APPENDIX 6-2

BAT IMPACT ASSESSMENT

BAT SURVEY REPORT TO INFORM THE PROPOSED COOLE WIND FARM, CO. WESTMEATH.

Results of the 2020 bat activity season and potential impact assessment report

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1 INTRODUCTION

1.1 Protected status of bats in Ireland

Bats are protected by law in the Republic of Ireland under the Wildlife Act 1976 and subsequent amendments (2000 and 2010). Under the Wildlife Act, it is an offence to intentionally disturb, injure or kill a bat or disturb its resting place. Under this legislation it is unlawful to destroy, alter or disturb known bat roosts without an appropriate derogation licence, as issued by the National Parks and Wildlife Service (NPWS).

All bat species fall under Annex IV of the EU Habitats Directive (1992), whereby member states have a burden of responsibility to protect bats and their resting places wherever they occur. The EU Habitats Directive has been transposed into Irish law with the European Communities (Birds and Natural Habitats) Regulations 2011. The lesser horseshoe bat (*Rhinolophus hipposideros*), which occurs only in Counties Cork, Kerry, Limerick, Clare, Mayo and Galway in the Republic of Ireland, is listed in Annex II of the EU Habitats Directive 1992. The level of protection offered to the lesser horseshoe bat effectively means that areas important for this species are designated as Special Areas of Conservation (SACs). For remaining bats, the EU requires that they are strictly protected. Among Ireland's obligations under the Habitats Directive, is the obligation to 'maintain favourable conservation status' of Annex-listed species.

Ireland has ratified two international conventions, which afford protection to bats amongst other fauna. These are known as the 'Bern' and 'Bonn' Conventions. The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982) exists to conserve all species and their habitats, including bats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries, which covers certain species of bat.

1.2 Requirements for impact assessment

In order to comply with the requirements of the EU Habitats Directive 1992 and the EC Habitats Regulations 2011, wind farm applications in Ireland need to be assessed as to their potential impact on bat populations. To inform the impact assessment at the proposed Wind Farm Site a range of bat surveys were undertaken including a desk-based study and field surveys. As of 2019 the appropriate methodological approach for assessing bat population on proposed wind farm sites is *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH *et al*., 2019).

1.3 Outline of the scope of works

This assessment considers the proposed Coole Wind Farm which is referred to as 'Wind Farm Site' throughout this assessment. The Wind Farm Site, as assessed within this report includes:15 no. turbines, access roads, onsite substation, borrow pit, temporary construction compound, and all associated works. The Wind Farm Site is located *c*. 2.4 km north of Coole village. The central grid reference for the site is IGN 40881-75839 [Lat. 54.730791, Long. -7.3812461]. The layout is shown in Figure 1.

The proposed wind turbines (WT) are located within the following townlands:

- Clonsura: WT-01, WT-02, WT-03, WT-04
- Doon: WT-05, WT-06, WT-07, WT-08
- Camagh: WT-09, WT-10, WT-11, WT-12, WT-13, WT-14
- Carlanstown: WT-15

The assessment also considers the proposed locations and routes of associated infrastructure, including a borrow pit in the townland of Mullagh, and access roads within the aforementioned townlands and also passing through Newcastle and Clonrobert. The locations proposed for the substation and temporary construction compound are within the townland of Camagh.

The Proposed Development includes for a grid connection route and turbine delivery route which do not form part of this assessment.

In compliance with SNH *et al*. (2019), static bat recording equipment was deployed three times at selected locations representative of the proposed turbine layout for the Wind Farm Site. The three deployments each lasting a minimum of 10 nights covered the spring, summer and autumn active season for bats and were undertaken in conjunction with continuous monitoring of climatic conditions on the site to ensure recording windows were inline within compliant weather parameters. An assessment of potential bat roost features within the Wind Farm Site was completed, along with roost emergence surveys and bat activity transects. Once the baseline bat populations and habitat suitability at the Wind Farm Site were described an impact assessment was conducted.

Previous bat surveys have been conducted for this site (WT-01 to WT-13) in 2013 and 2016 by Aardwolf Wildlife Surveys and MKO respectively (MKO, 2017). Woodrow have also undertaken bats surveys across selected sections of the site in 2018 and 2019, with the proposed turbine locations at WT-14 and WT-15 particularly well covered (Woodrow 2020a & Woodrow 2020b).

At the time of the conducting this impact assessment the following information regarding turbine specification was provided:

- Turbine make-model: Not specified
- Turbine tip heights: maximum of 175 m
- Rotor diameter: maximum of 155 m (blade length of 77.5 m)
- Hub height: minimum of 97.5 m
- Cut in speeds: Typical cut in speeds 7 to 9 mph (3 to 4 m/s)

Please note that although turbine make and model are not specified here, the bat data collected and impact assessment can be adjusted for alternative turbine dimensions, as well as changes to site layout. The impact assessment has been conducted by applying the most extreme (worst-case) scenario in turbine specifications, i.e. largest, lowest to ground level rotor swept areas; and as such is considered consistent with a precautionary approach.

1.4 Report layout

This report was written to be included as a technical appendix to Chapter 6 - Biodiversity: Flora & Fauna of the EIAR and provides details of methodologies and survey effort for the suite of bat surveys conducted at the proposed Wind Farm Site during the active bat survey season of 2020, including tabulated results, maps and charts, as well as reports from roost suitability surveys, bat activity surveys and seasonal static bat detector surveys.

Bat surveys were designed to provide the baseline information required to conduct an assessment of the potential impacts of the Wind Farm Site on bat populations utilising the area. The impact assessment is laid out after the baseline conditions have been described and includes recommended avoidance and/or mitigation measures that should be implemented as part of the design phase of the project.

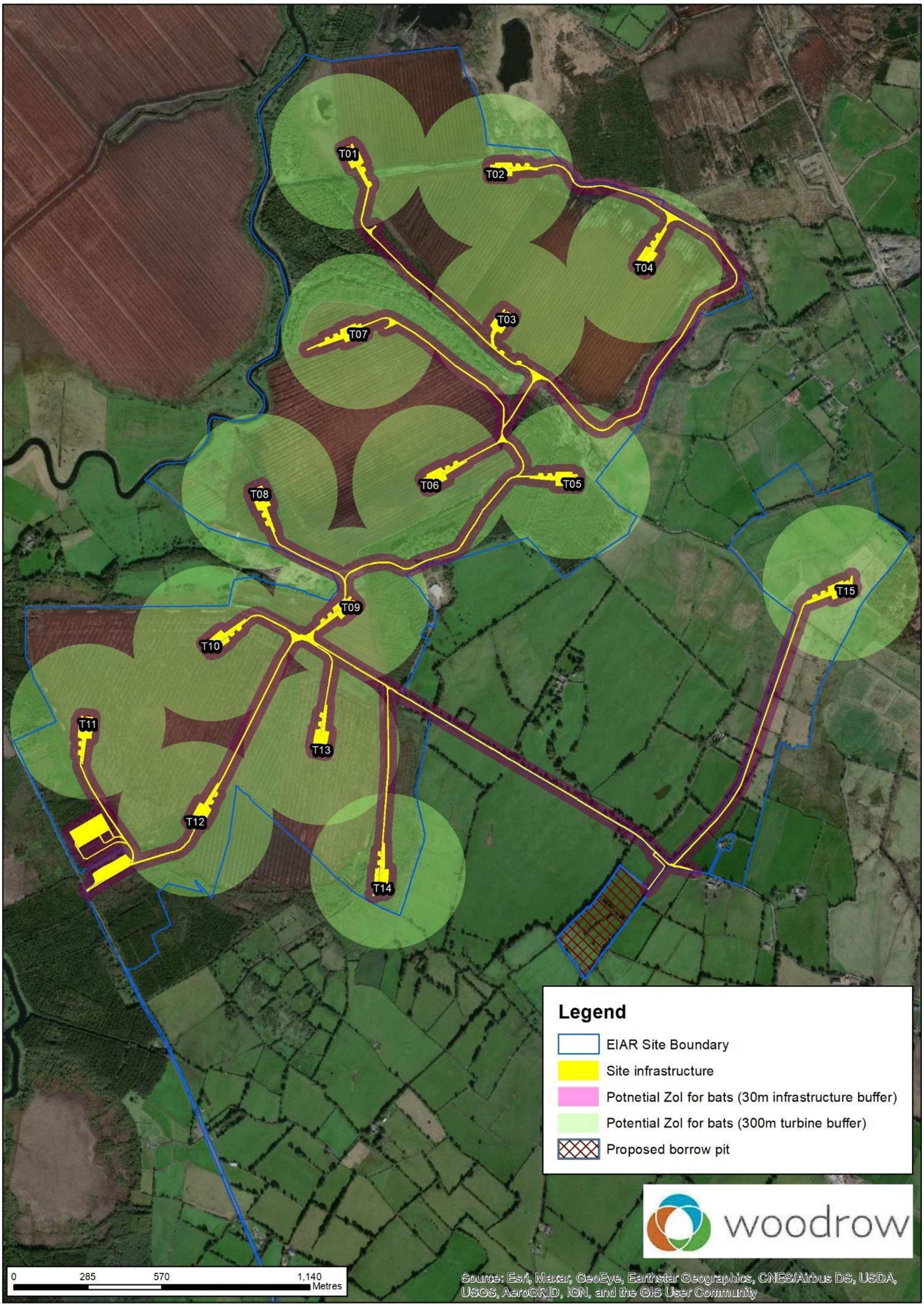

Figure 1 – Coole Wind Farm Site showing potential Zone of Influence (ZoI) on bats

1.5 Limitations

In the case of bat surveys, survey limitations often relate to weather conditions at the time of the surveying and equipment failing in the field, for example microphones can be damaged by livestock or can lose sensitivity when exposed to prolonged episodes of heavy rainfall.

The sections below provide details for any potential limitations to the 2020 bat surveys. Overall, it considered that the survey approach and coverage over the 2020 active season, provides robust data from which a full insight into the use of the site by bats can be obtained. As such, this information can be used to assess any potential impacts of the proposed Wind Farm Site on the local bat population. Given the survey methodologies used to ensure full coverage of the turbine envelope across the bat activity season during 2020, it is considered that the data obtained complies in full with the recommended guidelines set out within *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH, 2019).

1.5.1 Coverage limitations

It is considered that coverage of the Wind Farm Site for bat activity in 2020 was in line with the SNH *et al*. (2019) guidelines. However, due to reasons relating to security, bat equipment could not always be setup at turbine towers. While this was not considered to limit the robustness of the data set, it is important to acknowledge the deployment locations in relation to the turbines; as this has implications for interpretation of bat activity. For instance, deploying units away from proposed turbines locations in open bog and closer to habitat features is likely lead to more bats being registered, which may not be a true reflection of activity a given turbine location.

Appendix 3 provides series of aerial images, one for each turbine, and shows the deployment locations relative to the turbines. To distinguish between locations were bat recording equipment was deployed and the proposed turbine locations, different numbering systems have been used for these features throughout this report, numbers preceded by T refer to turbine locations and those with a D refer to deployment locations.

For clarity the relationship between turbine and deployment locations is reviewed in the following points. In summary, the majority of deployment locations (those covering T1, T3, T5, T6, T7, T8, T9, T14 and T15) were positioned within 70m of the turbine tower and as such are considered to be monitoring airspace within the rotor swept area. The deployment location covering T2 was just beyond the 70m mark. For T4, T10 and T12 the separation distance was slightly wider (135-155m).

- **T1** is in cut-over bog and *c*. 25m from a weak feature along the edge of the cut away and is 90 to 100m from a large drain with strong potential for connectivity to the wider area. Deployment location **D.01** is within 35m of the T1 tower, along edge of remnants of raised bog – This deployment is considered representative of the turbine location.
- **T2** is in cut-over bog and is 50 to 70m from strong habitat features including a section of bog woodland and the large densely vegetated drain leading out across the bog towards. Deployment location **D.02** is within 75m of the T2 tower, along edge of a drain backed by woodland – While this deployment is considered representative of the area, being adjacent to a feature it is likely to detect higher levels of bat activity than at the turbine situated in open bog.
- **T3** is in cut-over bog and *c*. 90m from woodland/scrub along the River Glore. Deployment location **D.03** is within 95m of the T3 tower, and while relatively distantly spaced it provides coverage of open cut-away representative of T3, although the deployment is further in to the open bog and is c. 160m from the closest feature. This unit provides a good proxy for bat activity at similar turbine location, like T11 where no unit was deployed or T4 where the unit was deployed significantly closer the feature than the proposed turbine location.
- **T4** is in cut-over bog and *c*. 200m from woodland/scrub along the edge of the cut away. Deployment location **D.04** was 155m from T4 and was positioned closer to features along the edge of the cut-away, and was within c. 85m of the remnants of raised bog, which grades in into scrub. It was also close to the NE corner of the cut-over bog and therefore could potentially detect bats commuting around the edge of the bog.

- **T5** is closed thicket coniferous plantation, c. 75m for the River Glore. Deployment location **D.05** is within 45m of the T5 tower, and was positioned closer to the river at 35m. Although the closer to the river, the deployment location was considered representative of the area.
- **T6** is in cut-over bog and *c*. 120m from woodland/scrub along the edge of the cut away. Deployment location **D.06** was 40m from T6 and positioned marginally closer the forestry edge (*c*. 90m away). Despite being marginally closer to the features, the deployment location was considered representative of the area.
- **T7** is in cut-over bog and *c*. 100m from a drain running along the edge of the bog and a plantation which is located more than 110m away from the turbine at the closest point. Deployment location **D.07** was 55m from T7 and positioned within 85m of the strong woodland feature running along the edge of the bog. Despite being closer to the features, the deployment location was considered representative of the area.
- **T8** is in cut-over bog and over 250m from the River Inny. The area is in a depression and collects water and is also slightly more vegetated than other parts of the cut-away. Deployment location **D.08** was 55m from T8, and although slightly closer to the River Inny (*c*. 220m) it was considered representative of the area.
- *c*. 100m from a drain running along the edge of the bog and a plantation which is located more than 110m away from the turbine at the closest point.
- **T9** is in cut-over bog and *c*. 80m from scrub/ secondary rotation forestry along the edge of the cut over bog. Deployment location **D.09** was within 20m from T9, and it was considered representative of the area.
- **T10** is in cut-over bog and *c*. 135m out from scrub along the main road running through the site. the edge of the cut over bog. Deployment location **D.10** was c. 135m from T10 and further out into the cut-over bog > 265m from the closest habitat features along the road.
- **T11** is in cut-over bog and *c*. 105m out from the edge of coniferous plantation and scrub. No recording equipment deployed at this turbine and based on distances from habitat features it is considered that D.06 would provide an indicative measure bat activity at this location.
- **T12** is located within the remnants of raised bog habitat and within 40m of a weak feature formed by the bank at the interface between remnant and cut-away bog. Stronger features willow scrub/bog woodland occurs c. 160m away. Deployment location **D.11** was c. 135m from T12, position deeper into the remnant raised bog and within 105m of the willow scrub.
- **T13** is in cut-over bog and *c*. 255m out from the edge of a young second rotation coniferous plantation. No recording equipment deployed at this turbine and based on distances from habitat features it is considered that D.10 would provide an indicative measure bat activity at this location.
- **T14** is located within young second rotation coniferous plantation. Deployment location **D.12** was c. 35m from T14 and was considered representative of the area.
- **T15** is located within agricultural grasslands, with several weak features running the area including small ditches/drains and gappy hedges/immature treelines. There is a block of broadleaved woodland within 80m. Deployment location **D.13** was c. 30m from T15 and was considered representative of the area.

1.5.2 Equipment related limitations

As noted in the methods section three different types of static bat detector were used during the 2020 active bat season – SM2s, SM4 and SM-minis. The microphones deployed with the latest generation of song-meters (SM4s and SM-minis) may, under certain circumstances, be more sensitive in detecting bat calls when compared to the type of microphones deployed with the SM2s. The difference in microphone specifications relates to signal to noise ratio (SNR). Essentially, the SM2 mics are ‘noisier’ than those of the SM4s/ SM-minis. This means that when using SM2s, decerning bat calls from background noise can be more taxing than for the SM4/ SM-minis that will provide a clearer signal. Deploying SM2 units in cluttered locations (locations with more background noise, e.g. rustling vegetation) or during periods of rain/ wind may result in lower sampling rates compared with SM4/ SM-minis. The magnitude of the difference between models of microphones in terms of any bias in the data for the Coole Wind Farm Site was not was not fully investigated; as it was not considered to affect the data set significantly and the factors affecting how many calls are picked up is considered too complex to measure and account for all the variables with sufficient accuracy.

Table 2 lists the types of models used for each deployment. In summary, during the spring deployment the majority of the deployment locations were covered by SM4s or SM-minis and only T9 was covered by a SM2. For the summer deployment only SM4s and SM-minis were used. During the autumn seven SM2s were deployed (T5, T6, T7, T9, T12, T15), with the other six locations covered by SM4s.

Equipment failure over the course of the three deployments in 2020 included:

- Summer: Data from one deployment location was lost due to corruption of the SD card
- Autumn: Batteries in three units becoming depleted just short of ten nights
- Autumn: One unit recorded for one night due to microphone failure

Equipment failure during the summer deployment was limited to a corrupted SD card from the unit covering T6, which resulted in sound files not being retrieved. For the Coole Wind Farm Site, with 15-turbines proposed, SNH *et al*. (2019) stipulate that 12 static bat detectors should be deployed at selected turbine location. In 2020 there were 13 units deployed during each season, and therefore, even with the SD card failure at T6, the 12 units that recorded successfully provide compliance with the SNH *et al*. (2019) guidelines. Furthermore, the habitat conditions at T6 (open cutover bog) were well represented within the data set and deployments at T03, T04, T07, T08 and T10 covered similar open features. The summer deployment window also lasted 19 nights ensuring comprehensive coverage of the summer survey window.

Due to the longer nights of autumn batteries failed just short of the requisite 10-nights within compliant weather conditions for three units covering T07, T08 and T12. Fortunately, weather conditions for the first 10 nights (up to 23/24-Sep) were in compliance with the climatic parameters as set out in SNH *et al*. (2019). For the time of year conditions would be considered optimal for bats, being dry with relative warm overnight temperatures and light winds throughout. By expressing the data as bat passes per hour, the bat passes recorded during the first 9 to 10 nights can be analysed comparatively between all the units to show relative densities of use across the site.

The unit covering T5 in autumn, only recorded for one night due to microphone failure. The one night of data was processed and high levels of bat activity were recorded. It was decided to include this in part of the analysis by using bat passes per hour to allow for comparison of bat activity with other locations over the same time period. Based on the habitat availability at the deployment location (woodland/ forestry rides near the River Glore) and the relatively high levels of activity recorded during the spring and summer deployments, it was considered that the high levels of activity recorded on the single autumn night were likely to be representative for the time year. Additional data is available from the locality of T5 and was collected in 2016 and 2018. As well as an emergence survey conducted near T5 in Jul-2020, a series of transects were undertaken along the track leading to T5 in 2018 and data from static bat detectors was collected from or sufficiently close to this location in 2016 and 2018.

Despite equipment failures at one deployment location in the summer and four deployment locations in autumn **it is considered that both seasonal deployments provide sufficient baseline data to facilitate a robust assessment of potential impacts of the proposed Wind Farm Site**.

1.5.3 Weather related limitations

In Ireland good survey conditions for static monitoring sessions are difficult to guarantee; as weather forecasts can change dramatically over the nights that static detectors are left out. However, deployment periods can be considered as capturing data that is representative of the real situation and provide useful insight into the sporadic and opportunistic use of more open sites by bats; for instance, foraging bats may be less inclined to venture onto open bog on nights when prevailing weather conditions, e.g. higher wind speeds, make flying more energetically costly or supresses activity levels of flying invertebrates upon which bats prey. A primary value of static detectors deployed in conjunction with a weather station is the ability to compare relative density of use across a site at a time when all variables (such as weather) are the same, rather than just recording during optimal weather conditions for bats.

Aside from the four units discussed above it is considered that a minimum of 10 nights within compliant weather parameters was collected by all the remaining units. To comply with SNH *et al*. (2019) guidelines, the duration of each deployment period should last a minimum of 10 nights within compliant weather parameters. Compliant weather conditions are defined as: temperatures at ≥ 8°C at dusk, maximum ground level wind speed of 5 m/s (11 mph) and no, or only very light periodic overnight rainfall. A Davis Vantage Vue weather station was deployed to provide real time data transfer, allowing the weather station to be fully monitored throughout the deployment periods, and to avoid the need for deployment of a second (back-up) weather station. As a further precaution to capture 10-nights of records within compliant weather conditions, deployment periods were generally extended beyond 10 nights, unless recorded weather conditions demonstrated compliance – **Table 2** provides deployment dates and the durations for recording. Weather data (temperature, wind speed and rainfall) are summarised for each seasonal deployment in **Figure 7**, **Figure 10** and **Figure 13**.

1.5.4 Other considerations

Walked or driven transects are no longer always a requirement under the SNH *et al*. (2019) guidelines. Transects were undertaken by Woodrow at the Coole Wind Farm Site, which covered the summer and autumn survey seasons in 2020. It is considered that manual bat activity surveys, such as these, can provide valuable context data in addition to the information that is recorded on static bat detectors. A total of three transects combined with roost emergence surveys were conducted to enhance the understanding of the general bat activity across the Wind Farm Site. For additional context, reference is made to bat surveys undertaken in previous years, including 2013, 2016, 2018 and 2019 – see Woodrow (2020a), Woodrow (2020b) and MKO (2017).

2 METHODOLOGY

Pre-planning surveying for bats at proposed wind farm sites aims to identify the species occurring within the proposed development area and provide an understanding of how local bat populations utilise the area in terms of density of use for foraging, roosting (maternity and hibernation) and social interactions. This information allows for the identification and assessment of the potential impacts the proposed development is likely to have and for appropriate avoidance and/or mitigation measure to be implemented as part of the design phase of the project.

Bat surveys were conducted by Woodrow Sustainable Solutions Ltd. at the Coole Wind Farm Site over the 2020 active bat season to ensure compliance with the most recently published guidelines pertaining to surveying, impact assessment and mitigation for bats at onshore wind turbines (SNH *et al*., January 2019)[1]. This guidance document supersedes previous guidelines (Collins, 2016[2] updating Hundt, 2012[3] & BCI, 2012[4]) and requires a site-by-site approach to survey design, with the only prescriptive element being the positioning, number and duration of static bat detector deployments, as well as the strongly recommended continual monitoring of site-specific weather data on rainfall, temperature and wind speeds.

The latest guidelines require as a minimum three deployments of static detectors aimed at covering spring (April to May), summer (June to mid-August) and autumn (mid-August to October), each with a minimum deployment period of 10 nights (within compliant weather parameters). Seasonal deployments of static detectors are set out at all potential turbine locations for proposals comprising ten or less turbines, with a third of any additional locations also covered up to a maximum of 40 detectors. Compliant weather conditions are defined as: temperatures at ≥ 8°C at dusk, maximum ground level wind speed of 5 m/s (11 miles/hr) and no, or only very light, periodic rainfall.

Additional requirements of the SNH *et al*. (2019) guidelines include swarming surveys and winter roost inspections, if potential hibernation roosts are identified. Transect and/or vantage point surveys are seen as methods used to complement the static detector surveys, with applicability being discretionary and site-specific.

2.1 Desk-based surveys

Desk based review of habitat availability in the environs of the Wind Farm Site and the available bat data was used of inform the scope to the bat surveys required. As recommended by both BCI (2012) and SNH *et al*. (2019) the area covered by the desk-based review was extended to 10 km surrounding the Wind Farm Site. The desk-based study included:

- Reviewing distances from closest Natura 2000 sites designated for bats (only bat SACs in Ireland are for lesser horseshoe bat *Rhinolophus hipposideros*) - the area of interest (in Co. Westmeath) is outside the range for lesser horseshoe bat in Ireland.
- Examining aerial imagery and 6-inch maps to identify potential bat foraging and roosting habitats
- Lundy *et al*. (2011)[5] provides a high-level assessment of potential habitat suitability for different species of bat occurring in Ireland.

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1 Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter & Bat Conservation Trust (2019). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*.

2 Collins, J. (ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edition). The Bat Conservation Trust, London.

3 Hundt, L. (2012). *Bat Surveys: Good Practice Guidelines*. 2nd Edition. BCT – Bat Conservation Trust, London.

4 Bat Conservation Ireland (2012) *Wind Turbine/Wind Farm Development Bat Survey Guidelines*, Version 2.8, December 2012. Bat Conservation Ireland

5 Lundy, M.G., Aughney, T., Montgomery, W.I., & Roche, N., (2011) *Landscape conservation for Irish bats & species specific roosting characteristics*. Bat Conservation Ireland

- Review of data received from BCI within 10 km of the Wind Farm Site and the results of Biodiversity Maps report for the 10-km squares covering the site [N37 & N47], including species recorded and known roosting sites.
- To provide additional context, a review of previous reports compiling the results for bat surveys for the Coole Wind Farm Site was carried out, including studies undertaken in 2013 (Aardwolf Wildlife) and 2016 (MKO); as well as studies conducted at a neighbouring site with some overlap with the Coole site, which were undertaken in 2018 and 2019 (Woodrow).

2.2 Roost assessment surveys

The most recent guidelines (SNH *et al*., 2019) recommend that "*features that could support maternity roosts and significant hibernation and/or swarming sites (both of which may attract bats from numerous colonies from a large catchment) within 200 m plus rotor radius of the boundary of the proposed development should be subject to further investigation*".

Turbine specification, as well as locations are regularly altered during the design phase of projects and as a precaution Woodrow always conduct roost assessment surveys within 300 m of the potential build area. Features along the access tracks between turbines (within *c*. 30 m) were also assessed in September 2020. Surveyors utilised the assessment criteria described in Collins (2016)[6] – see Page 35, Table 4.1, which provides guidelines for assessing potential suitability of habitat features as bat roosts and for foraging bats.

Surveyors employed non-invasive external and internal inspection techniques for any building encountered, and trees were assessed from the ground. Based on the young age of trees, a lack of suitable Potential Roost Features (PRFs), and species composition (mostly Sitka spruce) it can safely be assumed that conifer trees within plantations did not support roosting bats. Based on the findings of the roost inspection on other structures in the vicinity of the proposal, features classed as having moderate to high suitability for bats and/ or demonstrating likely occupancy, (e.g. bat dropping found) were targeted for further surveys, including dusk emergence surveys.

Habitat suitability assessment was undertaken on 09-Jul-2020, with additional visits undertaken in September to assess the proposed access track to T15 and the borrow pit, where removal of trees will be required during the construction phase of the project. All turbine locations were covered and an area of 300 m around turbines was assessed for bat roost potential.

2.3 Bat activity surveys – roost emergence/ re-entry surveys

Based on the findings of potential roost assessment surveys; emergence surveys were undertaken on three site visits and covered potential roost features within the 300 m search area around turbines. These features were identified as having moderate potential for supporting roosting bats. Potential access points for bats on the roost features were covered, employing up to two surveyors using professional Elekon Batlogger M bat detectors to record any bat activity.

Emergence surveys were undertaken at selected features within the Zone of Influence on 09-Jul-2020, 16-Jul-2020 and 14-Sep-2020, prior to commencing site walkovers and covered the period of time from *c*. 15-30 minutes before sunset and lasting up *c*. 1 to 1.75 hours after sunset, as shown in **Table 1**. Location of emergence surveys are shown in **Figure 3**, **Figure 4** and **Figure 5**.

2.4 Bat activity surveys – walked/ driven transects and point counts

Transect surveys were undertaken using professional Elekon Batlogger M bat detectors to collect geo-referenced records of bat activity. Following on from roost emergence surveys, dusk bat activity

6 Collins, J. (ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edition). The Bat Conservation Trust, London.

transects were undertaken on 09-Jul-2020, 16-Jul-2020 and 14-Sep-2020. A combination of walked and driven transects were employed.

Survey dates and weather conditions for transects conducted in 2020 are provided in **Table 1** below, with survey locations and transect routes are shown in **Figure 3**, **Figure 4** and **Figure 5**.

Field records were made of bat species encountered, number of bat passes, activity (where known: e.g. foraging, commuting, advertising), travelling direction and approximate height (where known). Temperature and wind speed were measured at intervals throughout the survey using a Silva hand held weather meter. Batloggers also recorded temperature throughout the surveys.

2.5 Static bat detector surveys

Static detector surveys were undertaken using Song Meters (SM2, SM4 or SM-minis) on three occasions covering spring, summer and autumn. Static bat detectors were deployed to record the types of bat species present and to provide an overview of how bat activity is broadly distributed over the site and specifically at selected turbine locations. As described in the limitation section static bat detectors were deployed at or as close as feasible to 13 turbine locations within the proposed turbine layout for the Coole Wind Farm Site. Units were deployed at ground level (0.5 to 3 m above the ground) and no units were deployed at height. The same locations were employed for all three seasonal deployments. **Figure 2** shows the deployment pattern for each season in relation to the final turbine layout and **Table 2** below provides details on deployment dates, duration and habitat features covered, including the closest turbine to the units. **Appendix II** provides plates of the deployment locations with units in situ.

2.6 Monitoring climatic of conditions

Monitoring of climatic conditions was undertaken through the deployment of an on-site fully automated weather station with 3G connectivity. The location at which the weather station was deployed is show in **Figure 2**.

Plate A – Weather station deployed at Coole WF Site

The Davis Vantage Vue wireless integrated sensor suite weather station deployed provided data on a real-time basis. This allows weather station functionality to be checked on a daily basis during the survey season and for action to be taken if a station fails or there are concerns regarding the data. This obviates the need for a second (backup) weather station. The weather station collected the full range of weather data, including temperature, wind speed and rainfall, which allows surveyors to determine whether deployments nights were compliant with the prescribed weather parameters (≥ 8°C at dusk, max. ground level wind speed of 5m/s and minimal rainfall).

Deployment periods can then be adjusted to ensure 10 nights of compliant data are captured. In addition, site specific weather data can be useful for investigating the recorded patterns of site usage by bats, for instance exposed bog sites can receive an influx of foraging bats during nights that are warm and relatively still, especially towards the end of the summer and into the autumn, as bats disperse from maternity roosts (Woodrow per. obs.).

2.7 Calibration and testing of recording equipment

Calibration and testing of recording equipment is required by the SNH *et al*. (2019) guidelines, and as a standard operating procedure Woodrow have a stringent schedule of testing all bat recording equipment prior to and during deployment in the field. Checks are logged in excel, providing an audit trail to ensure that all data can be relied on and form a robust and defendable data set. Unique numbering of static detectors, SD cards and microphones allows for reverse checking, if any issues arise, e.g. following a microphone failure. Checks undertaken include pre-deployment device setting and battery checks, and post- and pre- deployment microphone sensitivity checks. As detailed in the section on survey limitations, failure of bat recording equipment was limited to corruption of a single SD card during the summer deployment and premature battery depletion in three units during the longer nights of the autumn deployment.

2.8 Analysis

Analysis of sound recordings collected using SM2s, SM4s and SM-minis was undertaken using Kaleidoscope Pro software to confirm species (or genus for *Myotis* species) and the number of bat passes for each transect survey or deployment. For data collected using the Batloggers, analysis of sound recordings was undertaken using BatExplorer software.

Russ (2012)[7] and Middleton *et al*. (2014)[8] were used to aid in identification of bat calls during data analysis.

All sounds files were run through auto-identification and then manual verification was undertaken by Woodrow operatives. Any sound file identified as noise were manually checked, as these can hide bats calls, especially if calls are faint, e.g. if there are high levels of other background noise such as rustling leaves during windy conditions or during periods of rainfall. Recordings where more than one bat or more than one species was registered were split into separate passes.

The number of passes generated were considered synonymous with Registrations, as defined by Ecobat, which is considered to be species presence within a 15 second sound file. The SNH *et al*. (2019) guidelines recommend using the online tool *Ecobat* to allow for a measure of relative bat activity using a ranking system by comparing the data collected with bat survey information collected from similar areas during similar times of year.

Up until recently, the reference system was strongly oriented on UK bat populations and it was not clear whether reference data sets were relevant to Ireland. Comparative Irish data sets are now considered to have surpassed thresholds to allow for more robust assessments. Ecobat allows users to upload activity data and compare it to results within a reference range filtered by geographic location, time of year and the make of bat detector used. This generates robust reports tailored for a datasets specific location, timeframe and, equipment. The continued use of Ecobat improves its future accuracy as the data from each survey uploaded adds to their reference database (Lintott *et al.* 2017)[9].

