Chapter 8
Ecology

SCOTTISHPOWER RENEWABLES

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Technical Appendix 8.1: National Vegetation Classification (NVC) & Habitats Survey Report
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Technical Appendix 8.2B: Protected Species 2015 Survey Report
Technical Appendix 8.3A: Bat Survey Report (2017 surveys)
Technical Appendix 8.3B: Bat Survey Report (2015 surveys)
Technical Appendix 8.4: Bat Mitigation and Monitoring Plan
Technical Appendix 8.5: Electrofishing Survey Report

Chapter 8
Ecology

8.1 Introduction

1. This Chapter considers the likely significant effects on ecology associated with the construction and operation of the proposed Development. It should be read with reference to the scheme description in **Chapter 3: Description of the proposed Development**.

2. The specific objectives of the Chapter are to:

- describe the 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 likely significant effects; and
- assess the residual effects remaining following the implementation of mitigation.

3. This Chapter is supported by the following Technical Appendices and Figures:

- Technical Appendix 8.1: National Vegetation Classification (NVC) & Habitats Survey Report;
- Technical Appendix 8.2A: Protected Species 2017 and 2019 Survey Report;
- Technical Appendix 8.2B: Protected Species 2015 Survey Report;
- Technical Appendix 8.3A: Bat Survey Report (2017 surveys);
- Technical Appendix 8.3B: Bat Survey Report (2015 surveys);
- Technical Appendix 8.4: Bat Mitigation and Monitoring Plan;
- Technical Appendix 8.5: Electrofishing Survey Report;
- Figure 8.1 Ecological Designated Sites Within 5 km;
- Figure 8.2a-e Phase 1 Habitat Results;
- Figure 8.3a-i National Vegetation Classification (NVC) Study Area and Survey Results;
- Figure 8.4a-i Potential Groundwater Dependent Terrestrial Ecosystems (GWDTE) Study Area and Survey Results;
- Figure 8.5a-d Protected Species Survey Results 2017 and 2019;
- Figure 8.6 Bat Survey Study Area: 2017;
- Figure 8.7 *Nyctalus* Species Records within 20 km;
- Figure 8.8 Bat Roost Survey Results: 2015 & 2017;
- Figure 8.9 Temporal Bat Results 2017;
- Figure 8.10a-c Fisheries Survey Locations; and
- Figure 8.C1a-c Confidential: Protected Species Survey Results.

4. Figures and Technical Appendices are referenced within this Chapter where relevant.

5. The assessment has been carried out by MacArthur Green.

8.2 Approach to assessment and methods

8.2.1 Legislation, policy and guidance

6. Legislation, policy and guidance relevant to this assessment is provided in **Technical Appendix 4.1**.

8.2.2 Study areas

7. The area within which the desk-based research and field surveys were undertaken varies depending on the feature. Details of the extent of each study area are further described in associated Technical Appendices (**Technical Appendix 8.1 - 8.5** and are illustrated in **Figures 8.1 to 8.10**).

8. Details of the extent of each study area are outlined below. The specific study areas are as follows:

- National Vegetation Classification (NVC) & Habitats Survey: study area covered an area of 2503.46 ha (**Figure 8.3a-i**);
- protected species (otter (*Lutra lutra*), water vole (*Arvicola amphibius*), badger (*Meles meles*), red squirrel (*Sciurus vulgaris*) and pine marten (*Martes martes*). A watching brief was also kept and signs recorded for other protected species potentially inhabiting the Site, i.e. native reptiles: adder (*Vipera berus*), common or viviparous lizard (*Zootoca vivipara*), and slow worm (*Anguis fragilis*): the study area was defined by the infrastructure layout at the time the surveys were undertaken (**Technical Appendix 8.2A & B, Figures 8.5a-d**);
- bats: the study area was defined by the infrastructure layout at the time the surveys were undertaken (**Technical Appendix 8.3 A & B, Figure 8.6**); and
- electrofishing and fish habitats: study area included watercourses within the Site and application boundary (**Technical Appendix 8.5, Figures 8.10a-c**).

8.2.3 Temporal scope

9. The Chapter assesses cumulative effects as arising from the addition of the proposed Development to other developments, which are the subject of a valid planning application or Section 36 application. Operational, under construction and consented developments are considered as part of the baseline. Developments close to the end of their operational life will also be included as part of the baseline to present 'worst case' cumulative scenario.

10. The assessment is based on the proposed Development as described in **Chapter 3: Description of the proposed Development.**

11. The scope of the assessment has been informed by consultation responses summarised in **Table 8.1** and the legislation, policy and guidance set out in **Technical Appendix 4.1**.

12. As noted in the Scoping Report, there is no proposal to limit the lifetime of the proposed Development. The technical assessment therefore considers the effects of the operational phase of the proposed Development. Further detail on this approach can be found in **Chapter 3: Description of the proposed Development'**.

8.2.4 Effects assessed in full

13. The assessment considers the potential effects of construction and operation of the proposed Development on the ecological features identified during the baseline surveys. In general, effects on the following features are assessed:

- designated sites – direct effects (i.e. derived from land-take or disturbance) and indirect effects (i.e. changes caused by effects to supporting systems such as groundwater);
- terrestrial habitats – direct effects (i.e. derived from land-take) and indirect effects (i.e. changes caused by effects to supporting systems such as groundwater or overland flow);
- aquatic habitats – effects are limited in this Chapter to the ecological effects of changes in water conditions through potential pollution effects. Any hydrological effects are considered in **Chapter 10: Hydrology, Hydrogeology, Geology and Soils**; and

- protected species – direct effects (i.e. loss of life as a result of the proposed Development; loss of key habitat; displacement from key habitat; barrier effects preventing movement to/from key habitats; and general disturbance) and indirect effects (i.e. loss/changes of/to food resources; population fragmentation; degradation of key habitat e.g. as a result of pollution).

8.2.5 Effects scoped out

14. No effects were scoped out prior to commencement of desk-based and field surveys and determination of the presence and distribution of ecological features in relation to the planned infrastructure and activities associated with the proposed Development. On the basis of the results of the desk-based and survey work undertaken, the professional judgement of the EIA team, experience from other relevant projects and policy guidance or standards, the following species and habitats/habitat features have been 'scoped out' of the assessment.

15. Generally common or widely distributed habitats or species which do not fall within the following categories were scoped out of the assessment:

- Annex I habitats of the Habitats Directive, and species on Annex II of the Habitats Directive;
- UK Biodiversity Action Plan (UKBAP) or Scottish Biodiversity List (SBL) Priority Habitats; and
- habitats or species protected by other legislation such as The Wildlife and Countryside Act 1981 (as amended), the Nature Conservation (Scotland) Act 2004 (as amended), or The Protection of Badgers Act 1992 (as amended).

8.2.6 Baseline determination

8.2.6.1 Data sources

16. A desk study was undertaken to collate available ecological information in relation to the proposed Development and surrounding environment. South West Scotland Environmental Information Centre was consulted for records of notable species and habitats within 5 km of the Site and bat hibernation records within 10 km of the Site. This desk study also consisted of a search of *Nyctalus* bat records from the 'Scottish Leisler's Bat Project' which were supplied to MacArthur Green by John Haddow in May 2015.

17. A search was conducted for the presence of any designated sites with ecological qualifying features within 5 km of the proposed Development, using SNH's SiteLink website [https://sitelink.nature.scot] (**Figure 8.1**).

18. Scientific literature on species and habitats was considered and is cited in the sections below where applicable.

19. The ecological information from the desk study was used to inform the scope of surveys for the proposed Development and give a longer-term overview of the ecological features that may be present, to aid the impact assessment.

8.2.6.2 Field survey

20. Ecological fieldwork commenced in 2015 and was completed in February 2019. The following field surveys were undertaken to establish the baseline ecological conditions, and methods used followed standard best practice (see **Technical Appendix 8.1 to 8.5** for further details).

8.2.6.2.1 National Vegetation Classification (NVC) and Habitat Surveys

21. Surveys were undertaken as follows:

- 13 to 17 July 2015;
- 27 to 31 July 2015 and
- 4 to 6 July 2018.

22. Further information on the NVC surveys and methods are detailed in **Technical Appendix 8.1**.

8.2.6.2.2 Protected Species Surveys

23. Surveys were undertaken as follows:

- 12 and 14 October 2015;
- 19 and 21 June 2017 with an additional survey for water vole undertaken between the 6 and 9 September 2017; and
- 18 and 20 February 2019 along the proposed access route.

24. Further information related to the protected species surveys and their methods can be found in **Technical Appendix 8.2A & B**.

8.2.6.2.3 Bat surveys

25. Surveys were undertaken as follows:

- bat activity surveys 2015 (temporal and spatial surveys);
- bat activity surveys between 1 May 2017 and 2 October 2017 (temporal surveys);
- bat roost potential surveys between 12 and 14 October 2015;
- bat roost potential survey between 19 and 21 June 2017; and
- bat roost potential surveys between the 18 and 20 February 2019 along the proposed access route.

26. Further information related to the bat surveys and methods is detailed in **Technical Appendix 8.3 A & B).**

8.2.6.2.4 Fish surveys

27. Surveys were undertaken as follows:

- fisheries surveys in 2017 undertaken by the Ayrshire Rivers Trust (electrofishing surveys).

28. Further information on the electrofishing and habitat surveys can be found in **Technical Appendix 8.5[1].**

8.2.7 Consultation

29. In undertaking the assessment, consideration has been given to consultation undertaken with relevant organisations. **Table 8.1** outlines those consultation responses where more detailed consideration was required and provides information on where and/or how they have been addressed in the assessment.

30. Full details on the consultation responses can be reviewed in **Chapter 6: Scoping and Consultation**.

31. The following organisations provided comment on ecology: Fisheries Management Scotland, Marine Scotland, Royal Society for the Protection of Birds (RSPB), Scottish Environmental Protection Agency (SEPA), South Ayrshire Council (SAC), Colmonell and Lendalfoot Community Council and Scottish Natural Heritage (SNH).

Consultee	Date	Scoping / other consultation	Issue raised	Response / action taken
Fisheries Management Scotland	31/10/2018	Scoping Report Consultation	The proposed Development falls within the district of the Stinchar District Salmon Fishery Board, and the catchments relating to the Ayrshire Fisheries Trust. Proposals should be conducted in full consultation with these organisations. Strongly recommend that FMS/MSS guidelines are fully considered throughout the planning.	Fish surveys were undertaken by the Ayrshire Rivers Trust in 2017.
Marine Scotland	26/11/2018	Scoping Report Consultation	Developer to consider water quality within the EIA, particularly as the proposed Development area suffers from acidification problems.	Impacts on water are further detailed in **Chapter 10: Hydrology, Hydrogeology, Geology and Soils**. A fish population monitoring programme during and after

[1] Commissioned prior to EIA when Site was previously known as 'Arecleoch East'.

Consultee	Date	Scoping / other consultation	Issue raised	Response / action taken
			Furthermore, the potential impact on water quality and aquatic biota associated with the proposed felling should also be assessed. Recommended that the developer establishes an integrated water quality (hydrochemical and macroinvertebrate) and fish population monitoring programme before, during and after construction. Additional sampling may also be required one to two years prior to decommissioning. Developer consults our generic scoping and monitoring guidelines when drawing up appropriate site-specific mitigation measures and a monitoring programme. MSS recommends that the developer discusses the potential cumulative impact of adjacent windfarms on water quality and fish populations.	construction would be implemented. Mitigation and monitoring measures are outlined in this EIAR.
RSPB	29/11/2018	Scoping Report Consultation	In the main, the Scoping Report covers the topics and methodologies we would expect to be assessed as part of the EIA, however we would also make the following comments: 1. Red kites are known to be present in the area and ornithological surveys should take into account this species; 2. Should there be a need for any compensatory woodland planting as a result of the proposal, the biodiversity impacts of this must be assessed, ideally as part of the EIA process.	1. Ornithology, including red kites, is discussed in **Chapter 9: Ornithology** of this EIA-R. 2. Compensatory woodland planting is covered in **Technical Appendix 3.2, Forestry**.
SEPA	10/12/2018	Scoping Report Consultation	We consider that the following key issues must be addressed in the Environmental Impact Assessment process. To avoid delay and potential objection, the information outlined below and in the attached appendix must be submitted in support of the application. 1 - Map and assessment of all engineering activities in or impacting on the water environment including proposed buffers, details of any flood risk assessment and details of any related CAR applications.	1. Impacts on water are further detailed in **Chapter 10: Hydrology, Hydrogeology, Geology and Soils**. This includes CAR application requirements. 2. Potential GWDTE were mapped as part of the NVC surveys (see **Technical Appendix 8.1 and Figure 8.4a-i**). The full GWDTE assessment forms part of **Chapter 10**: **Hydrology, Hydrogeology, Geology and Soils**.
			2 - Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems (GWDTE) and buffers. [only extracts of the response relating to ecological issues are detailed here]	
South Ayrshire Council	20/11/2018	Scoping Report Consultation	Biodiversity: *"I've looked over the Scoping Report Ecological Designation, Ornithology files and Protected Species Survey Results and find everything in order regarding the proposed Development and baseline surveys and information regarding the ecological impact assessment proposals."*	Surveys were undertaken in line with the proposals detailed in the Scoping Report (see **Technical Appendices 8.1 to 8.5**).
Colmonell and Lendalfoot Community Council	29/11/2018	Scoping Report Consultation	Colmonell & Lendalfoot Community Council object strongly to the proposed extension of Arecleoch Windfarm for the following reasons: […] the proposed extension will have a material and adverse impact on flora and fauna damaging conservation work in the Stinchar Valley to preserve red squirrels and other native species under threat.	Impacts on flora and fauna have been assessed in this Chapter of the EIA report.
SNH	29/11/2018	Scoping Report Consultation	With regards to the ES, we recommend that the ecological chapters are split into topics, e.g. protected areas, species (birds, bats, otter, etc.), habitats (terrestrial, freshwater), etc. The ES should include information and assessment of which activities associated with the construction and operations of the development are likely to have direct and indirect (including cumulative) significant environmental effects on the relevant natural heritage receptors, along with clear details of any mitigation. A schedule of environmental mitigation should be provided in an annex for developments with impacts on natural heritage interests. The schedule should compile all the environmental mitigation/enhancement measures into one list/table, for ease of reference.	The ecology Chapter has been split into topics. The EIA report includes information and assessment of which activities associated with the construction and operations of the development are likely to have direct and indirect (including cumulative) significant environmental effects on the relevant natural heritage receptors, along with clear details of any mitigation. This includes separate technical appendices in regard to mitigation, where required. A schedule of all the environmental mitigation/enhancement measures is provided. A schedule of environmental mitigation is provided in Chapter 16 of this EIAR.

Consultee	Date	Scoping / other consultation	Issue raised	Response / action taken
			A schedule of environmental mitigation should be provided.	
			Advise that species surveys should have been completed no more than 18 months prior to submission of the application, to ensure that the survey results are a contemporary reflection of species activity at and around the Site.	Species surveys were undertaken over a period of time in 2018 and 2019. Although some data is more than 18 months old at time of submission, it is expected that due to species found and a low likelihood of significant changes, these baseline data still represents the situation within the study areas. In addition, pre-construction surveys would ensure that any changes from the baseline would be detected prior to the start of construction.
			Figure 7.1 of the Scoping report highlights other (non-avian) statutory designated sites within 5 km of the proposed Development. We do not consider that the any of these sites are connected to the development site. Therefore we are satisfied that they do not require further consideration and can be scoped out of the EIA.	The non-avian statutory designated sites are scoped out of the EIA, as detailed in **Section 8.3.8.1**.
			As only an indicative site layout is known at the moment (figure 1.2), we recommend that further work is undertaken to determine whether otter will be affected by the proposals. An otter protection plan should also be prepared and if the implementation of mitigation measures is not sufficient to avoid offences under protected species legislation, a licence will be required from SNH before works can proceed.	Further work was undertaken in 2019 to determine whether otter would be affected by the proposal, after design freeze. The final design informed any additional survey areas since scoping design stage and results are detailed in **Technical Appendix 8.2A & B** and summarised in **Section 8.3**. A Species Protection Plan (SPP), including otter, would be prepared prior to the commencement of the construction phase. Pre-construction protected species surveys (including otter) and presence of an Ecological Clerk of Works (ECoW) have also been included in the mitigation proposed.
			The scoping report confirms that there is suitable habitat for water vole throughout the development site and a water vole colony was recorded within the development site during the June 2017 survey. Usage of a site by water vole can change over time and we recommend that any suitable habitat should be surveyed for water vole activity in conjunction with the pre-construction update otter survey. If water vole and their habitat could be affected by the proposal a water vole protection plan should be prepared. If the implementation of mitigation measures is not sufficient to avoid offences under protected species legislation, a licence will be required from SNH before the works can proceed. Provided the development is carried out strictly in accordance with this additional mitigation measure, the proposal is unlikely to result in offences under protected species legislation. However, if the development is not carried out in accordance with the mitigation measure, the applicant may risk committing an offence.	A SPP, including water vole, would be prepared prior to commencement of the construction phase. Pre-construction protected species surveys and presence of an ECoW will also be included in the mitigation proposed.
			The scoping report confirms that there is suitable habitat for badger throughout the development site and a badger footprint was recorded during the June 2017 survey indicating their presence in the wider area. However no setts were identified during either the 2015 or 2017 survey. As badgers are a mobile species and their use of an area can change over time, we recommend the applicant should undertake a pre-construction update badger survey prior to	A SPP, including badger, would be prepared prior to commencement of the construction phase. Pre-construction protected species surveys and presence of an ECoW will also be included in the mitigation proposed.

