TECHNICAL APPENDIX 8.3

Kilgallioch Windfarm Extension

Bat Survey Report

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Executive Summary

The proposed Kilgallioch Windfarm Extension lies approximately 10 km north east of Kirkcowan and is fully within the administrative boundary of Dumfries and Galloway apart from the northern access track corridor and junction which lies partly within the South Ayrshire administrative area. The central OS grid reference of the Site (the area within the application boundary) is NX 242 700. It is the intention of ScottishPower Renewables (UK) Ltd., subject to planning permission being approved, to develop the Site into a windfarm site with 11 wind turbines, solar array and associated infrastructure.

Echoes Ecology Ltd were contracted by ITPEnergised to carry out a baseline assessment of the Site for bats to identify the potential for use by roosting, foraging and commuting bats, to identify any roosts on Site, and to identify any potential conflicts between bats and the proposed Development. A bat survey programme took place during the period 02.05.19 to 02.09.19.

The habitat within the Site is open moorland, with coniferous plantation to the east, south and west. The derelict High Eldrig Farm lies at the south east of the application boundary, at the west end of the proposed eastern access track.

A Preliminary Roost Assessment (PRA) of the buildings and trees at High Eldrig was carried out on 27.06.19 by two surveyors. The farmhouse and stone barns were only surveyed externally due to health and safety issues and were assessed as being of moderate and high suitability respectively for summer roosting bats. There were a small number of broadleaved trees with roost suitability. A distance of around 450 m will be maintained between the structures and trees and the nearest turbine and so no further bat surveys (summer or hibernation) were required as the features will not be impacted by the proposed development.

In total, 3,768 bat passes were recorded throughout the Site. The most commonly recorded species was soprano pipistrelle (64.1% of all bat passes), followed by common pipistrelle which made up 19.3% of all bat passes. 11.4% of all bat passes recorded were from *Nyctalus* species (noctule (*Nyctalus noctula*) or Leisler's (*Nyctalus leisleri*) bat), followed by *Myotis* species (5.1%) and brown long-eared bat (0.2%).

The maximum risk for common pipistrelle, soprano pipistrelle and *Nyctalus* species is medium at all detector locations except for D2, and during all survey months. The median risk is more variable, although for each species there was medium risk when the whole site was analysed. However, by focussing on the locations where turbines will be positioned, it can be seen that generally the risk at detector locations in open habitats (D2, D3, D4, D5 and D6) was low whereas risk at detectors closer to bat-friendly features was higher (D8, D9 and D10). Therefore, locating the turbines in open habitat means a low risk to bats using the site. Low risk species (*Myotis* species and brown long-eared bat) have low collision risk, so the impact of the development on the local bat population would likely be negligible.

The windfarm should be designed to allow the locations of the turbines to be situated well away from trees, forestry and water features to minimise the risk to bats. The survey guidelines (SNH, 2019a) suggests a minimum buffer of 50 m from rotor swept area to feature (e.g. woodland edge). The proposed layout shows there is a minimum buffer between turbine and habitat feature of around 250 m, more than is the recommended distance so there are no further suggestions regarding the location (or relocation) of turbines.

Conservation considerations include reducing the impact of lighting during construction of the wind farm site.

Temporal patterns in activity revealed the overall risk for common pipistrelle, soprano pipistrelle and *Nyctalus* species was lower in Spring and Summer and higher in Autumn. As there is no allowance for entering nights where no bat passes were recorded in Ecobat, the results will be skewed and therefore the medium risk recorded in Autumn will be significantly elevated above the actual risk level (more than half of the nights of recording have not been included within the analysis as no bats were recorded). Bearing in mind the overall temporal risk also includes locations which are no longer representative of turbine positioning (i.e. closer to bat-friendly habitat features) which further skews the results, no mitigation, such as curtailment, is considered necessary.

1 Introduction

1.1 Background

1.1.1 The proposed Kilgallioch Windfarm Extension lies approximately 10 km northwest of Kirkcowan and is fully within the administrative boundary of Dumfries and Galloway apart from the northern access track corridor and junction which lies within the South Ayrshire administrative area. The central OS grid reference of the Site (the area within the application boundary) is NX 242 700.

1.1.2 It is the intention of Scottish Power Renewables (SPR), subject to planning permission being approved, to develop the Site into a windfarm with 11 wind turbines. The proposed turbines are 180 m in height from ground to blade tip.

1.1.3 The planning application is proposed to be submitted in December 2019.

1.1.4 Echoes Ecology Ltd were appointed by ITPEnergised on behalf of SPR to carry out bat surveys at the Site. For a plan of the proposed Site, see **Figure TA_8.3.1**.

1.1.5 The aims of the survey were:

- to carry out a Preliminary Roost Assessment (PRA) of any buildings and trees within the Site to determine the suitability of features for use by roosting, foraging and commuting bats at the Site;
- to install automated detectors at turbine locations to record bat activity during Spring, Summer and Autumn periods;
- to assess the potential impacts of the development on bats; and
- to suggest mitigation and compensation to minimise any predicted impacts and maintain favourable conservation status of the species in question.

1.1.6 The following figures are included in this report:

- **Figure TA_8.3.1** - Plan of the proposed site;
- **Figure TA_8.3.2** - Farmhouse at High Eldrig;
- **Figure TA_8.3.3** - Stone barns;
- **Figure TA_8.3.4** - Inside of stone barns;
- **Figure TA_8.3.5** - Broadleaved trees near High Eldrig;
- **Figure TA_8.3.6** - Species composition of bat passes at each detector; and
- **Figure TA_8.3.7** - Species-specific emergence time shown for D10; overlap of coloured dots on grey bar shows soprano pipistrelle activity close to and before the species-specific roost emergence time.
- **Figure TA_8.3.8** - Number of pipistrelle bat passes per night per location at different percentiles compared to operational projects with a known category of bat fatality.
- **Figure TA_8.3.9** - Number of *Nyctalus* species bat passes per night per location at different percentiles compared to operational projects with a known category of bat fatality.
- **Figure TA_8.3.10** - At Locations D1 to D6 Only: Number of pipistrelle bat passes per night per location at different percentiles compared to operational projects with a known category of bat fatality.
- **Figure TA_8.3.11** - At Locations D1 to D6 Only: Number of *Nyctalus* species bat passes per night per location at different percentiles compared to operational projects with a known category of bat fatality.

1.1.7 The following tables are included in this report:

- **Table TA_8.3.1** - Guidelines for assessing suitability of habitat features in proposed development sites for bats (as adapted from Collins, 2016);
- **Table TA_8.3.2** - Detector locations;
- **Table TA_8.3.3** - Deployment lengths of detectors;
- **Table TA_8.3.4** - Level of potential vulnerability of populations of British bat species in Scotland (SNH, 2019a, adapted from Wray et al., 2010);
- Table TA_8.3.5 - Site risk levels based on habitat risk and project description (SNH, 2019a);
- **Table TA_8.3.6** - Overall risk assessment (SNH, 2019);
- **Table TA_8.3.7** - Resources and database search results;
- **Table TA_8.3.8** - Statutory designated sites;
- **Table TA_8.3.9** - Total number of bat passes recorded for each species across all detectors;
- **Table TA_8.3.10** - Median pass rate of each species/species group per detector;
- **Table TA_8.3.11** - Summary table showing key metrics for each species for site as a whole;
- **Table TA_8.3.12** - Summary table showing key metrics for each species for the whole site, split by month;
- **Table TA_8.3.13** - Summary table showing key metrics for each species split by detector; and
- **Table TA_8.3.14** - Overall risk assessment of high risk species for the site and per detector.

2 Legislation

2.1 Legal Considerations

2.1.1 Bats and their roosts are protected under UK and European Legislation. In Scotland, this is mainly provided by the Conservation (Natural Habitats, &c.) Regulations 1994, as amended (known as the Habitats Regulations). Under this legislation, bats are regarded as European Protected Species (EPS).

2.1.2 It is an offence to deliberately or recklessly:

- capture, injure or kill a bat;
- harass a bat;
- disturb a bat while it is occupying a roost (any place of shelter or protection);
- disturb a bat while it is rearing or otherwise caring for its young;
- obstruct access to a roost or deny a bat use of a roost;
- disturb a bat in a way which is likely to significantly affect the local distribution or abundance of the species;
- disturb a bat in a way that is likely to impair its ability to survive, breed or reproduce, or rear or care for its young; and
- disturb a bat while it is migrating or hibernating.

2.1.3 It is a strict liability offence to damage or destroy a bat roost. A bat roost is protected at all times irrespective as to whether any bats are using the roost at a given time.

2.2 Scottish Biodiversity Strategy

2.2.1 The Nature Conservation (Scotland) Act 2004 places a 'Biodiversity Duty' on public bodies to further the conservation of biodiversity and it requires Scottish Ministers to designate one or more strategies for the conservation of biodiversity as the Scottish Biodiversity Strategy. 'Scotland's Biodiversity: It's in Your Hands - A

strategy for the conservation and enhancement of biodiversity in Scotland' (Scottish Executive, 2004) and '2020 Challenge for Scotland's Biodiversity' (Scottish Government, 2013a) together form the Scottish Biodiversity Strategy.

2.2.2 'Scotland's Biodiversity: It's in Your Hands - A strategy for the conservation and enhancement of biodiversity in Scotland' sets out a 25-year strategy to assist government, the private and public sectors, non-governmental bodies and individual members of the public to conserve and enhance biodiversity in Scotland. The document '2020 Challenge for Scotland's Biodiversity' was published in response to the Aichi Targets set by the United Nations Convention on Biological Diversity (2010) and the European Union's Biodiversity Strategy for 2020 (2011).

