4.1 Data analysis	4
6.4.2 Habitat surveys	4
6.4.3 Bats	6
6.4.4 Avian surveys	6
6.5 Significance Criteria	7
6.6 Baseline Conditions	8
6.6.1 Data analysis	8
6.6.2 Extended Phase 1 survey	10
6.6.3 NVC survey	10
6.6.4 Bats	14
6.6.5 Avian surveys	14
6.7 Assessment of Effects and Mitigation	17
6.7.1 Construction	17
6.7.2 Operation	21
6.7.3 Decommissioning	23
6.7.4 Cumulative Effects	23
6.8 Residual Effects and Conclusions	25
6.9 Summary and Statement of Significance	25
6.10 References	25
Annexes	28
Annex A: Habitat Management Plan	28
Annex B: Extended Phase 1 Survey (confidential)	28
Annex C: National Vegetation Classification Survey	28
Annex D: Bat Activity Survey	28
Annex E: Ornithology Surveys	28

Contents

Figures

Figure 6-1	Extended Phase 1 Habitat Survey Results (confidential)
Figure 6-2	NVC Survey Results
Figure 6-3	Static Bat Detector locations
Figure 6-4	VP Viewsheds
Figure 6-5	Survey areas
Figure 6-6	Designated sites within 10km
Figure 6-7a	Vantage Point Activity - Raptors
Figure 6-7b	Vantage Point Activity - Waders
Figure 6-7c	Vantage Point Activity - Other
Figure 6-8	Breeding Bird Territories

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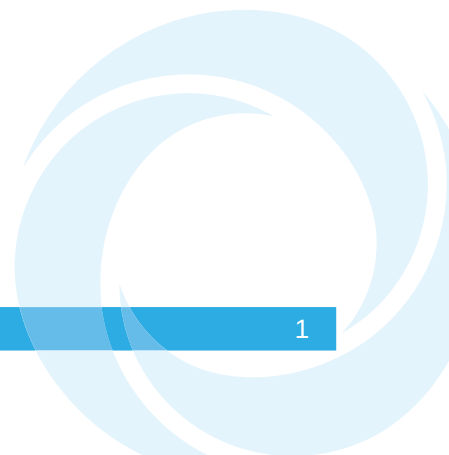
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6 Ecology and Ornithology

6.1 Introduction

This section of the appraisal presents a Technical Appendix which considers the effects of the proposed Woolfords Wind Farm (the Proposed Development) on the ecological and ornithological resources of the Proposed Development and the surrounding Study Area during construction, operation and decommissioning. Cumulative effects are also considered.

The appraisal is based on the description of the Proposed Development which is set out in Section 3 of the Environmental Appraisal (EA).

This report should be read in conjunction with the other sections of the EA and is supported by the following Annexes and Figures:

- Annex A: Habitat Management Plan;
- Annex B; Extended Phase 1 Survey;
- Annex C: National Vegetation Classification Survey;
- Annex D: Bat Activity Survey;
- Annex E: Ornithology Surveys; and
- Figures 6-1 to 6-8.
- Technical Appendix 13-1 CEMP

6.2 Methodology and Approach

6.2.1 Legislation, Planning Policy and Guidance

Section 4 of the EA considers the relevant plans and policies in full. This Technical Appendix takes account of the following specific policy and guidance:

- CIEEM, (2017). Guidelines for Preliminary Ecological Appraisal. December 2017. 2nd ed.
- CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. 2nd edition. CIEEM, Winchester.
- JNCC, (2010). Handbook for Phase 1 habitat survey – a technique for environmental audit, JNCC, Peterborough.
- Scottish Natural Heritage. (2019) Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.
- SEPA (2017) Land Use Planning System SEPA Guidance Note 31. Version 3. 11/09/17.

6.2.2 Consultation

The Screening Opinion (South Lanarkshire Council (SLC), February 2021) notes that the Proposed Development does not constitute an Environmental Impact Assessment (EIA) development as it is:

- Not of a scale that has the potential to have a significant environmental impact on the local area;
- Not within an area designated for its environmental sensitivity; and

- Not of a scale to have a wider significant environmental impact within the landscape.

The Screening Opinion notes that, whilst not being considered to constitute EIA development, any subsequent planning application should still be accompanied by a full suite of environmental assessments and reports including:

- Ecological and Ornithological Assessment; and
- Cumulative Impact.

These aspects have been considered as part of this appraisal.

No further consultation has been undertaken on the basis of the Screening Opinion and consideration of Key Planning and South Lanarkshire Development Plan Policies.

6.3 Assessment Methodology

The Ecological and Ornithological Assessment is based on the following field and desk studies, which are included in full as Annexes:

- Extended Phase 1 survey – infrastructure plus 250m where access was available;
- Data analysis of desk study data from two Local Environment Record Centres (the Proposed Development is located within two LERC areas);
- National Vegetation Classification and Groundwater Dependant Terrestrial Ecosystem survey (herein known as NVC survey);
- Bat activity surveys in line with NatureScot guidance including three seasons of static survey;
- Twelve months of vantage point surveys from one vantage point;
- Collision risk modelling from VP survey data;
- Breeding wader survey within the Proposed Development area; and
- Breeding raptor survey up to 1km from the Proposed Development area, where access was available.

Field work was carried out in suitable conditions between September 2020 and August 2021 and included visits to the Proposed Development site and suitable buffer within the wider the Study Area.

The key objective of field and data analysis is to identify those receptors liable to potential significant effects as a result of the Proposed Development.

6.4 The Study Area

The Survey Area comprises the Proposed Development plus a 250m buffer, however, no access was available on the ground outwith the wider site boundary for the Extended Phase 1 and NVC/GWDTE surveys. These areas are shown as un-surveyed land within the 250m buffer of the Proposed Development (i.e., infrastructure footprint) on Figure 6-1 and most were within commercial coniferous plantation. Observations of bird activity in the air above these areas was possible. The majority of the 250m buffer falls within the wider site boundary and was fully surveyed.

6.4.1 Data analysis

A review of online data¹ was undertaken in August 2021 to gather details of statutory nature conservation designations up to 20km of the site, e.g., Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar sites, Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs) and Local Nature Reserves (LNRs).

As the Proposed Development is within an area covered by two LERCs both the Glasgow Museums Biological Records Centre (GMBRC) and the Wildlife Information Centre (TWIC) were contacted for the following information from the centre of the Proposed Development²;

- Non-statutory designated sites up to 3km;
- Protected species records/records of high conservation significance (Scottish Biodiversity List, Schedule species from the Wildlife and Countryside Act 1981, local Biodiversity Action Plan species for up to 3 km from the centre of the Proposed Development); and
- Records of mobile species (bats and birds) up to 10km.

6.4.2 Habitat surveys

An extended phase 1 habitat survey was carried out on 13th July 2021. The survey covered the Proposed Development area plus a 250m buffer where this was achievable within the wider site boundary. Following the extended phase 1 survey, an NVC botanical survey was undertaken over 4 days in September 2021. The NVC survey targeted habitats within the Proposed Development area to include a 250m buffer from infrastructure (again, where this was achievable within the accessible land area).

The full results of the Extended phase 1 survey are presented in Annex B of this report, with the NVC presented in Annex C. and should be read in conjunction with this report

Limitations

It is noted that following the extended phase 1 survey the Proposed Development layout was revised and the access track shifted south to avoid other technical constraints (See Section 3.3, Design Evolution of the EA). As a consequence, in places, the full 250m buffer is not retained in the NVC survey.

In our expert judgement, it is considered that due to our understanding of the Site additional survey data would not change the conclusions of our findings in this or the Hydrology and Hydrogeology appraisal. The data gathered was extrapolated in places to complete the habitat/GWDTE appraisal and conclusions set out in this Report (and the Hydrology and Hydrogeology Report Technical Appendix 10-1 – herein known as the Hydrology TA).

¹ Using the MAGIC website (www.Magic.gov.uk) which provides authoritative geographic information about the natural environment from across government (accessed 28/09/20).

² NS 99756 57606.

Extended Phase 1 survey

The survey involved mapping areas of habitat greater than 0.1ha and listing target notes to describe notable features. These included features with the potential to support protected or otherwise notable species that may require further survey.

The 250m buffer was used to comply with Scottish Environment Protection Agency (SEPA) requirements where this is maximum distance at which GWDTEs could be affected by excavations greater than 1m depth such as for turbines or borrow pits. This information would then indicate areas for detailed NVC/GWDTE survey.

As noted above, please refer to Annex B of this report for full details.

NVC/GWDTE survey

The survey was carried in accordance with the standard methodology published in the National Vegetation Users Handbook (JNCC, 2006). The habitats present were classified to an NVC community by recording the presence and abundance (using the Domin scale) of each species in a quadrat of 2 x 2m and reference to British Plant Communities Vols 2 (Rodwell 1988 a), 3 (Rodwell 1998 b).

As part of the NVC survey any wetland habitats were evaluated in terms of their potential to be groundwater dependent terrestrial ecosystems (GWDTEs) and with reference to SEPA Land Use Planning Guidance (2017) they were assigned a high (likely to be highly groundwater dependent) or moderate (likely to be moderately groundwater dependent) dependency.

Due to the small scale of some habitats and areas where one habitat transitioned into another similar habitat, many of the mapped areas represent complex mosaics of two or more NVC communities. Second and third communities, such as M18, M19, S10 and U6 were not mapped (Figure 6.2) as they form very small percentages within mosaics of dominant habitats (e.g., M17, S9 and U5). Hence when determining whether a particular habitat was potentially groundwater dependent within the context of Land Use Planning System SEPA Guidance Note 31, the composition of the mosaic was taken into account, as outlined in Table 6.1 and seen in Figure 6-2.

Table 6-1: GWDTE Scoring System

Potential GWDTE Score 5 = Highest 0 = Lowest	Habitat attributes (adapted from Table 2 of SEPA Land Use Planning System SEPA Guidance Note 4, 2012)
5	All NVC communities present (regardless of number) are listed as being of HIGH potential dependence on groundwater.
4	NVC community/mosaic with dominant community listed as of HIGH potential dependence on groundwater with one or more communities of lesser dependence.
3	NVC community/mosaic with a sub-dominant community listed as of HIGH potential dependence on groundwater with the dominant community listed as lesser dependence.
2	NVC community/mosaic with dominant community listed as of MODERATE potential dependence on groundwater with other communities present of lesser dependence.
1	NVC community/mosaic with sub dominant community listed as MODERATE and dominant community not listed as potentially dependent on groundwater.
0	NVC community/mosaic supports no communities with potential dependence on

Potential GWDTE Score	Habitat attributes
5 = Highest	(adapted from Table 2 of SEPA Land Use Planning System
0 = Lowest	SEPA Guidance Note 4, 2012)
	groundwater.

To confirm whether any identified communities were likely to be groundwater dependent, an evaluation was carried out. In the first instance, this involved identifying whether there was an obvious groundwater feature (i.e., a spring head). If this was not apparent, plant species that required base-rich conditions were checked for. If these were located, further investigations took place to check whether the community was associated with an obvious rain-fed surface water feature.

As noted above, please refer to Annex C of this report for full details.

6.4.3 Bats

Three static bat detectors were deployed at three locations over three visits May, June and July as per SNH (2019) onshore wind farm guidance (Figure 6.3). Full spectrum bat detectors (Wildlife Acoustics Song Meter Mini Bats) were used. The detectors are set up to record activity from 30 minutes before sunset to 30 minutes after sunrise for a period of at least 10 nights. The detectors were deployed in areas close to the proposed turbine locations.

Analysis of full spectrum WAV files was undertaken using AnalookW v4.4a. All files were analysed with the assistance of bespoke species filters (using zero cross outputs). Sonogram data for each detector location during each of the survey sessions was organised and used for analysis of activity levels across static detector locations and across survey periods. In addition, the data was also organised into the required format to upload for additional analysis within the secure online tool Ecobat (<http://www.ecobat.org.uk/>).

Please refer to Annex D of this report and Figure 6-3 for full details.

6.4.4 Avian surveys

Standard VP methodology was used as per SNH guidance (SNH, 2013, revised 2017) based on one VP location as shown in Figure 6-4. This guidance has subsequently been re-issued, but it was the 2014 version which was extant at the time surveys commenced. The surveys were undertaken between September 2020 and August 2021.

Breeding bird surveys were carried out using a modified Brown and Shepherd methodology, following the modifications suggested in SNH 2017.

In 2021, five surveys were carried out at approximately monthly intervals between April – August, with all areas of the site approached to a distance of approximately 100m. All areas of the site were covered and land within a 500m buffer where access was available (Figure 6-8). Where full access was not available, public access was used where possible and watches were carried out from the nearest accessible land. All birds seen or heard were recorded using BTO codes on dedicated survey maps.

Breeding raptor surveys were carried during four surveys between April – August 2021. These used a walkover methodology for areas with access, where all parts of the site were approached to a distance of approximately 250m. Where areas in the 2km buffer

did not have access permission, public access was used to gain some access, with mini-VPs used looking over areas with no access to attempt to detect breeding raptors.

Please refer to Annex E of this report and Figures 6-4–6-8 for full details.

6.5 Significance Criteria

Guidelines for Extended Phase 1 survey do not contain significance criteria as noted in CIEEM (2017).

A PEA is normally used to inform an Ecological Impact Assessment (EcIA). In the context of these guidelines, EcIA is defined as the process of identifying, quantifying, and evaluating the potential effects of development-related or other proposed actions on habitats, species and ecosystems. These guidelines should be read in conjunction with CIEEM's Guidelines for Ecological Impact Assessment in the UK and Ireland.

(A PEA is generally synonymous with the Extended Phase 1 methodology and EcIA with EA).

Similarly, Guidance related to NVC and GWDTE survey does not set out significance criteria. Value is however defined as by the level of potential dependence on groundwater and whether habitats correspond with Annex 1 and UK Biodiversity Action Plan criteria.

Annex 1 habitats comprise a list of habitats afforded special protection under the European Union Council Directive 92/43/EEC otherwise known as the 'Habitats Directive'.

In relation to bats, the Ecobat analysis tool enables comparisons to be made in a spatial context allowing a geographically relevant assessment of activity levels. It should be noted that there is no function within Ecobat to know what volume of data is being used for geographic comparisons and as the system is in its infancy, interpreting comparative measures, especially within the remote Scottish uplands will require caution.

For Golden plover and Curlew, a collision risk model was run following the guidance provided by SNH (SNH 2000). The model adopted for all species was a random collision risk model because the flight activity for none of these species fulfilled the criteria for which a linear movements model is specified. The total number of seconds for which species were within the 'at risk' height was multiplied by the number of birds within each flight. An occupancy rate was calculated for the vantage point, defined as the observed 'at risk' activity levels divided by the observation time and area observed to give the occupancy per unit of time and area for the vantage point. This occupancy rate was applied to the wind farm based on the site area, risk volume and turbine rotor volumes and an estimate of flight activity time based on an algorithm for calculating day length. The model was run with relevant turbine and ornithological parameters to estimate the probability of transits resulting in a collision assuming no avoidance action. The number of transits for each species was multiplied by the collision rate, including avoidance factors and operational parameters for the proposed wind farm.

Whilst SLC's Screening Opinion advised that a formal EIA is not required, the terminology 'significant' and 'not significant' will still be used to identify and quantify effects. Although they will be not used in relation to the EIA Regulations.

6.6 Baseline Conditions

6.6.1 Data analysis

Statutory Designated Nature Conservation Sites

A review of statutory designated sites was undertaken within 10km and out to 20km for goose interests. The results of this are shown in Table 6-2; included are biological Sites of Special Interest (SSSIs) to 5km, or to 10km with ornithological interest. Special Areas of Conservation (SACs) are also included to 5km. Distances are from the closest part of the Proposed Development to the designated site.

Table 6-2: Designated Sites

Site name	Designated features	Distance from Proposed Development
Cobbinshaw Reservoir SSSI	Open water transition fen	0.7km east
Cobbinshaw Moss SSSI	Intermediate blanket bog	1.6km east
Skolie Burn SSSI	Lowland neutral grassland	4km north
Hermard Birchwood SSSI	Upland birch woodland	4km northeast
Braehead Moss SAC/SSSI	Primary – Annex 1 habitat (Active Raised bog)	4.7km southwest
Westwater SPA/Ramsar/SSSI	Migratory Pink-footed goose	11.6km east

Non-Statutory Designated Nature Conservation Sites

A review of non statutory designated sites was undertaken within 3km from data received from each of the two LERCs. Sites include Local Biodiversity Sites (LBS) and potential Local Biodiversity Sites (pLBS). Distances are from the closest part of the Proposed Development to the non-statutory designated sites.

Table 6-3: Non Statutory Designated Sites

Site name	Designated features	Distance from Proposed Development
Harwood Water pLBS	No information provided	0.12 km north
Cobbinshaw Reservoir LBS	Open water transition fen	0.7km east

Species Records

Table 6-4 comprises European protected species and species of conservation interest within 3km of the centre of the site and up to 10km for bat species from the last ten years. Species of conservation interest is defined as on either the Scottish Biodiversity List and/or the UK BAP. Distances are approximate, and each species may be associated with multiple records within the data as provided by the LERC.

Some locations were provided by the LERCs as 1km or 2km square references and many were site centroids or estimated. Therefore, they may not be the exact location where the species was observed.

Table 6-4: TWIC and GMBRC records from the last ten years within 3km of the Proposed Development and up to 10km for bat species

Species	Summary of records
TWIC	
Brown trout <i>Salmo trutta subsp. fario</i>	Cobbinshaw, 0.9km from Proposed Development, 2019.
Starling <i>Sturnus vulgaris</i>	Throughout Search area
Reed bunting <i>Emberiza schoeniclus</i>	Throughout Search and Proposed Development area
Bullfinch <i>Pyrrhula pyrrhula</i>	Throughout Search and Proposed Development area
Lapwing <i>Vanellus vanellus</i>	Near Cobbinshaw Reservoir
Yellowhammer <i>Emberiza citrinella</i>	Throughout Search and Proposed Development area
Crossbill <i>Loxia scotica</i>	To west of Proposed Development area in woodland
Siskin <i>Carduelis spinus</i>	Occasional records in Search area
Pipistrelle Bat species <i>Pipistrellus</i> sp.	Livingston, 9km from Proposed Development, 2013
Soprano Pipistrelle <i>Pipistrellus pygmaeus</i>	Near West Calder, 5km from Proposed Development, 2019
Myotis Bat species <i>Myotis</i> sp.	Longridge, 5km from Proposed Development, 2019
Water vole <i>Arvicola amphibius</i>	South Cobbinshaw, 0.7km from Proposed Development, 2015
GMBC	
Skylark	Tarbrax, 2km from Proposed Development, 2019-20
Brambling*	Location confidential. Outwith Proposed Development area, 2013-14.
Linnet	Tarbrax, 2km from Proposed Development, 2019
Grasshopper warbler	Hardgatehead, 2.4km from Proposed Development, 2021
Herring gull	Easterhouse/Loanhead & Maiden Hill (S of), 2.8km from Proposed Development, 2019-20
Curlew	Easterhouse/Loanhead & Maiden Hill (S of), 2.8km from Proposed Development, 2019-20
Golden plover	Maiden Hill (S of), 2.8km from Proposed Development, 2020
Starling	Easterhouse/Loanhead & Maiden Hill (S of), 2.8km from Proposed Development, 2019-20
Redwing*	3 records, closest approximately 6.5km from Proposed Development area
Fieldfare*	4 records, closest approximately 6.5km from Proposed Development area
* Listed as breeding	

It is noted that bullfinch, starling, and reed bunting were present throughout the Proposed Development area. The rest of the records for both bats and birds do not

necessarily indicate that these species are using the site given the distance of these records from the Proposed development.

Whilst records for redwing and fieldfare are listed as 'breeding' in the raw data the same records list them as 'passage migrant, winter visitor'. As such it is likely both species were observed migrating during the breeding season (either early or late) rather than actual breeding records having been observed. In addition, the distance from the Proposed Development, plus the lack of suitable nesting habitat, removes the possibility of effects on breeding redwing and fieldfare.

The proximity of water vole is noted in the desk top records.

6.6.2 Extended Phase 1 survey

Information on habitats from this survey is not included here as it is superseded by the NVC/GWDTE survey. To view the Extended Phase 1 information in full, please see Annex B and Figure 6-1.

No potential bat roost features were observed on any trees within the copses in the Survey Area. The mature trees were primarily Scot's pine, and no obvious fissures/cracks were visible from the ground. All broad-leaved trees were either semi-mature or species with small growth forms (due to the proximity of the mature Scot's pine and wind exposure) and lacked obvious bat roost potential.

No signs of water vole, or other non-avian protected species were seen during the survey.

6.6.3 NVC survey

As shown in Figure 6-2, the Survey Area was dominated by areas of blanket bog (M17a) which were found on the flatter higher ground to the north and west. These were surrounded by the M25a Molinia mire communities with the sloping ground to the south dominated by grasslands (U5a, MG6a, MG10a) and other mire (M23a, M23b and M25a) communities. M18, M19, S10 and U6 were seen as 2nd or 3rd communities within mosaics and are not shown on Figure 6-2 as they do not comprise another sub-community type (e.g., M17a). As such, they are classed as distinct NVC types. The NVC communities present within the Survey Area are summarised in Table 6-5 below.