7 Russ, J. (2012) *British Bat Calls: A Guide to Species Identification*.

8 Middleton N., Fround A. & French K (2014) Social Calls of the Bats of Britain and Ireland.

9 Lintott, P.R., Davison, S., van Breda, J., Kubasiewicz, L., Dowse, D., Daisley, J., Haddy, E. & Mathews, F. (2018). Ecobat: An online resource to facilitate transparent, evidence-based interpretation of bat activity data. Ecology and evolution, 8(2), pp.935-941

The activity levels were also examined in terms of bat passes per hour (bp/h). This is effectively bat contacts per hour and is worked out on the basis of the time that the static bat detectors operated during the deployment period (set to record from half an hour before sunset to half an hour after sunrise). In order to provide additional context for what constitutes significant levels of activity the bp/h data has been presented taking account of a Polish study by Kepel *et al*. 2011[10] (sourced from *'A Review of the Impacts of Wind Energy Developments on Biodiversity'*). The study sought to attribute significance levels to bat activity recorded during wind farm surveys.

[10] Kepel, A., Ciechanowski, M., Jaros, R. (2011). How to assess the potential impact of wind turbines on bats using bat activity surveys? A case study from Poland, XII European Bat Research Symposium, August 22-26, 2011, Vilinusm Lithuania.

Table 1 – Transect and roost survey dates, timing and weather conditions

Date	**Start time**	**End time**	**Survey type - coverage** (surveyors)	**Weather Conditions**
09-Jul-2020 Sunset 21:54	21:34	23:00	Emergence survey – At bridge near T15 (Mike Trewby)	Wind: Force 3 to 3/2 WNW Cloud: 7 oktas Dry Temp: 13 to 11°C
	21:28	23:07	Emergence survey – At stables on route to T15 (Aoife Moroney)	Wind: Force 2 WNW Cloud: 7 oktas Dry Temp: 14 to 11°C
	23:00	01:29	Dusk transect – Bridge nr. T15 to road, then driven section to middle and northern bog (Aoife Moroney & Mike Trewby)	Wind: Force 2/1 WNW Cloud: 7 to 5 oktas Dry Temp: 11 to 9°C
16-Jul-2020 Sunset 21:52	21:15	23:15	Emergence survey - Along R. Glore covering ivy clad poplar trees with rot holes (Rachel Irwin)	Wind: Force 2 SW Cloud: 7 oktas Dry Temp: 17°C
	21:27	23:15	Emergence survey – Near T5 covering mature trees adjacent to river (Aoife Moroney)	Wind: Force 2/1 SW Cloud: 7 oktas Dry Temp: 18°C
	23:15	01:03	Dusk transect – Middle bog, then along T5 to T9 access track, driven section on road, then walk to T15 (Rachel Irwin)	Wind: Force 2 SW Cloud: 7 oktas Dry Temp: 17°C
	23:15	00:02	Dusk transect – From R. Glore making a circuit of northern bog (Aoife Moroney)	Wind: Force 2 SW Cloud: 7 oktas Dry Temp: 17°C
14-Sep-2020 Sunset 19:47	19:32	20:34	Emergence survey – east side of beech wood on track leading to T05 (Liam Bliss)	Wind: Force 1/0 Cloud: 7 oktas Dry Temp: 17/18°C
	20:32	20:32	Emergence survey – west side of beech wood on track leading to T05 (Aoife Moroney)	Wind: Force 1/0 Cloud: 7 oktas Dry Temp: 17/18°C
	20:32	23:05	Dusk transect – T09 to T05 track, middle bog, then onto southern bog, driven section along road, then walked T15 access track	Wind: Force 1 Cloud: 7 oktas Dry Temp: 17/18°C

Table 2 – Static bat detectors deployment information

- deployment dates, duration, location, associated turbine number, unit ID code and habitat features covered (Model of song-meter: ✓ = SM2, † = SM4, * = SM-mini)

Map ID	Associated turbine	Unit location (Lat.-Long.)	Associate feature / habitats	Spring deployment date: 12-May-2020		Summer deployment date: 16-Jul-2020		Autumn deployment date: 14-Sep-2020	
				Unit code	Running time (mins)	Unit code	Running time (mins)	Unit code	Running time (mins)
D.01	T01	53.7440755 -7.3812022	Open: Remnants of raised bog at edge of industrial cutover bog, within c. 70m bog woodland to W and c. 130m of a bog lough to N	WSS-047*	14 Nights (7467)	WSS-050*	19 Nights (7983)	WSS-034†	15 Nights (11470)
D.02	T02	53.7439408 -7.3714235	Feature: On deep drain running alongside bog woodland and adjacent to large expanse of industrial cutover bog.	WSS-048*	14 Nights (7467)	WSS-049*	19 Nights (7983)	WSS-035†	15 Nights (11470)
D.03	T03	53.7391674 -7.3715083	Weak feature: Along drain surrounded by bare peat in industrial cutover bog, with closest vegetation being treeline along the R. Glore c.170m to SW	WSS-049*	14 Nights (7467)	WSS-041*	19 Nights (7983)	WSS-038†	15 Nights (11470)
D.04	T04	53.7399711 -7.3610967	Weak feature: Along drain surrounded by bare peat in industrial cutover bog, with closest woodland feature being c. 90m to SE	WSS-044*	14 Nights (7467)	WSS-046*	19 Nights (7983)	WSS-060†	15 Nights (11470)
D.05	T05	53.732995 -7.367475	Feature: At edge of young conifer plantation, c. 20m from River Glore	WSS-040†	12 Nights (6012)	WSS-038†	19 Nights (7983)	WSS-011✓	1 Night (735)
D.06	T06	53.732338 -7.376357	Weak feature: Along drain surrounded by bare peat in industrial cutover bog, with closest woodland feature being c. 110m to S	WSS-041*	14 Nights (7467)	WSS-045*	SD card corrupted	WSS-010✓	10 Nights (7836)
D.07	T07	53.73817 -7.380881	Weak feature: Along drain surrounded by bare peat in industrial cutover bog, with closest woodland feature being c. 80m to N	WSS-050*	14 Nights (7467)	WSS-047*	19 Nights (7983)	WSS-016✓	8 Nights (6339)
D.08	T08	53.732739 -7.386615	Weak feature: Along drain surrounded by bare peat in industrial cutover bog, c. 200m from any significant habitat features including scrub to S and River Inny N and W	WSS-045*	14 Nights (7467)	WSS-048*	19 Nights (7983)	WSS-019✓	9 Nights (7079)
D.09	T09	53.728438 -7.381034	Weak feature: Along drain surrounded by bare peat, marginal re-vegetated in industrial cutover bog. Closest area of scrub was c. 70 to W	WSS-013✓	14 Nights (7467)	WSS-043*	19 Nights (7983)	WSS-007✓	10 Nights (7875)
D.10	T10	53.726002 -7.389813	Weak feature: Along drain surrounded by bare peat in industrial cutover bog, with closest hedge/ treeline feature being c. 260m to N	WSS-043*	14 Nights (7467)	WSS-032†	19 Nights (7983)	WSS-051†	15 Nights (11470)
D.11	T12	53.719996 -7.389035	Open: Remnants of raised bog with lots of open drains, c. 110m from bog woodland to south	WSS-035†	14 Nights (7467)	WSS-034†	19 Nights (7983)	WSS-006✓	9 Nights (7106)
D.12	T14	53.718779 -7.379551	Feature: Young second rotation conifer plantation, with scrub planted on drained bog. Treelines within 40m to W, c. 70m to S and c. 115m to E	WSS-046*	14 Nights (7467)	WSS-044*	19 Nights (7983)	WSS-032†	15 Nights (11470)
D.13	T15	53.728711 -7.352207	Weak feature: Along damp field drain in cattle grazed pasture, c. 100m from woodland to E and c. 160m from River Glore to south	WSS-042*	14 Nights (7467)	WSS-042*	19 Nights (7983)	WSS-008✓	10 Nights (8319)

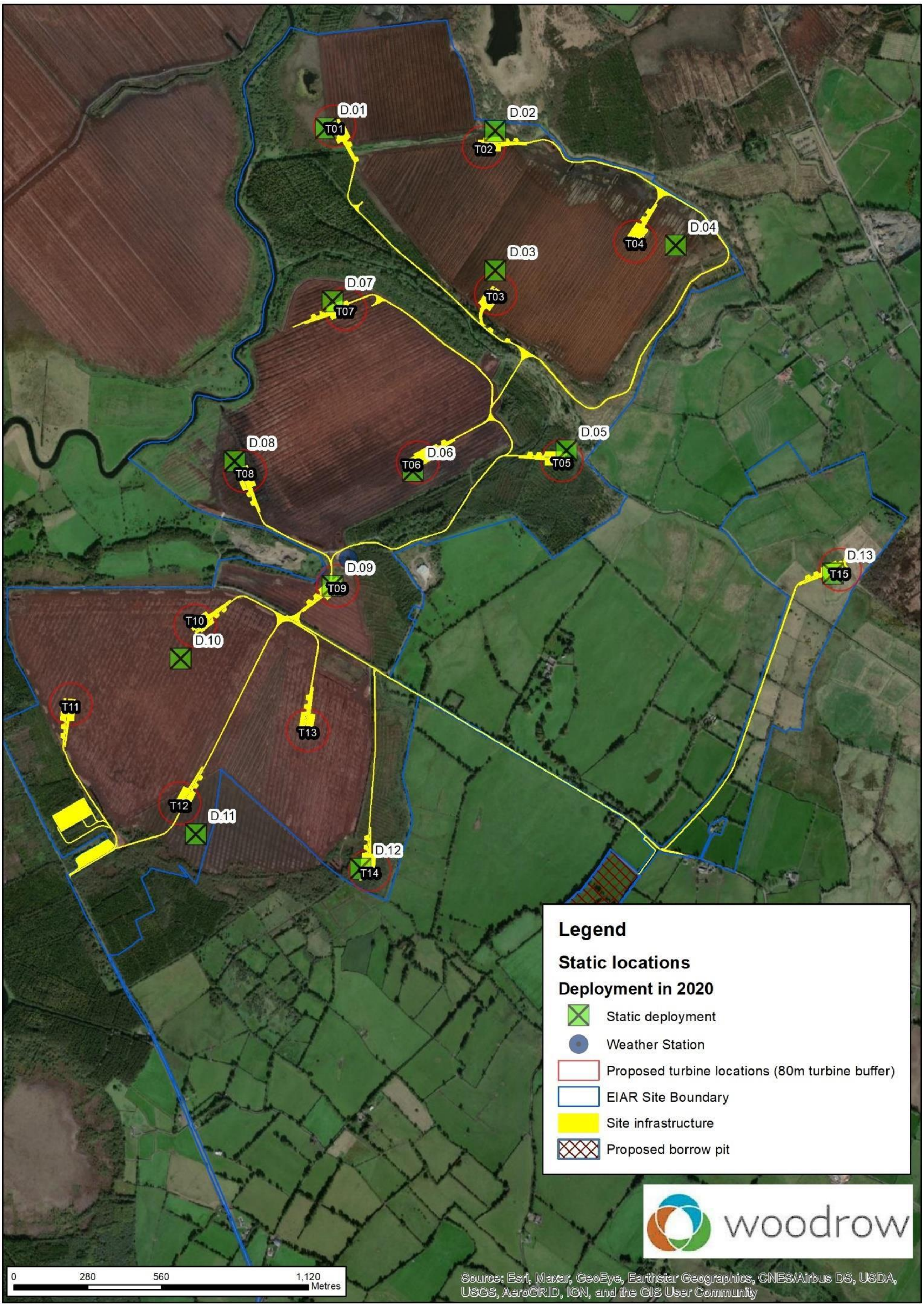


Figure 2 – Deployment locations for all static bat detectors and weather station

3 SURVEY RESULTS

This section, provides the detailed results for bat surveys conducted during the 2020 active bat season. These results along with the findings from previous surveys conducted in 2013, 2016, 2018 and 2019 are summarised in the section of this report describing the baseline conditions for the site. Appendix I and Appendix II provide plates too illustrate features within the site and the deployment locations with bat detectors in situ.

3.1 Desk based study

For the desk-based study, **Table 3** lists the bat data received from Bat Conservation Ireland (BCI) for the area extending 10 km out from the Wind Farm Site and shows that five species have been recorded in the environs, including:

- Common pipistrelle *Pipistrellus pipistrellus*
- Soprano pipistrelle *Pipistrellus pygmaeus*
- Leisler's bat *Nyctalus leisleri*
- Brown long-eared bat *Plecotus auritus*
- Daubenton's bat *Myotis daubentonii*

The only Natura 2000 sites designated for bats in Ireland are for lesser horseshoe bats (*Rhinolophus hipposideros*). The area of interest in Co. Westmeath is outside the range for this species; and with the closest Special Areas of Conservation (SACs) being in Co. Mayo, there are no designate sites within the 15 km Zone of Influence of the proposed wind farm at Coole.

A review of the roost records received from BCI (n = 3 records) found that none were located within the Wind Farm Site and all were beyond the Zone of Influence (300 m) of the proposed turbine locations. The 2013 bat surveys did not identify bat roosts within the study area (Wind Farm Site plus 200 m search buffer) and several roosts were identified in the wider area surrounding Wind Farm Site (Aardwolf, 2013) including:

- Soprano pipistrelle maternity roost with 81 bats *c*. 3.4 km from Wind Farm Site
- Soprano pipistrelle day roost *c*. 2.2 km from Wind Farm Site
- Brown long-eared bat night roost *c*. 3.1 km from Wind Farm Site
- A mating/lekking site of Leisler's bat *c*. 0.8 km from Wind Farm Site
- Seven potential bat roosts where bat presence was not confirmed

In 2013, no hibernacula were recorded in the study area or in the local area (Aardwolf, 2013).

Table 3 – BCI Roost Data within 10 km of the Wind Farm Site

BCI roost data within 10km of the proposed Coole Wind Farm Site			
Roost Data - Roost Surveys			
Name	***Grid reference***	***Species observed***	
Finnea, Co. Westmeath	Confidential; Not provided here – available on request	Unidentified bat – building roost	
Turbotstown, Coole, Co. Westmeath		*Plecotus auritus* – building roost	
Private		*Pipistrellus pygmaeus*	
Roost Data - Transect Surveys			
Name	***Grid reference***	***Species***	
Ballycorkey Bridge Transect	Confidential; Not provided here – available on request	*Myotis daubentonii; Nyctalus leisleri; Pipistrellus pipistrellus* (45kHz); *Pipistrellus pygmaeus; Pipistrellus* spp. (45kHz/55kHz); Unidentified bat	
Ballycorkey Bridge Transect; Spot 2		*Myotis daubentonii*; Unidentified bat	
Ballycorkey Bridge Transect; Spot 1		*Myotis daubentonii*; Unidentified bat	
Ballycorkey Bridge Transect; Spot 3		*Myotis daubentonii*; Unidentified bat	
Ballycorkey Bridge Transect; Spot 4		*Myotis daubentonii*; Unidentified bat	
Ballycorkey Bridge Transect; Spot 5		*Myotis daubentonii*; Unidentified bat	
Ballycorkey Bridge Transect; Spot 6		*Myotis daubentonii*; Unidentified bat	
Ballycorkey Bridge Transect; Spot 7		*Myotis daubentonii*; Unidentified bat	
Coolnagon Bridge Transect		*Myotis daubentonii; Pipistrellus* spp. (45kHz/55kHz); Unidentified bat	
Float Bridge Coole Transect		*Myotis daubentonii*; Unidentified bat	
Ad-hoc Observations			
Survey	***Grid reference***	***Species***	***Date***
BATLAS 2010 River Inny, Finnea Bridge, Co. Westmeath	Confidential; Not provided here – available on request	*Myotis daubentonii; Nyctalus leisleri; Pipistrellus pygmaeus*	17/09/2009
BATLAS 2010 Mullaghmeen Forest, Co. Westmeath		*Pipistrellus pipistrellus* (45kHz); *Pipistrellus pygmaeus*	17/09/2009
BATLAS 2010 Church grounds, Togher, Co. Westmeath		*Pipistrellus pipistrellus* (45kHz)	17/09/2009
BATLAS 2010 Bracklagh Lough, Co. Westmeath		*Myotis daubentonii; Pipistrellus pygmaeus*	17/09/2009
EIS Surveys		*Pipistrellus pipistrellus* (45kHz); *Pipistrellus pygmaeus; Plecotus auritus*	17/07/2006

3.2 Bat habitat suitability assessment

Based on Lundy *et al*., (2011)[11], the overall suitability for the 5x5 km squares encompassing the Wind Farm Site have been scored as holding habitats of moderate suitability for all bat species combined. For individual species, habitat suitability was ranked moderate or higher for all species, with the exception of two rarer (locally/ regional occurring) species - Nathusius' pipistrelles and whiskered bat, and habitat suitability was scored moderate-low and low respectively.

In terms of observed potential habitat suitability for bats, the turbine envelope (defined in this instance for bats, as a 300 m Zone of Influence - ZoI around the proposed 15 turbine layout – see **Figure 1**) would be considered a lowland site, with the majority of the ZoI surrounding turbines lying at altitudes of between 60 m to 75 m asl. **Table 4** provides detailed notes on bat habitat suitability assessments for turbine location plus 300 m buffer, access tracks and borrow pit. Plates in Appendix I provide photographs of habitat features at turbine locations. Overall, there were very few PRF with moderate or high potential and included the following features:

- Bridge over River Glore at [53.728105, -7.355162] and within the ZoI of T15 – LOW to MOD roost potential, although there were some fissures in the masonry the structure was assessed as low potential due to limited occurrence of features (connectivity) along this section of the river.
- Access track to T15 from the main road supports several lengths of treeline/ hedgerow, with occasional older ivy clad tree assessed as having MOD roost potential.
- The borrow pit holds mature treelines with some older, ivy clad specimens assessed as having MOD (possible HIGH) roost potential.
- On the main road leading from T14 to T15 there were mature, ivy clad trees with MOD roost potential. There are also several other potential roosts just beyond the ZoI along the main road - predominately occupied dwellings, although there are some abandoned buildings and mature trees within treelines. There is a notably mature treeline lined avenue leading to Newcastle house, which also has connectivity to the original ruined castle.
- Beech woodland and mature ivy clad spruce along the access track between T5 and T9 was ranked as having LOW to MOD roost potential
- Mature poplar treeline along River Glore lining the banks in places from T5 to T7, which were assessed as having NEGLIGIBLE to occasionally MOD roost potential for ivy clad trees, some with splits branches and rot holes.
- Three medium sized oak trees to north T10, within *c*. 200 m assessed as having LOW to NEGLIGIBLE roost potential, as only had a limited number of shallow knots.

Habitat types throughout the turbine envelope are dominated by open, cut-over bog which is industrially exploited for 'peat moss' and blocks of commercial forestry plantations, which are fringed by the remnants of raised bog and some bog woodland. The majority of the turbines will be sited within the exposed cut-over bog including T1, T2, T3, T4, T6, T7, T8, T9, T10, T11, T12 and T13, with T5 and T14 located within conifer plantations. The proposed location for T15 is within pastural grassland including some species rich wet grassland along the River Glore. The river dissects the Wind Farm Site and provides a linear feature with strong connectivity to the surrounding landscape via plantations and the River Inny.

Although the turbines are predominately located within open situations in exposed peat, the interface between the cut-over bog and forestry provides potential foraging and commuting features for bats. Turbines located closer to the forestry edge are predicted to experience higher levels of bat activity, especially when turbines are also located adjacent to the River Glore, where the insect biomass likely to be associated with forested sections of the river is anticipated to be preferentially exploited by foraging bats.

11 Lundy, M.G., Aughney, T., Montgomery, W.I., & Roche, N., (2011) *Landscape conservation for Irish bats & species specific roosting characteristics. Bat Conservation Ireland*

Table 4 – Summary of bat habitat suitability assessment - Coole Wind Farm Site, Co. Westmeath

Turbine	Foraging features and assessment of vegetation removal required for turbine buffer	Roost potential within c. 300m of turbines
NORTH BOG		
T1	In cut away, with weak feature along edge of remnant raised bog habitat. Bog woodland & bog pool within 300m. R. Inny just beyond 300m. Required bat buffer achievable – impinges into remnants of raised bog & may require removal of scrub at periphery (feature height: 15m)	To west birch woodland within 300m buffer – v limited roost potential, with conifer plantation to S & SW having been recently clear-felled. Some LOW-MOD roost potential in ivy clad poplar trees along R. Glore – slightly beyond 300m
T2	In cut away bog, with relatively strong foraging feature along vegetated drain & edge of bog woodland. To achieve the required bat buffer - some clearance may be required along drain (feature height: 5m) & into bog woodland	Very Limited to no roost potential within 300m turbine buffer, with bog woodland & conifer plantation to north of cut away
T3	In cut away, with strong foraging/ commuting feature along R. Glore within 100m for turbine Required bat buffer achievable only impinging into birch/ willow scrub (feature height: 10m) along R. Glore	Roost potential in poplar treeline along R. Glore – assessed as NEG to occasionally MOD bat roost suitability
T4	In cut away, with closest foraging/ commuting feature > 150m away Required bat buffer achievable - no vegetation clearance required	Very limited to no roost potential within 300m of turbine to north & east – bog woodland, scrub & 2nd rotation
Access track T3 to T1	Track will need to be constructed along R. Glore, possibly utilising a rough forestry track recently opened up to access clear-felled timber in plantation south of T1. Wind Farm Site includes treeline of relatively mature poplars, some of which are ivy clad – assessed as having NEG to occasionally MOD bat roost suitability, mostly LOW – see T7 assessment for best cover. If scrub and treeline are retained the consented access track will provide a sheltered ride for foraging bat adjacent to a river potentially rich in insects	
Access track T3 to T4	Construction will require upgrading of existing forestry track that has become over grown with birch scrub & 2nd rotation. Construction will alter habitat features, however provided an avenue of trees/ scrubs is retained the resultant track is likely to provided sheltered foraging options. Very limited/ no roost potential in Wind Farm Site. There were some more mature Scot's pines recorded at the NE bend (NEG. potential): [53.739022, -7.357606]	
Access track T4 to T2	Upgrading of existing track into bog will be required, with a limited part of the Wind Farm Site impinging on scrub/ bog woodland along the northern edge of the bog – neutral impact anticipated, as overall length of woodland edge will remain the same	
MIDDLE BOG		
T5	In plantation, located within *c*. 80m of R. Glore To achieve the required bat buffer - extensive clearance required of young plantation, birch and scrub (feature height: 15m). Also, taller trees along R. Glore (feature height: poplars up to 30m plus)	Roost potential in poplar treeline along R. Glore & ivy clad mature trees dispersed along track – assessed as NEG to occasionally MOD bat roost suitability
T6	In cut away bog within 110m of strong foraging/ commuting feature along edge of plantation Required bat buffer achievable	Ivy clad spruce treeline along track b/t T5 & T9 (also within 300m of T5) – LOW occ. MOD potential for roosts. More potential for bat roosts within beech woodland along track N of shed
T7	In cutaway bog within 115m of strong foraging/ commuting feature along edge of plantation Required bat buffer achievable	Bat roost potential within 300m, limited to maturing poplar treeline along R. Glore – NEG to occ. MOD potential in ivy clad poplars
T8	In cut away bog, *c*. 180m from closest foraging/ commuting feature, also *c*. 260m SE of R. Inny Required bat buffer achievable	No bat roost potential within 300m, very open

T9	In cut away bog within *c*. 75m of foraging/ commuting features Required Bat buffer largely achievable, some 2nd rotation & scrub removal maybe required (feature height: c. 5m)	No roost potential within 250m, although some older beech & ivy clad spruce offering Low to Neg roost potential with c. 300m – on lane leading to T5. Neg roost potential in large modern shed to NE which is beyond 300m
Access track T9 to T5/T6	Upgrading of existing forestry track with be required, which is likely to result in the loss of potential roost habitat in trees. Construction will alter habitat feature, however provided avenue of trees/ scrubs retained the resultant track is likely to provided sheltered foraging options.	
Access to T7	Wind Farm Site includes plantation on edge of cut away. Habitat feature many be impacted by construction of the access track which follows the edge of the bog very tightly.	
SOUTH BOG		
T10	In cut away bog within 150m of foraging/ commuting feature along road Required bat buffer achievable	Very limited bat roost potential within 300m, including three oaks on north side of road assessed as having NEG to LOW roost potential - some knots/ dead wood but no obvious holes, located at: [53.728917, -7.387972]
T11	In cut away bog within 115m of strong foraging / commuting feature along edge of plantation Required bat buffer achievable	No bat roost potential within 300m, only young plantation and scrub at edge of cut away
T12	In cut away bog with weak foraging feature along edge of remnant raised bog habitat Required bat buffer achievable	Remnants of raised bog backed by birch scrub/ plantation - very open habitat with limited features until *c* 280-300m where scrub/ plantations occur. Assessed as having no roost potential within 300m
T13	In cut away bog with some foraging potential at *c*. 300m along second rotation & edge of cut away bog Required Bat buffer achievable	No bat roost potential within 300m
Access T11/ T12	Potential for some loss/ alteration of bat foraging habitat - however provided forestry edge remains the resultant track will continue to provide potential foraging habitat for bats. Route to T12 may impact on remnants of raised bog	
NEWLY PROPOSED TURBINES		
T14	Within young 2nd rotation plantation – pre-closed thicket, which was dominated with scrub. Stronger linear feature consisting of more mature treelines noted around the edge of the plantation. To achieve the required bat buffer - extensive clearance required of young plantation	Potential roosts in ivy clad trees to east 2nd rotation (NE of T14) assessed as having NEG potential for roosting bats. Plantation & birch scrub to south assessed as not having any roost potential. Mature treelines to SE at *c*. 300m accessed having LOW to MOD roost potential
T15	***Initial assessment*** – Turbine located at [53.728530, -7.352458] within pastural grasslands, with low Sitka spruce treeline and a field of species rich wet grassland to south (NOTE: chipping snipe recorded) R. Glore & semi-natural woodland located within 200m. the required bat buffer achievable without any significant removal of bat foraging features at initial location ***Micro-siting*** - T15 has been re-positioned to [53.728850, -7.351831] - this re-location places the turbine within 85m of a plantation.	Bridge over R. Glore at [53.728105, -7.355162] LOW-MOD roost potential - although there were some fissures in masonry assessed as low potential due to limited features (connectivity) along this section of R. Glore. NOTE: Emergence surveys conducted in 2019 & 2020 – NO BATS RECORDED emerging No roost potential in woodland to NE of turbine – no old growth trees, mostly birch scrub around edge Potential roost beyond 300m in old house, stables & sheds at: [53.723702, -7.359208] - LOW to MOD – no building inspection conducted, as outside optioned lands; but has some potential – emergence survey conducted in July 2020 in conclusive (foraging bat recorded in area)
Access T15	Construction of the access track to T15 from the main road will involve removal of several lengths of treeline/ hedgerow. These features are used by foraging bats & will need to be replaced 'like-for-like' within the Wind Farm Site. There were some trees with dead wood & dense ivy that were classed as having LOW to MOD roost potential. On the main road there were more mature trees with MOD roost potential. There are several other potential roosts beyond 300m of T15, but closer to proposed access route from main road – these are predominately occupied by dwelling, but there are some abandoned buildings and some mature trees within treelines	
Borrow pit	There were some mature trees with MOD roost potential.	

3.3 Emergence/ re-entry surveys at potential roost

Habitat suitability surveys determined that there were a limited number of features with moderate to high potential for roosting bats. Emergence surveys were conducted on three occasions during the 2020 active bat season, with two surveyors covering different feature on each visit. The following sections provides survey reports for each visit.

Visit 1
Date: 09-Jul-2020 *Sunset*: 21:54 Start: c. 21:30 *Duration*: 1.5 hours
Locations covered: One surveyor cover the Bridge over the River Glore near T15 and the other surveyor covering the northern side of some buildings near the access route to T15 – see **Figure 3.**
Observations:

At bridge - No bats were observed emerging from the bridge. The first bat was recorded at 22:19 and was Leisler’s bat commuting south to north at height. Two more commuting Leisler’s bat were recorded at 22:46 and 22:58. Towards the end of the survey a common pipistrelle was detected foraging briefly in the area at 22:56 and 22:59, followed by a single soprano pipistrelle commuting along the river. NOTE: An emergence survey conducted on 18 July 2019 (21:30 to 22:30, 1 hour) also returned no bat activity.

Farm Buildings – The first bats were recorded at 22:21 and were common pipistrelles foraging in the SW corner of the field, followed by a soprano pipistrelle at 22:29. The first and only Leisler’s bat was recorded at 22:34. Both common and soprano pipistrelles continued to forage in the area throughout the survey and towards the end the of the survey at 23:03 a possible Nathusius' pipistrelle was recorded. While no bats were observed emerging from the northern end the building, the survey was deemed inclusive, as the remainder of the buildings were not covered.

Visit 2
Date: 16-Jul-2020 *Sunset*: 21:52 Start: c. 21:20 *Duration*: 1.75 hours
Locations covered: One surveyor covering poplar treeline along River Glore near T3 and the other surveyor covering some mature trees along River Glore adjacent to T5 – see **Figure 4**
Observations:

Poplar treeline at T3 – No emerging bats were recorded. The first bat was a common pipistrelle recorded at 22:14, followed by a Leisler’s bat at 22:22 which were only recorded once more at 22:32. Common pipistrelles continued to forage/ commute in area throughout the watch and dominated the registrations until approx. 22:40. The first was soprano bat was detected at 22:33 and there was flurry of activity up until 22:40. The first Myotis species was recorded at 22:37, with registrations starting dominate the records after 22:40.

Trees near T5 – No emerging bats were detected. The first bat was a common pipistrelle recorded at 22:16, followed by a soprano pipistrelle at 22:22. Both these species were recorded actively foraging throughout the surveys. Myotis species activity was first detected at 22:32 and were then regularly recorded foraging in the area for the remainder of the survey. A Leisler’s bat was recorded at 22:33; but no more detected until the near end of the survey when five passes were recorded between 23:04 and 23:08.

Visit 3
Date: 14-Sep-2020 *Sunset*: 19:47 *Start*: c. 19:32 *Duration*: 1 hour
Locations covered: Beech wood on access track between T5 and T9, with one surveyor covering western end and other covering eastern end – see **Figure 5**
Observations:
West side of wood – No emerging bats were recorded. The first bat recorded was a Leisler’s bat which passed through the area at 20:03 and this species was only again at 20:05 and 20:16. The first common and soprano pipistrelles were recorded around the same time at 20:14 and 20:17, respectively, with small numbers foraging in the area throughout the survey period. Social calls were recorded for both these pipistrelle species, indicating that there was mating behaviour occurring in the area. Myotis species were only recorded once during the survey at 20:21 and then again as the surveyor was leaving the area at 20:34. Similarly, brown long-eared bats were only detected once.

East side of wood – No emerging bats were recorded.

3.4 Transect survey reports

Visit 1: 09-Jul-2020
Following on from the emergence surveys conducted at the bridge and stables near T15 surveyors undertook a walked and driven transect which covered the access track to T15, main road section (driven) and the northern and middle bogs.

During the survey the most activity was recorded by common pipistrelles (49 passes) followed by soprano pipistrelles (33 passes), Leisler's bats (15 passes) and *Myotis* species (3 passes). As illustrated in **Figure 3**, bat activity was strongly associated with habitat features, with the forested track between River Glore - T5 and T9 generating the majority of the records. While foraging activity was high along the track, the numbers of bat observed did not exceed 3 individuals and many of the bat registrations were generated by the same animals foraging up and down the woodland edge of the track. As would be expect the transect sections covering open bog did not record any bats.

Visit 2: 16-Jul-2020
Following on from emergence surveys conducted along the River Glore adjacent to T3 and T5, surveyors undertook transects covering the northern and middle bog simultaneously, followed by a driven transect along the main road, then walked up towards T15.

During the survey the most activity was recorded by common pipistrelles (31 passes) and soprano pipistrelles (29 passes), Leisler's bats (11 passes) and *Myotis* species (3 passes). As illustrated in **Figure 4**, bat activity was strongly associated with habitat features with woodland edge along the River Glore adjacent to T3 generating much of the activity with a minimum of four species recorded. *Myotis* species activity had been relatively high along the River Glore during the emergence surveys; however, they were not recorded away the river during the transect and were only detected at one location along the river adjacent to T3. Small numbers of foraging bats were also detected along the proposed access route to T15 and at the beech wood between T5 and T9.

Providing some context to levels of activity recorded by the static units deployed to cover T2, a single common pipistrelle pass was recorded along the drain near the deployment location, which mirrored the activity recorded on the previous transect. The vegetated nature of the drain, which divides two sections of cut over bog provides the only feature with connectivity through the bog and is likely to be preferentially utilised by foraging and commuting bats.

Visit 3: 14-Sep-2020
Following on from emergence surveys conducted at the beech wood along the T5 to T9 track, surveys undertook transects undertook a transect covering the middle and southern bog, followed by a driven transect along the main road, then walked up towards T15.

During the survey the most activity was recorded by soprano pipistrelles (99 passes) followed by common pipistrelles (64 passes), *Myotis* species (3 passes), Nathusius' pipistrelle (3 passes), brown long-eared bat (3 passes) and Leisler's bats (1 pass). As illustrated in **Figure 5**, the highest levels of soprano pipistrelle and common pipistrelle activity associated with woodland edge along the River Glore leading out to T7 and around to periphery of the site along the River Inny. Other hotspots of foraging activity were also detected, including the interface between cut away and remanent raised bog adjacent to T12.