2.3 Scottish Biodiversity List

2.3.1 The Scottish Biodiversity List (SBL) was published in 2005 and last updated in 2012 (Scottish Government, 2013b). The aim of the list is to help public bodies carry out their 'Biodiversity Duty', as required by the Nature Conservation (Scotland) Act 2004, by identifying the species and habitats which are the highest priority for biodiversity conservation in Scotland. Nine species of bat are included on the SBL as detailed below:

- Brandt's bat (*Myotis brandtii*);
- Daubenton's bat (*Myotis daubentonii*);
- whiskered bat (*Myotis mystacinus*);
- Natterer's bat (*Myotis nattereri*);
- noctule;
- Nathusius' pipistrelle (*Pipistrellus nathusii*);
- common pipistrelle (*Pipistrellus pipistrellus*);
- soprano pipistrelle (*Pipistrellus pygmaeus*); and
- brown long-eared bat (*Plecotus auritus*).

2.4 Local Biodiversity Action Plan

2.4.1 Local Biodiversity Action Plan Partnerships were established in the UK following the ratification of the Convention on Biological Diversity in 1992. Each local partnership publishes biodiversity action plans, which identify the habitats or species selected as priorities for targeted conservation work. The survey area lies predominantly within Dumfries and Galloway, for which the Dumfries and Galloway Local Biodiversity Action Plan (LBAP) has been published (Dumfries and Galloway Biodiversity Partnership, 2009).

3 Methodology

3.1 Survey Methodology

3.1.1 The survey methods employed were taken from 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation' (SNH, 2019a) and 'Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition)' (Collins, 2016).

3.2 Desk Study Methods

3.2.1 A desk study was carried out to obtain baseline data of bat activity in or near to the study area. This desk study allowed for data within a 10 km radius of the Site to be considered. The following resources were consulted:

- South West Scotland Environmental Information Centre (SWSEIC);
- Dumfries and Galloway LBAP (Dumfries and Galloway Biodiversity Partnership, 2009);
- SiteLink (SNHb, 2019);
- NBN Atlas (NBN Atlas Partnership, 2019);
- 'Distribution Atlas of Bats in Britain and Ireland 1980-1999' (Richardson, 2000); and
- Echoes Ecology Ltd, 'ScoMam' Database (a database of over 5,000 mammal records collected by Echoes Ecology Ltd and associate surveyors over 10 years of surveys).

3.3 Preliminary Roost Assessment of Buildings and Trees

3.3.1 A PRA was carried out on 27.06.19 by Laura Carter Davis MCIEEM (SNH Bat Licence No. 88465) and Russell Keen ACIEEM, inspecting the exterior of the farm buildings at High Eldrig (NX 249 691). The buildings could not be entered to allow internal assessment due to the poor condition and therefore unsafe conditions. The farmhouse and stone barns were inspected externally, to assess the suitability for use by bats, and to look for any evidence of bats, such as corpses, droppings and feeding remains. Any potential roosting features (PRFs) (e.g. cracks, crevices, holes) were noted.

3.3.2 The mature trees around the farm were also surveyed from the ground, looking for potential roost features (PRFs), which could be used by roosting bats, such as holes, cracks and crevices.

3.3.3 A torch was used where needed, and binoculars were used to see high level external areas (magnification 10x42).

3.3.4 The PRA allowed the roost suitability of the structures and trees to be determined (see **Table TA_8.3.1** for descriptions).

Table TA_8.3.1 - Guidelines for assessing suitability of habitat features in proposed development sites for bats (as adapted from Collins, 2016)

Suitability	Roosting Habitats	Foraging and Commuting Habitats
Negligible	No habitat features on site likely to be used by roosting bats.	No habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. Such potential roost sites do not provide enough space, shelter, protection or appropriate conditions to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated and poorly connected to the surrounding landscape. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to the size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation statues (with respect to roost type only, not species conservation status).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	Continuous, high-quality habitat, well connected to the wider landscape, that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

3.4 Winter Hibernation Assessment

3.4.1 During the PRA the structures were assessed as to the suitability to support over-wintering bats.

3.5 Automated Bat Detector Surveys

3.5.1 A walkover assessment of the Site was conducted on 02.05.19 to assess the habitats within the Site and determine the locations for the automated recorders. The methodology follows that in the survey guidelines (SNH, 2019a).

3.5.2 Eleven automated bat detectors (Titley Anabat Swift detectors with omni-directional microphone on a 1.5 m microphone extension cable) were deployed in eleven locations within various habitats across the Site (**Table TA_8.3.2**). The locations were chosen for being close to the turbine locations proposed at the start of the survey programme (although these have since changed, to allow comparative results it was decided to keep the detector locations and not change them). D7, 8, 9, 10 and 11 were not located at the final turbine locations and were located closer to the River Tarf and forest edge and therefore these locations may show higher levels of activity.

3.5.3 The detectors were located on the ground with the microphones at least 1 m off the ground and sited horizontally so as to avoid water damage from rain. The microphones were attached to a habitat feature such as fence post or pile of stones in a bid to keep them secure.

3.5.4 Each detector was deployed with eight AA lithium batteries and two SD memory cards of at least 16Gb storage in total. The bat detectors were all deployed with the following settings:

- sensitivity - 15;
- minimum frequency - 15 kHz;
- maximum frequency - 150 kHz; and
- minimum event - 2 ms.

3.5.5 The detectors were deployed for periods of over ten days with the aim of gaining at least ten days of consecutive bat data each for three seasons (Spring, Summer and Autumn), recording in full spectrum. **Table TA_8.3.3** shows the number of nights each detector recorded for.

Table TA_8.3.2 - Detector locations

Detector	OS Grid Ref	Lat	Long	Description
D1	NX 22720 70911	55.001107	-4.7732597	At base of young conifer; microphone 1m above ground level (agl) facing east.
D2	NX 23658 70803	55.000471	-4.7585467	On the ground behind a stone wall; microphone 1m agl facing north east.
D3	NX 24506 70890	55.001551	-4.7453590	On the ground behind a stone wall. Microphone is 1m agl facing west (Spring survey period).
	NX 24556 70941	55.002026	-4.7446145	In south corner of wall of sheepfold, microphone 1m agl facing south (Summer and Autumn survey period).
D4	NX 23000 70191	54.994744	-4.7684423	On the ground behind a stone wall of sheepfold. microphone 1m agl facing south west.
D5	NX 23887 69834	54.991854	-4.7543747	On the ground in the south east corner of the wall, microphone 1m agl facing south.
D6	NX 24888 70204	54.995518	-4.7394427	Detector in willow tree, microphone is 1m agl facing south.
D7	NX 23118 69275	54.986564	-4.7660341	Installed at the base of a young conifer near the river, microphone 1m agl facing south.
D8	NX 24060 69062	54.984986	-4.7511996	On fence line near river, microphone 1m agl facing south west.
D9	NX 24948 69233	54.986834	-4.7374438	Installed at the base of a fence near High Eldrig Farm; microphone 1m agl facing south west.
D10	NX 25380 68593	54.981276	-4.7287496	Installed at the base of a fence, near forestry woodland, microphone 1m agl facing north.
D11	NX 26103 68246	54.978379	-4.7188156	Attached to a willow tree, near current wind farm in the south, microphone 1m agl facing north west.

Table TA_8.3.3 - Deployment lengths of detectors

Survey Session	Survey Dates	Detector	Habitat	Nights Recorded
Spring 2019	02.05.19 - 16.05.19	D1	Open/edge	14
		D2	Open	14
		D3	Open	14
		D4	Open/water	14
		D5	Open	14
		D6	Open	2*
		D7	Edge/water	14
		D8	Edge/water	14
		D9	Open/building	14
		D10	Edge	14
		D11	Open/edge	14
				142 nights / 11 detectors = average 12.9 nights per detector
Summer 2019	03.06.19 - 17.06.19	D1	Open/edge	14
		D2	Open	11
		D3	Open	0 (re-deployed)
		D4	Open/water	14
		D5	Open	14
		D6	Open	14
		D7	Edge/water	14
		D8	Edge/water	14
		D9	Open/building	14
		D10	Edge	14
		D11	Open/edge	14
	26.06.19 - 18.07.19	D3	Open	21
				158 nights / 11 detectors = average 14.4 nights per detector
Autumn 2019	21.08.19 - 02.09.19	D1	Open/edge	12
		D2	Open	12
	19.08.19 - 02.09.19	D3	Open	14
	21.08.19 - 02.09.19	D4	Open/water	12
		D5	Open	12
	19.08.19 - 02.09.19	D6	Open	14

Survey Session	Survey Dates	Detector	Habitat	Nights Recorded
	21.08.19 - 02.09.19	D7	Edge/water	2*
		D8	Edge/water	12
	19.08.19 - 02.09.19	D9	Open/building	14
	20.08.19 - 02.09.19	D10	Edge	13
		D11	Open/edge	13
				130 nights / 11 detectors = average 11.8 nights per detector

*detector malfunctioned and did not record for the required number of nights.

3.6 Automated Bat Detector Analysis

3.6.1 Bat activity was downloaded from the SD memory cards and onto PCs in .wav file format and analysed using Anabat Insight (v 1.9.0-4-g15fdd88) software (Titley Scientific).

3.6.2 Insight includes an auto-identification (ID) tool called Bat Classify UK which was designed to allow identification of British bat species based on call parameters. The data was processed in either one of two ways. Data from Spring and Summer were inputted into Insight and Bat Classify was run on each night folder from each detector at 80% confidence. An audit was carried out as follows and calls were re-labelled as appropriate:

- 25% of all *Pipistrellus* bat calls;
- 100% of all *Myotis* bat calls;
- 100% NSL (noctule/serotine/Leisler's) calls;
- 100% of any rare species; and
- 100% of any calls with multi-species labels.

3.6.3 From the analysed folder all non-labelled files were run through Bat Classify again but at a lower threshold of 60% confidence. Of the output of labelled files, 100% were checked for any false positive identification, and a minimum of 25% of the remaining files with no labels (i.e. those still with no labels) were checked to confirm they were non-bat-related, other noise files.

