

7 Ecology

7.1 Introduction

7.1.1 This chapter considers the likely significant effects on non-avian ecology associated with the construction and operation of the Bloch Wind Farm (the proposed development). Effects on birds are considered separately in Chapter 8. The specific objectives of the chapter are to:

- describe the current ecological baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address the likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation measures.

7.1.2 The assessment has been carried out by Dr Steve Percival of Ecology Consulting.

7.1.3 The chapter is supported by a set of figures and Technical Appendices as follows:

- Technical Appendix 7.1: Phase 1 and NVC Habitat Survey 2022.
- Technical Appendix 7.2: Bat Surveys 2021 and 2022.
- Technical Appendix 7.3 (Confidential): Protected Species Surveys 2022.
- Technical Appendix 7.4: Fisheries Surveys, September 2022.
- Technical Appendix 7.5: Draft Species Protection Plan.
- Technical Appendix 7.6: Outline Habitat Management Plan.

7.2 Legislation, Policy and Guidance

7.2.1 The following documents were taken into account for the ecological assessment:

Legislation

- Water Environment and Water Services (Scotland) Act 2003;
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive);

- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (the Habitats Regulations), which transposes the Habitats Directive into law in Scotland;
- The Conservation of Habitats and Species Regulations 2017 (as amended), relating to reserved matters in Scotland including the granting of consent under Section 36 of the Electricity Act (together, "the Habitats Regulations");
- Wildlife and Countryside Act 1981 (as amended);
- Protection of Badgers Act (1992);
- The Nature Conservation (Scotland) Act 2004;
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017;
- The Wildlife and Natural Environment (Scotland) Act 2011;
- Environmental Impact Assessment Directive 85/337/EEC (the EIA Directive);
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended); and
- Water Environment and Water Services (Scotland) Act 2003.

Policy

- Scottish Planning Policy (2014);
- Planning Advice Note (PAN) 1/2013 - Environmental Impact Assessment (Scottish Government 2013);
- PAN 51: Planning, Environmental Protection and Regulation (revised 2006);
- PAN 60: Planning for Natural Heritage (Scottish Government 2000);
- Scottish Executive Circular 6/1995 as amended (June 2000);
- Planning Circular 3 2011; the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011.
- Scottish Executive Circular 6/1995 EIR release (as amended June 2000). Information request and response under the Environmental Information (Scotland) Regulations 2004; and
- Planning Circular 1/2017; Environmental Impact Assessment Regulations. Guidance on The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (Scottish Government, 2017).

Guidance

- Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater and Coastal (CIEEM 2018¹);

¹ CIEEM. 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Winchester: Chartered Institute of Ecology and Environmental Management

- Scottish Executive (2001) European Protected Species, Development Sites and the Planning System: Interim guidance for local authorities on licensing arrangements;
- SEPA (2014) Land Use Planning System SEPA Guidance Note 4: Planning Guidance on Windfarm Developments;
- SNH (2012) Assessing the cumulative impact of onshore wind energy developments;
- Good Practice during Wind Farm Construction (Scottish Renewables et al. 2019²);
- ‘Managing Natura 2000 Sites’ (European Communities 2000);
- Dumfries and Galloway Local Biodiversity Action Plan (LBAP);
- The UK Post-2010 Biodiversity Framework; and
- The Scottish Biodiversity List (SBL) (Nature Scot 2020: (<https://www.nature.scot/doc/scottish-biodiversity-list>)).

7.3 Consultation

7.3.1 Consultation was undertaken primarily through the scoping process. The issues raised and key outcomes of this consultation relating to ecology are summarised in Table 7.1. Fisheries Management Scotland, Esk and Liddle Improvement Association, and the Scottish Wildlife Trust were consulted at scoping but did not submit any response.

Table 7.1. Consultation Responses relating to Ecology

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
NatureScot 10/5/22	Scoping Opinion	Any works should take account of protected species that may be present within the proposed development area.	Required protected species baseline surveys undertaken including bats, badgers, water vole, otter and fisheries, and impacts avoided/mitigated as required.
		If this development involves forestry activities in close proximity to watercourses, we advise that the proposed development adhere to the UK Forestry Standards Forests and Water guidelines.	Not applicable - no forestry activities required as part of this proposed development.

Consultee and Date	Scoping / Other Consultation	Issue Raised	Response / Action Taken
		Advise that a Pollution Prevention Plan be put in place, particularly to manage the risk of sedimentation and chemical pollution to the watercourses on and around the proposed development site.	An outline Pollution Prevention Plan is provided as Technical Appendix 2.3 and will form an integral part of the Construction Environmental Management Plan (CEMP).
		Advise that the proposed development should avoid or minimise impacts on areas of peat that exceed 50cm in thickness.	Peat depth has been a key criterion in site design and deeper peat avoided as much as possible. Impacts on peat are fully assessed in Chapter 9: Hydrology, Hydrogeology, Geology and Soils.
Natural England 11/5/22	Scoping Opinion	Biodiversity Net Gain should be delivered as part of the proposal.	An email was sent to Natural England in August 2022 setting out the reasons a BNG assessment would not be undertaken for this proposed development. No response has been received to date.
SEPA 25/4/22	Scoping Opinion	Site should be designed to avoid sensitive receptors (i.e. peat, Ground Water Dependent Terrestrial Ecosystems (GWDTE), water features, private water supplies) and incorporate appropriate buffer distances.	Potential GWDTE are identified in this chapter and impacts on them are assessed fully in Chapter 9: Hydrology, Hydrogeology, Geology and Soils.
Galloway Fisheries Trust 5/5/22	Scoping Opinion	A baseline fish survey should be undertaken to understand what fish species are present and their densities.	GFT have undertaken this survey in September 2022 and it is reported in this chapter and Technical Appendix 7.4.
		GFT noted that it considered that any new water course crossing must ensure fish access is protected.	A mitigation programmes for all watercourse crossings will be implemented, as recommended by GFT (see para. 7.8.7).
		GFT noted that it would appreciate the opportunity to comment in due course on any proposed Habitat Management Plan for the site, as there would be opportunities to improve the habitat for aquatic ecology especially fish.	GFT will be consulted on the HMP as it is developed and finalised.

² Scottish Renewables. 2019. Good Practice during Wind Farm Construction. Version 4.

7.4 Methodology

Scope of Assessment

7.4.1 The key issues for the assessment of potential ecological effects relating to onshore wind farms include the following, based on NatureScot (NS) (formerly Scottish National Heritage (SNH)) guidance published in 2018a³:

- direct loss of ecological habitat through construction of the proposed development infrastructure;
- disturbance of key protected species during construction and operation;
- mortality of bats through collision with wind turbine blades or towers during operation; and
- cumulative effects of wind farm collision mortality on populations of key target ecological communities/populations.

7.4.2 The assessment will consider the following potential effects:

- potential effects on habitats of conservation concern, during construction;
- potential effects on protected species recorded within the site, during construction;
- potential effects on Groundwater Dependent Terrestrial Ecosystems (GWDTE) during construction; and
- potential effects on bats, during operation.

7.4.3 The assessment did not consider the following:

- potential effects on designated sites (due to a lack of structural or functional connectivity); and
- potential effects on ecological features during operation (excluding bats).

Baseline Characterisation

Study Area

7.4.4 The ecology study areas were chosen to include all areas within the potential zone of ecological influence of the proposed development. The specific study areas are as follows:

- Designated nature conservation sites: search area included sites designated for ecological interests within 5km of the site (all statutory protected sites) and within 20km (internationally important sites) - see Figures 7.1 and 7.2.

- The Phase 1 and National Vegetation Classification (NVC) survey area: included the site boundary (the site), plus a 100m buffer covering a total area of 17.8km², shown in Figures 7.3 and 7.4.
- Cumulative Effects: other wind farm developments within NatureScot's the 'Border Hills' Natural Heritage Zone (NHZ 20) and 'West Southern Uplands and Inner Solway' (NHZ 19) are included in assessment of potential cumulative ecological effects. 18 of the 21 wind turbines are located within NHZ 20, and the remaining three in NHZ 19.

