atmos CONSULTING

July 2026

Environmental Impact Assessment Report

Lairdmannoch Energy Park

Technical Appendix 6-7: Revised Bat Curtailment Strategy (Additional Information)

Lairdmannoch Energy Park Limited

wind2

your project our expertise

Contents

Tables

1. Overview

1.1.1. In May 2025, Lairdmannoch Energy Park Limited (the 'Applicant') submitted a planning application (Ref. No: ECU00004900) to the ECU under Section 36 of the Electricity Act 1989 and for deemed planning permission under Section 57 of the Town and Country Planning (Scotland) Act 1997 for the construction and operation of Lairdmannoch Energy Park (the 'Proposed Development').

1.1.2. The application included an Environmental Impact Assessment Report (the '2025 EIA Report'), prepared in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (the 'EIA Regulations').

1.1.3. NatureScot made the following comments in their consultation feedback dated 18 August 2025 regarding the curtailment strategy proposed across the Proposed Development Site to minimise the risk upon bat species, particularly, *Nyctalus* sp.:

> "*In relation to bats, we recommend further consideration be given to the curtailment strategy currently proposed for Turbine 7…"*
>
> and
>
> *"We note also that 5 of the 8 turbines are located within 200 metres of the forest edge. Whilst this is well in excess of the minimum 50 metre buffer between blade tip and forest edge, these turbines are in a zone that is more likely to be regularly used by bats given the favourable habitat in the vicinity…"*

1.1.4. In response to these comments, the Applicant has conducted further analysis of bat activity data and revised the original curtailment strategy presented in **Volume 3**, **Technical Appendix** (TA) **6-3: Bats** of the 2025 EIA Report. A revised curtailment strategy has subsequently been developed to better reflect the use of the Site by bats and minimise the risk of the Proposed Development.

1.1.5. This Technical Appendix has been prepared in support of **AI Chapter 6: Ecology**.

2. Data Analysis

2.1 Overall Bat Activity

2.1.1. Data collection took place during all seasons in 2023 and the summer and autumn seasons in 2024. Detectors were deployed in two habitat types: either open or woodland edge, whether forestry plantation or native broadleaf, as detailed in Table 6-7-1 below. The table presents the percentage of bat activity recorded at each detector location for both survey years.

2.1.2. Five detectors (Detectors 3-6 inclusive and Detector 8) were located within 200 m of woodland edge, (see **Figure 6-3-1**, Appendix A of **TA 6-3** of the 2025 EIA Report). These woodland edge detectors accounted for approximately 44% of activity in 2023 and 61% in 2024.

Table 6-7-1: Overall Bat Activity and Habitat Types in 2023 and 2024

Detector	Habitat Type	Percentage of Calls	
		2023	2024
1	Open	14.8%	10.6%
2	Open	36.9%	6.5%
3	Woodland Edge	6.9%	11.3%
4	Woodland Edge	6.7%	8.4%
5	Woodland Edge	7.8%	9.2%
6	Woodland Edge	17.7%	21.6%
7	Open	1.3%	11.7%
8	Woodland Edge	5.2%	10.6%
9	Open	2.6%	10.3%

2.2 *Nyctalus* sp. Activity

2.2.1. In 2023 the median risk associated with *Nyctalus* sp. was low, although the maximum risk ranged from low to high across detector locations, with the highest risk recorded at Detector 2 during the summer survey. Whereas in 2024, the median risk associated with *Nyctalus* sp. was low and the maximum risk was moderate. Overall *Nyctalus* sp. activity was substantially higher in 2023 than in 2024, with 2,397 bat passes recorded compared to 747 passes, respectively.

2.2.2. Initial data analysis identified exceptional and high-activity nights within the 2023 dataset that were not evident in the 2024 data. Accordingly, the 2023 dataset has been selected for further detailed analysis.

2.2.3. In 2023, *Nyctalus* sp. use of the Proposed Development Site varied between the turbines and throughout the night (see Table 6-7-2 below). Approximately 98% of all recorded *Nyctalus* sp. activity occurred during the summer and autumn season periods with approximately 45% of activity recorded at Detector 2.

Table 6-7-2: *Nyctalus* sp. Activity per Turbine per Season in 2023

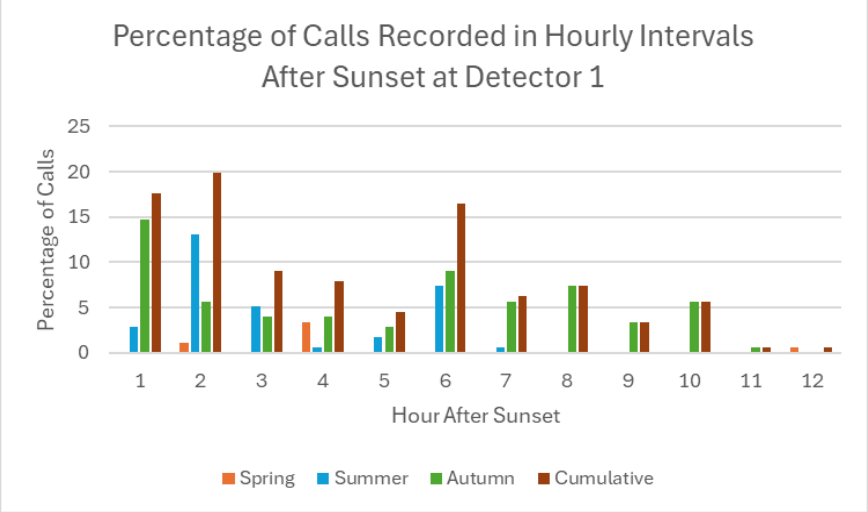
	Detector									
Season	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
Spring	10	21	0	10	0	4	0	1	0	**46**
Summer	55	1100	37	28	0	76	20	19	63	**1,398**
Autumn	111	77	127	102	213	229	0	95	0	**954**
Total	**176**	**1198**	**164**	**140**	**213**	**309**	**20**	**115**	**63**	**2,398**
Percentage	7.3%	50%	6.8%	5.8%	8.9%	12.9%	1%	4.8%	2.6%	