3.6.4 Data from Autumn were inputted into Insight and initially sorted using a pre-determined filter called 'All Bats'. Any files with no bats were sorted into a Trash folder. Every file in the Trash folder was then manually audited to ensure no files containing bats had been moved there. If files containing bats were found they were restored to their original location. The auto-ID (Bat Classify) was then run on all of the files containing bat calls, at 70% confidence. Of all of the calls with generated species labels, the audit was carried out as above (see para 3.6.2). Any files with no bat registrations were removed.

3.6.5 Once all of the files containing bat calls were labelled and the appropriate audit had occurred, the data were exported from Insight, per season and per detector location, using the disperse reporting format.

3.6.6 Guidance on call parameters was taken from Russ (2012) and Middleton *et al*. (2014).

3.7 Quantifying Bat Activity

3.7.1 In order to allow an objective assessment of bat activity a measure of relative activity was obtained using the online tool Ecobat, hosted and developed by the Mammal Society (Lintott *et al.*, 2018). The data input reveals a percentile score and categorised level of bat activity and the results can be interpreted at the local scale and site scale. For the purposes of this report, a single labelled Insight file of up to a maximum of 10 seconds in length containing a sequence of bat pulses was counted as one bat registration (i.e. a single bat pass).

3.7.2 Data were entered to allow analysis for within night variation (as opposed to just between night).

3.7.3 The data set range used for reference for the percentile analysis was stratified to include:

- only records from within 30 days of the survey date;
- only records from within 100 km^2 of the survey location; and
- records using any make of bat detector.

3.8 Alternative Method of Comparing Bat Activity

3.8.1 SPR have provided data to allow comparison of bat activity at the Site to that collected from operational projects in the same region (i.e. south west Scotland) which have a known rate of bat fatalities. SPR has conducted detailed acoustic and fatality monitoring at 10 operational windfarms and acoustic monitoring aligned to the current windfarm guidance (SNH, 2019a) at three development phase projects. This combined data set comprised data collected at 71 unique locations with static bat detectors deployed for a total of 1,710 nights, providing a total sample size of 9,367 detector nights of bat activity (sample unit = one detector/night) after some samples were removed due to equipment failure. Of these, 7,269 samples are from nine projects in south-west Scotland and were used for the comparison analysis.

3.8.2 Carcass surveys have been undertaken at all 10 of the operational wind farms using methods consistent with the DEFRA study (Mathews *et al.*, 2016). Of these, six were found to have zero bat fatalities, two had an incidental rate of fatality (considered to be less than two bat fatalities/turbine/year) and two had fatality rates greater than two bat fatalities/turbine/year.

3.8.3 That dataset can be used as a reference for new projects by providing a comparison of bat activity within a region in a similar manner to Ecobat, but in addition it can benchmark activity rates for new projects against activity rates of sites with a known rate of bat fatality.

3.9 Assessing Potential Risk

3.9.1 The potential vulnerability of bat populations to windfarms is based on the collision risk, the relative abundance and the activity at the Site. **Table TA_8.3.4** shows the potential vulnerability of bat populations in Scotland based on the collision risk (inferred by a number of factors including habitat preference, flight speed, foraging techniques and echolocation characteristics) and relative abundance.

3.9.2 The risk factors of the Site also need to be considered (**Table TA_8.3.5**) based on the habitat types present and the size of the proposed project. The bat activity output from Ecobat can then be assessed along side the risk factors of the Site (**Table TA_8.3.5**) and taking into account the relative species vulnerability (**Table TA_8.3.4**) to complete an overall risk assessment (**Table TA_8.3.6**). This overall risk can then guide the decision-making process in relation to the mitigation options.

Table TA_8.3.4 - Level of potential vulnerability of populations of British bat species in Scotland (SNH, 2019a, adapted from Wray *et al.*, 2010)

Relative Abundance	Collision Risk		
	Low	Medium	High
Common species			Soprano pipistrelle Common pipistrelle
Rarer species	Brown long-eared bat Daubenton's bat Natterer's bat		
Rarest species	Whiskered bat Brandt's bat		Noctule bat Leisler's bat Nathusius' pipistrelle
Green = low population vulnerability Amber = medium population vulnerability Red = high population vulnerability			

Table TA_8.3.5 - Site risk levels based on habitat risk and project description (SNH, 2019a)

Site Risk Level (1-5)*		Project Size		
		Small	Medium	Large
Habitat Risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5
Green (1-2) = lowest/low site risk Amber (3) = medium site risk Red (4-5) = high/highest site risk				

Habitat Risk	Description
Low	Small number of potential roost features, of low quality Low quality foraging habitat that could be used by small numbers of foraging bats Isolated site not connected to the wider landscape by prominent linear features
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site Extensive and diverse habitat mosaic of high quality for foraging bats Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows At/near edge of range and/or on an important flyway Close to key roost and/or swarming site
Project Size	**Description**
Small	Small scale development (≤10 turbines). No other wind energy developments within 10 km. Comprising turbines <50 m in height
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5 km. Comprising turbines 50-100 m in height
Large	Largest developments (>40 turbines) with other wind energy developments within 5 km. Comprising turbines >100 m in height

Table TA_8.3.6 - Overall risk assessment (SNH, 2019)

	Ecobat Activity Category					
Site Risk	Nil (0)	Low (1)	Low-moderate (2)	Moderate (3)	Moderate-high (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	16	20
Highest (5)	0	5	10	15	20	25
Green (0-4) = Low risk Amber (5-12) = medium risk Red (15-25) = high risk						

3.10 Limitations

3.10.1 The detectors were located as close as possible to proposed turbine locations. The turbine locations were altered during the survey period but it was decided, after consultation with ITPEnergised, that in order to allow consistency the detector locations would not change so as to allow comparable results between seasons. The detectors were still in habitats representative of where the turbines were to be constructed and so it is considered the conclusions of the study would still be as strong and as meaningful in terms of the results of bat activity.

3.10.2 Due to errors with the detectors, memory cards or batteries it was not always possible to achieve ten consecutive nights of recording on all detectors simultaneously. The detector D3 was redeployed 75 m from the original position in the Summer period after it recorded for only two nights due to being damaged by livestock. In Spring and Autumn detectors D6 and D7 did not record for the full period but due to time restrictions could not be redeployed at Site.

3.10.3 There was no internal access to the structures at High Eldrig due to the dilapidated condition of the buildings. The assessment for bats was carried out from the exterior, and the inside was only viewed from open doors and windows, so evidence could have been missed.

3.10.4 Weather data from a met mast on site was obtained, although data were not in suitable format to allow inclusion within this report for comparison against bat activity.

3.10.5 The detector records in Full Spectrum, but the application of any filters created within the Insight software takes data only from a ZCA version of the recorded call. Irrespective of this it was the Full Spectrum version of any call, or other noise, being audited that was investigated manually.

3.10.6 There are several limitations with regards to Bat Classify, the auto-ID plug-in used in Insight. Because Bat Classify was designed for woodland bat species there is no species label allocation for Nathusius' pipistrelle. Nathusius' pipistrelle bat calls would therefore only be identified during the audit of either noise files or tracks containing other pipistrelle calls. Also, calls with low frequency components may be allocated the species label NSL, meaning noctule/serotine/Leisler's. Calls labelled as NSL were found often not to be bat calls as instead they contained social calls relating to common or soprano pipistrelle, or background noise such as rain, small mammal calls or bird noise.

3.10.7 There are limitations with regards to the identification of bat species using sound analysis (Russ, 2012). For example, a pipistrelle bat calling at 50kHz could be either a common or a soprano pipistrelle because their frequency ranges overlap and therefore would be labelled an unidentified pipistrelle. In addition to this, some very faint pipistrelle calls cannot be identified due to the signal being too weak to analyse using the software. A similar issue is encountered while analysing *Nyctalus* species calls, as the two species, noctule and Leisler's bat will produce calls that overlap in frequency, depending on habitat and bat behaviour. Because of this all calls from these two species were labelled as *Nyctalus* species and separation to species level was not attempted. Both of these species would be treated the same for assessment purposes in any case. Serotine bats (*Eptesicus seritonus*) are not found in Scotland and so any confirmed bat calls with this label were a bat from the *Nyctalus* genus (noctule or Leisler's). Similarly, the echolocation calls of *Myotis* bats are notoriously difficult to narrow down to a species due to structural similarities and rather than attempt separation bats from this genus were labelled as *Myotis* species. All species of *Myotis* occurring within Scotland are deemed to be at the same level of collision risk (i.e. low) when considering wind farm development.

3.10.8 The approach to carrying out the analysis through Insight was amended after the Summer period. However, due to the rigorous auditing process bat calls were unlikely to be mis-identified or missed altogether (i.e. be categorised as noise) and so the variation in approach is not considered to have an impact on the resultant data. It should be borne in mind, that with the exception of *Pipistrellus* species, 100% of all other bat calls were checked.

3.10.9 When the analysis of the results was provided by Ecobat, an error was seen to have occurred with regards to the number of *Pipistrellus* bat passes; the number had inflated from 92 to 1,700. Due to time constraints of report deadlines it was not possibly to run the analysis again, and upon conversation with the Ecobat Data and Information Officer (who did not know why the error had happened) and ITPEnergised, it was decided that *Pipistrellus* passes

would be removed from the Ecobat analysis. Therefore 92 passes of 3,860, or 2.4% of all passes were removed from the analysis, bringing the total bat passes to 3,768.

3.10.10 When data are entered into Ecobat for analysis, there is no allowance for entering nights where no bat passes were recorded, and so the analysis is carried out only on presence data. This acts to skew the results and elevate the risk levels of the species. The detectors recorded on Site for 430 nights but bats were only recorded on 200 nights, and so more than half of the nights of recording have not been included within the analysis. On a site such as Kilgallioch where there is open, remote ground and few roosting opportunities or suitable habitat features for bats, it is not unexpected to have nights where bats have not been recorded, due to the fact that there are no bats on these occasions (i.e. rather than due to any other factor such as inclement weather). Although the output from Ecobat has been used to guide the results and discussion of this report, as per the recommendations of the guidelines (SNH, 2019a), it is clear that results incorporating all of the data from the Site (both presence and absence) would have given clearer results to base recommendations for mitigation and compensation on.