Table 6-5 NVC communities within the Survey Area (Proposed Development + 250m), their associated conservation designations and potential GWDTE status

NVC Code	NVC Community/Sub-community	Annex 1 habitat	UK BAP Priority habitat	Potential GWDTE
M6d	<i>Carex ecinata</i> – <i>Sphagnum recurvum</i> mire	None	Upland flushes, fen and swamp	High
M15d	<i>Scirpus cespitosus</i> – <i>Erica tetralix</i> wet heath	H4010 Northern Atlantic wet heaths with <i>Erica tetralix</i> H7130 Blanket bog, where peat depth is > 0.5m	Upland heathland Blanket bog if peat depth >0.5m	Moderate
M17a	<i>Scirpus cespitosus</i> – <i>Eriophorum vaginatum</i> blanket mire	H7130 Blanket bog	Blanket bog	None

NVC Code	NVC Community/Sub-community	Annex 1 habitat	UK BAP Priority habitat	Potential GWDTE
M18	<i>Erica tetralix</i> – <i>Sphagnum papillosum</i> raised and blanket mire	H7130 Blanket bog	Blanket bog	None
M19	<i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire	H7130 Blanket bog	Blanket bog	None
M23a M23b	<i>Juncus effusus/acutiflorus</i> – <i>Galium palustre</i> rush-pasture	None	Upland flushes, fen and swamp in M23a Purple moor-grass and rush pasture in M23b	High
M25a	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	H7130 Blanket bog, where peat depth is > 0.5m	Purple moor-grass and rush pasture	Moderate
MG6a	<i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland	None	None	High
MG10a	<i>Holcus lanatus</i> – <i>Juncus effusus</i> unimproved neutral grassland	None	None	Moderate
S9a	<i>Carex rostrata</i> swamp	None	Upland flushes, fen and swamp	None
S10	<i>Equisetum fluviatile</i> swamp	None	Upland flushes, fen and swamp	None
U5a	<i>Nardus stricta</i> – <i>Galium saxatile</i> grassland	None	None	None
U6	<i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland	None	None	Moderate

Blanket bog

Three blanket bog communities were found within the Survey Area; M17a, M18 and M19, all three of these communities are both Annex 1 and UK BAP priority habitats.

Large areas of the M17a blanket bog were found along the northern boundary of the Survey Area where the ground was flatter. The M18 and M19 communities were found in small areas as part of the mosaics of the M17a blanket bog and other mire communities

The M17 community was dominated by deergrass *Trichophorum cespitosum* and hare's-tail cottongrass *Eriophorum vaginatum*. In the flatter plateaus, which were wetter, more bog asphodel *Narthecium ossifragum* could be seen, along with a greater variety of Sphagnum mosses such as *Sphagnum papillosum* and *Sphagnum palustre*. In the drier areas to the south-west the bog was richer in dwarf shrubs such as heather *Calluna vulgaris* and crowberry *Empetrum nigrum* with an understory of *Sphagnum capillifolium* and Pleurocarpus mosses such as *Rhytidiadelphus squarrosus* and *Brachythecium rutabulum*.

Mires/ Molinia grassland

Three mire communities were found in the Survey Area: M6d, M23a and M23b and M25a.

The soligenous mire community M6d was found in one location in the east of the Survey Area along seepage lines and old drainage channels. This community was a mix of mosses such as *Sphagnum palustre*, *Rhytidiadelphus squarrosus* and common haircap moss *Polytrichum commune* underneath a sward of either soft rush *Juncus effusus* or sharp-flowered rush *Juncus acutiflorus*. M6 (and its sub-communities) is a UK BAP priority habitat.

The M23a and M23b mire communities were found in large areas on the slightly sloping ground in the southern part of the Survey Area and in many of the drainage channels running to the south. This community was dominated by rushes with grasses such as Yorkshire fog *Holcus lanatus* and sweet vernal grass *Anthoxanthum odoratum* and in the more species rich areas herbs such as marsh bedstraw *Galium palustre* and marsh willowherb *Epilobium palustre*. M23 (and its sub-communities) is a UK BAP priority habitat.

The M25a sub-community, dominated by purple moor-grass *Molinia caerulea* and sharp-flowered rush, was generally found around the edges of the blanket bog and was seen as a transition community between the bog communities and the other mires and marshy grassland communities. M25 is considered to be an Annex 1 habitat only in areas where the peat depth is greater than 0.5m, and a UK BAP priority habitat.

Grassland

The grassland communities were generally found on the sloping ground in the south and east of the Survey Area. The unimproved neutral grassland MG10a community covered the largest area, with the improved grassland MG6a and the acid grassland U5a community each covering less than a quarter of the area covered by the MG10a community. None of these grassland communities are either Annex 1 or UK BAP priority habitats.

The MG10a community was a grass-dominated community with Yorkshire fog and tufted hair-grass *Deschampsia cespitosa* often abundant in the sward interleaved with smaller species such as white clover *Trifolium repens* and heath bedstraw *Galium saxatile*. The MG6a community had a much shorter sward which was heavily grazed and dominated by agriculturally sown grasses perennial rye grass *Lolium perenne* and crested dog's tail *Cynosurus cristatus*. The U5a community was dominated by mat grass *Nardus stricta*, along with abundant sweet vernal grass and wavy hair-grass *Deschampsia flexuosa*.

Wet heath

One area of wet heath M15d community was present towards the north of the Survey Area, otherwise it was found as part of a mosaic with other mire communities. In drier areas this community was dominated by grasses such as purple moor-grass and wavy hair-grass and in the wetter areas there were more sedges such as deergrass and hare's-tail cottongrass. M15 (and its sub-communities) is both an Annex 1 habitat and a UK BAP priority habitat.

Swamps and fens

The S9a and S10 communities were found in one small area around a stream on the northern boundary of the Survey Area. The S10 community was part of a mosaic with

the S9a community where the S10 community was found in the deeper water in the stream and the S9 community surrounded it on the slightly drier areas around the banks of the stream. The species poor S10 community was dominated by water horsetail *Equisetum fluviatile* with few other species and transitioned into the S9a community as bottle sedge *Carex rostrata* became more dominant. The S9a community had a few herbs such as marsh willowherb *Epilobium palustre*, marsh thistle *Cirsium palustre* and cuckoo flower *Cardamine pratensis*. Both S9a and S10 are UK BAP priority habitats.

GWDTE

In order to consider potential effects on GWDTE (SEPA 2017) sensitivity scores are provided with revised scores following hydrogeological risk assessment in Table 6-6. Further information can be found in the Hydrology and Hydrogeology Report Technical Appendix 10-1). These sensitivity ratings are carried through to assessment.

Table 6-6: NVC habitats^{3 4} present within the Survey Area (Proposed Development plus 250m) with SEPA 2017 and hydrogeological sensitivity scores

Description	Area (ha)	% of total	SEPA LUPS Dependency (SEPA, 2017)	Assessed Dependency after assessment
M17a <i>Trichophorum cespitosum</i> - <i>Eriophorum vaginatum</i> blanket, <i>Drosera rotundifolia</i> - <i>Sphagnum</i> species sub-community	60.17	35.5	n/ a – non GWDTE	n/a
M25a <i>Molinia caerulea</i> - <i>Potentilla erecta</i> mire, <i>Erica tetralix</i> sub-community	51.68	30.11	n/ a – non GWDTE	n/a
M23b <i>Juncus effusus</i> / <i>acutiflorus</i> - <i>Galium palustre</i> rush-pasture, <i>Juncus effusus</i> subcommunity	27.78	16.18	High	Low-Moderate
MG10a <i>Holcus lanatus</i> - <i>Juncus effusus</i> unimproved neutral grassland	12.53	7.30	Moderate	Not GWDTE
MG6a <i>Lolium perenne</i> - <i>Cynosurus cristatus</i> grassland	7.39	4.30	n/ a – non GWDTE	n/a
M23a <i>Juncus effusus</i> / <i>acutiflorus</i> - <i>Galium palustre</i> rush-pasture, <i>Juncus acutiflorus</i> sub-community	4.79	2.79	High	Low-Moderate
U5a <i>Nardus stricta</i> - <i>Galium saxatile</i> grassland. species poor sub-community	2.77	1.61	n/ a – non GWDTE	n/a
Non NVC habitats	2.39	1.39		
M15d <i>Trichophorum cespitosum</i> - <i>Erica tetralix</i> wet heath, <i>Vaccinium myrtillus</i> sub-community	1.43	0.83	Moderate	Low
S9a <i>Carex rostrata</i> swamp, <i>Carex rostrata</i> sub-community	0.43	0.25	n/ a – non GWDTE	n/a
M6d <i>Carex echinata</i> - <i>Sphagnum fallax</i> /S.	0.30	0.17	High	Low-

³ Small areas of plantation, a non NVC habitat, are excluded

⁴ Second and third communities recorded in the NVC, such as M18, M19, S10 and U6 were not mapped (Figure 6.2). They form very small percentages within mosaics of dominant habitats (e.g., M17, S9 and U5).

Description	Area (ha)	% of total	SEPA LUPS Dependence (SEPA, 2017)	Assessed Dependence after assessment
denticulatum mire, <i>Juncus acutiflorus</i> subcommunity				Moderate
TOTAL	171.65	100.00	-	-

6.6.4 Bats

The results of the static detector surveys identified the presence of at least four species; common pipistrelle, soprano pipistrelle, *Myotis* sp. and *Nyctalus* sp. In total 871 bat passes were recorded, with 93.6% from pipistrelle species, 5.6% from *Nyctalus* species and 0.8% from *Myotis*. The highest activity level in the context of the site was in the vicinity of T2, with greatest activity levels at this turbine location by pipistrelle species. T2 also had the highest activity level for *Nyctalus* in the context of the site, with two nights of moderate/high activity, and the highest level of *Myotis* activity with one night of moderate activity in the context of the site. Based on the analysis in terms of the times bats were first and last recorded compared to dusk and dawn times, no roosts are likely to be in the vicinity.

It should be considered that the total number of recording nights for all three turbine locations was 36, and therefore suggesting an overall low use of the site by bats.

6.6.5 Avian surveys

VP surveys

The highest flight activity was associated with non-breeding flocks of gregarious birds, namely golden plovers and pink-footed geese. Golden plover is on the Scottish biodiversity list⁵. pink-footed geese are on the amber list of birds of conservation concern⁶. Table 6-7 lists flight activity with collision risk summary statistics. Collision risk is summarised by a figure for the number of years per single collision for species where collision risk exists - based on confirmed use of the Survey Areas, flight characteristics of species concerned (potential for collisions), and number of flights. As a result, this statistic is provided for curlew, golden plover and pick footed goose.

Table6-7: Results from vantage point surveys September 2020 – August 2021

Species	Scientific name	Min. No. of Birds	Max. No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds	No. of years per single collision
Curlew	<i>Numenius arquata</i>	1	3	13	323	293	39.9
Dunlin	<i>Calidris alpina</i>	1	1	1	16	16	
Golden plover	<i>Pluvialis apricaria</i>	3	44	9	24,558	24,065	0.6

⁵ listed on the Scottish Biodiversity List

⁶ Birds of Conservation Concern 5, BTO, 2021

Species	Scientific name	Min. No. of Birds	Max. No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds	No. of years per single collision
Goshawk	<i>Accipiter gentilis</i>	1	1	1	61	0	
Greylag goose	<i>Anser anser</i>	2	12	3	480	62	
Hen harrier	<i>Circus cyaneus</i>	1	1	1	90	5	
Herring gull	<i>Larus argentatus</i>	2	2	1	142	142	
Pink-footed goose	<i>Anser brachyrhynchus</i>	19	70	7	24,334	9,666	13.6

There were three greylag goose flights, it is possible that greylag may have bred close to, but outside of the survey area.

High flight activity of pairs of curlew in June including birds mobbing corvids, frequently associated with nest defence, this supports the results of the breeding bird surveys (below).

Single flights of locally uncommon species included individual sightings of:

- hen harrier *Circus cyaneus*;
- goshawk *Accipiter gentilis*;
- dunlin *Calidris alpina*; and
- herring gull *Larus argentatus*.

Hen Harrier and goshawk are Schedule 1 protected species, it is possible that goshawk may have bred locally. Dunlin and herring gull are on the amber and red lists of birds of conservation concern respectively.

BBS

Table 6-8 is abridged from the Annex E to include species of high conservation concern only⁷.

Table 6-8: Breeding bird results for species of high conservation concern April 2021 – August 2021

Species	Scientific name	Status ¹	Confirmed	Probable	Possible
Cuckoo	<i>Cuculus canorus</i>	Scottish Biodiversity List, Red List	0	0	1
Curlew	<i>Numenius arquata</i>	Scottish Biodiversity List, Red List	0	2	1
Dunnock	<i>Prunella modularis</i>	Scottish Biodiversity List,	0	0	1

⁷ listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended); SBL – listed on Scottish Biodiversity List; Red - categorised as 'red' on Birds of Conservation Concern; Amber - categorised as 'amber' on Birds of Conservation Concern 5, BTO, 2021.

Species	Scientific name	Status ¹	Confirmed	Probable	Possible
		Amber List			
Kestrel	<i>Falco tinnunculus</i>	Scottish Biodiversity List, Amber List	1	0	
Lapwing	<i>Vanellus vanellus</i>	Scottish Biodiversity List, Red List	0	1	0
Linnet	<i>Linaria cannabina</i>	Scottish Biodiversity List, Red List	0		1
Lesser Redpoll	<i>Carduelis flammea cabaret</i>	Scottish Biodiversity List, Red List	0	0	1
Meadow Pipit	<i>Anthus pratensis</i>	Amber List	Analysis not performed, no confirmed territories, the most numerous bird on site.		
Oystercatcher	<i>Haematopus ostralegus</i>	Amber List	0	0	2
Reed Bunting	<i>Emberiza schoeniclus</i>	Scottish Biodiversity List, Amber List	0	0	2
Skylark	<i>Alauda arvensis</i>	Scottish Biodiversity List, Red List	0	28	36
Spotted Flycatcher	<i>Muscicapa striata</i>	Scottish Biodiversity List, Red List	1	0	0
Common Snipe	<i>Gallinago gallinago</i>	Amber List	0	1	1
Song Thrush	<i>Turdus philomelos</i>	Red List	0	0	4
Willow Warbler	<i>Phylloscopus trochilus</i>	Amber List	0	7	9

No Schedule 1 species were recorded and confirmed breeding applies to kestrel and spotted flycatcher, Probable breeding applies to curlew, lapwing, skylark, common snipe, and willow warbler. Non-breeding records (i.e., birds showing no evidence of breeding and no linkage with birds which are showing signs of breeding on other visits) but for which there is a high likelihood of breeding, included starling and house martin. Both species are on the red list.

Breeding raptor

A concentration of buzzard *Buteo buteo* activity was observed in a copse in the north of the site, where it is probable there was a nest. Regular activity from this species was observed across the site.

One confirmed territory of kestrel *Falco tinnunculus*, an amber list species and considered at risk from wind farm development, was observed, approximately 700m north of the Proposed Development. Frequent hunting activity from multiple individuals was observed across the site.

A goshawk *Accipiter gentilis*, a Schedule 1 species, was observed in the west of the site carrying prey towards a conifer plantation and potential breeding habitat.

6.7 Assessment of Effects and Mitigation

6.7.1 Construction

Statutory Designated Nature Conservation Sites

There is no hydrological connectivity between the turbine locations and the SSSIs to the east of the Proposed Development (Cobbinshaw Reservoir SSSI and Cobbinshaw Moss SSSI, 0.7km and 1.6km respectively) because they lie on a western side of a ridge and as such, drain to the west and not to the east.

The access route would fall within the area hydrologically connected with these SSSIs however, there are no water crossings proposed and no water courses are crossed. Mitigation including pollution prevention and sedimentation measures will be in place as viewed in the HMP (Annex A) and Construction Environment Management Plan (CEMP). As such there are anticipated to be no effects on Cobbinshaw Reservoir SSSI and Cobbinshaw Moss SSSI.

The remaining sites designated for habitats are not within the zone of influence of the Proposed Development. As such, no further consideration is given to Skollie Burn SSSI, Hermand Birchwood SSSI and Braehead Moss SAC/SSSI which are all greater than 4km from the Proposed Development.

Whilst suitable grazing habitat for Pink footed geese is present, higher quality grazing is present to the east around Cobbinshaw Reservoir. In addition, the distance between the Proposed Development, the Westwater SPA/Ramsar/SSSI roost, and any feeding areas with a history of use by geese, would suggest that the Proposed Development is a low risk with a negligible risk of an effect as a result of construction activities.

Non-Statutory Designated Nature Conservation Sites

Cobbinshaw Reservoir LBS is located adjacent Cobbinshaw Reservoir SSSI and Cobbinshaw Moss SSSI. Therefore, for the reasons described for the SSSIs above, no significant effects are likely on the LBS.

As Harwood Water pLBS is 120m north of turbine 1 any effects are unlikely to be significant.

Habitats (overall)

During construction several habitats would undergo direct loss. The habitat communities which would be directly lost are outlined in Table 6-9 with the area of

habitat lost due to the building of the infrastructure plus a 5m buffer. All habitats are regarded as local value receptors.

Table 6-9 NVC communities within the Proposed Development (infrastructure footprint) plus 5m buffer.

NVC Community	Built infrastructure (ha)	Borrowpit search (ha)	Total area (ha)
M23b rush pasture	1.57	1.30	2.87
M25a mire	1.19	0.91	2.10
MG10a unimproved neutral grassland	1.75	0.34	2.09
M17a blanket bog	1.25		1.25
MG6a improved grassland	0.49		0.49
M23a rush pasture	0.28		0.28
U5a acid grassland	0.25		0.25
Total	6.78	2.55	9.32

Blanket bog

Blanket bog comprises Annex 1 and UK BAP priority habitat and dominates covering over a third of the Proposed Development area. These comprise M17a, and to a lesser extent, M18 and M19 in a mosaic with the M17a.

The direct habitat loss during construction would be due to the excavation and building of the turbine foundation, access tracks and crane hardstanding with a small area lost on temporary basis to the working areas. Mitigation to minimise effects includes phase 2 probing survey (to micro-site infrastructure from the deepest peat) and use of floating roads on > 1m peat. Restoration proposals include reuse of bog in borrow peats and re-wetting measures including grips, cut-off drains, elevated ridges (peat waves) and supplementary planting. Contact will be made by the project Environmental Clerk of Works (EnvCoW) with the adjacent Pates Hill Wind Farm with the view of enhancing degraded bog within the Proposed Development on similar principles to the bog restoration strategy adopted at Pates Hill, with potential to achieve larger scale blanket bog restoration as part of the Proposed Development.

As a result of these measures, and of those described in the hydrology chapter and Habitat Management Plan (HMP) (Annex A) it is likely that a minor adverse effect on a local level receptor will remain as a result of loss, disturbance and degradation of peat and peat soils and their hydrology during construction.

Mires/ Molinia grassland

The design has sought to minimise effects on GWDTE with revisions including relocating the track southwards, to cover a larger area of habitat not classed as GWDTE, such as MG6a *Lolium perenne-Cynosurus cristatus* grassland (Figure 6-2).

Drainage/ pumping will be minimised but where necessary water to be repumped to the vicinity of excavations. Temporary cut-off drains will be used to prevent water entering excavations. Trackside drainage to comprise either buffer strips or infiltration trenches in the vicinity of GWDTE. Reinstatement should occur as soon as practicable, ensure Suitable hydrological conditions, and avoid permanent drainage.

In areas where there are GWDTE, any shallow groundwater encountered during construction and requiring dewatering should be pumped to a small holding sump to

allow removal of suspended sediment. Once the solids have been removed, groundwater should either be discharged direct to or via a small down-slope trench up-gradient of the surrounding GWDTE allowing infiltration back into the ground. The work will be supervised by the EnvCoW and mandated in a Construction Environment Management Plan (CEMP). Pollution prevention measures will include run-off control (tamping soil bunds and covering during rainfall), silt-fencing and regular inspections by the EnvCoW.

A monitoring regime will be developed by the EnvCoW to measure potential effects of permanent and temporary works on GWDTE and within a format which may be provided to regulators upon request.

Temporary disturbance from indirect impacts may occur to moderately groundwater dependent GWDTE from localised reduction in flows and recharge rates. However, any indirect loss of habitats caused by dewatering at turbines will also be minimised by minimising any period of dewatering and designing dewatering in compliance with the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended).

Following mitigation, the main habitat to be directly affected would be the M23a and M23b rush-pasture, with a loss of just over 3ha (Table 6-8). This habitat is common and widespread both locally and nationally. Following hydrogeological appraisal, the M23a and M23b rush pasture is considered to be a low-moderate sensitivity GWDTE (Table 6-6) and is also a UK BAP priority habitat. However, a relatively small area would be lost due to the building of the infrastructure so a minor adverse effect on a local level receptor is likely as a result of construction.