Consultee	Date	Scoping / other consultation	Issue raised	Response / action taken
			commencement of construction. We recommend this survey should be undertaken as close to commencement of construction as possible, but no greater than eight months preceding commencement of construction. If changes in the use of the development site by badger are identified, an updated assessment of the impacts on the development on badger must be completed and appropriate mitigation measures identified (if required). If the implementation of the identified mitigation measures is not sufficient to avoid offences under protected species legislation, a licence will be required from SNH before works can proceed. Provided the development is carried out strictly in accordance with this additional mitigation measure, the proposal is unlikely to result in offences under protected species legislation. However, if the development is not carried out in accordance with the mitigation measure, the applicant may risk committing an offence.	
			The scoping report confirms that there is suitable habitat for red squirrel throughout the development site. Squirrel feeding signs were recorded during both the 2015 and 2017 surveys but it is not known whether these feeding signs were from red or grey squirrels. However, a red squirrel was sighted, during a 2017 ornithology survey, confirming their presence within the development area. No red squirrel dreys were recorded within the development site. As tree felling is proposed as part of the development, we recommend that a pre-construction update red squirrel survey should be carried out as close to commencement of construction as possible, but no greater than eight	A SPP, including squirrel, would be prepared prior to commencement of the construction phase. Pre-construction protected species surveys and presence of an ECoW will also be included in the mitigation proposed.

Consultee	Date	Scoping / other consultation	Issue raised	Response / action taken
			months preceding commencement of construction. If this survey work finds that red squirrel could be affected by the proposal a red squirrel protection plan should be prepared. If the implementation of the identified mitigation measures within this plan is not sufficient to avoid offences under protected species legislation, a licence will be required from SNH before the works can proceed. Provided the development is carried out strictly in accordance with this additional mitigation measure, the proposal is unlikely to result in offences under protected species legislation. However, if the development is not carried out in accordance with the mitigation measure, the applicant may risk committing an offence.	
			The scoping report confirms that there is suitable habitat for pine marten throughout the development site and a pine marten was sighted during the 2015 survey. In June 2017 pine marten were also thought to be heard calling, however no dens were identified within the development site. Potential pine marten scats were recorded during both the 2015 and 2017 survey. As tree felling is proposed as part of the development, we recommend that a pre-construction update pine marten survey should be carried out as close to commencement of construction as possible, but no greater than eight months preceding commencement of construction. If this survey work finds that pine marten could be affected by the proposal a pine marten protection plan should be prepared. If the implementation of the identified mitigation measures within this plan is not sufficient to avoid offences under protected species legislation, a licence	A SPP, including pine marten, would be prepared prior to commencement of the construction phase. Pre-construction protected species surveys and presence of an ECoW will also be included in the mitigation proposed

Consultee	Date	Scoping / other consultation	Issue raised	Response / action taken
			will be required from SNH before the works can proceed. Provided the development is carried out strictly in accordance with this additional mitigation measure, the proposal is unlikely to result in offences under protected species legislation. However, if the development is not carried out in accordance with the mitigation measure, the applicant may risk committing an offence.	
			The scoping report states that the 2015 bats surveys identified high risk bat species (Nyctalus species) using the site. Therefore the number of static detectors and recording duration was increased across the site for the 2017 bat survey. However no details have been provided as to the location of the static detectors and it is difficult to make an assessment without seeing the full month by month survey data results for 2015 and 2017. Note that no *"at height"* bat surveys were undertaken. With regards to mitigation for bats we are unable to comment on any detailed mitigation likely to be required at this stage. However, as a minimum, we would expect turbines to be located where no part of their structure or blades should fall within 50m of the nearest building, tree or hedgerow in line with Natural England's Bats and onshore wind turbines Interim guidance Technical Information note TIN059.	Details regarding bat survey undertaken during 2017 are provided in **Section 8.3.2.3** of this Chapter. A discussion of bat surveys at height is included in **Technical Appendix 8.3A & B**. Details on proposed mitigation for bats is summarised in **Sections 8.3.7 and 8.4.3.1** of this Chapter and detailed in **Technical Appendix 8.4.** Mitigation is in line with Natural England's Bats and onshore wind turbines Interim guidance Technical Information note TIN059. Surveys were undertaken following Bat Guidelines (Hundt, 2012), with higher survey effort applied. The newly released Bats and onshore wind turbines: Survey, assessment and mitigation (2019) was taken into account during the assessment process.
			There is no mention of great crested newt surveys having been undertaken within the scoping report.	The application boundary is out-with the area of suitable habitat for great-crested newts in Scotland (O'Brian et al, 2017). In addition, the desk study and habitats found during NVC surveys did not indicate suitability for this species. Therefore great-crested newts were scoped out prior to field surveys commencing.
			We note from the ecology section of the scoping report that an NVC survey was carried out in July 2015 and in July 2018 but there is no figure included within the scoping report showing the survey results. The ES should include a map of the 2015 and 2018 NVC habitat survey results with the windfarm boundary, proposed turbines, tracks and infrastructure layout overlapping.	A detailed map of the 2015, 2018 and 2019 NVC habitat survey results, including the application boundary, proposed turbine, track and infrastructure layout is provided (see **Figure 8.3a-i**).
			We note that electrofishing surveys were undertaken in 2017 at eight sites within or downstream from the proposed development. It would have been useful to know the location of these survey sites and the ES should include a map of fisheries survey locations with the windfarm boundary, proposed turbines, tracks and infrastructure layout overlapping. The electrofishing surveys recorded salmon, trout, eel and lamprey. Therefore we support the proposals to consult with the Stinchar River Salmon Fisheries Board and Ayrshire Rivers Trust prior to EIA submission. We would be happy to advise further on suitable fisheries mitigation measures if required. All works should be carried out in accordance with SEPA's Pollution Prevention Guidelines to prevent negative impacts from the discharge of surface water into any watercourses within the site.	A map of fisheries survey locations with the application boundary, proposed turbines, tracks and infrastructure layout overlapping is provided in **Figure 8.10**).
			We recommend that if deer are present on or will use the development site, an assessment of the potential impacts on deer welfare, habitats, neighbouring and other interests (e.g. access and recreation, road safety, etc.) should be presented. If the development would, or could, result in significant impacts, a draft deer management statement should be provided, setting out how the impacts will be addressed.	An assessment of the potential impacts on deer welfare, habitats, neighbouring and other interests has been made and consideration was given to the necessity of a deer management statement (**Section 8.3.8.1**).

Consultee	Date	Scoping / other consultation	Issue raised	Response / action taken
			We recommend that peat survey results should be used to inform the design and layout process, so that the development avoids, where possible, fragile and priority habitats and other sensitive areas (e.g. blanket bog and peat).	Phase I and Phase II peat surveys were undertaken with results considered during the design process and further detailed in **Chapter 10: Hydrology, Hydrogeology, Geology and Soils.**
Bardrochat and Knockdolian Estates, Colmonell, Ayrshire	12/2018	Scoping Report Consultation	Careful consideration has been given to the Scoping Report […] it is considered that there are only a limited number of matters where early stage comment is needed as follows: […] g. Ecology – there will be a need for a clear analysis of the combined ecological effects of the proposal and the operational windfarm and of the implications of the windfarm extension proposal for current HMP activities and monitoring	There are no HMP activities for the operational Arecleoch Windfarm site and therefore no implications from the proposed Development regarding these.

Table 8.1: Consultations responses

8.2.8 Approach to assessment of effects

32. This section defines the methods used to assess the significance of effects on Important Ecological Features (IEFs) through the process of an evaluation of Nature Conservation Value, Conservation Status and Magnitude of Impact. **Chapter 5: Environmental Impact Assessment** provides further detail on the approach to assessment.

33. There can often be varying degrees of uncertainty over the sensitivity or magnitude of impacts as a result of limited information. A precautionary approach is therefore adopted where the response of a population to an impact is uncertain.

34. The evaluation for wider-countryside interests (interests unrelated to a Special Area of Conservation (SAC) involves the following process:

- identification of the potential ecological impacts of the proposed Development, including both beneficial and adverse;
- consideration of the likelihood of occurrence of potential impacts where appropriate;
- defining the Nature Conservation Value of the important ecological features present;
- establishing the feature's conservation status where appropriate;
- establishing the magnitude of the likely impact (both spatial and temporal);
- based on the above information, a professional judgement is made as to whether the identified effect is significant in the context of the EIA Regulations;
- if a potential effect is determined to be significant, measures to avoid, reduce, mitigate or compensate for the effect are suggested where required;
- opportunities for enhancement are considered; and
- residual effects after mitigation, compensation or enhancement are considered.

8.2.8.1 Determining Nature Conservation Value of ecological features

35. Nature Conservation Value is defined on the basis of the geographic context given in **Table 8.2** (which follows the standard guidance CIEEM, 2018). Attributing a value to an ecological feature is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of an importance level. For example, a SAC, designated under the Habitats Directive, is implicitly of European (International) importance. In the case of species, assigning value is less straightforward as contextual information about distribution and abundance is fundamental, including trends based on historical records. This means that even though a species may be protected through legislation at a national or international level, the relative value of the population at the Site may be quite different (e.g. the Site population may consist of a single transitory animal, which within the context of a thriving local/regional/national population of a species, is therefore of local or regional value rather than national or international).

36. Where possible, the valuation of habitat/populations within this assessment will make use of any relevant published evaluation criteria (e.g. The SBL(Scottish Government, 2013), Joint Nature Conservancy Council (JNCC) on selection of biological SSSIs(JNCC, 2013)). Furthermore, JNCC guidance 2014 has been consulted, where relevant, so that cross-referencing of classifications within different systems can be standardised (e.g. correctly matching NVC types with Annex I habitats where relevant etc.).

37. Where relevant, information regarding a feature's conservation status is also considered to fully define its importance. This enables an appreciation of current population or habitat trends to be incorporated into the assessment.

Value of feature in Geographical context[2]	Description
International	An internationally designated site (e.g. SAC).
	Site meeting criteria for international designations or qualifying species of a SAC where there is connectivity.
	Species present in internationally important numbers (>1 % of biogeographic populations).
National (UK)	A nationally designated site (SSSI, or a National Nature Reserve (NNR)), or sites meeting the criteria for national designation or qualifying species where there is connectivity.
	Species present in nationally important numbers (>1 % UK population).
Regional (National Heritage Zone or Local Authority Area)	Species present in regionally important numbers (>1 % of Natural Heritage Zone population).
	Areas of habitat falling below criteria for selection as a SSSI (e.g. areas of semi-natural ancient woodland larger than 0.25 ha).
Local	Local Nature Reserves (LNR).
	Areas of semi-natural ancient woodland smaller than 0.25 ha.
	Areas of habitat or species considered to appreciably enrich the ecological resource within the local context, e.g. species-rich flushes or hedgerows.
Negligible	Usually widespread and common habitats and species. Features falling below local value are not normally considered in detail in the assessment process.

Table 8.2: Approach to valuing ecological features

38. IEFs to be assessed were taken to be those features of local, regional, national and international value.

8.2.8.2 Criteria for assessing the magnitude of change

39. Determining the magnitude of any likely effects requires an understanding of how the ecological features are likely to respond to the proposed Development. This change can occur during construction or operation of the proposed Development.

40. Effect magnitude refers to changes in the extent and integrity of an ecological receptor. A suitable definition of ecological 'integrity' is found within Scottish Executive circular 6/1995 updated in Scottish Executive 2000[3] which states that, "*The integrity of a site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*". Although this definition is used specifically regarding European level designated sites (SACs and SPAs), it is applied to wider countryside habitats and species for the purposes of this assessment.

41. Effects can be adverse, neutral or beneficial. Effects are judged in terms of magnitude in space and time. There are five levels of spatial effects and five levels of temporal effects as described in **Table 8.3** and **Table 8.4** respectively.

Spatial magnitude	Description
Very High	Would cause the loss of the majority of a feature (>80 %) or would be sufficient to damage a feature sufficient to immediately affect its viability.
High	Would have a major effect on the feature or its viability. For example, more than 20 % habitat loss or damage.
Moderate	Would have a moderate effect on the feature or its viability. For example, between 10 – 20 % habitat loss or damage.
Low	Would have a minor effect upon the feature or its viability. For example, less than 10 % habitat loss or damage.
Negligible	Minimal change on a very small scale; effects not dissimilar to those expected within a 'do nothing' scenario.

Table 8.3: Definition of spatial effect magnitude upon IEFs

Temporal magnitude	Description
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken here as 30+ years), except where there is likely to be substantial improvement after this period in which case the category Long Term may be more appropriate.
Long term	Between 15 years up to (and including) 30 years.
Medium term	Between 5 years up to (but not including) 20 years.
Short term	Up to (but not including) 5 years.
Negligible	No effect.

Table 8.4: Definition of temporal effect magnitude upon IEFs

8.2.8.3 Criteria for assessing cumulative effects

42. SNH's cumulative assessment guidance (SNH, 2012) is used to inform the cumulative assessment in this Chapter. Cumulative effects are not possible to evaluate through the study of one development in isolation but require the assessment of effects when considered in combination with other developments, projects or activities. However, in the interests of focusing on the potential for significant effects, this assessment considers the potential for cumulative effects with other EIA developments. The context in which these effects are considered is heavily dependent on the ecology of the feature assessed. For example, for water voles it may be appropriate to consider effects specific to individual catchments, should the distance between neighbouring catchments be sufficient to assume no movement of animals between them, whereas for blanket bog the region/Natural Heritage Zone may be the relevant spatial scale. Therefore, an assessment of cumulative impacts will be made for each scoped in feature, appropriate to its ecology.

8.2.8.4 Significance of effect

43. The potential significance of the effect was determined through a standard method of assessment based on professional judgement, considering the nature conservation value of the IEF and the magnitude of change.

44. **Table 8.5** details the significance criteria that have been used in assessing the effects of the proposed Development. 'Major' and 'Moderate' impacts are considered to be Significant in accordance with EIA Regulations. 'Minor' and 'Negligible' impacts are considered to be Not Significant in accordance with EIA Regulations.

[2] Adapted from Hill (2005).
[3] Although the document is no longer available on the Scottish Executive Website: The Court of Justice of the European Union (CJEU) in Sweetman [Case C-258/11 Peter Sweetman, Ireland, Attorney General, Minister for the Environment, Heritage and the Local Government v An Bord Pleanála [2014] P.T.S.R. 1092 (Sweetman)] has also provided some clarification on the meaning of 'site integrity' in relation to an SAC. The CJEU explains that in order for the integrity of a site not to be adversely affected, the site needs to be preserved at a 'favourable conservation status'. This requires "*the lasting preservation of the constitutive characteristics of the site concerned that are connected to the presence of a natural habitat type whose preservation was the objective justifying the designation of that site*." [n.7, para.39].;

Level of significance of effect	Description
Major	**Significant effect**, as the effect is likely to result in a long term significant adverse effect on the integrity of the feature.
Moderate	**Significant effect**, as the effect is likely to result in a medium term or partially significant adverse effect on the integrity of the feature.
Minor	The effect is likely to adversely affect the feature at an insignificant level by virtue of its limited duration and/or extent, but there will probably be no effect on its integrity. The level of effect would be **Minor** and **Not Significant**.
Negligible	No material effects. The effect is assessed to be **Not Significant**.

Table 8.5: Significance criteria

45. Using these definitions, it is decided whether there would be any effects which would be sufficient to adversely affect the IEF to the extent that its conservation status deteriorates significantly beyond that which would be expected should baseline conditions remain (i.e. the 'do nothing' scenario).

8.2.8.5 Limitations to the assessment

46. Limitations exist regarding the knowledge base on how some species, and the populations to which they belong, react to effects. A precautionary approach is taken in these circumstances, and as such it is considered that these limitations do not affect the robustness of this assessment.

47. Access restrictions existed across the Site for some of the ecology surveys. Areas around the active railway track could not be surveyed for health and safety reasons and were excluded from the survey areas.

48. Access restrictions existed to those areas where survey buffers existed out-with the application boundary. Survey limitations due to access restrictions, where these existed, are outlined within the respective **Technical Appendices 8.1 to 8.5**.

49. The 2019 protected species surveys were conducted in February, which is not considered to be within the optimal, or recommended, survey period for water voles. To overcome this limitation, notes were taken during the survey period of any watercourses or habitats which showed suitability for supporting the species. Given the results of the surveys, appropriate mitigation will be recommended as part of a SPP for the site which will provide protection to any water voles utilising the habitats along the proposed access route. Therefore, the survey timing is not considered to have affected the integrity of the surveys along the proposed access route.

50. Minor gaps in the habitat mapping coverage and associated buffer have, where possible, been filled in by extrapolation of existing survey information using detailed aerial imagery and surveyor knowledge of the study area (**shown in Figure 8.3a-i**). Where a reliable extrapolation could not be made the minor gaps remain unaltered. These are not considered to limit the assessment as the few gaps are on the verge of the access track and over existing borrow pits where habitat has been lost already.

51. The limitations and assumptions related to the bat survey data are outlined within **Technical Appendix 8.3A & B** and are mainly associated with the collection and analysis of the temporal survey data.