4 Results

4.1 Desk Study Results

4.1.1 A resources and database search was carried out during September 2019. The results are shown in **Table TA_8.3.7** below. Where no records exist for a particular species, the Bat Distribution Atlas (Richardson, 2000) has been consulted to identify species known to occur in the area.

4.1.2 There are no bat records in ScoMam within 10 km from within the last 10 years.

4.1.3 The Dumfries and Galloway LBAP (Dumfries and Galloway Biodiversity Partnership, 2009) contains a Species Statement for mammals, and the following bat species are listed as Local Priority Species:

- common pipistrelle;
- soprano pipistrelle;
- brown long-eared bat;
- Daubenton's bat;
- whiskered bat;
- Natterer's bat;
- noctule; and
- Leisler's bat.

4.1.4 The following Habitat Action Plans may be relevant to the protection of bats at the study Site:

- traditional field boundaries (e.g. drystone dykes and sheep pens);
- farm woods and shelter belts; and
- walls and buildings.

4.1.5 There are four designated sites located within 10km of the Site (SNH, 2019b). These include Kirkcowan Flow Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC), which borders the proposed development to the north. Other designated sites include Blood Moss SSSI, Kilhern Moss SSSI and Ring Moss SSSI. All of the sites are designated for their blanket bog or raised bog habitats (see **Table TA_8.3.8**).

Table TA_8.3.7 - Resources and database search results

Species	Potential Roosting within Structures and Trees at the Site*	Record Type	Location
Soprano pipistrelle	High	Records provided by SNH Bat Casework Recording Log in a domestic dwelling, accessed through NBN Atlas website (data set covered by a Open Government Licence (OGL): http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/)**	Within 8.5km south west of the site
Common pipistrelle (*P. pipistrellus*)	High	Records provided by The BCT Roost Count Survey, accessed through NBN Atlas website (data set covered by a Creative Commons with Attribution 4.0 Licence (CC-BY): https://creativecommons.org/licenses/by/4.0/legalcode)**	Within 5.5km south east of the site
Nathusius' pipistrelle (*P. nathusii*)	Low	Known to occur in this area	
Brown long-eared bat (*Plecotus auritus*)	Low	Known to occur in this area	
Daubenton's bat (*Myotis daubentonii*)	Moderate	Known to occur in this area	
Natterer's bat (*M. nattereri*)	Moderate	Known to occur in this area	
Whiskered bat (*M. mystacinus*)	Low	Known to occur in this area	
Noctule (*Nyctalus noctula*)	Low	Known to occur in this area	
Leisler's bat (*N. leisleri*)	Low	Known to occur in this area	
Notes: The lack of bat records in any given area should by no means be interpreted as an indication that no bats and/or roosts exist. *The potential for the species to be found at the site takes into account not just the geographic species distribution but also the habitat in and around the site. ** The Data Provider, Original Recorder [where identified], and the NBN Trust bear no responsibility for any further analysis or interpretation of that material, data and/or information.			

Table TA_8.3.8 - Statutory designated sites

Name and Distance from Site	Details
Kirkcowan Flow SAC/SSSI The site borders the proposed windfarm site to the north	**Designation:** SAC/SSSI **Notified natural features:** **SAC** - blanket bog and depressions on peat substrates. **SSSI -** blanket bog.

Name and Distance from Site	Details
River Bladnoch SAC The site borders the proposed windfarm site to the west and south	**Designation:** SAC **Notified natural features:** **SAC** - Atlantic salmon (*Salmo salar*).
Blood Moss SSSI 3.5km north east of the central point of the site	**Designation:** SSSI **Notified natural features:** **SSSI -** blanket bog.
Kilhern Moss SAC 7.7km south west of the central point of the site	**Designation:** SAC/SSSI **Notified natural features:** **SAC** - blanket bog and depressions on peat substrates. **SSSI -** blanket bog.
Ring Moss SSSI 8.6km south-east of the central point of the site	**Designation:** SSSI **Notified natural features:** **SSSI -** raised bog.

4.2 Preliminary Roost Assessment of Buildings

4.2.1 The only buildings within the development boundary are those at High Eldrig. The former farmhouse is situated to the south of the farmyard at NX 24997 69148 and north of that are stone barns at NX 24991 69177.

4.2.2 The farmhouse (**Figure TA_8.3.2**) is constructed from corrugated metal overlain on brick walls, with a pitched sheet metal roof. The doors and windows were open to the elements and internally it could be seen that walls were crumbling and wooden cladding was removed in places. Evidence of bird nesting was seen but there was no evidence of bat roosting (although close inspection of the inside was not possible for health and safety reasons). There were features bats could use for roosting such as spaces between the bricks where mortar was missing, behind internal wooden cladding and around loose stonework of the chimneys on the inside. The structure was assessed as having moderate summer roost suitability and low winter roost suitability.

4.2.3 The barns are constructed of stone with pitched slate roofs lined internally with wooden sarking (**Figures TA_8.3.3** and **TA_8.3.4**). There are open doorways on both the north and the south sides and the internal space is partitioned into several rooms. One of the spaces had an enclosed loft which was not entered. Slates were missing in places letting water in. The barns were used for storage of farm goods and look to have been used to shelter animals at some point. Although the condition of the barns looked better than the farmhouse a thorough internal inspection was not carried out. Suitable locations for bat roosting included under slates, at wallheads, within crevices in the stonework, and within the wooden lintels of the doorways. The barns were assessed as having high bat roost suitability in summer and moderate roost suitability in winter. There was evidence of bird nesting in the barns.

4.3 Preliminary Roost Assessment of Trees

4.3.1 Trees with potential for use by roosting bats are situated close to the barns at High Eldrig (**Figure TA_8.3.5**). There are no other trees with suitability for use by roosting bats within the Site. The trees at High Eldrig were only assessed from the ground and not subject to an endoscope inspection or aerial inspection of elevated features.

4.4 Winter Hibernation Assessment Results

4.4.1 The barns were assessed as having moderate suitability for winter roosting bats and the farmhouse had low winter suitability. There are features suitable for small numbers of bats but due to the partially exposed nature of both structures it is considered unlikely for a large hibernation roost to be present as the conditions are not optimal with regards to the protection from winter weather and temperature changes.

Figure TA_8.3.2 - Farmhouse at High Eldrig

Figure TA_8.3.3 - Stone barns

Figure TA_8.3.4 - Inside of stone barns

Figure TA_8.3.5 - Broadleaved trees near High Eldrig

4.5 Whole Site Results

4.5.1 The resultant tables and figures from Ecobat refer to 'month' whereby May constitutes Spring, June is Summer and August and September are Autumn.

4.5.2 Eleven detectors were located throughout the Site over three survey seasons and a total recording time of 430 nights was achieved, averaging 13 nights per detector per season. The location of the detectors is shown in **Figure TA_8.3.1.**

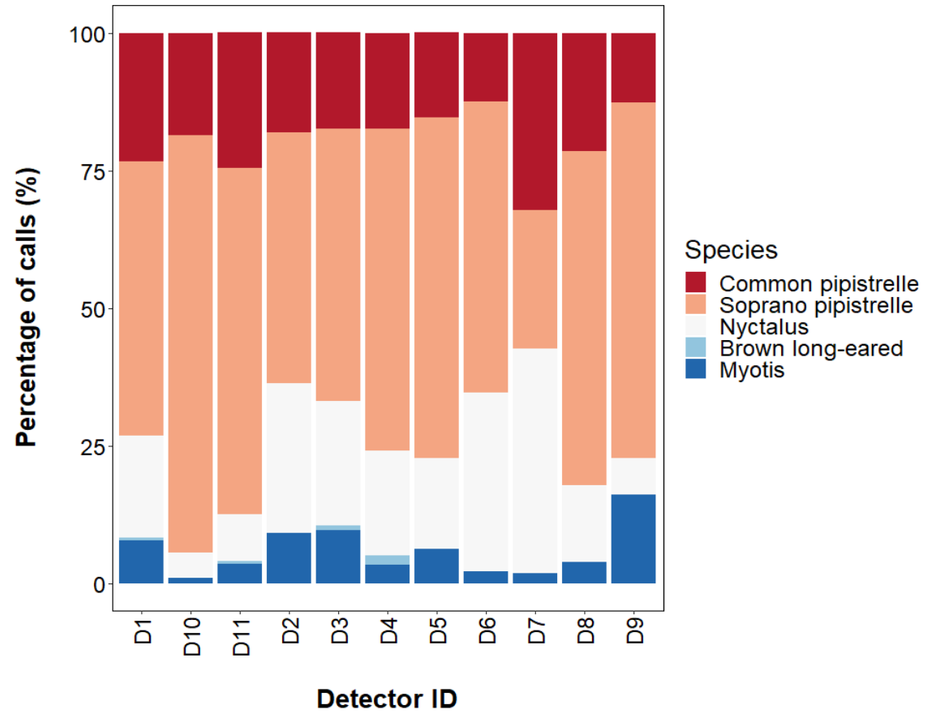
4.5.3 In total, five species (or genera in the case of more cryptic species) were recorded on the static detectors: soprano pipistrelle, common pipistrelle, *Myotis* species, *Nyctalus* species and brown long-eared bat. Across all detectors for the whole survey period, the total number of passes of all bat species was 3,768, shown in **Table TA_8.3.9**. The most commonly recorded species was soprano pipistrelle (64.1% of all bat passes), followed by common pipistrelle which made up 19.3% of all bat passes. 11.4% of all bat passes recorded were from *Nyctalus* species (noctule or Leisler's bat), followed by *Myotis* species (5.1%) and brown long-eared bat (0.2%).