Whilst there will be no direct loss of M6d mire, a small area is located within 50m of the access track in the east of the Proposed Development area. As such localised dewatering may occur and a minor adverse effect on a local level receptor is likely as a result of construction.

The M25a mire community which covers almost a third of the Proposed Development area is potentially an Annex 1 habitat but, following hydrogeological appraisal is not classed as GWDTE. Due to the potential Annex 1 classification a minor adverse effect on a local level receptor is likely as a result of construction.

Potential areas identified as moderate-high GWDTE dependant within the infrastructure buffers where coverage is sub 250m will be re-examined before construction takes place to confirm the findings and set out mitigation if appropriate.

Wet heath

An area of wet heath M15d community was present towards the north of the Proposed Development area, otherwise it was found as part of a mosaic with another mire community. It is considered of little or low groundwater dependency and sufficiently far from the Proposed Development infrastructure not to be affected.

Grassland

The direct habitat loss of MG10a unimproved neutral grassland on a permanent basis would be due to the borrowpit and access track and on a temporary basis to the construction compound. However, this habitat is not an Annex 1 or UK BAP priority habitat, and not considered to be a GWDTE following hydrogeological appraisal. As a result, a negligible effect on a less than local receptor is likely as a result of construction.

The loss of the MG6a improved grassland would be due to the construction of the access track so would be a permanent loss. However, as this is a small area of a habitat which is widespread and generally of low ecological value, and because it is not considered a GWDTE following hydrogeological appraisal, a negligible effect on a less than local receptor is likely as a result of construction operations.

A small area of the U5a acid grassland community would be lost on a permanent basis to the construction of the turbine foundation, crane hardstanding and access track and an even smaller area on a temporary basis to the working areas. This habitat is common and widespread across Scotland and has no nature conservation designations or ground water dependency, as such it is considered that a negligible adverse effect on a less than local receptor is likely as a result of construction.

Bats

The common species which comprise most of the results - soprano and common pipistrelle – are unlikely to commute across the Proposed Development in notable numbers for there are no habitat features by which to navigate. Burns and treelines are beyond the Proposed Development bordering it to the north, and to a lesser extent, the east. Sufficient numbers of these common species are unlikely to fly over the large area of open habitat which dominates the Proposed Development, to result in a significant effect. In addition, any displacement effects from construction lighting will be mitigated by directional lighting/cowls. Given the large area of woodland edge and burn network in the area but located beyond the zone of influence of the Proposed Development, negligible adverse effects on local receptors are likely as a result of construction.

Birds

Wader species and pink footed geese are taken forward for assessment with the latter discussed in the statutory designated site sections due to their designation as part of the Westwater SPA/Ramsar/SSSI populations. General measures to protect active nests detailed in the CEMP and Habitat Management Plan (Annex A) are considered sufficient to mitigate effects on other species including skylark and spotted flycatcher (SBL and red list species with confirmed/probable breeding).

Goshawk and hen harrier are not taken forward as two and one flights, respectively, were recorded from 12 months across all survey types and there was no evidence of breeding.

Results from avian surveys can be seen on Figures 6-4- 6-8.

Waders

Whilst no confirmed breeding territories were found, the Survey Area is noted for its wader species including curlew, lapwing and snipe. It is probable however that low numbers of curlew are breeding within the Survey Area and based on the three records from the BBS (Table 6-8), one probable breeding territory is present in the zone of influence of the Proposed Development, 600m from turbine 3 (Figure 6-8). Lapwing and snipe territories (probable-possible) are outwith the zone of influence however non-breeding golden plover was seen in flocks throughout the Survey Area.

There will be no direct impacts on breeding success of confirmed nests (for any wild bird) as pre-construction checks will ensure appropriate protection zones are in place before construction. In terms of indirect effects from displacement from breeding

territories, this is low risk due to the low numbers of territories involved. A study by Whitfield et al. (2010) examined effects on curlew and golden plover populations (presumed breeding) on five UK wind farm projects found no evidence of displacement and that breeding birds would need to be very close to infrastructure for displacement to occur. As a result, and on a precautionary basis, a minor adverse effect on breeding curlew is possible, and a negligible effect on non-breeding golden plover is likely, from construction. Both are considered local level receptors.

6.7.2 Operation

Whilst effects from construction on hydrologically sensitive habitats persist into operation, they are not new effects generated by the operational phase. This is as per the approach in the Hydrology and Hydrogeology Report Technical Appendix 10-1 which has informed the effects thresholds for habitats in this appraisal. The HMP (Annex A) will include monitoring and feedback mechanisms such that should the restoration of the peatland habitats and GWDTEs not recover as anticipated, remedial measures will be introduced in the operational phase.

Statutory Designated Nature Conservation Sites

For reasons described under Construction (6.7.1) sites designated for habitats are scoped out of the assessment.

Westwater SPA/Ramsar/SSSI is designated for its wintering population of Pink-footed goose *Anser brachyrhynchus*. At the time of citation, it held a mean of 29,600 individuals. The most recent counts (Frost et al. 2020) give a five year mean of 40,048 individuals. Mitchell (2012) shows no records of feeding geese within 2km of the Proposed Development.

NatureScot's guidance for small scale wind developments and their effects on grey geese (SNH 2014) considers developments which are three or fewer turbines with a tip height of up to 150m. The Proposed Development has a maximum tip height of 180m and as such is not fully covered by the guidance, but the distance between the Proposed Development, the SPA roost, and any feeding areas with a history of use by geese, would suggest that the Proposed Development is a low-risk site for the SPA. All collision risk flights were on a north-south axis and considered to be migratory with modelling predicting a single collision in 13.6 years (Table 6-7). The timing of most flights was outwith the dawn/dusk window when geese move between foraging grounds adding further weight to the view that flights are migratory, and that the Survey Area is infrequently used for foraging. No significant effects are therefore likely from collision risk, barrier effects or feeding displacement as a result of operation.

Non-Statutory Designated Nature Conservation Sites

As Harwood Water pLBS is 120m north of turbine 1 any effects are unlikely to be significant.

Blanket bog

After mitigation as detailed in paragraph 6.7.1, the HMP and Hydrology TA, a minor adverse effect will remain as a result of loss, disturbance and degradation of peat and peat soils and their hydrology during operation.

Mires/ Molinia grassland

After mitigation as detailed in paragraph 6.7.1, the HMP and Hydrology TA, a minor adverse effect is likely on the M23, M6 and M25 low-moderate sensitivity GWDTEs as a result of loss or degradation of GWDTE during operation.

Wet heath

Given the distance from the Proposed Development of the small areas of M15 habitats concerned, with good practice construction measures, no effects on this low sensitivity GWDTE are likely as a result of operation.

Grasslands

Given the distance from the Proposed Development and negligible to low GWDTE sensitivity no effects on MG10, MG6 and U5 grasslands are likely as a result of operation.

Bats

The comparatively highest activity levels were in the vicinity of T2 by pipistrelle species and is expected given the presence of woodland edge and burns. Turbines tip distances from the woodland edge are approximately 100m from T1 and 150m from T2 and T3.

The low percentage of the larger, more direct flying bats *Nyctalus* species that could fly over open habitats means that significant effects are unlikely on this species group.

Given the low use of the Proposed Development overall, the distance of likely foraging habitat, and that a concentration occurs at a single proposed turbine (from common species) a minor adverse effect on local level receptors is likely as a result of collision events and displacement effects during operation.

Birds

Confirmed breeding territories were recorded for kestrel and spotted flycatcher at approximately 700m from the Proposed Development. Whilst there is sufficient evidence from kestrel flight behaviour (including hovering) for vulnerability to collision (Whitfield, D.P. & Madders, M. (2006) cited in SNH, n.d). the confirmed territories for both species are considered adequately distant for no significant effects to occur. No flights were recorded during the VP surveys for either species.

The Survey Area is noted for its presence of wader species including curlew, lapwing and snipe and a probable breeding territory was recorded 600m from turbine 3. However, waders are known to avoid wind turbines when in flight and have a high avoidance rate (98% - SNH (2010)). In addition, the three proposed turbines are over 500m apart and located within a much larger area of suitable habitat. Numerous studies note the lack of displacement effects from operational wind farms (e.g., (Douglas et al. (2011), Fielding and Haworth (2010)) and the latter study found that golden plover numbers increased during the operational phase in comparison to the construction period. Collision risk modelling produced a low number of potential individual collisions, with one every 39.9 years for curlew and every 13.6 years for pink-footed goose. Whilst the collision risk for non-breeding golden plover is moderate-high it is considered over-estimated and heavily influenced by one large flock which used the site briefly during migration.

As a result, a negligible effect on all wader species is likely from operation. All are considered local level receptors.

6.7.3 Decommissioning

For the purposes of the appraisal, it is assumed that decommissioning assumes removal of all above-ground infrastructure with tracks and bases remaining.

Statutory Designated Nature Conservation Sites

No effects are anticipated on statutory designated sites as a result of decommissioning.

Non-Statutory Designated Nature Conservation Sites

No effects are anticipated on non-statutory designated sites as a result of decommissioning.

Blanket bog

Decommissioning may result in disturbance to localised areas of peat during dismantling. Opportunities for peat reinstatement may arise however which could link to the restoration project planned in tandem with Pates Hill WF (see 6.7.1). As a result, and on a precautionary basis, a short term minor adverse effect is possible.

Mires/ Molinia grassland

As a result of measures described in the HMP (Annex A) and of those described in the hydrology chapter it is considered that a minor adverse effect on low-moderate sensitivity GWDTE will remain as a result of loss or degradation of GWDTE during decommissioning.

Wet heath

Given the distance from the Proposed Development of the small areas of M15 habitats concerned no effects on this low sensitivity GWDTE is likely as a result of decommissioning.

Grasslands

Given the distance from the Proposed Development and negligible to low GWDTE sensitivity no effects on MG10, MG6 and U5 grasslands are likely as a result of decommissioning.

Bats

Whilst there may be a short-term increase in disturbance during decommissioning overall a minor beneficial effect is considered likely as the minor adverse effect from operational turbines will no longer occur.

Waders

Pre-construction checks will take place prior to the dismantling of infrastructure. On the basis that protection zones are installed around confirmed breeding site prior to works, no significant effects on wader species are likely from decommissioning. All are considered local level receptors.

6.7.4 Cumulative Effects

The primary reason to undertake a cumulative assessment is to identify situations where effects on important features are judged to be unacceptable combined with nearby operational developments or approved projects. The Proposed Development has been designed to appear to form an extension to the cluster of wind farms that lie between

Tormywheel to the west and Harburnhead to the east. These developments are listed in sequential order from west to east in Table 6-10.

Table 6-10: Cumulative Developments

Site Name	Hub Height	Tip Height	No of Turbines	Status
Tormywheel	65	111	15	Operational
Tormywheel Extension		149.9	2	Approved
Heathland		132	17	Approved
Heathland Resubmission		180	14	Scoping
Longhill Burn	110	180	8	Approved
Pates Hill	67	107	7	Operational
Pearie Law		125	6	Operational
Harburnhead		126	22	Operational

An online search was carried out looking for assessments undertaken on operational and approved developments as listed in Table 6-10. Both SLC's and West Lothian's planning portals were searched, and a general search online was undertaken. Information was available for Heathland and Longhill Burn Wind Farms. It is noted that habitat within the Development footprint of these Wind Farms was largely dominated by conifer plantation, the latter site located within Woodmuir Plantation with blanket bog comprising 2.6% of the development footprint (EnergieKontor UK Ltd., 2019). As a result, comparisons are limited in respect of the Proposed Development.

Although no information was found online for Pates Hill Wind Farm, which lies immediately to the north of the Proposed Development, it is known that a bog restoration programme has been undertaken here. The extended phase 1 survey for the Proposed Development confirmed that bog habitat at Pates Hill was similar, in terms of character and species composition, to that within the Proposed development.

No significant effects are likely upon habitats from either direct loss or indirect dewatering as a result of cumulative effects. This is based upon the proximity of restored bog habitat at Pates Hill, mitigation detailed in 6.7.1. It is recommended that the EnvCoW works with Pates Hill Wind Farm in applying the HMP to ensure that restoration is compatible with measures used there and based on on the ground knowledge.

Low numbers of pink footed goose flights were recorded in studies related to Longhill Burn WF, with seven flights. The Heathland WF was deemed to affect Pink footed goose and a breeding protection plan was implemented as a result (Arcus Consulting, 2021). Given that all flights for the Proposed development are migratory however, and that evidence for use of the area for foraging is limited, there is unlikely to be a cumulative effect on pink footed goose as result of the Proposed Development.

Low numbers of breeding territories were identified for curlew, lapwing and snipe at Heathland WF and there were insufficient flights to undertake collision risk modelling for Longhill Burn WF. It is not clear if CRM was done for Heathland WF as the full EIA could not be sourced. However, based on the Proposed Development and from available information from other developments low numbers of waders have been identified overall with negligible significant effects established on the other projects. On this basis there is unlikely to be a cumulative effect on waders as result of the Proposed Development.

The full EIA for Heathland WF could not be found but in relation to bats the non-technical summary noted low-moderate numbers using the Site for feeding and/or commuting (EnergieKontor UK Ltd., 2019). At Longhill Burn WF minor - negligible effects remained for bat populations based on suboptimal habitat due to the small number of potential roost features and low-quality foraging habitat. Based on the information available and the low numbers of common species found during surveys for the Proposed Development there is unlikely to be a cumulative effect on bats as result of the Proposed Development.

6.8 Residual Effects and Conclusions

Adverse effects remain for several local value receptors, but as they are minor, are not considered significant, they are:

- A minor adverse effect on blanket bog from loss, disturbance and degradation of peat and peat soils and their hydrology during construction;
- Minor adverse effects on low-moderate sensitivity GWDTEs (M23a, M23b rush pastures and M6d and M25a mires) from loss/degradation during construction;
- Minor adverse effects on curlew from displacement during construction;
- A minor adverse effect on blanket bog from loss, disturbance and degradation of peat and peat soils and their hydrology during operation;
- Minor adverse effects on low-moderate sensitivity GWDTEs (M23a, M23b rush pastures and M6d and M25a mires) from loss/degradation during operation;
- Minor adverse effects on bats from collision events and displacement effects during operation;
- A short-term minor adverse effect on blanket bog from loss, disturbance and degradation of peat and peat soils and their hydrology during decommissioning; and
- Minor adverse effects on low-moderate sensitivity GWDTEs (M23a, M23b rush pastures and M6d and M25a mires) from loss/degradation during decommissioning.

These minor effects can be managed further through iterative review of mitigation as described in the HMP and CEMP for these will remain live documents.

6.9 Summary and Statement of Significance

No significant residual effects are likely to remain as a result of the Proposed Development

6.10 References

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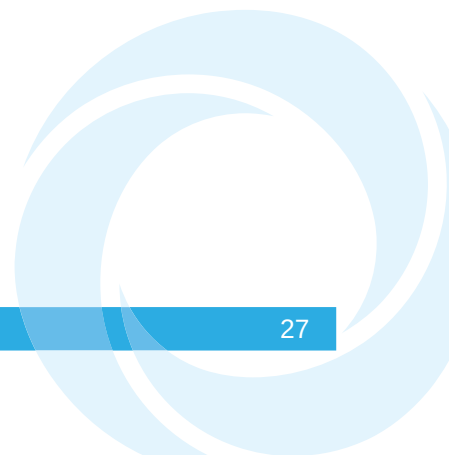
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Annexes

Annex A: Habitat Management Plan

Annex B: Extended Phase 1 Survey

Annex C: National Vegetation Classification Survey

Annex D: Bat Activity Survey

Annex E: Ornithology Surveys

Technical Appendix 6-1; Annex A

Woolfords Wind Farm

Outline Habitat Management Plan

Wind2 Ltd

December 2021



Contents

1	Introduction	1
1.1	Terms of Reference	1
1.2	Site Details and Project Description	1
1.3	Aims and Objectives	1
1.4	Scope of the Habitat Management Plan	2
2	Ecological Features on Site	3
2.1	Limitations	4
2.2	Habitats	4
2.3	Fauna	8
2.3.1	Mammals	8
2.3.2	Birds	8
3	Habitat Management Recommendations	10
3.1	Outline Prescriptions	10
3.2	Timings	12
4	Figures	13

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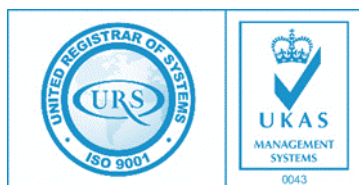
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1 Introduction

1.1 Terms of Reference

This outline Habitat Management Plan (HMP) is provided in support of a planning application to construct and operate three wind turbines with a tip height of up to 180 m plus associated infrastructure at a site approximately 4km northeast of Forth in South Lanarkshire (hereafter referred to as the 'Proposed Development' which refers to the infrastructure footprint). It has been informed by the results of baseline ecology and ornithological studies.

This outline HMP will be finalised following the completion of the planning process in collaboration with The South Lanarkshire Council (SLC) and at this stage, should be regarded as a first iteration.

The developer is referred to as 'the Applicant'.

The infrastructure footprint is referred to as the Proposed Development and the Survey Area comprises the Proposed Development plus 250m where access was available.

1.2 Site Details and Project Description

The Proposed Development is located on agricultural land dominated by blanket bog, rush pasture and grassland approximately at National Grid Reference (NGR) 298935,657572. The Site occupies an area of approximately 293 hectares (ha); however, the footprint of the Proposed Development will be substantially less. The site is grazed as agricultural land and located south of the operational Pates Hill Wind Farm. There are several 'operational', 'consented' and 'in planning' wind farms in the vicinity of the Proposed Development including Pates Hill, Heathland, Tormywheel, Longhill Burn, Pearie Law, Pearie Law Extension, and Harburnhead.

The Proposed Development will consist of three wind turbines with maximum dimensions of 155m rotor diameter, 102.5m hub and 180m blade tip height, along with associated infrastructure including access tracks, turbine foundations (of an area up to 25 m x 25 m) and crane hardstandings (up to 45m x 25m), a control building, substation, and a temporary construction compound.

The area of predicted habitat loss from the Proposed Development is 5.6 ha and is represented by 'infrastructure footprint' as shown on Figure 6.2

1.3 Aims and Objectives

The primary objective of the outline HMP is minimise effects on bog habitats by aiding the recovery, enhancement and compensation of areas affected by the Proposed Development. In addition, restoration work in the north of the Site is proposed where bog is identified by the proposed EnvCoW as being in poor condition. Much of this area is outwith the Proposed Development and constitutes enhancement as opposed to mitigation or compensation. The aim is to improve the condition and extent of habitat in the vicinity of the Proposed Development by connecting to the existing restored bog within the Pates Hill Wind Farm – located to the north of the Proposed Development.

The mechanism for facilitating this should be via the Applicant's Environmental Clerk of Works (EnvCoW) and operators of Pates Hill Wind Farm (WF).

Mitigation for effects on ground water dependant terrestrial ecosystems (GWDTEs) is also required to ensure no loss in functionality and floristics of the low - moderate-high GWDTE status habitats within the Proposed Development.

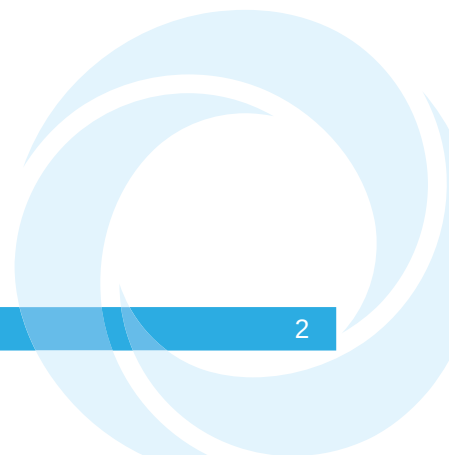
1.4 Scope of the Habitat Management Plan

This is a framework document intended to be a live document, modified and refined throughout the monitoring period of the HMP and reported through the Applicant's EnvCoW to SLC and stakeholders. The proposed methodologies will therefore be refined considering emerging monitoring results.

This HMP considers the specific features of the Proposed Development and the local area in making recommendations based on best information currently available. If aspects relating to the Proposed Development are altered, or new ecological information emerges then the HMP will be required to be adapted accordingly. In this way the HMP, through monitoring, will take account of the successes and failures of the management measures; modifications to the management regime can then be proposed as necessary.

The HMP considers the management of the habitats and species over the expected operational lifespan of the Proposed Development. Issues relating to the construction phase of the Proposed Development and the immediate re-instatement post-construction are covered within the Construction Environmental Management Plan (CEMP).

Data from the Extended Phase 1 habitat survey as not included as NVC survey supersedes it as a 'Phase 2' survey.



2 Ecological Features on Site

The background information presented in this section of the HMP has been sourced from the technical studies carried out as part of the Proposed Development application process.

A National Vegetation Classification (NVC) survey was undertaken on habitats within the Proposed Development area plus 250m (hereon collectively referred to as the Survey Area).