The single Leisler's bat was recorded passing along the edge of the plantation adjacent to T7. Brown long-eared bats were recorded at two locations, including along the track between T5 and T9 (2 passes), and single bat was also detected in the middle of the southern bog. The *Myotis* species were recorded at the beech wood at the end of the emergence survey and there was single pass recorded at the start of the proposed access track to T15. Nathusius' pipistrelles were recorded at two locations including the on the proposed access track up to T15 and along the main road between T10 and T13.

3.5 Winter roost inspection surveys

SNH *et al*. (2019) guidelines recommend that winter roost surveys should also be carried out for any potential hibernation roost within 200 m plus rotor radius of developable area.

No potentially suitable significant hibernation roost features were identified within the potential Zone of Influence extending 300 m from proposed turbines and 30 m from access tracks. Therefore, no winter roost surveys were required on this site

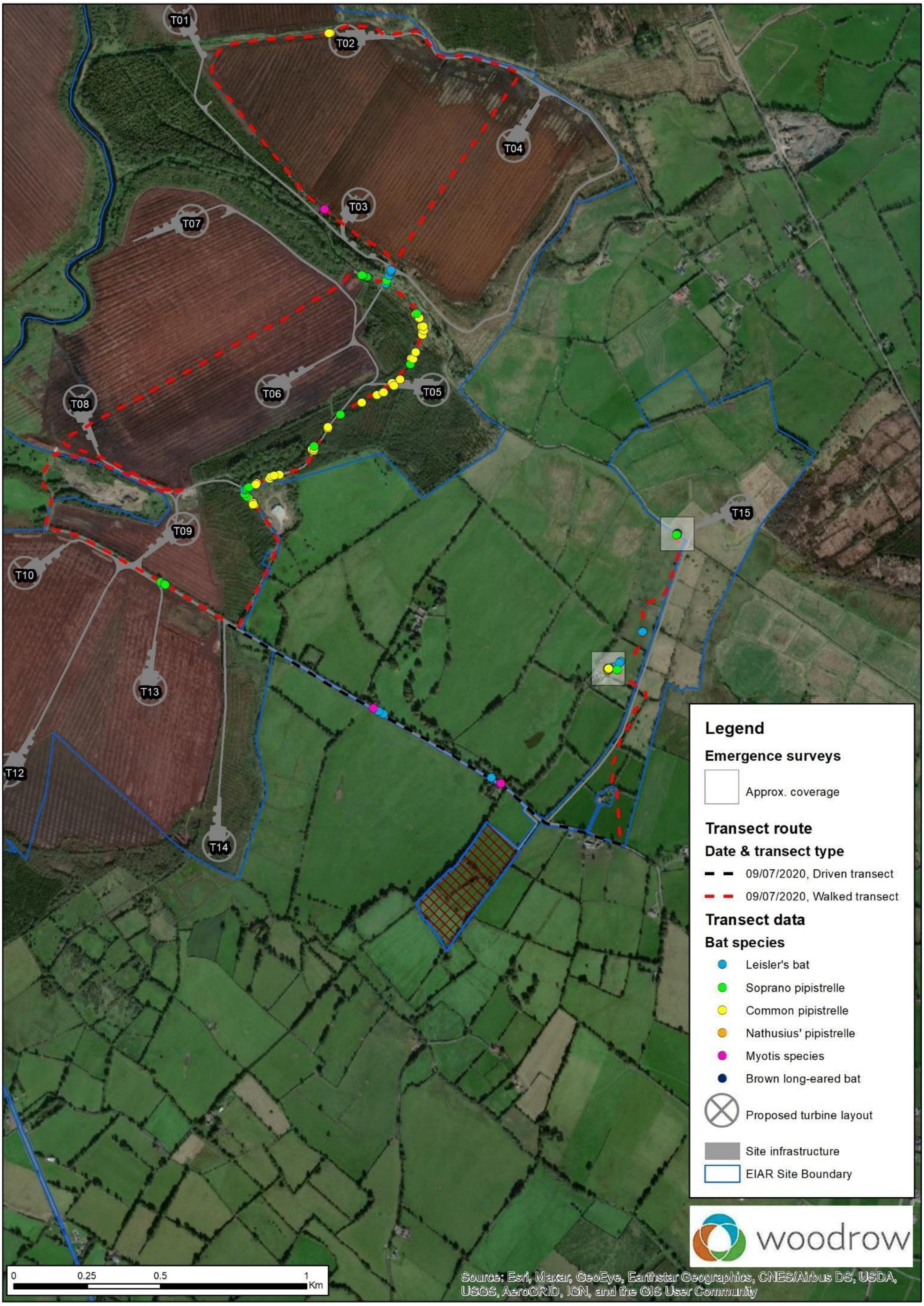


Figure 3 – Roost emergence and bat activity transect 09-Jul-2020

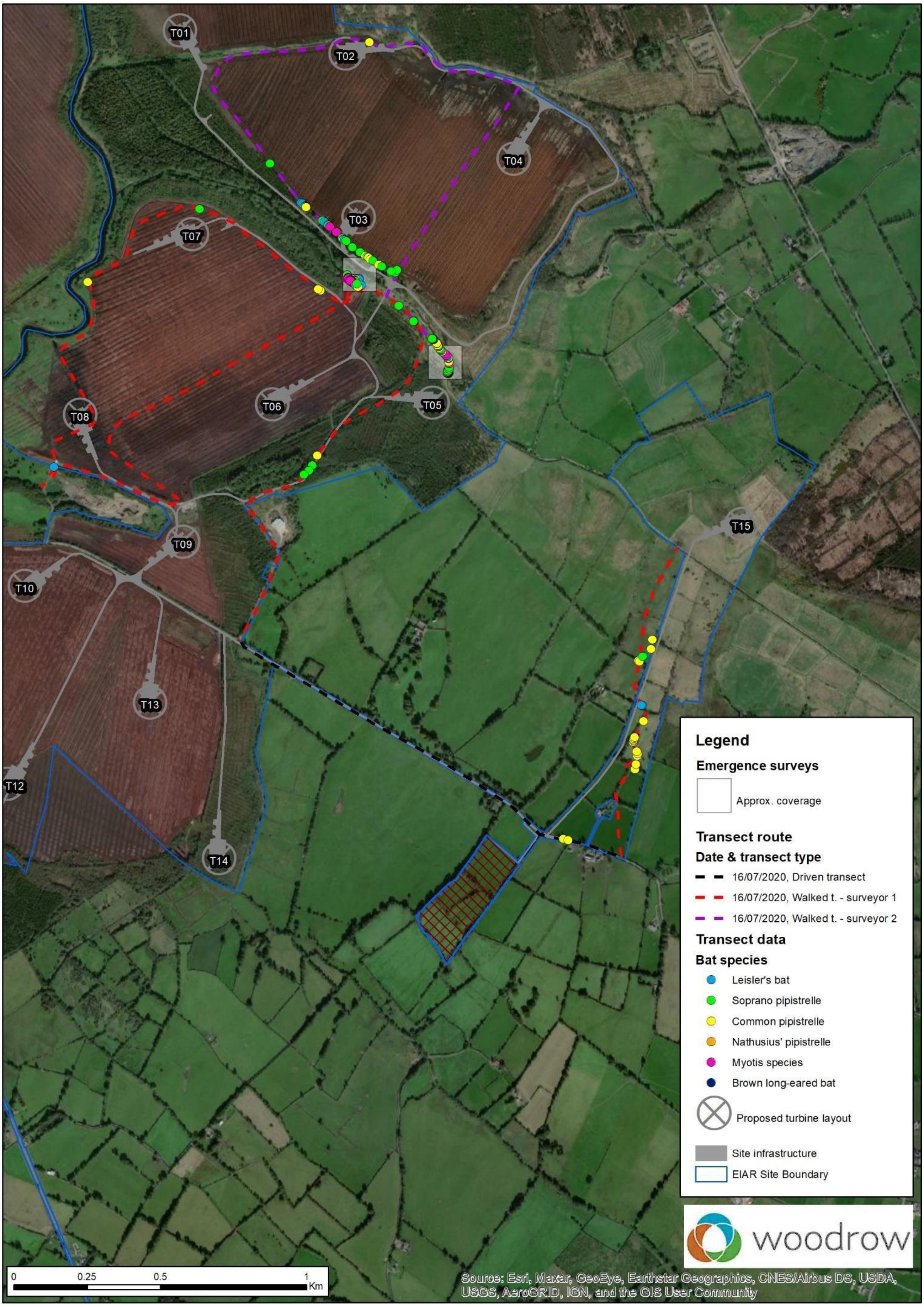


Figure 4 – Roost emergence and bat activity transect 16-Jul-2020

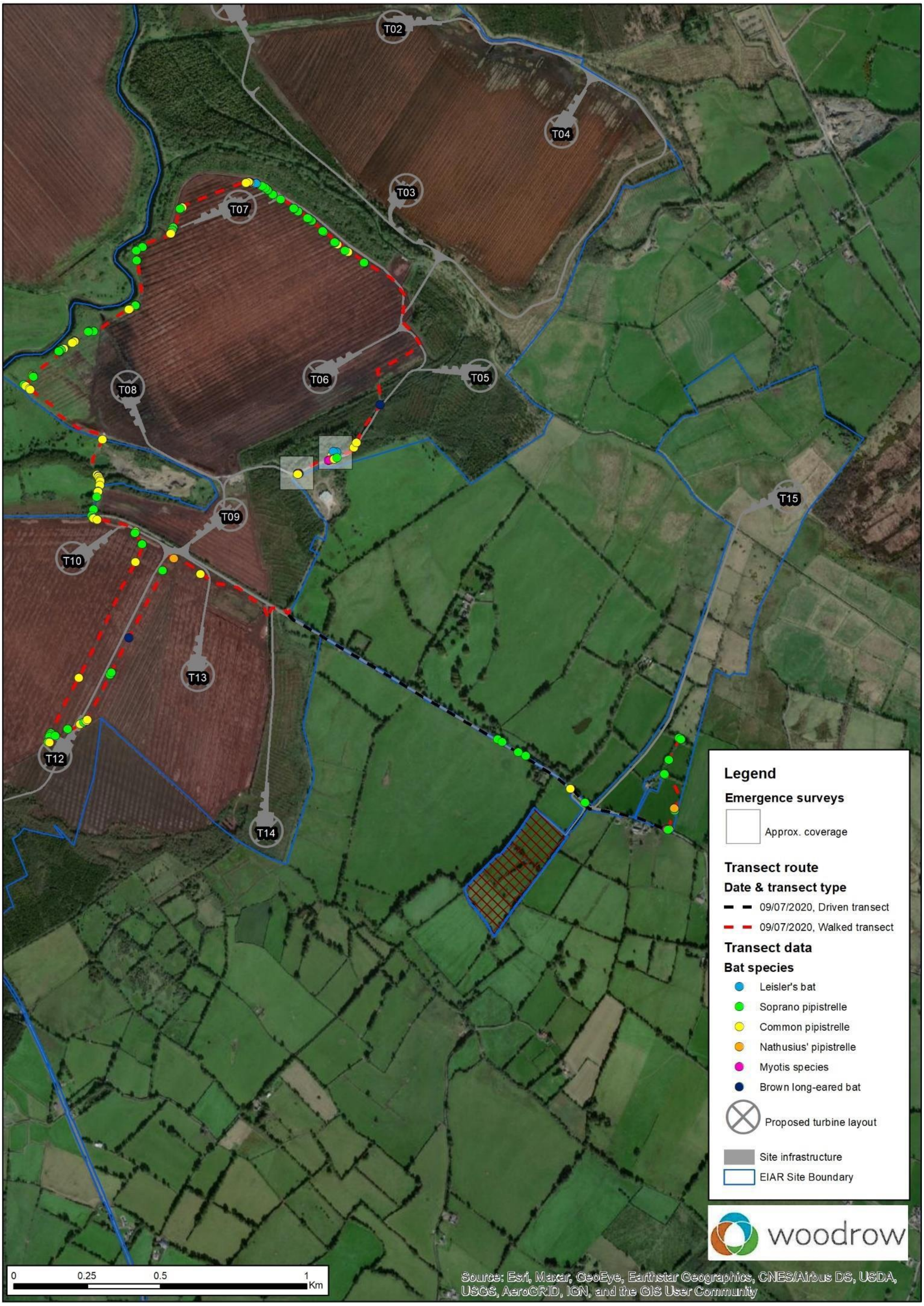


Figure 5 – Roost emergence and bat activity transect 14-Sep-2020

3.6 Static detector surveys

The SNH *et al*. (2019) guidelines recommend using the online tool Ecobat[12] (or equivalent) to allow for a measure of relative bat activity using a ranking system, which compares the data collected at the study site with bat survey information collected from similar areas during similar times of year. Up until recently, the reference system was strongly oriented on UK bat populations and it was not clear whether reference data sets were relevant to Ireland. Comparative Irish data sets are now considered to have surpassed thresholds to allow for more robust assessments. Data collected from static bat recording units deployed at the Coole Wind Farm Site during the 2020 active bat season was run through Ecobat on 02-Nov-2020 and a report was generated on 05-Nov-2020.

Ecobat is a web-based interface which allows users to upload activity data and to contrast results with a comparable reference range of data already inputted into Ecobat*'s* system, allowing objective interpretation. Data provided to Ecobat contributes to further analysis through their interface providing a greater number of reference records for their system, improving future reports (Lintott *et al*., 2017). For the Coole Ecobat report, database records used in the analyses were limited to those within a similar geographic region (200 km), using Wildlife Acoustic detectors and also limited to records within a 30-day timescale. As shown in **Table 8**, the data set for the Coole Wind Farm Site was compared to reference data from 2,693 to 9,156 nights.

The percentiles generated by Ecobat for specific nights of bat activity allows for the objective classification of bat activity as low, moderate or high. **Table 5** shows the levels of bat activity categories by Ecobat percentile scores, which is suggested by SNH *et al.* (2019) for use in the assessment of risk to local bat population from wind farm developments.

Table 5 – Bat activity levels categorised by percentile scores
Source: SNH *et al*. (2019)

Ecobat Percentile	Bat Activity Level
81 - 100	High
61 - 80	Moderate/High
41 - 60	Moderate
21 - 40	Moderate/Low
0 - 20	Low

This initial analysis examines the data for the site as a whole and all the values are taken from across all of the detectors and all three deployments to provide site-wide averages/medians. From an entire site perspective, across all three deployments there were no high level of bat activity for any species according to the activity percentile classifiers provided by Ecobat - see **Table 6**. *Myotis* species., Nathusius' pipistrelles and brown long-eared bats all had moderate/low levels of activity. Leisler's bats, common pipistrelles and soprano pipistrelles had moderate activity levels on a site wide basis across all three deployments. **Table 7** shows that while overall activity levels did not exceed Moderate Activity Levels, there were some nights when activity for Leisler's bats, common pipistrelles and soprano pipistrelles was High or Moderately-high, with single nights noted as having High or Moderately-high brown long-eared bat activity.

As shown in **Table 8** several detectors located at T2, T5 and T7 during the spring deployment registered nights with high levels of activity for common pipistrelles, soprano pipistrelles and Leisler's bats. During the autumn deployment high activity was detected at T5 for Leisler's bats and brown long-eared bats.

12 http://www.ecobat.org.uk/

Table 6 – Summary of key metrics for each species recorded within the study area

Species	Median Percentile	95% Confidence Intervals	Max Percentile	Nights Recorded	Median Activity Levels
Myotis species	**21**	49.5 - 72.5	76	327	**Moderate/Low**
Leisler's bat	**54**	66.0 - 77.5	96	422	**Moderate**
Nathusius' pipistrelle	**21**	34.5 - 34.5	58	80	**Moderate/Low**
Common pipistrelle	**48**	91.5 - 95.5	98	419	**Moderate**
Soprano pipistrelle	**48**	76.5 - 92.5	94	441	**Moderate**
Brown long-eared bat	**21**	30.8 - 35.0	74	116	**Moderate/Low**

Table 7 – Number of nights of activity for each species within SNH *et al*. (2019) activity categories
Note: This is relative to the sum of nights recorded across all detectors, n = 555 nights

Species	Nights of activity					Total nights recorded
	High	Moderate/ High	Moderate	Low/ Moderate	Low	
Myotis species	0	20	68	239	0	327
Leisler's bat	33	128	114	147	0	422
Nathusius' pipistrelle	0	0	10	70	0	80
Common pipistrelle	56	88	113	162	0	419
Soprano pipistrelle	37	119	120	165	0	441
Brown long-eared bat	0	1	12	103	0	117

Table 8 – Turbine locations and species with High or Moderately-High activity levels

Season	Turb. No.	Species	Median Percentile	95% Confidence Interval	Max Percentile	Nights Recorded	Reference Range (nights)
Spring	T-01	Leisler's bat	73	66 - 77.5	86	14	7,666
		Common pipistrelle	66	55 - 70.5	77	12	9,156
	T-02	Common pipistrelle	84	56 - 94	98	14	9,156
		Soprano pipistrelle	76	48 - 89	94	14	9,124
	T-04	Leisler's bat	61	48 - 66.5	78	13	7,666
		Common pipistrelle	67	49.5 - 77	90	12	9,156
	T-05	*Myotis* species	63	49.5 - 72.5	73	7	3,183
		Leisler's bat	61	57.5 - 75.5	76	7	3,333
		Common pipistrelle	94	91.5 - 95.5	96	7	9,156
		Soprano pipistrelle	88	76.5 - 92.5	93	7	9,129
	T-06	Leisler's bat	70	49 - 75.5	84	14	7,666
	T-07	Leisler's bat	83	58.5 - 90	96	14	7,666
		Common pipistrelle	81	53 - 87	96	13	9,156
	T-08	Leisler's bat	71	46 - 77.5	84	11	7,666
		Common pipistrelle	61	42.5 - 70	90	13	9,156
	T-10	Leisler's bat	64	49.5 - 73	80	12	7,666
		Common pipistrelle	61	49.5 - 69	77	10	9,156
	T-14	Leisler's bat	65	43.5 - 69.5	75	10	7,666
	T-15	Leisler's bat	67	54 - 75	86	14	7,666
Summer	T-02	Soprano pipistrelle	70	58 - 79.5	94	16	9,125
	T-05	Leisler's bat	68	48 - 74.5	89	19	7,667
		Common pipistrelle	72	55.5 - 79	94	14	9,152
		Soprano pipistrelle	79	64 - 81.5	88	14	9,129
	T-09	Leisler's bat	64	54.5 - 72	88	19	7,667
Autumn	T-01	Common pipistrelle	72	51 - 82	90	11	9,156
		Soprano pipistrelle	64	49.5 - 70	82	15	9,129
	T-02	Common pipistrelle	75	51 - 82	96	14	9,156
		Soprano pipistrelle	75	53 - 81.5	91	15	9,129
	T-05*	Leisler's bat	84	0	84	1	7,666
		Common pipistrelle	64	0	64	1	9,156
		Soprano pipistrelle	70	0	70	1	9,129
	T-14	Soprano pipistrelle	61	41 - 66	75	14	9,129

*Due to microphone failure the unit covering T5 only recorded for one night

Prior to the use of outputs from Ecobat, analysis of the data recorded during static detector surveys used bat passes per hour (bp/h) to assess levels of bat activity during surveys. This is effectively bat contacts per hour and is worked out on the basis of the time that the static bat detectors operated during the deployment period (set to record from half an hour before sunset to half an hour after sunrise). Bat activity within sites is considered to be a useful proxy for assessing the potential collision risk posed by new wind farm sites. This was the approach employed for previous surveys undertaken at Coole in 2018 and 2019, and to allow for comparison to previous data sets it is used again for the 2020 static data.

As for the outputs from Ecobat, in order to provide a context for significant levels of activity for the recorded data, the data has been presented taking account of a Polish study by Kepel *et al*. (2011)[13]. This study sought to attribute significance levels to bat activity recorded during wind farm surveys.

Table 9 shows the levels attributed to low, medium and high activity in the Polish study. For the purpose of wind farms in Ireland, the activity levels of the Polish study have been adapted into bands representing low, medium, and high levels of bat activity. These are illustrated in **Table 10**.

Table 9 – Bat activity levels associated with bat passes per hour (bp/h) - Kepel *et al*. (2011)
Image sourced from A Review of the Impacts of Wind Energy Developments on Biodiversity[14]

Bat activity	*Nyctalus* species	*Pipistrellus* species	All bat species
Low	2.5	2.5	3
Medium	4.3	4.1	6
High	8.6	8.0	12

Table 10 – Bat activity levels associated with bp/h adapted from Kepel *et al*. (2011)

Attributed activity level	*Nyctalus* species	Pipistrelle species	All bats
Low	0.0 to 3.5	0.0 to 3.5	0.0 to 4.0
Medium	3.6 to 6.5	3.6 to 6.5	4.1 to 10.0
High	> 6.5	> 6.5	> 10.0

The following sections detail the results from static monitor surveys for each of the seasonal deployments in 2020. The map in **Figure 2** shows the deployment locations for each season – spring, summer and autumn. **Table 11** provides a summary of the data recorded for each deployment period. **Figure 6**, **Figure 9** and **Figure 12** are maps illustrating the relative density of bat activity (bat passes/ hour - bp/h) at each deployment location across the site, for each seasonal deployment – spring, summer and autumn, respectively. The location of each static detector is represented as a pie chart. The relative size of the pie charts illustrates the total number of bat passes per hour in relation to neighbouring units, with segments showing the percentage makeup of different bat species. This helps to provide a visual indication of usage of the site by the local bat population. Note the pie charts are set to the same scale across the three separate maps for each seasonal deployment and

13 Kepel, A., Ciechanowski, M. & Jaros, R. (2011). How to assess the potential impact of wind turbines on bats using bat activity surveys? A case study from Poland, XII European Bat Research Symposium, August 22-26, 2011, Vilinsum Lithuania.

14 Tosh, D.G., Montgomery, W.I. & Reid, N. (2014). A review of the impacts of wind energy developments on biodiversity. Report prepared by the Natural Heritage Research Partnership (NHRP) between Quercus, Queen's University Belfast and the Northern Ireland Environment Agency (NIEA) for the Research and Development Series No. 14/02.

therefore provide a visual comparison of relative activity between seasons. For comparative assessment, across all the deployments and for all the species recorded, refer to bat passes per hour in **Table 11**.

Weather data (temperature, wind speeds and rainfall) is displayed graphically for each of the deployment windows in **Figure 7**, **Figure 10** and **Figure 13**.

Note the distance that bats are from static bat detectors when calls were recorded cannot be gauged effectively; and the same is often true for handheld recording devices in some instances. The detection distance for bat recording equipment is highly variable, and affected by atmospheric attenuation, the frequency of the bat call, the loudness of the bat and the direction of the bat call itself. Results therefore show bat activity for a general locality (for example within 30-40m of a location, rather than at a single point (Note: Under certain conditions and for certain species. e.g. Leisler's bats this can extend up to 100m).

3.6.1 Spring – Static detector monitoring report: 12-May to 26-May-2020

The spring deployment covered 14 nights from the middle of May onwards and a total of 13 units were deployed. All the units recorded for 14 nights, with the exception of the unit covering T5, which managed to record for 12 nights and the relatively high numbers of bat recorded at this location, combined additional background noise from trees, may have resulted in earlier depletion of batteries.

Weather data illustrated on graphs in **Figure 7** shows that the majority of the nights were compliant the weather parameter stimulated by SNH *et al*. (2019). Temperatures at dusk were at or above 8°C and remained above higher than 8°C for most the deployment period. The overnight temperatures did dip below 8°C over the first 3 nights of the deployment, dropping below zero around mid-night on 13/14-May and 14/15-May. Temperatures dropped to *c*. 1°C for one of the final nights of the deployment (24/25-May). Significant rainfall was only recorded on the night of 21/22-May with some prolonged moderate showers occurring. Some periodic light showers occurred on the morning of 23-May and overnight on 23/24-May. Overnight wind speeds rarely exceeded 11 mph (5 m/s), with blustery conditions only occurring from the night of the 21-May to the morning of the 23-May, when average wind speeds of 14 to 15 mph (6 to 7 m/s) were recorded.

It is considered that the spring deployment provides sufficient baseline data to facilitate a robust assessment of potential impacts of the proposed Wind Farm Site.

Figure 6 shows the distribution of bat passes recorded at all the deployment location over the spring (May) deployment period and **Table 11** provides a summary of the data recorded by each of the static units deployed.

Across all the deployment locations a minimum of six bat species were recorded during the spring (May) deployment (n = 1,593 hours), including common pipistrelles (6.1 bp/h), Leisler's bats (3.2 bp/h), soprano pipistrelles (1.8 bp/h), *Myotis* species (0.4 bp/h), brown long-eared bat (0.04 bp/h) and Nathusius' pipistrelles (0.04 bp/h). As summarised in **Table 11**, aggregated bat passes per hour for each deployment location were classed as high activity for three deployment locations (D.02, D.05 and D.07) and medium activity for five deployment locations (D.01, D0.04, D.06, D.08 and D.13), with the remainder classed as low activity (D.03, D.09, D.10, D.11, and D.12). Overall, the highest levels of activity were recorded at D.02 (5,782 passes or 46.5 bp/h) and the lowest levels of activity were recorded at D.11 (26 passes or 0.2 bp/h).

Activity levels at the three turbine locations ranked as high were driven by high levels of common pipistrelle activity, combined with high levels of soprano pipistrelle activity at D.02 and with high levels of Leisler's bat activity at D.07. Both D.02 and D.05 were adjacent to habitat features with strong connectivity to the wider landscape and therefore high levels of activity would not be unexpected. In contrast, the unit covering D.07 was located *c*. 80 m away from any habitat features in open cut away bog.

Figure 8 shows the number of bat passes recorded each hour by the unit deployed near T7 (D.07) in spring and it can be seen that bat activity increases at this location on the night of the 16/17-May, which was the first night of the deployment period when overnight temperatures remained above 8°C. Coinciding with this warming of overnight temperatures, hourly bat passes for Leisler's bat and common pipistrelle often exceeded 50 bat passes per hour for the two nights, which is indicative of bats concertedly foraging in the general area.

The unit covering T7 (D.07) was located in open bog, and while there were definitely very distinct (strong) sonograms indicating that bats were forging/ commuting in relatively close proximity to the unit, as would be expected during the warm and calm weather conditions experienced during the deployment period; there was also a high proportion of fainter sonographs suggestive of bat activity further away from the unit. This was especially the case for Leisler's bats, a species known for being detected over longer distance, due the loudness of their call and maximum pick-up distances of 80 to 100 m are quoted in the literature (e.g. Shiel & Boston[15]). Obviously, it is not possible to infer what direction a call comes from based on static bat detector recordings; however, examining habitat availability in the locality of T7 it is likely that a significant amount of the more distant bat activity was associated with the linear strip forestry following the River Glore to the north of T7 and veering round to meet the River Inny to the west of T7.

The northwest corner of the open bog at T7 is framed by a right angle formed by the confluence of the Glore and Inny Rivers which are fringed by scrub, semi-natural woodland and forestry forming a significant commuting feature through the Wind Farm Site with strong connectivity to the surrounding landscape. It is possible that some of the activity detected at T7 was bats crossing the corner of the open bog to commute between the two riverine features. In addition, the prevailing light south-westerly airflow over the busiest nights of this deployment meant that the forestry edge adjacent to the cut away bog would be a relatively sheltered location for foraging bats.

3.6.2 Summer – Static detector monitoring report: 16-Jul to 04-Aug-2020

The summer deployment covered 19 nights from the middle of July and into early August. A total of 13 units were deployed and 12 units recorded successfully for 19 nights. The SD card from the unit covering T6 was corrupted and the sound files were lost. Fortunately, for Coole Wind Farm where the proposal is for 15-turbines, SNH *et al*. (2019) stipulate that a minimum of 12 static bat detectors should be deployed at selected turbine locations; and therefore, the summer deployment was deemed compliant with the guidelines. Additional consideration is also given to the extend period of the deployment, as well as the fact the habitat type covered by the unit deployed at T6 (open, industrial cut-away bog) was well represented in the data set.

Weather data illustrated on graphs in **Figure 10** shows that the majority of the nights were compliant the weather parameter stimulated by SNH *et al*. (2019). Overnight temperatures only dropped below 9°C on three occasions and on these nights, temperatures were above 8°C at dusk. Wind speeds, although occasionally reaching 11 to 12 mph during the day (above 5 m/s), remained calm overnight typically staying lower than 8 mph. The deployment period was relatively wet and rainfall was recorded on a total of ten nights; however, the periodic duration and low levels recorded on four nights or part thereof, including 17/18-Jul, 23-Jul. am, 24/25-Jul, 02/03- Aug were not considered to affect compliance with SNH guidelines. Prolonged and/ or heavy rainfall on six nights or part thereof were considered to breach thresholds for compliance, including periods on: 22-Jul. am, 25-Jul. pm, 26/27-Jul, 30-Aug. am, 01-Aug. pm, 04-Aug. am. This equates to a maximum of 3.5 non-compliant nights during the summer deployment due to rainfall, which was more than adequately accounted for by a 19-night deployment window.

It is considered that the summer deployment provides sufficient baseline data to facilitate a robust assessment of potential impacts of the proposed Wind Farm Site.

Figure 9 shows the distribution of bat passes recorded at all the deployment locations over the summer (Aug-Jul) deployment period and **Table 11** provides a summary of the data recorded by each of the static units deployed.

15 Shiel, C.B. & Boston, E.S. (Assessed Nov-2020). VWT: Species Profile – Leisler's bat. https://www.vincentwildlife.ie/species/leislers-bat

Across all the deployment locations a minimum of six bat species were recorded during the summer deployment (n = 1,597 hours), including soprano pipistrelles (1.8 bp/h), Leisler's bats (1.5 bp/h), common pipistrelles (1.3 bp/h), *Myotis* species (0.27 bp/h), brown long-eared bat (0.04 bp/h) and Nathusius' pipistrelles (0.006 bp/h). Overall activity levels were notably lower than those recorded in the spring and this drop off in activity was likely to be the result of maternity roosts being distributed well beyond the deployment locations for some of the proposed turbines. As summarised in **Table 11**, aggregated bat passes per hour for each deployment location were classed as high for two deployment locations (D.02and D.05) and medium activity for four turbine locations (D.01, D.04, D.07 and D.09), with the remainder classed as low activity (D.03, D.08, D.10, D.11, D.12 and D.13). Overall, the highest levels of activity were recorded at D.05 deployed near T5 (2,046 passes or 12.2 bp/h) and the lowest levels of activity were recorded at D.10 deployed near the middle of the bog adjacent to T10 (28 passes or 0.2 bp/h).

As for the spring deployment, activity levels were high at D.02 and D.05, with broadly equivalent levels of soprano and common pipistrelle driving up the bat passes per hour, along with Leisler's bat activity at T5. As mentioned above, both T2 and T5 are adjacent habitat features with strong connectivity to the wider landscape and therefore high levels of activity would not be unexpected. There were no potential roost sites identified in the vicinity of D.02, and it considered likely that this is a commuting route with bats that utilise the deep vegetated drain through the bog and woodland edge to the north, which may also be consistently attracting foraging bats, especially soprano and common pipistrelles.

Figure 11 shows the number of bat passes recorded each hour by the unit deployed adjacent to T5 in summer and it can be seen that there was a notably large spike in common pipistrelle activity over the 30/31-Jul, which accounted for the majority of records for this species over the deployment period. This was a dry night, bookended by periods of overnight night rain and this could explain the increased activity. On other nights activity appears to be supressed including: 17/18-Jul, 24/25-Jul, 25/26-Jul, 01/02-Aug and 02/03-Aug, and low levels of activity may be correlated to rainfall patterns. In context of the whole wind farm, D.05 emerges as one of the more heavily utilised locations for *Myostis* species within the site, although levels of activity remained low. This is likely to be the result of the relatively close proximity of D.05 to the River Glore, where transect surveys conducted in July found the river to be a hotspot for *Myostis* species and the two most commonly *Myotis* species occurring in Ireland (Daubenton's bat and Natterer's bat) known to have strong associations with rivers (Roche *et al*., 2014).

3.6.3 Autumn – Static detector monitoring report: 14-Sep to 24-Sep-2020

The autumn deployment covered 15 nights from the middle of September onwards and a total of 13 units were deployed. The newer SM4 units deployed recorded successfully for 15 nights (D.01, D.02, D.03, D.04, D.10 and D.12). However, batteries in some SM2 units became depleted just short of achieving the requisite ten-night deployment, due the extended length of the autumn nights. The unit covering T15 (D.13) captured 10 nights, with units covering T5, T6 and T9 (D.05, D.06 and D.09) recorded up until approximately halfway through the eleven night. Units cover T8 and T12 (D.08 and D.11) stopped recording on the tenth night and the unit covering T7 recorded up until the ninth night. Fortunately, weather conditions for the all of the first 10 nights (up to 23/24-Sep) were in compliance with the climatic parameters as set out in SNH *et al*. (2019). For the time of year condition would be considered optimal for bats, being dry with relative warm overnight temperatures and light winds throughout. For the last five nights of the deployment overnight temperatures were significantly cooler, although rainfall was minimal and wind remained light. By expressing the data as bat passes per hour, the bat passes recorded during the first 9 to 10 nights can be analysed comparatively between all the units to show relative densities of use across the site.