Table TA_8.3.9 - Total number of bat passes recorded for each species across all detectors

Species/Species Group	No. of Passes	Percentage of total (%)
Common pipistrelle	727	19.3
Soprano pipistrelle	2,416	64.1
Nyctalus	428	11.4
Brown long-eared	6	0.2
Myotis	191	5.1
Total	**3,768**	100.1

4.5.4 The species composition of passes at each detector (D1 to D11) is shown as a percentage in **Figure TA_8.3.6.** Soprano pipistrelle passes were most frequent at D10, and common pipistrelle passes were most frequent at D7, as were *Nyctalus* passes. D4 recorded most activity of brown long-eared bat, whilst *Myotis* activity was most frequent at D9. D7 and D10 were close to linear features (the river, and a wall and coniferous plantation respectively) while D9 was within 60 m of High Eldrig Farm. D4 was located in open habitat.

Figure TA_8.3.6 - Species composition of bat passes at each detector



4.5.5 As the detectors were not sampling the whole Site, presence only data has been used as a precaution (i.e. nights where no bats of a certain species were recorded have been removed from the analysis). The nightly bat pass rate (bat passes per hour) only takes into account the presence, not the absence, of each bat species so for each night, there is no 'zero data' for when species were not detected.

4.5.6 The median pass rate has been chosen to present the data, as bat activity levels between nights can be highly variable, and thus the median provides a more reliable value than the mean (Lintott and Mathews, 2018). The data set is unlikely to be normally distributed, therefore the median will be the most appropriate metric to report.

4.5.7 The median nightly pass rate of each species at each detector is shown in **Table TA_8.3.10**. Common pipistrelle showed the highest median pass rate at D8 (0.6 bat passes/hour/night) while the lowest (0.1 passes/hour/night) was recorded at D2, D4 and D6. The highest activity overall was seen by soprano pipistrelle at D8 (1.0 bat pass/hour/night), with its lowest (0.3 passes/hour/night) being recorded at six of the detectors. *Nyctalus* activity ranged between 0.1 passes/hour/night at D4 to 0.5 passes/hour/night at D8 and D10. *Myotis* species activity was low across all detectors, with rates of 0.1 or 0.2 passes/hour/night recorded, with the exception of D9 where a rate of 0.4 passes/hour/night was recorded. Brown long-eared bat activity was low at the four detectors where it was encountered.

Table TA_8.3.10 - Median pass rate of each species/species group per detector

Species/Species Group	Detector	Median Pass Rate (passes/hour/night)
Common pipistrelle	D1	0.3
	D2	0.1
	D3	0.2
	D4	0.1
	D5	0.2
	D6	0.1
	D7	0.4
	D8	0.6
	D9	0.3
	D10	0.4
	D11	0.4
Soprano pipistrelle	D1	0.4
	D2	0.3
	D3	0.5
	D4	0.3
	D5	0.3
	D6	0.3
	D7	0.3
	D8	1
	D9	0.3
	D10	0.7
	D11	0.9
Nyctalus	D1	0.4
	D2	0.2
	D3	0.3
	D4	0.1
	D5	0.2
	D6	0.4
	D7	0.4
	D8	0.5
	D9	0.2
	D10	0.5
	D11	0.2
Myotis	D1	0.1
	D2	0.1
	D3	0.2
	D4	0.1
	D5	0.1
	D6	0.1
	D7	0.1
	D8	0.1
	D9	0.4
	D10	0.2
	D11	0.1
Brown long-eared	D1	0.1
	D3	0.1
	D4	0.1
	D8	0.1
	D11	0.1

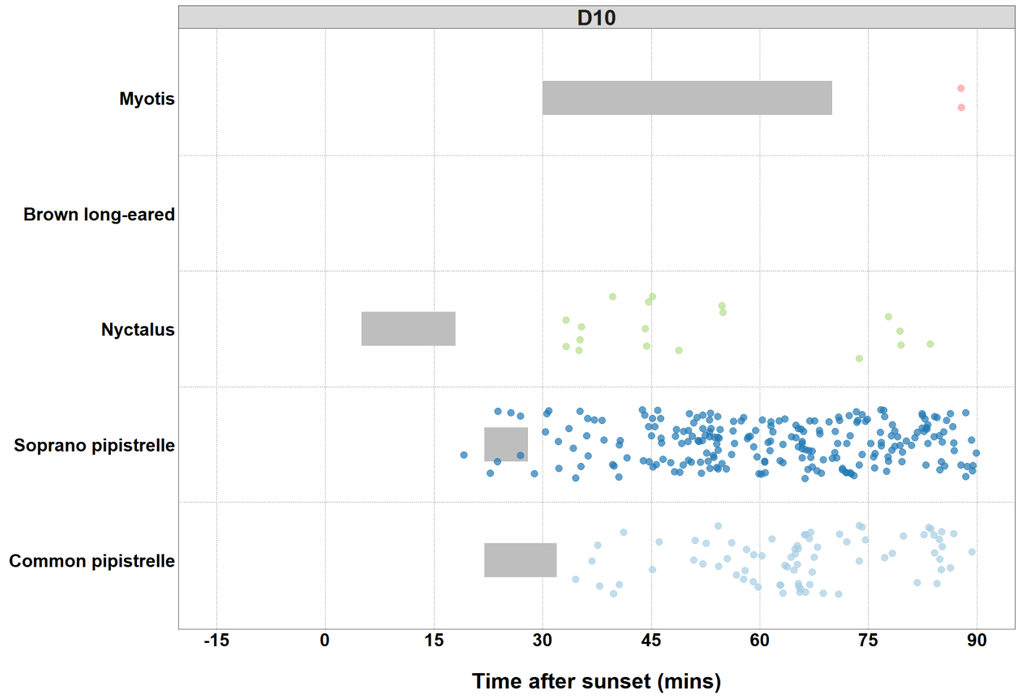
4.6 Potential Roosts Within or Close To the Site

4.6.1 Ecobat showed that on four occasions (20.08.19, 24.08.19, 25.08.19 and 01.09.19) there were high numbers of soprano pipistrelle recorded on D10 within the species-specific roost emergence time which may potentially indicate a roost nearby (**Figure TA_8.3.7**). The median pass rate at D10 was only the third highest recorded (0.7 passes/hour/night, compared to higher rates of activity at D8 and D11).

4.6.2 There were other species recorded on other detectors close to the specific-emergence times although the numbers were not considered high enough to indicate the proximity of a roost.

4.6.3 Ecobat did not show *Myotis* passes within the species-specific emergence time around D9 which may indicate a roost, however median bat pass rate for Myotis species was highest at D9 (0.4 passes/hour/night). Given the proximity of D9 to the farm buildings it is possible there is a roost present.

Figure TA_8.3.7 - Species-specfic emergence time shown for D10; overlap of coloured dots on grey bar shows soprano pipistrelle activity close to and before the species-specific roost emergence time



4.7 Data Compared to Ecobat Reference Range

4.7.1 Using Ecobat the data gathered at the Site were compared to a stratified reference range of data from other Sites to allow for bat activity to be categorised into percentiles. The reference range for each species is shown in the last column in **Table TA_8.3.11**.

4.7.2 Activity bands were categorised into percentiles as follows:

- low activity: >0 to 20th percentiles;
- low/moderate activity: 21st to 40th percentiles;
- moderate activity: 41st to 60th percentiles;
- moderate/high activity: 61st to 80th percentiles; and
- high activity: 81st to 100th percentiles.

4.7.3 **Table TA_8.3.11** shows the median percentile and corresponding activity level, and maximum percentile and maximum activity level for each species for the Site as a whole. The median activity level for soprano pipistrelle, common pipistrelle and *Nyctalus* species was moderate, while median activity of *Myotis* species and brown long-eared bat was low. However, when considering the maximum percentile and corresponding activity level, common pipistrelle, soprano pipistrelle, *Nyctalus* and *Myotis* species all displayed high activity, while brown long-eared bat still showed low activity.

Table TA_8.3.11 - Summary table showing key metrics for each species for site as a whole

Species / Species Group	Median Percentile	Activity Level	95% CIs	Max Percentile	Activity Level	Nights Recorded	Reference Range
Common pipistrelle	50	Moderate	49.5-67.5	93	High	124	1,482
Soprano pipistrelle	57	Moderate	50.5-82	98	High	157	1,551
Nyctalus	50	Moderate	37-78	86	High	99	1,016
Myotis	10	Low	30-75	89	High	68	864
Brown long-eared	10	Low	10-10	10	Low	6	177

4.7.4 The activity levels were calculated per species or species group per month, to allow any temporal variations to be seen (**Table TA_8.3.12**). Again, median and maximum percentiles and corresponding activity levels were examined. In all species except brown long-eared bats, activity was highest in Autumn (August and/or September). For common pipistrelle the median percentile ranged between 37 and 71 with the greatest activity level occurring in September whereby activity was moderate/high in comparison to the reference range. The maximum percentile activity was greatest in August. A similar pattern was seen in soprano pipistrelle, with a greatest median percentile level in September (84th percentile, which corresponds to high activity level) and the maximum percentile was at its highest in August (98th percentile).

4.7.5 The median percentile was greatest in *Nyctalus* bats in August although this level was moderate comparable to reference sites, while the maximum percentile, also in August was high (86th percentile) compared to the reference range). The median percentiles of *Myotis* species were low in May, June and August (10th percentile) and greater in September, although maximum percentile was 89 in May which in, comparison to the reference range, was high. The percentiles for median and maximum brown long-eared bat activity were low for both months the species was encountered.