Desk Study

7.4.5 The ecological desk study provided information on the ecological interests of the site, including the locations of any relevant statutory protected sites and collation of data on key species. The following sources of information were used for the desk study:

- NatureScot website (<https://sitelink.nature.scot/home>) - statutory designated site boundaries, including Sites of Special Scientific Interest (SSSI) and SSSI citation details;
- Joint Nature Conservation Committee (JNCC) website (<https://jncc.gov.uk/our-work/special-protection-areas-overview/>) - European protected site boundaries and designations (Special Areas of Conservation (SAC)/Ramsar);
- Information published in Environmental Statements (ES) and Environmental Impact Assessment (EIA) Reports for other developments in the 'Border Hills' NatureScot Natural Heritage Zone (NHZ 20) and the adjacent the 'West Southern Uplands and Inner Solway' (NHZ 19) (including for the adjacent Solwaybank Wind Farm ES).
- South-west Scotland Environmental Information Centre (SWSEIC).

Field Survey

7.4.6 A comprehensive range of baseline ecological surveys have been undertaken at the site between August 2021 and August 2022, to provide a full year of baseline data, in line with the current NatureScot survey guidance (NatureScot et al. 2021⁴). These surveys comprised:

- Extended Phase 1 and NVC habitat surveys;
- Bat surveys (walked transect and static recorder surveys); and
- Badger, water vole, otter and fisheries surveys.

7.4.7 Full details of the surveys are given in Technical Appendices 7.1-7.4.

³ Scottish Natural Heritage. (2018a). Assessing Significance of Impacts from Onshore Wind Farms Outwith Designated Areas. SNH.

⁴ NatureScot, Natural England et al. (2021). Guidance on 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation'.

Extended Phase 1 Habitat Survey

7.4.8 An extended Phase 1 survey was carried out during 27-29 July 2022, including identification and mapping of the vegetation communities present within the study area, following the standard (JNCC 2016⁵) Phase 1 survey methodology. Any rare or scarce plant species found were also recorded, and habitat suitability was assessed for protected species (to inform the need for any further surveys). Aerial photography was used to help define habitat boundaries.

NVC Habitat Survey

7.4.9 Further, more detailed, habitat surveys (Phase 2) were undertaken to map the NVC across the site at the same time as the Phase 1 surveys. This included the acquisition of vegetation species composition and percentage cover data from a series of representative quadrats from each community. These data also informed the potential GWDTE within the site. These were mapped and have been assessed as part of the hydrological impact assessment (see Chapter 9).

7.4.10 The vegetation communities within each of the survey fields were mapped to a minimum mappable polygon size of 150m². At least five 2x2m quadrat sample of vegetation composition and cover (recorded to the estimated percentage cover) were taken in each vegetation class of the main stand types (following Rodwell et al. 1992⁶). The field quadrat samples were assigned to NVC class using the MAVIS analysis software (Smart et al. 2016⁷) and professional judgement.

Bat Surveys

7.4.11 The bat survey programme was designed with reference to the recent NatureScot et al. (2021) guidance on 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation'. The surveys were undertaken in autumn 2021 and spring/summer 2022 and comprised the following:

- Roost potential survey - to assess all potential roosts sites within the proposed development site and its surrounds;
- Ground-level activity surveys - one transect-based survey each month from April-September. Access was restricted to the parts of the site that could be accessed safely at night - the transect routes walked are shown in Figure 7.5;

- Automated surveys at ground level - static detectors were deployed at 14 locations across the survey area representative of the habitats available and focussed on the areas where the proposed development would be located (in line with NatureScot et al. 2021 guidance). A total of 1,164 bat-nights' coverage was obtained (mean 28 nights/season/location). The locations of the recorders are shown in Figure 7.5.

7.4.12 Surveys at height were considered unnecessary at this site, given the generally low-quality bat habitats present (predominantly open moorland).

Otter and Water Vole Surveys

7.4.13 These surveys were carried out in August 2022. They included detailed inspection of the watercourses within and adjacent to the development footprint (focussing on the area within 200m of the proposed development, as per NatureScot guidance⁸). Habitat suitability for these species was assessed with factors such as food resources, cover and water quality taken into consideration. A systematic search of all suitable habitat was made for signs indicating use by water vole and otter, and all signs found were mapped (following Chanin 2003⁹ and Strachan 2011¹⁰).

Badger Surveys

7.4.14 Badger surveys were undertaken in August 2022 to cover the site plus a 100m buffer where access/viewing was possible, following the method of Harris et al. (1989¹¹) and SNH (2003¹²). All areas of potential value to badgers were surveyed and any evidence of badger activity recorded including details of setts and associated soil excavation, latrines and dung pits, prints, hairs, paths and evidence of foraging activity.

7.4.15 As badgers are specially protected under the 1992 Badgers Act and are subject to illegal persecution, information on this species has been provided in a Confidential Appendix (Technical Appendix 7.3). The amount of information contained in the Confidential Appendix has been kept to a minimum but includes more detailed data that indicate sett locations. The assessment of the effects that the proposed development may have on this species has been included within this chapter (but without identifying sett locations).

⁵ JNCC 2016. Handbook for Phase 1 habitat survey. A technique for environmental audit.

⁶ Rodwell, J. S. (1992) British Plant Communities: Volume 3 Grasslands and montane communities, Cambridge: Cambridge University Press.

⁷ Smart, S., Goodwin, A., Wallace, H. and Jones, M. (2016). MAVIS (Ver 1.03) User Manual. <https://www.ceh.ac.uk/services/modular-analysis-vegetation-information-system-mavis>

⁸ <https://www.nature.scot/doc/standing-advice-planning-consultations-otters>

⁹ Chanin P (2003b) *Monitoring the Otter Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No 10. English Nature, Peterborough.

¹⁰ Strachan R and Moorhouse T (2006) *Water vole conservation handbook 2nd Edition*. Wildlife Conservation Research Unit, Oxford.

¹¹ Harris S, Cresswell P and Jefferies D (1989) *Surveying Badgers*, Mammal Society.

¹² Scottish Natural Heritage (2003) *Best Practice Guidance - Badger Surveys*. Inverness Badger Survey 2003. Commissioned Report No. 096

Fisheries

7.4.16 The Galloway Fisheries Trust (GFT) was commissioned to carry out baseline electrofishing surveys in summer 2022 to inform the ecological impact assessment. Electrofishing of sample watercourses across the site was undertaken (at 12 locations plus two additional reference locations outside the site). Standard methodologies using the Scottish Fisheries Co-ordination Centre (SFCC) agreed survey and data collection methodologies for electrofishing surveys were used. Full details are given in Technical Appendix 7.4.

Other Species

7.4.17 No other dedicated species-specific surveys were considered to be required, as set out in the scoping document (and informed by the habitat suitability assessment and the habitats that would be affected by the proposed development). There would be no effects on any woodland habitat, so no red squirrel surveys were carried out.

Assessment Methodology

7.4.18 The significance of the potential effects of the proposed development has been classified by professional consideration of the value of the receptor and the magnitude of the potential effect.

7.4.19 The assessment includes a full evaluation of the ecological importance of the ecological populations and communities at the site and identification of any particularly sensitive areas. The assessment has been carried out with reference to the assessment methodologies produced by Scottish Natural Heritage (2018a) for the wider countryside, and the CIEEM Guidelines (2018).

Criteria for Assessing Value (Conservation Importance)

7.4.20 Value (conservation importance) was assigned using the criteria set out in Table 7.2. Key ecological receptors included species/habitats listed on Annex I of the Habitats Directive, species specially protected under the Wildlife and Countryside Act 1981 (as amended), and the Protection of Badgers Act (1992), and species/habitats included on the Scottish Biodiversity List (SBL)

7.4.21 The conservation value (as defined in Table 7.2) of the receptors present in the potential impact zone were identified, then the magnitude of the possible impact on those receptors determined (as described in Table 7.3).