The application of the 250m survey buffer was applied as it allows for the identification of any potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs) within 250m of excavations anticipated to be greater than 1m deep, in line with regulator guidance (SEPA, 2017). Habitats were mapped by eye and classified according to Rodwell (1998a¹, 1998b², 2006³) then accordingly to their dominant NVC community, although some habitats were made up of mosaics of NVC communities (Figure 6.2). Hence when determining whether a particular habitat was potentially groundwater dependent, the composition of the mosaic was considered.

A hydrologist undertook a hydrogeological risk assessment of potential GWDTE communities identified in the NVC survey to confirm their GWDTE status, based on both hydrogeological setting and floristics.

Full details of both surveys can be found in the respective ecology⁴ and hydrology⁵ chapters of the Environmental Appraisal (EA).

Surveys included:

- Extended Phase 1 habitat survey as per JNCC 2010 guidance⁶;
- Bat activity surveys in line with NatureScot (NS) guidance⁷ requiring three seasons of static survey;
- Six months of vantage point surveys from one vantage point (to complete twelve months of surveys, with six already undertaken);

¹ Rodwell, J.S., (1998a). British Plant Communities. *Volume 2: Mires and heaths*. Cambridge: Cambridge University Press.

² Rodwell, J.S., (1998b). British Plant Communities. *Volume 3: Grasslands and montane communities*. Cambridge: Cambridge University Press.

³ Rodwell, J.S. (2006) NVC Users' Handbook, JNCC, Peterborough, ISBN 978 1 86107 574 1.

⁴ Atmos consulting (2021). Woolfords Wind Farm. Ecology and Ornithology Appraisal. Technical Appendix 6-1.

⁵ Atmos consulting (2021). Woolfords Wind Farm. Hydrology and Hydrogeology Appraisal. Technical Appendix 10-1.

⁶ JNCC, (2010). Handbook for Phase 1 habitat survey – a technique for environmental audit, JNCC, Peterborough.

⁷ Scottish Natural Heritage. (2019) Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.

- Breeding wader survey within the site boundary; and
- Breeding raptor survey up to 1 km from the site boundary, dependent on public access.

2.1 Limitations

The NVC survey covered the Proposed Development area plus a 250m buffer where this was achievable within the Site boundary (i.e., access was not permitted to land outside the Site Boundary as shown on Figure 6-2). The NVC survey targeted habitats within the Proposed Development area to include a 250m buffer from infrastructure (again, where this was achievable within the accessible land area).

It is noted that following this survey the Proposed Development layout was revised and the access track shifted south to avoid other technical constraints. Consequently, in places, the full 250m buffer is not retained in the NVC survey.

In our expert judgement, it is considered that due to our understanding of the Site, additional survey data would not change the conclusions of our findings in this (Hydrology and Hydrogeology) or the Ecology appraisal. The data gathered was extrapolated in places to complete the habitat/GWDTE appraisal and conclusions set out in this Report (and the Environmental Appraisal, and in particular, its Technical Appendix 6-1- Ecology and Ornithology Appraisal).

2.2 Habitats

The Survey Area was dominated by blanket bog (M17) was found on the flatter higher ground to the north and west. This surrounded by the M25 *Molinia* grassland communities with the sloping ground to the south dominated by other grassland (U5, MG6, MG10) and other mire (M23) communities. The NVC communities present within the Survey Area are summarised in Table 1 below.

Table 1: NVC communities within the Survey Area (Proposed Development + 250m), their associated conservation designations and potential GWDTE status

NVC Code	NVC Community	Annex 1 habitat	UK BAP Priority habitat	Potential GWDTE
M6	<i>Carex ecinata</i> – <i>Sphagnum recurvum</i> mire	None	Upland flushes, fen and swamp	High
M15	<i>Scirpus cespitosus</i> – <i>Erica tetralix</i> wet heath	H4010 Northern Atlantic wet heaths with <i>Erica tetralix</i> H7130 Blanket bog, where peat depth is > 0.5m	Upland heathland Blanket bog if peat depth >0.5m	Moderate
M17	<i>Scirpus cespitosus</i> – <i>Eriophorum vaginatum</i> blanket mire	H7130 Blanket bog	Blanket bog	None
M18	<i>Erica tetralix</i> – <i>Sphagnum papillosum</i> raised and blanket mire	H7130 Blanket bog	Blanket bog	None
M19	<i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i>	H7130 Blanket bog	Blanket bog	None

NVC Code	NVC Community	Annex 1 habitat	UK BAP Priority habitat	Potential GWDTE
	blanket mire			
M23	<i>Juncus effusus/acutiflorus</i> – <i>Galium palustre</i> rush-pasture	None	Upland flushes, fen and swamp in M23a Purple moor-grass and rush pasture in M23b	High
M25	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	H7130 Blanket bog, where peat depth is > 0.5m	Purple moor-grass and rush pasture	Moderate
MG6	<i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland	None	None	High
MG10	<i>Holcus lanatus</i> – <i>Juncus effusus</i> rush-pasture	None	None	Moderate
S9	<i>Carex rostrata</i> swamp	None	Upland flushes, fen and swamp	None
S10	<i>Equisetum fluviatile</i> swamp	None	Upland flushes, fen and swamp	None
U5	<i>Nardus stricta</i> – <i>Galium saxatile</i> grassland	None	None	None
U6	<i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland	None	None	Moderate

The NVC communities present within the Proposed Development are summarised in Table 2.

Table 2: NVC communities within the Proposed Development area.

Description	Area (ha)	% of total ⁸
M23b <i>Juncus effusus/acutiflorus-Galium palustre</i> rush-pasture, <i>Juncus effusus</i> sub community	18,675	32.9
M25a <i>Molinia caerulea-Potentilla erecta</i> mire, <i>Erica tetralix</i> sub-community	14,152	25
MG10 <i>Holcus lanatus-Juncus effusus</i> rush-pasture	12,782	22.6
M17 <i>Trichophorum cespitosum-Eriophorum vaginatum</i> blanket, <i>Drosera rotundifolia-Sphagnum</i> species sub-community	6,102	10.8
MG6a <i>Lolium perenne-Cynosurus cristatus</i> grassland	2,242	4
U5 <i>Nardus stricta-Galium saxatile</i> grassland. species poor sub-community	1,546	2.7
M23a <i>Juncus effusus/acutiflorus-Galium palustre</i> rush-pasture, <i>Juncus acutiflorus</i> sub-community M23a	1,071	1.9

⁸ Tallies 9.99% due to rounding differences

Description	Area (ha)	% of total ⁹
TOTAL	56, 570	100 ⁹

Blanket bog

Three blanket bog communities were found within the Survey Area; M17, M18 and M19, all three of these communities are both Annex 1 and UK BAP priority habitats.

Large areas of the M17a blanket bog were found along the northern boundary of the Survey Area where the ground was flat. The M18 and M19 communities were found in small areas as part of the mosaics of the M17 blanket bog and other mire communities

The M17 community was dominated by deergrass *Trichophorum cespitosum* and hare's-tail cottongrass *Eriophorum vaginatum*. In the flat areas which were wetter, more bog asphodel *Narthecium ossifragum* could be seen, along with a greater variety of Sphagnum mosses such as *Sphagnum papillosum* and *Sphagnum palustre*. In the drier areas to the south west the bog was richer in dwarf shrubs such as heather *Calluna vulgaris* and crowberry *Empetrum nigrum* with an understory of *Sphagnum capillifolium* and Pleurocarpus mosses such as *Rhytidiadelphus squarrosus* and *Brachythecium rutabulum*.

Mires/ Molinia grassland

Three mire communities were found in the Survey Area; M6, M23 and M25.

The soligenous mire community M6 was found along the southern edge of the Survey Area along seepage lines and along old drainage channels. This community was a mix of mosses such as *Sphagnum palustre*, *Rhytidiadelphus squarrosus* and *Polytrichum commune* underneath a sward of either soft rush *Juncus effusus* or sharp-flowered rush *Juncus acutiflorus*. M6 is a UK BAP priority habitat.

The M23 mire was found in large areas on the slightly sloping ground in the southern part of the Survey Area and in many of the drainage channels running to the south. This community was dominated by rushes with grasses such as Yorkshire fog *Holcus lanatus* and sweet vernal grass *Anthoxanthum odoratum* and in the more species rich areas herbs such as marsh bedstraw *Galium palustre* and marsh willowherb *Epilobium palustre*. M23 is a UK BAP priority habitat.

The M25 community, dominated by purple moor-grass *Molinia caerulea* and sharp-flowered rush, was generally found around the edges of the blanket bog and was seen as a transition community between the bog communities and the other mires and marshy grassland communities. M25 is considered to be an Annex 1 habitat only in areas where the peat depth is greater than 0.5 m and a UK BAP priority habitat.

Grassland

The grassland communities were generally found on the sloping ground to the south of the Survey Area. The unimproved neutral grassland MG10 community covered the largest area, with the improved grassland MG6 and the acid grassland U5 community each covering less than a quarter of the area covered by the MG10 community. None of these grassland communities are either Annex 1 or UK BAP priority habitats.

⁹ When rounded

The MG10 community was a more grassy community with Yorkshire fog and tufted hair-grass *Deschampsia cespitosa* often abundant in the rush sward interleaved with smaller species such as white clover *Trifolium repens* and heath bedstraw *Galium saxatile*. The MG6 community had a much shorter sward which was heavily grazed and dominated by the grasses perennial rye grass *Lolium perenne* and crested dog's tail *Cynosurus cristatus*. Both of the U5 communities were dominated by mat grass *Nardus stricta*, along with abundant sweet vernal grass and wavy hair-grass *Deschampsia flexuosa*.

Wet heath

There were two small areas of the wet heath M15 community towards the north of the Survey Area, otherwise it was found as part of a mosaic with another mire community. In drier areas this community was dominated by grasses such as purple moor-grass and wavy hair-grass and in the wetter areas there were more sedges such as deergrass and hare's-tail cotton grass. M15 is both an Annex 1 habitat and a UK BAP priority habitat.

Swamps and fens

The S9 and S10 communities were found in one small area around a stream on the northern boundary of the Survey Area. The S10 community was part of a mosaic with the S9 community where the S10 community was found in the deeper water in the stream and the S9 community surrounded it on the slightly drier areas around the banks of the stream. The species poor S10 community was dominated by water horsetail *Equisetum fluviatile* with few other species and transitioned into the S9 community as bottle sedge *Carex rostrata* became more dominant. The S9 community had a few herbs such as marsh willowherb *Epilobium palustre*, marsh thistle *Cirsium palustre* and cuckoo flower *Cardamine pratensis*. Both S9 and S10 are UK BAP priority habitats.

GWDTE

In order to consider potential effects on GWDTE SEPA 2017 sensitivity scores are provided with revised scores following hydrogeological risk assessment in Table 3. Further information can be found in the Hydrology and Hydrogeology Report Technical (Appendix 10-1). These sensitivity ratings are carried through to assessment.

Table 3: NVC habitats^{10 11} present within the Survey Area (Proposed Development plus 250m) with SEPA 2017 and hydrogeological sensitivity scores

Description	Area (ha)	% of total	SEPA LUPS Dependency (SEPA, 2017)	Assessed Dependency after assessment
M17a <i>Trichophorum cespitosum</i> - <i>Eriophorum vaginatum</i> blanket, <i>Drosera rotundifolia</i> - <i>Sphagnum</i> species sub-community	60.17	35.5	n/ a – non GWDTe	n/a
M25a <i>Molinia caerulea</i> - <i>Potentilla erecta</i> mire, <i>Erica tetralix</i> sub-community	51.68	30.11	n/ a – non GWDTe	n/a

¹⁰ Small areas of plantation, a non NVC habitat, are excluded

¹¹ Second and third communities recorded in the NVC, such as M18, M19, S10 and U6 were not mapped (Figure 6.2). They form very small percentages within mosaics of dominant habitats (e.g., M17, S9 and U5).

Description	Area (ha)	% of total	SEPA LUPS Dependence (SEPA, 2017)	Assessed Dependence after assessment
M23b <i>Juncus effusus/ acutiflorus-Galium palustre</i> rush-pasture, <i>Juncus effusus</i> subcommunity	27.78	16.18	High	Low-Moderate
MG10a <i>Holcus lanatus-Juncus effusus</i> rush-pasture	12.53	7.30	Moderate	Not GWDTE
MG6a <i>Lolium perenne-Cynosurus cristatus</i> grassland	7.39	4.30	n/ a – non GWDTE	n/a
M23a <i>Juncus effusus/ acutiflorus-Galium palustre</i> rush-pasture, <i>Juncus acutiflorus</i> sub-community	4.79	2.79	High	Low-Moderate
U5a <i>Nardus stricta-Galium saxatile</i> grassland. species poor sub-community	2.77	1.61	n/ a – non GWDTE	n/a
Non NVC habitats	2.39	1.39		
M15d <i>Trichophorum cespitosum-Erica tetralix</i> wet heath, <i>Vaccinium myrtillus</i> sub-community	1.43	0.83	Moderate	Low
S9a <i>Carex rostrata</i> swamp, <i>Carex rostrata</i> sub-community	0.43	0.25	n/ a – non GWDTE	n/a
M6d <i>Carex echinata-Sphagnum fallax/S. denticulatum</i> mire, <i>Juncus acutiflorus</i> subcommunity	0.30	0.17	High	Low-Moderate
TOTAL	171.65	100.00	-	-

2.3 Fauna

2.3.1 Mammals

No evidence of mammals was seen during the Extended Phase 1 survey. Small drainage ditches are present, mainly at the edges of the survey area, and these did not reveal any protected species interest, such as otter *Lutra lutra* or water vole *Arvicola amphibius*.

No potential bat roost features were observed on any tree within the copses. The mature trees were primarily Scot's pine, and no obvious fissures/cracks were visible from the ground. All broad-leaved trees were either semi-mature or species with small growth forms (due to the proximity of the mature Scot's pine and wind exposure) and lacked obvious bat roost potential.

2.3.2 Birds

Numerous bird species were observed during ornithology surveys carried out between September 2020 and August 2021. High numbers of potentially breeding curlew, lapwing and snipe were noted as were large counts of non-breeding (passage) golden plover. Only curlew and non-breeding plover were taken through to the assessment however, as all but one breeding territory was beyond the zone of influence of the proposed infrastructure footprint. This single record relates to a probable curlew territory.

Golden plover was taken forward due to the high numbers of flights observed. As a result of the nationally declining status of many wader species measures to enhance existing habitat for nesting and foraging are included in this plan.

Whilst pink footed goose was taken forward to assessment habitat enhancement measures are not included to avoid attracting geese to the vicinity of operational turbines.

3 Habitat Management Recommendations

The design has gone through various iterations to avoid the deepest areas of peat with the access track pulled south so that it mostly passes through grassland and rush pasture. This does however leave effects on potential GWDTE to be considered, therefore mitigation follows a dual approach to limit potential effects on peat habitats whilst addressing protection of GWDTEs in line with *SEPA Land Use Planning Guidance: Note 31 (2017)*. This relates primarily to blanket bog and rush-pasture marshy grasslands where the latter apply to moderate or low GWDTE status (Table 3).

The primary opportunities for mitigation are therefore considered to be as follows:

1. To ensure bog habitat temporarily disturbed during construction is reinstated;
2. To ensure no negative effects occur on restored bog habitat within the adjacent Pates Hill Wind Farm;
3. To protect and enhance GWDTE wherever possible; and
4. To monitor the effect of the Wind Farm on wader species and habitats.

The HMP will apply throughout the lifetime of the wind farm and will involve the key stakeholders such as the Applicant, landowner, NS, SEPA and SLC (as applicable). All costs associated with the implementation and maintenance of the HMP are to be met by the Applicant.

3.1 Outline Prescriptions

The following includes, in part, measures set out in the Woolfords Environmental Appraisal, Technical Appendix 10-1; Hydrology and Hydrogeology Appraisal.

Bog habitats

On the basis the layout may change from that presented in Figure 6.2 prior to construction, the EnvCoW should identify and map bog habitats and areas of permanent removal. Consideration should be given to where temporary removal is possible, and where a storage/reinstatement strategy can be adopted. Areas for permanent and temporary removal should be clearly demarcated on site and communicated to the design team/contractors.

The EnvCoW should liaise with the design team to understand where micro-siting can help avoid areas of deepest peat. A detailed survey involving peat probing on a grid up to 10 m will be carried out in advance of excavation in those areas where there is likely to be residual shallow peat to allow for micro siting within a 50 m tolerance to further avoid and minimise peat disturbance.

Tracking across deep peat should be avoided and floating roads used wherever possible. Where peat < 1m deep the tracks will be of conventional 'cut' road design. Where the track crosses peat > 1m deep the method of track construction will be floating road. Floating roads have fewer impacts on peat and release less carbon than excavating peat soils. SNH (2010) Guidance will be followed for the design of track sections identified as requiring floating roads.

Movement of floating tracks over peat could lead to changes in peat hydrology. Regular maintenance of access tracks will be required in order to assess the stability of the peat.

Restoration proposals will be developed for the beneficial reuse of excavated Peat to be used alongside floating tracks for reinstatement and landscaping of verges and for remediation should settlement and ponding occur on infrastructure restoration.

Any residual peat will be used in the borrow pit areas and emplaced to raise peat wetness and groundwater levels within the peat body returning it to a more natural state.

Dependent upon the ground conditions surrounding the turbines, existing drains or furrows should be blocked to encourage water retention and the re-wetting of peat. Drains will be blocked to encourage the collection of standing water within the open ground and re-hydration of the peat.

Area of poor-quality bog should be identified by the EnvCoW prior to construction. Effort should be focused on the northern border of the Proposed Development adjacent Pates Hill WF. A low-pressure ground excavator and bog mats should be used where required.

No later than three months prior to construction the EnvCow should liaise with Pates Hill WF representatives to clarify restoration measures used there, and how mitigation in the Proposed Development could compliment the programme at Pates Hill. Identification of species used in any supplementary planting at Pates Hill would form part of this liaison.

Habitat Surveys should be undertaken at 3-year intervals with monitoring locations identified to ensure long term condition and ensure consistency. Criteria for success should include increase in Sphagnum species.

The measures will be supervised by the EnvCoW and mandated in a Construction Environment Management Plan.

GWDTE¹²

Re-wetting and soil stabilisation measures as detailed for Bog Habitats will be applied where appropriate.

On the basis the layout may change from that presented in Figure 6.2 prior to construction, the EnvCoW should identify and map moderate-high status GWDTEs. Permanently affected areas should be differentiated from temporary areas and these should be clearly demarcated on site and communicated to the design team/contractors.

In the vicinity of GWDTE where there is M6, M25 or M23 down gradient, cross drains should be installed under the track where the access track intersects the habitat. This is to maintain the water table and any shallow subsurface flow feeding the GWDTE across the track.

Drainage/ pumping to be minimised but where necessary water to be repumped to vicinity of excavation. Temporary cut-off drains to prevent water entering excavations. Trackside drainage to comprise either buffer strips or infiltration trenches in the vicinity of GWDTE. Reinstatement should occur as soon as practicable, ensure suitable hydrological conditions, and avoid permanent drainage.

¹² Adapted from GWDTE training presentation provided by Adrian Davis (Naiad Ecology) (A.Davis 2018, personal communication).

Pollution prevention measures to include run-off control (tamping soil bunds and covering during rainfall), silt-fencing and regular inspections by the EnvCoW.

In areas where there are potential GWDTE, any shallow groundwater encountered during construction and requiring dewatering should be pumped to a small holding sump to allow removal of suspended sediment. Once the solids have been removed, groundwater should either be discharged direct to or via a small down slope trench up gradient of the surrounding GWDTE allowing infiltration back into the ground. The work will be supervised by the EnvCoW and mandated in CEMP.

Any indirect loss of habitats caused by dewatering at turbines will also be minimised by minimising any period of dewatering and designing dewatering in compliance with the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended)).

A monitoring regime should be developed by the EnvCoW quantifying extent of effects of permanent and temporary works on GWDTE and within a format which may be provided to regulators upon request.

Waders

Areas of agriculturally improved grassland which currently hold little interest to waders should be identified and enhanced. Adjusting existing mowing regimes to allow tussocky, wet areas to persist throughout the year. For lapwing, fields should be cut/seeded to encourage patchy clumps of taller vegetation (10-15 cm) over 20% of the field, and no more than 10% rush cover¹³. Curlews prefer a taller and greater density of tussock to grassland ratio. These measures will benefit snipe too.

Agrochemical inputs should be limited in these areas and scrapes, waterlogged fields and splash pools should be used. Predator control should be introduced in consultation with local farmers if appropriate and safe to do so.

Post-construction monitoring should be undertaken in years 1, 2, 3 and 5 following operations commencing with a review being undertaken as to the need for any further monitoring following year 5.

3.2 Timings

The HMP will function for the lifespan of the Proposed Development. It is suggested that the schedule for carrying out the above objectives should be developed.

¹³ <https://naturalengland.blog.gov.uk/2018/07/11/looking-after-our-breeding-waders-on-upland-farms/> (accessed 14 October 2021).