52. Locations of static bat detectors (Anabats) for temporal bat surveys were based on a preliminary layout of the proposed Development. The location of the Anabats does not therefore exactly match the final layout. However, the locations are considered to provide a representative sample of conditions on the Site and so are considered to be robust and sufficient to undertake this assessment.

53. The EcoBat tool was not operational at the time of data analysis. Therefore, activity levels for bats were assessed using reference-sites for bat activity and fatality rates and undertaking statistical analysis to provide comparison with bat activity recoded within the study area. The methodology was developed based on professional judgement, and although not strictly based on the EcoBat analysis as detailed in the guidance, analysis of activity data was undertaken using a similar method (using nightly activity percentiles) (**Technical Appendix 8.4**).

54. The electrofishing techniques used are specifically designed for assessing juvenile salmonid populations therefore fish from other groups may not be quantified effectively. It is also possible that if fish populations are low or have a clumped distribution, the survey data from sample sites may not sample the full fish population in an area.

55. Ecological surveys are limited by factors which affect the presence of plants and animals such as the time of year and behaviour. The ecological surveys undertaken to inform this assessment have not therefore produced a complete list of plants and animals and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it would not be present in the future. However, the results of these surveys are considered to be robust and sufficient to undertake this assessment.

56. Therefore, whilst limitations have been identified, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant effects on important ecological features.

8.3 Baseline conditions

57. This section details the results of the desk study and field surveys, providing the baseline conditions for the proposed Development Site, including:

- designated sites and desk study;
- habitats; and
- protected species.

8.3.1 Current baseline

8.3.1.1 Designated sites and species

58. There are five statutory designated sites within 5 km of the proposed Development which are designated for ecological features. Details on these are provided in **Table 8.6 and Figure 8.1**.

Site	Designation	Designated features	Distance from Site
Craig Wood	Site of Special Scientific Interest (SSSI)	Biological: Woodland: Upland oak woodland	2.29 km
River Bladnoch Special Area of Conservation	SAC	*Salmo salar* - Atlantic salmon	3.00 km
Kirkcowan Flow	SAC & SSSI	Biological: Bogs: Blanket Bog Depressions on peat substrates of the *Rhynchosporion*	3.06 km
Feoch Meadows	SSSI	Biological: Fens: Fen meadow; Biological: Lowland grasslands: Lowland neutral grassland	2.80 km
Blood Moss	SSSI	Biological: Bogs: Blanket bog	4.82 km

Table 8.6: Designated sites within 5 km of the proposed Development

59. **Figure 8.1** illustrates the designated sites located within 5 km of the Site which have an ecological (non-ornithological) interest.

60. Glen App and Galloway Moors SPA & SSSI is designated for ornithological interests and therefore discussed in **Chapter 9: Ornithology**.

61. The proposed Development within the peripheral zone of a Biosphere Reserve[4] which is a non-statutory designation that aims to ensure sustainable development. The peripheral zone is referred to as the 'Transition Area' and is detailed within the Biosphere Reserve's website, as an area "*where people live and where sustainable economic and community development is being actively promoted*".

62. All designated sites have been scoped-out of the assessment as explained **in Section 8.3.8.1.1** below.

8.3.1.2 Desk study

63. The results of the desk study are detailed in **Technical Appendices 8.1 to 8.5**.

64. No data was provided by the local record centre[5].

65. Ecological information available in the public domain relating to applications for the following three local windfarm projects was also considered (within 2 km from the proposed Development's application boundary):

- Arecleoch;
- Kilgallioch; and
- Chirmorie.

8.3.1.3 Carbon & Peatland Map 2016

66. The Carbon and Peatland Map 2016[6] was consulted to determine likely peatland classes present in the study area; the map provides an indication of the likely presence of peat at a coarse scale. The Carbon and Peatland map has been developed as '*a high-level planning tool to promote consistency and clarity in the preparation of spatial frameworks by planning authorities*'[7]. It identifies areas of '*nationally important carbon-rich soils, deep peat and priority peatland habitat*' as 'Class 1' and 'Class 2' peatlands. Class 1 peatlands are also '*likely to be of high conservation value*' and Class 2 '*of potentially high conservation value and restoration potential*'.

67. The Carbon and Peatland Map identifies areas of Class 1 and 2 peatland out-with the proposed Development to the north, south and east on **Figure 10.6.1 (Technical Appendix 10.6)**.

68. As the Carbon and Peatland Map is a high-level tool, detailed habitat and peat depth surveys (**Technical Appendices 10.6 and 10.7**) have also been carried out across the study area to establish the extent and quality of the peatland (Paragraph 105).

8.3.1.4 Otter

69. Otters are known to occur in the wider area and are likely to be present along all main watercourses in the surrounding of the Site. Data available from other windfarms within 2 km of the Site also confirm presence of otter. Windfarms where otter presence was recorded within 2 km include Arecleoch, Kilgallioch and Chirmorie.

8.3.1.5 Water vole

70. Water voles have frequently been recorded and data from surrounding windfarms indicate that there is a large population present in this area of Scotland, Windfarms within 2 km where water vole activity was recorded include Arecleoch, Kilgallioch and Chirmorie.

8.3.1.6 Badger

Badgers are known to occur within the wider area. Although data recorded for surrounding windfarm developments did not contain records of badger setts, there is a possibility that these records were not accessible due to data confidentiality. Generally good habitat suitability for badger was noted for most windfarm developments within the surrounding area.

8.3.1.7 Pine marten

71. A population of pine marten is known to be present within the Galloway Forest Park (Croose et al., 2013), located approximately 12 km east of the study area. No survey data on this species was available from the desk study on data from surrounding windfarms.

8.3.1.8 Red squirrel

72. Red squirrel is known to be present within the wider area of the Site. Guidance produced by the Forestry Commission states that forestry with dominant Sitka spruce (*Picea sitchensis*) has a low potential carrying capacity with an estimated 0.00 to 0.11 squirrels per hectare (Gurnell et al., 2009). The Fleet Basin in the Galloway Forest Park, approximately 23 km east of the Site, has been proposed as a red squirrel stronghold against grey squirrels, and Glentrool within the Galloway Forest Park, located approximately 14.5 km east of the Site had formerly been noted as a Red Squirrel Priority Woodland (Poulsom et al., 2005). Red squirrel were recorded at very low densities at Arecleoch windfarm with estimated densities from feeding transects of 0.002 squirrels per hectare. Killgallioch windfarm's ecology chapter (ScottishPower Renewables, 2010) reports similar densities of 0.0026 squirrels per ha estimated from Drey surveys.

8.3.1.9 Reptiles

73. Adder and common lizard are known to occur on the wider area. Windfarm data from within 2 km of the proposed Development note suitable habitat present, with adder and common lizard records also present.

8.3.1.10 Amphibians

74. Great crested newt: According to O'Brian et al. (2017), the Site is in category C of the suitability, therefore categorised as unsuitable for this species. No great crested newt records were found in the data available for windfarms within 2 km of the proposed Development area during the desk study. Habitat information noted no suitable habitat for great crested newt within any of the windfarms for which information was available. The Environmental Statement for the neighbouring Kilgallioch Windfarm (ScottishPower Renewables, 2010) to the south of the proposed Development states that lochs and lochans in the study area of this windfarm are "*highly unlikely to support protected amphibians, as such species are not normally associated with upland acid mire habitats and acid waterbodies*". This includes the group of lochs around Loch Martle to the south of the access route for the proposed Development and applies to the lochs and lochans within 500 m of the developable area of the proposed Site. Drumlamford Loch to the south of the access route is a fisheries loch and therefore considered unsuitable for newts. Records of common frog and common toad were found during the desk study and these species are known to occur in the wider area.

8.3.1.11 Terrestrial invertebrates

75. No data on noteworthy terrestrial invertebrates were found during the desk study.

8.3.1.12 Bats

76. The Site was assessed as a medium risk site in 2015 with spatial and temporal surveys carried out as per recommended guidance (Hundt, 2012).

77. Survey effort was based on the site assessment methodology from 2015; a site assessment was undertaken post-data collection to Inform the assessment strategy. When using the new assessment table (SNH et al., 2019) the study area is also assessed to be a medium risk site due to the following factors:

- the proposed Development is medium-sized (>10 turbines), with relatively large turbines (75 m blade length), and has other windfarm projects within 5 km;
- geographical location – the Site is located within the known range of high collision risk species (Leisler's / *Nyctalus* spp. and Pipistrellus spp.);
- there is negligible roosting suitability within the 200 m plus rotor radius of turbines with the Site dominated by closed conifer planation which is considered suboptimal for a bat roost;
- during operation there would be medium foraging and commuting suitability within 200 m plus rotor radius of turbines, based on the assumption that clear-felling would occur in stages, and turbines would be key-holed and connected by 5 m wide access tracks; and
- the Site is connected to the wider landscape by some limited linear features of moderate suitability (some watercourses).

78. Data available from windfarm sites within 2 km of the Site shows presence of common pipistrelle, soprano pipistrelle, Leisler's bat, noctule, brown long-eared bat, Natterer's and Daubenton's bat. Further species belonging to the groups *Pipistrellus* and *Myotis* were noted to possibly be present within the wider area.

[4] http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/
[5] A data record request was made, but not processed by the record centre in time for the writing (e-mail from SWSEIC from 17 April 2019).
[6] https://soils.environment.gov.scot/maps/thematic-maps/carbon-and-peatland-2016-map/
[7] https://www.nature.scot/professional-advice/planning-and-development/general-advice-planners-and-developers/planning-and-development-soils/carbon-and-peatland-2016-map

8.3.1.13 Fish

79. Atlantic salmon, brown trout and eels were recorded within the wider surrounding of the Site (data from windfarm developments within 2 km of the Site). The potential of Lamprey being present was recorded at Chirmorie, only.

8.3.1.14 Deer

80. Current population estimates for the wider area (Western Galloway) are at approximately 7 deer per km^2 (roe and red deer with low numbers of fallow deer potentially present). The estimates are based on the Deer Population Assessment report (Strath Caulaidh Ltd, 2015), and taking into account the current forest structure and the last three years of deer culls[8]. Deer management within the area of the proposed Development would continue throughout the construction and operation phases.

8.3.2 Field surveys

81. Details regarding the field survey methodologies and results are included within **Technical Appendices 8.1 to 8.5**. The following section summarises the baseline conditions as identified during these surveys.

8.3.2.1 Habitat surveys

82. NVC surveys were undertaken within the habitats study area in 2015 and 2018. Surveys followed the NVC scheme (Rodwell et al 1991-2000) using standard methods (Rodwell, 2006). Surveys were undertaken within the study area as detailed within **Technical Appendix 8.1** and illustrated in **Figure8.3a-i**.

83. The NVC study area for the proposed Development covered approximately 2503.46 ha (**Technical Appendix 8.1, Figure 8.3a-i**) and in places is within or out-with the application boundary as a consequence of the requirement to ensure sufficient buffer areas were surveyed to account for the presence of potential GWDTEs, in line with SEPA guidance (SEPA, 2017b), and to account for earlier larger layout iterations of the proposed Development.

8.3.2.1.1 Phase I

84. The NVC data was also cross-referenced to the Phase 1 Habitat Survey Classification (JNCC, 2010) to allow a broader characterisation of habitats (**Figures 8.2a-e**). The extent of Phase 1 habitat types was calculated using the correlation of specific NVC communities to their respective Phase 1 types (see **Table 8.7** and **Technical Appendix 8.1** for details), and their extents were determined within GIS; including within mosaic areas. The results of this analysis are summarised in order of Phase 1 type in **Table 8.7**; **Figure 8.2a-e** displays the Phase 1 survey results. The Phase 1 shading in **Figure 8.2a-e** has been used to broadly characterise stands of vegetation based on the dominant NVC community within a particular area.

85. **Table 8.7** summarises the Phase 1 habitats recorded within the habitats study area in order of extent (as per **Figure 8.2a-e**).

Phase 1 habitat code	Phase 1 habitat description	Corresponding NVC types & other habitats recorded9	Extent in study area (ha)	% of study area
A1.2.2	Coniferous Plantation Woodland	CP, YCP	1593.85	63.67
A4.2	Recently Felled Coniferous Woodland	CF, CF>BG, CF>CP, CF>Ja, CF>Je, CF>M19, CF>M20, CF>M23, CF>M23a, CF>M23b, CF>M25, CF>M25a, CF>M25b, CF>M6, CF>M6c, CF>MG10a, CF>MG9, CF>OV27, CF>RG, CF>U2, CF>U20, CF>U4, CF>W11, CF>W4	479.63	19.16
E1.7	Wet Modified Bog	M17, M19, M20, M25a	183.08	7.31
B5	Marsh/Marshy Grassland	DG>Je, Ja, Je, M23, M25b, M27, M28, MG10	68.36	2.73
J4	Bare Ground	BG	43.54	1.74
E2.1	Acid/Neutral Flush	M4, M6	34.98	1.40
B2.1	Unimproved Neutral Grassland	MG1, MG9	20.06	0.80
B1.1	Unimproved Acid Grassland	U2, U4	19.17	0.77
C1.1	Continuous Bracken	U20	17.55	0.70
NSA	No Surveyor Access	NSA	16.31	0.65
A1.1.1	Broad-Leaved Semi-Natural Woodland	W11, W4, W7	13.35	0.53
J3.6	Building	BD	3.10	0.12
D2	Wet Dwarf Shrub Heath	M15	3.03	0.12
A1.1.2	Broad-Leaved Plantation Woodland	BP	2.46	0.10
D1.1	Acid Dry Dwarf Shrub Heath	H10, H12, H9	1.75	0.07
A2.1	Dense/Continuous Scrub	W21, W23	0.84	0.03
A3.1	Scattered Broad-Leaved Tree	ST	0.82	0.03
C3.1	Other Tall Herb & Fern: Tall Ruderal	OV27	0.80	0.03
G1	Standing Water	SW	0.57	0.02
F1	Swamp	S12, S28	0.21	0.01
G1.4	Standing Water: Dystrophic	M2, M3	0.02	0.0008
		TOTAL	**2503.46**	**100**

Table 8.7: Phase 1 habitat types within the study area

8.3.2.1.2 NVC

86. The NVC communities and non-NVC habitat types recorded within the study area are provided in **Table 8.8** and include the proportions of particular community or habitat types that are found within the study area, including proportions within mosaic habitats. Full descriptions of the habitats, NVC communities, non-NVC communities and associated flora of the study area are provided in **Technical Appendix 8.1**.

87. The NVC surveys undertaken in 2015 and 2018 resulted in 29 recognised NVC communities (and associated sub-communities) being recorded within the study area around the proposed Development. A number of non-NVC habitat types are also present, in particular coniferous plantation (CP) woodland and associated clear-felled (CF) areas. Only a small number of communities account for the majority of the study area, as per **Tables 8.7 and 8.8**.

NVC community code and name		Study area extent (ha)	% of study area	Potential groundwater dependency	Annex I habitat type	SBL priority habitat
Mires and flushes						
M2a	*Sphagnum cuspidatum / fallax* bog pool community	0.002	0.0001	-	-	-

[8] Pers. Comment Forest Liaison Officer FES 24/12/2018

[9] See **Technical Appendix 8.1** for full code and associated habitat descriptions.