Table 7.2: Value (conservation importance) of species/communities

Value	Definitions
Very High	Cited interest of Special Areas of Conservation (SACs) and SSSIs. Cited means mentioned in the citation text for those protected sites as a species for which the site is designated (SACs) or notified (SSSIs).
High	Other species/habitat that contribute to the integrity of an SAC or SSSI. A local population of more than 1% of the national population of a species/habitat. Any ecologically sensitive species. European Protected Species, or species specially protected under the Wildlife and Countryside Act. Other specially protected species/habitat.
Medium	Regionally important population of a species/habitat, either because of population size or distributional context. UK Biodiversity Action Plan (BAP) priority species (if not covered above).
Low	Scottish Biodiversity List species/habitat or other species of conservation interest not covered above

Magnitude of Impact

7.4.22 An impact is defined as a change of particular magnitude to the abundance and/or distribution of a population as a result of the proposed development. The magnitude of impact is assessed in terms of the extent of the impact (spatial) and the temporal aspects of the impact, in terms of timing, frequency, duration and reversibility. Table 7.3 shows the definitions of the impact magnitude classification used for the assessment.

Table 7.3: Definition of terms relating to the magnitude of ecological impacts

Magnitude	Definition
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions such that post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. Guide: >80% of population/habitat lost
High	Major alteration to key elements/ features of the baseline conditions such that post development character/composition/attributes will be fundamentally changed. Guide: 20-80% of population/habitat lost
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/ composition/ attributes of baseline will be partially changed. Guide: 5-20% of population/habitat lost
Low	Minor shift away from baseline conditions. Change arising from the loss/ alteration will be discernible but underlying character/composition/ attributes of baseline condition will be similar to pre-development circumstances/patterns. Guide: 1-5% of population/habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. Guide: <1% of population/habitat lost

Significance Criteria

7.4.23 The combined assessment of the magnitude of an impact and the value of the receptor was used to determine the significance of potential effects. These two criteria were cross tabulated to assess the overall effect and significance of that effect (Table 7.4). This gives a guide as to the determination of significance, though the final assessment was still subject to professional judgment.

Table 7.4: Matrix of magnitude of impact and sensitivity used to test the significance of effects.

	CONSERVATION VALUE					
		Very high	High	Medium	Low	Nil
MAGNITUDE	Very high	Major	Major	Major-moderate	Moderate	Negligible
	High	Major	Major	Moderate	Minor	Negligible
	Medium	Major	Major-moderate	Minor	Negligible	Negligible
	Low	Moderate	Minor	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible

7.4.24 The significance category of each combination is shown in each cell. Shaded cells indicate potentially significant effects in terms of the EIA Regulations.

7.4.25 The interpretation of these significance categories was as follows:

- Negligible and Minor are not normally of concern, though normal design care should be exercised to minimise adverse effects;
- Moderate represents a potentially significant adverse effect on which professional judgment has to be made, though for which it is likely that mitigation will reduce it below the significance threshold; and
- Major and Major-moderate represent significant adverse effects on species/communities which are regarded as significant for the purposes of EIA.

7.4.26 The SNH (2018a) wider countryside assessment guidance defines the key significance test as follows: “An impact should be judged as of concern where it would adversely affect the favourable conservation status of a species or stop a recovering species from reaching favourable conservation status, at international or national level or regionally.”

7.4.27 A cumulative ecological assessment (using the same criteria as the main assessment) has been undertaken following the NatureScot guidance on 'Assessing the cumulative impacts of onshore wind farms', considering impacts on the favourable conservation status of key species/habitats within the relevant NHZ, in this case NHZ 20 'Border Hills'.

Limitations and Assumptions

7.4.28 No significant information gaps have been identified. Inevitably with any ecological survey it cannot be guaranteed to detect all target species/individuals and surveys cannot be fully representative of all conditions (e.g. severely reduced visibility). However, in this case it was concluded that the baseline surveys provide a robust data set on which to carry out the assessment.

7.5 Current Baseline

Statutory Protected Sites

7.5.1 There are eight statutory designated nature conservation sites in the study area around the proposed development. The locations of the internationally important sites within 20km are shown in Figure 7.1, and the nationally important sites within 5km in Figure 7.2:

- Bigholms Burn SSSI - adjacent to the northern edge of the site - a small (1.7ha.) site notified for its geological interest.
- River Esk, Glencartholm SSSI - 3.7km east from the site - another site notified for its geological interest.
- Bell's Flow SSSI - 2.6km south from the site - an intermediate raised bog notified for its botanical interest.
- Langholm - Newcastleton Hills SPA/SSSI - 2.6km north-east from the site - upland moorland designated for its breeding hen harrier population (SPA), and its upland breeding bird assemblage, upland habitats and geological interest (SSSI).
- Raeburn Flow SAC - 7km west - designated for its active raised bog and degraded raised bog habitats.
- Upper Solway Flats and Marshes SPA/Ramsar/SSSI - 13km south from the site - a very extensive inter-tidal habitat with an internationally important wintering waterfowl community, and also its natterjack toad population (Ramsar/SSSI).
- Solway Firth SAC (13km south) - designated for the following habitats: Atlantic salt meadows, estuaries, dune grassland, intertidal mudflats and sandflats, coastal shingle vegetation outside the reach of waves, reefs, glasswort and other annuals colonising mud and sand, and subtidal sandbanks, as well as its populations of river lamprey and sea lamprey.
- River Tweed SAC (15km north) - designated for its populations of River lamprey, brook lamprey, sea lamprey, otter, and Atlantic salmon, and for its rivers with floating vegetation often dominated by water-crowfoot habitat.

- Castle Loch, Lochmaben SPA/Ramsar/SSSI - 19km west from the site - designated for its internationally important wintering population of pink-footed geese. No non-avian qualifying features.
- Bolton Fell Moss SAC - 18km south-east - designated for its degraded raised bogs (still capable of natural regeneration).
- Walton Moss SAC - 19km south-east - designated for its active raised bog and degraded raised bog habitats (still capable of natural regeneration).
- South Solway Mosses SAC - 19km south-west - designated for its active raised bog and degraded raised bog habitats (still capable of natural regeneration).
- River Eden SAC - 17km south - designated for (1) Oligotrophic to mesotrophic standing water with vegetation, (2) water courses of plain to montane levels with water-crowfoot, (3) alluvial woods with alder and ash, and (4) its populations of freshwater crayfish, sea lamprey, brook lamprey, river lamprey, Atlantic salmon, bullhead and otter.

7.5.2 The potential connectivity of each of these SACs to the site is summarised in Table 8.5. This lists the qualifying features for each SPA, the distance from the site at its closest point and an initial assessment of whether the site could possibly be affected by the proposed development. No potential impact pathways were identified for any qualifying features of any SAC, so it was concluded that there would be no Likely Significant Effects (LSE) on any SAC under the Habitats Regulations.

Table 7.5: SACs/Ramsar within 20km of the proposed development, their qualifying features and likely connectivity to the site.

SAC/Ramsar	Distance from site	Qualifying features	Qualifying features with impact pathway (non-avian)
Raeburn Flow SAC	7km	Active raised bog and degraded raised bog.	None
Upper Solway Flats and Marshes Ramsar	13km	Internationally important wintering waterfowl community and natterjack toad	None
Solway Firth SAC	13km	Atlantic salt meadows, estuaries, dune grassland, intertidal mudflats and sandflats, coastal shingle vegetation outside the reach of waves, reefs, glasswort and other annuals colonising mud and sand, and subtidal sandbanks, as well as its populations of river lamprey and sea lamprey	None
River Tweed SAC	15km	River lamprey, brook lamprey, sea lamprey, otter, and Atlantic salmon, and for its rivers with floating	None

SAC/Ramsar	Distance from site	Qualifying features	Qualifying features with impact pathway (non-avian)
		vegetation often dominated by water-crowfoot habitat.	
River Eden SAC	17km	(1) Oligotrophic to mesotrophic standing water with vegetation, (2) water courses of plain to montane levels with water-crowfoot, (3) alluvial woods with alder and ash, and (4) its populations of freshwater crayfish, sea lamprey, brook lamprey, river lamprey, Atlantic salmon, bullhead and otter.	None
Bolton Fell Moss SAC	18km	Degraded raised bogs (still capable of natural regeneration).	None
South Solway Mosses SAC	19km	Active raised bog and degraded raised bog habitats (still capable of natural regeneration).	None
Walton Moss SAC	19km	Active raised bog and degraded raised bog habitats (still capable of natural regeneration).	None

Survey Results: Habitats

Phase 1/NVC habitats

7.5.3 The Phase 1 habitats recorded in the survey area are summarised in Table 7.6, and their distributions are shown in Figure 7.3. Table 7.6 also gives details of the NVC communities recorded and their distributions are shown in Figure 7.4. Further details of the Phase 1/NVC habitats are given in Technical Appendix 7.1.