4 Figures

Technical Appendix 6-1; Annex B- **CONFIDENTIAL**

Woolfords Wind Farm

Extended Phase 1 Survey

Wind2 Ltd

December 2021



Technical Appendix 6-1; Annex C

Woolfords Wind Farm

National Vegetation Classification (NVC) Survey

December 2021



Contents

1	Introduction	2
1.1	Terms of Reference	2
1.2	Objectives	2
1.3	Site Description	2
1.4	Relevant Legislation	2
2	Survey Methodology	4
2.1	NVC survey	4
3	Results	6
3.1	NVC communities	6
3.2	Annex 1 and Scottish Biodiversity List Status	8
3.3	Groundwater Dependent Terrestrial Ecosystems (GWDTE)	10
4	Summary	12
5	References	13
	Appendix	14
	Appendix A. Survey Results	14
	Appendix B. Species List	15
	Appendix C. Quadrat data	17

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Executive Summary

There are proposals to construct a wind farm consisting of three wind turbines and associated infrastructure near Woolfords in South Lanarkshire. It is important to identify if there are any sensitive habitats that may be negatively affected from these proposals, as such a National Vegetation Classification (NVC) Survey of the Proposed Development area plus a 250m buffer was conducted. The NVC communities were identified and assessed for their conservation value and their potential as Groundwater Dependent Terrestrial Ecosystems (GWDTE). Thirteen NVC communities were recorded, six of which had potential for groundwater dependency.

1 Introduction

1.1 Terms of Reference

Atmos Consulting Ltd. (Atmos) has been commissioned by Wind2 Ltd to prepare a National Vegetation Classification (NVC) survey as part of a suite of reports which will combine to form an Environmental Appraisal (EA) (Ecology and Ornithology Appraisal Report Technical Appendix 6-1).

The EA is in relation to a proposed planning application to construct and operate three wind turbines with maximum dimensions of 155m rotor diameter, 102.5m hub and 180m blade tip height, along with associated infrastructure including access tracks, turbine foundations (of an area up to 25 m x 25m) and crane hard-standings (up to 45 m x 25 m), a control building, substation, and a temporary construction compound.

The National Vegetation Classification (NVC) survey was undertaken within the infrastructure footprint which is referred to as the Proposed Development. The Survey Area comprises the Proposed Development plus 250m buffer on the redline boundary where access was available (Appendix A, Figure 6.2).

1.2 Objectives

The purpose of this study was to identify the NVC communities within the Survey Area and to assess their nature conservation value and their potential as Groundwater Dependent Terrestrial Ecosystems (GWDTE).

This report details the following:

- Field survey methodology; and
- Field survey results.
- Site Description

The Study Area is approximately 4km northeast of Forth in South Lanarkshire, centred on National Grid Reference (NGR) 299380, 657570.

It is an area consisting mainly of blanket bog, mire, and grassland with three small copses of coniferous woodland. There are no water bodies or major water courses within the Study Area other than two small burns to the west and north and a few drainage channels.

1.3 Relevant Legislation

Habitats

Certain habitats and plants are protected under Scottish law, prior to leaving the European Union (EU) this was through the Conservation (Natural Habitats &c.) Regulations 1994 as amended in Scotland which transposed into Scottish law the European Community's Habitats Directive (92/43/EEC). Since leaving the European Union the requirements of the Habitats Directive have been transposed into the Conservation (Natural Habitats, &c.) (EU exit) (Scotland) (Amendment) Regulations 2019, along with the Wildlife and Countryside Act 1981 (as amended).

GWDTEs

GWDTEs are wetland habitats which critically depend on groundwater flows and/or particular hydrochemistry. As such the distribution of these wetland communities are dependent on a combination of botanical, hydrological and geological influences.

Where habitats are confirmed as being significantly dependent on groundwater, they are afforded protection from disturbance under the Water Framework Directive (Directive 2000/60/EC) which is transposed into Scottish Law through the Water Environment and Water Services (Scotland) Act (WEWS) 2003.

2 Survey Methodology

2.1 NVC survey

The NVC survey was carried out over four days in September 2021 during good conditions. The NVC survey was carried out in accordance with the standard methodology published in the National Vegetation Classification Users Handbook (Rodwell, 2006), with reference to British Plant Communities Vols 2 (Rodwell 1988), 3 (Rodwell 1998).

The NVC survey was carried out by identifying a homogenous stand and recording the presence and abundance (using the Domin scale) of each species in a quadrat of 2 x 2m. If possible, more than one quadrat was taken for each NVC community.

Analysis of the data was complemented by using the Modular Analysis of Vegetation Information Systems (MAVIS) program from the Centre of Ecology and Hydrology (CEH) website (<http://www.ceh.ac.uk/services/modular-analysis-vegetation-information-system-mavis>).

Results of the survey showing the NVC communities present are shown in Appendix A, Figure 6.2.

Higher plant nomenclature follows that of Stace (2020) and bryophyte nomenclature follows that of Hill et al. (2008).

2.2 GWDTE survey methods

GWDTE's are identified here in the context of the SEPA Land Use Planning Guidance (2012, 2017). Within this guidance is a list of NVC communities which are regarded as potential GWDTE's based solely on their vegetation composition. To fully assess if an NVC community is actually dependent on groundwater requires further input from a hydrogeological perspective.

A hydrologist undertook a hydrogeological risk assessment of potential GWDTE communities identified in the NVC survey. As a result, the sensitivity scores in Table 4 do not reflect the final categorisations of GWDTE, as they are based on categorisation prior to hydrogeological assessment.

Full details this assessment can be viewed in Environmental Appraisal (EA) (Hydrology and Hydrogeology Report Technical Appendix 10-1).

Due to the small scale of some habitats and areas where one habitat transitioned into another similar habitat, many of the mapped areas represent complex mosaics of two or more NVC communities. Hence when determining whether a particular habitat was potentially groundwater dependent within the context of Land Use Planning System SEPA Guidance Note 31 (2017), the composition of the mosaic was taken into account, as outlined in Table 1 and seen in Figure 6.2 of Appendix A.

Table 1: GWDTE scoring system

Potential GWDTE Score 5 = Highest 0 = Lowest	Habitat attributes (adapted from Appendix 4 of SEPA Land Use Planning System SEPA Guidance Note 31, 2017)
5	All NVC communities present (regardless of number) are listed as being of HIGH potential dependence on groundwater.
4	NVC community/mosaic with dominant community listed as of HIGH potential dependence on groundwater with one or more communities of lesser dependence.
3	NVC community/mosaic with a sub-dominant community listed as of HIGH potential dependence on groundwater with the dominant community listed as lesser dependence.
2	NVC community/mosaic with dominant community listed as of MODERATE potential dependence on groundwater with other communities present of lesser dependence.
1	NVC community/mosaic with sub dominant community listed as MODERATE and dominant community not listed as potentially dependent on groundwater.
0	NVC community/mosaic supports no communities with potential dependence on groundwater.

2.3 Limitations

Surveys for NVC are normally carried out between April and September to cover the growth and flowering of the majority of plant species so that they can be easily identified and hence the NVC community identified more easily. These surveys were undertaken during September which is an appropriate time of year to identify most species so there were no significant limitations with regard to the timing of the surveys.

It is noted that following the survey the Proposed Development layout was revised and the access track shifted south to avoid other technical constraints. Therefore, in places, the further sections of the 250m buffer were not covered in the survey. This is not considered to be a limitation as per reasons described in the Environmental Appraisal (EA) (Ecology and Ornithology Report Technical Appendix 6-1) where results from the hydrogeological assessment were incorporated into an overall assessment.

3 Results

3.1 NVC communities

Results of the NVC survey are presented in Figure 6.2 in Appendix A with a species list in Appendix B and quadrat data in Appendix C. Table 2 below details of the dominant NVC communities and their coverage within the Survey Area.

Table 2: NVC communities and coverage within the Survey Area

NVC community	Area (ha)	% of total area
M17a <i>Scirpus cespitosus</i> – <i>Eriophorum vaginatum</i> – <i>Drosera rotundifolia</i> – <i>Sphagnum</i> spp. sub-community	60.17	35.05
M25a <i>Molinia caerulea</i> – <i>Potentilla erecta</i> – <i>Erica tetralix</i> sub-community	51.68	30.11
M23b <i>Juncus effusus/acuteiflorus</i> – <i>Galium palustre</i> – <i>Juncus effusus</i> sub-community	27.78	16.18
MG10a <i>Holcus lanatus</i> – <i>Juncus effusus</i> – Typical sub-community	12.53	7.30
MG6a <i>Lolium perenne</i> – <i>Cynosurus cristatus</i> – Typical sub-community	7.39	4.30
M23a <i>Juncus effusus/acuteiflorus</i> – <i>Galium palustre</i> – <i>Juncus acuteiflorus</i> sub-community	4.79	2.79
U5a <i>Nardus stricta</i> – <i>Galium saxatile</i> species poor sub-community	2.77	1.61
Non NVC habitats	2.39	1.39
M15d <i>Scirpus cespitosus</i> – <i>Erica tetralix</i> – <i>Vaccinium myrtillus</i> sub-community	1.43	0.83
S9a <i>Carex rostrata</i> – <i>Carex rostrata</i> sub-community	0.43	0.25
M6d <i>Carex ecinata</i> – <i>Sphagnum recurvum</i> <i>Juncus acuteiflorus</i> sub-community	0.30	0.17
Total	171.65	100.00

Blanket bog

There were three blanket bog communities found within the Proposed Development area; the M17a *Scirpus cespitosus* – *Eriophorum vaginatum* *Drosera rotundifolia* – *Sphagnum* spp. sub-community, the M18b *Erica tetralix* – *Sphagnum papillosum* *Empetrum nigrum* ssp. *nigrum* – *Cladonia* spp. sub-community and the M19a *Calluna vulgaris* – *Eriophorum vaginatum* *Erica tetralix* sub-community. The M18b and M19a communities were found in small areas as part of the mosaics of the M17a blanket bog and other mire communities. Large areas of the M17a blanket bog were found along the northern boundary of the Proposed Development area where the ground was flat. This community was dominated by deergrass *Trichophorum cespitosum* and hare's-tail cottongrass *Eriophorum vaginatum*. In the flat areas which were wetter more bog asphodel *Narthecium ossifragum* could be seen, along with a greater variety of *Sphagnum* mosses such as *Sphagnum papillosum* and *Sphagnum palustre*. In the drier areas to the south-west the bog was richer in dwarf shrubs such as heather *Calluna*

vulgaris and crowberry *Empetrum nigrum* with an understory of *Sphagnum capillifolium* and Pleurocarpus mosses such as *Rhytidiadelphus squarrosus* and *Brachythecium rutabulum*.

The M18b community was found in one small area to the north-east of the Proposed Development area. Here there was a low sward of cross-leaved heath *Erica tetralix* with occasional heather *Calluna vulgaris* over a carpet of bryophytes particularly *Sphagnum papillosum* and *Sphagnum capillifolium* with the lichen *Cladonia* sp. only rarely recorded.

Within the M17 blanket bog could be found small areas of the M19a community where there was more cross-leaved heath, heather, blaeberry *Vaccinium myrtillus* and hare's-tail cottongrass, giving a more tussocky sward. Bryophytes are represented by *Sphagnum capillifolium* as a constant with *S. papillosum* and *Pleurozium schreberi* as occasional species.

Other mires

Five other mire communities were found in the Proposed Development area, these were; the M25a *Molinia caerulea* – *Potentilla erecta* *Erica tetralix* sub-community, the M23a *Juncus effusus/acutiflorus* – *Galium palustre* *Juncus acutiflorus* sub-community, the M23b *Juncus effusus/acutiflorus* – *Galium palustre* *Juncus effusus* sub-community, the M6c *Carex echinata* – *Sphagnum recurvum/auriculatum* *Juncus effusus* sub-community and M6d *Carex echinata* – *Sphagnum recurvum/auriculatum* *Juncus acutiflorus* sub-community.

The M25a community, dominated by purple moor-grass *Molinia caerulea* and sharp-flowered rush *Juncus acutiflorus*, was generally found around the edges of the blanket bog and was seen as a transition community between the bog communities and the other mires and marshy grassland communities. There were a few bryophytes such as *Hylocomium splendens* and *Pleurozium schreberi*.

The two M23 communities were found in large areas on the slightly sloping ground in the southern part of the Proposed Development area and in many of the drainage channels which ran south. The less species rich M23b sub-community dominated by soft rush *Juncus effusus* was the more prolific of the two communities, covering large areas between the mire and grassland communities. The M23a community dominated by sharp-flowered rush was more species rich with grasses such as Yorkshire fog *Holcus lanatus* and sweet vernal grass *Anthoxanthum odoratum*, herbs such as marsh bedstraw *Galium palustre* and marsh willowherb *Epilobium palustre* and mosses such as *Brachythecium rutabulum* and *Rhytidiadelphus squarrosus*.

The two soligenous mire communities of M6c and M6d were found along the southern edge of the Proposed Development area along seepage lines and along old drainage channels. These communities were a mix of mosses such as *Sphagnum palustre*, *Rhytidiadelphus squarrosus* and *Polytrichum commune* underneath a sward of soft rush in M6c and sharp-flowered rush in M6d.

Grassland

The grassland communities were generally found on the sloping ground to the south of the Proposed Development area. The unimproved neutral grassland MG10a *Holcus lanatus* - *Juncus effusus* Typical sub-community covered the largest area, with the improved grassland MG6a *Lolium perenne* – *Cynosurus cristatus* Typical sub-community and the acid grassland U5a *Nardus stricta* – *Galium saxatile* Species poor sub-

community each covering less than a quarter of the area covered by the MG10a. The other two acid grassland communities; U5b *Nardus stricta* – *Galium saxatile* *Agrostis canina* – *Polytrichum commune* sub-community and U6a *Juncus squarrosus* – *Festuca ovina* *Sphagnum* sub-community were found as smaller areas in mosaics with mire communities.

The MG10a community was a more grassy community with Yorkshire fog and tufted hair-grass *Deschampsia cespitosa* often abundant in the rush sward interleaved with smaller species such as white clover *Trifolium repens* and heath bedstraw *Galium saxatile*. The MG6a community was a much shorter sward which was heavily grazed and dominated by the grasses perennial rye grass *Lolium perenne* and crested dog's tail *Cynosurus cristatus* with only very scattered rushes. Both of the U5 communities were dominated by mat grass *Nardus stricta*, along with abundant sweet vernal grass *Anthoxanthum odoratum* and wavy hair-grass *Deschampsia flexuosa*. There were two small areas of the U6a community which were dominated by heath rush *Juncus squarrosus* over a carpet of mosses, particularly *Sphagnum capillifolium*, *Polytrichum commune* and *Hylocomium splendens*.

Wet heath

There were two areas of the wet heath M15d *Scirpus cespitosus* – *Erica tetralix* *Vaccinium myrtillus* sub-community towards the north of the Proposed Development area. The other M15b *Trichophorum cespitosum* – *Erica tetralix* Typical sub-community was only found as part of a mosaic with another mire community. The M15d sub-community was a drier and grassier assemblage with grasses such as purple moor-grass and wavy hair-grass and the dwarf shrub blaeberry. The other sub-community M15b was found in a slightly wetter area where there were more sedges as in deergrass and hare's-tail cottongrass.

Swamps and fens

The S9a *Carex rostrata* *Carex rostrata* sub-community and the S10a *Equisetum fluviatile* *Equisetum fluviatile* sub-community were found in one small area on the northern boundary of the Proposed Development area around a stream. The S10a community was part of a mosaic with the S9a community where the S10a community was found in the deeper water in the stream and the S9a community surrounded it on the slightly drier areas around the banks of the stream. The species poor S10a community was dominated by water horsetail *Equisetum fluviatile* with few other species and transitioned into the S9a community as bottle sedge *Carex rostrata* became more dominant. The S9a community had a few herbs such as marsh willowherb *Epilobium palustre*, marsh thistle *Cirsium palustre* and cuckoo flower *Cardamine pratensis*.

3.2 Annex 1 and Scottish Biodiversity List Status

Several NVC communities are also considered to have a conservation value at European level (Annex 1) and/or at a national level as in the Scottish Biodiversity List (SBL) priority habitats¹. The status of an NVC community as an Annex 1 or SBL priority habitat can depend on a number of factors such as quality, extent and species assemblages which means that not all instances of an NVC community would

¹ which supercede UK Biodiversity Action Plan (BAP) priority habitats in Scotland

constitute an Annex 1 or a SBL priority habitat. Table 3 below outlines the NVC communities found within the Survey Area and their associated conservation designations.

Table 3: NVC communities within the Study Area and their conservation designations

NVC Code	NVC Community	Annex 1 habitat	SBL/UK BAP Priority habitat
M6	<i>Carex ecinata</i> – <i>Sphagnum recurvum</i> mire	None	Upland flushes, fen and swamp
M15	<i>Scirpus cespitosus</i> – <i>Erica tetralix</i> wet heath	H7130 Blanket bog, where peat depth is > 0.5m H4010 Northern Atlantic wet heaths with <i>Erica tetralix</i>	Upland heathland Blanket bog if peat depth >0.5m
M17	<i>Scirpus cespitosus</i> – <i>Eriophorum vaginatum</i> blanket mire	H7130 Blanket bog	Blanket bog
M18	<i>Erica tetralix</i> – <i>Sphagnum papillosum</i> raised and blanket mire	H7130 Blanket bog	Blanket bog
M19	<i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire	H7130 Blanket bog	Blanket bog
M23	<i>Juncus effusus/acutiflorus</i> – <i>Galium palustre</i> rush-pasture	None	Upland flushes, fen and swamp in M23a Purple moor-grass and rush pasture in M23b
M25	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	H7130 Blanket bog, where peat depth is > 0.5m	Purple moor-grass and rush pasture Blanket bog if peat depth >0.5m
MG6	<i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland	None	None
MG10	<i>Holcus lanatus</i> – <i>Juncus effusus</i> rush-pasture	None	None
S9	<i>Carex rostrata</i> swamp	None	Upland flushes, fen and swamps
S10	<i>Equisetum fluviatile</i> swamp	None	Upland flushes, fen and swamps
U5	<i>Nardus stricta</i> – <i>Galium saxatile</i> grassland	None	None
U6	<i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland	None	None

Annex 1

Five of the NVC communities found within the Study Area have a conservation value at Annex 1 level; these are the mire communities M15, M17, M18, M19 and M25.

Annex 1 type H7130 blanket bog relates most closely to three of the NVC communities such as M17, M18 and M19. Although M18 and M19 were only found in very small pockets of larger areas of M17 they nonetheless comprised the main peat forming

communities and are considered collectively as Annex 1 communities. M25 and M15 can also be included in the H7130 blanket bog Annex 1 type if the underlying peat depth is greater than 0.5m. The peat depth in areas of M25 is not known so as a worst-case scenario these have also been classified as potential Annex 1 blanket bog. The peat depth in areas of M15 is also not known, however as M15 comes under H4010 Northern Atlantic wet heaths with *Erica tetralix* it would be considered to come under this Annex 1 type.

SBL Priority Habitats

Nine of the NVC communities found within the Study Area would come under SBL priority habitats. The relevant SBL priority habitat types and associated NVC communities are as follows:

- Blanket bog: M18, M18, M19 and M15 and M25 in areas where the peat depth is greater than 0.5m
- Upland flushes, fens and swamps: M6, M23a, S9 and S10
- Purple moor-grass and rush pasture: M23b and M25
- Upland heathland: M15

3.3 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

The distribution of the NVC communities within the Survey Area which are potentially influenced by ground water can be seen in Figure 6.2 at Appendix A. According to the guidance in SEPA (2017) wetland NVC communities are classified according to their potential to be dependent on groundwater in certain hydrogeological settings and identified as having the potential to be either highly groundwater dependent or moderately groundwater dependent. Table 4 below lists the NVC communities found within the Study Area and their relative potential dependency on groundwater.

As discussed in 2.2 the sensitivity scores in Table 4 do not reflect the final categorisations of GWDTE as the Table 4 categorisations are prior to hydrogeological analysis. They indicate potential GWDTE presence which requires hydrogeological analysis to confirm.

Table 4: NVC communities and their relative potential dependency on groundwater prior to hydrogeological risk assessment.

NVC Code	NVC Community	Potential GWDTE
M6	<i>Carex ecinata</i> – <i>Sphagnum recurvum</i> mire	High
M15	<i>Scirpus cespitosus</i> – <i>Erica tetralix</i> wet heath	Moderate
M17	<i>Scirpus cespitosus</i> – <i>Eriophorum vaginatum</i> blanket mire	None
M18	<i>Erica tetralix</i> – <i>Sphagnum papillosum</i> raised and blanket mire	None
M19	<i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire	None
M23	<i>Juncus effusus/acutiflorus</i> – <i>Galium palustre</i> rush-pasture	High
M25	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	Moderate
MG6	<i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland	None
MG10	<i>Holcus lanatus</i> – <i>Juncus effusus</i> rush-pasture	Moderate
S9	<i>Carex rostrata</i> swamp	None
S10	<i>Equisetum fluviatile</i> swamp	None

NVC Code	NVC Community	Potential GWDTE
U5	<i>Nardus stricta</i> – <i>Galium saxatile</i> grassland	None
U6	<i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland	Moderate

Within the Survey Area there were two communities (M6 and M23) which had a high potential to be dependent on ground water and four communities (M15, MG10 M25, and U6) which had a moderate potential. There was only one area of the M6 community in the centre of the Study Area, otherwise it was present as small areas within mosaics with other wetland communities such as M23.