The unit deployed to cover T5 (D.05) only recorded for one night due to microphone failure. The one night of data was processed and relatively high levels of bat activity were recorded. It was decided to analyse this data using bat passes per hour to allow for comparison of bat activity with other locations over the same time frame. Based on the habitat availability at the deployment location (woodland/ forestry rides near the River Glore) and the relatively high levels of activity recorded during the spring and summer deployments, it was considered that the high levels of activity recorded on the single autumn night were likely to be representative for the time year. Additional data is available from the locality of T5 and was collected in 2016 and 2018. An emergence survey was conducted along the River Glore near T5 in Jul-2020, and series of transects were undertaken along the track leading to T5 in 2018. Data from static bat detectors was collected from or sufficiently close to the location of T5 in 2016 and 2018.

It is acknowledged that one unit recorded for one night and three units were just short of the requisite 10-night deployment within compliant weather conditions; however, given the optimal weather conditions during the slightly curtailed deployment period for three units, the deployment of an additional unit covering the microphone failure at D.05 and analysing the data using bat passes per hour, as well as the additional contextual data available for the location; **it is considered that the autumn deployment provides sufficient baseline data to facilitate a robust assessment of potential impacts of the proposed Wind Farm Site**.

Figure 12 shows the distribution of bat passes recorded at all the deployment locations over the Autumn (September) deployment period. **Table 11** provides a summary of the data recorded by each of the static units deployed.

Across all the deployment locations a minimum of six bat species were recorded during the autumn deployment (n = 1,902 hours), including soprano pipistrelles (1.0 bp/h), common pipistrelles (1.0 bp/h), *Myotis* species (0.2 bp/h), Leisler's bats (0.2 bp/h), brown long-eared bat (0.05 bp/h) and Nathusius' pipistrelles (0.03 bp/h). Activity levels were notably lower than those recorded in the summer and this drop off in activity can be observed during the autumn deployment on sites where mating activity and formation of transitional roost in the vicinity of turbine locations is limited. As summarised in **Table 11**, aggregated bat passes per hour for deployment location were only classed as medium activity for one deployment location (D.02), with another just missing the cut (D.01). The high activity rating for D.05 deployed near T5 was based on one night of recording. Analysing the data collected over a single night for the unit deployment at T5, as bat passes per hour, returns a high level of activity for the location, which is considered to be representative of the area for the time of year, given the strong bat habitat features in the area, including forestry/ woodland rides and close proximity to the River Glore. The main limitation of just recording for one night is that there is a higher probability that less commonly recorded species, namely *Myotis* species, brown long-eared bats, and Nathusius' pipistrelles would go under recorded.

Excluding the single night of data at D.05/ T5 (150 passes or 12. 2 bp/h), overall, the highest levels of activity were recorded at D.02 (1,809 passes or 9.5 bp/h) and the lowest levels of activity were recorded at D.10 (68 passes or 0.4 bp/h). The higher activity levels at D.02 were generated by common pipistrelle activity, combined with soprano pipistrelle activity to a lesser extent. Across the three deployments the area around D.02 emerges as hotspot for bat activity. If the single night of data captured at D.05/ T5 for autumn is included as being representative, then this location emerges as another hotspot for bat activity across the whole of the active bat season. The high level of activity at D.05/ T5 on 14/15-Sep was generated by soprano pipistrelles (59 passes), Leisler’s bats (50 passes) and common pipistrelles (41 passes). Over the autumn period it was noted that there was a high proportion of pipistrelle social calls, which can be difficult to categories as definitively common or soprano pipistrelle.

Figure 14 shows the number of bat passes recorded each hour by the unit deployed at along with bog edge adjacent to T2 (D.02) in autumn, and shows two distinct peaks in bat activity one on the night of the 21/22-Sep and a larger surge in activity, especially by common pipistrelles over the night of the 27/28-Sep. Both these peaks in activity coincide with periods when overnight temperatures remained above 12°C. In contrast the three nights registering the lowest activity levels, between 23/24-Sep and 26/27-Sep coincided with periods when overnight temperatures plummeted, falling below 0°C on two of the nights.

Table 11 – Bat activity (bp/h) recorded by static detectors in 2020

Colour coded to reflect relative levels of bat activity (green – *Low* amber – *Medium* red – *High*)

***NOTE**: For T5 in autumn shows data collected over one night (14.15-Sep)

Deployment date	Unit ID	Type	Map ID	Turb. No.	Nights	Minutes	Leisler's bat Passes - bp/h		Soprano pipistrelle Passes - bp/h		Common pipistrelle Passes - bp/h		Nathusius' pipistrelle Passes - bp/h		*Myotis* species Passes - bp/h		Brown long-eared bat Passes - bp/h		Total Passes - bp/h	
Spring 12-May-2020	047	SM-mini	D.01	**T1**	14	**7,466**	414	**3.327**	114	**0.916**	219	**1.760**	31	**0.249**	66	**0.530**	13	**0.104**	857	**6.887**
	048	SM-mini	D.02	**T2**	14	**7,466**	238	**1.913**	1,344	**10.800**	4,143	**33.293**	1	**0.008**	52	**0.418**	4	**0.032**	5,782	**46.464**
	049	SM-mini	D.03	**T3**	14	**7,466**	101	**0.812**	52	**0.418**	197	**1.583**	6	**0.048**	18	**0.145**	0	0	374	**3.005**
	044	SM-mini	D.04	**T4**	14	**7,466**	185	**1.487**	68	**0.546**	402	**3.230**	0	0	20	**0.161**	1	**0.008**	676	**5.432**
	040	SM4	D.05	**T5**	12	**6,011**	279	**2.785**	593	**5.919**	1,914	**19.104**	0	0	253	**2.525**	25	**0.250**	3,064	**30.582**
	041	SM-mini	D.06	**T6**	14	**7,466**	308	**2.475**	95	**0.763**	391	**3.142**	1	**0.008**	22	**0.177**	8	**0.064**	825	**6.630**
	050	SM-mini	D.07	**T7**	14	**7,466**	2,484	**19.961**	302	**2.427**	1,447	**11.628**	0	0	19	**0.153**	0	0	4,252	**34.169**
	045	SM-mini	D.08	**T8**	14	**7,466**	302	**2.427**	98	**0.788**	323	**2.596**	11	**0.088**	9	**0.072**	2	**0.016**	745	**5.987**
	013	SM2	D.09	**T9**	14	**7,466**	109	**0.876**	14	**0.113**	75	**0.603**	0	0	8	**0.064**	1	**0.008**	207	**1.663**
	043	SM-mini	D.10	**T10**	14	**7,466**	114	**0.916**	3	**0.024**	69	**0.554**	3	**0.024**	0	0	0	0	189	**1.519**
	035	SM4	D.11	**T12**	14	**7,466**	10	**0.080**	4	**0.032**	12	**0.096**	0	0	0	0	0	0	26	**0.209**
	046	SM-mini	D.12	**T14**	14	**7,466**	151	**1.213**	64	**0.514**	167	**1.342**	1	**0.008**	11	**0.088**	14	**0.113**	408	**3.279**
	042	SM-mini	D.13	**T15**	14	**7,466**	334	**2.684**	135	**1.085**	345	**2.772**	4	**0.032**	121	**0.972**	0	0	939	**7.546**
Summer 16-Jul-2020	050	SM-mini	D.01	**T1**	19	**7,983**	250	**1.879**	247	**1.856**	84	**0.631**	0	0	31	**0.233**	1	**0.008**	613	**4.607**
	049	SM-mini	D.02	**T2**	19	**7,983**	93	**0.699**	850	**6.389**	613	**4.607**	2	**0.015**	57	**0.428**	2	**0.015**	1,617	**12.153**
	041	SM-mini	D.03	**T3**	19	**7,983**	72	**0.541**	147	**1.105**	61	**0.458**	0	0	19	**0.143**	2	**0.015**	301	**2.262**
	046	SM-mini	D.04	**T4**	19	**7,983**	172	**1.293**	198	**1.488**	102	**0.767**	1	**0.008**	58	**0.436**	3	**0.023**	534	**4.014**
	038	SM4	D.05	**T5**	19	**7,983**	614	**4.615**	599	**4.502**	731	**5.494**	1	**0.008**	90	**0.676**	11	**0.083**	2,046	**15.378**
	045	SM-mini	D.06	**T6**	0	**Failed**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	047	SM-mini	D.07	**T7**	19	**7,983**	186	**1.398**	259	**1.947**	146	**1.097**	1	**0.008**	14	**0.105**	0	0	606	**4.555**
	048	SM-mini	D.08	**T8**	19	**7,983**	152	**1.142**	189	**1.421**	59	**0.443**	1	**0.008**	11	**0.083**	2	**0.015**	414	**3.112**
	043	SM-mini	D.09	**T9**	19	**7,983**	404	**3.036**	180	**1.353**	88	**0.661**	1	**0.008**	73	**0.549**	16	**0.120**	762	**5.727**
	032	SM4	D.10	**T10**	19	**7,983**	1	**0.008**	10	**0.075**	16	**0.120**	0	0	1	**0.008**	0	0	28	**0.210**
	034	SM4	D.11	**T12**	19	**7,983**	32	**0.241**	75	**0.564**	36	**0.271**	0	0	5	**0.038**	1	**0.008**	149	**1.120**
	044	SM-mini	D.12	**T14**	19	**7,983**	112	**0.842**	123	**0.924**	80	**0.601**	1	**0.008**	14	**0.105**	15	**0.113**	345	**2.593**
	042	SM-mini	D.13	**T15**	19	**7,983**	294	**2.210**	60	**0.451**	52	**0.391**	1	**0.008**	52	**0.391**	12	**0.090**	471	**3.540**
Autumn 14-Sep-2020	034	SM4	D.01	**T1**	15	**11,469**	48	**0.251**	228	**1.193**	385	**2.014**	19	**0.099**	67	**0.351**	10	**0.052**	757	**3.960**
	035	SM4	D.02	**T2**	15	**11,469**	27	**0.141**	654	**3.421**	973	**5.090**	6	**0.031**	138	**0.722**	11	**0.058**	1,809	**9.464**
	038	SM4	D.03	**T3**	15	**11,469**	22	**0.115**	142	**0.743**	81	**0.424**	5	**0.026**	20	**0.105**	8	**0.042**	278	**1.454**
	060	SM4	D.04	**T4**	15	**11,469**	18	**0.094**	124	**0.649**	95	**0.497**	2	**0.010**	30	**0.157**	16	**0.084**	285	**1.491**
	011	SM2	D.05	**T5***	1	**735**	50	**4.082**	59	**4.816**	41	**3.347**	0	0	0	0	0	0	150	**12.245**
	010	SM2	D.06	**T6**	10	**7,836**	10	**0.077**	76	**0.582**	26	**0.199**	3	**0.023**	10	**0.077**	4	**0.031**	129	**0.988**
	016	SM2	D.07	**T7**	8	**6,338**	24	**0.227**	78	**0.738**	25	**0.237**	4	**0.038**	9	**0.085**	3	**0.028**	143	**1.354**
	019	SM2	D.08	**T8**	9	**7,079**	10	**0.085**	141	**1.195**	51	**0.432**	14	**0.119**	16	**0.136**	2	**0.017**	234	**1.983**
	007	SM2	D.09	**T9**	10	**7,875**	17	**0.130**	53	**0.404**	23	**0.175**	6	**0.046**	21	**0.160**	0	0	120	**0.914**
	051	SM4	D.10	**T10**	15	**11,469**	2	**0.010**	42	**0.220**	15	**0.078**	5	**0.026**	4	**0.021**	0	0	68	**0.356**
	006	SM2	D.11	**T12**	9	**7,106**	18	**0.152**	67	**0.566**	48	**0.405**	7	**0.059**	8	**0.068**	1	**0.008**	149	**1.258**
	032	SM4	D.12	**T14**	15	**11,469**	66	**0.345**	196	**1.025**	121	**0.633**	4	**0.021**	44	**0.230**	29	**0.152**	460	**2.406**
	008	SM2	D.13	**T15**	10	**8,318**	62	**0.447**	62	**0.447**	55	**0.397**	1	**0.007**	76	**0.548**	9	**0.065**	265	**1.911**

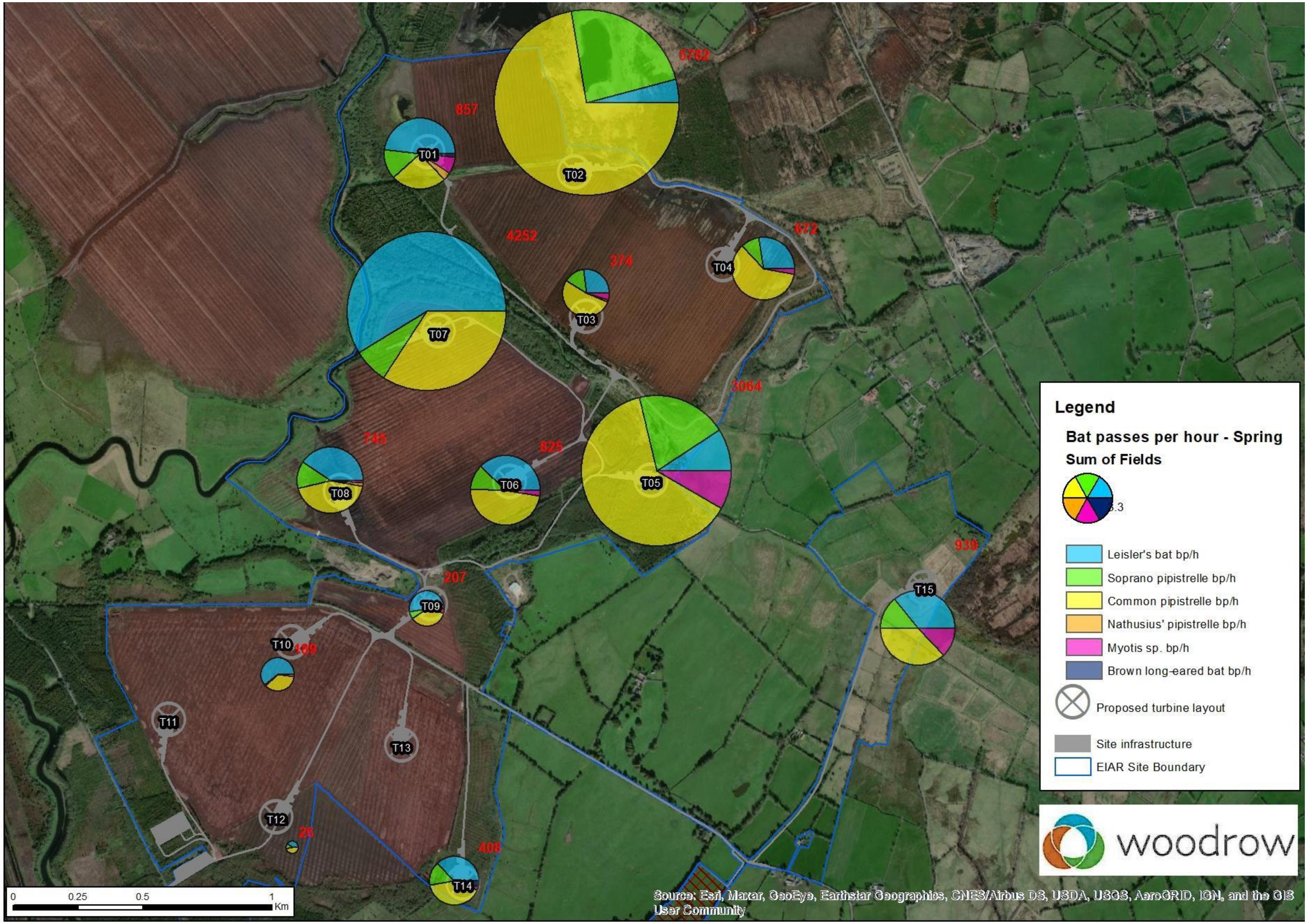


Figure 6 – Spring (May-2020) – Distribution of bat passes recorded for each species

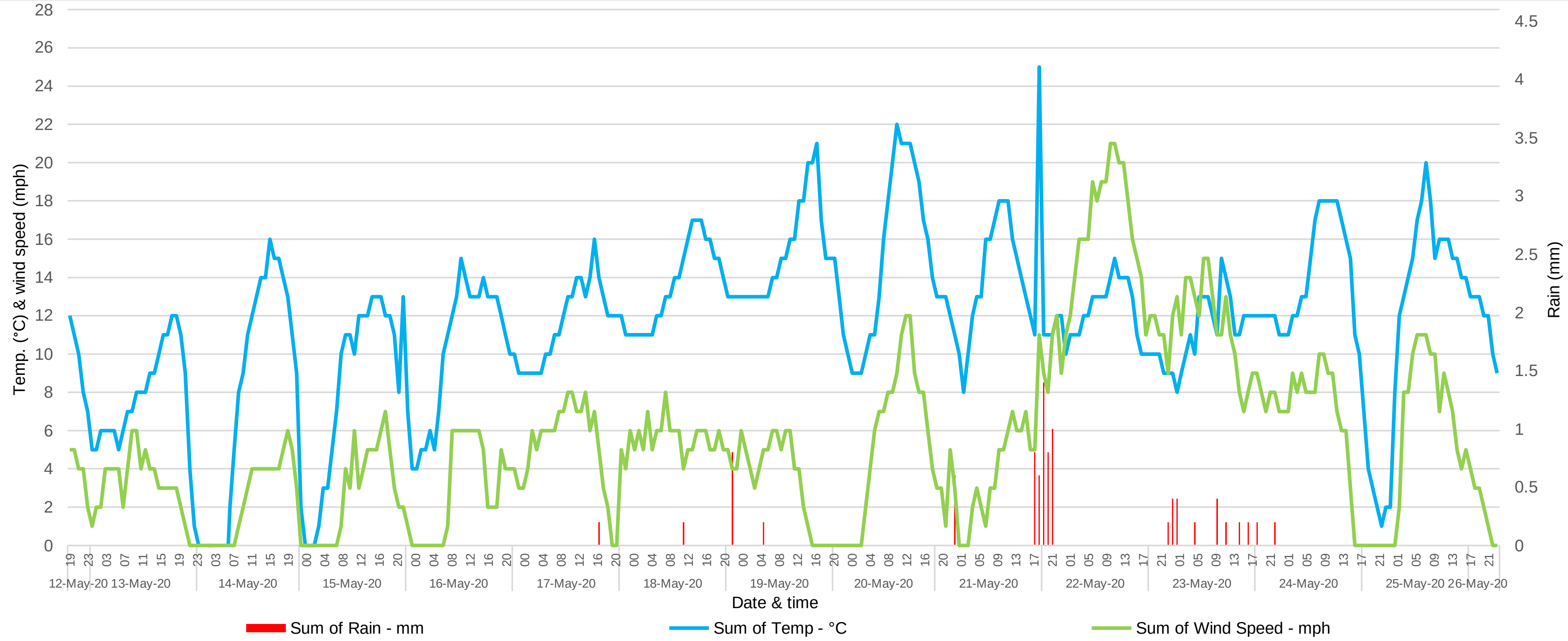


Figure 7 – Spring deployment - Mean hourly temperature, wind speed and rainfall

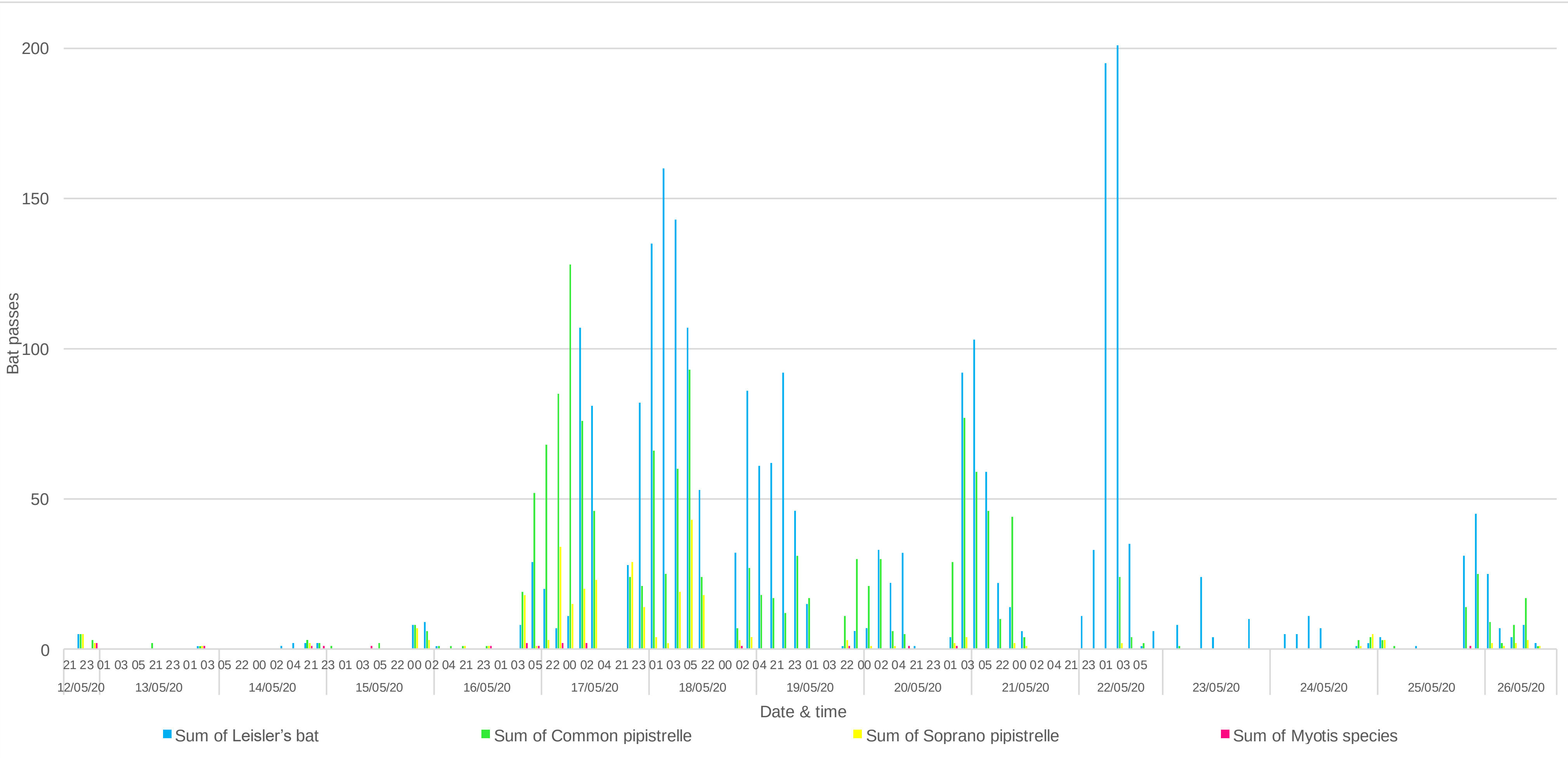


Figure 8 – Bat passes over time: 12 to 26-May-2020 (Unit at T07)

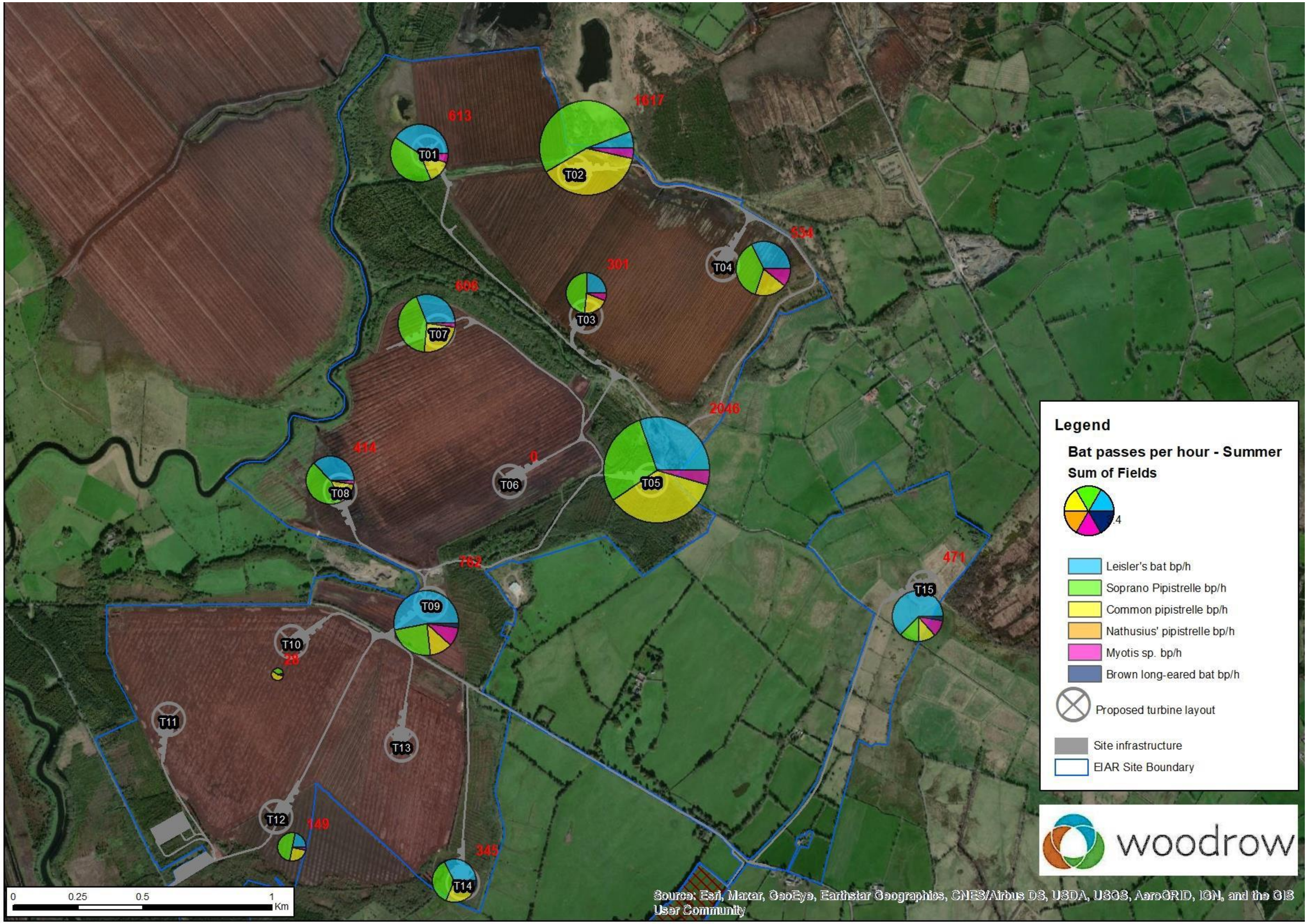


Figure 9 – Summer (Jul/ Aug-2020) – Distribution of bat passes recorded for each species

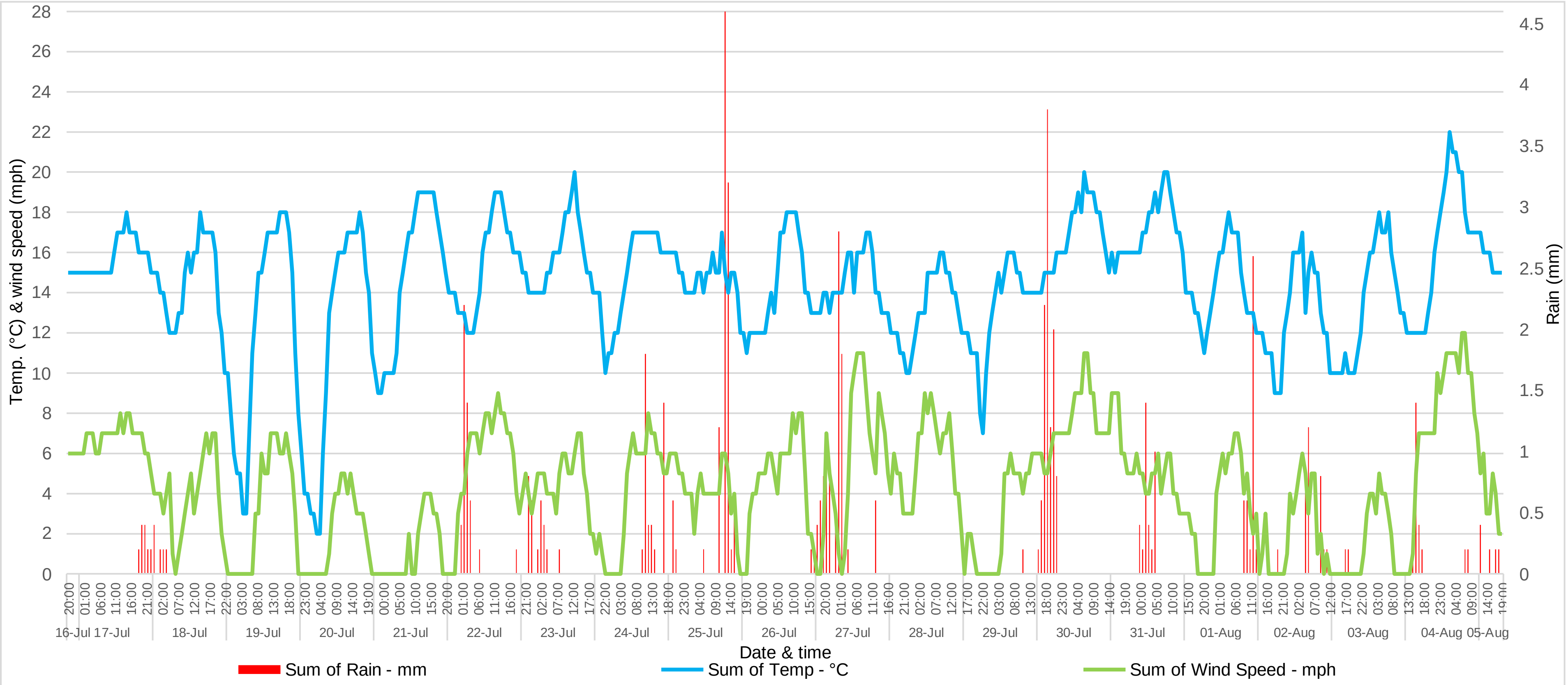


Figure 10 – Summer deployment – Mean hourly temperature, wind speed and rainfall

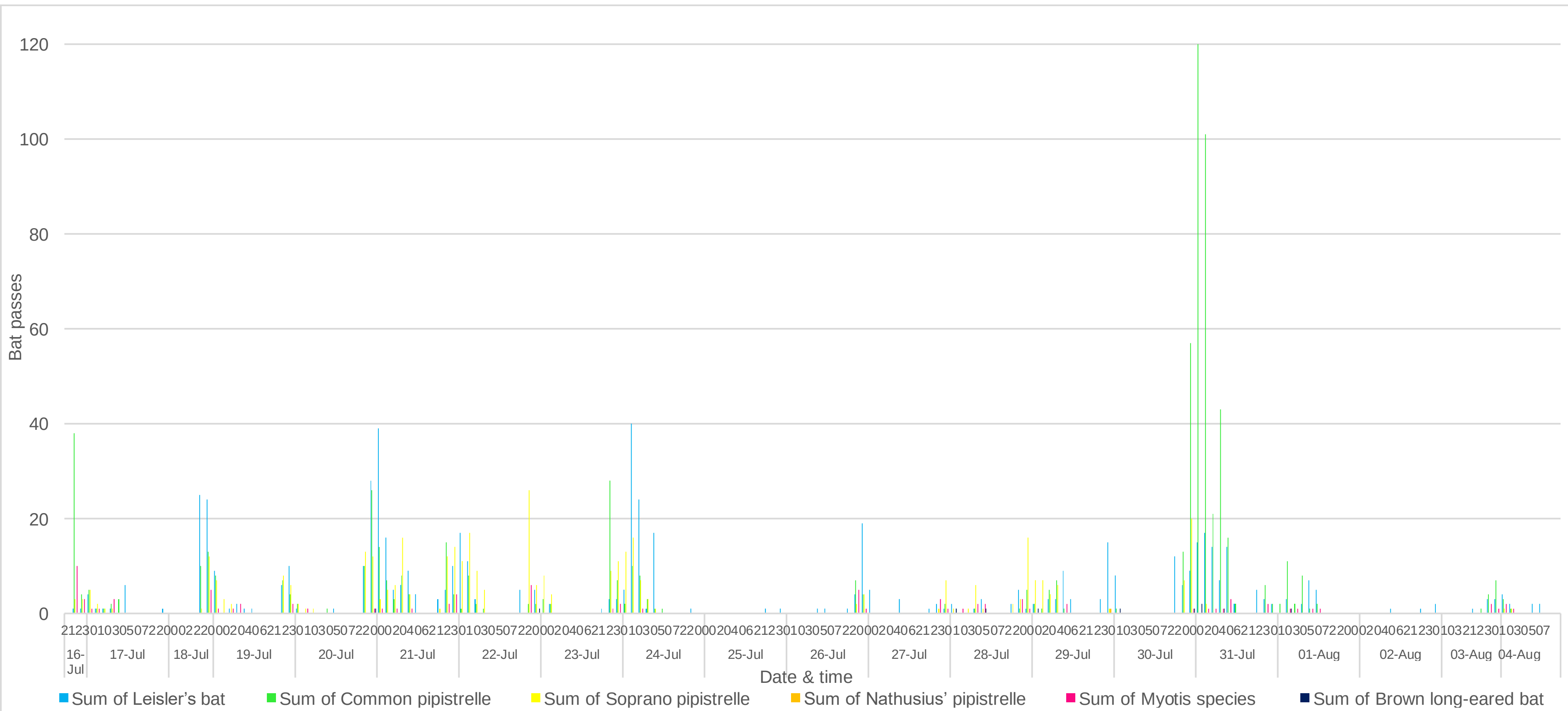


Figure 11 – Bat passes over time: 16-Jul to 04-Aug-2020 (Unit at T05)