Table 7.6: Phase 1 and NVC habitats within the ecology survey area.

Phase 1 Habitat	Phase 1 Code	NVC Class	Total Area (ha.)	% Survey Area
Broad-leaved woodland	A1.1.1	W7	9.99	0.8%
Broad-leaved plantation	A1.1.2	n/a	4.10	0.3%
Coniferous plantation	A1.2.2	n/a	154.4	12.4%
Scrub - dense/continuous	A2.1	W7	0.67	0.1%
Recently-felled conifer	A4.2	n/a	9.89	0.8%
Neutral grassland - unimproved	B2.1	MG1	1.87	0.2%
		MG10a	0.46	0.0%
Neutral grass - semi-improved	B2.2	MG6a	5.08	0.4%
		MG10a	221.3	17.8%
Improved grassland	B4	MG6a	29.04	2.3%

Phase 1 Habitat	Phase 1 Code	NVC Class	Total Area (ha.)	% Survey Area
Marsh/marshy grassland	B5	M23a	212.7	17.1%
		M25a	200.2	16.1%
		M27c	4.30	0.3%
Bracken	C1.1	U20a	21.3	1.7%
Wet heath	D2	M16a	43.17	3.5%
Blanket bog	E1.6.1	M18b	130.7	10.5%
Wet modified bog	E1.7	M25a	187.8	15.1%
Acid/neutral flush	E2.1	M6d	3.04	0.2%
Swamp	F1	S9	0.15	0.0%
Amenity grassland	J1.2	n/a	0.28	0.0%
Building	J3.6	n/a	1.19	0.1%

Marshy Grassland

7.5.4 Marshy grassland was the most common Phase 1 habitat, covering 33% of the survey area. There were three NVC communities within the marshy grassland habitat:

- M23a - Soft/sharp-flowered rush *Juncus effusus/ acutiflorus* - Marsh bedstraw *Galium palustre* rush pasture - *Juncus acutiflorus* sub- community). Its total cover was 213ha.
- M25a - Purple moor grass *Molinia caerulea* -dominated grassland on shallower peat. Its total cover was 200ha.
- M27c - Meadowsweet *Filipendula ulmaria* - dominated swamp. It was only found in small patches along the northern edge of the site, and just to the west of the proposed substation location. Its total cover was 4.3ha.

Wet Modified Bog

7.5.5 Wet modified bog was the most widespread mire habitat, covering 15% of the survey area (189ha). This habitat type was classified as M25a Purple moor grass *Molinia caerulea* - Tormentil *Potentilla erecta* mire. Purple moor-grass was extensive and dominant, probably as a result of grazing and burning, with little bog moss *Sphagnum* or dwarf shrub cover.

Blanket Bog

7.5.6 Blanket bog covered 11% of the survey area (131ha) and supported a more-species-rich community than the wet modified bog. This included *Sphagnum* bog mosses (though cover was generally low, probably as a result of drainage, grazing and burning), more abundant dwarf shrubs including heather, cross-leaved heath *Erica tetralix* and cranberry *Vaccinium oxycoccos*, and frequent occurrence of bog rosemary *Andromeda polyfolia* (a Dumfries and Galloway LBAP priority species).

7.5.7 The blanket bog habitat was all classed as M18b NVC community, *Erica tetralix* - *Sphagnum papillosum* blanket mire.

Wet Heath

7.5.8 Heathland habitats were scarcer than the mires, covering 4% of the survey area (43ha). It was classed as NVC community M16a. It was found mainly in the southern part of the central block of the site, to the south of the Bloch Plantation (see Figure 7.3).

Acid/neutral Flush

7.5.9 Small areas of acid flush (3.4ha) were scattered across the survey area, covering only 0.2% of the survey area. This habitat type comprises a combination of rushes and/or sedges over a thick layer of *Sphagnum* mosses and *Polytrichum commune*. It was classified as NVC community M6d *Carex echinata* - *Sphagnum fallax/denticulatum* mire.

Neutral Grassland

7.5.10 Drier grassland areas across the survey area have mostly been affected by agricultural improvement and have been classed as semi-improved neutral grassland. They were extensive over the lower ground particularly in the north-eastern part of the survey area, covering 222ha in total (18% of the survey area). Most were classified as MG10a, with a smaller area of more improved MG6a. A few small patches of MG1 neutral unimproved grassland were found on the northern edge of the site.

Improved Grassland

7.5.11 These were more agriculturally improved fields, with extensive seeding with perennial ryegrass *Lolium perenne*, used for silage production and more intensive stock grazing. They were classified as MG6a. They covered a total area of 29ha.

Bracken

7.5.12 Patches of bracken-dominated vegetation were widespread in drier parts of the survey area. A total of 21ha (2%) of the survey area was covered in continuous bracken habitat. It was classed as NVC community U20a *Pteridium aquilinum* - *Galium saxatile* community.

Swamp

7.5.13 One small area of swamp was located on the fringe of a small waterbody in central part of survey area on Bloch Flow, with the vegetation dominated by bottle sedge *Carex rostrata* (NVC community S9).

Woodlands

- 7.5.14 Semi-natural broad-leaved woodland was found mainly in the northern part of the survey area along the Bigholms Burn/Wauchope Water valley, with 10ha. (0.8% of the survey area) in total (plus a further 0.7ha. of scrub). Much of this has been identified as ancient woodland. It was classed as NVC community W7. There were also small areas of broad-leaved plantation (4ha.).
- 7.5.15 Much of the survey area was fringed with conifer plantation of various ages (including recent clear-fell, particularly around the Solwaybank wind farm), mainly comprising Sitka spruce *Picea sitchensis*. There has been extensive recent planting of trees along much of the southern border of the site.

Groundwater Dependent Terrestrial Ecosystems

- 7.5.16 Three of the NVC communities recorded have been identified by SEPA as having high potential to be GWDTE:
- Marshy grassland (M25);
 - Wet heath (M16); and
 - Acid flush (M6).
- 7.5.17 A further four habitats have moderate potential to be GWDTE:
- Neutral (semi-improved grassland (MG10);
 - Marshy Grassland (M23);
 - Wet modified bog (M25); and
 - Marshy grassland (M27).
- 7.5.18 The distribution of these habitats across the site is shown in Figures 7.3 and 7.4. Further analysis and assessment of groundwater dependency is included in Chapter 9.

Survey Results: Bats

Desk Study

- 7.5.19 There were recent records of nine bat species/taxa SWSEIC database within 2km of the site, including noctule, Leisler's, common, soprano and Nathusius' pipistrelle, brown long-eared, Daubenton's, whiskered/Brandt's and natterer's bats.
- 7.5.20 The Solwaybank Wind Farm ES reported six bat species, including noctule (and possibly Leisler's), common and soprano pipistrelle, brown long-eared, Daubenton's and natterer's bats. It was concluded that that site was not of particular importance for bats but typical of the wider region.

Bat Survey Results: Bat Roost Survey

- 7.5.21 The results of the bat roost suitability survey are summarised in Figure 7.5. The large majority of the potential bat roost sites were located around the fringes of the survey area, with few within the site itself.
- 7.5.22 With regard to commuting/foraging habitat for bats, the main areas that would be likely to be used include the lower altitude parts of the survey area outside the proposed development footprint, where there was more woodland and larger watercourses, and greater availability of potential roost sites.