	Detector									
Season	1	2	3	4	5	6	7	8	9	Total
Habitat Type	Open	Open	WE	WE	WE	WE	Open	WE	Open	

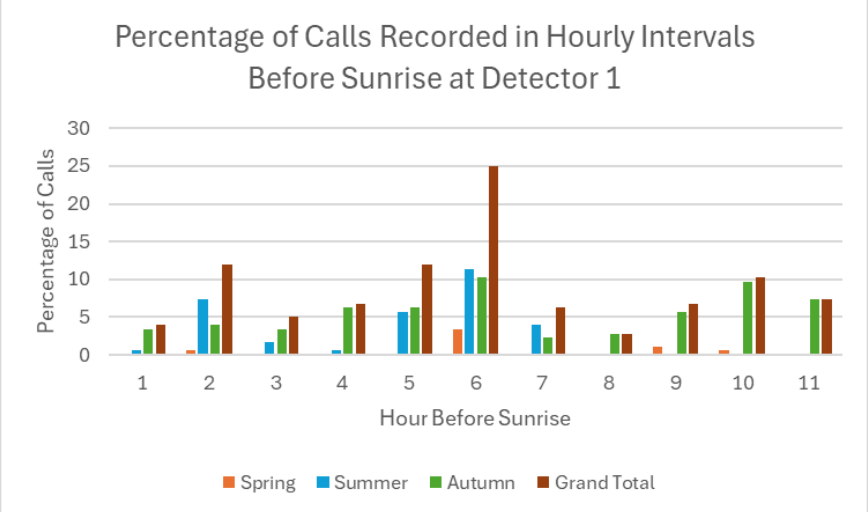
2.2.4. Activity was grouped into post-sunset and pre-sunrise hourly intervals per turbine per season which allows for further analysis into the spread of activity throughout the night. This data is displayed in Graphs 1-18 (see below).

2.2.5. Activity around Detector 1 accounted for approximately 7% of overall activity, more than half of which was recorded during the autumn (see Table 1). Activity around Detector 1 was concentrated within the hours 0-1, 2-3, and 5-6 after sunset, approximately 18%, 20% and 16%, respectively (see Graph 1). Activity was concentrated within the hours 5-6 before sunrise (see Graph 2).

Graph 1: Percentage of Calls Recorded within Hourly Intervals After Sunset at Detector 1

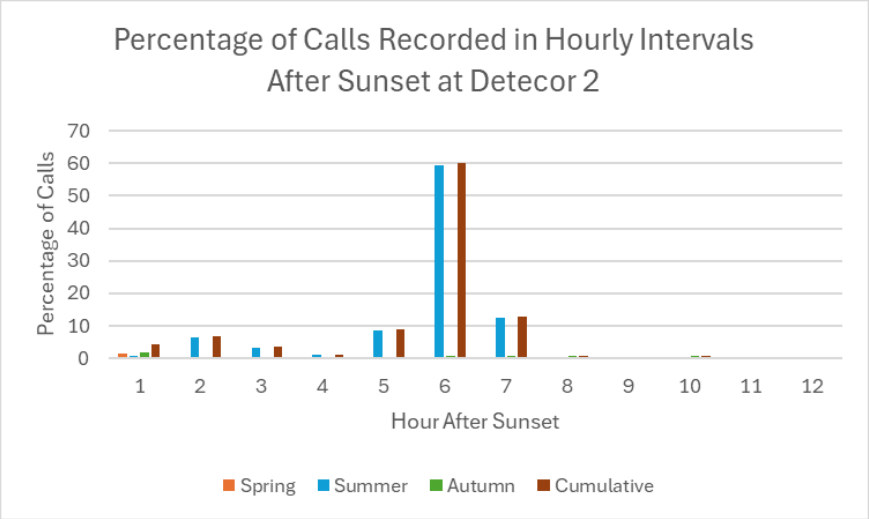


Graph 2: Percentage of Calls Recorded within Hourly Intervals Before Sunrise at Detector 1

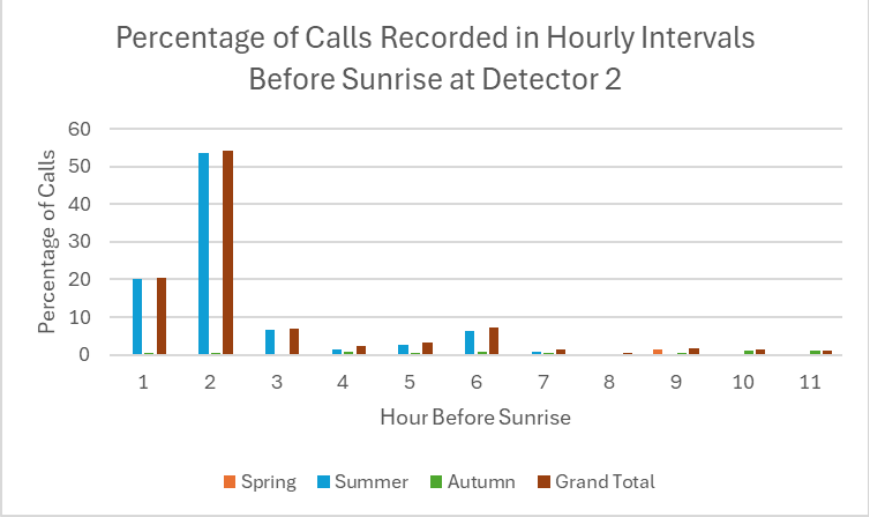


2.2.6. Activity around Detector 2 accounted for approximately 50% of overall activity across the Proposed Development Site, with the vast majority of this activity (approximately 92%) recorded during the summer survey period. Temporal analysis indicates that activity was concentrated during the first half of the night, with approximately 60% of passes recorded within 5-6 hours after sunset (see Graph 3). A second pronounced peak in activity was recorded shortly before dawn, with approximately 53% of calls occurring within 1-2 hours before sunrise (see Graph 4).