Table TA_8.3.12 - Summary table showing key metrics for each species for the whole site, split by month

Species/ Species Group	Month	Median Percentile	Activity Level	95% CIs	Max Percentile	Activity Level	Nights Recorded
Common pipistrelle	May	37	Low/ moderate	49.5 - 67.5	81	High	9
	Jun	37	Low/ moderate	49.5 - 67.5	91	High	42
	Aug	50	Moderate	49.5 - 67.5	93	High	68
	Sep	71	Moderate/ high	49.5 - 67.5	83	High	5
Soprano pipistrelle	May	10	Low	50.5 - 82	96	High	17
	Jun	37	Low/ moderate	50.5 - 82	87	High	43
	Aug	71	Moderate/ high	50.5 - 82	98	High	91
	Sep	84	High	50.5 - 82	96	High	6
Nyctalus	May	10	Low	33.5 - 78.5	50	Moderate	5

Species/ Species Group	Month	Median Percentile	Activity Level	95% CIs	Max Percentile	Activity Level	Nights Recorded
	Jun	24	Low/ moderate	33.5 - 78.5	69	Moderate/ high	28
	Aug	50	Moderate	37 - 78	86	High	62
	Sep	34	Low/ moderate	33.5 - 78.5	57	Moderate	4
Myotis	May	10	Low	30 - 75	89	High	21
	Jun	10	Low	10 - 30	10	Low	3
	Aug	10	Low	30 - 75	69	Moderate/ high	43
	Sep	37	Low/ moderate	10 - 30	37	Moderate	1
Brown long-eared	Jun	10	Low	10-10	10	Low	1
	Aug	10	Low	10-10	10	Low	5

4.7.6 **Table TA_8.3.13** shows the key metrics for each species split by detector. For common pipistrelle, activity level (median) percentile varied between 10 and 62 and was highest at D8 (moderate/high) and lowest at D2, D4 and D6 (low). The maximum percentile occurred at D10, although high activity was also seen at D8, D9 and D11. Median activity percentile for soprano pipistrelle varied between 34 (low/moderate) at D2 to 72 (moderate/high) at D8. The maximum percentile was also lowest at D2 (57, moderate activity) and highest at D10 (98, high activity), with high activity recorded at eight of the 11 detectors.

4.7.7 The median percentile for *Nyctalus* species was lowest at D4 and D11 (10th percentile, low activity) and peaked at the 62nd percentile at D8. Maximum percentiles ranged from 37 at D2, to high activity levels (85th and 86th percentile) at D6 and D8. Median activity for *Myotis* species was generally low, with only D3, D9 and D10 showing higher levels (24th, 50th and 37th percentiles, respectively). Maximum percentile ranged from low (D2, D4, D6 and D7) to high at D9 (89th percentile).

4.7.8 Brown long-eared passes were only recorded on five detectors, and the percentiles for median and maximum brown long-eared bat activity were low at all five locations.

Table TA_8.3.13 - Summary table showing key metrics for each species split by detector

Species/ Species Group	Detector	Median Percentile	Activity Level	95% CIs	Max Percentile	Activity Level	Nights Recorded
Common pipistrelle	D1	44	Moderate	33.5 - 59.5	79	Moderate/ high	12
	D2	10	Low	10 - 10	10	Low	2
	D3	24	Low/ moderate	10 - 43.5	66	Moderate/ high	8
	D4	10	Low	10 - 23.5	50	Moderate	7
	D5	37	Low/ moderate	10 - 55.5	74	Moderate/ high	5
	D6	10	Low	10 - 36	62	Moderate/ high	9
	D7	47	Moderate	23.5 - 61.5	71	Moderate/ high	10
	D8	62	Moderate/ high	49.5 - 67.5	91	High	20
	D9	44	Moderate	23.5 - 63.5	81	High	14
	D10	50	Moderate	37 - 69.5	93	High	19
	D11	54	Moderate	37 - 67.5	87	High	18
Soprano pipistrelle	D1	57	Moderate	33.5 - 70	84	High	15
	D2	34	Low/ moderate	33.5 - 33.5	57	Moderate	2
	D3	62	Moderate/ high	36 - 75	81	High	9
	D4	50	Moderate	10 - 62	74	Moderate/ high	10
	D5	50	Moderate	36 - 72.5	87	High	9
	D6	47	Moderate	10 - 69	87	High	12
	D7	37	Low/ moderate	23.5 - 49.5	62	Moderate/ high	11
	D8	72	Moderate/ high	48 - 79	96	High	22
	D9	50	Moderate	30 - 64.5	96	High	23
	D10	69	Moderate/ high	50.5 - 82	98	High	21
	D11	69	Moderate/ high	43.5 - 75	91	High	23
Nyctalus	D1	50	Moderate	30 - 62	71	Moderate/ high	10
	D2	24	Low/ moderate	23.5 - 23.5	37	Low/ moderate	2
	D3	50	Moderate	37 - 78	78	Moderate/ high	5
	D4	10	Low	10 - 23.5	50	Moderate	8
	D5	37	Low/ moderate	10 - 55.5	74	Moderate/ high	5
	D6	57	Moderate	23.5 - 75	85	High	7
	D7	50	Moderate	30 - 62	74	Moderate/ high	11
	D8	62	Moderate/ high	33.5 - 78.5	86	High	13
	D9	37	Low/ moderate	10 - 45	80	Moderate/ high	13
	D10	57	Moderate	33.5 - 66.5	78	Moderate/ high	12

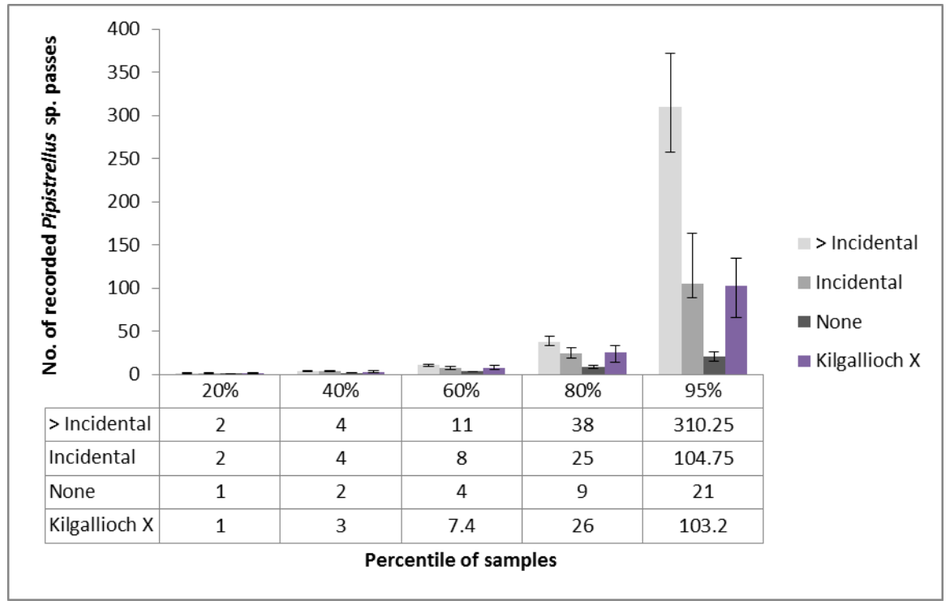
Species/ Species Group	Detector	Median Percentile	Activity Level	95% CIs	Max Percentile	Activity Level	Nights Recorded
	D11	10	Low	10 - 50	80	Moderate/ high	13
Myotis	D1	10	Low	10 - 30	50	Moderate	10
	D2	10	Low	0	10	Low	1
	D3	24	Low/ moderate	10 - 39.5	69	Moderate/ high	4
	D4	10	Low	10 - 10	10	Low	2
	D5	10	Low	10 - 10	37	Low/ moderate	5
	D6	10	Low	10 - 10	10	Low	3
	D7	10	Low	10 - 10	10	Low	2
	D8	10	Low	10 - 36	62	Moderate/ high	14
	D9	50	Moderate	30 - 75	89	High	11
	D10	37	Low/ moderate	10 - 50	57	Moderate	5
	D11	10	Low	10 - 30	57	Moderate	11
Brown long-eared	D1	10	Low	0	10	Low	1
	D3	10	Low	0	10	Low	1
	D4	10	Low	0	10	Low	1
	D8	10	Low	0	10	Low	1
	D11	10	Low	10 - 10	10	Low	2

4.8 Data Compared to SPR Reference Range

4.8.1 **Figure TA_8.3.8** shows the number of pipistrelle bat passes (soprano and common pipistrelle combined) per location per night at different percentiles compared to the same values derived from operational projects with different categories of bat fatality. From these data it is seen that the bat activity at the proposed Development may generate a fatality rate between zero and incidental as the activity level falls between these two benchmarks at four of the five percentiles. At the 80th percentile the fatality rate is between incidental and greater than incidental.

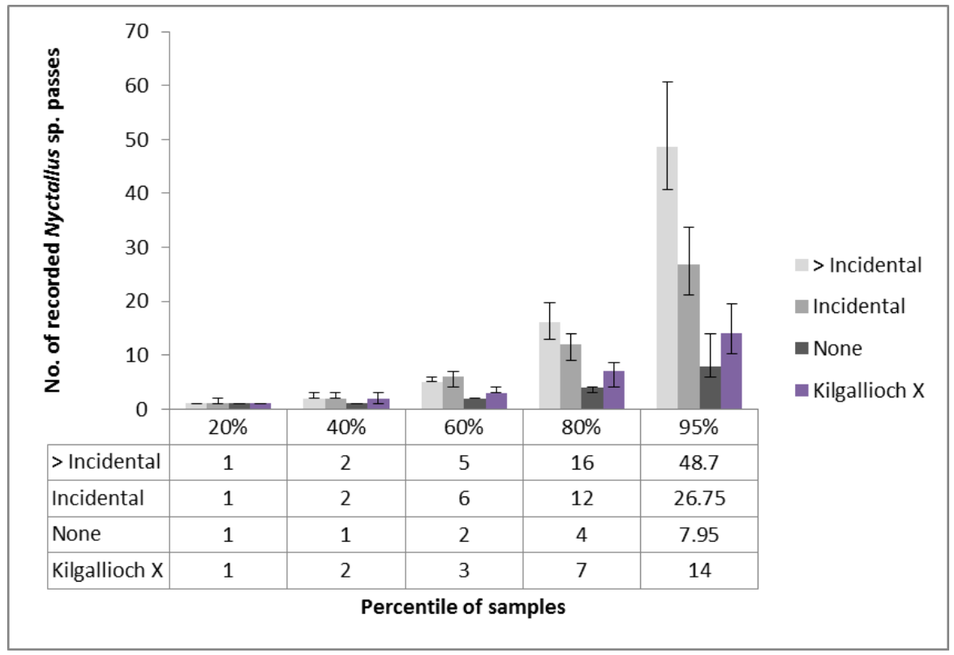
4.8.2 **Figure TA_8.3.9** shows the number of *Nyctalus* species bat passes per location per night at different percentiles compared to the same values derived from operational projects with different categories of bat fatality. From these data it is expected that the bat activity at the proposed Development will generate a fatality rate between zero and incidental as the activity level falls between these two benchmarks at each percentile.