Bat Survey Results: Walked Transects

- 7.5.23 The bat walked transect surveys recorded eight species in total, with common and soprano pipistrelle the two most frequently encountered. Other less abundant species comprised: Daubenton's bat, whiskered bat, natterer's bat, noctule, Nathusius' pipistrelle and brown long-eared bat.
- 7.5.24 The highest concentration of bat records was on the lower ground on the northern edge of the survey area (along the Bigholms Burn), within/in proximity to wooded areas and to farm buildings, with fewer records on the open moorland habitat where the proposed wind turbines would be located.

Bat Survey Results: Static Recorders

- 7.5.25 Nine species of bat were recorded in total during the surveys. Common pipistrelle was the most frequently recorded species, with soprano pipistrelle, Daubenton's bat and brown long-eared also frequently encountered, particularly during the autumn surveys. Other less abundant species comprised: Nathusius' pipistrelle, whiskered bat, Brandt's bat, natterer's bat and noctule.

7.5.26 Overall bat activity (from an ECOBAT analysis, Lintott et al. 2018¹³) was classed as follows:

- High: no species
- Moderate/high: no species
- Moderate: no species
- Low/moderate: noctule, brown long-eared bat, *Myotis* sp. and natterer's bats.
- Low: common pipistrelle, soprano pipistrelle and Daubenton's bat.

7.5.27 There were insufficient data from both the regional baseline and the site records (i.e. too few numerically were recorded) to give a reliable activity level comparison for Nathusius' pipistrelle, Brandt's, and whiskered bats.

7.5.28 The number of bat passes recorded during roost emergence time was low, indicating that there were not likely to be any important roosts located within/in proximity to the proposed development.

7.5.29 Overall, the bat numbers recorded within the proposed development were generally low, reflecting the low quality bat habitat across the site.

Survey Results: Fisheries

7.5.30 The SWEIC data included records of three fish species: European eel, Atlantic salmon and brown trout. There were numerous records of all three species from the Bigholms Burn/Wauchope Water and its feeder streams on the northern edge of the site, and a small number of records of European eel and brown trout in watercourses to the south. There were, though, no records of any of these species in proximity to the proposed development footprint (none within 250m).

7.5.31 The results of the electrofishing surveys are summarised in Table 7.7 and Figure 7.6. Where a Zippin (1958¹⁴) calculation could be carried out, 95% confidence limits are shown. Where only the number appears, a Zippin estimation could not be carried out. In these cases, the number represents a minimum estimate of fish density per 100m². Traffic light colour coding represents the sensitivity of each sampling location with regards to fish, with red indicating very sensitive, amber moderately sensitive and green not sensitive.

7.5.32 Brown trout were recorded at six of the 12 sampling locations within the site (see Figure 7.6). Four sites had no fish and two locations were classed as unfishable.

7.5.33 Brown trout were found within both reference locations outside the site, with Atlantic salmon present within one of the reference locations (though there were no records of salmon within the site).

7.5.34 European eels were encountered at four of the wind farm sampling locations (see Figure 7.6).

¹³ Lintott, P. R., S. Davison, J. van Breda, L. Kubasiewicz, D. Dowse, J. Daisley, E. Haddy, and F. Mathews. 2018. Ecobat: An online resource to facilitate transparent, evidence-based interpretation of bat activity data. *Ecology and Evolution* 8:935-941.

¹⁴ Zippin, C. 1958. The Removal Method of Population Estimation *Journal of Wildlife Management*, 22. Pp 82-90

Table 7.7. Results from the 2022 electrofishing survey for Bloch Wind Farm.

Site Code	Watercourse/ River Order	Site Location	Grid Ref	Survey Date	Presence Of Other Species	Area Fished (m ²)	Density per 100 m ² *				Sensitivity
							Salmon Fry (0+)	Salmon Parr (1+ and older)	Trout Fry (0+)	Trout Parr (1+ and older)	
EWCB3	Border Esk, Bloch Burn	Downstream ford	E333093 N581353	07/09	Eel (1)	61.6	0	0	15.912 ± 5.464	11.69 ± 2.067	FISH
EBL1	Border Esk, Blough Sike	In woodland	E332130 N579242	06/09	Minnow (16), Stoneloach (1)	56.3	0	0	19.531	3.551	FISH
EWCB1	Border Esk, Back Burn	In field	E331461 N580955	07/09	Eel (1), Stoneloach (36)	49.6	0	0	8.058	2.015	FISH
EWCC1	Border Esk, Cow Sike	Downstream of the road and culvert	E332765 N581290	07/09	Eel (1)	58.7	0	0	0	1.705	FISH
EWCH1	Border Esk, Hope Burn	Upstream of the bridge	E331038 N580384	08/09	Eel (1), Stoneloach (13)	42	0	0	4.763	0	FISH
EWCL1	Border Esk, Colin Burn	Upstream of channel split	E330180 N581193	07/09	NONE	47	0	0	8.5013	0	FISH
EKB1	Border Esk, Trib of Kerr Burn	Adjacent to Kerr Plantation	E333485 N579458	06/09	NONE	53.5	0	0	0	0	NONE
EWCB1	Border Esk, Farrold Sike	Upstream confluence with Bloch Burn	E333513 N582331	07/09	NONE	11.4	0	0	0	0	FISH DOWNSTREAM
EWCB2	Border Esk, Yellow Sike	Upstream watergate and confluence with Bloch Burn	E333134 N581329	07/09	NONE	33.1	0	0	0	0	FISH DOWNSTREAM
EWCB4	Border Esk, Upper Woodie Sike	In field	E333091 N580576	07/09	NONE	14.7	0	0	0	0	NONE
EWCB5	Border Esk, Nether Woodie Sike	In field	E333084 N580688	07/09	NONE	N/A	0	0	0	0	NONE
EWCH2	Border Esk, Peat Sike	By bridge	E330967 N580438	08/09	NONE	N/A	0	0	0	0	NONE
EEG1	Border Esk, Glendivan Burn (CONTROL)	Downstream bridge	E337144 N590934	06/09	Stoneloach (2)	57	7.020	0	68.555 ± 17.988	0	N/A (CONTROL)
EEA1	Border Esk, Arkleton Burn (CONTROL)	Upstream quad bike track	E337584 N591511	06/09	Eel (2)	65.3	0	0	127 ± 15.267	1.532	N/A (CONTROL)

Survey Results: Other Protected Species

Otter

- 7.5.35 There were four records of otter in the SWSEIC database, but the most recent was from 1991. Three were from the Bigholms Burn on the northern edge of the site, and the other was 2km south-east from the site.
- 7.5.36 There were several records of otter from the Solwaybank Wind Farm baseline surveys reported in that ES, to the west of the site. It was, though, concluded that the majority of watercourses on that site did not appear to be used by otter, with most watercourses offering very little shelter opportunities and a lack of foraging opportunities in their upper reaches.
- 7.5.37 No evidence was found of any otter activity within the site during the 2022 otter surveys.

Water Vole

- 7.5.38 There were four records of water voles within 2km of the site in the SWEIC database, the most recent in 2002. None were recorded during the Solwaybank Wind Farm baseline surveys.
- 7.5.39 No evidence was found of any water vole activity within the site during the water vole surveys.

Badger

- 7.5.40 There was a single SWSEIC record of this species within 2km of the site from 2005, but this is likely to be under-recorded.
- 7.5.41 The Solwaybank Wind Farm ES concluded that badgers were active across that site, particularly in drier areas of coniferous woodland.
- 7.5.42 Two badger setts were located within the during the badger surveys in August 2022, together with evidence of badger activity (paths, incidental sightings during bat surveys). Their locations are given in Technical Appendix 7.3 (Confidential). All setts and other records were outside the potential impact zone of the proposed development on this species (i.e. more than 30m from the proposed development). There were no setts within 100m of the proposed development footprint.