Graph 3: Percentage of Calls Recorded within Hourly Intervals After Sunset at Detector 2



Graph 4: Percentage of Calls Recorded within Hourly Intervals Before Sunrise at Detector 2

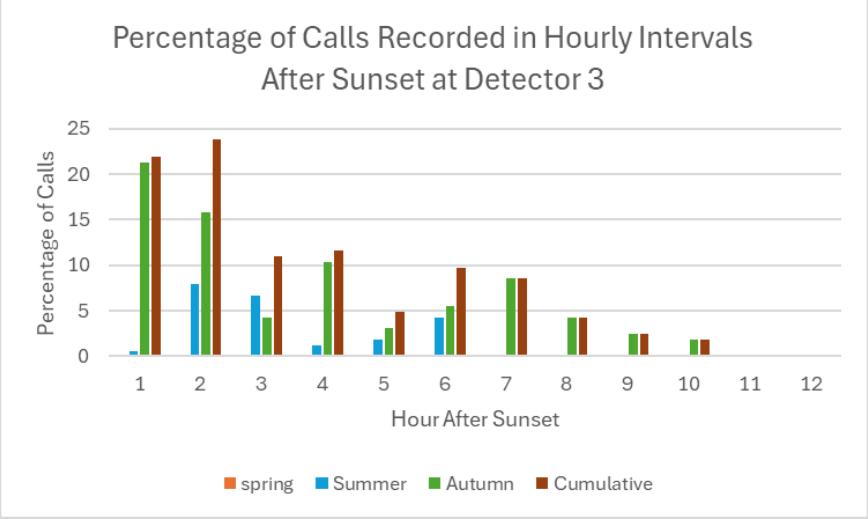


2.2.7. Activity around Detector 3 accounted for approximately 7% of overall *Nyctalus* sp. activity, all of which was recorded during the summer and autumn survey periods.

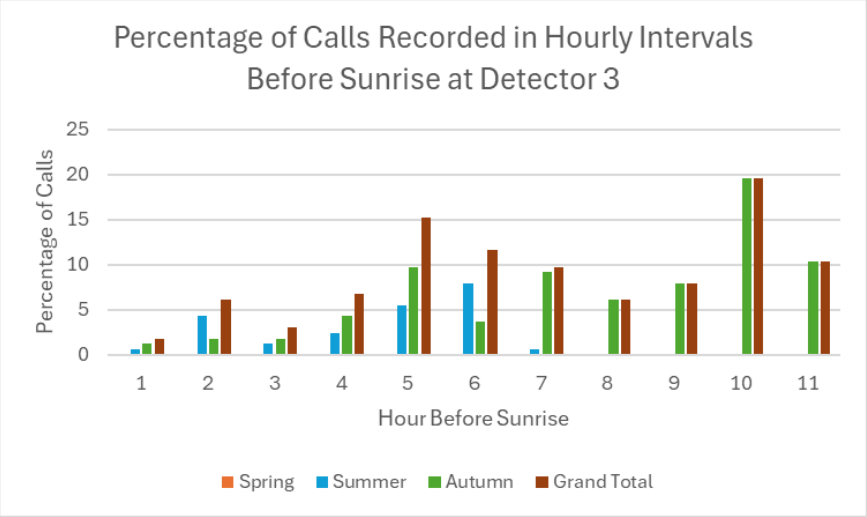
2.2.8. Activity was most concentrated during the early part of the night, with approximately 22% and 24% of calls recorded within 0–1 hour and 1–2 hours after sunset, respectively, the majority of which occurred during the autumn season (see Graph 5).

2.2.9. Analysis relative to sunrise indicates additional peaks in activity, with approximately 15% of passes recorded 4–5 hours before sunrise and 20% recorded 9–10 hours before sunrise (see Graph 6).

Graph 5: Percentage of Calls Recorded within Hourly Intervals After Sunset at Detector 3

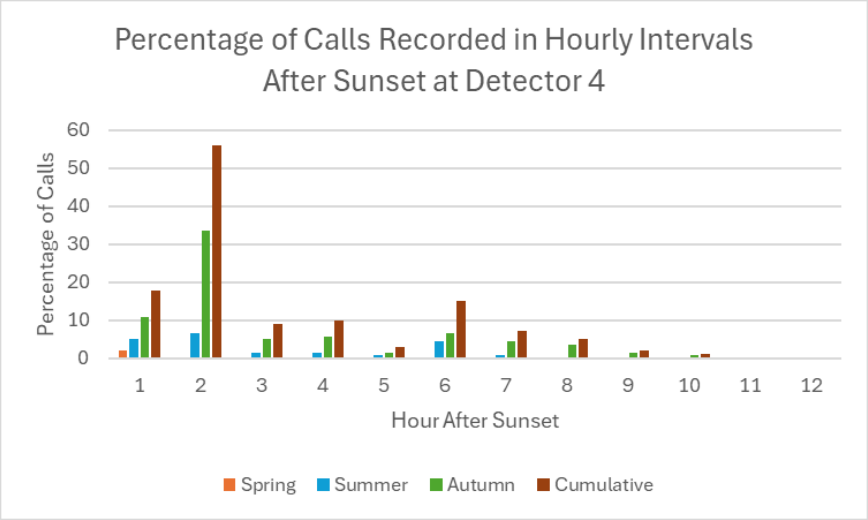


Graph 6: Percentage of Calls Recorded within Hourly Intervals Before Sunrise at Detector 3