NVC community code and name		Study area extent (ha)	% of study area	Potential groundwater dependency	Annex I habitat type	SBL priority habitat
M3	*Eriophorum angustifolium* bog pool community	0.02	0.001	-	-	-
M4	*Carex rostrata - Sphagnum fallax* mire	0.39	0.02	-	7140 Transition mires and quaking bogs	Upland flushes, fens and swamps
M6, M6c, M6d	*Carex echinata - Sphagnum fallax / denticulatum* mire	34.59	1.38	High	-	Upland flushes, fens and swamps
M17, M17a	*Trichophorum germanicum – Eriophorum vaginatum* blanket mire	1.79	0.07	-	7130 Blanket bogs	Blanket bog
M19, M19a	*Calluna vulgaris – Eriophorum vaginatum* blanket mire	6.39	0.26	-	7130 Blanket bogs	Blanket bog
M20	*Eriophorum vaginatum* blanket mire	2.57	0.10	-	7130 Blanket bogs	Blanket bog
M23, M23a, M23b	*Juncus effusus/acutiflorus – Galium palustre* rush pasture	44.78	1.79	High	-	Upland flushes, fens and swamps
M25, M25a, M25b	*Molinia caerulea – Potentilla erecta* mire	178.40	7.13	Moderate	7130 Blanket bogs (where peat is greater	Blanket bog (where peat is greater than 0.5 m deep)-
M27	*Filipendula ulmaria – Angelica sylvestris* mire	0.08	0.003	Moderate	-	Upland flushes, fens and swamps
M28	*Iris pseudacorus – Filipendula ulmaria* mire	0.002	0.0001	Moderate	-	Upland flushes, fens and swamps
Woodland and scrub						
W4, W4b	*Betula pubescens – Molinia caerulea* woodland	3.69	0.08	High	-	Wet woodland
W7	*Alnus glutinosa – Fraxinus excelsior – Lysimachia nemoreum* woodland	1.72	0.07	High	-	Wet woodland
W11	*Quercus petraea – Betula pubescens – Oxalis acetosella* woodland	7.93	0.32	-	-	-
W21	*Crataegus monogyna – Hedera helix* scrub	0.08	0.003	-	-	-
W23	*Ulex europaeus – Rubus fruticosus* scrub	0.76	0.03	-	-	-
Wet heath						
M15	*Trichophorum germanicum – Erica tetralix* wet heath	2.17	0.09	Moderate	4010 Northern Atlantic wet heaths with	Moderate
Dry heath						
H9, H9c	*Calluna vulgaris – Deschampsia flexuosa* heath	0.04	0.002	-	4030 European dry heaths	Upland heathland
H10	*Calluna vulgaris - Erica cinerea* heath	0.38	0.02	-	4030 European dry heaths	Upland heathland
H12, H12a	*Calluna vulgaris – Vaccinium myrtillus* heath	1.32	0.05	-	4030 European dry heaths	Upland heathland
Calcifugous grasslands						
U2, U2b	*Deschampsia flexuosa* grassland	1.34	0.05	-	-	-
U4, U4a, U4b, U4d	*Festuca ovina – Agrostis capillaris – Galium saxatile* grassland	17.84	0.71	-	-	-
U20, U20a, U20c	*Pteridium aquilinum – Galium saxatile* community	17.55	0.70	-	-	-
Mesotrophic grasslands						
MG1	*Arrhenatherum elatius* grassland	12.75	0.51	-	-	-
MG9, MG9a	*Holcus lanatus – Deschampsia cespitosa* grassland	7.32	0.29	Moderate	-	-
MG10, MG10a	*Holcus lanatus – Juncus effusus* rush pasture	11.29	0.45	Moderate	-	-
Swamps and tall-herb fens						
S12, S12a	*Typha latifolia* swamp	0.04	6.88	-	-	-

NVC community code and name		Study area extent (ha)	% of study area	Potential groundwater dependency	Annex I habitat type	SBL priority habitat
S28	*Phalaris arundinacea tall-herb* fen	0.17	0.01	-	-	-
Vegetation of open habitats						
OV27	*Chamerion angustifolium* community	0.8	0.03	-	-	-

Table 8.8: Summary of NVC communities recorded within the study area

8.3.2.1.3 Habitat descriptions

88. A brief description of the main Phase 1 habitats and associated NVC types recorded within the NVC study area, generally in order of abundance, is presented below (full descriptions are provided in **Technical Appendix 8.1; see also Figures 8.2a-e** & **8.3a-i**). In the following paragraphs where reference is made to NVC community or non-NVC habitat codes, the full community name can be cross-referred to **Table 8.8**.

89. **Plantation Woodland**: There are a number of plantation woodland communities present within the NVC study area. Conifer plantation makes up the vast majority of the study area (63.67 %), mainly *Picea sitchensis* plantation. The plantation areas (CP, YCP, BP) were unremarkable in terms of their flora and species composition. In more mature plantations there is often no ground flora except some scattered mosses, bare ground and spruce needles due to the density of trees and the shading effects of maturing trees. Throughout the study area the open habitats sometimes contain a few scattered or isolated trees (ST), but not in enough abundance or extent to constitute woodland, these are usually small invading conifers from nearby plantation or scattered scrubby *Salix* spp. In other instances, some small areas of formerly felled plantation contained abundant small naturally self-seeded and regenerating *Picea sitchensis* (RG); e.g. within keyhole areas for Arecleoch Windfarm turbines in the west of the study area.

90. **Felled Plantation Woodland**: Recently felled coniferous woodland makes up the second largest area within the NVC study area (19.16 %). Active harvesting was ongoing during the survey periods. Consequently, the proportions of standing planation and clear-fell are in constant flux; habitat mapping undertaken indicates respective extents at the time of survey. Many areas of clear-fell, due to the short time since felling contain little other than stumps, brash, broken or disturbed ground and sometimes isolated patches of mosses such as *Plagiothecium undulatum*. However, some areas that have been clear-felled for longer periods and not yet re-planted are now re-vegetating with secondary semi-natural vegetation through the remnant stumps and brash. The majority of re-vegetating clear-fell areas are denoted by the '>' symbol within **Figure 8.3a-i**. This also indicates the closest-fit NVC community to which the clear-felled area now appears to be developing towards, e.g. 'CF > M19' indicates that mire vegetation resembling the M19 community is recolonising the clear-fell area. Throughout the NVC study area sections of clear-fell appear in transition to a number of different communities, the most common being M6, M19, M20, M23, M25, MG9, MG10, OV27, U2, U4, U20, Ja, Je and RG. In a few areas young broadleaved trees are invading and in time fragments of W4 and W11 communities would likely develop in the future.

91. **Wet Modified Bog**: Wet modified is the third most common habitat type, and the most common open habitat type, within the study area; covering 183.08 ha and 7.31 % of the study area (**Table 8.7**). Wet modified bog is primarily made up of extensive areas of the M25 (Molina bog) NVC community (**Table 8.8**). M25 forms the major component of most forest rides and is also extensive within the larger open areas of the study area, these areas characteristically being dominated by a dense sward of the dominant purple moor-grass (*Molinia caerulea*). The extensiveness of M25 is likely due to the effects of commercial forestry plantation of the study area. The majority of M25 stands align to the M25a *Erica tetralix* sub-community and indicates the area may have previously been blanket bog, degraded remnants and fragments of which still exist within the study area and form mosaics and transitional zones with this M25 community. These degraded remnant patches of blanket bog, which are also classified here as wet modified bog, are present in much smaller parts of the study area and consist of NVC communities M17, M19, and M20 in small extents (**Table 8.8**). These areas, albeit impacted by forestry, generally represent the better examples of blanket mire vegetation within the NVC study area and contain little purple moor-grass. Instead the vegetation in these areas is characterised by more typical blanket bog species and includes heather *Calluna vulgaris*, deer grass *Trichophorum germanicum*, hares-tail cottongrass *Eriophorum vaginatum*, common cottongrass *Eriophorum angustifolium*, bog asphodel *Narthecium ossifragum*, bilberry *Vaccinium myrtillus*, cross-leaved heath *Erica tetralix* and common *Sphagnum* mosses amongst others (full descriptions within **Technical Appendix 8.1**).

92. **Marsh/Marshy Grassland**: This habitat type covers 68.36 ha and 2.73 % of the study area and is made up of NVC communities M23, M25b, M27, M28, MG10, and the non-NVC habitat types Ja, Je and DG>Je; the respective proportions of each community type are detailed within **Table 8.8**. M23 is the most common of these within the study area and notable expanses of the community are often present in watercourse floodplains, as well as abundant smaller patches in mosaics with and throughout a variety of other habitats where soil moisture conditions are favourable, often in close association with mire. Both sub communities, M23a *Juncus acutiflorus* sub-community and M23b *Juncus effusus* sub-community are present; however, M23a is the most common. Few areas of the M25b *Anthoxanthum odoratum* sub-community were recorded. M27 was recorded in only two locations, both stands being within the very north west of the study area, within mosaics with the rush dominated M23. A single small patch of M28 type habitat was recorded in the very western end of the study area by Knockreach. MG10, mostly being recorded as the MG10a typical sub-community, is also relatively widespread throughout the open parts of the study area. It is found in variety of locations such as damp grasslands, wet hollows, following the edges of drainage channels and roadside verges and in mosaics with various other grassland and mire communities. The sward is typically species-poor and very heavily dominated by a thick growth of soft rush *Juncus effuses.* Both the Je and Ja communities are found within the study area, however Je is by far the more prevalent of the two. These communities were found to be more common within the central and south eastern half of the study area.

93. **Bare Ground**: Areas of bare ground (BG) were lacking vegetation within the study area, these areas generally relate to areas of existing tracks, hardstandings etc. 1.74 % of the study area (43.54 ha) consisted of bare ground.

94. **Acid/Neutral Flush**: Acid and neutral flush habitats make up 34.98 ha and 1.4 % of the NVC study area (**Table 8.7**) and consist of NVC communities M4 and M6. M4 is infrequent within the study area (**Table 8.8**), where it does appear often marking the passage and localised ponding of surface water in depressions; it is often in mosaics with other similar communities. M4 within the study area is typically dominated by *Carex rostrata* (exclusively so in some stands) over a carpet of the mosses *Sphagnum fallax* with lesser amounts of *Sphagnum palustre* and *Polytrichum commune.* M6 is by far the most common flush community type within the study area, in all cases it is dominated by common rush species over a dense carpet of the mosses *Sphagnum fallax* and *Polytrichum commune*; other associate species are sparse in the sward. In the study area the M6d *Juncus acutiflorus* sub-community is the most prevalent (**Table 8.8**). These areas of M6 are commonly found in small runnels and channels through areas of mire (particularly M25) and flanking and in the floodplains of small watercourses within the study area.

95. All other habitat types present make up a very small proportion of the study area, covering less than 1 % (**Table 8.7**) and none are of more than local nature conservation value (**Table 8.2**). Given their limited extents, details of these habitat types can be found within **Technical Appendix 8.1**.

8.3.2.1.4 Annex I habitats

96. Certain NVC communities can also correlate to various Annex I habitat types listed under the Habitats Directive[10]. However, the fact that an NVC community can be attributed to an Annex I habitat type does not necessarily mean all instances of that NVC community constitute Annex I habitat. Its status can depend on various factors such as quality, extent, species assemblages, geographical setting, and substrates.

97. NVC survey data and field observations have been compared to JNCC Annex I habitat listings and descriptions[11]. Those habitats within the study area which could be considered Annex I habitats are also summarised in **Table 8.8**.

98. The extents and often relatively low quality and degraded nature of these potential Annex I habitats within the study area means none are considered of more than local nature conservation value (**Table 8.3 and Table 8.2**). Full details and discussion of Annex I habitat types present with the NVC study area are provided within **Technical Appendix 8.1**.

[10] As defined by the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora – the 'Habitats Directive'

[11] JNCC (2016). Annex I habitats and Annex II species occurring in the UK. URL: http://jncc.defra.gov.uk/page-1523 [21/11/2018].

8.3.2.1.5 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

99. The NVC results were also referenced against SEPA guidance (2017a, 2017b) to identify those habitats which may be classified, depending on the hydrogeological setting, as being potentially groundwater dependent (GWDTE). Potential GWDTE NVC communities recorded within the study area are summarised in **Table 8.8** and are shown in **Figure 8.4a-i**.

100. Within **Figure 8.4a-i** the potential GWDTE sensitivity of each polygon containing a potential GWDTE community was classified on a four-tier approach as follows:

- 'Highly – dominant' where potential high GWDTE(s) dominate the polygon;
- 'Highly – sub-dominant' where potential high GWDTE(s) make up a sub-dominant percentage cover of the polygon;
- 'Moderately – dominant' where potential moderate GWDTE(s) dominate the polygon and no potential high GWDTEs are present; and
- 'Moderately – sub-dominant' where potential moderate GWDTE(s) make up a sub-dominant percentage cover of the polygon and no high GWDTEs are present.

101. Where a potential high GWDTE exists in a polygon, it outranks any potential moderate GWDTE communities within that same polygon.

102. GWDTE sensitivity has been assigned here solely on the SEPA guidance. However, depending on several factors such as geology, superficial geology, presence of peat and topography, many of the potential GWDTE communities recorded may in fact be only partially groundwater fed or not dependent on groundwater. Further information on groundwater dependency is provided within **Chapter 10: Hydrology, Hydrogeology, Geology and Soils**.

8.3.2.1.6 Scottish Biodiversity List Priority Habitats

103. The Scottish Biodiversity List (SBL)[12] is a list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. The SBL identifies habitats which are the highest priority for biodiversity conservation in Scotland. Some of these priority habitats are quite broad and can correlate to many NVC types.

104. Relevant SBL priority habitat types and corresponding associated NVC types recorded within the study area are also summarised in **Table 8.8** and in **Technical Appendix 8.1**. These SBL priority habitats also correlate with UK Biodiversity Action Plan (BAP) Priority Habitats[13].

8.3.2.2 Peatland

105. High resolution peat depth surveys and blanket mire condition surveys have been undertaken within the Site and are reported on within **Technical Appendix 10.6 and 10.7, Figures 10.6.1 to 10.6.17 and 10.7.1 to 10.7.3** within these appendices. In total, data from 1804 peat depth sample locations were utilised to inform a detailed peat interpolation **(Figure 10.7.2 & 10.7.3)**. A 2 m squared quadrat was also taken at each Phase 1 peat survey sample point, providing 882 samples to inform blanket mire condition.

106. The peat depth surveys and associated interpolation show that the middle and southern parts of the Site contain greater depth and distribution of peat than the most northerly section. The northerly section has islands of peat (commonly up to around 3-4 m depth) however there is generally less peatland habitat in this area (**Technical Appendix 10.6, Figures 10.6.1 and 10.6.2**).

107. The blanket mire condition assessment illustrates clearly that the commercial plantation has caused substantial damage to the peatland habitat through canopy closure, drainage and drying effects. For example, **Figure 10.6.8** shows high abundance and widely distributed non-sphagnum mosses – an indicator of drying; **Figure 10.6.16** shows high abundance and extensive distribution of bare ground and needles – indicating inactive/moribund peatland; **Figure 10.6.17** shows the extensive drainage network. However, whilst the peatland at the Site is generally highly damaged, some small fragments of active peatland persist within forest rides and glades. These are indicated by the presence of Sphagnum spp (**Figure 10.6.6**), *Eriophorum vaginatum* (**Figure 10.6.12**) with the higher quality areas indicated by the presence of the broad branched Sphagnum species *Sphagnum papillosum* in discreet areas within the middle and southern sections of the Site (**Figure 10.6.7**).

8.3.2.3 Protected species

108. Full details pertaining to the survey methods employed and the legal status of each species below are included within **Technical Appendix 8.2 A & B and Figures 8.5a-d and 8.C1a-c**.

8.3.2.3.1 Otter

109. All accessible watercourses within the study area were surveyed for otter field signs. Otter field signs and survey methods are described in Bang & Dahlstrøm (2001), Sargent & Morris (2003) and Chanin (2003).

110. Evidence of otter was recorded during the 2015 survey, with spraints recorded in eight locations. No protected features were recorded.

111. The 2017 surveys found similar levels of otter activity to that recorded in 2015. Spraints were recorded at 15 different locations during the June survey, whilst two spraint records were recorded during the September survey. The spraints varied in age, from fresh to old and weathered. A potential resting site was also recorded close to a watercourse under a tree root plate.

112. The 2019 access track surveys recorded evidence of otter, with spraints recorded at 13 locations. There was a higher level of otter activity recorded around the area of Pullower Burn and Loch Long, including several well used paths linking the waterbodies, which are likely to be used by otter given the field signs recorded within their vicinity. No protected features for otter were recorded during the surveys.

113. The Water of Tig is likely to provide good foraging opportunities for otter, given its suitability for supporting fish and other prey species such as amphibians. The watercourse also offers commuting opportunities for otter and is likely to be used as commuting link between the study area and the other watercourses within the wider vicinity of the Site. The watercourses are located within habitat which offers suitable sheltering opportunities for otter, such as from upturned tree root plates, fallen tree and branch debris and suitable bankside vegetation. Along the access track route, the River Cree to the east offers good habitat for supporting otter, likely providing good foraging opportunities. It is likely that many of the watercourses which drain or feed the Long Loch, Black Loch, Cow Loch and Craigie Loch, act as links between these habitats and are used by otters for foraging, commuting and sheltering opportunities.

8.3.2.3.2 Water vole

114. All watercourses within the study area were surveyed for water vole field signs following the methodology prescribed in Dean et al. (2016).

115. There was no evidence of water vole recorded within the study area in 2015, although the good suitability of the habitat along the watercourses was noted as having potential to support the species.

116. A water vole colony was recorded within the study area during the June 2017 survey, along a tributary to the Cross Water. The colony consisted of at least nine burrows and a total of six latrines were recorded. A water vole was also seen to jump into the watercourse. The surrounding habitat, which consisted of dense rush vegetation, made it difficult to fully determine the total number of burrows within the colony and it is possible that there were more present than were recorded. The colony is located within a stretch of habitat that contains historic clear-fell but offers good water vole habitat given the slow water flow, suitable bank substrate and vegetation.

117. The second survey visit in September 2017 recorded two potential water vole burrows further north along a tributary to Cross Water, although no further evidence for water vole were recorded within the vicinity. Several water vole droppings were recorded further downstream of the water vole colony recorded in June, although no burrows were recorded in this area.

118. There was no evidence of water vole in the 2019 survey along the proposed access route, although the high suitability of the habitat for supporting water vole in this area was noted. As mentioned in **Section 8.2.8.5**, the surveys were not conducted within the recommended survey period for water vole, and it is possible that there were no field signs present at this time due to the timing of the survey, rather than the absence of the species. Given the suitability of the habitat, and the knowledge of water vole presence within the study area, there is the potential for water voles to utilise the suitable habitats within the Site,

[12] Scottish Government (2013). Scottish Biodiversity List. URL: http://www.gov.scot/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL [21/11/2018]

[13] JNCC (2016). UK BAP priority habitats. URL: http://jncc.defra.gov.uk/page-5718 [21/11/2018]

as discussed below. The watercourses within the study area offer suitability for water vole in areas with slow flowing sections and soft, peaty banks offer good burrowing opportunities. The terrestrial vegetation also offers suitable foraging habitat.

8.3.2.3.3 Badger

119. Land with the potential to support badger within the study area was searched for field signs with particular attention given to areas around woodland and areas underlain by mineral soils. Field signs of badger are described in Neal and Cheeseman (1996), Bang and Dahlstrøm (2001), and Scottish Natural Heritage (2001).