Other Species

- 7.5.43 There are numerous records of red squirrel in the SWSEIC database from the woodland around the site, the most recent of which was in 2015. As none of its woodland habitat would be affected by the proposed development, red squirrel would be unaffected and is not considered further in this assessment.
- 7.5.44 Adder was the only reptile species reported to be present in the area in the SWSEIC database. Though the most recent record was from 2001, the site does support suitable habitat for this species. The Solwaybank Wind Farm ES also reported historic records of slow worm and common lizard in the region.
- 7.5.45 Other SBL priority species recorded in the SWSEIC database within 2km of the site included brown hare (widespread over the site and seen frequently during the 2021-22 baseline surveys), mountain hare (though only historic records, most recent in 1974), hedgehog (only two records from 1968 but given the habitat present still likely to use the area), small heath and large heath butterflies (the latter on site on Bloch Flow/Healy Hill, in 2003), and five moth species (Rosy Rustic, Small Phoenix, Small Square-spot, Autumnal Rustic, Green-brindled Crescent).
- 7.5.46 The SWSEIC database also held records of two further Dumfries and Galloway LBAP plant species, juniper and bog rosemary. The latter species was found to be widespread over much of blanket bog habitat on the site during the habitat surveys.

Future Baseline

- 7.5.47 In the “do nothing” scenario without the construction of the proposed development, it is anticipated that the current management of the site will continue as part of wider estate management activities and that the species/habitats currently present will continue at the site, though subject to changes occurring at the national and regional levels. Local future trends in numbers will be dependent primarily on habitat change. Further afforestation could reduce open ground species and habitats. The main current land uses within the site (sheep grazing) would likely continue into the future. Changes are also likely to occur as a result of climate change, though would be anticipated to be minor over the lifetime of the proposed development.

7.6 Ecological Conservation Evaluation

Conservation Evaluation of Habitats

7.6.1 The conservation value of the habitats was determined using the criteria specified in Table 7.2. The results are summarised in Table 7.8. All of the species with very high - low value have been taken forward in the ecological assessment (i.e. only those with nil value have been scoped out).

Table 7.8: Conservation Evaluation of the Habitats in the Bloch Wind Farm survey area

Habitat	NVC	EU Habs Dir priority	UK BAP priority habitat	Scottish BAP habitat	D&G LBAP habitat	Potential GWDTE	Conservation Value
Broad-leaved woodland	W7	✓	✓	✓	✓	High	High
Broad-leaved plantation	n/a						Nil
Coniferous plantation	n/a						Nil
Scrub	W7		✓	✓	✓	High	Medium
Recently-felled conifer	n/a						Nil
Neutral grassland - unimproved	MG1						Nil
	MG10a					Medium	Nil
Neutral grass - semi-improved	MG6a						Nil
	MG10a					Medium	Nil
Improved grassland	MG6a						Nil
Marsh/marshy grassland	M23a		✓	✓	✓	High	Medium
	M25a	✓	✓	✓	✓	Medium	High
	M27c		✓	✓	✓	Medium	Medium
Bracken	U20a						Nil
Wet heath	M16a	✓	✓	✓	✓	High	High
Blanket bog	M18b	✓	✓	✓	✓		High
Wet modified bog	M25a	✓	✓	✓	✓	Medium	High
Acid/neutral flush	M6d	✓	✓	✓	✓	High	High
Swamp	S9		✓	✓	✓		Medium

7.6.2 Six habitats were classed as high sensitivity, though their listing as EU Habitats Directive Annex 1 habitats: blanket bog, wet heath, wet modified bog, marshy grassland (purple moor grass), acid/neutral flush and broad-leaved woodland.

7.6.3 Four habitats were classed as medium conservation value: scrub, marshy grassland (rush pasture), marshy grassland (Molinia) and swamp. All were classed as medium value for their listing as UK Biodiversity Action Plan (BAP)/Scottish Biodiversity List priority habitats.

Conservation Evaluation of Protected Species

7.6.4 The conservation value of the protected species using the survey area was determined using the criteria specified in Table 7.2. The results are summarised in Table 7.9. All of the species with very high - low value have been taken forward in the ecological assessment (i.e. only those with nil value have been scoped out).

Table 7.9: Conservation Evaluation of the Protected Species in the Bloch Wind Farm survey area

Species	European Protected Sp	Wildlife and Countryside Act Sch 5/ Badgers Act sp	UK priority sp	Scottish BAP sp	D&G LBAP sp	Conservation Value
Badger		✓				High
Otter	✓	✓	✓	✓	✓	High
Water Vole		✓	✓	✓	✓	High
Red Squirrel		✓	✓	✓	✓	High
Atlantic Salmon	✓		✓	✓	✓	High
Brown Trout			✓	✓		Medium
European Eel			✓	✓	✓	Medium
Daubenton's bat	✓	✓				High
Natterer's bat	✓	✓		✓	✓	High
Whiskered bat	✓	✓				High
Brandt's bat	✓	✓				High
Noctule	✓	✓	✓	✓	✓	High
Leisler's bat	✓	✓			✓	High
Common pipistrelle	✓	✓			✓	High
Soprano pipistrelle	✓	✓	✓	✓	✓	High
Nathusius' pipistrelle	✓	✓		✓		High

Species	European Protected Sp	Wildlife and Countryside Act Sch 5/ Badgers Act sp	UK priority sp	Scottish BAP sp	D&G LBAP sp	Conservation Value
Brown long-eared bat	✓	✓	✓	✓	✓	High
Brown Hare			✓	✓	✓	Medium
Adder		✓	✓	✓	✓	High
Hedgehog			✓	✓		Medium
Large Heath			✓	✓		Medium
Small Heath			✓	✓		Medium
SBL moth species: Rosy Rustic, Small Phoenix, Small Square-spot, Autumnal Rustic, Green-brindled Crescent			✓	✓		Medium
Bog Rosemary					✓	Low
Juniper			✓	✓	✓	Medium

7.7 Assessment of Potential Effects

7.7.1 Following SNH (2018a) guidance, the assessment has focussed on the key species/habitats likely to be affected by the proposed development. Key species/habitats were defined using the following criteria:

- European Protected Species and Habitats (species/habitats listed on Annex 1 of the EU Habitats Directive);
- species specially protected under Schedule 5 of the 1981 Wildlife & Countryside Act;
- species/habitats identified as priority in the UK BAP, the Scottish Biodiversity List and the Dumfries and Galloway LBAP.

Construction Effects

7.7.2 Direct Effects: Loss of Habitat (Direct loss or degradation of habitat through construction of the wind farm and its associated infrastructure)

7.7.3 Table 7.10 summarised the areas of each habitat that would be lost permanently to each component of the proposed development. It also gives the total loss of each habitat, and the percentage that this loss represents of the whole survey area.

Table 7.10: Predicted Permanent Habitat Loss associated with the proposed development

Habitat	NVC	Turbines	Hardstands	Access Tracks	Substation/ battery storage	Total loss (ha.)	% survey area resource lost
Acid/neutral flush	M6d	-	-	0.04	-	0.04	1.3%
Blanket bog	M18b	0.06	0.37	0.41	-	0.84	0.6%
Bracken	U20a	0.02	0.10	0.01	-	0.13	0.6%
Marsh/marshy grassland	M23a	0.03	0.60	1.05	0.89	2.57	1.2%
	M25a	0.10	2.66	1.92	0.16	4.83	2.4%
	M27c	-	-	0.01	-	0.01	0.2%
Neutral grass - semi-improved	MG10a	0.06	0.45	0.53	-	1.03	0.5%
	MG6a	0.01	0.09	0.14	-	0.24	4.7%
Wet heath	M16a	0.06	0.84	0.98	-	1.88	4.4%
Wet modified bog	M25a	0.09	1.22	1.66	-	2.97	1.6%

7.7.4 Table 7.11 summarises the additional areas of each habitat that would be lost temporarily to each component of the proposed development (which would be restored following construction). As for Table 7.10, this Table also gives the total (temporary) loss of each habitat, and the percentage that this loss represents of the whole survey area.