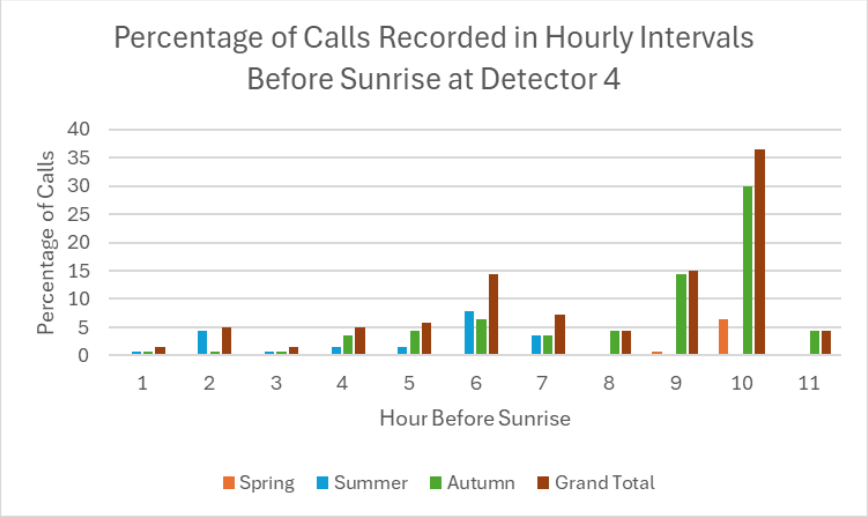


2.2.10. Activity around Detector 4 accounted for approximately 6% of overall *Nyctalus* sp. activity, with approximately 72% recorded during the autumn survey period. Activity was concentrated within 1-2 hours after sunset (see Graph 7) and 9-10 hours before sunrise (see Graph 8).

Graph 7: Percentage of Calls Recorded within Hourly Intervals After Sunset at Detector 4



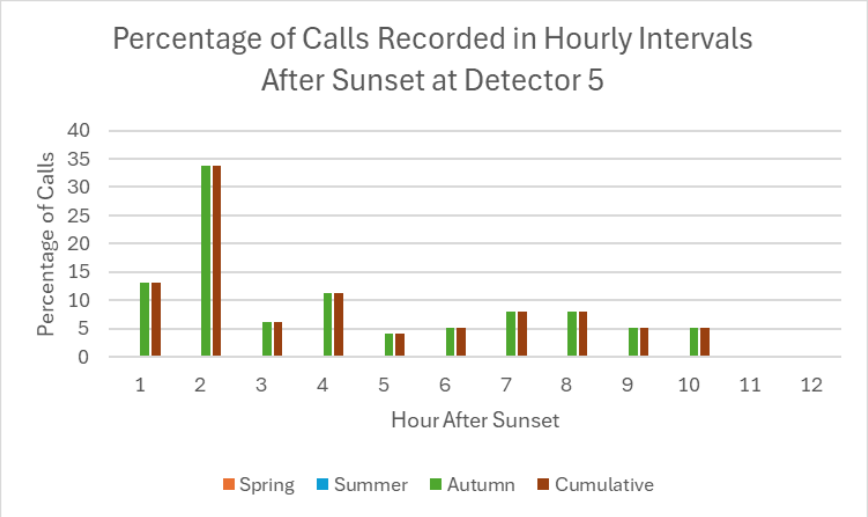
Graph 8: Percentage of Calls Recorded within Hourly Intervals Before Sunrise at Detector 4



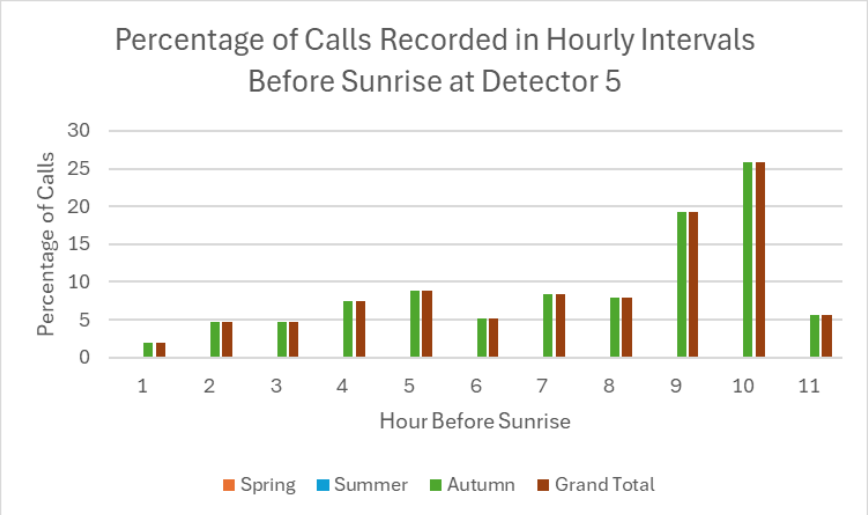
2.2.11. Activity around Detector 5 accounted for approximately 9% of overall *Nyctalus* sp. activity, all of which recorded during the autumn survey period. Activity was concentrated during the early part of the night, with approximately 34% of all calls recorded within 1–2 hours after sunset (see Graph 9).