NOTE: T5 pie chart generated from single night of data

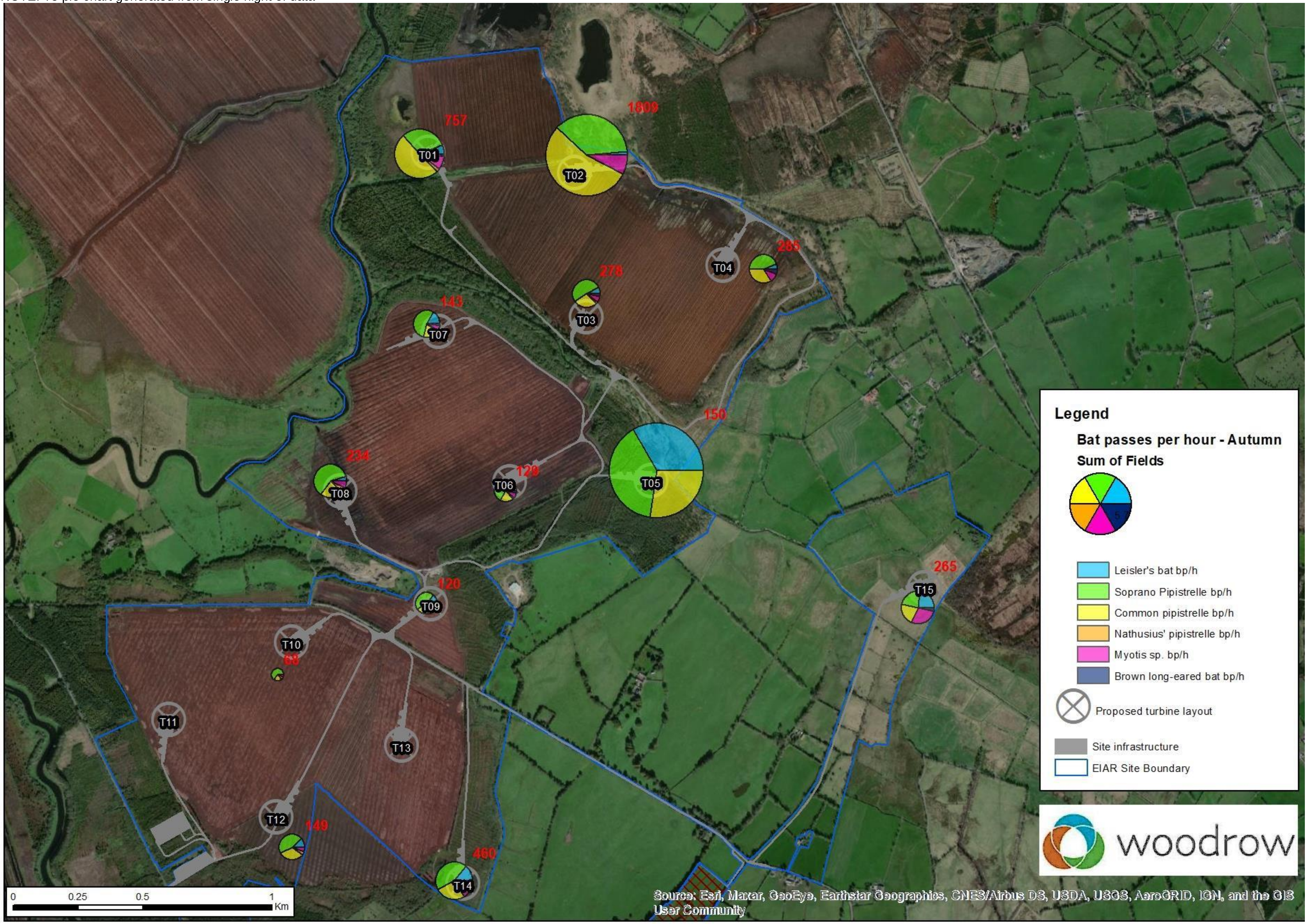


Figure 12 – Autumn (Sep-2020) – Distribution of bat passes recorded for each species

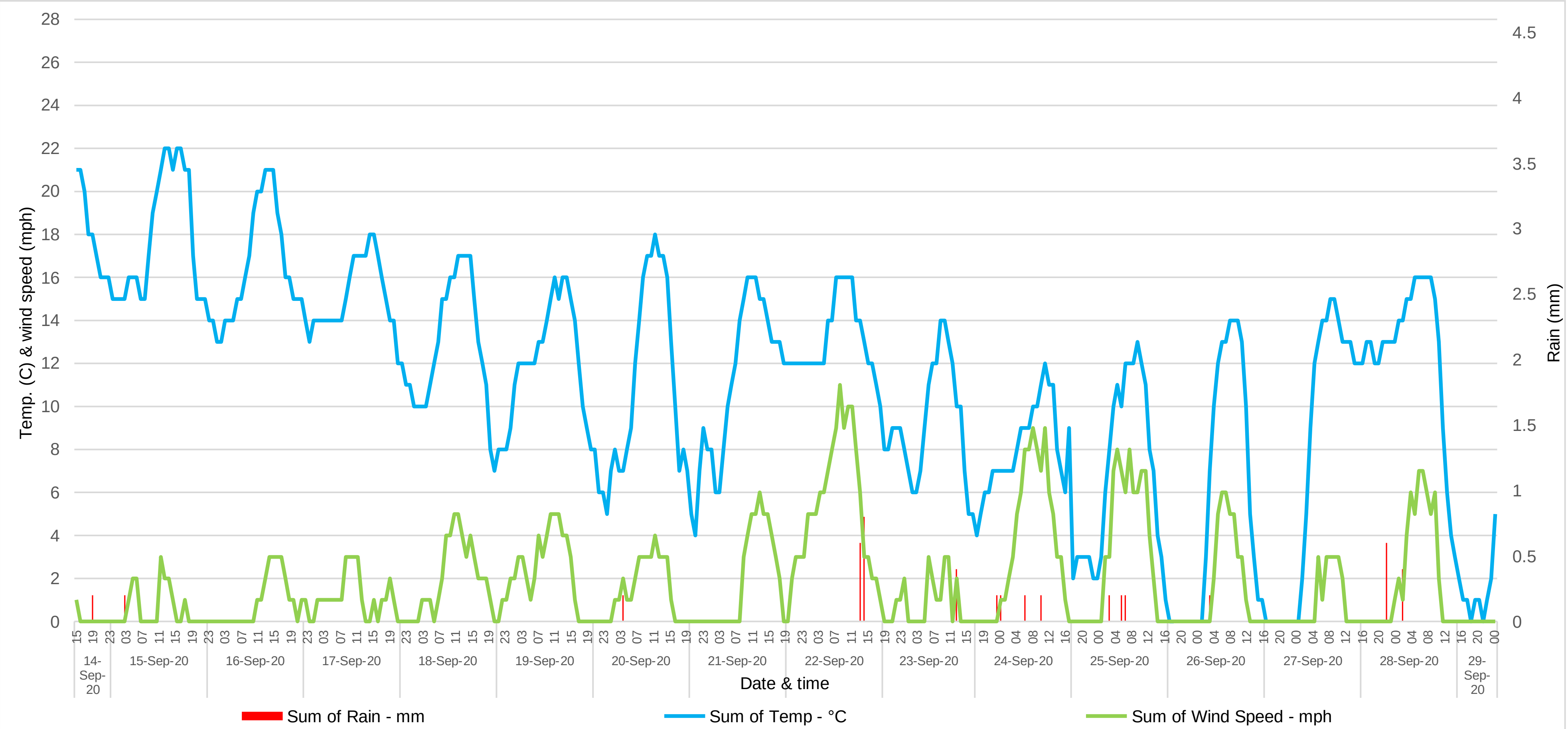


Figure 13 – Autumn deployment – Mean hourly temperature, wind speed and rainfall

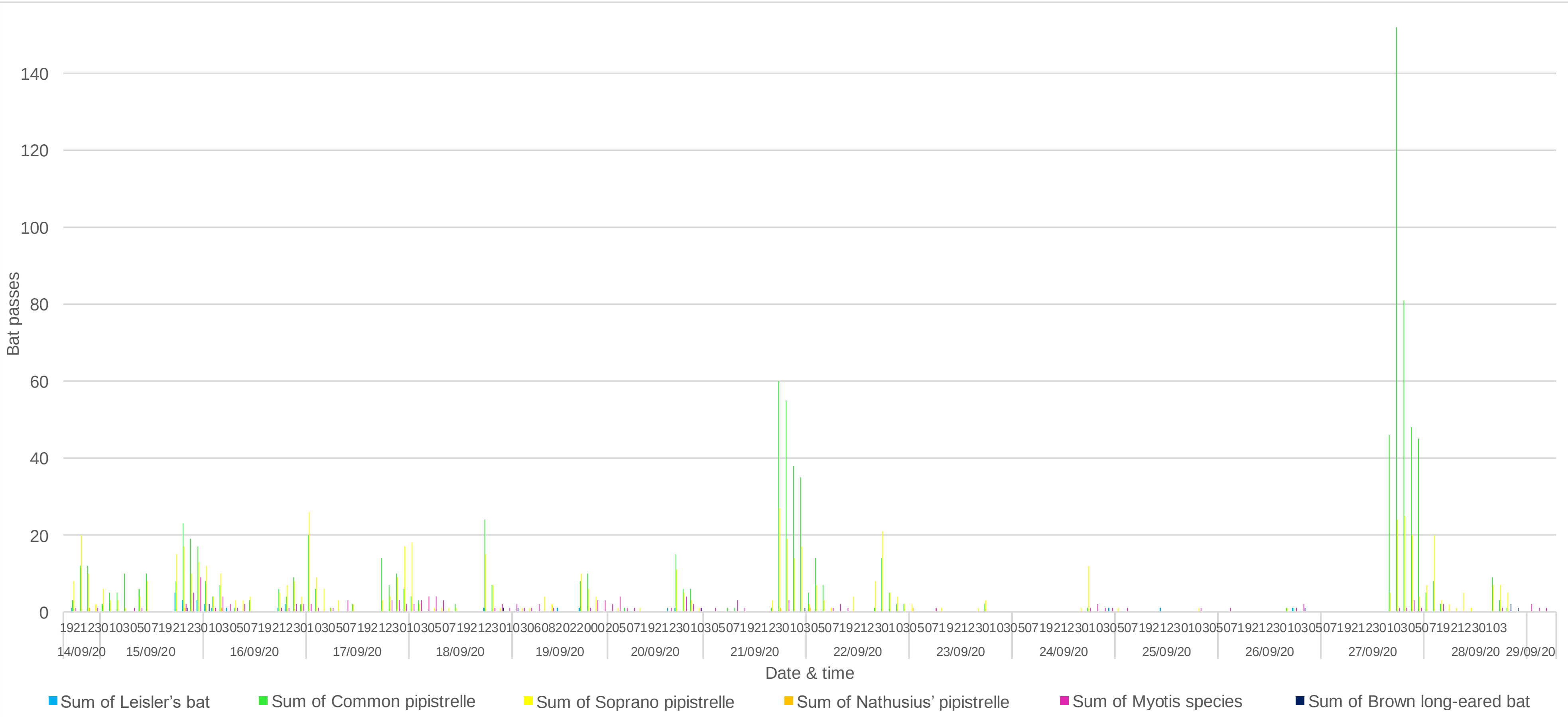


Figure 14 – Bat passes over time: 14 to 29-Sep-2020 (Unit at T02)

4 BASELINE CONDTIONS

This section summaries the main findings of bat surveys conducted in 2020 for the proposed Coole Wind Farm Site and references previous surveys, as detailed in MKO (2017), Woodrow (2020a) and Woodrow (2020b), where applicable.

4.1 Habitat availability and roost suitability

Habitat types throughout the turbine envelope are dominated by open, cut-over bog and blocks of commercial forestry plantations, which are fringed by the remnants of raised bog and some bog woodland. The majority of the turbines will be sited within the exposed cut-over bog including T1, T2, T3, T4, T6, T7, T8, T9, T10, T11, T12 and T13, with T5 and T14 located within conifer plantations. The proposed location for T15 is within pastural grassland including some species rich wet grassland along the River Glore. The river dissects the Wind Farm Site and provides a linear feature with strong connectivity to the surrounding landscape via plantations and the River Inny.

Although the turbines are predominately located within open situations in exposed peat, the interface between the cut-over bog and forestry provides potential foraging and commuting features for bats. Turbines located closer to the forestry edge are predicted to experience higher levels of bat activity, especially when turbines are also located adjacent to the River Glore, where the insect biomass associated with forested sections of the river is anticipated to be preferentially exploited by foraging bats.

Overall, there were very few PRF with moderate or high potential identified during preliminary habitat suitability assessments of the 300 m Zone of Influence (ZoI) around the proposed turbine locations. This concurs with the findings of previous surveys of the site conducted in 2013 and 2016 (MKO, 2017). It was also considered that there are no features suitable of supporting a hibernacula within the ZoI of the proposed turbines.

Some areas earmarked for wind farm access tracks and the borrow pit supported a number of more mature trees with potential suitable ivy cover, rot holes and knots. Aside from the beech woodland on the access track between T9 and T5, these PRFs were not surveyed and pre-construction roost checks will be required prior to modification or removal of any potential roost features. The beech wood was surveyed in September 2020 and no roosting activity was identified. Other emergence surveys were conducted along the River Glore and all returned nil results.

4.2 Summary of static deployment data

1. Bat activity was recorded within the survey area for a minimum of six species, including common pipistrelle, soprano pipistrelle, Leisler’s bat, *Myotis* species, brown long-eared bat and Nathusius' pipistrelle.
2. As shown in **Table 12**, over the three seasons combined the static detectors (successfully deployed at 12 to 13 locations) recorded a total 31,065 bat passes over *c*. 4,873 hours, which equates to 6.4 bats passes per hour for the survey area as a whole and across all the seasonal deployments. Based on Kepel *et al*. (2011) this would be considered representative of medium levels of bat activity across the site. This result was strongly influenced by high overall activity during the spring deployment (11.5 bp/h), with relatively lower levels of overall activity recorded in summer (2.6 bp/h) and autumn (2.5 bp/h).
3. As highlighted by **Table 6**, applying SNH *et al*. (2019) classifications levels of bat activity within the survey area for all the deployment locations and across all three seasons was categorised as:

- Moderate for common pipistrelle, soprano pipistrelle, Leisler's bat.
- Moderate/ low for *Myotis* species, brown long-eared bat and Nathusius' pipistrelle

4. While overall activity levels are moderate to moderate/ low, the high values for max percentiles in **Table 6** are indicative that high or moderate/ high levels of activity were exhibited on some nights as shown in **Table 7** for all the species recorded except for Nathusius' pipistrelle. *Myotis* species and brown long-eared bat only registered moderate/ high activity for 20 nights and 1 night, respectively.
5. For the spring deployments a minimum of six species were recorded. As shown in **Table 12** the highest levels of bat activity, both in terms of bat passes and distribution of records, being recorded for common pipistrelle (6.1 bp/h), followed by Leisler's bat (3,1 bp/h) and soprano pipistrelle (1.8 bp/h). The number of bat passes recorded during the spring deployment was over double the number recorded during subsequent deployments, and if the number of bat passes per hour is examined, then activity during May was significantly higher than later in the active season.
6. For the summer deployments a minimum of six species were recorded. As shown in **Table 12** the highest levels of bat activity in terms of bat passes per hour were recorded for soprano pipistrelle (1.8 bp/h), followed by Leisler's bats (1.5 bp/h) and common pipistrelles (1.3 bp/h).
7. For the autumn deployments a minimum of six species were recorded. As shown in **Table 12** there were similar levels of bat activity recorded for common pipistrelles (1.0 bp/h) and soprano pipistrelle (1.0 bp/h). During this deployment Leisler's bat activity (0.2 bp/h) saw a significant drop compared to previous deployments and was on a par with *Myotis* species (0.2 bp/h).

Table 12 – Bat passes recorded for each species during all seasonal deployment of statics

Deployment	Leisler's bat	Soprano pipistrelle	Common pipistrelle	Nathusius' pipistrelle	*Myotis* species	Brown long-eared bat	Total
Spring: May-2002 (n = 1,593 hrs)	5,029 **3.1 bp/h**	2,886 **1.8 bp/h**	9,704 **6.1 bp/h**	58 **0.03 bp/h**	599 **0.4 bp/h**	68 **0.04 bp/h**	18,344 **11.5 bp/h**
Summer: Jul/Aug-2020 (n = 1,597 hrs)	2,382 **1.5 bp/h**	2,937 **1.8 bp/h**	2,068 **1.3 bp/h**	9 **0.01 bp/h**	425 **0.3 bp/h**	65 **0.04 bp/h**	7,886 **2.6 bp/h**
Autumn: Sep-2020 (n = 1,902 hrs)	374 **0.2 bp/h**	1,922 **1.0 bp/h**	1,939 **1.0 bp/h**	76 **0.04 bp/h**	443 **0.2 bp/h**	93 **0.05 bp/h**	4,847 **2.5 bp/h**
Total n = 4,873 hrs	**7,785**	**7,745**	**13,711**	**143**	**1,467**	**226**	31,077 **6.4 bp/h**

4.3 Species activity within the site

4.3.1 Pipistrelle species

Common and soprano pipistrelles were recorded by all units on every seasonal deployment in 2020. Common pipistrelles exhibited a significant spike in activity over the spring deployment, prior to dispersal to maternity roosts. During later deployments units at D.02 and D.05 emerged as the most heavily utilised areas within the study area, which highlights the strong association pipistrelles have with habitat features including treelines, drains/ rivers and forestry edge which occur at these deployment locations.

There has been two years of data collect for T14 and T15. The bat passes/ hour are listed below for common and soprano pipistrelles and shows that activity remained low in all seasons over both years, for both species.

	T14		T15	
	Soprano pipistrelle bp/h	Common pipistrelle bp/h	Soprano pipistrelle bp/h	Common pipistrelle bp/h
Spring 2019	0.3	0.6	0.4	0.6
Summer 2019	1.1	1.0	0.7	0.4
Autumn 2019	0.2	0.2	0.2	0.2
Spring 2020	0.5	1.3	2.8	1.1
Summer 2020	0.9	0.6	0.4	0.5
Autumn 2020	1.0	0.6	0.4	0.4

Nathusius' pipistrelle bat activity was low based on Kepel *et al*. (2011) classification and moderate to low based on the SNH *et al*. (2019) criteria. In 2020 there were a total of 58 passes in spring, 9 passes in summer and 76 passes in autumn. The species has been recorded regularly in small numbers since 2016 and static detector surveys in 2018 and 2019 suggest activity in the environs of the proposed Wind Farm Site may peak pre- and post-breeding. However, in 2020 there was no discernible pattern observed regarding the occurrence of Nathusius' pipistrelle within the Wind Farm Site.

4.3.2 Leisler's bat

Leisler's bats were the second most commonly recorded species during the spring and summer deployments (5,029 passes and 2,382 bat passes, respectively). Registrations of Leisler's bats were significantly lower during the autumn deployment (374 bat passes). The autumnal drop off in Leisler's bat activity was also detected during 2019 surveys.

During the spring deployment there were nights with significant peaks in Leisler's bat activity recorded at D.07 (within 20 m of T7) – see **Figure 8**. As indicted by the weather data in **Figure 7**, it can be seen that bat activity increases at this location on the night of the 16/17-May, which was the first night of the spring deployment period when overnight temperatures remained above 8°C. There was noticeable peak in activity between 02:51 and 04:41 (dawn) over the morning of the 17-May, with 193 Leisler's bat passes recorded over approximately 2 hours (105 bp/h) and passes were judged to be well distributed over this period. Another notable peak of well distributed activity occurred over the following night on the 17/18-May, when between 22:41 and 04:38 (dawn) there were 705 Leisler's bat passes recorded over approximately 6 hours (118 bp/h)

During the deployment period the highest spike in activity recorded at D.07 was between 02:03 and 04:19 (*c*. 10 mins before dawn) on the morning of the 22-May, when 431 Leisler's bat passes were recorded over approximately 2 hours (190 bp/h). Over this period, activity was found to be relatively consistent, with 1 to 6 passes recorded per minute, with the gap between passes rarely exceeding 40 seconds. This period of time coincided with a break in rainfall after 02:00, mild temperatures (mean hourly 10 to 12°C) and gentle SW/ SSW breeze (mean hourly 8 to 12 mph). Spring 2020 was notably dry and rain falling over the area is likely to have resulted in the emergence of insects, upon which bat prey.

The consistency with which Leisler's bat passes were recorded over the peak periods examined for D.07 were suggestive of bats (probably a small number) foraging in the area. As mentioned in the report for the spring deployment, a high proportion of the bat passes were considered to be relatively distant from the unit placed on the open near the turbine location, due to the faintness of the sonogram. It has been noted that Leisler's bats are often recorded foraging over the tops of trees in the spring.

The spring deployment adjacent to T7 was the only occasion when Leisler's bat activity was ranked as high (applying both Kepel *et al*., 2011 & SNH *et al*., 2019 activity categories); and overall activity levels recorded during the May deployment represented a peak in activity for this species when compared with activity levels during deployments later in the season. This spring peak is thought to be linked to a burst in activity prior to Leisler's bats setting up at maternity colonies. They may even utilise transitional roosts sites in the vicinity.

4.3.3 *Myotis* species

Activity for *Myotis* species was relatively low throughout the active season, with a peak in registrations over the spring deployment (599 passes) and less activity recorded during summer (425 passes) and autumn deployments (443 passes). Of the *Myotis* species occurring in Ireland Daubenton's bat is the most commonly occurring and is strongly associated with water courses, like the River Glore and River Inny. Natterer's bat has been recorded from just beyond 10 km from the Coole Wind Farm Site on the Upper Inny River[16]; however, this species tends to occurs less frequently than Daubenton's bat. The third *Myotis* species occurring in Ireland are whiskered bats. Whiskered bats are considered to occur locally in small numbers across Ireland and it is acknowledged that it is a species that can go undetected during surveys (McAney, 2006)[17]. There are no records for Co. Westmeath published on NBDC Biodiversity Maps and the closest locations are *c*. 40 km away from the Wind Farm Site near Mohill, (Co. Leitrim) and Edenderry (Co. Offaly). The species could potentially occur on a site like Coole Wind Farm; however, expected occurrence would be considered unlikely.

4.3.4 Brown long-eared bat

It is acknowledged that accurately monitoring brown long-eared bats is problematic; as this species has very quiet echolocation calls, which means that surveys reliant on bat detectors can under record the occurrence of this bat species. As brown long-eared bat populations are not considered a species at high risk from wind farm developments additional surveys (transects) were deemed unnecessary and it is considered sufficient for the purposes of this impact assessment that occurrence of the species is noted. After Nathusius' pipistrelle, brown long-eared bat activity was the lowest recorded for the Coole Wind Farm Site. The total number of bat passes recorded over the spring (68 passes) and summer (65 passes) were very similar. During the autumn deployment activity levels were marginally higher (93 passes). While this species was detected at all deployment locations in 2020, except T10, the highest activity levels emerged from units deployed at D.01, D.05, D.09 and D.12 (T14). The woodland habitat surrounding D.05 generated the most activity for this species. Surveys conducted in 2019, where static bat detectors also covered T14 and T15 found these locations to generate low levels of activity, but this was relatively consistent. Similarly, in 2018, when surveys covered the T15 area, including the access track, low levels of brown long-eared bat activity were detected. In 2016, static detector surveys recorded brown long-eared bats in the woodland along the River Glore, between T5 and T3.

16 Tina Aughney - All Ireland Daubentons Bat Waterways Survey – Published on NBDC Biodiversity Maps: https://maps.biodiversityireland.ie/Map

17 McAney, K. (2006) A conservation plan for Irish vesper bats. Irish Wildlife Manuals, No. 20. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

4.4 Bats activity associated with proposed turbine locations

In compliance with the 2019 SNH guidelines, static detectors were deployed at selected turbine locations (or as close as was feasible) on three occasion during the active bat season. Activity levels for each species (as per Kepel *et al*., 2011) are summarised in **Table 13** for each turbine location covered in 2020 and shows that the static detectors recorded:

- High levels of bat activity at/adjacent to **T2**, **T5** and **T7** during the *spring* deployment,
- Medium levels of bat activity at/adjacent **T1**, **T4**, **T6**, **T8** and **T15** during the *spring* deployment,
- High levels of bat activity at/adjacent to **T2** and **T5** during the *summer* deployment,
- Medium levels of bat activity at/adjacent to **T1**, **T4**, **T7** and **T9** during the *summer* deployment,
- High levels of bat activity at/adjacent to **T5** (one night) during the a*utumn* deployment,
- Medium levels of bat activity at/adjacent to **T2** during the *autumn* deployment.

These results broadly correspond to the results shown in **Table 8**, which lists turbine-deployment locations where high or moderate-high activity levels were detected for given species as per categories outlined in SNH *et al*. (2019). Additional locations, not flagged in **Table 13** where higher levels of activity were noted in **Table 8** and indicate that bats may be at risk of interactions with turbines include: **T10** and **T14** in *spring* and **T1** and **T14** in *autumn*.

Based on Kepel *et al*., (2011) activity categories, for the 13 turbines locations surveyed T3, T10, T12 and T14 recorded low levels of activity across all three seasonal deployments. However, T10 and T14 did record moderate/ high activity levels on activity on some nights for certain species (as per SNH *et al*., 2019 activity categories – see **Table 8**).

Based on Kepel *et al*., (2011) activity categories, the proposed turbine-deployment locations potentially posing the highest risk to bats were considered to be T2-D.02, T5-D.05 and T7-D.07. Medium levels of activity were recorded in two seasons at T1-D.01, T4-D.04 and potentially T6-D.06 (no summer deployment). Medium levels of activity were recorded in a single season a T8-D.08, T9-D.09 and T15-D.013

Table 13 – Summary of bat activity recorded by static detectors in 2020
Colour coded to reflect activity levels (green – Low, amber – Medium, red – High), as per Kepel *et al*. (2011)
*NOTE: For T5 in autumn shows data collected over one night (14.15-Sep)

Season	Turbine No.	Total bat passes	Passes - bp/h
Spring	T1 – D.01	857	6.89
	T2 – D.02	5,782	46.46
	T3 – D.03	374	3.01
	T4 – D.04	676	5.43
	T5 – D.05	3,064	30.58
	T6 – D.06	825	6.63
	T7 – D.07	4,252	34.17
	T8 – D.08	745	5.99
	T9 – D.09	207	1.66
	T10 – D.10	189	1.52
	T12 – D.11	26	0.21
	T14 – D.12	408	3.28
	T15 – D.13	939	7.55
Summer	T1 – D.01	613	4.61
	T2 – D.02	1617	12.15
	T3 – D.03	301	2.26
	T4 – D.04	534	4.01
	T5 – D.05	2,046	15.38
	T6 – D.06	0	0.00
	T7 – D.07	606	4.55
	T8 – D.08	414	3.11
	T9 – D.09	762	5.73
	T10 – D.10	28	0.21
	T12 – D.11	149	1.12
	T14 – D.12	345	2.59
	T15 – D.13	471	3.54
Autumn	T1 – D.01	757	3.96
	T2 – D.02	1,809	9.46
	T3 – D.03	278	1.45
	T4 – D.04	285	1.49
	T5 – D.05	150	12.24
	T6 – D.06	129	0.99
	T7 – D.07	143	1.35
	T8 – D.08	234	1.98
	T9 – D.09	120	0.91
	T10 – D.10	68	0.36
	T12 – D.11	149	1.26
	T14 – D.12	460	2.41
	T15 – D.13	265	1.91

4.4.1 Bat activity at T1 and T2

The main factor determining why certain deployment locations generated high levels of activity is related to proximity to habitat features. In the case of units deployed to cover T1 and T2, the deep vegetated drain running east-west through the northern bog is likely act as a corridor of connectivity between forestry/ woodland/ scrub on either side of the cut over bog, with the proximity of woodland edge to each of the deployments likely to generate foraging activity. The linear nature of these features means that even a small number bats tracking back and forth will result in high levels of activity.

Due to machinery use occurring in the bog, the deployment location for the unit covering T2 had to be deployed along the edge of the bog next to a deep vegetated drain and bog woodland, as opposed to more out into the middle of the bog at the actual location of the proposed turbine. Therefore, data collected from this location will definitely inflate activity potentially attributed to T2. To a lesser extent, the unit covering T1 was located along the edge of the cut away bog and the remnants raised bog, which may explain some the higher levels of activity recorded. Bats could be using the weak linear feature at the interface between cut-away and remnant bog to commute to bog pool to the north of T1/ D.01. The low levels of activity recorded at the unit covering T3, is likely to provide better representation of bat activity likely to occur at T1 and T2.

4.4.2 Bat activity at T3 and T4

The difference in activity levels recorded by units covering T3 (low activity) and T4 (medium activity), while appearing to be covering the same habitat features, may be explained in part by the location of the unit deployed to cover T4. Due to on site deployment constraints the unit covering T4 had to be located to the east of the proposed turbine location. This alteration meant the unit was closer to the north-eastern corner of the bog and within *c*. 50 m of remnants of the raised bog and *c*. 85 m of a thin plantation bordering the bog. Transect surveys (e.g. Sep-2020 covering T12 area – see **Figure 5**) have found small numbers of bats appearing to be preferentially foraging along the sheltered turf banks created at the edge of the remnant and cut away bog. In addition, any bats commuting across the north-eastern tip of the bog would be more likely to be recorded from the location of the unit, than if it were set-up at the proposed turbine location, which was *c*. 200 m from the closest habitat feature.

Given the relatively calm conditions over the majority of survey nights and the lack of obstructions to dampen the distances that bat calls can potentially travel across open bogs, it is also likely that the positioning of this unit in the northeast corner of bog would result in it picking up a lot of activity occurring around the edge of the bog, where woodland/ forestry edge would be attracting foraging bats. Therefore, it is considered that the altered location of the unit covering T4 has inflated the level of bat activity that would actually be expected at T4. The low levels of activity recorded at the unit covering T3, which was *c*. 165 m away from the closest habitat features along the River Glore is likely to provide better representation of bat activity likely to occur at T4.

4.4.3 Bat activity at T5

The reasons for the high levels of activity recorded by the unit covering T5 are clear and are related to the location of this deployment within forestry rides relatively close to the River Glore. This is a location heavily utilised by bats, although the evidence from transects points to high activity levels being generated by relatively small numbers of bats consistently foraging in the area. The unit was positioned to the north of the proposed turbine location and was closer to the River Glore. Based on observations from transect surveys, activity in the general area was high and activity levels recorded are likely to be representative of T5.

Emergence time recorded by the static detector at T5, also indicate that there are potential roosts adjacent to the Wind Farm Site for *Myotis* species, Leisler's bat, soprano pipistrelle and common pipistrelle - see **Figure 15**. The grey bars represent the core emerging time (after sunset) for each species and when the dots (bat passes) are clustered within the grey areas it is suggestive of a nearby roost. However, it also important to note that some species, Leisler's bat in particular are known to be strong fliers capable of covering relatively large distances from a roost to foraging area over a very short period of time (Shiel *et al*., 1999).