Table 7.11: Predicted Temporary Habitat Loss associated with the proposed development

Habitat	NVC	Wind Turbines	Access Tracks	Temporary compound	Total temporary loss (ha.)	% survey area resource lost
Acid/neutral flush	M6d	0.04	0.08	-	0.12	4.0%
Blanket bog	M18b	0.51	1.00	-	1.52	1.2%
Bracken	U20a	0.11	0.00	-	0.11	0.5%
Marsh/marshy grassland	M23a	0.31	3.02	0.32	3.64	1.7%
	M25a	1.22	5.23	-	6.46	3.2%
	M27c	-	0.04	-	0.04	0.9%
Neutral grass - semi-improved	MG10a	0.56	1.00	-	1.56	0.7%
	MG6a	0.10	0.44	-	0.54	10.6%
Wet heath	M16a	0.63	1.68	-	2.31	5.4%
Wet modified bog	M25a	0.74	4.38	-	5.12	2.7%

7.7.5 Additional to the temporary losses in Table 7.11, there would also be temporary loss of habitat from the three borrow pits that are planned as part of the proposed development. These would be 2.5ha each (7.5ha in total), but only indicative areas have currently been identified for these, so it is not possible to calculate the precise habitat loss that these would involve. Table 7.12 gives the cover of each habitat type in each of the three search areas.

Table 7.12: Bloch Wind Farm borrow pit search area habitats

Habitat	NVC	Borrow Pit North	Borrow Pit Centre	Borrow Pit South
Blanket bog	M18b	-	-	25%
Bracken	U20a	-	-	2%
Marsh/marshy grassland	M23a	47%	21%	-
	M25a	-	79%	27%
Neutral grass - semi-improved	MG10a	53%	-	-
Wet heath	M16a	-	-	45%
Wet modified bog	M25a	-	-	1%
Total area (ha.)		7.1	1.9	12.1

7.7.6 There would be a direct loss of five high value habitats:

- Acid flush (M6d) - permanent loss of 0.04ha and temporary loss of 0.12ha - together this equates to 5.3% of the area of this habitat within the survey area. Habitat loss would be an effect of medium magnitude on this high value community, which would be of high significance (and hence a significant impact in EIA terms).
- Blanket bog (M18b) - permanent loss of 0.84ha and temporary loss of 1.52ha - together this equates to 1.8% of area of this habitat within the survey area. Habitat loss would be an effect of low magnitude on this high value community, which would be of low significance, and not significant.
- Wet modified bog (M25a) - permanent loss of 2.97ha and temporary loss of 5.12ha - together this equates to 4.3% of area of this habitat within the survey area. Habitat loss would be an effect of low magnitude (1-5% loss of resource - see Table 7.3) on this high value community, which would be of low significance, and not significant.

- Marshy grassland (M25a) - permanent loss of 4.83ha and temporary loss of 6.46ha - together equates to 5.6% of area of that habitat within the survey area (5-20% of resource - see Table 7.3). Habitat loss would be an effect of medium magnitude on this high value community, which would be of high significance (and hence a significant impact in EIA terms).
- Wet heath (M16a) - permanent loss of 1.88ha and temporary loss of 2.31ha - together this equates to 9.8% of area of this habitat within the survey area. Habitat loss would be an effect of medium magnitude on this high value community, which would be of high significance (and hence a significant impact in EIA terms).

7.7.7 There would also be direct loss of two medium value habitats:

- Marshy grassland (M23a) - permanent loss of 2.57ha and temporary loss of 3.64ha - together this equates to 2.9% of area of this habitat within the survey area. Habitat loss would be an effect of low magnitude on this medium value community, which would be of low significance, and not significant.
- Marshy grassland (M27c) - permanent loss of 0.01ha and temporary loss of 0.04ha - together this equates to 1.1% of area of this habitat within the survey area. Habitat loss would be an effect of low magnitude on this medium value community, which would be of low significance, and not significant.

7.7.8 There would be no effects on any other habitats of conservation value.

Effects of Habitat Loss on Key Species

7.7.9 Key species that could be affected by the proposed development have been defined as those present or likely to be present in the potential impact zone of the wind farm.

7.7.10 Effects on high value species are predicted as follows:

- Badger - there were no records from the potential impact zone for this species (30m, though there were no records within 100m) but there is habitat suitable in that zone so future use of this zone cannot be ruled out. Damage to any setts would be significant, so pre-construction surveys would be required to inform the need for any mitigation measures (see Section 7.8).
- Otter, water vole and adder - as for badger there were no records within the potential impact zones for any of these species, but given the habitats present they could use this area in the future and would require pre-construction checks to inform the need for any mitigation measures (see Section 7.8).

- Bats - there would be no loss of any potential bat roosts. There would be a negligible loss of habitat in terms of their foraging ranges and preferred habitats. This very small loss of foraging habitat of negligible magnitude on high value receptors results in an effect of very low significance (as per Table 7.4) for all of the bat species affected and would not be significant.

7.7.11 The loss of low/negligible areas of habitat for the medium and low value species, in the context of their ranges, would be of at most low significance and not significant.

Indirect Effects: Construction Disturbance (Noise and Visual)

7.7.12 Noise and visual disturbance associated with construction activities could potentially affect breeding and foraging species in the locality of the site. Species that are disturbed at breeding sites are vulnerable to a variety of potential effects that could lead to a reduction in the productivity or survival of their populations. Species subject to disturbance outside the breeding season may also feed less efficiently or resort to less favoured roosting areas, either of which may reduce their survival prospects. The potential impact will vary between species according to each species' tolerance of disturbance from human activity and the availability of suitable alternative breeding and foraging habitat.

7.7.13 The key species that could be affected are the same as those that could be affected by habitat loss, as set out above.

7.7.14 From the current baseline data, there is no evidence that any key species would be affected by construction disturbance. However, the possibility that these species could move into the impact zone (and therefore potentially be significantly affected by disturbance) prior to construction cannot be ruled out. Therefore, pre-construction surveys will be required to inform the need for any mitigation measures.

Pollution Impacts

7.7.15 Fish populations would be particularly vulnerable to pollution incidents into the watercourses, including the high value Atlantic salmon and medium value brown trout and European eel. As set out in Technical Appendix 7.4, this could include siltation from ground disturbance, accelerated or exacerbated erosion of watercourse banksides, hydrological changes to watercourses and surface water run-off, pollution of watercourses, and the blocking or hindering of the upstream/downstream migration of fish, and could, in the absence of mitigation, result in significant impacts on these species' populations.

7.7.16 Otter populations could similarly be significantly affected, either directly by pollution or indirectly through reductions in their fish prey populations.

Operational Effects

7.7.17 The only operational phase ecological impact taken forward for assessment is collision risk to bats. There would be potential for some disturbance to key species during the operational phase of the proposed development, from vehicle use of the new access track moving to/from the site, but this would be of negligible magnitude and not significant for all species.

Bat Collision Risk

7.7.18 Collision mortality, barotrauma and other injuries to bats have all been reported at operational wind farms, though these need to be considered in the context of other forms of anthropogenic mortality. The approach taken with this bat collision risk assessment has been to follow NatureScot et al. (2021) guidance on the assessment process, with the key criterion being any effect on Favourable Conservation Status. Vulnerability to collision is based on relative abundance, collision risk and activity recorded at the site.

7.7.19 For the first stage of the assessment, the site has been assessed as follows:

- Habitat Quality - moderate - there are potential roosts nearby and habitats that could be used by bats, and connectivity to the wider landscape.
- Project size - medium - on basis of number of wind turbines (10-40 range - the proposed development has 21 wind turbines).
- Cross-tabulating these give a score of 3, i.e. this is a medium risk site.

7.7.20 For the Stage 2 risk assessment:

- With medium site risk, for the three species with low ECOBAT activity levels (common pipistrelle, soprano pipistrelle and Daubenton's bat) this gives a Low risk overall.
- For the four species/taxa with low/moderate ECOBAT activity levels (noctule, brown long-eared bat, Myotis sp. and natterer's bats), this gives a Medium risk overall. This is particularly important for noctule as this is a high vulnerability species (the others are low vulnerability).

- There were three species with insufficient number of records to generate a reliable measure of activity levels (Nathusius' pipistrelle, Brandt's, and whiskered bats). With such low levels of activity at the site, the risk has been classed as Low, and these species would not be likely to be significantly affected by the proposed development.