2.2.12. Elevated levels of activity were also recorded towards the end of the night, with approximately 19% and 26% of passes occurring 8-9 hours and 9-10 hours before sunrise, respectively (see Graph 10).

Graph 9: Percentage of Calls Recorded within Hourly Intervals After Sunset at Detector 5

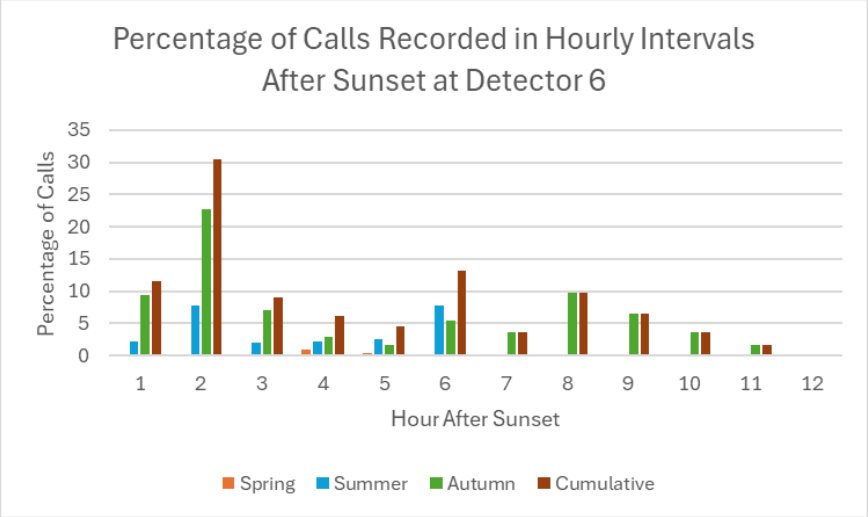


Graph 10: Percentage of Calls Recorded within Hourly Intervals Before Sunrise at Detector 5

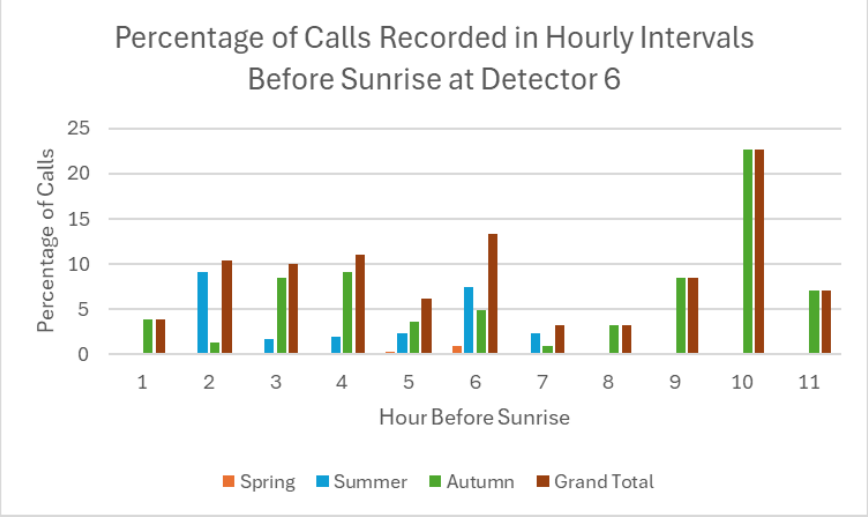


2.2.13. Activity around Detector 6 accounted for approximately 13% of total *Nyctalus* sp. Activity, with approximately 74% of this activity recorded during the autumn survey period. Activity was most concentrated during the early part of the night, with around 31% of all calls recorded within 1-2 hours after sunset (see Graph 11). A further peak in activity was observed towards dawn, with approximately 23% of passes recorded 9-10 hours before sunrise (see Graph 12).

Graph 11: Percentage of Calls Recorded within Hourly Intervals After Sunset at Detector 6

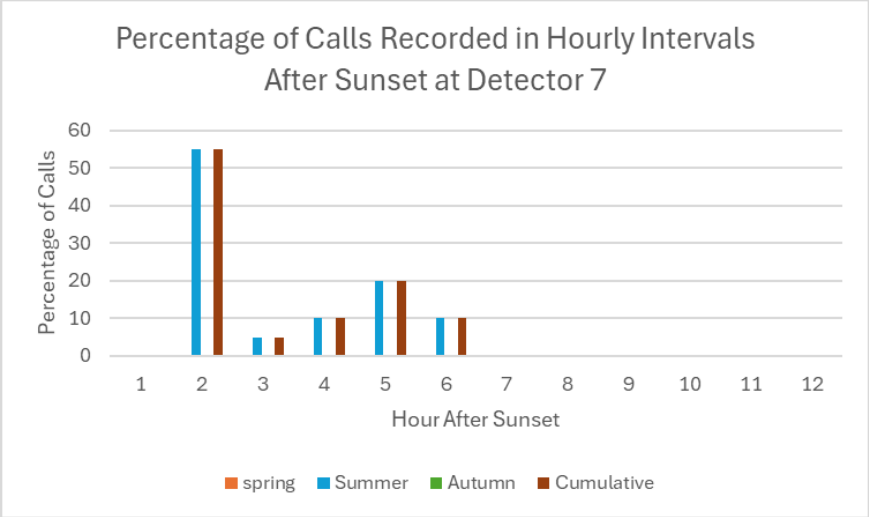


Graph 12: Percentage of Calls Recorded within Hourly Intervals Before Sunrise at Detector 6