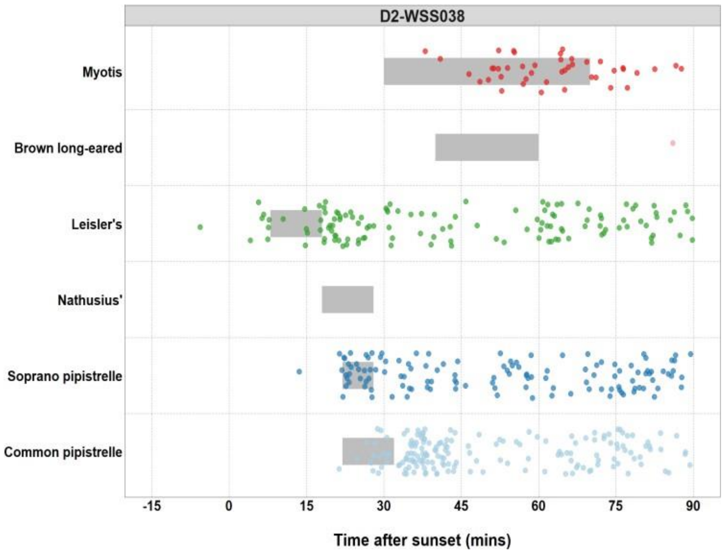


Figure 15 – Spread of bat passes in relation to time after sunset: Summer T5

4.4.4 Bat activity at T6

The spring deployment for T6 detected medium levels of bat activity, however the summer deployment failed. Given the proximity of the proposed turbine to the forestry edge (*c*. 100 m) it would be predicted that medium levels of activity would have been recorded over the summer deployment. The majority of bat activity would be predicted to occur along the forestry edge away from the proposed turbine location.

4.4.5 Bat activity at T7 and T8

The high levels of bat activity recorded at T7 during the spring deployment were highlighted in the sections above in relation to Leisler's bats and common pipistrelles; and as for T4, bat activity at T7 is thought to be related in part to the set-up of unit having to be shifted closer to the adjacent habitat features along the edge of the cut away bog. In this instance, while the offset only brought the unit *c*. 20 m closer to the feature; the device was within 90-100m of a feature at the edge of the bog with strong connectivity to the River Inny, via a deep drain running along the edge of forestry plantation. A high proportion of the activity recorded for Leisler's bats was found to be relatively faint and therefore likely to be distant calls, probably from bats utilising the edge of the plantation or foraging above the trees (e.g. commonly reported behaviour for Leisler's bats in spring). However, there was definitely some stronger calls recorded indicative of bats occurring closer to the unit. The forestry around the edge of the bog half encircles the proposed turbine location and there is a risk that bats cutting across the north-western corner of the middle bog (commuting between the River Inny and River Glore) will come into close proximity with T7. A transect survey in Sep-2020 found the edge of the plantation and the banks of the Inny to be heavily utilised by small numbers of foraging bats – see **Figure 5**. Based on emergence times for Leisler's bats, as shown in **Figure 16** there is a possibility of a maternity roost in the vicinity of T7. However, there are limited potential roost features in the vicinity and Leisler's bats are known to fly quickly and far (over 10 km) from roosts to forage (Shiel *et al*., 1999); and therefore, the unit was likely to be detecting bats regularly commuting between roosts beyond the Zone of Influence and foraging areas along the River Glore.

Medium levels of bat activity were recorded at T8 during the spring, with activity levels driven largely by Leisler's bats and common pipistrelles. Low levels of activity were recorded over the summer and autumn deployments. Interestingly, the distribution of records over the spring deployment at T8 followed relatively closely the pattern of activity observed for T7, and supports the assertion that there is spring time movement of bats between the River Inny and the River Glore. The River Inny is within *c* 250 m of T8 and there were less defined habitat features in the vicinity, which explains the lower levels of activity recorded and why activity tails off over the summer and autumn, whereas at T7 medium activity levels were recorded during the summer deployment.

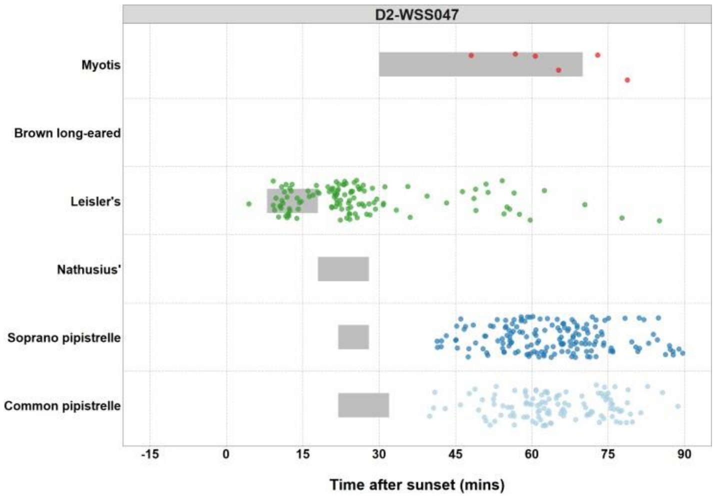


Figure 16 – Spread of bat passes in relation to time after sunset: Summer T7
Note: The grey bars represent the core emerging time (after sunset) for each species and when the dots (bat passes) are clustered within the grey areas it is suggestive of a nearby roost.

4.4.6 Bat activity at T9

Seasonal activity levels recorded at T9 are interesting in that they are low for the spring and autumn deployments, but medium for summer, with Leisler's bats generating most of the activity. Examining the spread of registrations over the summer deployment finds that peaks in Leisler's bat activity typically occurs between dawn and sunrise (19 to 31 mins before sunrise), for example:

- 49 passes recorded on 17-Jul (dawn: 04:34 sunrise: 05:22) between 04:29 and 04:50
- 38 passes recorded on 18-Jul (dawn: 04:35 sunrise: 05:24) between 04:12 and 04:53
- 39 passes recorded on 23-Jul (dawn: 04:44 sunrise: 05:31) between 04:17 and 05:05
- 31 passes recorded on 26-Jul (dawn: 04:50 sunrise: 05:36) between 04:26 and 05:17
- 12 passes recorded on 01-Aug (dawn: 05:02 sunrise: 05:46) between 04:49 and 05:22

Although less prominent, there were smaller peaks in activity detected around sunset, as shown in **Figure 17**. Both dawn and dusk patterns were consistent with 1 or 2 bats habitually foraging in the area, and could be indicative of a maternal roost in the vicinity; however potential roost features within 300 m were exceptionally limited, with the only structure being a modern shed deemed largely unsuitable and the beech wood between T9 and T5 with low-moderate potential. However, Shiel *et al*. (1999) found that Leisler's bats in Ireland commuted rapidly (up to 40 km/h) between roost sites and foraging locations, which can be located at up to 13.4 km away.

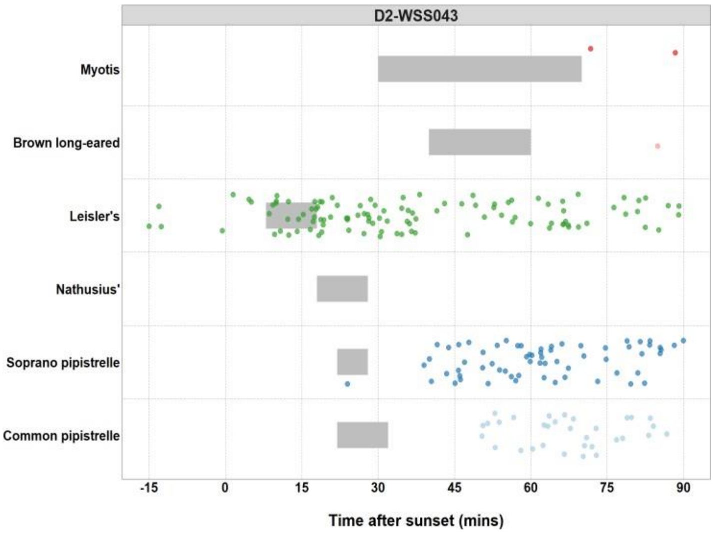


Figure 17 – Spread of bat passes in relation to time after sunset: Summer T9

Note: The grey bars represent the core emerging time (after sunset) for each species and when the dots (bat passes) are clustered within the grey areas it is suggestive of a nearby roost.

4.4.7 Bat activity at T10 and T12

As for T3, the proposed location for T10 (in open cut away bog) is relatively distant from any habitat features typically utilised by bat and this is likely to have contributed to the in low activity levels recorded for this location across all the seasonal deployments. The moderate-high activity flagged in **Table 8** for Leisler's bat and common pipistrelle at T10, was generated by relatively high levels of activity on certain nights, probably one or possibly two bats. For instance, during the highest night for Leisler's bat activity on 17/18-May there were 56 bat passes recorded between 23:09 to 04:36. Typically, there was a series of repetitive bat passes recorded within short periods of time, followed by a prolonged period of no triggers, which is indicative of one or two bats foraging in the area periodically, then moving on.

The deployment location covering T12 was located closer to the woodland/ scrub edge along the southern bog, than the proposed location for T12 and this could potentially lead to increased activity levels being recorded. However, low levels of bat activity were recorded in all three seasons. This turbine is located on the southern bog where the remnant raised bog meets the cut away bog. This feature can be exploited by bats, as was observed during a transect in Sep-2020, when a small number of bats were foraging along this feature (see **Figure 5**).

4.4.8 Bat activity at T11 and T13

These two proposed turbine locations were not surveyed. Based on habitat characteristics at T11 and T13 (open cut away bog), this habitat type was well represented by the locations sampled. Based on results from turbines with similar conditions, these locations would be predicted to generate low levels of activity across all the season, especially T13 which is located in the middle of the southern bog. The proposed location for T11 is in closer proximity to the bog edge where the forestry/ scrub provides a potential foraging/ commuting feature for bats and would be likely to pick up more adjacent habitat feature related activity than at T13.

4.4.9 Bat activity at T14

The proposed location for T14 is within a thin strip of young, scrubby second rotation plantation running parallel to the southern bog and neighboured by pasture to the east. This location recorded low levels of bat activity across all three deployments. However, as flagged in **Table 8** moderate-high activity at T14 was noted for Leisler's bat in spring and soprano pipistrelle in autumn. This was generated by relatively high levels of activity on certain nights and likely to be generated by a small number of bats.

4.4.10 Bat activity at T15

The location where bat activity was monitored for T15 was along a dry ditch, which was considered a weak feature. Medium levels of activity were recorded in spring, which were dominated by Leisler's bat and common pipistrelle activity. Low activity levels were recorded in summer and autumn.

5 ASSESSMENT OF IMPACTS

5.1 Ecological evaluation of bat species

Bats are protected by law in the Republic of Ireland under the Wildlife Act 1976 and subsequent amendments (2000 and 2010). Under the Wildlife Act, it is an offence to intentionally disturb, injure or kill a bat or disturb its resting place. Under this legislation it is unlawful to destroy, alter or disturb known bat roosts without an appropriate derogation licence, as issued by the National Parks and Wildlife Service (NPWS).

All bat species fall under Annex IV of the EU Habitats Directive (1992), whereby member states have a burden of responsibility to protect bats and their resting places wherever they occur. The EU Habitats Directive has been transposed into Irish law with the European Communities (Birds and Natural Habitats) Regulations 2011. In order to comply with the requirements of these regulations wind farm applications in Ireland need to be assessed as to their potential impact on bat populations.

In order to undertake an assessment of the potential impact of the proposal on bats, it is necessary not only to have carried out surveys to ascertain what bat species and numbers are present on the site, but also how susceptible those species are to impacts from wind turbines and how susceptible populations of the species occurring are to the impacts in an Irish context.

SNH *et al*. (2019) provides guidelines for conducting risk assessment for bat species occurring on wind farms; however, it is not fully clear how the assessment methodology relates to Irish bat populations. Therefore, the assessment of the Coole Wind Farm Site draws on several sources to emulate the SNH guidance, including Marnell *et al.* (2009)[18] and Wray *et al*. (2010)[19] for the bat population assessments in Ireland (see **Table 14**). For collision risk of bat species to wind turbines (see **Table 15**) SNH *et al*. (2019) is used, which updates previous species risk assessment published in Natural England (NE, 2014)[20].

As listed in **Table 14**, on an all-Ireland basis Leisler's bats are considered to be *Near Threatened*, while all other species are categorised as *Least Concern* (Marnell *et al.*, 2009).

As shown in **Table 15**, Leisler's bats and Nathusius' pipistrelles are considered as *high risk* of direct impacts from with wind turbines, as they regularly fly in the open and at heights, which may put them at risk of collision or barotrauma from turbines. The SNH *et al*. (2019) guidelines consider both common and soprano pipistrelles to be at *high risk* of direct impacts from wind turbines; based on a study investigating bat collisions at wind farm sites across the UK (Mathews *et al*, 2016), which found both these species to be amongst the most commonly recorded casualties during searches of turbines. The SNH *et al*. (2019) guidelines update Natural England guidance, which had classified common and soprano pipistrelle as *medium risk* species (NE, 2014), based on flight behaviours of common and soprano pipistrelles that habitually fly low and close to landscape features, such as hedgerows. *Myotis* species and brown long-eared bats are considered as *low risk* based on behaviour and foraging techniques of these species.

Based on population status in Ireland and risk level in relation to adverse interactions with turbines, it is important to ascertain, which bat populations may be threatened due to impacts from wind turbines, and this assessment is shown in **Table 16**. On the basis of this information, it is clear that particular attention should be paid to Leisler's bats and Nathusius' pipistrelles, which are believed to be susceptible to impacts from wind turbines and have populations of *high population vulnerability*, in the

18 Marnell, F., Kingston, N. & Looney, D. (2009). *Ireland Red List No. 3: Terrestrial Mammals*, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

19 Wray, S., Wells, D., Long, E. & Mitchell-Jones, T. (2010) *Framework for valuing bats in Ecological Impact Assessment*, CIEEM journal. Edition 70. Pg. 23 – 25. December 2010.

20 Natural England (2014). *Bats and onshore wind turbines*: *Interim Guidance* 3rd Ed. Natural England Technical Information Note TIN051, Natural England, Peterborough.

context of wind turbine developments in Ireland. Leisler's bats are generally considered to forage habitually at height in more open landscapes and are less associated with habitat features than other bat species. Nathusius' pipistrelles are known to be migratory and may fly at height during migration. For this assessment we adhere to SNH *et al*. (2019) guidance, under which common and soprano pipistrelles are considered to have *medium population vulnerability* to wind farm developments in Ireland due to behaviour in relation to turbines. Whiskered bats are also classed as *moderately vulnerable*, due to scarcity in Ireland. Brown long-eared bats and the two other Irish *Myotis* species (Daubenton's bat and Natterer's bat) are considered to have *low vulnerability* to wind farm developments in Ireland.

Table 14 – Conservation status of bat species in Ireland

Species	Rarity in Ireland Wray *et al*. (2010)	Irish status (Marnell *et al*., 2009)
Daubenton's bat *Myotis daubentonii*	Rarer (Frequent/widespread)	Least concern
Whiskered bat *Myotis mystacinus*	Rarest (Scarce/widespread)	Least concern
Natterer's bat *Myotis nattereri*	Rarer (Scarce/widespread)	Least concern
Leisler's bat *Nyctalus leisleri*	Rarer (Frequent/widespread)	Near threatened
Common pipistrelle *Pipistrellus pipistrellus*	Common (Widespread)	Least concern
Soprano pipistrelle *Pipistrellus pygmaeus*	Common (Widespread)	Least concern
Nathusius'pipistrelle *Pipistrellus nathusii*	Rarer (Rare/restricted)	Least concern
Brown long-eared bat *Plecotus auritus*	Rarer (Frequent/widespread)	Least concern

Table 15 – Level of collision risk to individual bats from wind turbines
Sources: Adapted from Natural England (2017) & SNH *et al*. (2019)

Collision risk		
Low risk	**Medium risk**	**High risk**
Myotis species Brown long-eared bat	Common pipistrelle (NE, 2014) Soprano pipistrelle (NE, 2014)	Leisler's bat Nathusius' pipistrelle Common pipistrelle (SNH, 2019) Soprano pipistrelle (SNH, 2019)

Table 16 – Level of potential vulnerability of bat populations in Ireland
Sources: Adapted from Wray *et al*. (2010), Natural England (2014) & SNH *et al*. (2019)
Yellow = ***low*** population vulnerability Beige = ***medium*** population vulnerability Red = ***high*** population vulnerability

<table>
<tr><th colspan="2" rowspan="2">Ireland</th><th colspan="3">Collision risk</th></tr>
<tr><th>Low risk</th><th>Medium risk</th><th>High risk</th></tr>
<tr><td rowspan="3">Relative abundance</td><td>Common species</td><td></td><td>Common pipistrelle
Soprano pipistrelle
(NE, 2014)</td><td>Common pipistrelle
Soprano pipistrelle
(SNH et al., 2019)</td></tr>
<tr><td>Rarer species</td><td>Daubenton's bat
Natterer's bat
Brown long-eared bat</td><td></td><td>Leisler's bat
Nathusius' pipistrelle</td></tr>
<tr><td>Rarest species</td><td>Whiskered bat</td><td></td><td></td></tr>
</table>

5.2 Valuing bat populations

The nature conservation value of a receptor is based upon a geographic hierarchy of importance. The following categories are used to inform the assessment of impacts:

International: sites, habitats and species populations of international or European importance;

National: sites, habitats & species populations of national importance;

Regional: sites, habitats & species populations of importance in a regional (midlands) context;

County: sites, habitats & species populations of importance in a county context;

Local: sites, habitats & species populations of importance in a parish or district context;

Low: sites, habitats & species populations of less than local importance, still of some value.

Approaches to attributing nature conservation value to species have been developed for bats (see Wray *et al*. 2010) [21]. The approach to scoring foraging habitat and commuting features is summarised in **Table 17** below.

Using the criteria set out in **Table 17** and based on the baseline data collected during surveys, it is considered that the study area (Coole Wind Farm Site) scored:

- 5 to 10 for numbers of bats recorded for all species recorded
- 1 to 3 for no to potentially small nearby roosts for all species recorded
- 4 for foraging habitat characteristics for all species recorded, due occurrence of large connected woodland blocks

Which translates to species scores of:

- 12 to 19 for common species - common and soprano pipistrelles, ranking the Wind Farm Site as holding foraging populations of these species that are of ***Local Importance***.
- 15 to 17 for rarer species - Leisler's bat, Nathusius' pipistrelle, *Myotis* species (Daubenton's bat and Natterer's bat) and brown long-eared bat, ranking the Wind Farm Site as holding foraging populations of these species that are of ***Local Importance***.
- 30 to 32 for rarest species - *Myotis* species (whiskered bat if occurring*) ranking the Wind Farm Site as holding foraging populations which are of ***County to Regional Importance***.

  ***Note**: Whiskered bats are considered to occur locally in small numbers across Ireland and it is acknowledged that it is a species that can go undetected during surveys (McAney, 2006)[22]. There were no records received from BCI within 10-km of the site and there are no records for Co. Westmeath published on NBDC Biodiversity Maps. The closest locations are *c*. 40 km from the Wind Farm Site near Mohill, (Co. Leitrim) and Edenderry (Co. Offaly). The species could potentially occur on a site like Coole Wind Farm; however, expected occurrence would be considered unlikely, and as the risk of collision for *Myotis* species is considered low further consideration is only given to this species within its Genus (i.e. as *Myotis* species).

With the exception of Nathusius' pipistrelle (and whiskered bat if it occurred), the bat species recorded utilising the Wind Farm Site are generally considered common and widespread in an Irish context (Marnell *et al*., 2009 & Roche *et al*., 2014). Taking into account the EU Annex IV protected status of bats, the bat assemblage is considered to represent a feature of ***Local (Higher) importance***.

21 Wray, S., Wells, D., Long, E. & Mitchell-Jones, T. (2010) *Framework for valuing bats in Ecological Impact Assessment*, CIEEM journal. Edition 70. Pg. 23 – 25. December 2010.

22 McAney, K. (2006) A conservation plan for Irish vesper bats. Irish Wildlife Manuals, No. 20. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Table 17 – Scoring system for valuing sites and foraging areas/ commuting routes for bats

Score	Species	Score	Number of bats	Score	Roosts/ potential roosts nearby	Score	Foraging habitat characteristics / Type and complexity of linear features
2	Common	5	Individual bats	1	None	1	Site without established vegetation e.g. urban
						1	Absence of (other) linear features
				3	Small number	2	Suburban areas or intensive agriculture
						2	Unvegetated fences and large field sizes
5	Rarer	10	Small number	4	Moderate number or not known	3	Isolated woodland, less intensive agriculture etc
						3	Walls, gappy or flailed hedgerows, isolated well grown hedgerows, and moderate field sizes
				5	Large number or close to protected areas for bats	4	Large connected woodland blocks, mixed agriculture etc
						4	Well-grown and well-connected hedgerows, small field sizes)
20	Rarest	20	Large number	20	Close to or within SAC for bats	5	Mosaic of pasture, woodlands and wetlands
						5	Complex network of mature well-established hedgerows, small fields and rivers/streams

Importance	Score
International	> 50
National	41-50
Regional	31-40
County	21-30
Local	11-20
Not important	1-10

5.3 Risk assessment

An initial (Stage 1) potential risk assessment for the Coole Wind Farm Site was carried out using the risk assessment matrix provided in SNH *et al*. (2019) - Table 3a. For habitat risk, *Moderate* was entered into the matrix as the site, at least in part was considered to have:

- *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*.

Although a *Moderate* habitat risk was applied, it is import to acknowledge that a substantial proportion of the Wind Farm Site, being cut over bog would fall into the *Low* habitat risk category.

For project size the *Medium* category was selected, as this is the best fit for the proposed Coole Wind Farm. These two parameters returned a site risk score of **3**, which is considered a ***medium site risk***.

The next of step of the risk assessment (Stage 2) uses a second matrix (Table 3b in SNH *et al*., 2019) to derive an overall risk assessment based on the activity level of high collision risk species, which in this instance are Leisler's bat, common pipistrelle, soprano pipistrelle, and Nathusius' pipistrelle. The Stage 2 - risk assessment matrix is reproduced below in **Table 18** and for each of the four high collision risk species the activity score is multiplied by the site risk score, which as stated above was determine to be 3 – medium risk site. Active levels are derived from Ecobat; however, consideration is also given to activity levels derived from Kepel *et al*. (2011) and both are summarised in the following bullet points:

- Based on Kepel *et al*. (2011), activity recorded by the majority of the static deployments was low for all the species recorded, with the exception of specific deployment locations in specific seasons, when moderate to high activity levels were generated by three species - common pipistrelles, soprano pipistrelles and Leisler's bat.
- Based on the SNH *et al*. (2019) activity categories used to describe the percentile outputs generated by Ecobat, the overall levels of bat activity for the turbine location surveyed and across all three seasonal deployments in 2020 found ***moderate*** levels of activity for Leisler's bats, common pipistrelles and soprano pipistrelles and ***moderately-low levels*** of activity for *Myotis* species, brown long-eared bats and Nathusius' pipistrelles. As above, specific deployment locations in specific seasons and sometimes on a specific night were flagged as generating high or moderate/high levels of bat activity.

Table 18 – Stage 2: Overall risk assessment matrix
Source: SNH *et al*. (2019)

Potential site risk level	**Ecobat activity category** (or equivalent justified categorisation)					
	0 Nil	**1 Low**	**2 Low-moderate**	**3 Moderate**	**4 Moderate-high**	**5 High**
1 Lowest	0	1	2	3	4	5
2 Low	0	2	4	6	8	10
3 Medium	0	3	6	9	12	15
4 High	0	4	8	12	15	18
5 Highest	0	5	10	15	20	25

For **Leisler's bat**, **common pipistrelle** and **soprano pipistrelle**, which overall are scored by Ecobat as having *moderate* activity levels within the turbine envelope, the Stage 2 risk assessment matrix returns a median score of ***9 – medium risk***.

Nathusius' pipistrelle, which overall are scored by Ecobat as having *low-moderate* activity levels within the turbine envelope, the Stage 2 risk assessment matrix returns a score of ***6 – medium risk***.

To account for seasonal or localised peaks in activity SNH *et al*. (2019) note the importance of also assessing the highest levels of activity recorded for each of the high collision risk species within the Wind Farm Site.

Leisler's bat, **common pipistrelle** and **soprano pipistrelle** were all scored by Ecobat as having seasonally and locally *high* activity levels, which returns a Stage 2 risk assessment matrix maximum score of ***15 – high risk***.

Nathusius' pipistrelle was scored by Ecobat as having seasonally and locally *moderate* activity levels, which returns a Stage 2 risk assessment matrix maximum score of ***9 – medium risk***.

The outputs of the overall risk assessment are then considered in the context of any potential impacts at the population level for species assessed as having high population vulnerability (see **Table 16**), which in Irish context are Leisler's bat and Nathusius' pipistrelle.

Table 19 provides a summary of bat population vulnerability to wind farm impacts (see **Table 16**), species activity recorded at the Coole Wind Farm Site (low, medium, high based on Kepel *et al*., 2011 and high, moderate-high based on SNH *et al*., 2019) and the regional importance attached to bat populations found to occur at the Coole Wind Farm Site (locally to internationally important based on Wray *et al*, 2010 – see **Table 17**).

Table 19 – Summary of impact assessment
Including bat population vulnerability to wind farm impacts, species activity recorded and the regional importance attached to bat populations found to occur at the Coole Wind Farm Site

Species	Population vulnerability wind farms impacts	Activity levels at Coole WF Site Based on Kepel *et al.* (2011) Range in bp/h is shown for all the static bat detectors deployed	Activity levels at Coole WF Site Ecobat	Population Importance at Coole WF Site (Scoring based on Wray *et al.*, 2010)
Leisler's bat	**High**	**Low** at most turbine locations, except: HIGH: T7 in spring MED: T5 in summer <u>Range of bat passes/ hour</u> 2020: 0.008 to 19.96 Abundance: Possibly occurring sporadically in moderate number	**Moderate** - Median Activity Levels **High** 33 of 442 nights T7 (spr) & T5 (aut) **Moderate-high** 128 of 422 nights T1, T4, T5, T6, T8, T10, T14, T15 (spr) & T5, T9 (sum)	Local (15 to 17) <u>Risk Assessment</u> 9 to 15 Medium to High
Nathusius' pipistrelle	**High**	**Low** Notes: Sporadic - activity <u>Range of bat passes/ hour</u> 2020: 0.007 to 0.25 bp/h Abundance: Small numbers	**Moderate-low -** Median Activity Levels **Moderate** 10/80 nights	County to regional (30 to 32) <u>Risk Assessment</u> 6 to 9 Medium
Soprano pipistrelle	**Medium**	**Low** at most turbine locations, except: HIGH: T2 in spr. MED: T5 in spr. MED: T2, T5 in sum. <u>Range of bat passes/ hour</u> 2020: 0.007 to 10.80 bp/h Abundance: Small numbers (1 to 5 bats)	**Moderate** - Median Activity Levels **High** 37of 441 nights T5 (spr) **Moderate-high** 119 of 441 nights T2 (spr) & T2, T5, T9 (sum) & T1, T2, T5, T14 (aut)	Local (12 to 19) <u>Risk Assessment</u> 9 to 15 Medium to High
Common pipistrelle	**Medium**	**Low** at most turbine locations, except: HIGH: T2, T5, T7 in spr. MED: T2, T5 in sum. MED: T2 in aut. <u>Range of bat passes/ hour</u> 2020: 0.008 to 33.30 bp/h Abundance: Small numbers (1 to 5 bats)	**Moderate** - Median Activity Levels **High** 56 of 419 nights T2, T5, T7 (spr) **Moderate-high** 88 of 419 nights T1, T4, T8, T10 (spr) & T5, (sum) & T1, T2, T5 (aut)	Local (12 to 19) <u>Risk Assessment</u> 9 to 15 Medium to High
***Myotis* species**	**Low**	**Low** <u>Range of bat passes/ hour</u> 2020: 0.008 to 2.50 bp/h Abundance: Small numbers (1 to 5 bats)	**Moderate-low -** Median Activity Levels **Moderate-high** 20 of 327 nights T5 (spr)	Local (15 to 17) <u>Risk Assessment</u> N/A
Brown long-eared bat	**Low**	**Low** <u>Range of bat passes/ hour</u> 2020: 0.008 to 0.40 bp/h Abundance: Small numbers	**Moderate-low -** Median Activity Levels **Moderate-high** 1 of 117 nights T5 (spr)	Local (15 to 17) <u>Risk Assessment</u> N/A

5.4 Impacts on bats

Wind turbines and associated infrastructure present a number of potential impacts to bats, namely:

1. Damage of / or disturbance to roost sites
2. Loss or fragmentation of habitat
3. Collision with rotor blades and barotrauma
4. Displacement or disturbance of commuting or migration routes

The first two of these are most relevant to the construction phase of the project, while the latter two relate to potential impacts in the operational phase. The following sections provide an assessment of the potential impacts on bats during the two phases of the project, including construction phase impacts and operational phase impacts.

Overall, for the turbine location surveyed and across all three seasonal deployments the results from bat surveys conducted over the 2020 active season found moderate levels of activity for Leisler's bats, common and soprano pipistrelles and moderately-low levels of activity for *Myotis* species, brown long-eared bats and Nathusius' pipistrelle. No hibernation or maternity roosts were identified within the turbine envelope; however, given the levels of activity within the survey area it is considered that bats are traveling from roosting locations adjacent to the Wind Farm Site to forage at some key locations associated with the River Glore and commercial forestry which provides connectivity through the area.

5.5 Construction phase: Potential direct impacts on bats

Loss of a roost site resulting from demolition or disturbance during construction would be considered as a significant negative impact of a proposed development. Potential direct impacts on bats resulting from wind farm construction include vegetation removal, resulting in a loss of potential roost sites in mature trees or the removal/ modification to existing buildings on the site.

Emergence survey undertaken over the 2020 active bat season did not identify any roosts. Potential roost feature (PRFs) identified within the 300m Zone of Influence around proposed turbine locations were limited to a stonework bridge over River Glore near T15 and three medium sized oak trees to north T10. These feature both lie just beyond the lands made available for this project and under the proposal there are no plans that will impact on these PRFs.

Construction of access tracks, widening of existing roads/ tracks and creation of the borrow pit will involve the clearance of vegetation and potentially result in direct impacts to bat roosts. Several areas supporting trees with low to moderate potential for roosting bats were identified, including:

- *Proposed access track to T15* from the main road supports lengths of treeline/ hedgerow, with occasional older ivy clad tree assessed as having MODERATE roost potential.
- The *borrow pit* holds mature treelines with some older, ivy clad specimens assessed as having MODERATE roost potential.
- On the *public road leading from T14 to T15* there were mature, ivy clad trees with MODERATE roost potential.
- *Beech woodland along the access track between T5 and T9*, including mature ivy clad spruce along track - ranked as having LOW to MODERATE roost potential
- *Mature poplar treeline along River Glore* lining the banks in places from T5 to T7, which were assessed as having NEGLIGIBLE to occasionally MODERATE roost potential for ivy clad trees, some with splits in branches and rot holes.

Construction works undertaken in the absence of mitigation, have the potential for direct impacts on roosting bats that are considered to be ***Significant*** at the ***Local*** level.

5.6 Construction phase: Potential secondary impacts on bats

Potential secondary impacts on bats resulting from construction works are limited to the loss and fragmentation of foraging and commuting habitats/ features utilised by bats. Disturbance of roosting and foraging bats through lighting impacts was considered; however, this is deemed not significant.

The development of infrastructure for the turbines and access tracks will mainly result in the loss of small areas of cut over bog and commercial forestry plantations, dominated by Sitka spruce, as well as some remnants of raise bog at T12 and pasture leading up to T15 and for the excavation of the borrow pit. The potentially valuable areas of habitat for foraging/ commuting bats that will be impacted by the proposal include:

- Removal of treelines and hedges to facilitate construction of the access track leading to T15
- Removal of treelines and hedges to facilitate excavation of the borrow pit
- Removal of treeline to construct access track leading to T14, in particular the maturing Scot's pines along the edge of the bog
- Removal of trees to widen the existing access tracks within the site, including T1 to T3, T3 to T4, T5 to T9, in particular tree removal affecting the extent of the beech woodland (between T5 and T9) and the poplar treeline (along the River Glore).

In the absence of mitigation, vegetation removal has the potential for secondary impacts on foraging and commuting bats that are considered to be ***Significant*** at the ***Local*** *scale*. Vegetation clearance for some of the access tracks could provide sheltered rides for foraging bat, as long as the scrub and treelines are retained adjacent to the tracks.

Note: Vegetation removal and other habitat alteration measures will be required to implement appropriate standoffs between rotor swept areas and features utilised by foraging/ commuting bats. The impact of vegetation removal for turbine stand-offs on bat foraging/ commuting behaviour needs to be assessed.

5.7 Operational phase: Potential direct impacts on bats

Both direct collision with rotor blades and barotrauma (injuries to internal air cavities and blood vessels caused by sudden change in air pressure behind a moving blade), have been found to directly impacts bats (e.g. Cryan & Barclay, 2009,[23] Rydell *et al*., 2010,[24], Cryan *et al*. 2014,[25] & Mathews *et al*., 2016[26]). The evaluation of Irish bat species likely to be at risk from collision and barotrauma is detailed in **Table 15** above; and is in part related to the likelihood of different species

23 Cryan, P. & Barclay, R (2009). Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. *Journal of Mammalogy* 90, 1330-1340

24 Rydell, J., L. Bach, M. J. Dubourg-Savage, M. Green, L. Rodrigues & A. Hedenström. (2010). Bat mortality at wind turbines in northwestern Europe. *Acta Chiropterologica* 12:261-274.