120. No evidence of badger was recorded during the 2015 survey visit. The presence of suitable habitat with the potential to support badgers within the study area was noted.

121. During the June 2017 survey, badger footprints were recorded along a mud track to the north of the study area. No other field signs of badger or protected features (i.e. setts or day nests) were recorded.

122. The areas of farmland that are present adjacent to the north and east of the study area provide good habitat for sett building given the suitability of the substrate. The coniferous forestry plantation within the north of the study area offers suitability for sett building, although no setts were recorded. It is possible that badgers will use the study area for foraging and commuting.

123. The surveys in 2019 recorded badger activity along the proposed access track route. This data has been added to **confidential Annex** of **Technical Appendix 8.2A (Figure 8.C1a-c)**, given its sensitivity.

8.3.2.3.4 Pine marten

124. Signs of pine marten were searched for within the study area following guidance from O'Mahony *et al*. (2006).

125. Evidence of pine marten was recorded within the study area during the 2015 survey, in the form of potential scats and an incidental sighting of a pine marten crossing the track during a bat survey.

126. There was similar evidence of pine marten using the study area during the 2017 surveys. Two potential pine marten scats were recorded during the survey in June. An unconfirmed pine marten call was recorded in two locations during the June survey. Pine marten are known to make a shrill call during their mating season, and the timing of the survey coincided with this period. No dens were recorded during the survey.

127. There was no evidence of pine marten recorded during the 2019 surveys of the proposed access route, however pine marten were recorded on Site and confirmed present by camera during landowner surveys in 2019.

128. The study area offers good suitability for pine marten given the mixed age of coniferous forestry and the presence of features which offer suitable denning opportunities. Given the evidence of pine marten recorded during the surveys, it is likely that the Site falls within the home range of a pine marten.

8.3.2.3.5 Red squirrel

129. Areas of woodland that have the potential to support red squirrel were surveyed for squirrels, following guidance from Gurnell *et al*. (2009).

130. Feeding signs of squirrel, in the form of predated cone cores, were recorded during the 2015 surveys, although it was not possible to determine if these were from red or grey squirrel. No protected features were recorded during the survey.

131. During the 2017 survey, feeding signs of squirrel were also recorded, in the form of predated cone cores found in two locations. It is not possible to determine species of squirrel, red or grey, from these field signs alone.

132. An incidental observation of a red squirrel was made during an ornithology survey within the study area. The sighting confirms that red squirrel is using the habitats within the study area.

8.3.2.3.6 Reptiles

133. There were two sightings of common lizard during the survey in June 2017. The study area offers good suitability for supporting basking and hibernating reptiles, including adder.

8.3.2.3.7 Amphibians

134. There were several records of common frog (*Rana temporaria*) and common toad (*Bufo bufo*) recorded during the surveys.

8.3.2.3.8 Bats – roost surveys

135. A daytime inspection of the study area was carried out in 2015. In accordance within BCT Guidelines (Hundt, 2012) structures such as building, bridge, trees etc. within 200 m of a turbine or adjacent to proposed access tracks were surveyed for potential roost features and recorded as target notes. There are three small railway buildings present within the study area along the railway line (Target note 1 to 3, **Figure 8.8**)); however these buildings are more than 200 m from proposed turbines and more than 150 m from any other infrastructure.

136. No other potentials roost features were recorded within the study area.

8.3.2.3.9 Bats – spatial survey - point counts 2015

137. Detailed results are provided in **Technical Appendix 8.3 A & B** and **Figures 8.6 to 8.9**). A summary of key results is provided below.

138. In total three bat species were recorded during the spatial survey point counts: soprano pipistrelle (*Pipistrellus pygmaeus*), common pipistrelle (*Pipistrellus pipistrellus*), brown-long eared (*Plecotus auritus*) and three genus groups *Myotis* spp., *Nyctalus* sp. and Pipistrelle spp. (*Pipistrellus* spp.). *Pipistrelle* spp. calls were either soprano or common pipistrelle.

139. A total of 819 bat registrations equating to a BAI per hour of 25.7 (brph) was recorded for the study area. The most commonly recorded species by BAI per hour was soprano pipistrelle (16.73 brph), followed by common pipistrelle (4.71 brph), Pipistrelle spp. (2.51 brph), *Nyctalus* spp. (1.26 brph), *Myotis* spp. (0.38 brph), unknown bat species (0.09brph) and brown-long eared bat (0.03 brph).

140. *Nyctalus* spp., which are considered to be high risk species at both the collision and the population level, were recorded during the June, July, August and September surveys. A total of 40 *Nyctalus* registrations were recorded across all survey visits as detailed below:

- May: 0 registrations;
- June: 5 registrations;
- July: 19 registrations;
- August: 15 registrations; and
- September: 1 registration.

141. The earliest registration of Nyctalus spp. was in August, which was recorded 00:33 to 00:39 minutes after dusk. While the majority of the registrations were recorded more than 60 minutes after sunset.

8.3.2.3.10 Bats – temporal surveys (static detectors)

142. Temporal surveys were carried out for the study area in 2015 and in 2017. Detectors used over both years were calibrated Anabat SD2 detectors. Anabat SD2 detectors are automated detectors that record bat calls as zero crossing files which are then viewed on a sonogram/spectrogram to identify bat species. Each detector recorded bats from dusk to dawn with detectors starting 30 minutes before dusk and finishing 30 minutes after dawn.

8.3.2.3.11 Bats – temporal surveys 2015

143. In 2015 a total three bat species were recorded during the temporal surveys: soprano pipistrelle, common pipistrelle and brown-long eared and three genus groups *Myotis* spp., *Nyctalus* spp. and Pipistrelle spp. (*Pipistrellus* spp.). Pipistrelle spp. calls were either soprano or common pipistrelle calls which overlapped and could not be assigned to either species. A total of 9,351 registrations were recorded equating to a BAI of 6.78 brph (**Table 8.9**). The list below details BAI per hour for each species from most to least common:

- Soprano pipistrelle with 5866 registrations and a BAI of 4.26 brph;
- Common pipistrelle with 3288 registrations and a BAI of 2.39 brph;
- *Nyctalus* spp. with 74 registrations and a BAI of 0.05 brph;
- Pipistrelle species with 72 registrations and a BAI of 0.05brph;
- *Myotis* spp. with 40 registrations and a BAI of 0.03 brph; and

- Brown long-eared bat with 8 registrations and a BAI of 0.01 brph.

2015	Species	Bat Activity Index (BAI) [brph]
Total BAI		6.78
Nyctalus spp.	noctule	0.05
	Leisler's	
	Nyctalus spp.	
Pipistrelle spp.	Soprano	4.26
	Common	2.39

Table 8.9: BAI of high-risk bat species 2015

144. The static detector locations (**Figure 8.3B-2a)** that recorded the greatest bat activity index per hour (in order of greatest to least) were:

- location 4 with 4731 registrations and a BAI of 20.63 brph;
- location 3 with 2551 registrations and a BAI of 10.97 brph;
- location 2 with 1697 registrations and a BAI of 6.69 brph;
- location 1 with 203 registrations and a BAI of 0.89 brph;
- location 5 with 93 registrations and a BAI of 0.44 brph; and
- location 6 with 76 registrations and a BAI of 0.34 brph.

145. The bat activity index remained consistently low throughout the survey visits apart from the final visit (visit five) in September to October with an average BAI per hour of 21.79 brph. This was mainly attributed to the bat activity that was recorded at location 4 (forest ride) and location 3 (forest ride) which recorded a BAI per hour of 60.5 brph and 44.7 brph, respectively with 6,625 common and soprano registrations recorded for these locations.

146. The temporal surveys recorded *Nyctalus* species at all sample locations with a total BAI per hour of (0.05 brph; 74 registrations). The location with the greatest *Nyctalus* BAI per hour was location 5 (forest ride close to a burn) which recorded a value of 0.02 brph. Registrations were recorded in sampling periods: June/July, July, August and September/October. Surveys recorded more than 1 bat registration per night (BAI/brpn) from June to July at locations 1 (3 brpn), location 4 (1.8 brpn) and location 5 (1.5 brpn) and in July at location 5 (3.67 brpn).

8.3.2.3.12 Temporal surveys 2017

147. In 2017 thirteen Anabat SD2 detectors were placed at thirteen fixed sample locations. Detectors recorded for the whole month with a minimum of 30 nights recorded in May, July and September totalling 1,260 nights.

148. In total seven bat species were recorded for the study area. A total of 30,669 bat registrations were recorded within the study area throughout the survey period. Species recorded were soprano pipistrelle, common pipistrelle, Leisler's (*Nyctalus leisleri*), noctule (*N. noctula*), brown-long eared bat, Natterer's (*Myotis nattereri*) and Daubenton's (*M. daubentonii*) with a total BAI per hour of 2.27 (brph) (**Table 8.10**). Bat registrations identified to genus level were *Nyctalus* spp. and *Myotis* spp. (MYO).

149. The list below details BAI per hour for each species from most to least common:

- Soprano pipistrelle with 23,203 registrations and a BAI of 1.7 brph;
- Common pipistrelle with 5,201 registrations and a BAI of 0.4 brph;
- Noctule with 937 registrations and a BAI of 0.07 brph;
- Leisler's with 638 registrations and a BAI of 0.05 brph;
- Daubenton's with 195 bat registrations and a BAI of 0.01 brph;
- *Myotis* spp. with 50 bat registrations and a BAI of 0.003 brph;
- *Nyctalus* spp. with 47 bat registrations and a BAI of 0.003 brph;
- Natterers' with 17 registrations and a BAI of 0.001 brph; and

- Brown long-eared bat with 11 registrations and a BAI of 0.001 brph.

2017	Species	Bat Activity Index (BAI) [brph]	
Total BAI		2.27	
Nyctalus spp.	noctule	0.07	0.1
	Leisler's	0.05	
	Nyctalus spp.	0.003	
Pipistrelle spp.	Soprano	1.7	2.1
	Common	0.4	

Table 8.10: BAI of high-risk bat species 2017

150. High risk species (*Nyctalus* species) accounted for 5 % of the registrations recorded while medium risk (pipistrelle species) and low risk species (*Myotis* and *Plecotus* spp.) accounted for 94 % and 1 % of the species recorded onsite, respectively. Pipistrelle species were recorded at all locations across the study area.

151. July recorded a high activity level for medium risk species with a BAI of 11.34 brph recorded at location 1 with 3,291 registrations recorded. During September a moderate activity level with a BAI of 6.35 brph (2,666 registrations) was recorded at location 9 (5,178 registrations) and high activity was recorded at location 13 with a BAI of 12.32 brph (5, 178 registrations)

152. The static detector locations (**Figure 8.6)** that recorded the greatest bat activity index per hour (in order of greatest to least) are shown in Error! Reference source not found.**Table 8.11**.

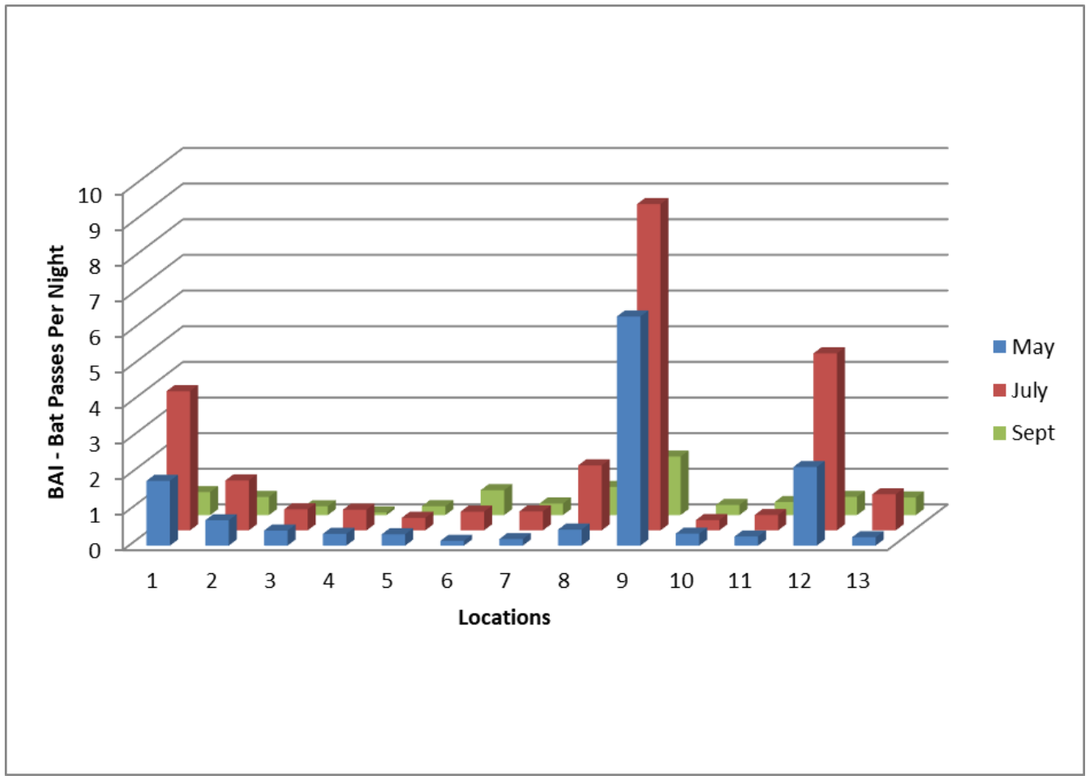
Bat detector location	Bat registrations	BAI [brph]	Distance to nearest turbine location [m]	Nearest turbine location
9	5762	5.43	2006	9
13	5706	5.38	1529	13
1	4303	4.21	1937	2
11	3689	3.48	395	13
4	3184	3	302	6
12	2346	2.21	1150	13
7	1645	1.55	314	1
10	1227	1.16	234	10
5	989	0.93	510	4
8	801	0.87	898	9
3	417	0.39	104	2
2	348	0.36	1133	2
6	216	0.22	323	1

Table 8.11: Bat Activity at detector locations in 2017

153. *Nyctalus* spp. (noctule and Leisler's) were recorded at all locations in May, July and September.

154. The location that recorded the greatest *Nyctalus* spp. activity index per night for the survey period was location 9 with an average of 5.7 brpn followed by location 12 with 2.6 brpn, location 1 with 2.1 brpn and location 8 with 1.0 brpn (all locations except 8 are out-with the application boundary. All other locations recorded less than 1 brpn for the survey period.

155. *Nyctalus* spp. average registrations per month were greater than 1 brpn at location 1 (May 1.8 brpn and July - 3.9 brpn), location 2 (July – 1.4 brpn), location 8 (July – 1.8 brpn), location 9 (May - 6.4 brpn, July 9.2 brpn and Sept - 1.6) and location 12 (May 2.2 brpn). The highest activity recorded was at location 9 in July with 9.21 brpn recorded (**Graph 8.1)**.



Graph 8.1: BAI for Nyctalus species at survey locations

8.3.2.3.13 Summary of temporal surveys 2015 & 2017

156. For high risk species (*Nyctalus* spp) a total number 74 registrations and a BAI per hour of 0.05 were recorded in 2015; while in 2017 a total number of 1622 registrations and a BAI of 0.01 brph were recorded.

157. The overall BAI per hour for medium risk species (common and soprano pipistrelle species) was 6.65 brph[14] in 2015 and 2.1 brph in 2017.

158. Low numbers of Myotis species (Daubenton's and Natterer's) and brown long-eared bats were recorded for the Site in both 2015 and 2017. *Myotis* species and brown long-eared bats are at low risk for collision and also at low risk at the population level (Natural England, 2014).

159. Locations with the highest BAIs in 2017 (9, 13 and 1) are at over 1.5 km distance of turbine locations (**Figure 8.6**).

8.3.2.3.14 Fish

160. Ayrshire Rivers Trust (ART) undertook electrofishing surveys on a number of watercourses within the Duisk Water catchment near Barrhill in South Ayrshire in 2017 (**Technical Appendix 8.5**).

161. The electrofishing surveys carried out were completed following the Scottish Fisheries Coordination Centre's (SFCC) protocols for this technique using SFCC accredited surveyors.

162. Fish populations at each site were assessed using electrofishing. Battery powered backpack equipment was used to carry out each survey. All of the sites surveyed were surveyed fully quantitatively, using 3-run depletion techniques. Upstream and

[14] 7.08 brpn when calls only identified to Pip spp level added.

downstream stop-nets were used to delimit the survey area; the survey sweep began at the downstream end of the section and moved back and forth across the channel so that every part of the bed was covered. Analysis of length-frequency histograms and scale samples enabled fish densities to be separated into fry and parr age classes for the presentation of results, and classified according to the SFCC Scottish national classification scheme (Godfrey, 2005). Fish year classes were defined as follows: salmonid fish less than one year old are recorded as 0+ year class or fry; fish one year or older are recorded as 1+ or parr. If there were sufficient fish present, absolute fish densities were calculated, together with a measure of statistical confidence, otherwise a minimum density estimate was used. Other fish species were also counted and recorded.