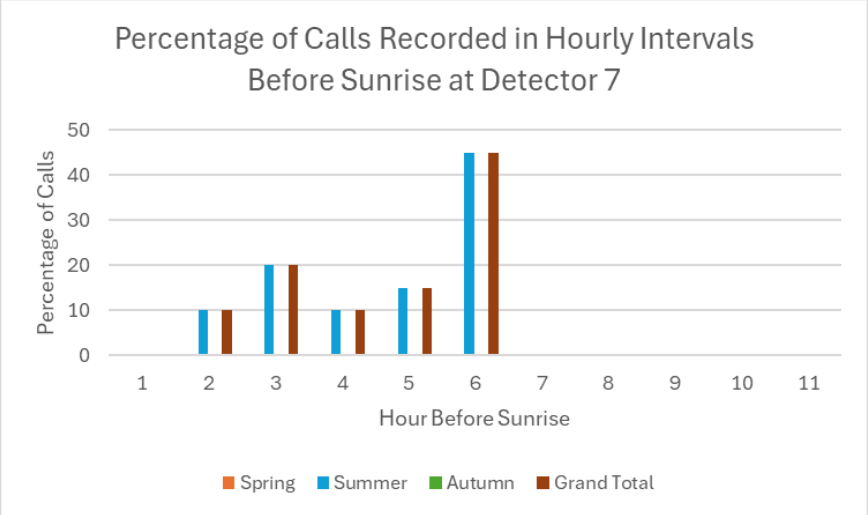


2.2.14. Activity around Detector 7 accounted for approximately 1% of total *Nyctalus* sp. activity. Activity was most concentrated within 1-2 hours after sunset (see Graph 13) and 5-6 hours before sunrise (see Graph 14)

Graph 13: Percentage of Calls Recorded within Hourly Intervals After Sunset at Detector 7

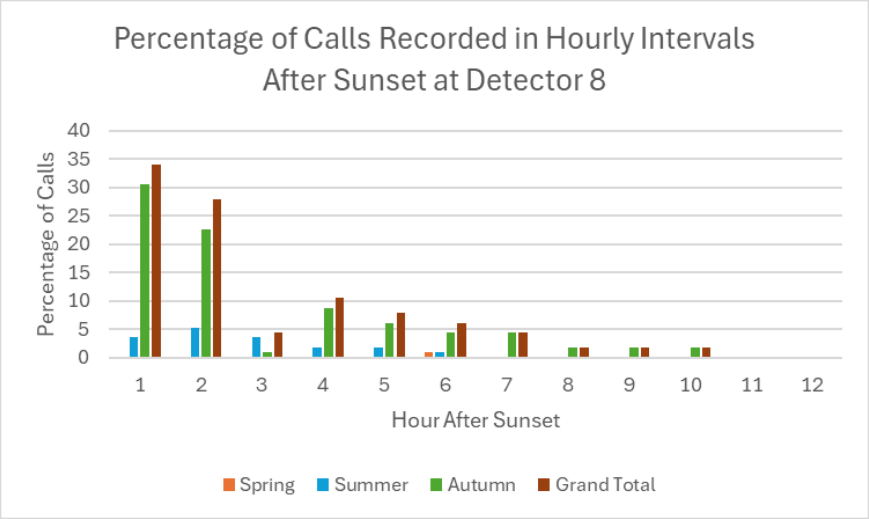


Graph 14: Percentage of Calls Recorded within Hourly Intervals Before Sunrise at Detector 7

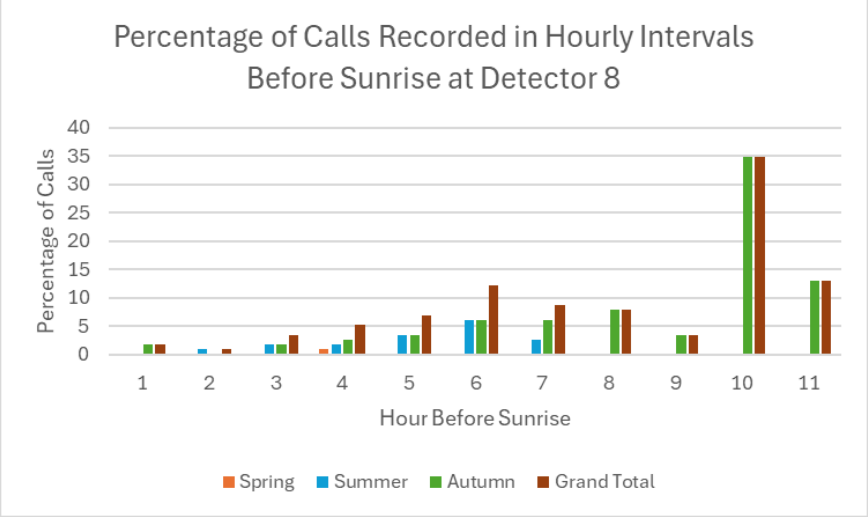


2.2.15. Activity recorded around Detector 8 accounted for approximately 5% of total *Nyctalus* activity, with approximately 82% of this activity recorded during the autumn survey period. Activity was concentrated within 0-1, and 1-2 hours after sunset, approximately 34% and 28%, respectively see Graph 15. Activity was concentrated within 9-10 hours before sunrise, approximately 35%, see Graph 16.