Figure TA_8.3.8 - Number of pipistrelle bat passes per night per location at different percentiles compared to operational projects with a known category of bat fatality.



	20%	40%	60%	80%	95%
> Incidental	2	4	11	38	310.25
Incidental	2	4	8	25	104.75
None	1	2	4	9	21
Kilgallioch X	1	3	7.4	26	103.2

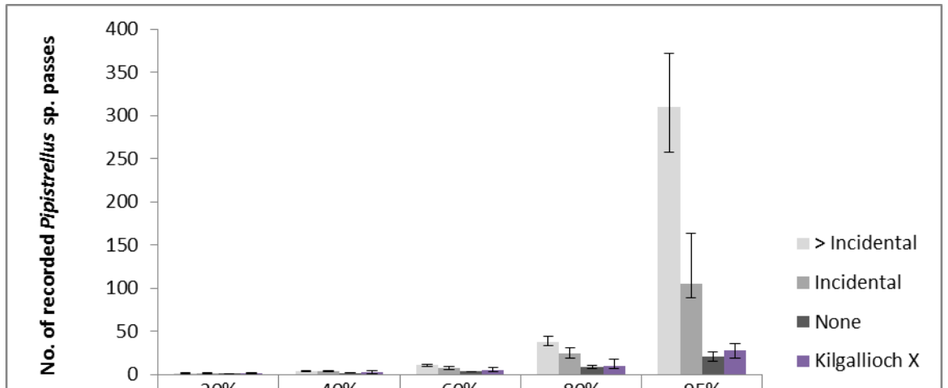
Figure TA_8.3.9 - Number of *Nyctalus* species bat passes per night per location at different percentiles compared to operational projects with a known category of bat fatality.



	20%	40%	60%	80%	95%
> Incidental	1	2	5	16	48.7
Incidental	1	2	6	12	26.75
None	1	1	2	4	7.95
Kilgallioch X	1	2	3	7	14

4.8.3 **Figure TA_8.3.10** shows, for locations D1 to D6 only, the number of pipistrelle bat passes (soprano and common pipistrelle combined) per location per night at different percentiles compared to the same values derived from operational projects with different categories of bat fatality. It can be seen that removing the activity recorded at locations where turbines will not be sited (i.e. D7 to D11) lowers the number of bat passes greatly and the fatality rate generated reduces to between zero and incidental at each percentile.

Figure TA_8.3.10 - At Locations D1 to D6 only: Number of pipistrelle bat passes per night per location at different percentiles compared to operational projects with a known category of bat fatality.

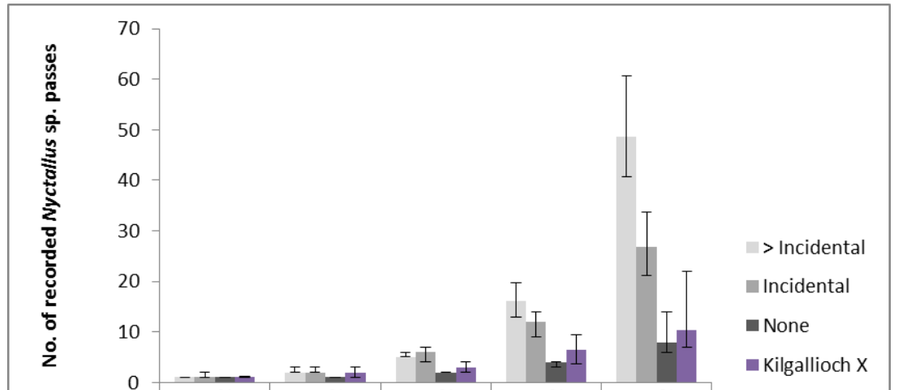


	20%	40%	60%	80%	95%
> Incidental	2	4	11	38	310.25
Incidental	2	4	8	25	104.75
None	1	2	4	9	21
Kilgallioch X	1	2.4	5.6	10	28.1

Percentile of samples

4.8.4 **Figure TA_8.3.11** shows, for locations D1 to D6 only, the number of *Nyctalus* species bat passes per location per night at different percentiles compared to the same values derived from operational projects with different categories of bat fatality. As was seen for pipistrelle species, removing the activity recorded at locations where turbines will not be sited (i.e. D7 to D11) lowers the number of bat passes and the fatality rate generated remains between zero and incidental at each percentile.

Figure TA_8.3.11 - At Locations D1 to D6 only: Number of *Nyctalus* species bat passes per night per location at different percentiles compared to operational projects with a known category of bat fatality.



	20%	40%	60%	80%	95%
> Incidental	1	2	5	16	48.7
Incidental	1	2	6	12	26.75
None	1	1	2	4	7.95
Kilgallioch X	1	2	3	6.4	10.4

Percentile of samples

4.9 Assessment of Potential Risk

4.9.1 Only high collision risk species (common and soprano pipistrelle and *Nyctalus* species) are included within the impact assessment. Low risk species (*Myotis* species and brown long-eared bat) have low collision risk, so the impact of the development on the local bat population would likely be negligible.

4.9.2 The Site has been assessed as having low habitat risk, as there are no potential roost features within the Site, the foraging habitat is of low quality and there are no prominent linear features connecting the Site with the wider landscape. It is proposed to install 11 turbines of 180m ground to blade tip height and so the project size has been assessed as medium. Therefore, the site risk level has been assessed as low (2), in line with **Table TA_8.3.5**.

4.9.3 Using **Table TA_8.3.6** which multiplies site risk (low, 2) against Ecobat activity category, the overall level of risk for each species across the whole site, and per detector and per month can be examined (**Table TA_8.3.14**). Both the median and maximum levels of activity were used so as to calculate the typical site risk level, and the maximum site risk level.

4.9.4 The overall risk level for all high risk species was either low (green) or medium (amber). No species are at high risk overall at any detector or during any temporal period. When considered per month, the maximum risk to common pipistrelle, soprano pipistrelle and *Nyctalus* bats was medium. The median risk was low for both pipistrelle species in May and June (i.e. Spring and Summer) but medium in August and September (i.e. Autumn). Overall risk was low in May, June and September for *Nyctalus* species but medium in August.

4.9.5 When looking at detector location including the whole Site, the maximum risk for all species/species groups is almost always medium (the exceptions being common pipistrelle and *Nyctalus* species at D2). The median risk varied between low and medium although for the whole Site, the risk is medium for the three species/species groups.

Table TA_8.3.14 - Overall risk assessment of high risk species for the site and per dectector

Species / Species Group	Location	Median Risk	Maximum Risk	Month	Median Risk	Maximum Risk
Common pipistrelle	Whole site	6	10	May	4	10
	D1	6	8	June	4	10
	D2	2	2	August	6	10
	D3	4	8	September	8	10
	D4	2	6			
	D5	4	8			
	D6	2	8			
	D7	6	8			
	D8	8	10			
	D9	6	10			
	D10	6	10			
	D11	6	10			
Soprano pipistrelle	Whole site	6	10	May	2	10
	D1	6	10	June	4	10
	D2	4	6	August	8	10
	D3	8	10	September	10	10
	D4	6	8			
	D5	6	10			
	D6	6	10			
	D7	4	8			
	D8	8	10			
	D9	6	10			
	D10	8	10			
	D11	8	10			
Nyctalus	Whole site	6	10	May	2	6
	D1	6	8	June	4	8
	D2	4	4	August	6	10
	D3	6	8	September	4	6
	D4	2	6			
	D5	4	8			
	D6	6	10			
	D7	6	8			
	D8	8	10			
	D9	4	8			
	D10	6	8			
	D11	2	8			

5 Discussion

5.1 Roosting

5.1.1 When establishing the conservation needs of bats there are three important aspects that should be considered when making changes to the local habitat or features. These are roosting sites, foraging areas and commuting/navigational corridors or features (Entwistle *et al.*, 2001).

5.1.2 Throughout the year, during periods of inactivity, all bats require safe and sheltered roosting sites. They will use different roosts at different times of the year. No bats were confirmed to be roosting at the Site during the survey period, although the only suitable features were the structures and broadleaved trees at High Eldrig. D9 located approximately 60 m from the farm buildings recorded *Myotis* bat passes in Spring (median bat pass rate of 0.9 passes/hour/night) with lower rates in Summer (none recorded) and Autumn (median pass rates of 0.2 passes/hour/night in August and no passes recorded in September). Median bat pass rate for *Myotis* species was highest at D9 (0.4 passes/hour/night) and activity (both median and maximum percentiles) was highest at D9. Ecobat analysis of the time after sunset that the bats were recorded does not indicate presence of a *Myotis* roost (i.e. bat passes were not recorded in the typical time window of emergence after sunset). However, given the proximity of D9 to the farm buildings it is possible there is a *Myotis* roost present in the structures. As activity and bat pass rates were lower in Summer and Autumn, it indicates that if there was a roost present it may have dispersed before the second period of monitoring or bats may have been moving away from the Site and therefore were not picked up on the detector.

5.1.3 The closest proposed turbine to High Eldrig (T11) is approximately 450 m away, and therefore this is a suitable distance that any bats roosting in the buildings or trees will not be impacted by the development. As such, no activity surveys were carried out and no further bat surveys of the farm or trees are recommended.