163. Nine sites were electro-fished in order to establish the nature of the fish populations relevant to the proposed Development. Electrofishing allowed the two main tributaries located within the application boundary, the Water of Tig and the Cross Water, to be surveyed along with two smaller watercourses the Laggish and Haw Burns also within the application boundary. Details of the electrofishing sites are shown on **Figure 8.10**. Sites on the Duisk Water and Pollgowan Burn are located immediately downstream of the application boundary and the fish species within these areas will also be receptors to any potential impact. A site on the Muck Water was selected as a control site due to the similar ecological and habitat characteristics found in the monitoring sites.

164. Juvenile salmon were present in six out of the nine sites including the control site whilst trout were recorded in all sites. Salmon fry were in the 'excellent' category at the Duisk Water site where 93.3/100 m^2 were recorded and also the lowermost Water of Tig site at Balkissock which produced 50.6/100 m^2. Where salmon parr were recorded, they were mostly in the 'moderate' or 'poor' category.

165. Trout fry densities were variable between sites. Notably, the highest trout fry densities were recorded in the Laggish Burn where they were in the 'excellent' category. Trout parr densities were also variable between sites but the highest densities were recorded in those sites where salmon fry or parr were absent or low.

166. Electrofishing surveys therefore show salmon and trout use this sub-catchment as a juvenile nursery area. Of particular importance are the main Duisk Water and Cross Water where salmon fry densities were excellent. Although juvenile salmon were not recorded in every watercourse, juvenile brown trout were present. This indicates that the habitat and the water quality at these sites is very good.

167. Eels were present in all sites with the exception of the Haw Burn and the upper Water of Tig site. One lamprey spp. was recorded on the Duisk Water site.

168. Habitat observations noted substrates were stable and un-compacted with no high organic matter or excess silt recorded in any of the survey sites. Spawning gravels were clean and the water conductivity had a range of 35-50 μScm^{-1}. It was also noted the water in the Haw Burn had a dark peaty appearance to it.

8.3.3 The 'Do Nothing' scenario

169. In the absence of the proposed Development, it is likely that the ecological receptors would generally remain as they are at present, although numbers and distribution may fluctuate depending on the location and timing of ongoing land management activities (e.g. felling) at specific locations within the Site.

8.3.4 Predicted future baseline

170. Climate change predictions for Scotland could see an increase in temperatures. There may be an increase in winter rainfall and a decrease in summer rainfall. Increases in wind speed are not expected. There is an increased risk of flood, drought, and extreme weather events. (Lowe et al., 2018).

171. None of these projections would give rise to gross changes in precipitation and temperatures, such that might affect species or habitat onsite. Therefore, none of the climate change predictions are considered likely to have a material effect on baseline conditions for ecology.

8.3.5 Future forestry baseline without the windfarm

172. In the absence of the proposed Development, it is likely that the IEFs would generally remain as they are at present (see forest plan summary within **Technical Appendix 3.2, Forestry**), although numbers and distribution of species may fluctuate naturally. Vegetation and habitat composition and extents in the study area may fluctuate marginally in the long-term in line with fluctuating deer densities and forestry management practices.

8.3.6 Information gaps

173. Nyctalus spp. calls are considered together, since it is difficult to distinguish calls from Leisler's and noctule bats with certainty. The BAI considered here is therefore higher for both species together, than it would be when calculated for each species separately, following the precautionary principle.

8.3.7 Design layout considerations

174. As part of the iterative design process for the proposed Development (see **Chapter 2: Site Description and Design Evolution**), ecological constraints identified through baseline survey results were considered in order to prevent or minimise adverse effects on ecological receptors. This involved:

- a minimum 50 m buffer for any infrastructure or construction activity around all watercourses, except where a minimum number of watercourse crossings are required. The layout has sought to minimise the number of watercourse crossings. The application of 50 m buffer would minimise effects on associated habitats and species;
- Natural England Guidance TIN 059 advises that a minimum buffer of 50 m from turbine tip to the top height of the nearest edge feature (in this case, the forestry plantation) should be applied to reduce collision risk to bats. The keyhole area around each turbine is 90m radius (**Technical Appendix 3.2**) and the minimum required buffer is 64 m (based on the assumptions of 125 hub height, 73 m blade length and 20m top height of forestry) – therefore this minimum requirement is more than met at the proposed Development;
- avoidance of deeper peatland (>1 m) for the location of turbines and other infrastructure as far as practicable; and
- the track length and alignment has been designed to reduce the extent of track and number of watercourse crossings required, where feasible.

8.3.8 Summary of sensitive receptors

8.3.8.1 Scoped-out IEFs

175. With consideration of the desk-study and baseline data collected and following the design mitigation and those measures described in the design layout considerations and project assumptions sections, several potential effects on IEFs can be scoped out of further assessment based on the professional judgement of the EIA team and experience from other relevant projects and policy guidance or standards. The following paragraphs detail the ecological receptors and effects scoped out following the completion of surveys.

8.3.8.1.1 Designated sites

176. There are no designated sites present within the Site. Based on the qualifying interests and distance from the Site, all five designated sites within 5 km of the Site are scoped out of the assessment based on a lack of connectivity.

177. The proposed Development is within the peripheral zone of a Biosphere Reserve (non-statutory designation). With sustainable economic and community development being actively promoted within this zone, the Biosphere Reserve has been scoped out of the assessment.

8.3.8.1.2 Habitats

178. **Table 8.13** and **8.14** detail the estimated direct and indirect relative losses expected to occur, by habitat type, for all new infrastructure. A total of 28.84 ha of habitat would be directly lost due to the proposed Development (including worst case mineral extraction area losses), with 14.68 ha (51 %) of this comprising conifer plantation.

179. The majority of the study area is made up of non-NVC habitats such as conifer plantation and recently felled coniferous plantation (**Technical Appendix 8.1 and Figure 8.3a-i**). These habitats are of low conservation value and would not be subject to significant ecological effects by the proposed Development. They are therefore scoped out of the assessment.

180. Marshy grassland, which within the study area is of the Je, M23, M25b, M27, M28 and MG10 NVC types and DG>Je and Ja non-NVC types, is scoped out of the ecology assessment. M23 is a rush dominated habitat generally of low ecological value unless particularly species-rich examples are found. M23 is considered a potentially high GWDTE (SEPA, 2017a; 2017b), however designation as a GWDTE does not infer an intrinsic ecological value, and GWDTE status has not been used as a criteria to determine conservation importance in this ecology assessment. There is however a statutory requirement to consider GWDTEs and the data gathered during the NVC surveys has been used to inform the assessment in **Chapter 10: Hydrology, Hydrogeology, Geology and Soils**. Aside from conifer plantation and wet modified bog, marshy grassland is the most common community type within the study area (**Table 8.7**). It commonly occurs in forest rides and within the larger open

areas of the study area. Approximately 7.86 ha of marshy grassland may be lost (direct and indirect loss) due to infrastructure. M25b was recorded as single stands and commonly in mosaics with (M23, M25, M6). M27 was recorded in only two locations, both stands being within the very north west of the study area. In each case the stands are characteristically dominated by *Filipendula ulmaria.* A single small patch of M28 like habitat was recorded in the very western end of the study area. The MG 10 is widespread throughout the study area, its sward is typically species-poor and very heavily dominated by a thick growth of *J. effusus*. Je and Ja and is of limited botanical interest. Je and Ja non-NVC types are found within the study area, however Je is by far the more prevalent of the two. These communities were found to be more common within the central and south eastern half of the study area. In light of the SEPA classification of potential GWDTEs NVC and non-NVC types (M25b, M27, MG10, Je and Ja) also qualify for potential moderate GWDTE status and the data gathered during the NVC surveys has been used to inform their assessment in **Chapter 10: Hydrology, Hydrogeology, Geology and Soils**.

181. Acid/Neutral Flush (M4, M6) are identified as being of local importance at the Site due to their intrinsic value as being listed as Annex I or SBL habitats (**Table 8.8** and **Technical Appendix 8.1**), however they occupy such small areas within the study area, any direct or indirect effects on the habitat are so minor (see habitat loss calculations in **Table 8.13 and 8.14**) that they are scoped out of the assessment.

182. The following additional habitats are identified are IEFs of local importance at the Site, some due to their intrinsic value as being listed as Annex I or SBL habitats (**Table 8.8** and **Technical Appendix 8.1**), however they occupy such small areas within the study area, they are species-poor examples, or any direct or indirect effects on the habitat so minor that effects on them are scoped out of the assessment: Unimproved (acid and neutral) Grassland,; semi-natural broadleaved woodland, Wet Dwarf Shrub Heath, Acid Dry Dwarf Shrub Heath and swamp.

183. All other habitats of negligible Nature Conservation Importance and sensitivity (e.g. continuous bracken and tall ruderal community) have been scoped out of the assessment.

8.3.8.1.3 Protected species

184. As detailed below, a SPP is proposed ensure that all reasonable precautions are taken to safeguard protected species from disturbance, injury and death and to protect any structure or place, which any such protected species uses for, breeding, resting, shelter or protection during the construction of the proposed Development. A SPP will be agreed with consultees prior to commencement of construction and will comprise the following objectives:

a. Objective A - Implement a monitoring and protection plan for protected species;

b. Objective B – Follow an approved procedure if an active protected species feature is found; and

c. Objective C – Ensure adequate education and awareness of site personnel.

185. Otter is scoped out of this assessment. Otter is known to be present within the local area and otter field signs, including a potential resting site were recorded during surveys in 2015, 207 and 2019. As outlined in **Section 8.3.7 'Design Layout Considerations'**, all infrastructure would be buffered by a minimum of 50 m from watercourses (except for watercourse crossings) and measures would be employed during construction as part of the SPP which would avoid impacts on otter, including pre-construction surveys.

186. Water vole is scoped out of this assessment. Water voles are known to occur in the area and field signs were found during surveys in 2017, including a water vole sighting. As outlined in **Section 8.3.6,** all infrastructure would be buffered by a minimum of 50 m from watercourses (except for watercourse crossings) and measures would be employed during construction as part of the SPP which would avoid impacts on water vole, including pre-construction surveys.

187. Although present within the Site, badger is not identified as an IEF and is therefore scoped out of the assessment. The closest possible badger sett recorded in 2019 was located approximately 43 m away from the proposed access route (which at this point would be already constructed and only require minor works) and over 100 m from borrow pits or turbines. Given the recommended SNH disturbance buffer distances for badger (30 m, or 100 m if blasting/piling), it is considered unlikely that any sett would be affected by the proposed Development if the appropriate buffers are applied. Should any setts be found within the prescribed disturbance-free buffer distances prior to commencement of construction, appropriate mitigation measures would be undertaken in accordance with an agreed SPP to ensure legal compliance and avoid impacts on badgers.

188. Pine marten is scoped out of this assessment. A pine marten was heard within the study area in 2017 and two potential scats were recorded. No pine marten dens were recorded within the study area. Measures would be employed as part of the SPP which would avoid impacts on pine marten, including pre-construction surveys for this species.

189. Red squirrel is scoped out of this assessment. Field signs were found during surveys in the form of a small number of predated cones, but no protected features were recorded during field surveys. Guidance produced by the Forestry Commission states that forestry with dominant Sitka spruce (*Picea sitchensis*) has a low potential carrying capacity with an estimated 0.00 to 0.11 squirrels per hectare (Gurnell et al., 2009). Because the woodland within the Forestry Study Area has a low tree species diversity (95% Sitka spruce and 5% broadleaves (**Figure 7.3, Technical Appendix 3.2, Forestry**)) it is likely that the carrying capacity of the forest is at the lower end of this range as indicated by the desk study results for Arecleoch and Killgallioch windfarms. Sitka spruce tends to start producing cones at around 25 years and cone production can vary considerable between years with large crops (mast crops only being produced between 3-5 years (Broome et al., 2017) with virtually none being produced in between (Petty et al., 1995). Compounding the irregular cone production is the synchronous cone production of Sitka spruce across an area >600 km (Broome et al., 2007). Furthermore, Sitka spruce tends to shed most of the seeds from its cones in the first 4 months after they mature in September (Fletcher, 1992), thus only providing squirrels with a source of food during the autumn. Under the windfarm restocking plan, the area of Sitka spruce will reduce by 90.7 ha while broadleaf woodland would increase by 30.6 ha resulting in a total woodland area reduction of 60.1 ha (1.2 % reduction to the Forestry Study Area). This limited area of forestry reduction represents a negligible loss of habitat which is already sub-optimal for red squirrel. There will also be a small increase in advanced felling (2.6% of the Forest Plan Area) between 2018-2022 followed by decreases in felling over the rest of the plan period (2023-2042). This represents a negligible change to already sub-optimal habitat.

190. Additionally, the SPP would ensure that all reasonably practicable measures are taken to ensure that provisions of the relevant wildlife legislation are complied with in relation to red squirrel and would include pre-felling and pre-construction checks for squirrels and dreys by an ECoW.

191. Reptiles were not identified as IEFs and have been scoped out of the assessment. Common lizard were recorded during the surveys. These are a mobile species which are considered to be capable of avoiding disturbance except during the hibernation period. All structures recorded as potential hibernacula are located at least 100 m from any proposed infrastructure. The recommended disturbance buffer for potential hibernaculum is 30 m (Catherine, 2018), making it unlikely that the proposed Development would cause disturbance to any of these structures. The SPP would ensure appropriate measures are put in place to protect reptiles and any hibernaculum during construction.

192. Great crested newt were not identified as IEFs and is scoped out of the assessment. Based on the results of the desk study, the proposed Development is out with the suitable habitat area for this species (O'Brian et al., 2017). The desk study found assessments for surrounding lochs and lochans confirming these of unsuitable habitat and the overall habitat within the proposed Development makes it highly unlikely that great crested newt is present.

193. Effects on roosting bats are scoped out of the assessment. No buildings or trees with bat roost potential were found present within 200 m of a turbine location or 150 m of any other infrastructure. The SPP would ensure that all reasonable measures are taken to ensure that provisions of the relevant wildlife legislation are complied with in relation to buildings and trees with bat roost potential, including where road widening and creation of passing places is proposed along the access route.

194. Habitat loss effects on foraging/commuting bats during the construction and operational periods are scoped out of the assessment. Due to the generally poor quality of the habitat for bats, the negligible proportion of habitat occupied by turbines and no impact on roost, the displacement of foraging/commuting bats during the construction and operational period is likely to have a negligible impact on local populations.

195. Based on SNH et al. (2019) guidance, brown long-eared bat, Natterer's bat, Daubenton's bat and *Myotis* species in Scotland are considered to be of low population vulnerability to windfarms, relating to their relative abundance and low collision risk. Activity rates of these species recorded during baseline surveys were low. It is therefore considered that these species can be scoped out from the assessment as they are of low sensitivity and of no more than local Nature Conservation Value.

196. Fish were not identified as IEFs and are scoped out the assessment. To avoid direct or indirect impacts on these receptors, a minimum 50 m buffer distance would be kept between turbine locations and watercourses (except at crossing locations). It is also assumed that pollution prevention measures and a Construction Environmental Management Plan (CEMP) would be

implemented during construction and operation of the proposed Development to ensure no adverse impacts occur from pollution, sedimentation etc. In addition to these measures, it is proposed that monitoring be carried out specifically in relation to fish populations. This would be in the form of pre-, during and post-construction monitoring surveys to identify whether there has been any impact on fish populations or habitats. The main method of determining fish populations would be the use of electrofishing surveys. The surveys would be carried out at locations agreed with SNH and the Ayrshire Rivers Trust as part of the consent. Post-construction surveys would be completed during the first year of operation.

197. Deer are scoped out of this assessment as explained here. **Section 8.3.1.13** explains that deer densities are predicted to be around 7 deer/km^2 within the Site[15]. Strath Caulaidh (2015) explains that, '*FES[16] deer management teams generally try to maintain deer densities at less than 10 deer per km^2 (and ideally closer to 5 per km^2) to help the other FES functions deliver their objectives*'. FES objectives are principally to produce quality timber and to protect the environment (Strath Caulaidh, 2015). For impacts on peatland habitats, which are sensitive to impacts arising from deer, densities are considered to be high if they exceed a density of ~15 deer/km^2 (Cummins *et al.* 2011). SNH (2016) state that, '*As a general guide, sustainable deer densities of <3-5 deer/km^2 may be appropriate for woodland establishment and for blanket bog sites, while <8-12 deer/km2 may be appropriate for some less susceptible moorland habitats*'. Thus, given that the Site is dominated by mature commercial forestry plantation with minor areas of peatland habitat it is considered that the densities are at an appropriate level.

198. Deer management would continue at the same level as it is currently undertaken throughout construction and operation as part of FES's ongoing deer management plan for this area. This is expected to be sufficient to maintain deer populations at an appropriate size for the area. The construction impacts associated with the proposed Development are considered to be sufficiently similar to ongoing commercial forestry activities within the Site, and with habitat change limited to key-holed areas and small sections of new access track, significant effects on deer or large-scale displacement of deer from the Site is unlikely. In the event, however, that deer are displaced by construction activity, the most likely scenario is that they would move elsewhere to similar habitat within the large expanse Galloway Forestry to the west and south of the Site.

199. No species records of terrestrial invertebrates were found during the desk study. These are scoped out of the assessment.

8.3.8.2 Scoped-in IEFs

200. The assessment of likely effects will be applied to those 'scoped-in' IEFs of local, regional, national, and international Nature Conservation Value (**Table 8.12**) that are known to be present within the Site or surrounding area (as confirmed through survey results and consultations outlined above). These comprise: wet modified bog and bats.