Graph 15: Percentage of Calls Recorded within Hourly Intervals After Sunset at Detector 8

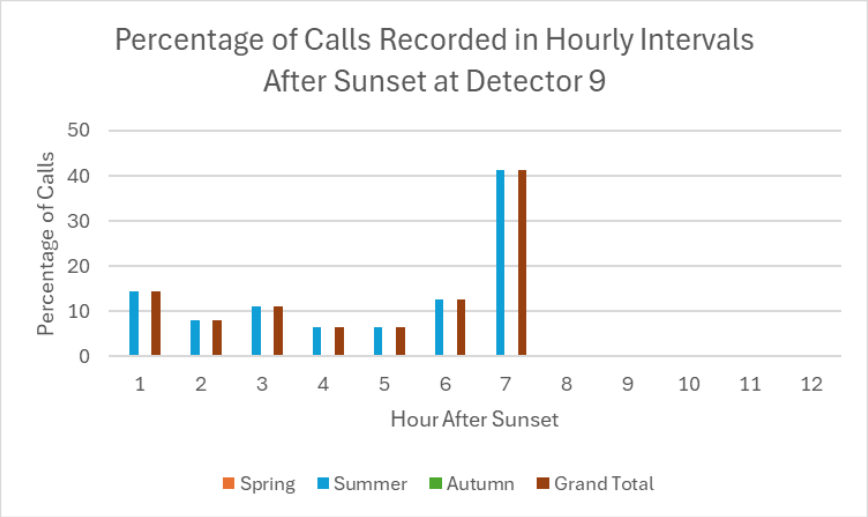


Graph 16: Percentage of Calls Recorded within Hourly Intervals Before Sunrise at Detector 8

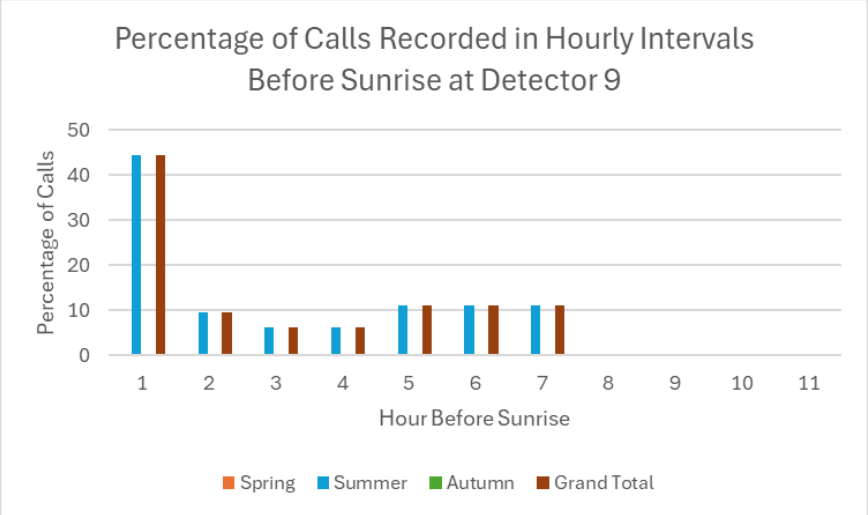


2.2.16. Activity recorded around Detector 9 accounted for approximately 3% of total *Nyctalus* activity, with all data recorded during the summer survey period. Activity was concentrated within 6-7 hours after sunset, approximately 41% of activity (see Graph 17). Activity was concentrated within 0-1 hours before sunrise, approximately 45% (see Graph 18).

Graph 17: Percentage of Calls Recorded within Hourly Intervals After Sunset at Detector 9



Graph 18: Percentage of Calls Recorded within Hourly Intervals Before Sunrise at Detector 9



3. Evaluation

3.1.1. Analysis of overall bat activity indicated a large percentage of calls were recorded by detectors located close to the woodland edge. In 2023, excluding Detector 2 as it recorded an anomalously large portion of activity, the majority of data was recorded by detectors along the woodland edge (approximately 44%). In 2024, approximately 60% of activity was recorded by woodland edge detectors. This evidence aligns with general bat behaviour, whereby individuals will tend to use linear features to migrate across the landscape (Collins, Bat Surveys for Professional Ecologists: Good Practice Guidlines, 3rd Edition., 2023) (Huston, 2022). Therefore, post-construction monitoring is recommended at these turbines to inform bat activity during operation.

3.1.2. Analysis of the *Nyctalus* sp. data in 2023, indicated Detector 2 recorded the largest amount of activity (44% of activity), mostly recorded in the summer; greater than 90% of the activity. Initial analysis found one night of exceptional activity, and two nights of high activity were recorded at this detector. Further analysis of the hourly activity in relation to sunset and sunrise indicated more than 50% of the passes were recorded during one period in relation to sunset and one period in relation to sunrise, 5-6 hours after sunset and 1-2 hours before sunrise. During certain times of the year, these periods overlap but most of the year they occur at different times of the night. The initial mitigation strategy (**TA 6-3: Bats** of the 2025 EIA Report) suggested curtailment is required to mitigate the risk to *Nyctalus* sp. at Detector 2, Turbine 7. The suggested curtailment was based upon weather conditions and two periods of the night; two hours after sunset and two hours before sunrise. However, upon further analysis of hourly activity, a revised curtailment period is recommended which would align with the most active periods of the night, 5-6 hours after sunset and 1-2 hours before sunrise.

4. Mitigation Proposal

4.1 Curtailment Strategy

4.1.1. The mitigation strategy has been revised in response to NatureScot's responses to the initial mitigation proposal (see Section 1). The curtailment strategy is recommended to take place within the Proposed Development Site during the summer and autumn seasons, 1st of June – 31st of October, inclusive. It is recommended during the first year of operation that a tiered approach to mitigation is implemented whereby weather conditions and time periods dictate curtailment.

4.1.2. Analysis of the 2023 dataset identified *Nyctalus* sp. was significantly more active during the summer and autumn (from 1st of June until 31st of October), compared to the spring (from 1st of April until 31st of May), therefore curtailment would only be required during this period as there was sufficient activity to warrant mitigation.