5.1.4 Ecobat showed that on four occasions there were high numbers of soprano pipistrelle recorded on D10 within the species-specific roost emergence time which may indicate a roost nearby. There are no roosting features near to D10; the detector was located near to a woodland edge and the closest potential roosting feature is High Eldrig (~700 m away). There are structures located over 2 km away from D10 which roosting bats could have come from; the access track through the existing Airies windfarm to the south east could act as a linear corridor along which bats could commute into the Site.

5.2 Foraging and Commuting

5.2.1 All bats within the UK require large amounts of insect food in order to survive and they require linear features (e.g. woodland edge, tree lines, waterways etc.) in order to orientate themselves in the dark and to act as commuting corridors between their roosts and their foraging areas. This is especially true for smaller species and a gap in a linear feature as little as 10m may act as a barrier to movement (Entwistle *et al.*, 2001). Such linear features can also provide a degree of protection from potential predators and from adverse weather. There are features within and close to the Site which can be used by foraging bats.

5.2.2 As would be expected, bat activity was lower at detectors located in open areas of habitat, and higher where detectors were located closer to linear features. Activity at D2 and D4 was low, when looking at both activity rates of bats (median passes/hour/night) and at percentiles of activity and these two detectors were located in the open with few, if any, habitat features. With the same logic it would be expected that activity would also be low at D3, D5 and D6 which were also in open habitat, and this was seen for some species but not all.

5.2.3 Highest activity for both pipistrelle species and *Nyctalus* bats was recorded at D8 and *Myotis* activity was highest at D9. D8 was on woodland edge and close to the Tarf Water, and 500 m from High Eldrig Farm (D9) and the access track leading in to the Site. D10 was also close to a woodland edge and closer to structures outwith the Site than other detectors. These three detectors were all located in the vicinity of habitat features which may be favourable to bats and which may be used by bats to access the Site. Once in the Site the presence of bats may be diluted, due to lack of habitat features, which explains the lower activity on the detectors in open habitat.

5.3 Comparison of Detectors at Turbine versus Non-Turbine Locations

5.3.1 Because the turbine locations changed during the survey programme, the detector locations were not all at proposed turbine locations. D7, D8, D10 and D11 were located closer to the River Tarf and forest edge than the proposed turbines will be. Also, there will now not be a turbine near High Eldrig although a detector (D9) was located there. This allows a comparison of bat activity at turbine versus non-turbine locations. For common pipistrelle median percentile was moderate or moderate/high for the five non-turbine locations, compared to low, low/moderate or moderate at the turbine locations (with activity highest at D1). For soprano pipistrelle activity was moderate/high at three of the non-turbine locations, although was also moderate/high at D3 and moderate at D1 which are locations where turbines are proposed. For *Nyctalus* species, activity was moderate/high at D8, but then similar at all other detector locations. *Myotis* species showed similar, with highest activity at D9, a non-turbine location compared to similar levels at tall other detectors. Activity for brown long-eared bats was low at all detector locations.

5.4 Impact Assessment

5.4.1 The impact assessment has provided an overall risk for median and maximum bat activity by multiplying site risk with Ecobat activity category. The maximum risk for common pipistrelle, soprano pipistrelle and *Nyctalus* species is medium at all detector locations except for D2, and during all survey months. The median risk is more variable, although for each species there was medium risk when the whole site was analysed. However, by focussing on the locations where turbines will be positioned, it can be seen that generally the risk at detector locations in open habitats (D2, D3, D4, D5 and D6) was low whereas risk at detectors closer to bat-friendly features was higher (D8, D9 and D10). Therefore, locating the turbines in open habitat means a low risk to bats using the site.

5.4.2 This low risk can also be demonstrated by comparing the activity at the Site and known bat fatality at operational SPR sites. When looking at the detectors sited where the turbines will be located, the predicted fatality rate is between zero and incidental (equating to less than two bats per turbine per year) for pipistrelle and *Nyctalus* species.

5.5 Mitigation and Compensation

5.5.1 The mitigation hierarchy states that a development must aim to avoid significant effects from the outset, and this means considerations made from an early stage of the project. If this cannot be achieved, the impacts must be mitigated.

5.5.2 When the detector locations were chosen they were to be located close to the proposed turbine locations. The turbine locations changed during the survey period although to allow for consistency the detectors positions did not change as they still sampled bat activity across the Site and in a range of habitats. The turbines are now to be located closer to the centre of the Site and further from any features which were shown to be favourable for bats and so the impact of the turbines on bats will be lower than imagined through the analysis.

5.5.3 The windfarm should be designed to allow the locations of the turbines to be situated well away from trees, forestry and water features to minimise the risk to bats. The survey guidelines (SNH, 2019a) suggests a minimum buffer of 50 m from rotor swept area to feature (e.g. woodland edge). The proposed layout shows there is a minimum buffer between turbine and habitat feature of around 250 m, more than that which is recommended so there are no further suggestions regarding the location (or relocation) of turbines.

5.5.4 Conservation considerations include reducing the impact of lighting during construction of the wind farm site. Limiting lighting to allow for some dark periods will also reduce the impact upon foraging bats. Whilst the site is under construction lights should be switched off during the night. Operational lighting during the construction phase and any permanent lighting to be installed should be directed away from any of the identified commuting and foraging routes (i.e. woodland edges and water courses) to avoid unnecessary disturbance to bats.

5.5.5 Temporal patterns in activity revealed the overall risk for common pipistrelle, soprano pipistrelle and *Nyctalus* species was lower in Spring and Summer and higher in Autumn. As there is no allowance for entering nights where no bat passes were recorded in Ecobat, the results will be skewed and therefore the medium risk recorded in Autumn will be significantly elevated above the actual risk level (more than half of the nights of recording have not been included within the analysis as no bats were recorded). Bearing in mind the overall temporal risk also includes locations which are no longer representative of turbine positioning (i.e. closer to bat-friendly habitat features) which further skews the results, no mitigation, such as curtailment, is considered necessary.

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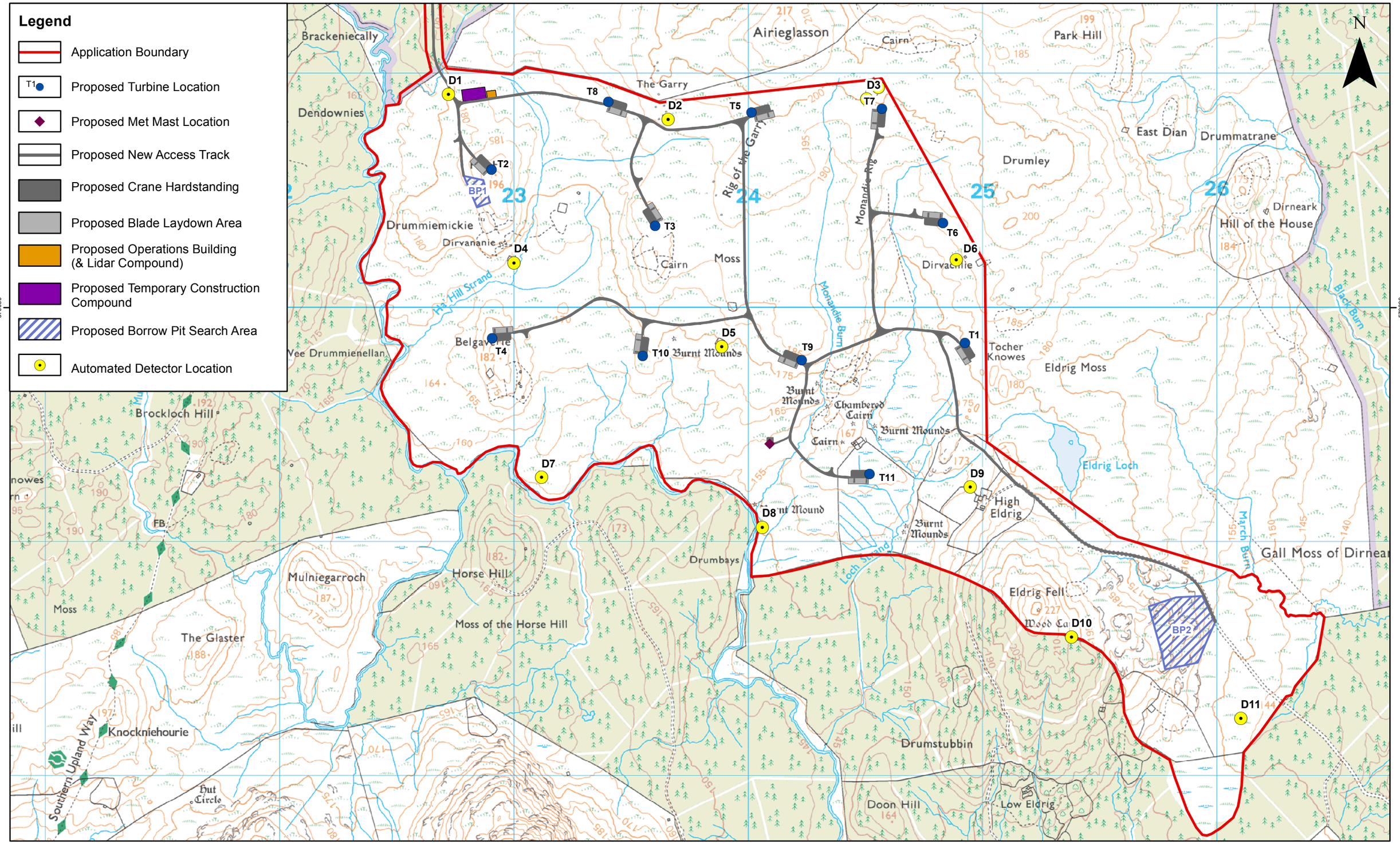

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	A	30/10/2019	RK	First Issue.		
	Rev	Date	By	Comment		

Kilgallioch Windfarm Extension

EIA Report

Location of Automated Bat Detectors

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