IEF	Nature Conservation Value	Justification
Wet modified bog	Local	Wet modified bog habitats have been heavily influenced by anthropogenic impacts, with the single largest factor being the widespread commercial conifer plantation and its associated drainage, drying and shading effects. Bog communities are therefore deemed to be poor or degraded forms of Annex I and SBL habitats. Wet modified bog within the study area is not considered to be nationally or regionally important due to its condition, with it only making up 7.31 % coverage of this habitat within the survey area. Its Nature Conservation Value is therefore considered to be Local.
Bats: *Nyctalus* and *Pipistrellus spp*.	Regional for *Nyctalus* spp. Local for soprano and common pipistrelle.	All bats species are protected under the following legislation: • The Habitats Directive 92/43/EEC; • The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (''The Habitats Regulations; • The Wildlife and Countryside Act 1981 (as amended); and • The Nature Conservation (Scotland) Act 2004 (as amended). In total seven bat species were recorded for the Site: soprano pipistrelle, common pipistrelle, Leisler's (*Nyctalus leisleri*), noctule (*N. noctula*), brown-long eared bat, Natterer's (*Myotis nattereri*) and Daubenton's (*M. daubentonii*) and to genus level were *Nyctalus* spp. and *Myotis* spp. These species are considered to appreciably enrich the ecological resource within the local context. No effects on roosting bats are likely. No effects on brown long-eared and Myotis bats (including Natterer's and Daubenton's bats) are likely. Based on SNH et al. (2019) guidance, soprano and common pipistrelle species in Scotland are considered to be of medium population vulnerability to windfarms as they are high collision risk, but common species. For soprano pipistrelle Mathews et al. (2018) estimated a national population of 4,670,000 adults, with a Scottish population of 1,210,000 adults. For common pipistrelle Mathews et al. (2018) estimated a national population of 3,040,000 adults, with a Scottish population of 875,000 adults. The current population trends of both species are unknown, although it was predicted that range and habitat quality are likely to remain stable. When considering the information available, pipistrelle species are classified as being of Local Nature Conservation Value, based on the likely large, stable regional populations, and potential medium vulnerability to windfarm developments. Based on SNH et al. (2019) guidance, *Nyctalus* species in Scotland are considered to be of high population vulnerability to windfarms. Mathews et al. (2018) concluded that there were insufficient data to make a population estimate for *Nyctalus* sp. at a national level. Although a population estimate of approximately 10,000 individuals was given for Leisler's bats, in Harris et al. (1995) (250 individuals in Scotland), this estimate was noted as having very poor reliability. Subsequent evidence from the Southern Scotland Bat Survey of breeding Leisler's bat colonies in south west Scotland confirm that the estimate of 250 individuals is too low and has suggested a wider range in south west Scotland than previously estimated.

[15] Pers. Comment Forest Liaison Officer FES 24/12/2018

[16] Forestry Enterprise Scotland

IEF	Nature Conservation Value	Justification
		For noctule bat, JNCC (2013b) provided a national estimate of 50,000 individuals, with 250 in Scotland. Again Mathews et al. (2018) concluded that there is considerable uncertainty surrounding the population estimates for this species, although they revised the population estimates to 100,500 in Great Britain, and 6,100 in Scotland. Recent research work has estimated through spatial modelling that between 16 % and 24 % of the regional populations of high-risk species (*Nyctalus* spp. and *Pipistrellus nathusii*) in southern Scotland overlaps existing and approved windfarms, with 50 % of this overlap concentrated at just 10 % of windfarms (Newson *et al*., 2017), indicating that there are very localised risk areas for *Nyctalus* spp. The study used spatial modelling to stratify the region (southern Scotland) according to potential impact on high risk species by highlighting areas of risk. According to this spatial modelling the predicted occurrence of *Nyctalus* spp. is distributed in the south and south eastern areas of Dumfries and Galloway. The proposed Development is within this area of predicted occurrence for *Nyctalus* species. When considering the information available, *Nyctalus* species are classified as being of Regional Nature Conservation Value, based on the likely low regional populations, and potential vulnerability to windfarm developments, as well as falling within the northern population distribution edge.

Table 8.12: Summary of receptor sensitivity

8.4 Assessment of effects

201. This section provides an assessment of the likely effects of the proposed Development on the IEFs identified through the baseline studies. The assessment of effects is based on the development description outlined in **Chapter 3: Description of the proposed Development**, and is structured as follows:

- construction effects;
- operational effects; and
- cumulative effects.

8.4.1 Project assumptions

202. The assessment below makes the following assumptions:

- All electrical cabling between the proposed turbines and the associated infrastructure would be underground in shallow trenches which would be reinstated post-construction and, in most cases, follow the proposed windfarm tracks;
- any disturbance areas around temporary and permanent infrastructure during construction would be temporary and areas would be reinstated or restored before the construction period ends. The only excavation in these areas would be for cabling as noted above and otherwise may only be periodically used for side-casting of spoil and turfs until reinstatement;
- To ensure all reasonable precautions are taken to avoid negative effects on habitats, protected species and aquatic interests, ScottishPower Renewables would appoint a suitably qualified ECoW prior to the commencement of construction and they would advise SPR and the Principal Contractor on ecological matters. The ECoW would be required to be present on the Site during the construction period and would carry out monitoring of works and briefings with regards to any ecological sensitivities to the relevant staff within the principal contractor and subcontractors;
- A SPP would be implemented during construction of the proposed Development. The SPP would detail measures to safeguard protected species known to be in the area. The SPP would include pre-construction surveys and good practice measures during construction. Pre-construction surveys would be undertaken to check for any new protected species signs/sites in the vicinity of the construction works; and
- Implementation of appropriate pollution prevention measures and standard good practice construction environmental management would occur across the Site as standard and form part of a Site 'Environmental Management Plan' (EMP) See **Chapter 3: Description of the proposed Development**.

8.4.2 Potential construction effects

203. This section provides an assessment of the likely effects of construction of the proposed Development upon the scoped-in IEFs.

8.4.2.1 Habitats

204. Impacts on habitats may include direct loss of habitat, e.g. from permanent land-take for infrastructure or temporary land-take for the land required to accommodate construction site compounds. Impacts on habitats can also be indirect through increased habitat fragmentation, or changes caused by pollution, or effects to supporting systems such as groundwater or water-table levels.

205. The most tangible effect during the construction stage of the proposed Development would be direct habitat loss due to the construction of the turbines and associated tracks, hard-standings, laydown areas, compounds, substation and stone extraction areas. Much of this infrastructure would be permanent, however the temporary construction compound and a proportion of each crane hardstanding would be restored during the construction period. Despite the restoration, and taking a precautionary approach, it is assumed for the assessment that the areas of land-take for infrastructure also represent permanent losses of habitat due to the complexities in re-creating habitat types such as blanket bog which rely on a constant water table being achieved.

206. There could also be some indirect habitat losses to wetland habitats due to drainage effects, and changes to the hydrological regime may also occur. For the purposes of this assessment it is assumed that wetland habitat losses due to indirect drainage effects may extend out to 10 m from infrastructure (i.e. in keeping with indirect drainage assumptions within the carbon calculator). It is expected that any indirect drainage effects would only impact wetland habitats at the Site such as wet modified bog, flushes & springs, wet heath and swamp. No indirect drainage effects are expected to impact or alter the quality or composition of dry habitats.

Phase 1 habitat type	NVC community or habitat types lost	Total phase 1 extent in study area (ha)	Direct habitat loss (ha)	Direct habitat loss as a % of Phase 1 type in study area	Direct & indirect habitat loss (ha)	Direct & indirect habitat loss as % of type in study area
Broad-Leaved Semi-Natural Woodland (A1.1.1)	W4	13.35	0.05	0.4	0.69	5.21
Coniferous Plantation Woodland (A1.2.2)	CP, YCP	1593.85	5.13	0.32	As per direct	
Recently Felled Coniferous Woodland (A4.2)	CF, CF>various	479.63	3.78	0.79	As per direct	
Unimproved Acid Grassland (B1.1)	U2, U4	19.17	0.15	0.77	As per direct	
Unimproved Neutral Grassland (B2.1)	MG9	20.06	0.01	0.04	0.09	0.43
Marsh/Marshy Grassland (B5)	M23, M25b, MG10, Ja, Je	68.36	1.16	1.70	7.51	10.98
Continuous Bracken (C1.1)	U20	17.55	0.13	0.76	As per direct	
Tall Ruderal (C3.1)	OV27	0.8	0.01	1.25	As per direct	
Acid Dry Dwarf Shrub Heath (D1.1)	H10, H12	1.75	0.07	4.16	As per direct	
Wet Dwarf Shrub Heath (D2)	M15	3.03	0	0	0.002	0.08
Wet Modified Bog (E1.7)	M19, M20, M25, M25a	183.08	1.71	0.93	8.04	4.39
Acid/Neutral Flush (E2.1)	M4, M6	34.98	0.20	0.57	0.79	2.26
Swamp (F1)	S12	0.21	0.0001	0.05	0.005	2.33
Standing Water (G1)	SW	0.57	0.002	0.31	As per direct	
Bare Ground (J4)	BG	43.54	8.53	19.58	As per direct	
No Surveyor Access (NSA)	NSA	16.31	0.0001	0.001	As per direct	

Table 8.13: Estimated loss of habitat for permanent infrastructure (excluding mineral extraction areas)

Phase 1 habitat type	NVC community or habitat types lost	Total Phase 1 extent in study area (ha)	Direct habitat loss (ha)	Direct habitat loss as a % of Phase 1 type in study area	Direct & indirect habitat loss (ha)	Direct & indirect habitat loss as % of type in study area
Coniferous Plantation Woodland (A1.2.2)	CP	1593.85	3.38	0.21	As per direct	
Recently Felled Coniferous Woodland (A4.2)	CF	479.63	2.39	0.50	As per direct	
Marsh/Marshy Grassland (B5)	M23, MG10	68.36	0.31	0.45	0.35	0.51
Tall Ruderal (C3.1)	OV27	0.8	0.01	1.25	As per direct	
Acid Dry Dwarf Shrub Heath (D1.1)	H12	1.75	0.10	5.71	As per direct	
Wet Modified Bog (E1.7)	M25	183.08	0.41	0.22	0.48	0.26
Acid/Neutral Flush (E2.1)	M6	34.98	0.004	0.01	0.01	0.03
Bare Ground (J4)	BG	43.54	1.3	2.98	As per direct	

Table 8.14: Estimated loss of habitat for permanent infrastructure (mineral extraction areas only)

207. The following sections assess the effect of these losses for each IEF scoped-in.

8.4.2.1.1 Wet modified bog

208. Impact: Effects upon wet modified bog habitat during construction would be direct (through habitat loss occurring during construction of the proposed Development) and indirect (through potential drying effect upon neighbouring bog habitats occurring from the construction period into the operational period).

209. Nature Conservation Value and Conservation Status: As per **Table 8.12**, wet modified bog within the study area is considered to be of Local Nature Conservation Value. Conservation status of this habitat as assessed in JNCC report on blanket bog (JNCC, 2012) is 'Bad' and 'Declining' at the UK level.

210. Magnitude: The UK has an estimated 2,196,736 ha of blanket bog (JNCC, 2012) of which around 1,759,000 to 1,800,000 ha is in Scotland (approximately 23 % of the land area) (JNCC, 2012; SNH, 2017).

211. Wet modified bog, covers 183.08 ha (7.31 %) of the NVC study area, with most of this comprising of NVC community M25a and smaller areas of M19, M20 and M17 (**Tables 8.7 and 8.8)**. Of this extent, a total of 2.12 ha would be directly lost due to infrastructure (**Table 8.13 and 8.14**). Direct habitat loss due to permanent infrastructure is predicted to be at most 1.15 % of the wet modified bog within the NVC study area. Direct loss of this habitat is therefore of a very small extent in the local and regional context.

212. In addition to direct loss, there may be some indirect loss because of the zone of drainage around infrastructure (as a worst-case assumed to extend out to 10 m from infrastructure in line with the carbon calculator assumptions). If indirect drainage impacts are fully realised out to 10 m in all wet modified bog areas, then predicted indirect loss would be 6.40 ha or 3.50 % of the habitat within the NVC study area. The distance of the impacts of drainage on a peatland is variable and depends on various factors such as the type of peatland and its characteristics and properties of the peat; the type, size distribution and frequency of drainage feature; and whether the drainage affects the acrotelm, penetrates the catotelm, or both. Consequently, drainage impacts can be restricted to just a few metres around the feature or extend out to tens of metres, or further (e.g. see

review within Landry & Rochefort (2012). The hydraulic conductivity of the peatland is one of the key variables which affect the extent of drainage. In general, less decomposed more fibric peatlands (which tend to be found commonly in fen type habitats) generally have a higher hydraulic conductivity and drainage impacts can extend to around 50 m, whilst in more decomposed (less fibrous) peat drainage impacts may only extend to 2 m or so. Blanket bog habitats, such as the type found at the proposed Development, commonly are associated with more highly decomposed peats (Nayak et al., 2008) and indirect impacts out to around 2m are therefore more likely.

213. With the adoption of good practice and environmental management techniques, and an appropriate and considered drainage design, it is considered unlikely that indirect drainage impacts of this scale (i.e. out to 10 m either side of infrastructure) on an already modified habitat would occur or would have such an impact on the habitat as to result in large-scale vegetation shifts to a lower conservation value habitat type (such as acid grassland for example).

214. When considering the likely direct and indirect habitat losses (total area of 8.52 ha), the magnitude of impact within a local or regional context is considered to be **Negligible Spatial,** and **Long-term Temporal**.

215. Significance of Effect: Given the above consideration of sensitivity and magnitude, the effect significance is considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations.

8.4.2.1.2 Proposed mitigation

216. There is no mitigation required during construction in addition to the standard in-built mitigation (50 m watercourse buffer) and adoption of good practice as detailed in the project assumptions above. Furthermore, an ECOW would advise on micro-siting requirements to ensure impacts on bog are reduced further where possible.

8.4.2.1.3 Residual construction effects

217. Effects on wet modified bog during construction are considered to be of **Negligible Spatial,** and **Long-term Temporal** magnitude.

218. Although no unmitigated significant effects were predicted for wet modified bog habitat, the inclusion of standard in-built mitigation and adoption of good practice, as detailed in the project assumptions above, would further reduce the likelihood of any adverse effects. Effects therefore remain **Negligible** and **Not Significant** under the terms of the EIA Regulations.

219. **Table 8.15** below summarises the significance of construction effect for wet modified bog and the residual significance after mitigation measures are considered.

Predicted Construction Effect	Significance	Mitigation	Significance of Residual Construction Effect
Habitats – wet modified bog	Negligible	None other than standard in-built mitigation and adoption of good practice	Negligible

Table 8.15 Summary of predicted construction effects

8.4.3 Potential operational effects

220. This section provides an assessment of the likely effects of the operation of the proposed Development upon the scoped-in IEFs.

221. All likely direct and indirect effects on wet modified bog, have been considered in the construction effects section above. Indirect habitat loss tends to occur during the operational phase as drying impacts occur, however for completeness and ease of assessing impacts, they are considered together in the construction effects section. No further impacts on wet modified bog are predicted during the operational phase.

[17] as per Article 222 of the UK Air Navigation Order (ANO) 2016

8.4.3.1 Bats

222. Impact: During the operational phase, there is potential for collision risk upon bats, together with the risk that bats may be affected by barotrauma when flying in close proximity of the turbine blades. For the purposes of this assessment, the potential impacts from barotrauma are assumed to be the same as for collision risk. This is due to the lack of published empirical evidence in causes of bat fatalities around windfarms and the difficulties in determining whether bat fatalities are due to strikes (collisions) with the turbine blades or barotrauma.

223. Research work by Exeter University (DEFRA, 2016) found that in their study, most bat fatalities at UK windfarms were common pipistrelle, soprano pipistrelle and noctule bats. Collision rates were higher than the relative proportions of their calls recorded in ground-level acoustic surveys but were more similar to the species distributions found in recordings made at turbine nacelles. The study also found that the risk to bats from windfarms increased with the number of turbines and increased rotor size. In contrast, the height of the nacelle, and the period for which the windfarm had been operational were not linked with the risk to bat collisions. The study conducted by ScottishPower Renewables also found that bat collisions were related to bat activity (**Technical Appendix 8.4**)

224. For all bats collectively, the number of bat casualties was found to decline with the area of broadleaf woodland within a 1.5 km radius of the centre of the windfarm, possibly through the provision of alternative foraging habitat. Conversely, the total area of coniferous woodland (including recent clear-fell) was associated with increased risks to noctules. At a smaller spatial scale, sites without broadleaved and mixed woodland in a 500 m radius had a 94 % probability of no noctule bat casualties (coniferous woodland gave similar results to those for broadleaved and mixed woodland) (DEFRA, 2016).

225. Because the proposed turbines have a blade tip over 150 m, they would require to be lit with medium intensity (2000 candela) steady red aviation warning lights (with dimming option)[17]. The light would be mounted on the nacelle of the wind turbines with a second light (unilluminated) for redundancy. Further to this, at least three low-intensity (32 candela) red lights would be provided at an intermediate level of half the nacelle height on the tower. There is some recent evidence that migratory pipistrelle bats may be attracted to red lights, which according to the authors (Voigt et al. 2018), may lead to an increased collision risk of migratory bats at wind turbines. The authors did however note a lack of insect hunting at the red light sources, which indicates that the attraction of migratory bats to red light sources was not caused by foraging. Although migratory activities of bats within the UK are relatively poorly understood, baseline results suggest that no significant migratory movements were likely to have occurred within the study area, and the risk of additional collisions associated with local foraging bats being attracted to red lights is therefore low.