4.1.3. A significant proportion of this activity was recorded around Detector 2, Turbine 7 in 2023, as outlined in Table 6-7-2. Therefore, it is recommended curtailment only take place at this turbine location. Furthermore, a significant proportion of activity around this turbine was recorded during two periods of the night, 5-6 hours after sunset and 1-2 hours before sunrise (see Graphs 3 and 4).

4.1.4. Based upon academic research, bat activity is affected by two factors, wind speed above 6.99 m/s, and temperature below 11ºC (Collins, Bat Surveys for Professional Ecologists: Good Practice Guidlines, 3rd Edition., 2023) (Lintott & Matthews, 2018) (Matthews, Lintott, Richardson, & Hosken, 2019). It is recommended curtailment would take place when optimal bat conditions are present (see Table 6-7-3 below).

Table 6-7-3: Generation Weather Conditions

	Temperature <11ºC	Temperature > 11ºC
Wind Speed < 6 m/s	Generation	Curtailment
Wind Speed > 6 m/s	Generation	Generation

4.1.5. In effect, it means during warm, still periods of the night, generation will not occur. However, if the wind either increases or the temperature decreases below a certain threshold at which bat activity would be significantly reduced, generation would be permitted to occur.

4.1.6. It should be noted that, although generation appears to be the most common occurring situation, the number of times each of those situations would occur is not equal. For example, weather data from Castle Douglas in 2023 indicated that between 1st of June and 31st of October, approximately 18% of the days recorded the temperature below 11ºC at sunrise (Time and Date, 2024). As such, the only time when generation would be permitted using these criteria would be if the wind speed at the hub height increased to 6 m/s.

4.1.7. The thresholds are fixed, but in reality, the weather varies constantly. Additionally, with large scale machinery, there is considerable inertia involved in stopping and starting generation, particularly since curtailment reduces or stops the turbine from turning. As a result, it would not be possible to stop and start generation as readily as the weather fluctuates. The turbines on Site will be feathered as per standard mitigation practice which, once generation has ceased, results in turbine blades continuing to rotate but at a slower speed than if generation was occurring, as the blades are pitched away from the wind direction.

4.1.8. For operational reasons, it may be necessary to amend the curtailment operation definition e.g. IT issues, equipment malfunction or other unforeseen circumstance. In such circumstance, reasonable

endeavours will be taken to ensure compliance with the spirit of the curtailment strategy to ensure the risk to bats is managed.

4.1.9. The revised curtailment strategy therefore recommends that Turbine 7 is inactive under optimal weather conditions for bat activity between the 1st of June and 31st of October (inclusive). Curtailment would be applied during two defined periods each night: 5–6 hours after sunset and 1–2 hours before sunrise.

4.2 Post-construction Monitoring

4.2.1. Post-construction monitoring is recommended for the first five years of operation in order to adjust the mitigation strategy iteratively during years two to five; it is assumed that by year five an optimum level of avoidance will have been determined and would be perpetuated for the lifetime of the Proposed Development.

4.2.2. These surveys would take place from 1st of June until 31st October for the first five years of operation and will consist of the following:

- Nightly recording of bat activity at each turbine location by static detectors (30 nights July to mid-August and 30 nights Mid-August to October); and
- Monthly carcass searches around each turbine location.

4.2.3. Bat detectors will be carried out comprising the erection of bat detectors into all the turbine nacelles. This will provide more accurate, constant monitoring of bat activity at the centre point of each turbine. This will be facilitated by the use of an omnidirectional microphone erected on the back, top or bottom (or a combination of two of these) of the nacelle, connected to a song meter mini detector.

4.2.4. Bat detector technology and survey methodology for monitoring bat activity at height is constantly evolving, therefore, the industry standard equipment and methods at the time will be used. The bat detectors would record constantly between 1st of June and 31st of October of each year during a five-year period of mitigation refinement.

4.2.5. As mentioned previously, bat activity is known to be affected by weather conditions. These would be reported with the bat activity data. Each wind turbine will have an anemometer at hub height to measure wind speed, wind direction and ambient temperature.

4.2.6. There will also be a single meteorology mast that would measure the same weather parameters. A rain gauge would also be erected on this mast to measure precipitation. The data collected would provide a better understanding of the relationship between bat activity and weather conditions.

4.2.7. Information will be provided on any routine maintenance involving night-time lighting in close proximity to wind turbines. This is the only predicted activity that could potentially impact upon bat activity within the Proposed Development.

4.2.8. Analysis of the bat activity within the Proposed Development Site would take place at the end of each survey year, 1st November until 31st May, in order to understand the temporal and spatial usage of the Proposed Development Site. The intention would be to tailor the curtailment strategy to the Proposed Development, i.e. change the hours of curtailment at Turbine 7 to better match the most active periods of the night for *Nyctalus* sp. throughout the summer and autumn.

4.2.9. Carcass searches will be conducted using trained cadaver dogs rather than human searches as research has shown that dogs are more effective and efficient at location bat carcasses (Matthews, et al., 2013); the Proposed Development could be used to further test the efficacy of such methods. Where it is practical to carry out these searches, they will be used to gauge the success of any amended mitigation strategies applied, as described above.

4.2.10. A bat death threshold would be implemented at each turbine, whereby curtailment will be implemented once a certain number of carcasses have been identified in the year. The threshold will be set at 3 carcasses. Once this is met, curtailment will be implemented at this turbine for the remainder of the season and iterative curtailment will be implemented at during the following year.

4.2.11. It is assumed that if the turbine selected for curtailment is turned off for the key periods of bat activity during both the night and the year, then the risk of killing bats through turbine collision will be significantly reduced.