7.7.21 Medium magnitude impacts on high value species (as predicted above for noctule, brown long-eared bat, *Myotis* sp. and natterer's bats) would be a high significance effect and would represent a significant impact in EIA terms. Mitigation will therefore be required to reduce this to a low magnitude.

7.7.22 Low magnitude impacts on high value species (as predicted above for common pipistrelle, soprano pipistrelle, Daubenton's bat, Nathusius' pipistrelle, Brandt's, and whiskered bats) would be a low significance effect and would not be a significant impact in EIA terms.

Effects on Protected Sites

7.7.23 There are no likely effects of the proposed development on any protected sites, due to a lack of structural or functional connectivity.

7.8 Mitigation

7.8.1 The proposed development could result in a number of significant ecological effects, so a package of mitigation measures will be required to reduce the magnitude of these effects and ensure that there are no significant residual effects, and to ensure compliance with the nature conservation legislation.

Design Mitigation

7.8.2 The proposed development has been designed to reduce the potential for ecological effects by avoiding more sensitive ecological interest features. This has included:

- Avoidance of areas of deeper peat - this has reduced the habitat loss of more sensitive higher quality habitats such as blanket bog.
- Avoidance of watercourses - these have all been buffered by 50m, apart from locations where access tracks unavoidably need to cross watercourses. See Chapter 9: Geology, Hydrology and Hydrogeological Assessment for further information regarding watercourse crossings.
- Avoidance of bat preferred habitat features - a minimum 50m buffer has been maintained between wind turbine blade tips and the nearest woodland edge, as set out in current NatureScot guidance (NatureScot et al. 2021).

- Avoidance of badger setts - all setts found during the baseline surveys have been avoided by a minimum 100m buffer.

Mitigation of the Construction Phase

7.8.3 The applicant has committed to the production of a Construction Environmental Management Plan (CEMP) to the satisfaction of NatureScot and other relevant stakeholders, before construction commences, and would follow Windfarm Good Construction Guidance, Scottish Renewables et al (2019). An Outline CEMP is included within Technical Appendix 2.1. A Species Protection Plan will be required to ensure compliance with the Wildlife and Countryside Act (a) to avoid any impacts to species specially protected under Schedule 5 of that Act and (b) to avoid any damage to active setts/holts/hibernacula. A draft Species Protection Plan is included within Technical Appendix 7.5. This will include employment of an Ecological Clerk of Works (ECoW) to monitor compliance.

7.8.4 Given the predicted habitat losses (including a significant loss of *Molinia* grassland (M25), wet heath (M16) and acid flush (M6)), a Habitat Management Plan (HMP) will be implemented to deliver a net gain in peatland habitat. A draft outline HMP is included in Technical Appendix 7.6. The HMP will deliver benefits to the peatland habitats and to the breeding bird community (particularly curlew). It will include enhancement of at least 50ha. of peatland. The overall aims of the HMP are to:

- improve the overall quality of the wet modified bog and blanket bog habitat;
- increase the suitability of the moorland habitats for breeding curlew and other breeding waders including snipe and lapwing, thus providing enhanced breeding habitat over 500m from the proposed wind turbines.

7.8.5 This will ensure that habitat losses are offset through an increase in peatland habitat quality.

7.8.6 Though no species specially protected under Schedule 5 of the Wildlife and Countryside Act or the Badgers Act was found within the potential impact zone of the proposed development, species such as badger, otter and water vole could move into that area in the future. Further surveys for these species will therefore be undertaken immediately prior to construction. If any were found, then appropriate mitigation would be implemented and/or licence sought from NatureScot (as set out in the Species Protection Plan in Technical Appendix 7.5).

- 7.8.7 Potential impacts on fisheries will be mitigated by using best practice protocols to address potential fish access issues, silt management and pollution risks (as set out in the CEMP). Where construction will take place directly next to sites where fish populations have been found, fish rescues will be carried out by GFT to reduce the risk of impacting sensitive populations.

Mitigation of the Operational Phase

- 7.8.8 A significant collision risk was predicted for four bat species/taxa in the absence of any mitigation: noctule, brown long-eared bat, *Myotis* sp. and natterer's bats. Mitigation is therefore required to reduce the magnitude of this effect to ensure that the impact is not significant.
- 7.8.9 This mitigation will be delivered following the guidance set out in NatureScot et al. (2021), by preventing the wind turbine blades from turning when they are not operational at low wind speeds, at times when bats might be active (30 minutes before sunset to 30 minutes after sunrise, March-October). Wind turbine blades may be locked or the angle of the blades may be changed to be parallel to the wind. This has been shown to reduce bat collision risk by up to 50% (Berthinussen et al. 2021)¹⁵.
- 7.8.10 This measure can be implemented without any loss of output. It will be applied automatically through the wind turbines supervisory control and data acquisition (SCADA) system. This would be sufficient to reduce the predicted medium magnitude impact to low (and hence not significant).
- 7.8.11 No other mitigation for the operational phase of the proposed development will be required.

7.9 Assessment of Residual Effects

- 7.9.1 Following mitigation, the residual ecological effects of the proposed development will be a non-significant loss of a small amount of upland moorland habitat, a non-significant risk of disturbance during construction, a non-significant risk of pollution, and a non-significant risk of bat collision with the wind turbines.
- 7.9.2 None of these will have any long-term impact on the integrity of the site's ecological features or the conservation status of the species found here, and no significant residual ecological effects are predicted.

¹⁵ Berthinussen, A., Richardson O.C. and Altringham J.D. (2021) Bat Conservation: Global Evidence for the Effects of Interventions. Conservation Evidence Series Synopses. University of Cambridge, Cambridge, UK.

7.10 Assessment of Cumulative Effects

- 7.10.1 The potential for cumulative ecological effects were considered following NatureScot guidance, considering impacts on the favourable conservation status of key species within the relevant NHZ (in this case NHZ 20 The Border Hills, within which most of the proposed development falls, though consideration has also been given to NHZ 19 West Southern Uplands, which has three of the 21 wind turbines). Given this overlap of NHZ areas, the cumulative assessment has focussed on developments within 35km of the site.
- 7.10.2 All of the potential effects of the proposed development have the potential to contribute to cumulative ecological impacts. However, the predicted residual effects of the proposed development, with regard to habitat loss and disturbance are so low (negligible magnitude) it was considered that these would not make any material contribution to any potentially significant cumulative impact at the NHZ level.
- 7.10.3 Consideration of the cumulative collision risk to bats was carried out to determine whether the proposed development could materially contribute to a potentially significant cumulative collision risk. However, given the combination of low collision risks resulting from the Bloch Wind Farm once the proposed mitigation measures are implemented, and the gains from the proposed HMP, it was concluded that these would not make any material contribution to any potentially significant cumulative impact at the NHZ level.

7.11 Summary

- 7.11.1 Table 7.12 provides a summary of the effects of the proposed development on features of ecological interest detailed within this chapter.

7.11.2 Overall, there are not likely to be any significant residual effects on ecology as a result of the proposed development assuming that the mitigation measures referred to in this chapter are adopted (and which are required to ensure compliance with the nature conservation legislation). The proposed development would not affect the favourable conservation status of any species/community of conservation importance within the NHZ, either alone or in-combination with other schemes. It would also not contribute to any Likely Significant Effect on any SPA qualifying interests. No effects would result in any breach of the Habitats Regulations.

Table 7.12: Summary of Residual Effects

Potential Environmental Effect	Significant Yes/No	Mitigation	Means of Implementation	Residual Effect
Direct habitat loss from construction	Yes	Avoidance of more sensitive habitats in design process	Design mitigation, CEMP, HMP	Not significant
Disturbance to European Protected Species, Schedule 5 species and badgers during construction	Yes	Pre-construction survey checks; if present avoid disturbing activity in proximity with species-specific buffer zone implemented.	Species Protection Plan, CEMP	Not significant
Disturbance to other key ecological receptors	Yes	Pre-construction survey and impacts avoided.	Species Protection Plan, CEMP	Not significant
Operational phase collision risk to bats	Yes	Preventing wind turbine blades turning when they are not operational at low wind speeds	Condition	Not significant
Cumulative ecological impacts	No	None required	-	Not significant