8.4.3.1.1 Nyctalus spp.

226. Nature Conservation Value and Conservation Status: *Nyctalus* spp. are of regional Nature Conservation Value, with an uncertain conservation status at regional or Scotland-wide level. As per the population vulnerability levels to collision risk advised by SNH et al. (2019), the overall sensitivity for *Nyctalus* species, is considered to be high (**Table 8.12**).

227. Magnitude: SNH et al. (2019) guidance recommends a two-stage process when assessing potential collision risk to bats for a windfarm. Stage 1 considers habitat within a site, and development-related features such as size, and number of turbines. An overall assessment of risk is then informed by considering the results for a site in relation to the bat activity output from the EcoBat[18] software tool or equivalent analysis and taking into account the relative vulnerability of each species of bat present, at the population level.

228. The BCT assessment table (Hundt, 2012), which was used to determine the Site's risk level for bats (**Technical Appendix 8.3A, Annex 2 and Annex 3**), is comparable to the SNH et al. (2019) new survey guidelines, with both assessment tables using similar factors such as roost sites, value of habitats and connectivity of the study area to determine the risk of the Site to bats. The new guidance does however, also consider the size of the windfarm and the proximity of the study area to other windfarms. When using the new assessment table, the study area is also assessed to be a Medium risk site due to the following factors:

- the proposed Development is medium-sized (>10 turbines), with relatively large turbines (75 m blade length), and has other windfarm projects within 5 km;
- geographical location – the Site is located within the known range of high collision risk species (Leisler's / Nyctalus spp. and Pipistrellus spp.);

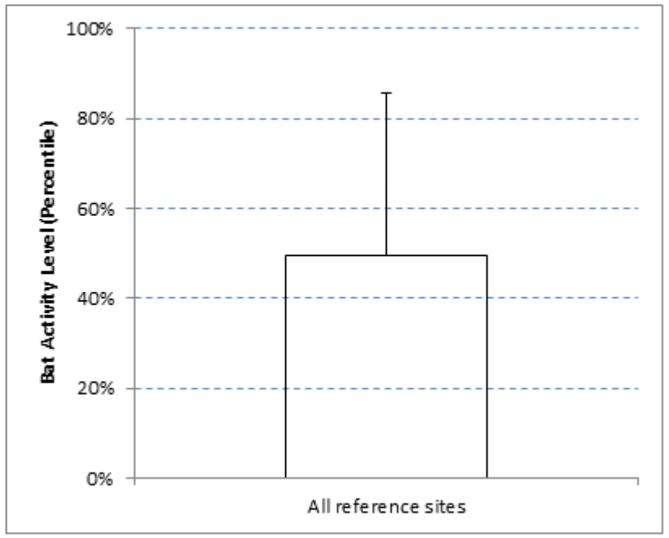
[18] http://www.ecobat.org.uk

- there is negligible roosting suitability within the 200 m plus rotor radius of turbines with the Site dominated by closed conifer planation which is considered suboptimal for a bat roost;
- during operation there would be medium foraging and commuting suitability within 200 m plus rotor radius of turbines, based on the assumption that clear-felling would occur in stages, and turbines would be key-holed and connected by 5 m wide access tracks; and
- the Site is connected to the wider landscape by limited water courses of moderate suitability.

229. SNH et al. (2019) recommend that an overall assessment of collision risk can then be made by considering the above noted study area risk assessment in relation to the comparative bat activity output from the Ecobat tool or alternative analysis (Stage 2), which accesses a dataset of results of studies to place the baseline survey results within a wider context.

230. With EcoBat analysis not available at the time of writing, an assessment of activity levels was undertaken using data from windfarm monitoring projects in the wider area. A comparison was made between the bat activity recorded at the Site in comparison to 9 operational windfarms within south west Scotland for which data on activity levels were available. An additional comparison of bat activity levels and known fatality rates at reference-sites was made with those data collected at recording locations on Site that fell within 1 km of a turbine location (bat detector locations 3 to 8 and 10 and 11). Data collected at all other locations of the Site (bat detector locations 1,2, 9, 12 and 13) was not considered in the analysis, as the distances to turbine locations (>1 km) are deemed to be out with the relevant area of ecological context to the Site in regards to collision risk.

231. A percentile comparison of bat activity per night was undertaken, with *Nyctalus* bat activity falling in the 20th to just above the 40th percentiles (see **Graph 8. 2**) of the activity reference-sites' activity rates. This shows that the overall *Nyctalus* activity at the Site is low in comparison with activity at all 9 reference-sites. The median activity falls at 0.068%, showing that activity during each night is overall very low (few bat passes per night). Therefore, the overall *Nyctalus* spp. activity level category, in comparison to the 9 reference-sites, was determined to be Low, (**Graph 8.2**).



Graph 8.2: *Nyctalus spp.* activity shown as percentiles of the 9 comparison sites from the South of Scotland.

232. For *Nyctalus* bats, the activity level fell below activity levels at the 10 fatality reference-sites overall and below activity levels of the reference-sites where zero fatalities were recorded during the operational phase (Pers Comm, Peter Robson). The overall *Nyctalus* collision risk based on recorded activity was therefore determined to be Low.

[19] Percentiles provide a numerical indicator of the relative importance of a nights' worth of bat activity. For example, activity data in the 70th percentile would indicate that the recorded data was in the top 30% of activity for the reference range.

233. When the Site risk level (Medium) is combined with the activity level category (Low) and collision risk category (Low), the overall risk for *Nyctalus* spp. is considered to be Low.

	Site risk	Activity level	Collision risk	Overall risk
Nyctalus spp.	Medium	Low	Low	Low

Table 8.16: Risk summary table for *Nyctalus spp*.

234. Based on the above consideration of Site risk, activity level and collision risk the magnitude of impact is assessed as **Low spatial** and **Long-term temporal**.

235. Significance of Effect – *Nyctalus* spp.: Given the above consideration of Nature Conservation Value, Conservation Status and Magnitude, the effect significance of collision risk on *Nyctalus* bats is **Negligible** to **Minor Adverse** and **Not Significant** under the terms of the EIA Regulations.

8.4.3.1.2 Common and soprano pipistrelle

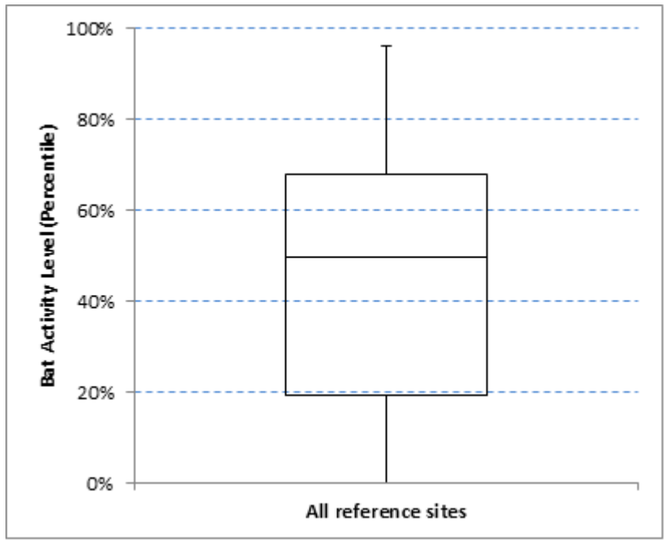
236. Nature Conservation Value and Conservation Status: Pipistrelle bats were determined to be of local Nature Conservation Value, with a likely stable conservation status at a regional and Scotland-wide level (**Table 8.12**).

237. Magnitude – SNH et al. (2019) guidance recommends a two-stage process when assessing potential collision risk to bats for a proposed Development. Stage 1 considers habitat within a site, and development-related features such as size, and number of turbines. An overall assessment of risk is then recommended, by considering the results for a site in relation to the bat activity output from the EcoBat software tool or equivalent analysis and taking into account the relative vulnerability of each species of bat present, at the population level.

238. The study area is assessed to be a Medium risk Site, based on assessment methodologies as per Hundt, 2012 and SNH et al., 2019.

239. With EcoBat analysis not available at the time of writing, an assessment of activity levels was undertaken using data from windfarm monitoring projects in the wider area. A comparison was made between the bat activity recorded at the Site that fell within 1 km of a turbine location (bat detector locations 3 to 8 and 10 and 11) and 9 operational windfarms within south west Scotland for which data on activity levels were available (see **Technical Appendix 8.4**). An additional comparison of bat activity levels and known fatality rates at reference-sites was made with those data collected at recording locations that fell within 1 km of a turbine location (bat detector locations 3 to 8 and 10 and 11). Data collected at all other locations (bat detector locations 1,2, 9, 12 and 13) was not considered in the analysis, as the distances to turbine locations (>1 km) are deemed to be out with the relevant area of ecological context to the Site in regards to collision risk.

240. A percentile[19] comparison was undertaken. Pipistrelle bat activity on Site falls into the 20th to just above the 60th percentile (see **Graph 8.3**) of the reference-site activity. The median activity falls within the 40th to 60th percentile. Therefore the overall common and soprano pipistrelle activity level category, in comparison to the 9 reference-sites was determined to be Moderate.



Graph 8.3: *Pipistrellus pipistrellus* and *P. pygmaeus* activity shown as percentiles of the 9 comparison sites from the South of Scotland.

241. In regards to fatality data comparison, it is expected that the bat activity at Arecleoch Extension will generate a fatality rate between zero and incidental (<2 per turbine per year) (**Technical Appendix 8.4**). In total therefore, the worst-case expected annual mortality is 26 pipistrelle. The overall collision risk based on recorded activity is therefore classified as Medium for the Site (**Technical Appendix 8.4**).

242. SNH et al. (2019) classify common and soprano pipistrelle bats in Scotland as of high collision risk and medium population vulnerability. According to research work by Exeter University (DEFRA, 2016), common and soprano pipistrelle have been identified to be of high collision risk. Furthermore, acoustic recording from the ground underestimates the abundance of common and soprano pipistrelle bats, therefore, the temporal surveys may have underestimated the abundance of these species. However, the study also found that ground level monitoring of activity for both species is a better predictor of fatality than recording at height.

243. When the Site risk level (Medium) is combined with the activity level category (Moderate) and the collision risk category (Medium), the overall risk for common and soprano pipistrelle is considered to be Medium.

	Site risk	Activity level	Collision risk	Overall risk
Common pipistrelle	Medium	Moderate	Medium	Medium
Soprano pipistrelle	Medium	Moderate	Medium	Medium

Table 8.17: Risk summary table for soprano and common pipistrelle bats

244. The spatial and temporal magnitudes of impacts on the populations of these two species across the Site are therefore considered to be **Moderate Spatial** and **Long-term Temporal**.

245. Significance of Effect – Common and soprano pipistrelle: Given the above consideration of Nature Conservation Value, Conservation Status and Magnitude, the effect significance of collision risk on common and soprano pipistrelle bats is **Moderate Adverse** and **Significant** in the context of the EIA Regulations.

8.4.3.1.3 Proposed mitigation

246. A detailed Bat Mitigation and Monitoring Plan is provided in **Technical Appendix 8.4**.

247. The mitigation consists of a two-step approach, including curtailment of the operation of the wind turbines while they are idling i.e. below the cut-in wind speed at which electricity generation occurs (feathering). The mitigation measures would be implemented at each turbine between the months of April - October between sunset and sunrise each year for the lifetime of the proposed Development unless monitoring results provide further evidence to justify modifying mitigation.

248. The long-term monitoring plan would ensure that mitigation measures are appropriate for the Site. Monitoring would comprise of measurement of bat activity and fatality rates and would be undertaken annually until validation of the initial parameters and any amendments are established. The objective of the monitoring is to provide a robust estimate of the total number of bat fatalities, if applicable, which would be used to determine whether the mitigation is effective.

8.4.3.1.4 Residual operational effects

249. Although unmitigated non-significant effects were predicted for *Nyctalus* bats, mitigation measures for bats would mean that Residual effects on *Nyctalus* spp. would reduce to **Negligible** and **Not Significant**.

250. Mitigation measures for bats would mean that the residual significance of operational effects (collision risk) on common and soprano pipistrelle bats is reduced to **Negligible Adverse** and **Not Significant.**

251. Error! Reference source not found.**8** summarises the significance of operational effects for each receptor and the residual significance after mitigation measures are considered.

Predicted Effect	Significance	Mitigation	Significance of residual effect
Bat species: *Nyctalus* spp.	Not Significant	None other than standard in-built mitigation though design.	Not Significant
Bat species: Common and soprano pipistrelle	Significant	In addition to the standard in-built mitigation though design, as detailed in **Appendix 8.4 Mitigation and Monitoring Plan**, with measures including curtailment by curtailment (feathering) and a detailed monitoring programme, including bat activity monitoring and carcass searches.	Not Significant

Table 8.18: Summary of residual effects

8.4.4 Potential cumulative effects

252. The primary concern regarding the assessment of cumulative impacts is to identify situations where impacts on habitats or species populations that may be acceptable from individual developments, are judged to be unacceptable when their impact is combined with nearby existing or proposed projects that are subject to an EIA process. The main projects likely to cause similar impacts to those associated with the proposed Development are other operational windfarms, those under construction or those consented. Several other windfarms are present within the wider area, in planning, under construction and operational.

253. Windfarm projects at scoping stage have been scoped out of the cumulative assessment because they generally do not have sufficient information on potential impacts to be included, as the baseline survey period is ongoing, or results have not been published. Projects that have been refused or withdrawn have also been scoped out.

254. Small projects with three or fewer turbines have also been excluded from the cumulative assessment as often these projects are not subject to the same level of detail of assessment, and so there are no directly comparable data.

8.4.4.1 Habitats

255. The loss of 8.52 ha of wet modified bog as a result of the proposed Development is assessed as Negligible due to the small extent and highly degraded and fragmented condition of the habitat within the Site. The contribution of the proposed

Development to cumulative impacts on wet modified bog within the wider Natural Heritage Zone is therefore considered be negligible and an extensive cumulative impact assessment is therefore not necessary. Cumulative impacts on wet modified bog are therefore considered to be **Negligible and Not Significant** in the context of the EIA Regulations.

8.4.4.2 Bats

256. Bats are most likely to be affected by cumulative windfarm development because of the distances travelled by some species of foraging bat and the cumulative risks to bat populations as a result of barotrauma and/or collision with wind turbines during operation.

257. Although a small number of suitable roost features were recorded during baseline surveys for windfarm projects within 10km, no roosts were confirmed in locations that may be affected by construction activities, therefore significant construction-related cumulative effects (habitat loss or disturbance) on bats are considered unlikely (**Negligible** and **Not Significant**).

258. Collision impacts have been minimised through the design of the project by implementation of standard good practice measures regarding buffer distances of turbines from forestry edges to minimise impacts on commuting and foraging bats and therefore the likelihood of cumulative construction impacts. As detailed in **Section 8.4.3.1.3**, further mitigation through curtailment of idling turbines reduces the impact of the proposed Development further to Negligible for bats.

259. With a Negligible residual non-significant effect predicted on *Nyctalus* and Pipistrelle spp., cumulative impacts on *Nyctalus* and Pipistrelle spp are considered to be **Negligible and Not Significant** in the context of the EIA Regulations

8.4.4.3 Proposed mitigation

260. As detailed in **Section 8.4.3.1.3** and **Technical Appendix 8.4**.

8.4.4.4 Residual cumulative effects

261. Mitigation measures for bats as detailed in **Section 8.4.3.1.3** and **Technical Appendix 8.4** would mean that the residual significance of operational cumulative effects (collision risk) on pipistrelle bats **Negligible Adverse** and **Not Significant.**

262. All other bat species have been scoped out of the residual cumulative operational assessment given that no significant cumulative effects are predicted.

8.5 Summary and statement of significance

263. Residual effects on all IEFs are considered to be at worst, Negligible Adverse and Not Significant.

Description of effect	Significance of potential effect		Mitigation measure	Significance of residual effect	
	Significance	Beneficial / adverse		Significance	Beneficial / adverse
During construction					
Loss of habitat: wet modified bog	Negligible	Adverse	CEMP, ECoW monitoring	Negligible	Adverse
During operation					
Habitats	No impacts		None required	No impacts	
Nyctalus bats: collision risk	Negligible to Minor	Adverse	Minimum turbine set-back distance of 50 m from blade tip to plantation edge. Curtailment (feathering) between the months of April - October between sunset and sunrise each year for the lifetime of the proposed Development and monitoring of activity and carcass searches.	Negligible	Adverse
Pipistrelle bats: collision risk	Moderate	Adverse	Minimum turbine set-back distance of 50 m from blade tip to plantation edge Curtailment (feathering) between the months of April - October between sunset and sunrise each year for the lifetime of the proposed Development and monitoring of activity and carcass searches.	Negligible	Adverse
Cumulative effects					
Habitats	Negligible	Adverse	None required	Negligible	Adverse
Nyctalus bats	Negligible	Adverse	As outlined for the construction and operational phases.	Negligible	Adverse
Pipistrelle bats	Negligible	Adverse	As outlined for the construction and operational phases.	Negligible	Adverse

Table 8.19: Summary table

8.6 References

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