The majority of the M23 areas were found around drainage channels, particularly on the gently sloping ground to the south of the Study Area, so are more likely to be supplied by surface water. The NVC communities with a moderate potential to be GWDTEs were mostly found on the flatter ground to the north and western part of the Study Area so potentially fed by rainwater rather than ground water.

Although these NVC communities have been classified as potential GWDTE, this does not necessarily give any additional conservation importance to these habitats, but they may be more sensitive to particular impacts, particularly hydrogeological ones.

4 Summary

The NVC and GWDTE survey carried out in September 2021 identified 13 different NVC communities, six of which had the potential to be a GWDTE.

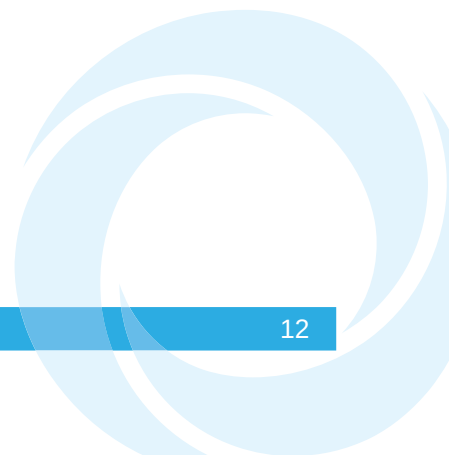
The Survey Area was dominated by M17 blanket bog on the flatter ground to the north and west of the Study Area and M23 and MG10 rush pastures on the gently sloping areas to the south, with M25 mire in transitional areas between the blanket bog and rush pasture.

The grassland communities such as MG6 and U5 were found to the south of the Study Area and were grazed by sheep and cattle.

Two Annex 1 habitats were present within the Study Area. The H7130 blanket bog habitat was widespread and included stands of reasonable quality M17, M18 and M19, and potentially included stands of M15 and M25 if they were in areas with a peat depth greater than 0.5m.

The other Annex 1 habitat H4010 wet heath was represented by small areas of M15. Also present in the Study Area were four SBL priority habitats; Blanket bog, Upland flushes, fens and swamps, Purple-moor grass and rush pasture and Upland heathland. These were widespread across the Study Area.

Wetland habitats which had GWDTE potential were widespread across the Study Area, particularly on the sloping ground to the south. These were represented by the M6 and M23 communities which had a high potential to be ground water dependent, although the M23 community was often located in places which were fed by surface water, and the M15, MG10, M25 and U6 which had a moderate potential to be GWDTEs. Occasionally the NVC communities which had a moderate groundwater potential were located next to blanket bog on flatter areas and were fed by rainfall rather than ground water.



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Appendix

Appendix A. Survey Results

Appendix B. Species List

Scientific name	Common name	Red data list
<i>Acer pseudoplatanus</i>	Sycamore	
<i>Achillea millefolium</i>	Yarrow	Least concern
<i>Agrostis capillaris</i>	Common bent	Least concern
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass	Least concern
<i>Bellis perennis</i>	Daisy	Least concern
<i>Betula pubescens</i>	Downy Birch	
<i>Calluna vulgaris</i>	Heather	Scottish Biodiversity List
<i>Cardamine pratensis</i>	Cuckoo flower	Least concern
<i>Carex echinata</i>	Star sedge	Least concern
<i>Carex nigra</i>	Common sedge	Least concern
<i>Carex rostrata</i>	Bottle sedge	Least concern
<i>Cirsium arvense</i>	Creeping thistle	Least concern
<i>Cirsium palustre</i>	Marsh thistle	Least concern
<i>Cirsium vulgare</i>	Spear thistle	Least concern
<i>Crataegus monogyna</i>	Hawthorn	Least concern
<i>Cynosurus cristatus</i>	Crested dog's tail	Least concern
<i>Dactylis glomerata</i>	Cock's-foot	Least concern
<i>Deschampsia cespitosa</i>	Tufted hair grass	Least concern
<i>Deschampsia flexuosa</i>	Wavy hair grass	Least concern
<i>Drosera rotundifolia</i>	Round leaved sundew	Least concern
<i>Empetrum nigrum</i>	Crowberry	Least concern
<i>Epilobium palustre</i>	Marsh willowherb	Least concern
<i>Equisetum fluviatile</i>	Water horsetail	Least concern
<i>Erica tetralix</i>	Cross-leaved heath	Least concern
<i>Eriophorum angustifolium</i>	Common cotton-grass	Least concern
<i>Eriophorum vaginatum</i>	Hare's-tail cotton-grass	Least concern
<i>Fagus sylvatica</i>	Beech	Least concern
<i>Festuca rubra</i>	Red fescue	Least concern
<i>Galium palustre</i>	Marsh bedstraw	Least concern
<i>Galium saxatile</i>	Heath bedstraw	Least concern
<i>Holcus lanatus</i>	Yorkshire fog	Least concern

Scientific name	Common name	Red data list
<i>Juncus acutiflorus</i>	Sharp-flowered rush	Least concern
<i>Juncus effusus</i>	Soft rush	Least concern
<i>Juncus squarrosus</i>	Heath rush	Least concern
<i>Larix decidua</i>	European larch	
<i>Lolium perenne</i>	Perennial rye-grass	Least concern
<i>Luzula multiflora</i>	Heath wood-rush	
<i>Molinia caerulea</i>	Purple moor grass	Least concern
<i>Nardus stricta</i>	Mat grass	Least concern
<i>Narthecium ossifragum</i>	Bog asphodel	Least concern
<i>Pinus sylvestris</i>	Scot's pine	Scottish Biodiversity List
<i>Poa annua</i>	Annual meadow-grass	Least concern
<i>Potentilla erecta</i>	Tormentil	Least concern
<i>Ranunculus acris</i>	Meadow buttercup	Least concern
<i>Ranunculus repens</i>	Creeping buttercup	Least concern
<i>Rumex acetosa</i>	Common sorrel	Least concern
<i>Rumex obtusifolius</i>	Broad-leaved dock	Least concern
<i>Senecio vulgaris</i>	Common groundsel	Least concern
<i>Sorbus aucuparia</i>	Rowan	Least concern
<i>Trichophorum germanicum</i>	Deer grass	Least concern
<i>Ulmus glabra</i>	Witch elm	Least concern
<i>Urtica dioica</i>	Common nettle	Least concern
<i>Vaccinium myrtillus</i>	Bilberry	Least concern
<i>Vaccinium oxycoccus</i>	Cranberry	Least concern
<i>Viola palustris</i>	Marsh violet	Least concern
Mosses		
<i>Brachythecium rutabulum</i>		
<i>Cladonia sp.</i>		
<i>Hylocomium splendens</i>		
<i>Polytrichum commune</i>		
<i>Rhytidiadelphus squarrosus</i>		
<i>Sphagnum capillifolium</i>		
<i>Sphagnum palustre</i>		
<i>Sphagnum papillosum</i>		

Appendix C. Quadrat data

Tables for sampled vegetation in each community are shown over the following pages. The Domin value is based on the percentage cover of each species within the 2 x 2m quadrat as in the following table.

% cover	DOMIN value
91 - 100	10
76 - 90	9
51 - 75	8
34 - 50	7
26 - 33	6
11 - 25	5
4 - 10	4
< 4 many	3
< 4 several	2
< 4 few	1

	MG6a	MG6a	MG10a	MG10a
Quadrat No.	1	2	8	9
Easting	299999	299510	299735	299663
Northing	657859	657618	657724	657868
Species	Domin	Domin	Domin	Domin
<i>Lolium perenne</i>	7	7		
<i>Cynosurus cristatus</i>	5	6		
<i>Juncus effusus</i>	2	1		6
<i>Juncus acutiflorus</i>			8	
<i>Trifolium repens</i>	5	7	5	
<i>Ranunculus repens</i>	4	3	5	4
<i>Cirsium arvense</i>	2	4		
<i>Rumex acetosa</i>	2	3		
<i>Galium saxatile</i>	1		2	
<i>Cirsium vulgare</i>	1			
<i>Deschampsia cespitosa</i>		1		7

<i>Agrostis capillaris</i>		3		5
<i>Holcus lanatus</i>			3	2
<i>Cirsium palustris</i>			2	1
<i>Rhytidadelphus squarrosus</i>			3	

	M23b	M23b	M23a	
Quadrat No	3	4	5	
Easting	299967	299768	299882	
Northing	657847	657735	657791	
Species	Domin	Domin	Domin	
<i>Juncus effusus</i>	9	9	3	
<i>Juncus acutiflorus</i>		5	9	
<i>Cirsium palustre</i>	2	2	2	
<i>Festuca rubra</i>	4		3	
<i>Epilobium palustre</i>	1	2	3	
<i>Galium palustre</i>	2			
<i>Viola palustris</i>			4	
<i>Rumex acetosa</i>		1	3	
<i>Potentilla erecta</i>			3	
<i>Rhytidadelphus squarrosus</i>			3	
<i>Sphagnum palustre</i>			3	
<i>Trifolium repens</i>			1	
<i>Ranunculus repens</i>			3	

	M6d	M6d	M25	M15d	M15b
Quadrat No	6	7	16	17	18
Easting	299964	299943	299856	299941	298704
Northing	657840	657821	657898	658036	657193
Species	Domin	Domin	Domin	Domin	Domin
<i>Molinia caerulea</i>	6	5	4	7	5
<i>Festuca rubra</i>	6	4		7	
<i>Juncus squarrosus</i>	2	2		3	
<i>Juncus effusus</i>			2		
<i>Juncus acutiflorus</i>			9		
<i>Potentilla erecta</i>	4	1	2	3	2
<i>Polytrichum commune</i>	4	3		3	2
<i>Sphagnum capillifolium</i>	4	9		3	4
<i>Rhytidadelphus squarrosus</i>	3		2	4	
<i>Hylocomium splendens</i>	3				
<i>Carex nigra</i>	1			1	
<i>Eriophorum vaginatum</i>		2			7
<i>Eriophorum angustifolium</i>		1			
<i>Anthoxanthum odoratum</i>		2	6		
<i>Erica tetralix</i>		2			2
<i>Viola palustris</i>		1	1		
<i>Holcus lanatus</i>		2			
<i>Deschampsia cespitosa</i>			2		
<i>Poa annua</i>			4		
<i>Rumex acetosa</i>			2		
<i>Holcus lanatus</i>			4		
<i>Ranunculus acris</i>			1		
<i>Cirsium palustre</i>			1		
<i>Vaccinium oxycoccos</i>				1	
<i>Vaccinium myrtillus</i>				1	
<i>Luzula multiflora</i>				1	

	M17a	M17a	M19a	M19a
Quadrat No	10	11	12	13
Easting	298612	299514	298579	299482
Northing	657003	657824	656953	657701
Species	Domin	Domin	Domin	Domin
<i>Trichophorum germanicum</i>	6	5		4
<i>Calluna vulgaris</i>	7		1	
<i>Erica tetralix</i>	4	4	6	5
<i>Narthecium ossifragum</i>	2	5		
<i>Molinia caerulea</i>	2	2	3	7
<i>Empetrum nigrum</i>	1			
<i>Sphagnum capillifolium</i>	4	4	4	4
<i>Eriophorum vaginatum</i>	4	7	7	7
<i>Sphagnum papillosum</i>	2	7	2	4
<i>Eriophorum angustifolium</i>	2			
<i>Festuca rubra</i>	2			
<i>Vaccinium myrtillus</i>			6	
<i>Polytrichum commune</i>			2	4
<i>Vaccinium oxycoccus</i>			1	

	U5a	U5a	S9a	
Quadrat No	14	15	19	
Easting	299815	299231	298855	
Northing	657750	657320	657853	
Species	Domin	Domin	Domin	
<i>Nardus stricta</i>	6	7		
<i>Festuca rubra</i>	6			
<i>Molinia caerulea</i>	2	3		
<i>Polytrichum commune</i>	4			
<i>Anthoxanthum odoratum</i>	4	5		
<i>Potentilla erecta</i>	3	4		
<i>Galium saxatile</i>	4	6		
<i>Brachythecium rutabulum</i>	5			
<i>Rhytidia delphus squarrosus</i>		4		
<i>Hylocomium splendens</i>	4			
<i>Juncus squarrosus</i>		2		
<i>Agrostis capillaris</i>		4		
<i>Deschampsia flexuosa</i>		6		
<i>Carex nigra</i>		1		
<i>Carex rostrata</i>			9	
<i>Equisetum fluviatile</i>			6	
<i>Epilobium palustre</i>			2	
<i>Cardamine pratensis</i>			1	
<i>Rumex acetosa</i>			1	
<i>Cirsium palustre</i>			1	
<i>Galium palustre</i>			1	

Technical Appendix 6-1; Annex D

Woolfords Wind Farm

Bat Activity Survey 2021

Wind2 Ltd

December 2021



Contents

1	Introduction	1
1.1	Terms of Reference	1
1.2	Site Description	1
1.3	Report Aims	1
2	Legislative Context	2
3	Methodology	3
3.1	Automatic Detector Survey	3
3.2	Sonogram Analysis	3
4	Results	5
5	Summary	8
6	References	9

Tables

Table 1:	Bat static deployment details	3
Table 2:	Bat static location details	3
Table 3:	Summary table showing the number of nights recorded bat activity fell into each activity bands for each species. Data excludes 'zero activity' nights. (See section 3.2)	6

Figures

Figure 1.	The median nightly pass rate (bat passes per hour) of each species.	5
Figure 2.	Time of bat passes from 15 minutes before to 90 minutes after sunset. Blue dots represent passes and grey bars indicate species specific emergence time ranges.	7

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1 Introduction

1.1 Terms of Reference

This report presents the results of the bat survey work carried out in support of the proposed Woolfords Wind Farm in South Lanarkshire (the Proposed Development).

The survey work and production of this report have been carried out by Atmos Consulting Ltd on behalf of Wind 2, the Applicant.

The surveys discussed within this report were carried out between May 2021 and September 2021

1.2 Site Description

The Proposed Development) is located approximately 4 km northeast of Forth in South Lanarkshire, NGR NS 99594 57188.

The site consists of agricultural land that slopes down towards Woolfords Cottages and the unnamed road to the south. Conifer plantations form boundaries to the site on the east and west. Access is proposed to be taken from the northeast of the site. The site location is shown in Figure 3-1 of the EA Report.

1.3 Report Aims

This report seeks to confirm the presence or likely absence of bats within the structures of interest and document the results of the surveys with the following details:

- Legislative context;
- Field survey methodology;
- Field survey results; and
- Discussion.

2 Legislative Context

All bat species in Scotland are protected by the Conservation (Natural Habitats, &c.) Regulations 1994 as amended in Scotland and are commonly referred to as European Protected Species (EPS). The Regulations transpose into Scottish law the European Community's Habitats Directive (92/43/EEC).

It is an offence to deliberately or recklessly:

- Capture, injure or kill a bat;
- Harass an individual or group of bats;
- Disturb a bat while it is occupying a structure or place used for shelter or protection;
- Disturb a bat while it is rearing or otherwise caring for its young;
- Obstruct access to a breeding site or resting place, or otherwise deny the animal use of the breeding site or resting place;
- Disturb a bat in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs;
- Disturb a bat in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young;
- Disturb a bat while it is migrating or hibernating;

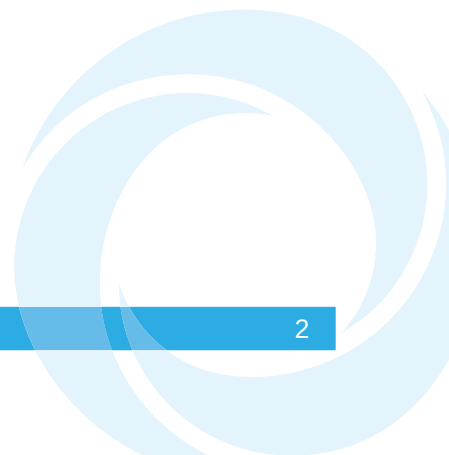
It is also an offence of strict liability to:

- Damage or destroy a breeding site or resting place of a bat even if they are not in use at the time (i.e. a summer roost during the winter period).

Of the 18 UK bat species, ten occur in Scotland: common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *P. pygmaeus*, Nathusius' pipistrelle *P. nathusii*, Natterer's *Myotis nattereri*, Daubenton's *M. daubentonii*, noctule *Nyctalus noctula*, brown long-eared bats *Plecotus auritus*, Leisler's *N. leisleri* and whiskered/Brandt's *M. mystacinus*/*M. brandtii* bats.

In addition to the above a number of bat species are included within the Scottish Biodiversity List, including: Brandt's, Daubenton's, whiskered, Natterer's, noctule, Nathusius', common pipistrelle, soprano pipistrelle and brown long-eared.

Bats are also detailed within the UK BAP.



3 Methodology

3.1 Automatic Detector Survey

Static bat detectors were deployed at three locations over three visits in May, June and September 2021. Full spectrum bat detectors (Wildlife Acoustics Song Meter Mini Bats) were used.

The detectors were set up to record activity from 30 minutes before sunset to 30 minutes after sunrise for a period of at least 10 nights. Table 1 shows the details of each of the three visits.

Table 1: Bat static deployment details

Visit Number	Date of deployment and retrieval	Number of nights deployed	Automatic time on and off	Hours detector on per night
1	07/05/2021 – 17/05/2021	10	20:35 – 05:47	8.2
2	17/06/2021 – 01/07/2021	14	21:32 – 04:58	6.4
3	15/09/2021 – 27/09/2021	12	19:31 – 06:46	11.25

Detectors were deployed in areas close to the proposed turbine locations as shown in Table 2.

Table 2: Bat static location details

Static	Habitat	Approximate Grid Reference
T1	Open grassland	NS 98967 57965
T2	Open grassland	NS 98746 57690
T3	Open grassland	NS 98825 57076

3.2 Sonogram Analysis

Analysis of full spectrum WAV files was undertaken using AnalookW v4.4a. All files were analysed with the assistance of bespoke species filters (using zero cross outputs).

Some species of bat are also difficult to confidently identify from sonogram analysis alone. As a result, not all calls were identified to species level with all species from the *Myotis* genera identified to genera level only.

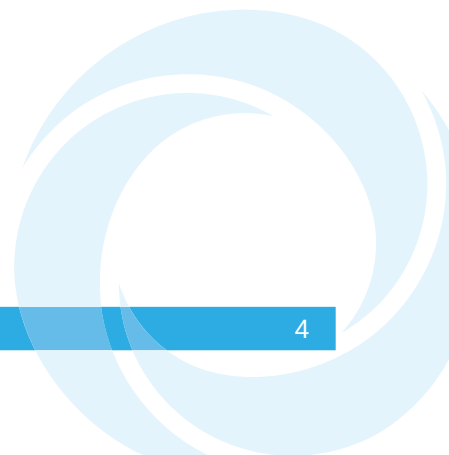
Absolute measures of bat activity are not possible to reliably calculate for automated field studies as during recording sessions it is not possible to differentiate between one bat passing the detector ten times or ten different bats passing the detector on a single occasion. As a result, relative measures are used and must be taken into consideration when interpreting results.

The index of bat activity was taken to be a sonogram file (maximum length of 15 secs) recorded from the static detectors. Although this is to some degree an arbitrary measure, the activity levels are comparable across detectors and it is a frequently used index. For the purpose of this report each file containing a call from a species is termed a 'pass'. Data is then converted to passes per hour adjusting for location specific night

time duration (sunset to sunrise) and days of deployment (adjusted to each detectors period of functioning).

Sonogram data for each detector location during each of the survey sessions was organised and used for analysis of activity levels across static detector locations and across survey periods. In addition, the data was also organised into the required format to upload for additional analysis within the secure online tool Ecobat (<http://www.ecobat.org.uk>). This analysis tool enables comparisons to be made in a spatial context allowing a geographically relevant assessment of activity levels. It should be noted that there is no function within Ecobat to know what volume of data is being used for geographic comparisons and as the system is in its infancy, interpreting comparative measures, especially within the remote Scottish uplands will require caution.

The Ecobat analysis approach includes a variety of outputs useful for ascertaining the importance of a site with respect to bat distribution and activity levels. In upland habitats, the issue of spatial and temporal variation is very pronounced with the potential for bat detectors to record no activity at locations generally unsuitable for bats, for example some wind farm sites. Ecobat can analyse rates of activity including or excluding 'zero activity' nights. Analysis provided by Ecobat with respect to the geographical context provides a comparative measure of high, moderate or low activity, however, and is based on the exclusion of 'zero activity' nights and although presented here, is likely to be an over-estimation of true activity levels.