25 Cryan, P. M., P. M. Gorresen, C. D. Hein, M. R. Schirmacher, R. H. Diehl, M. M. Huso, D. T. Hayman, P. D. Fricker, F. J. Bonaccorso & Johnson D. H. (2014). Behavior of bats at wind turbines. *Proceedings of the National Academy of Sciences* 111:15126-15131.

26 Mathews, F. Richardson, S. Lintott, P. & Hosken, P. (2016). *Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management*. Final Report from University of Exeter University for RenewableUK and the UK Department of Energy & Climate Change (DECC)

flying at rotor blade height in an open landscape. The SNH *et al*. (2019)[27] guidance incorporates the 50 m set-back distance between the rotor swept area and habitat features (such as forestry edge and treelines/ hedgerows), which was originally published in the Natural England guidance[28]. However, this guidance mainly applies to certain species, such as common and soprano pipistrelles, which are known to follow linear habitat features when foraging or commuting. It is not relevant to areas where linear features are absent or sites where Leisler's bat activity is high, since this species is just as likely to fly over open terrain as along habitat features.

Different bat species have different foraging behaviours and ecological requirements, and infrastructure such as wind turbines will affect different species in different ways. Each of the bat species recorded at the Wind Farm Site are considered in the following sections. It is important to note that the probability of impact is lower for those turbines located away from habitat features. In such open habitat, the probability of such an impact are considered less likely, given the overall moderate levels of activity recorded for the bat species considered at highest risk from collision or barotrauma – common pipistrelle, soprano pipistrelle and Leisler's bat.

5.7.1 Operational phase: Potential direct impacts on common and soprano pipistrelles

As listed in **Table 15**, both common pipistrelles and soprano pipistrelles are considered to be of *high risk* of injury or mortality from wind turbines, resulting from either barotrauma or collision, based on the behaviour and foraging techniques of these species. Both species typically show an affinity to habitat features such as scrub, treelines and hedgerows; however, pipistrelles are also known to forage more regularly in open habitat, such as the open bog that occupies the vast majority of the Wind Farm Site. Some of the proposed infrastructure at the site is close to features that are used by these species for foraging/ commuting. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found that these two species of pipistrelle were amongst the casualties most commonly recorded during turbine searches.

As summarised in **Table 19**, common and soprano pipistrelles are widespread and common in Ireland; however due to flight behaviour, population vulnerability to windfarm developments for both species is classed as *Medium*. Overall common and soprano pipistrelle activity was classed as low (Kepel *et al*., 2011) or moderate (SNH *et al*., 2019), which gives an overall risk assessment of *medium* for this species in the context of the Wind Farm Site. However, a number of proposed turbine locations emerge as having a higher risk for these species based on proximity to habitat features, in particular T2, T5 and T7.

Without mitigation, potential impacts of the operational phase on common pipistrelles and soprano pipistrelles are considered to be ***Significant*** at the ***Local*** *level*.

5.7.2 Operational phase: Potential direct impacts on Nathusius' pipistrelle

As listed in **Table 15**, Nathusius' pipistrelle are considered as *high risk* of injury or mortality from wind turbines resulting from either barotrauma or collision; as this species regularly flies in the open and at heights. Nathusius' pipistrelles are strong flyers and known to be migratory in parts of their European range and may fly at height during migration. A review of turbine related bat fatalities in Europe (Rydell *et al*., 2010) found that 13% of the casualties were Nathusius' pipistrelles.

As summarised in **Table 19**, Nathusius' pipistrelles are classed as having high population vulnerability to wind farm developments due the assumed vulnerability of the population and flight behaviour. It is acknowledged that there is limited population assessment data available for this species in Ireland; however, indications are that the range and frequency with which this species are recorded is

27 Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter & Bat Conservation Trust (2019). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*.

28 Natural England (2014). *Bats and onshore wind turbines: Interim Guidance* 3rd Ed. Natural England Technical Information Note TIN051, Natural England, Peterborough.

increasing. In an Irish context, the apparent range expansion could be an apparition caused by increased survey effort and improved survey techniques. Nathusius' pipistrelles activity was classed as low (Kepel *et al*., 2011) or moderate/ low (SNH *et al*., 2019), which gives an overall risk assessment of *medium* for this species in the context of the Wind Farm Site. Even when considering seasonal or localised risk the assessment remains medium.

Without mitigation, potential impacts of the operational phase on Nathusius' pipistrelles are considered to be ***Significant*** at the ***County to Regional*** *level*.

5.7.3 Operational phase: Potential direct impacts on Leisler's bats

As listed in **Table 15**, Leisler's bats are considered to be at *high risk* of injury or mortality from wind turbines, resulting from either barotrauma or collision, based on species behaviour and foraging techniques. Leisler's bats are strong and fast in flight, regularly foraging over, or taking direct flights across, open habitats at heights within the collision risk zone for wind turbines. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found that common noctule bats (*Nyctalus noctula*), were amongst the casualties most commonly recorded during turbine searches (along with common and soprano pipistrelles). Common noctule bats are not known to occur in Ireland; however, it is a similar species to Leisler's bats (lesser noctule bats) in terms flight behaviour, and therefore similar levels of collision-risk would be predicated. Leisler's bats are very sparsely distributed in England and Wales, and only occasionally recorded in Scotland; and this explains why it was not encountered during turbine searches based in the UK.

As summarised in **Table 19**, population vulnerability to windfarm developments is classed as *High*, given the importance of Ireland as a global stronghold for Leisler's bat. Overall Leisler's bat activity was classed as low (Kepel *et al*., 2011) or moderate (SNH *et al*., 2019), which gives an overall risk assessment of *medium* for this species in the context of the Wind Farm Site. However, a number of proposed turbine locations emerge as having a higher risk for Leisler's bat based on high seasonal activity levels, in particular T5 in summer and T7 in spring.

Without mitigation, potential impacts of the operational phase upon Leisler's bat are considered to be ***Significant*** at the ***Local*** *level*.

5.7.4 Operational phase: Potential direct impacts on *Myotis* bat species

As listed in **Table 15**, *Myotis* bats are considered as being at *low risk* of impact from wind turbines, based on species behaviour and foraging techniques. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found a single carcass of a *Myotis* bat during the searches (a Natterer's bat - *Myotis nattereri*). *Myotis* species in the UK are rarely recorded fly at heights above the canopy (20 to 30 m) and tend to prefer a more cluttered habitat due to their short range, high frequency echolocation characteristics. Furthermore, their relatively slow flight speed allows them to manoeuvre well and therefore have the agility to avoid collision events (Mathews *et al*., 2016 & Rydell *et al*., 2010). Because of the behaviour exhibited by these species, the probability of direct operational impact is *Unlikely*.

As summarised in **Table 19**, overall *Myotis* bat activity was classed as low (Kepel *et al*., 2011) or moderate/ low (SNH *et al*., 2019) and population vulnerability to windfarm developments for all three *Myotis* species regularly occurring in Ireland is classed as *Low*. Therefore, no overall collision risk assessment is required for these Genus.

Even without further mitigation, potential impacts of the operational phase on *Myotis* species are considered to be ***Not Significant***.

5.7.5 Operational phase: Potential direct impacts on brown long-eared bats

As listed in **Table 15**, brown long-eared bats are considered as being at *low risk* of impact from wind turbines, based on species behaviour and foraging techniques. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found a single brown long-eared bat carcass during the searches. Typically, this species flies at low height and close to vegetation. Because of the behaviour exhibited by this species, the probability of such an impact is *Unlikely*.

As summarised in **Table 19**, overall brown long-eared bat activity was classed as low (Kepel *et al*., 2011) or moderate/ low (SNH *et al*., 2019) and population vulnerability to windfarm developments for this species is classed as *Low*. Therefore, no overall collision risk assessment is required for this species.

Even without further mitigation, potential impacts of the operational phase on brown long-eared bats are considered to be ***Not Significant***.

5.8 Operational phase: Potential secondary impacts

The potential effects from any on-site lighting on foraging bats were considered; however, this is deemed not significant..

6 RECOMMENDATIONS AND MITIGATION

The potential significant effects of the proposed Wind Farm Site on bats have been assessed and in the absence of mitigation the following potential significant effects were identified:

- During the construction phase the potential for direct impacts on bats roosting in trees located on access tracks between the turbines and for the excavation of the borrow pit was considered *Significant* at the *Local scale*
- During the construction phase the potential for secondary impacts on foraging/ commuting bats due to removal of vegetation was considered *Significant* at the *Local scale*
- During the operational phase the potential for direct impacts on foraging/ commuting bats from collision or barotrauma due to the location of wind turbines was considered to be:
  - *Significant* at the *County to Regional level* for Nathusius' pipistrelles
  - *Significant* at the *Local scale* for common pipistrelles, soprano pipistrelles and Leisler's bats.
  - *Not significant* for other less-susceptible species recorded, i.e. *Myotis* species and brown long-eared bats

Mitigation measures have been identified and are discussed for the following potential significant effects:

1. Avoidance of potential direct impacts to tree roosting bats
2. Avoidance of potential secondary impacts on bat foraging/ commuting habitat
3. Avoidance of wind turbine collision or barotrauma events for bats

This section also discusses the options for the provision of compensatory habitat and any requirements for post-construction monitoring.

6.1 Mitigation to avoid potential direct impacts on tree roosting bats

Throughout the Wind Farm Site vegetation removal will be required to facilitate construction of wind farm infrastructure, mainly for access tracks. Several treelines have been identified as supporting potential roost feature (PRFs) classed as low to moderate, with the occasional high PRF. While no roosts were identified during the 2020 active season, roost surveys were not exhaustive and there is a risk that any trees identified as supporting PRF, which are earmarked for removal during construction, could become occupied prior to works commencing. Given the types of features identified within the works corridor, mainly ivy clad trees with the occasional potentially suitable holes/cracks, it is anticipated that occupancy of any PFR, if any, will be limited to transitional roosts, e.g. autumn mating roosts. It is also considered that the surrounding area holds a number structures offering higher suitability for the formation of significant maternity and hibernation roosts, e.g. abandoned stone buildings at Newcastle and Ballynameagh House.

Pre-construction roost surveys will be required to identify and protect any bats potentially occupying roosts in vegetation earmarked for removal. For any trees found to be occupied by roosting bats prior to construction, an exclusion zone will be implemented to prevent disturbance during times of occupancy. **Table 20** provides optimal time periods for works at different roost types, and therefore by extension restrictive periods for construction works, during which the exclusion zone for construction work would be applicable. The extent of the exclusion zone can be up to 30 m for any notably disruptive works such as pile-driving; however, the mitigation measure should be proportional to the disturbance levels emanating from the construction activity.

Under the Wildlife Act, it is an offence to intentionally disturb, injure or kill a bat or disturb its resting place. Under this legislation it is unlawful to destroy, alter or disturb known bat roosts without an appropriate derogation licence, as issued by the National Parks and Wildlife Service (NPWS). Pre-construction surveys will inform the application of a derogation license from NPWS to undertake appropriate mitigation actions as required to ensure the conservation of bats, if found to be utilising roosts within the construction corridor. Reporting of pre-construction bat surveys will be required to demonstrate due diligence regarding avoidance of disturbance to potential bat roosts.

Given the types of features identified within the works corridor, mainly ivy clad trees with the occasional potentially suitable holes/cracks, it is anticipated that occupancy of any PFR, if any, will be limited to transitional roosts, e.g. autumn mating roosts.

While acknowledging the limited likelihood of the treelines where vegetation removal/cutting is proposed to facilitate wind farm infrastructure; the mature trees identified as supporting PRFs will require further pre-construction roost surveys and assessment. The following locations have been highlighted as requiring additional assessment:

- Main road between T14 to new access track to T15
- Borrow pit
- New access track to T15
- Beech wood between T5 and T9

Pre-construction/ pre-vegetation removal bat roost surveys will include the following elements:

1. Areas listed above which are earmarked for vegetation removal will be thoroughly re-assessed for PRFs. Surveys will be conducted by an appropriately experienced ecologist.
2. Any trees supporting PRFs will be targeted with further surveys, including emergence/re-entry surveys and/or roost inspections (using endoscopes and thermal imaging cameras) to determine occupancy of any moderate to high PRFs identified.
3. If any bat roosts are identified, further assessment will be required to determine the type of roost (e.g. maternity, hibernation, mating, transitional), species using the roost and the level of occupancy.
4. For any roost sites occupied these surveys will inform the application of a derogation license from NPWS to undertake appropriate mitigation actions as required to ensure the conservation of bats. These could include measures to exclude bats from potential roost holes prior to vegetation removal and provision of alternative roost sites.
5. Reporting of pre-construction bat surveys will be required to demonstrate due diligence regarding avoidance of disturbance to potential bat roosts.

Table 20 – Optimal season for works at different roost types
Source: Kelleher & Marnell (2006)[29]

Bat usage of site	**Optimum period for carrying out works** (some variation between species)
Maternity	01-Oct to 01-May
Summer (not a proven maternity site)	01-Sep to 01-May
Hibernation	01-May to 01-Oct
Mating/swarming	01-Nov to 01-Aug

6.2 Mitigation to avoid potential secondary impacts on bat foraging/ commuting habitat

Several locations have been identified where, vegetation removal has the potential to impact on foraging and commuting bats, with the follow areas highlighted as locations where the impact will be negative., including:

- The loss of trees from the maturing beech woodland between T5 and T9
- The removal of treelines and hedgerows on the access track for T15

29 Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. *Irish Wildlife Manuals*, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland

- The excavation of the borrow pit

Habitat surveys undertaken for the proposed development by ecologists from MKO have calculated that treeline removal will be 963m and hedgerow will be 218m within the Wind Farm Site.

Project design has attempted to avoid the removal of treelines, hedgerows and woodland habitats utilised by bats. In relation to the woodland between T5 and T9 this will be retained as part of the operational of the windfarm. There will be minimal encroachment on this habitat in order to facilitate the widening of the existing road. To compensate for any unavoidable loss of bat commuting/ foraging habitat there will be an equivalent area identified as compensatory habitat.

Compensation should aim to maximise future woodland, hedgerow and treeline ecological function by specifying an appropriate species mix and replacement locations to maximise connectivity. In the latter case, full consideration must be taken of bat usage of the site. It is proposed that compensatory planting of hedgerow/treeline habitat is undertaken along the access road to T15..

The removal of vegetation to implement 50 m stand-offs between rotor swept areas and bat features is not anticipated to significantly reduce the edge effects that create habitat features utilised by bats and may actually increase this, in combination with compensatory planting..

6.3 Mitigation to avoid collision or barotrauma

6.3.1 Mitigation by avoidance

The main mitigation measure here is avoidance. This relates to the design of the wind farm infrastructure to implement a minimum of 50 m separation distance from habitat features used by bats and the tips of turbine blades; as recommended by the Natural England (2014)[30] guidelines, which have been adopted by SNH *et al*. (2019)[31]. The equation used to calculate stand-offs is reproduced in **Figure 18**.

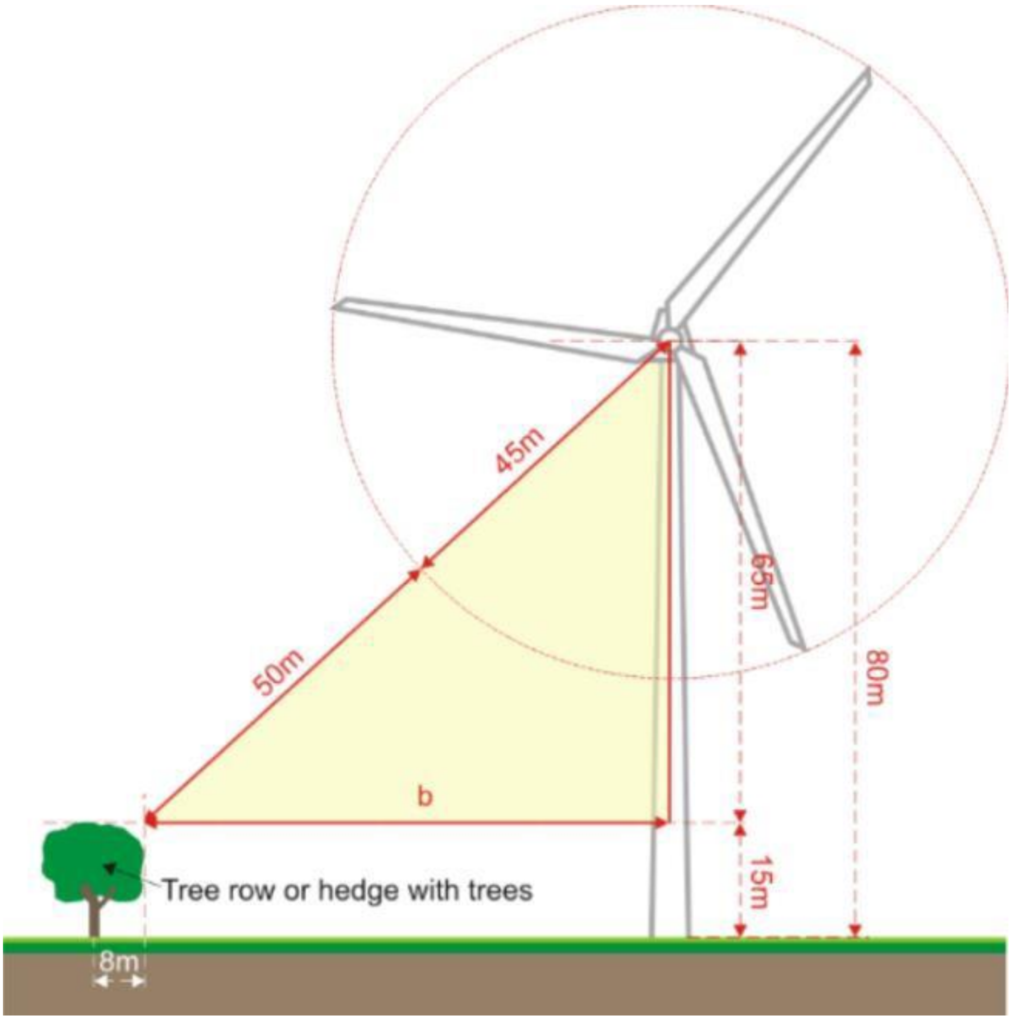
To generate turbine buffers the worst case scenario for the potential turbine specification for the Coole Wind Farm Site have been applied in this assessment, including:

- Turbine tip heights: up to 175 m
- Rotor diameter: up to 155 m
- Hub height: minimum 97.5 m

As shown in **Table 21**, the worst-case scenario (Scenario 1) gives a lowest rotor swept height of 20 m, and a range of turbine-feature buffers, depending on feature heights (3 to 30 m) of between 85.6 m and 108 m from the turbine tower.

30 Natural England (2014). *Bats and onshore wind turbines: Interim Guidance* 3rd Ed. Natural England Technical Information Note TIN051, Natural England, Peterborough

31 Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter & Bat Conservation Trust (2019). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*.



Where bl = blade length, hh = hub height, fh = feature height (all in metres)

$$b = \sqrt{(50 + bl)2 - (hh - fh)2}$$

Figure 18 – Equation to calculate turbine tower buffers

- required to maintain 50 m standoffs - blade tip to habitat feature

Table 21 – Turbine tower buffers for bat habitat features of different heights

	Turbine-feature buffer	
Feature height (fh)	**Scenario 1** bl = 77.5 m hh = 97.5 m Lowest rotor swept = 20 m	**Scenario 2** bl = 75.0 m hh = 100.0 m Lowest rotor swept = 25 m
3 m	85.6 m	78.8 m
5 m	87.8 m	81.2 m
10 m	92.7 m	86.8 m
15 m	97.2 m	91.7 m
20 m	101.2 m	96.1 m
25 m	104.9 m	100.0 m
30 m	108.2 m	103.6 m

Figure 19 shows the proposed turbine locations with 86 m and 108 m turbine-feature buffers applied to illustrate the maximum and minimum extents of the vegetation clearance zones that will be required for scenario 1, depending on the heights of features. Maps showing the range for turbine buffers for each turbine location are provided in **Appendix III**. Note: Depending on final turbine specifications, if the lowest rotor swept height is 25m (Scenario 2) then this range can be reduced to a range 79 m and 104 m for turbine-feature buffers.

Significant vegetation removal to achieve 50m separation distances is only required at T5 and T14. The majority of the turbine locations have been designed to maximise the use of open industrial bog, within the site and therefore avoid potential bat foraging/commuting features, including:

- No vegetation removal required: T3, T4, T6, T7, T8, T10, T11 and T13
- Small amount of vegetation removal/lowering required: T1, T2, T9 and T15

The area where trees/ scrub is cleared to create the turbine-feature buffers for foraging/ commuting bats must be rendered as unsuitable as possible, and maintained as such over the lifetime of the wind farm. Felled timber and branches must be removed, with stumps brashed to ground level. Any excess spoil from excavation works during construction can be broadcast to cover over any ground stumps to create a more homogeneous surface.

Post-construction monitoring will be required to ensure a homogeneous surface is maintained through the operational life span of the project.

6.3.2 Mitigation by curtailment

Based on current knowledge of seasonal use of the area by bats, a turbine curtailment plan is recommended, whereby specific high-risk turbines are feathered to run at < 2 rpm. Typically, this mitigation measure will kick in during, for example predetermined climatic conditions at specified times during the active bat season. This has the potential to limit collision risk for Leisler’s bat, as this species’ flight behaviour is often associated with open areas and are therefore less responsive to mitigation involving vegetation removal around turbines. In addition, Leisler’s bats are a species regularly recorded flying heights within the rotor swept area.

The Leisler’s bat utilising the Coole Wind Farm Site exhibited noticeable peaks in activity over the spring deployment, prior to and while bats are starting to move maternity roosts. Smart curtailment would significantly reduce collision risk over this period, especially if employed at T7 in combination with T8. The need for curtailment at other Leisler’s spring hot spots (T1, T4, T5, T10, T14, T15) was considered likely to be less effective; as activity was generally thought to be generated by a very small number of bats, active over a limited timeframe. In addition, for locations like T4 the activity levels registered were deemed to be a function of the close proximity of the unit to adjacent habitat features, rather than the open bog habitat at the proposed turbine location. With the extensive vegetation clearance required for T5, it is difficult to justify curtailment as an additional measure, as vegetation removal and re-planting should limit bat activity in the vicinity of T5. Nevertheless, post-construction monitoring is recommended for this location, specifically to determine whether proposed vegetation removal results in a reduction of spring activity by Leisler’s bats in the vicinity of T5.

It is proposed that the spring curtailment period for T7 and T8 would be in effect over April, May and mid-June inclusive for the first operational year of the Wind Farm. Further surveying (post-construction) is required to determine the if this curtailment measure can be reduced or removed during the second operational year of the Wind Farm based on the post construction survey activity. Maternity roosts and associated foraging areas are assumed to be removed for the Wind Farm Site, based on limited availability of suitable roost sites and the drop off in activity detected over the summer (July) deployment period. Based on peaks in

Leisler's bat activity in relation to weather data collected for the site, curtailment at T7 and T8 is only required on nights when speeds drop below 5 m/sec and overnight temperatures remain above 8°C.

During the summer (July) deployment, T9 recorded consistent dawn-dusk activity by a small number of Leisler's bats. Smart curtailment of T9 for an hour around dusk and *c*. 2 hours around dawn is recommended as mitigation in the first year of operation to limit collision risk at this location over the summer period (June to August). Further surveying (post-construction) is required to determine the if this curtailment measure can be reduced or removed for the second operational year of the Wind Farm based on the post construction survey activity. In addition, it is possible that T9 would result in displacement for bats from locality due to vegetation removal. This highlights the importance of ongoing monitoring to implement a dynamic response to continued mitigation wind farm sites where the responses of bat to mitigations measures can be unpredictable.

SNH *et al*. (2019), states:

> *The effectiveness of curtailment needs to be monitored in order to determine*
>
> a) *whether it is working effectively (i.e. the level of bat mortality is considered to be incidental), and*
>
> b) *whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties*.

In this regard, the following section proposes a post-construction monitoring strategy for adoption at Coole Wind Farm.

6.4 Post-construction monitoring

Based on SNH *et al*. (2019) guidelines, post-construction monitoring for wind turbines would only be required at developments where the mitigation involves turbine curtailment. With mitigation in place, only through the creation of appropriate turbine to features buffers, the proposed Coole Wind Farm Site has still been assessed as posing a medium risk to bat populations utilising the area in the vicinity of the Wind Farm Site. Thus, Smart curtailment has been recommended for specific turbines as an additional mitigation measure at Coole Wind Farm; and therefore, post-construction monitoring at selected turbines will be required.

Post construction bat monitoring should be developed in line with recommendations in *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH *et al*., 2019).

A three-year monitoring programme is recommended for bats, with monitoring in years 1, 2, and 3 post-construction, and will include several elements, including bat activity surveys and collision monitoring, which incorporates turbine searches and scavenger removal trails.

Note: Start dates for monitoring years should be in line with either the start of the breeding season or non-breeding season; and it is acceptable for the post-construction – monitoring year 1 to commence prior to the final close-out of construction, as long as the turbine is erected and turning, i.e. posing a collision risk.

6.4.1 Survey area for bat monitoring

The bat survey area for post-construction phase monitoring is defined as the turbine locations identified as establishing a risk to bats and requiring curtailment. On the basis of existing information, this is considered to be T8 and T7 in the spring and T9 in the summer. Given the proximity of T5 to the River Glore, the high levels of bat activity recorded and to monitor the effects of proposed vegetation around the turbine, it is recommended that this turbine is included in the monitoring program. Post-construction monitoring at T14 is also recommended to determine the effects of vegetation removal at this location.

6.4.2 Activity surveys

SNH *et al*. (2019) provides recommendations for monitoring bat activity post-construction. For Coole Wind Farm, it is recommended that post-construction monitoring incorporates the deployment of static bat detectors throughout the active bat season in-conjunction with collection of weather data, specifically data on temperature, wind speed and rainfall. This will allow for more accurate curtailment parameters to be developed for the turbines deemed to pose a collision risk for bats.

It is proposed that several continuously recording (April to October, inclusive) static bat recorders will be deployed. These will set-up to monitor bat activity at T7 and T5. The option of deploying a microphone to recorded bat activity at height will be investigated; however, it should be noted that a unit deployed at 5m is likely to record most bat calls within a 20 to 30m radius, and will therefore be detecting bat activity within the lower reaches of the rotor swept area, probably higher for some calls from Leisler's bats.

Activity surveys will also include three seasonal deployments of static detectors lasting a minimum of 10 weather compliant nights per deployment (as per the pre-construction surveys). These deployments will target T2, T8, T9 and T14. An additional two units will be deployed during each seasonal deployment period to provide context, and will placed at habitat features adjacent to turbine locations and will be compared with units at turbines.

Weather data will be collated from on-site monitoring equipment; and, it is strongly recommended that a dedicated weather station is deployed as well, to ensure conditions on site can be monitored remotely by bat surveyors.

Bat activity on site is compared with weather conditions to tweak curtailment parameters; and as outlined in the follow sections turbine searches are undertaken to determine if any bats are colliding with turbines.

6.4.3 Collision monitoring

Turbine searches are implemented to detect any fatalities (and possibly injured animals) due to collisions with turbines.. A post-construction bat monitoring plan must include detailed methodology for conducting turbine searches and this has been outlined in the following sections.

Search area: The search area has been defined as a 65 m radius around each turbine.

JUSTIFICATION: In the absence of a detailed methodology, a search area of r = 65 m was selected as studies monitoring collision have found that the core radius around turbines, where the majority of collision casualties fall, is within 50 m of turbines (Johnson *et al*. 2003 & Arnett 2006).

Target turbines: Turbine searches will be undertaken at T5, T7, T8 and T9

JUSTIFICATION: These are the turbines locations identified as posing the highest potential collision risk to bats within the Wind Farm Site and monitoring is required to ensure mitigations measure are working effectively.

Search frequency: Daily searches at selected turbines over two periods of 10 days in the spring (late-April and May). Additional turbine searches will be conducted in the summer (July) and early autumn (Aug/Sep), with searches conducted on alternate days over a 10-day period.

JUSTIFICATION: In this instance, where turbine searches are being employed to any link casualty events with weather and acoustic data with the aim of refining curtailment parameter, SNH *et al*. (2019) recommends daily searches. Activity across the Wind Farm Site was found to drop after the spring and therefore, a slight less frequent search regime is considered appropriate. Based on findings over the first monitoring year, search regime can be modified to include additional turbines and more search effort. However, the search regime recommended above is the minimum required and must implemented over the 3-year post-construction. If based on the findings, modifications to curtailment, further re-planting or additional vegetation removal are identified to reduce collision risk, then an extension of the turbine searches will be required.

Searches employing wildlife detection dogs: During the flight period for bats searches will be undertaken using an appropriately trained dog team. All dog teams will have detection rates tested and scored.

JUSTIFICATION: Given the diminutive stature of bats, detection rates using human searchers are notably unreliable. Trained wildlife detection dogs have been shown to be significantly more effective than humans in detecting fatalities from collision, especially in detection of bat carcasses.

Timing of searches: Searches will commence at dawn and the first turbine to be searched on a given survey day will be rotated over the season.

JUSTIFICATION: Commencing searches at dawn is done to limit scavenging of any causalities from the preceding night, by diurnal species like hooded crow.

Determination of scavenging rates: Baited trip cams will be deployed during each of the four 10-day search periods to determine what scavengers are active on the site and how quickly carcasses are removed. A total of 6 cameras will be used for each deployment. To emulate bat carcasses, dark coloured mice carcases with be used to bait the camera traps.

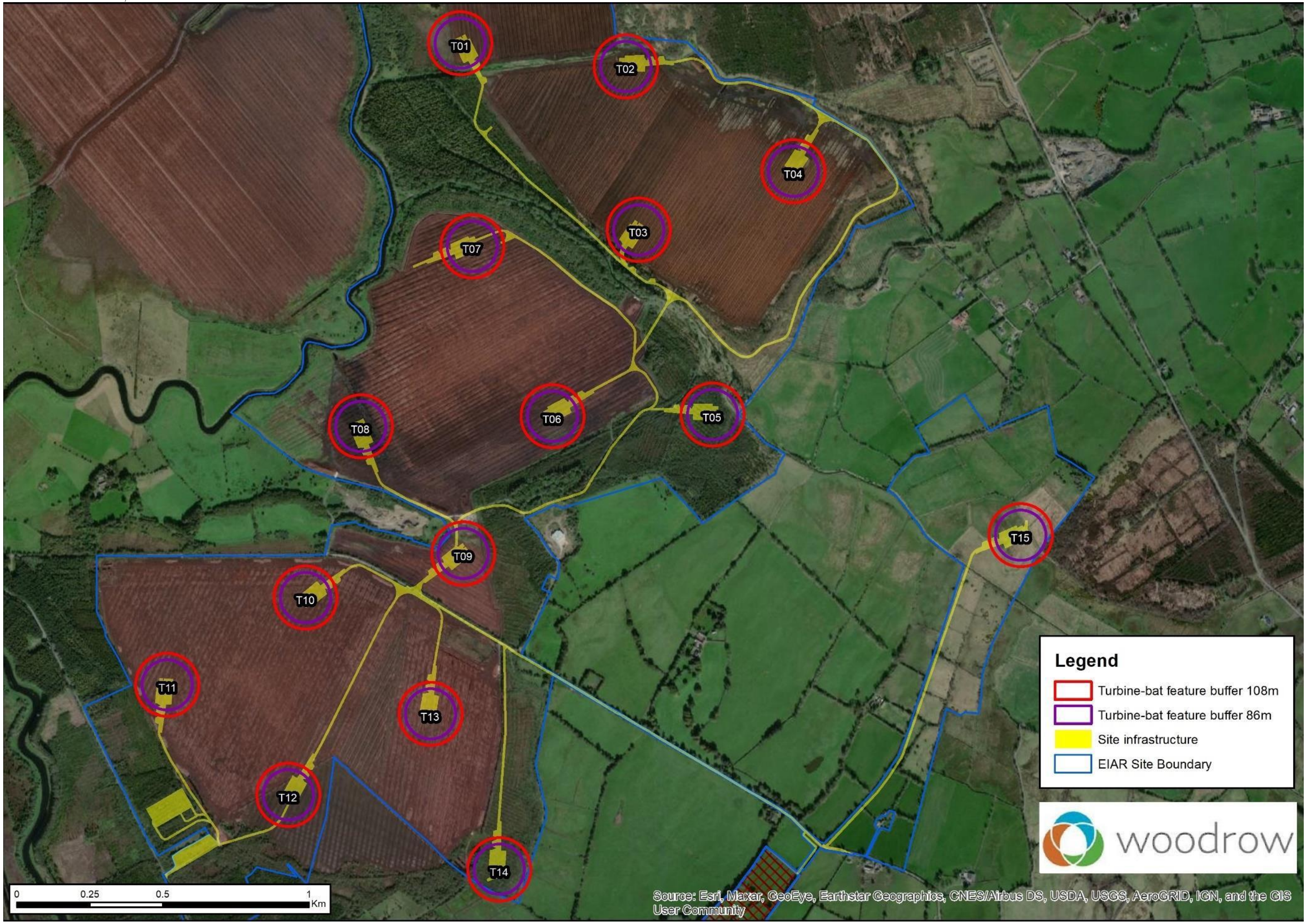


Figure 19 – Range for turbine-bat feature buffers

7 CONCLUSIONS

A preliminary impact assessment for bat population utilising the proposed site for Coole Wind Farm Site was conducted and, in the absence of mitigation, found there is potential for significant effects on the following features that are considered to be of Local to County Importance (Higher Value), including:

- During the construction phase the potential for direct impacts on bats roosting in trees located on access tracks between the turbines and for the excavation of the borrow pit was considered *Significant* at the *Local scale*
- During the construction phase the potential for secondary impacts on foraging/ commuting bats due to removal of vegetation was considered *Significant* at the *Local* scale
- During the operational phase the potential for direct impacts on foraging/ commuting bats - collision or barotrauma to Leisler's bats, common and soprano pipistrelle bats considered *Significant* at the *Local scale* and for Nathusius' pipistrelles considered *Significant* at the *County to Regional scale*

Mitigation measures have been proposed, including:

- Pre-construction bat roost surveys to identify any active tree roosts within the works corridor prior the commencement of construction works; and will include the application for a derogation licence from NPWS, to conduct any species protection works/ operations/ procedures as required.
- Removal of vegetation to maintain a minimum separation distance of 50 m between blade tip and feature.
- Compensatory habitat for foraging/commuting bats to replace 'like-for-like' within the Wind Farm Site. This will include replacement planting of 963m of treeline and 218m of hedgerow along the proposed access track to T15.
- Smart curtailment at specific turbines, including full suite of post-construction bat surveys as detailed in SNH *et al*. (2019).