4 Results

Weather

Current guidance (Scottish Natural Heritage, 2019) stipulates that surveys should capture a sufficient number of nights with appropriate weather conditions for bat activity. Lower temperature requirements are identified for Scotland with a minimum recommended temperature of 8°C at dusk.

Overall Site Activity

The results of the static detector surveys identified the presence of at least four species: common pipistrelle, soprano pipistrelle, *Myotis sp.* And *Nyctalus sp.* In total 871 bat passes were recorded, with 93.6% from pipistrelle species, 5.6% from *Nyctalus* species and 0.8 % from *Myotis*. Some records were recorded to the Pipistrelle genus only. The median nightly pass rate was highest for all species detected at T2 as shown in figure 1, inset.

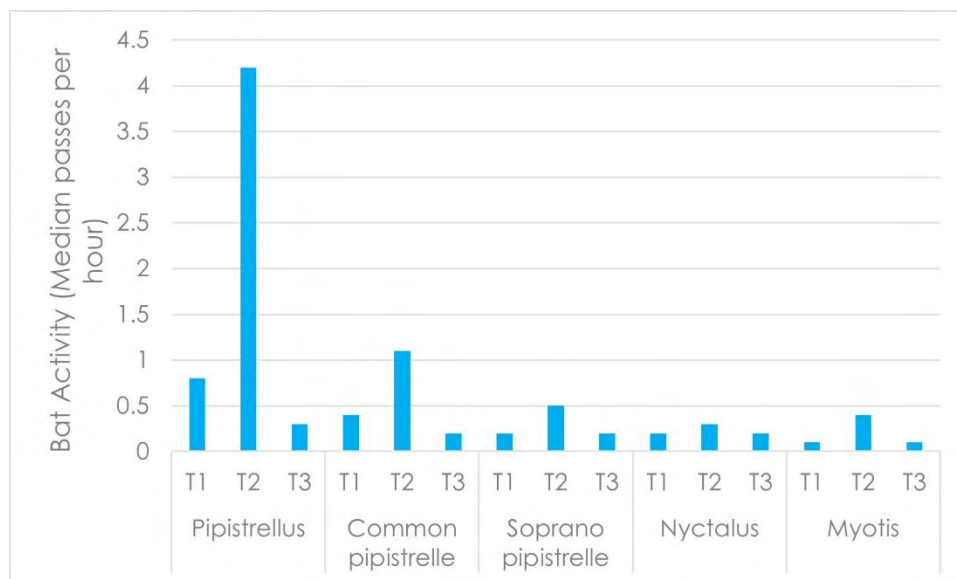


Figure 1. The median nightly pass rate (bat passes per hour) of each species.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. This is particularly pronounced on sites within the Scottish uplands. In these circumstances, the median is likely to be a more useful summary of the typical activity than is the mean (Lintott & Mathews, 2018).

Spatial Variation

Table 3 presents the activity levels within the context of the geographic location and temporal coverage as computed by Ecobat. As discussed in Section 3.2 this approach excludes 'zero activity' nights and as a result is likely to represent data skewed towards high activity levels. The analysis compares activity levels to centrally held data recorded within 30 days of the survey date and within 100 km² of the detector location. The results show the highest activity level to be in the vicinity of T2, with all the high activity levels at this turbine location by pipistrelle species. T2 also had the highest activity level for *Nyctalus* with two nights of moderate/high activity, and the highest level of *Myotis* activity with one night of moderate activity. It should be considered that the total number of recording nights for all three turbine locations was 36, therefore suggesting an overall low use of the site by bats.

Table 3: Summary table showing the number of nights recorded bat activity fell into **each activity bands for each species. Data excludes 'zero activity' nights.** (See section 3.2)

Detector ID	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
T1	<i>Myotis spp.</i>	0	0	0	0	1
T2		0	0	1	1	0
T3		0	0	0	0	1
T1	<i>Nyctalus spp.</i>	0	0	0	1	3
T2		0	2	2	3	4
T3		0	0	0	1	3
T1	<i>Pipistrellus</i>	0	1	2	0	0
T2		6	3	2	0	0
T3		0	2	2	2	0
T1	<i>Pipistrellus pipistrellus</i>	0	0	6	1	3
T2		3	7	4	0	3
T3		0	1	3	2	7
T1	<i>Pipistrellus pygmaeus</i>	0	0	2	2	6
T2		3	3	4	1	5
T3		0	0	2	3	6

Temporal variation

Activity levels can vary significantly throughout the activity season which may indicate a number of potential features being close by, such as maternity roosts, swarming sites and hibernation roosts. Figure 2, inset, shows the bat passes recorded for each species in relation to their emergence time, between 15 minutes before and 90 minutes after sunset. There was a single record of *Common pipistrelle* at T3 and a single record of *Nyctalus* at T2 during the emergence time range but as no cluster of activity was present, it is not considered to represent a roost in the vicinity.

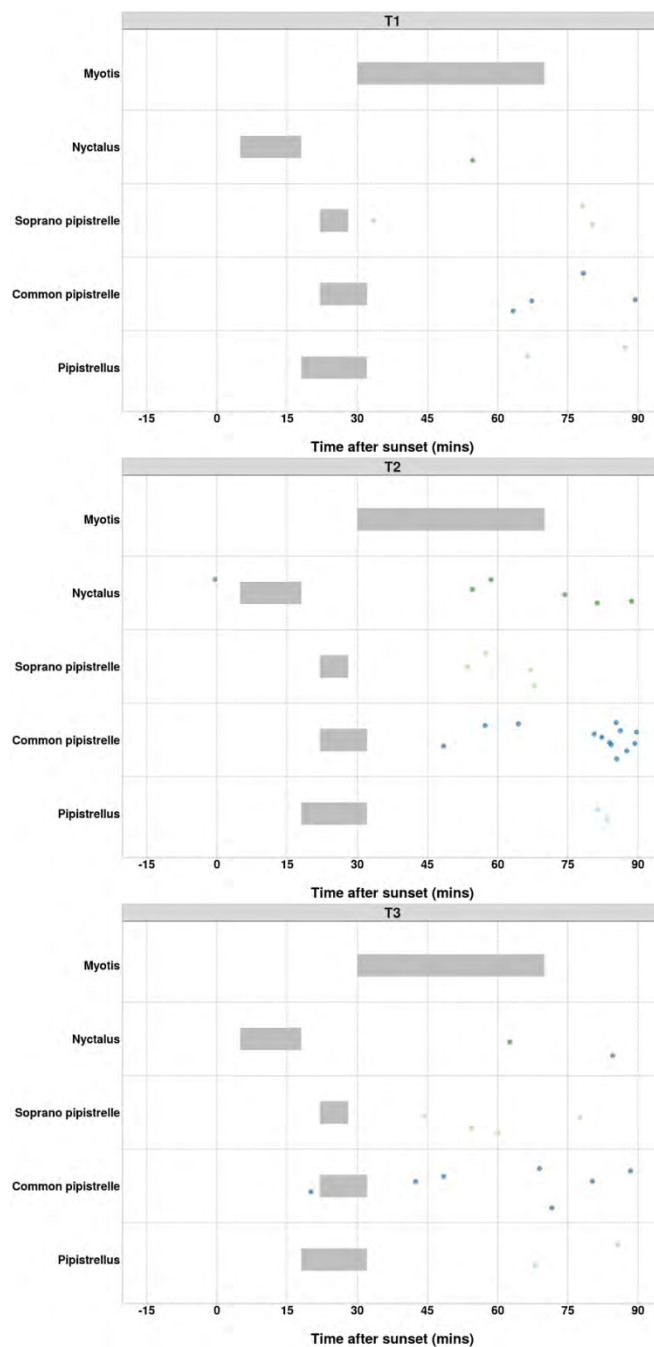


Figure 2. Time of bat passes from 15 minutes before to 90 minutes after sunset. Blue dots represent passes and grey bars indicate species specific emergence time ranges.

5 Summary

Bat activity surveys were undertaken across the Proposed Development site during the 2021 season. Three static bat detectors were deployed in May, June and September. Analysis of data collected by the bat detectors indicated that the site was predominantly used by common species such as Common and Soprano pipistrelles.

Small numbers of Nyctalus and Myotis species were also recorded. Activity was highest around T2 for all species recorded, with Pipistrelle species showing the highest level of activity here.

The lack of activity during the species-specific emergence times, would indicate that there is unlikely to be a roost in the vicinity of the static locations. Overall, the data indicates that bat activity on site is low.

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Technical Appendix 6-1; Annex E

Woolfords Wind Farm

Ornithology Surveys

Wind 2

December 2021



Contents

1	Introduction	1
1.1	Terms of Reference	1
1.2	Site Description	1
1.3	Objectives	1
2	Methodology	2
2.1	Desk study	2
2.1.1	Site designations	2
2.2	Vantage point surveys	2
2.2.1	Limitations	2
2.3	Breeding bird surveys	3
2.3.1	Limitations	3
2.4	Breeding raptor surveys	4
2.4.1	Limitations	4
3	Results	5
3.1	Desk study	5
3.1.1	Designated Sites	5
3.2	Vantage point surveys	5
3.3	Breeding bird surveys	6
3.4	Breeding raptor surveys	9
4	Collision risk modelling	11
4.1	Random Collision Risk Model	11
5	Conclusions	14
6	References	15
	Appendices	16
	Appendix A. Dates and times of VPs	17
	Appendix B. Vantage Point Flights	19

Contents

Tables

Table 1:	Hours of VP observation	2
Table 2:	Dates and times of breeding bird surveys	3
Table 3:	Dates and times of breeding raptor surveys	4
Table 4:	Designated site search results	5
Table 5:	Results from vantage point surveys September 2020 – August 2021	5
Table 6:	Breeding bird results April 2021 – August 2021	6
Table 7:	Non-breeding records	8
Table 8:	Summary of raptor territories	9
Table 9:	Turbine Parameters	11
Table 10:	Random CRM Biometric Parameters	12
Table 11:	Random CRM results	13
Table 12:	Dates and times of VPs	17
Table 13:	Vantage Point Flights	19

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1 Introduction

1.1 Terms of Reference

This report presents the results of the ornithology desk study, survey and collision risk modelling work carried out in support of the Proposed Development in South Lanarkshire.

This report details the results of ornithology survey work carried out between August 2020 – September 2021.

1.2 Site Description

The proposed Woolfords Wind Farm (hereafter referred to as the Proposed Development) is located approximately 4km northeast of Forth in South Lanarkshire centred on National Grid Reference (NGR) 299380, 657570.

The Proposed Development lies between 250 - 314m AOD and is located south of the operational Pates Hill Wind Farm. The site consists of agricultural land that slopes down to Woolfords Cottages and the main road to the south. Conifer plantations form boundaries to the site on the east and west. Access is proposed to be taken via the northeast of the site.

1.3 Objectives

The aims of the report are to:

- Describe the desk study undertaken in support of the Ecology and Ornithology Report Technical Appendix 6-1;
- Describe the methodology used for site surveys and the data gathered as a result of those site surveys; and
- Describe the collision risk methodology in detail and present the results of that collision risk modelling.

2 Methodology

2.1 Desk study

2.1.1 Site designations

A desktop search of designated sites in proximity to the Proposed Development was undertaken using the following criteria:

- Any nationally/internationally designated site with an avian designation (e.g., Natura sites, Sites of Special Scientific Interest (SSSIs)) within 10km of the Proposed Development boundary; and
- Any internationally designated site with geese as a qualifying feature within 20km of the Proposed Development.

Criteria were chosen based upon likely connectivity of selected receptors (SNH, 2016).

2.2 Vantage point surveys

The Proposed Development is covered by one vantage point (VP1) (Figure 6-4). Vantage point surveys commenced in September 2020 and were carried out at the frequencies indicated in Table 1. Details of VPs times and dates is shown in Appendix A.

Standard VP methodology has been used as per SNH guidance (SNH, 2013, revised 2014). This has subsequently been re-issued, but it was the 2014 version which was extant at the time surveys commenced.

Table 1: Hours of VP observation

Month	Dawn	Diurnal	Dusk
Sep-20		6	
Oct-20		6	
Nov-20		3	3
Dec-20		6	
Jan-21		6	
Feb-21	3	3	
Mar-21		6	
Apr-21		6	
May-21		6	
Jun-21		6	
Jul-21		6	
Aug-21		6	

2.2.1 Limitations

There were no noted limitations during this survey period.

2.3 Breeding bird surveys

Table 2 shows the dates and times of breeding bird surveys, which were carried out using a modified Brown and Shepherd methodology, following the modifications suggested in SNH 2018.

In 2021, surveys were carried out at approximately monthly intervals between April – August, with all areas of the site approached to a distance of approximately 100m. Breeding bird surveys (BBS) surveys were carried out across the entire red line boundary and to those areas within the 500m buffer to which we had access, therefore excluding the forestry to the west, south and east and the land to the south-east of the railway and to the east of the main road which passes through Woolfords village (Figure 6-5).

Where full access was not available, public access was used where possible and watches were carried out from the nearest accessible land. All birds seen or heard were recorded using BTO codes on dedicated survey maps.

Table 2: Dates and times of breeding bird surveys

Visit number	Date	Start time	Duration (hrs)	Surveyor
1	12/04/2021	10:30	5:30	Michael Christie
2	17/05/2021	13:30	4:15	Laura Shelbourn
	18/05/2021	13:05	2:25	Laura Shelbourn
3	09/06/2021	09:30	4:07	Laura Shelbourn
	17/06/2021	09:00	6:10	Roisin McGrory
4	05/07/2021	12:30	5:20	Andrew Francis
5	03/08/2021	10:30	5:05	Roisin McGrory

The behaviour and location of species were recorded on 1:10,000 scale maps, using standard BTO codes and nomenclature.

Once surveys were complete, analysis of territories was undertaken. This involved of assessment of bird records across all five surveys. Four categories were recognised and are summarised from BTO breeding evidence codes:

- Confirmed territory – a nest with eggs or young was found, adults were seen carrying food (unless raptors) or nesting materials or juvenile birds were present on site and sufficiently young that they were unlikely to have come in from elsewhere;
- Probable territory – pairs of birds were seen in suitable breeding habitat, singing bird was observed on more than one occasion, or other territorial behaviour (e.g., courtship, display territorial disputes or anxiety calls) were observed at least once;
- Possible territory – birds were observed in suitable breeding habitat and if singing did so on no more than one occasion; and
- Non-breeding – birds were observed flying over, potentially on migration or with no evidence of breeding behaviour as discussed above.

2.3.1 Limitations

Due to access restrictions survey was mainly limited to the wider site boundary with some coverage from roads.

2.4 Breeding raptor surveys

Breeding raptor surveys were carried out on an approximately monthly basis between April – August 2021. These used a walkover methodology within areas with access, where all parts of the site were approached to a distance of approximately 250m. No access was possible in part of the 2km buffer, and these locations were viewed from publicly accessible land where mini-VPS were undertaken.

Table 3 shows the dates and times of surveys.

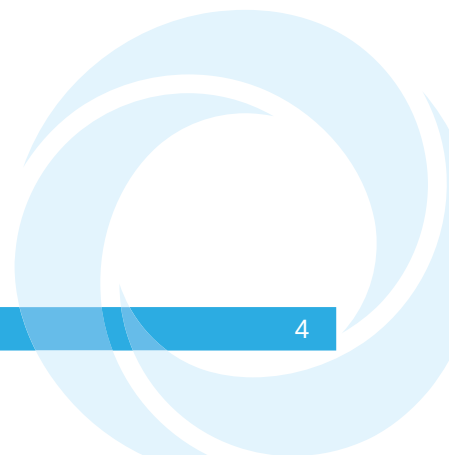
Table 3: Dates and times of breeding raptor surveys

Visit number	Date	Time	Duration (hrs)	Surveyor
1	13/04/2021	11:00	5:30	Michael Christie
2	06/05/2021	09:40	4:58	Laura Shelbourn
3	29/06/2021	09:30	6:30	Michael Christie
4	04/08/2021	10:45	5:26	Roisin McGrory

2.4.1 Limitations

The weather was suitable through the survey period, however on visit 4, visibility was hindered in the east of the site by smoke from a nearby wildfire.

Access was not available to all areas of buffer out with the wider site boundary; in these areas, access was limited to publicly accessible land only. This does mean that less obvious species within the buffer areas may have gone undetected.



3 Results

3.1 Desk study

3.1.1 Designated Sites

The results of this search are shown in Table 4. The designated sites, which also includes non-ornithology nature conservation designations are shown on Figure 6-6.

Table 4: Designated site search results

Site name	Distance from Site boundary	Designation ¹	Reason for designation
Westwater	11.6 km	Westwater SPA/Ramsar/SSSI	Pink-footed Goose, Non-breeding. Wildfowl Assemblage.

¹ – Special Protection Area/Site of Special Scientific Interest

3.2 Vantage point surveys

Table 5 shows the target species observed during VPs and the number of bird seconds observed at collision risk height. A list of all flights is shown in Appendix B and Figures 6-7a-c shows how this flight activity was distributed over the Survey Area. Collision risk modelling (CRM) was carried out for the three species that showed highest levels of flight activity over the Proposed Development during the first year of survey.

Table 5: Results from vantage point surveys September 2020 – August 2021

Species	Min. No. of Birds	Max. No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds	Corrected Annual Risk	No. of years per single collision	No. of birds colliding over 25 years
Curlew <i>Numenius arquata</i>	1	3	13	323	293	0.025	39.9	0.627
Dunlin <i>Calidris alpina</i>	1	1	1	16	16			
Golden plover <i>Pluvialis apricaria</i>	3	44	9	24,558	24,065	1.559	0.6	38.963
Goshawk <i>Accipiter gentilis</i>	1	1	1	61	0			
Greylag goose <i>Anser anser</i>	2	12	3	480	62			
Hen harrier <i>Circus cyaneus</i>	1	1	1	90	5			

Species	Min. No. of Birds	Max. No. of Birds	No. of Flights	Total Bird Seconds	At Risk Bird Seconds	Corrected Annual Risk	No. of years per single collision	No. of birds colliding over 25 years
Herring gull <i>Larus argentatus</i>	2	2	1	142	142			
Pink-footed goose <i>Anser brachy- rynchus</i>	19	70	7	24,334	9,666	0.074	13.6	1.842

The highest flight activity was associated with non-breeding flocks of gregarious birds, namely golden plover, and pink-footed geese. Golden plover is on the Scottish Biodiversity List. pink-footed geese are on the amber list of birds of conservation concern.

There were three greylag goose flights, 12 on the 10th December 2020, and two birds together on the 22nd March 2021 and 10th May 2021. It is possible that greylags may have bred close to, but outside of the survey area.

High flight activity of pairs of curlew was observed in June 2021 included birds mobbing corvids, frequently associated with nest defence. This supports the results of the breeding bird surveys (section 3.3) in substantiating that they bred on site. However, they are a wide-ranging species, and it is hard to localise territories without finding nests or witnessing agitated birds close to presumed nests and the collision risk attributed to curlew is very low given the small numbers involved.

Single flights of locally uncommon species included, a single male hen harrier was observed on site on the 17th November 2020, a single goshawk on the 22nd March 2021, a dunlin on the 25th of September 2020 and a herring gull on the 13th October 2020. Hen Harriers and goshawks are Schedule 1 protected species, it is possible that goshawks may have bred locally. Dunlin and herring gull are on the amber and red lists of birds of conservation concern respectively.

3.3 Breeding bird surveys

Table 6 shows the results of the breeding bird surveys. Figure 6-8 shows how these territories are distributed spatially.

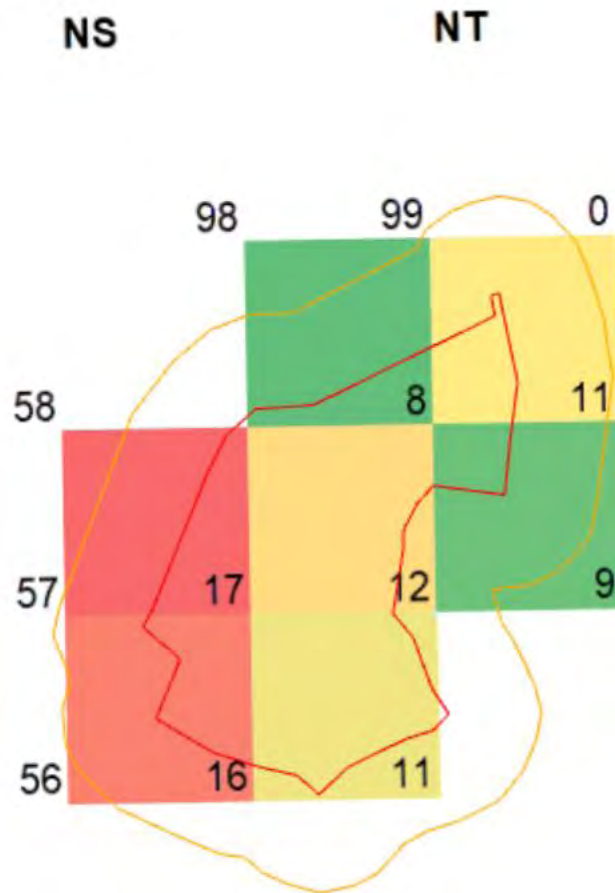
Table 6: Breeding bird results April 2021 – August 2021

Species	Scientific name	Status ¹	Confirmed	Probable	Possible
Blackbird	<i>Turdus merula</i>		0	0	4
Blue Tit	<i>Cyanistes caeruleus</i>		1		2
Buzzard	<i>Buteo buteo</i>		0	1	
Chiffchaff	<i>Phylloscopus collybita</i>		0	0	1
Chaffinch	<i>Fringilla coelebs</i>			7	9
Cuckoo	<i>Cuculus canorus</i>	Scottish Biodiversity List,	0	0	1

Species	Scientific name	Status ¹	Confirmed	Probable	Possible
		Red List			
Coal Tit	<i>Parus ater</i>		1	1	5
Curlew	<i>Numenius arquata</i>	Scottish Biodiversity List, Red List	0	2	1
Dunnock	<i>Prunella modularis</i>	Scottish Biodiversity List, Amber List	0	0	1
Goldfinch	<i>Carduelis carduelis</i>		0	0	6
Great Tit	<i>Parus major</i>		0	0	3
Jay	<i>Garrulus glandarius</i>		1	0	0
Kestrel	<i>Falco tinnunculus</i>	Scottish Biodiversity List, Amber List	1	0	0
Lapwing	<i>Vanellus vanellus</i>	Scottish Biodiversity List, Red List	0	1	
Linnet	<i>Linaria cannabina</i>	Scottish Biodiversity List, Red List	0	0	1
Lesser Redpoll	<i>Carduelis flammea cabaret</i>	Scottish Biodiversity List, Red List	0		1
Meadow Pipit	<i>Anthus pratensis</i>	Amber List	Analysis not performed, no confirmed territories, the most numerous bird on site.		
Oystercatcher	<i>Haematopus ostralegus</i>	Amber List	0	0	2
Pied Wagtail	<i>Motacilla alba yarrellii</i>		0	0	1
Robin	<i>Erithacus rubecula</i>		0	1	2
Reed Bunting	<i>Emberiza schoeniclus</i>	Scottish Biodiversity List, Amber List	0	0	2
Rook	<i>Corvus frugilegus</i>		0	1	2
Skylark	<i>Alauda arvensis</i>	Scottish Biodiversity List, Red List	0	28	36
Stonechat	<i>Saxicola torquata</i>		1	1	
Spotted Flycatcher	<i>Muscicapa striata</i>	Scottish Biodiversity List, Red List	1	0	0
Common Snipe	<i>Gallinago gallinago</i>	Amber List	0	1	1
Song Thrush	<i>Turdus philomelos</i>	Red List	0	0	4
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>		0	1	2
Wheatear	<i>Oenanthe Oenanthe</i>		0	0	2
Wood pigeon	<i>Columba palumbus</i>		0	0	1
Wren	<i>Troglodytes troglodytes</i>		0	0	3
Willow Warbler	<i>Phylloscopus trochilus</i>	Amber List	0	7	9

¹ Sch1 – listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended); SBL – listed on Scottish Biodiversity List; Red - categorised as 'red' on Birds of

Conservation Concern; Amber - categorised as 'amber' on Birds of Conservation Concern



This figure shows average densities of meadow pipit records observed per km² of surveyed land (see Section 2.3), per visit during Breeding Bird Surveys.

Table 7: Non-breeding records

Species	Scientific name	Conservation status	Likelihood of breeding	Comments
Carrion Crow	<i>Corvus coone</i>		High	Corvids in general are under-recorded because they lack conservation status and tend to breed either in proximity to houses or potentially in trees in dense woodland.
Common Sandpiper	<i>Actitis hypoleucos</i>	Amber List	Very Low	One sighting in late summer, probably a migrant.
Fieldfare	<i>Turdss pilaris</i>		Very Low	Extremely rare breeder and common winter visitor in the UK (Schedule 1), single sighting in early spring lingering from winter.
Greylag Goose	<i>Anser anser</i>	Amber List	Very Low	No suitable breeding habitat.
Golden Plover	<i>Pluvialis apricaria</i>	Scottish Biodiversity List	Very Low	Habitat probably not suitable, hard to miss as a breeding bird.
Herring Gull	<i>Larus argentatus</i>	Red List, Scottish Biodiversity	Very Low	Frequently breed more in coastal areas or, when inland, on flat roofs as found in urban areas, no

Species	Scientific name	Conservation status	Likelihood of breeding	Comments
		ty List		suitable habitat.
Pheasant	<i>Phasianus colchicus</i>		High	Numerous introduced bird of negligible conservation status, often captive reared and hard to assess breeding likelihood.
House Martin	<i>Delichon urbica</i>	Red List	High	Typically associated with human habitation where expediency curtails the use of binoculars by bird surveyors.
Magpie	<i>Pica pica</i>		High	Single record in suitable breeding habitat far to the east of buffer, probably under-recorded.
Jackdaw	<i>Corvus monedula</i>		High	(See house martin)
Raven	<i>Corvus corax</i>		Low	Whilst they prefer cliff faces they may nest in trees and could be associated with the plantation that for practical reasons was not surveyed in detail.
Starling	<i>Sturnus vulgaris</i>	Red List	High	(See house martin)
Swift	<i>Apus apus</i>	Red List, Scottish Biodiversity List	Low	(See house martin) but also a rarer breeder and typically associated with taller buildings.
Swallow	<i>Hirundo rustica</i>		High	(See house martin)
Siskin	<i>Carduelis spinus</i>		High	Likely under-recorded, generally a very common bird in conifer plantations to which we did not access for health and safety reasons.

3.4 Breeding raptor surveys

A small number of species were recorded during breeding raptor surveys, however multiple flights of these species were observed during visits.

Table 8 lists the raptor territories identified in 2021.

Table 8: Summary of raptor territories

Species	Scientific name	Within development boundary			Outwith development boundary but within survey area		
		Conf	Prob	Poss	Conf	Prob	Poss
Buzzard	<i>Buteo buteo</i>	0	1	0	0	0	1
Kestrel	<i>Falco tinnunculus</i>	0	0	0	0	0	1

A concentration of buzzard *Buteo buteo* activity was observed in a copse in the north of the site, where it is probable there was a nest. Regular activity from this species was observed across the site.

One possible territory of kestrel *Falco tinnunculus*, an amber list species and considered at risk from wind farm development, was observed, with frequent hunting activity from multiple individuals across the site.

On June 29th, 2021, a goshawk, *Accipiter gentilis*, a schedule 1 species, was observed in the west of the site carrying prey towards a conifer plantation and potential breeding habitat.

4 Collision risk modelling

CRM was carried out for the three species that showed highest levels of flight activity over the Proposed Development during the first year of survey: golden plover, curlew, and pink-footed goose. Four species were not included in the collision risk model because their total at-risk bird seconds were very low. These were dunlin with 15 seconds of flight, greylag goose with 62 seconds, hen harrier with 5 seconds and herring gull with 142 seconds.

A model (Forsyth *et al.* 1995) was used to calculate the daytime length as a function of latitude (55° 11' 11" N for the centre of the Proposed Development area. Table 9 presents the turbine parameters used for this model.

Table 9: Turbine Parameters

Parameter		Unit
Number of turbines	3	turbine
Blades per turbine	3	blades
Hub height	105	metres
Rotor radius	75	metres
Maximum chord	4.2	metres
Pitch	15	degrees
Rotation period	4	seconds
Proportion operational	0.85	-

4.1 Random Collision Risk Model

The random CRM was used for the three species as they exhibit more random flight patterns as opposed to regular linear flightpaths. An argument could have been made for including Pink-footed goose in a linear flight path model, but all flights appeared to be migratory flights and not regular movements to and from the goose roosts. It was felt that this activity did not fulfil the requirement for 'regularity' set out in the SNH guidance (SNH, 2000) regarding the use the linear movements model.

The general methodology used to predict collision risk for birds using the wind farm airspace is provided by SNH (SNH, 2000b).

In summary, the following steps were followed for random bird movements (as assumed for all three species) in this assessment:

- Digitise all flight lines and record relevant characteristics (including species, number of birds, start time of flight and time within each height band) in a database;
- Review the flight line data, which in this instance indicated that a random collision analysis should be conducted for each species;
- Identify all flights for each species that are at any point within the 'at risk' height band and sum the total 'at risk' flight duration for each VP, multiplying any flight at risk time by the number of birds observed, where more than one bird is recorded per flight line;
- Calculate an 'occupancy rate' for the VP, defined as the observed 'at risk' activity levels divided by total observation time and area observed, giving the occupancy per unit time and unit area for each VP;

- Apply the average occupancy rate to the wind development site, based on the site area, risk volume and total turbine rotor volume, applying a factor to estimate the total time that the birds could theoretically be active during the year, based on an algorithm for calculating day length (Forsythe et al. 1995); thus determining the total predicted time spent by the individual species within air space that could be swept by turbine blades;
- Run the collision model with relevant turbine and ornithological parameters to calculate the theoretical probability of transits resulting in a collision assuming no avoiding action; and
- multiply the number of transits by the collision rate, avoidance factor and operating parameters of the proposed wind farm to estimate the theoretical number of collisions per year.

Avoidance rates used were in accordance with SNH guidance on default values (SNH, 2017).

The predicted mortality through collision is dependent on a number of variables, including flight activity within the turbine envelope, the species' physiology, nocturnal flight behaviour and flight velocity, weather conditions, the predicted avoidance rate, the number, rotational speed and dimensions of the turbines, and the proportion of the time that the turbines are operational throughout the year.

The following assumptions were made for the species included for CRM:

- A daylight calculator was used to produce figures for the total daylight period at the Proposed Development area;
- Biometric data (bird length and wingspan) for the various species were obtained from the BTO webpage; and,
- Flight speed data taken from Alerstam et al. (2007).

Table 10 presents a summary of the model data used for all species subject to CRM including biometric parameters and avoidance rates.

Table 10: Random CRM Biometric Parameters

Species	Bird Length (m)	Wingspan (m)	Bird speed (m/s)	Avoidance rate	Months Active	Daylight hours	Night-time hours	Total hours	Assumed activity period	Flapping/ Gliding
Curlew	0.55	0.90	16.3	0.980	the year	4497	0.00	4497	daylight hours only	Flapping
Golden plover	0.28	0.72	13.7	0.980	the year	4497	0.00	4497	daylight hours only	Flapping
Pink-footed goose	0.68	1.52	17.1	0.998	September - March	2054	0.00	2054	daylight hours only	Flapping

Finally, Table 11 presents the results of the CRM for all species.

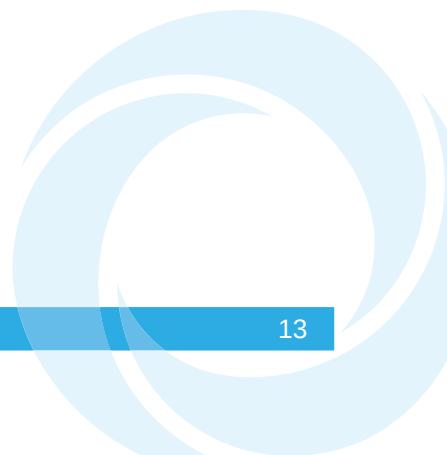
Table 11: Random CRM results

Species	Random CRM		
	Annual collision risk	Years per collision	Collisions over 25 years
Curlew	0.025	39.9	0.627
Golden plover	1.559	0.6	38.963
Pink-footed goose	0.074	13.6	1.842

It is considered that the collision risk rate for golden plover is over-estimated. It is heavily influenced by one flock of golden plover that used the site briefly during migration. However, the model would then assume that that is a reliable estimate of the frequency such an event occurs at. It is likely that a rarer event has been captured within the survey hours and that a flock of that size would not fly through the site as frequently as this set of data suggests. The collection of data through the second year of surveys should help to make this estimate more accurate.

The collision risk attributed to curlew is very low given the small numbers involved.

For Pink-footed goose, levels of collision risk are considered negligible, especially given the probable migratory provenance of the birds.



5 Conclusions

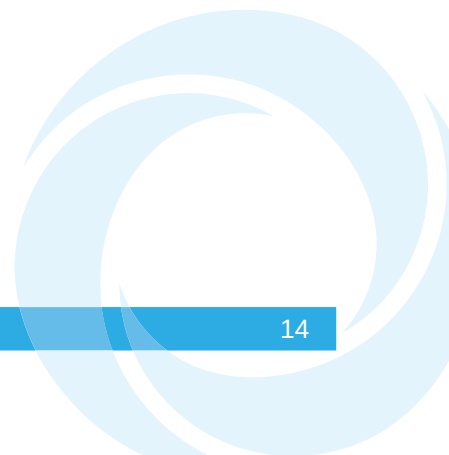
The limited flight activity of pink-footed goose seems to concern migratory birds, probably not associated with the Westwater SPA. Collision risk attributed to all pink-footed geese was estimated at less than two birds in 25 years. As such, we would identify no adverse impacts on the SPA goose population.

There are no statutory or non-statutory designated sites designated for breeding golden plovers in the zone of influence of the Proposed Development. There was some early migrant activity with a flock of up to 52 birds present during spring, recorded during breeding bird and vantage point surveys and which resulted in a moderately high estimate of collision risk for this species however It is considered that the collision risk rate is over-estimated and heavily influenced by one flock of non-breeding golden plover which used the Survey Area briefly during migration.

The site holds a moderate population of breeding waders, including curlew, lapwing oystercatcher and snipe, with only 3 discovered territories within 1km of turbine locations. One probable curlew territory is centred within 600m of Turbine 3, but this is considered too far to likely be displaced.

Single flights of Hen Harrier and Goshawk contribute negligibly to collision risk at this site although it is possible that the latter breed in forestry to the west of the site.

Further information on potential effects can be viewed in Ecology and Ornithology Report Technical Appendix 6-1.



6 References

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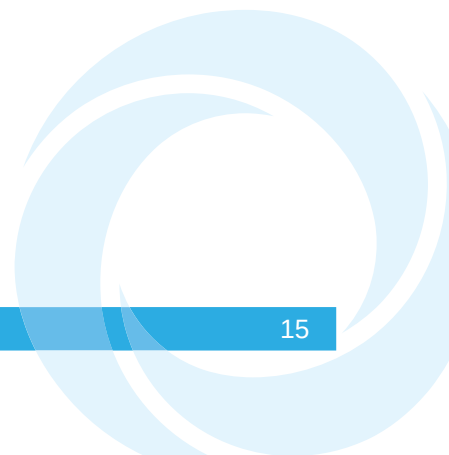
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Appendices

Appendix A. Dates and times of VPs

Table 12: Dates and times of VPs

Survey Date	Start Time	Finish Time	Duration	Surveyor	VP Type	Cloud cover	Visiblty	Precipitation	Temp (°C)	W. Speed (Beaufort Scale)	W. Direction
25/09/2020	10:15	13:15	03:00:00	Michael Christie	Diurnal	6	> 2km	None	9	3	N
25/09/2020	13:20	16:20	03:00:00	Michael Chhristie	Diurnal	6	> 2km	None	10	2	N
13/10/2020	10:00	13:00	03:00:00	Michael Christie	Diurnal	8	> 2km	Light Intermittent	8	4	NE
13/10/2020	13:10	16:10	03:00:00	Michael Christie	Diurnal	7	> 2km	None	8	4	NE
17/11/2020	09:50	12:50	03:00:00	Michael Christie	Diurnal	8	> 2km	None	12	4	SW
17/11/2020	13:00	16:00	03:00:00	Michael Christie	Dusk	8	> 2km	None	13	4	SW
10/12/2020	09:15	12:15	03:00:00	Michael Christie	Diurnal	8	> 2km	None	3	0	SE
10/12/2020	12:20	15:20	03:00:00	Michael Christie	Diurnal	8	> 2km	None	5	1	S
07/01/2021	09:30	12:30	03:00:00	Michael Christie	Diurnal	7	> 2km	None	0	1	W
07/01/2021	12:40	15:40	03:00:00	Michael Christie	Diurnal	5	> 2km	None	1	1	NW
19/02/2021	07:30	10:30	03:00:00	Michael Christie	Dawn	8	> 2km	Light Intermittent	6	5	S
19/02/2021	10:40	13:40	03:00:00	Michael Christie	Diurnal	8	> 2km	None	6	5	S
22/03/2021	10:10	13:10	03:00:00	Michael	Diurnal	8	> 2km	None	8	3	SW

Survey Date	Start Time	Finish Time	Duration	Surveyor	VP Type	Cloud cover	Visibilty	Precipitation	Temp (°C)	W. Speed (Beaufort Scale)	W. Direction
				Christie							
22/03/2021	13:30	16:30	03:00:00	Michael Christie	Diurnal	8	> 2km	None	8	3	SW
07/04/2021	09:40	12:40	03:00:00	Michael Christie	Diurnal	6	> 2km	None	1	2	NW
07/04/2021	13:00	16:00	03:00:00	Michael Christie	Diurnal	7	> 2km	None	4	2	NW
10/05/2021	09:20	12:20	03:00:00	Michael Christie	Diurnal	6	> 2km	Light Intermittent	10	1	SE
10/05/2021	12:40	15:40	03:00:00	Michael Christie	Diurnal	7	> 2km	None	11	3	SE
16/06/2021	10:40	13:40	03:00:00	Roisin McGrory	Diurnal	6	> 2km	None	12	3	SW
16/06/2021	14:00	17:00	03:00:00	Roisin McGrory	Diurnal	6	> 2km	None	13	2	SW
14/07/2021	16:43	19:43	03:00:00	Laura Shelbourn	Diurnal	6	> 2km	None	18	4	W
15/07/2021	13:18	16:18	03:00:00	Laura Shelbourn	Diurnal	0	> 2km	None	22	3	W
24/08/2021	10:26	13:26	03:00:00	Laura Shelbourn	Diurnal	2	> 2km	None	20	1	NE
24/08/2021	13:45	16:45	03:00:00	Laura Shelbourn	Diurnal	2	> 2km	None	20	2	NNE

Appendix B. Vantage Point Flights

Table 13: Vantage Point Flights

Date	Species	Time First Observed	No. of Birds	Height Band	Time in Height Band (s)	No. of Bird Seconds at Risk height
25/09/2020	Dunlin	13:49	1	B	16	16
25/09/2020	Pink-footed goose	10:53	35	C	52	0
25/09/2020	Pink-footed goose	10:57	40	C	31	0
25/09/2020	Pink-footed goose	12:08	70	C	91	0
25/09/2020	Pink-footed goose	12:14	20	C	82	0
25/09/2020	Pink-footed goose	13:08	28	C	100	0
13/10/2020	Herring gull	11:36	2	B	71	142
13/10/2020	Pink-footed goose	10:50	19	C	42	0
17/11/2020	Hen harrier	11:20	1	A	65	0
17/11/2020	Hen harrier	11:20	1	A	20	0
17/11/2020	Hen harrier	11:20	1	B	5	5
10/12/2020	Golden plover	10:45	13	B	184	2392
10/12/2020	Golden plover	12:29	16	B	288	4608
10/12/2020	Golden plover	14:34	13	A	21	0
10/12/2020	Greylag goose	09:20	12	C	29	0
07/01/2021	Pink-footed goose	11:40	54	B	179	9666
22/03/2021	Goshawk	12:20	1	A	61	0
22/03/2021	Greylag goose	10:40	2	B	31	62
07/04/2021	Golden plover	09:54	3	B	69	207
07/04/2021	Golden plover	12:03	3	B	11	33
07/04/2021	Golden plover	12:10	22	B	244	5368
07/04/2021	Golden plover	13:02	44	A	5	0
07/04/2021	Golden plover	13:02	44	B	90	3960
07/04/2021	Golden plover	13:51	13	B	51	663
07/04/2021	Golden plover	13:55	34	B	201	6834
10/05/2021	Curlew	09:45	1	A	2	0
10/05/2021	Curlew	09:45	1	B	10	10
10/05/2021	Curlew	09:48	1	A	15	0
10/05/2021	Curlew	12:02	1	A	26	0
10/05/2021	Curlew	12:02	1	B	10	10
10/05/2021	Curlew	15:21	1	A	10	0
10/05/2021	Curlew	15:30	1	A	21	0
10/05/2021	Greylag goose	10:02	2	A	35	0
16/06/2021	Curlew	10:30	2	B	22	44
16/06/2021	Curlew	10:46	3	B	27	81
16/06/2021	Curlew	11:33	2	B	7	14
16/06/2021	Curlew	11:33	3	B	16	48
16/06/2021	Curlew	12:00	1	B	9	9

Date	Species	Time First Observed	No. of Birds	Height Band	Time in Height Band (s)	No. of Bird Seconds at Risk height
16/06/2021	Curlew	12:00	2	B	11	22
16/06/2021	Curlew	12:08	1	A	2	0
16/06/2021	Curlew	12:08	1	B	11	11
16/06/2021	Curlew	12:08	1	B	23	23
16/06/2021	Curlew	14:18	1	B	12	12
16/06/2021	Curlew	14:42	1	B	7	7