It is considered that the proposed measures, if implemented as recommended and in full, will mitigate entirely for any potential impacts on foraging, commuting or roosting bats at the proposed Coole Wind Farm, and will result in an overall residual impact on bats that utilise the Wind Farm Site of ***negligible significance***.

8 REFERENCES

Aughney, T., Roche, N., & Langton, S (2018) The Irish Bat Monitoring Programme 2015-2017. *Irish Wildlife Manuals*, No. 103. NPWS, Department of Cultural heritage and the Gaeltacht, Ireland.

Bat Conservation Trust (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edition). The Bat Conservation Trust, London.

Bat Conservation Ireland (2012). *Wind Turbine/Wind Farm Development Bat Survey Guidelines*. Version 2.8, December 2012. BCI - Bat Conservation Ireland.

CIEEM (2018, updated 2019) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

Collins, J. (ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn). The Bat Conservation Trust, London. ISBN-13 978-1-872745-96-1

Cryan, P. & Barclay, R (2009). Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. *Journal of Mammalogy* 90, 1330-1340

Cryan, P. M., P. M. Gorresen, C. D. Hein, M. R. Schirmacher, R. H. Diehl, M. M. Huso, D. T. Hayman, P. D. Fricker, F. J. Bonaccorso & Johnson D. H. (2014). Behavior of bats at wind turbines. *Proceedings of the National Academy of Sciences* 111:15126-15131.

European Community Habitats Directive (92/43/EEC) – The Habitats Directive.

European Communities (Birds and Natural Habitats) Regulations 2011.

Hundt L. (2012) Bat Surveys: Good Practice Guidelines, 2nd edition, Bat Conservation Trust ISBN-13: 9781872745985 [Namely Chapter 10 - *'Surveying proposed onshore wind turbine developments'*]

Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals. No. 25. NPWS, Department of Environment, Heritage & Local Government, Dublin, Ireland.

Kepel, A., Ciechanowski, M., Jaros, R. (2011). How to assess the potential impact of wind turbines on bats using bat activity surveys? A case study from Poland, XII European Bat Research Symposium, August 22-26, 2011, Vilinusm Lithuania.

Lintott, P.R., Davison, S., van Breda, J., Kubasiewicz, L., Dowse, D., Daisley, J., Haddy, E. & Mathews, F. (2018). Ecobat: An online resource to facilitate transparent, evidence-based interpretation of bat activity data. *Ecology and evolution*, 8(2), pp.935-941

Lundy, M.G., Aughney, T., Montgomery, W.I., & Roche, N., (2011) Landscape conservation for Irish bats & species specific roosting characteristics. BCI - Bat Conservation Ireland.

Mathews, F. Richardson, S. Lintott, P. & Hosken, P. (2016). Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management. Final Report from University of Exeter University for RenewableUK and the UK Department of Energy & Climate Change (DECC)

Marnell, F., Kingston, N. & Looney, D. (2009) Ireland Red List No. 3: Terrestrial Mammals, NPWS, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

McAney, K. (2006) A conservation plan for Irish vesper bats. *Irish Wildlife Manuals*, No. 20. NPWS, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Middleton N., Fround A. & French K (2014) *Social Calls of the Bats of Britain and Ireland*.

MKO (2017). Bat Survey Report Proposed Coole Wind Farm, Co. Westmeath

Natural England (2014). *Bats and onshore wind turbines: Interim Guidance* 3rd Ed. Natural England Technical Information Note TIN051, Natural England, Peterborough.

Shiel, C.B., Shiel, R.E., & Fairley, J.S. (1999) Seasonal changes in the foraging behaviour of Leisler's bats (*Nyctalus leisleri*) as revealed by radio-telemetry. *Journal of Zoology*: 249: 347-358

Roche, N., Aughney, T., Marnell, F. & Lundy, M. (2014*). Irish Bats in the 21st Century. Bat Conservation Ireland*. Cavan, Ireland

Russ, J. (2012) *British Bat Calls: A Guide to Species Identification*.

Russ, J., Briggs, P. & Wembridge, D. (2008) *The Bats and Roadside Mammals Survey 2008. Final Report on Fourth Year of Study.* The Bat Conservation Trust and People's Trust for Endangered Species, London.

Rydell, J., L. Bach, M. J. Dubourg-Savage, M. Green, L. Rodrigues & A. Hedenström. (2010). Bat mortality at wind turbines in northwestern Europe. *Acta Chiropterologica* 12:261-274.

Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter & Bat Conservation Trust (2019). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*.

Wildlife Act 1976 (as amended).

Woodrow (20120a) Bat survey report to inform the proposed Coole II Wind Farm, Co. Westmeath - Results of the 2018 bat activity season.

Woodrow (2020b). Bat survey report to inform the proposed Coole II Wind Farm, Co. Westmeath - Results of the 2019 bat activity season.

Wray, S., Wells, D., Long, E. & Mitchell-Jones, T (December 2010). Valuing Bats in Ecological Impact Assessment, IEEM In-Practice p 23-25.

9 APPENDIX I – IMAGES OF SITE

T1 Open Location

T2 Open location

T3 Open location

T3 poplar treeline with ivy – River Glore

T3 Poplar treeline with ivy – River Glore

T4 open location

T4 bog track & scrub along bog edge

T4 Scot's pine periphery of access trackT4 & T3

T5 Example of young plantation

T5 example of ivy on poplar

T6 Open, but backed by older woodland

T5-T6 Mature spruce trees with low potential in ivy

T6 Beech woodland

T6 Beech – spruce trees

T7 Open, backed by woodland along River Glore

T7 Poplar treeline along River Glore

T7 Poplar treeline along River Glore

T7-T3 Poplar treeline along River Glore

T7-T3 Poplar treeline along River Glore – BEST EXAMPLE

T8 Open bog

T9 Open bog – with scrub

T9 Open bog – with scrub & 2nd rotation

T9 Open bog – with scrub & 2nd rotation

T9 large shed (beyond 300m)

T10 Located in cut away bog

T10 Foraging habitat along road, N of turbine

T10 Oak trees – Low to Neg roost potential

T10 Oak trees – Low to Neg roost potential

T10 Oak trees – Low to Neg roost potential

T10 Oak trees – Low to Neg roost potential

T11 Open bog – viewed from south

T11 Open bog – viewed from north

T12 Open bog

T12 Located adjacent remnants of raised bog

T12 Open bog

T13 Open bog

T14 Second rotation

T14 Second roation

T15 – view from bridge looking towards turbine location

T15 Bridge over River Glore
East side

View east from bridge

West side

View west from bridge

T15 Old house/ sheds/ stables to south (beyond 300m)

10 APPENDIX II – STATIC DETECTOR DEPLOYMENT LOCATIONS

Plate 1 - Turbine 1

Plate 2 - Turbine 2

Plate 3 - Turbine 3

Plate 4 - Turbine 4

Plate 5 - Turbine 5

Plate 6 - Turbine 6

Plate 7 - Turbine 7

Plate 8 - Turbine 8

Plate 9 - Turbine 9

Plate 10 - Turbine 10

Plate 11 - Turbine 12

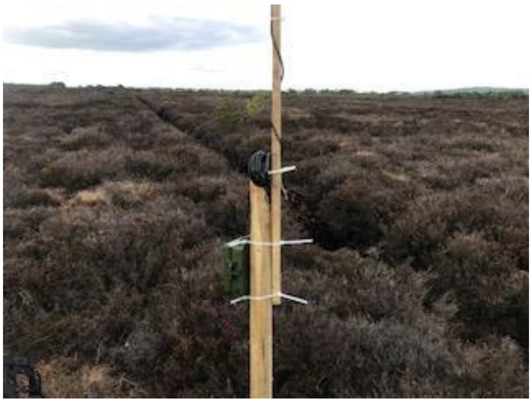
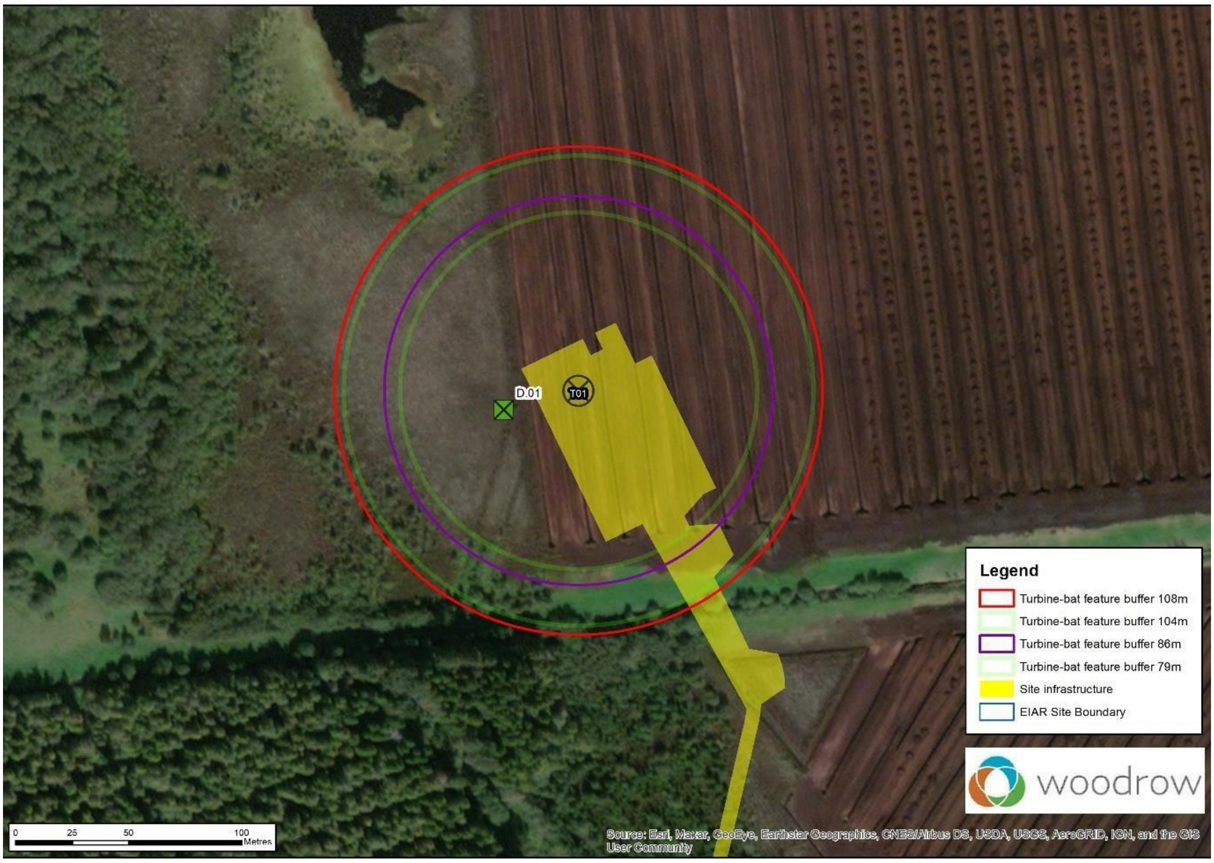
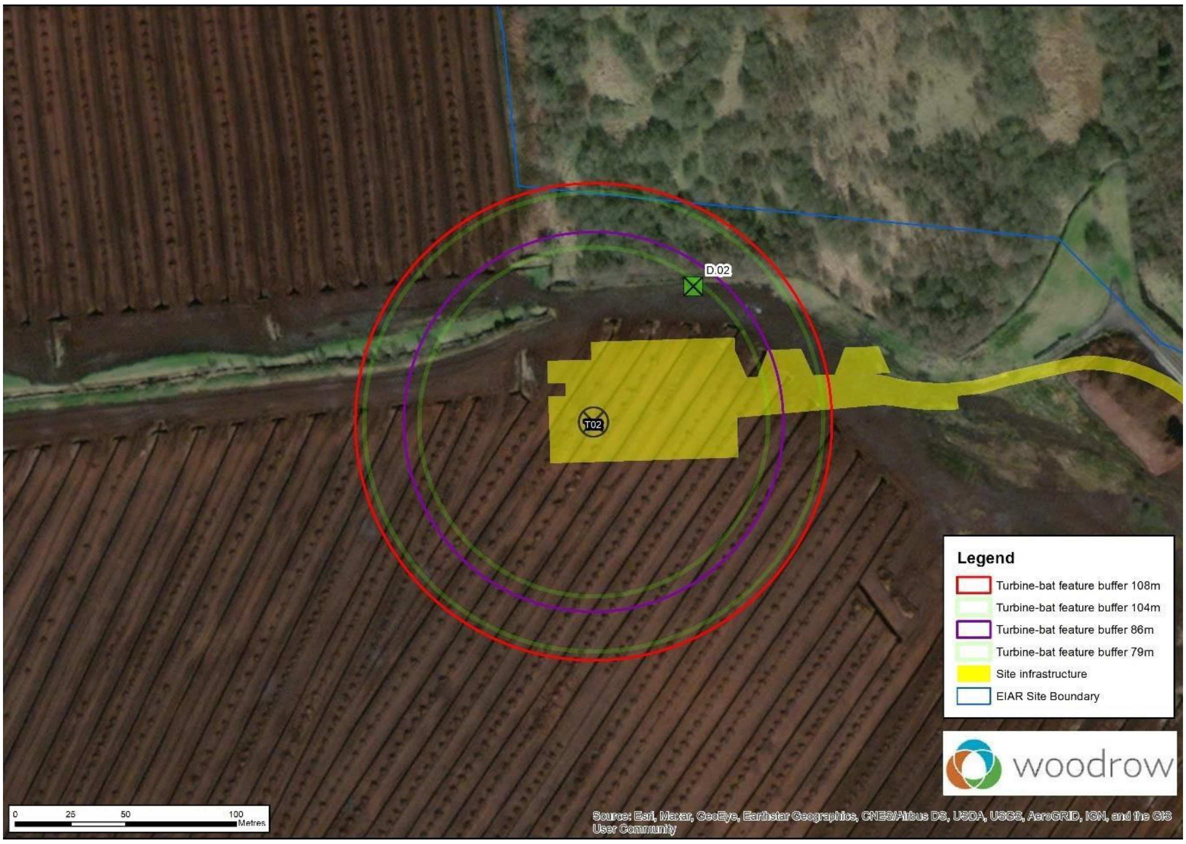


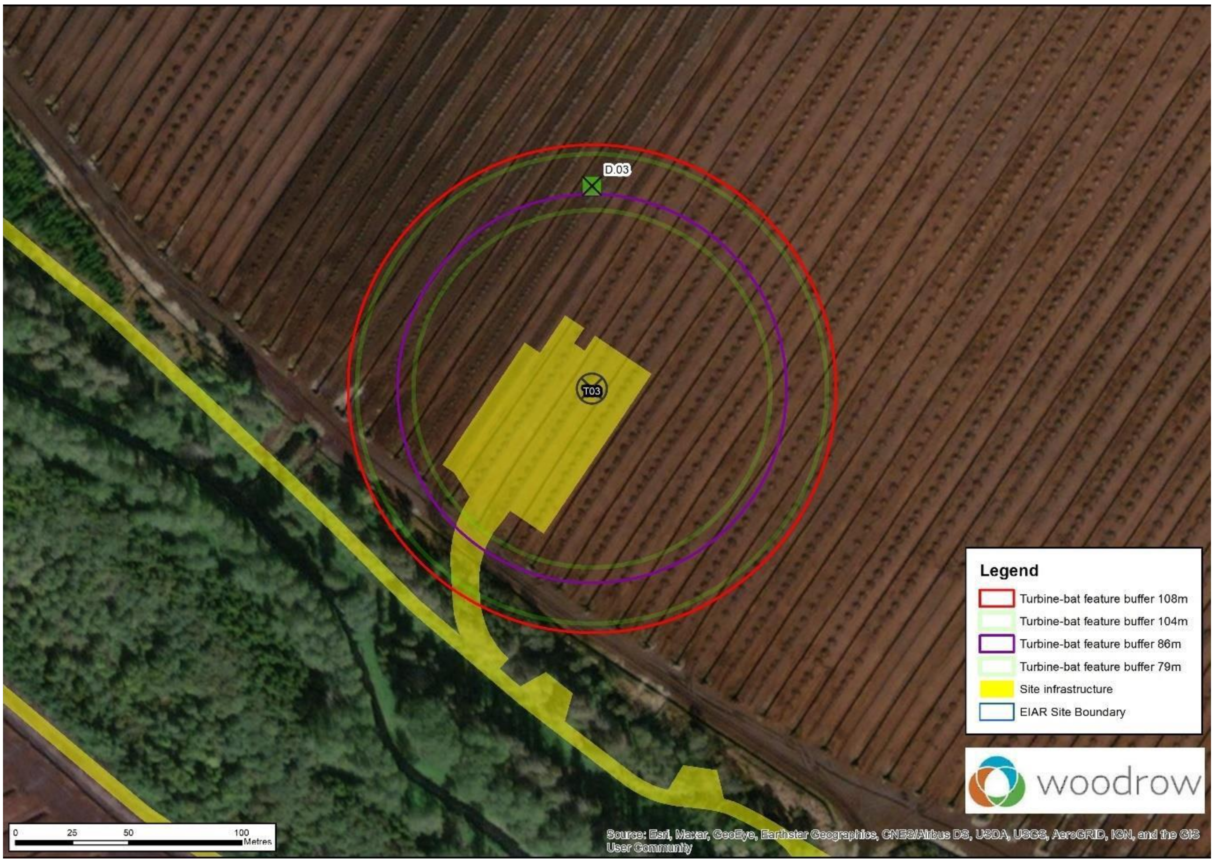
Plate 12 - Turbine 14

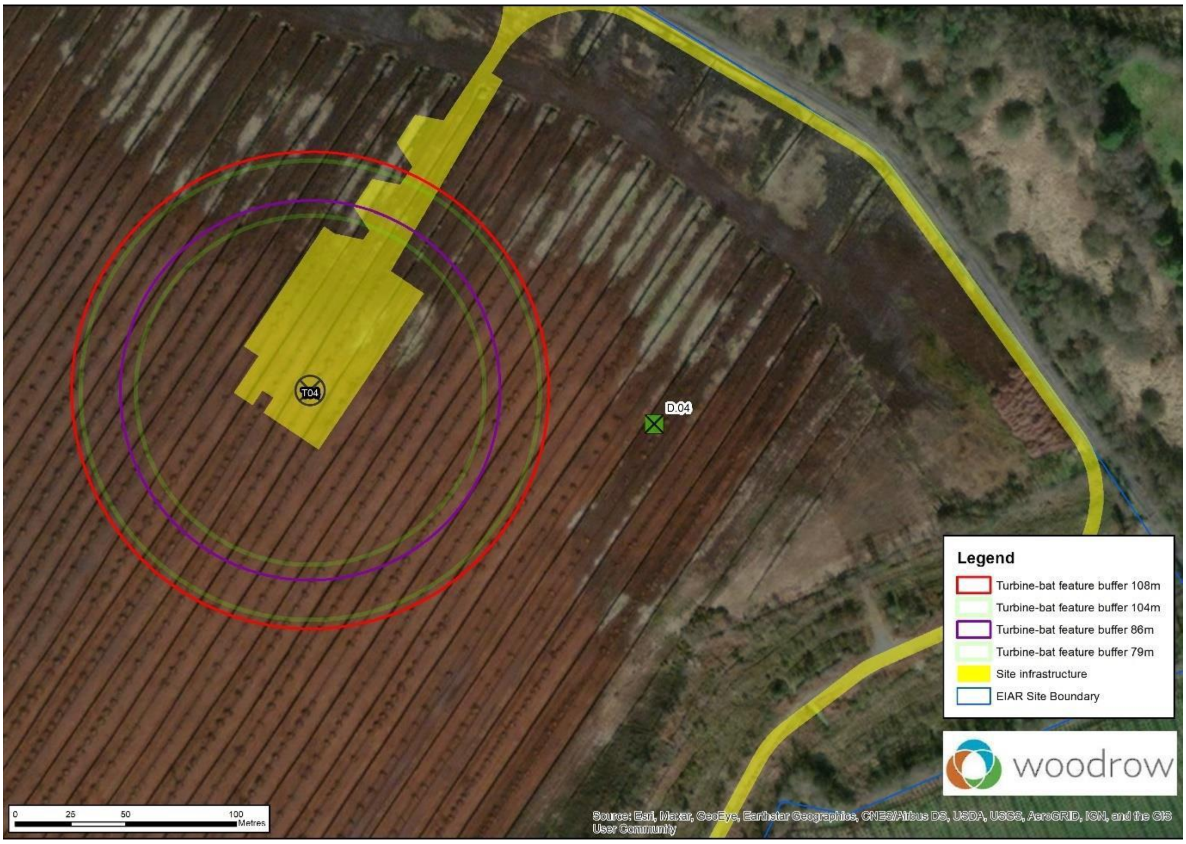
Plate 13 - Turbine 15

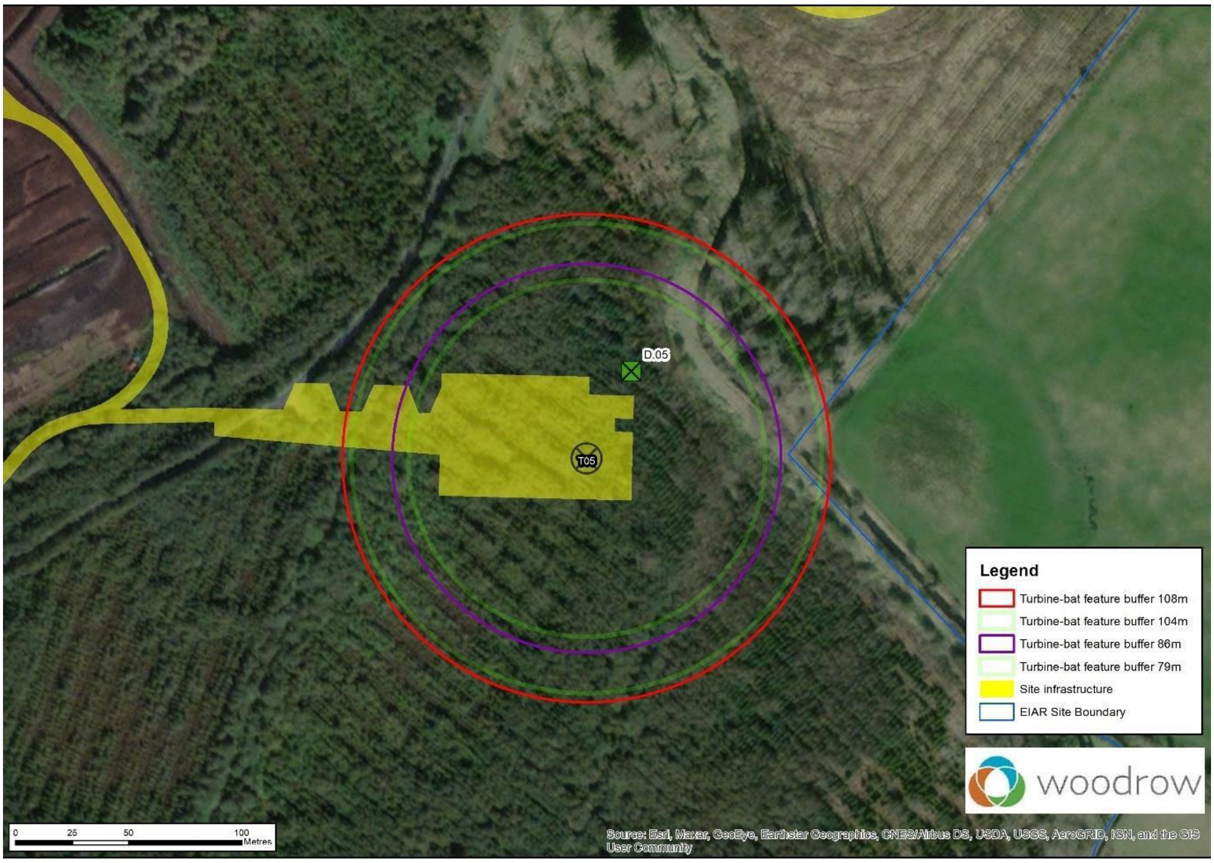
11 APPENDIX III – MAPS SHOWING TURBINE-BATS FEATURE BUFFERS






D.03
T03
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0
25
50
100
Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


T04
D.04
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0
25
50
100
Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


D.05
T05
Legend
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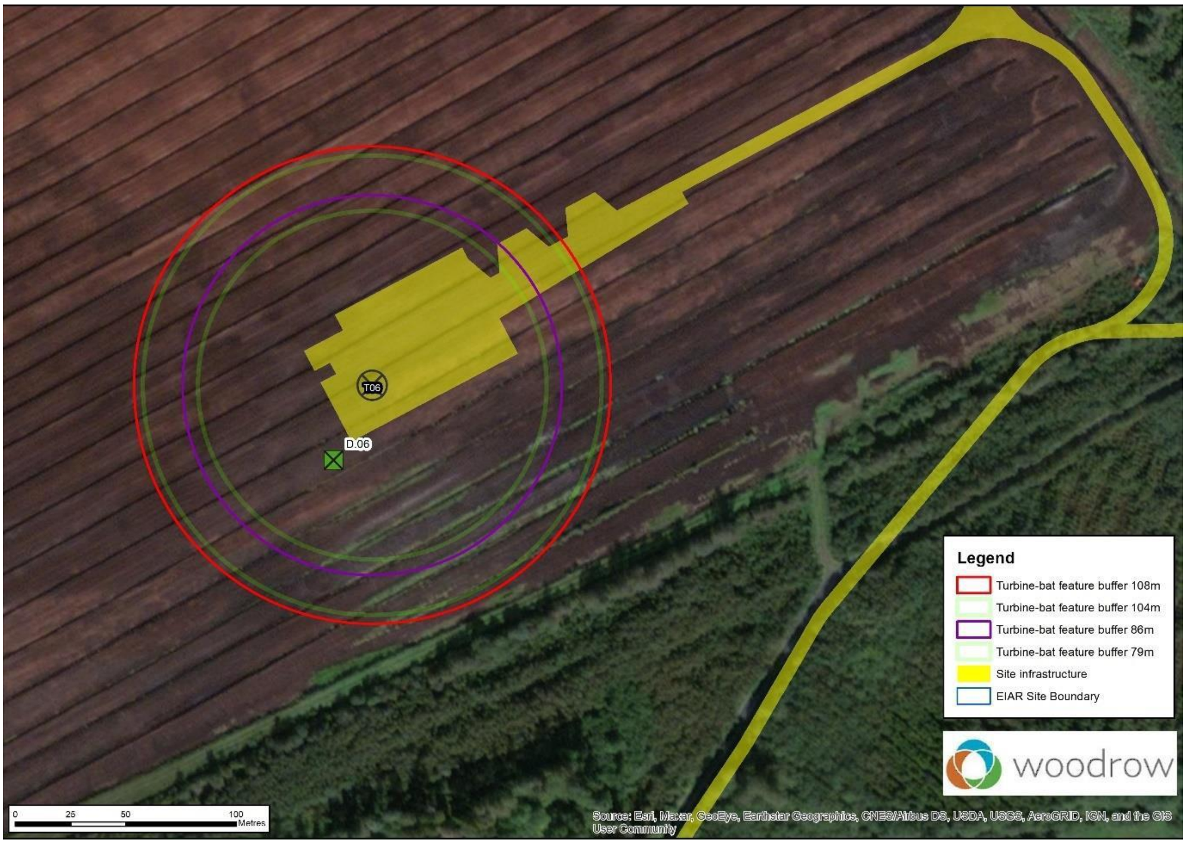
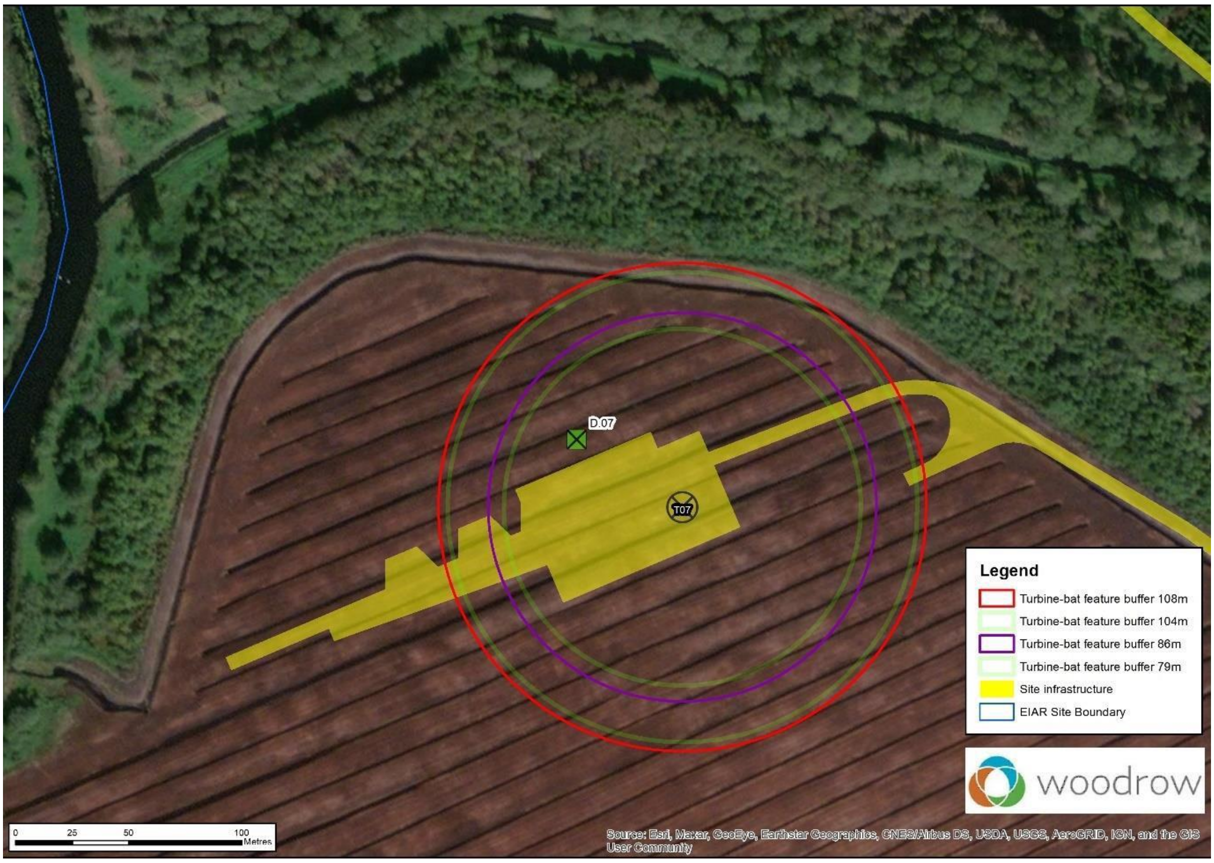
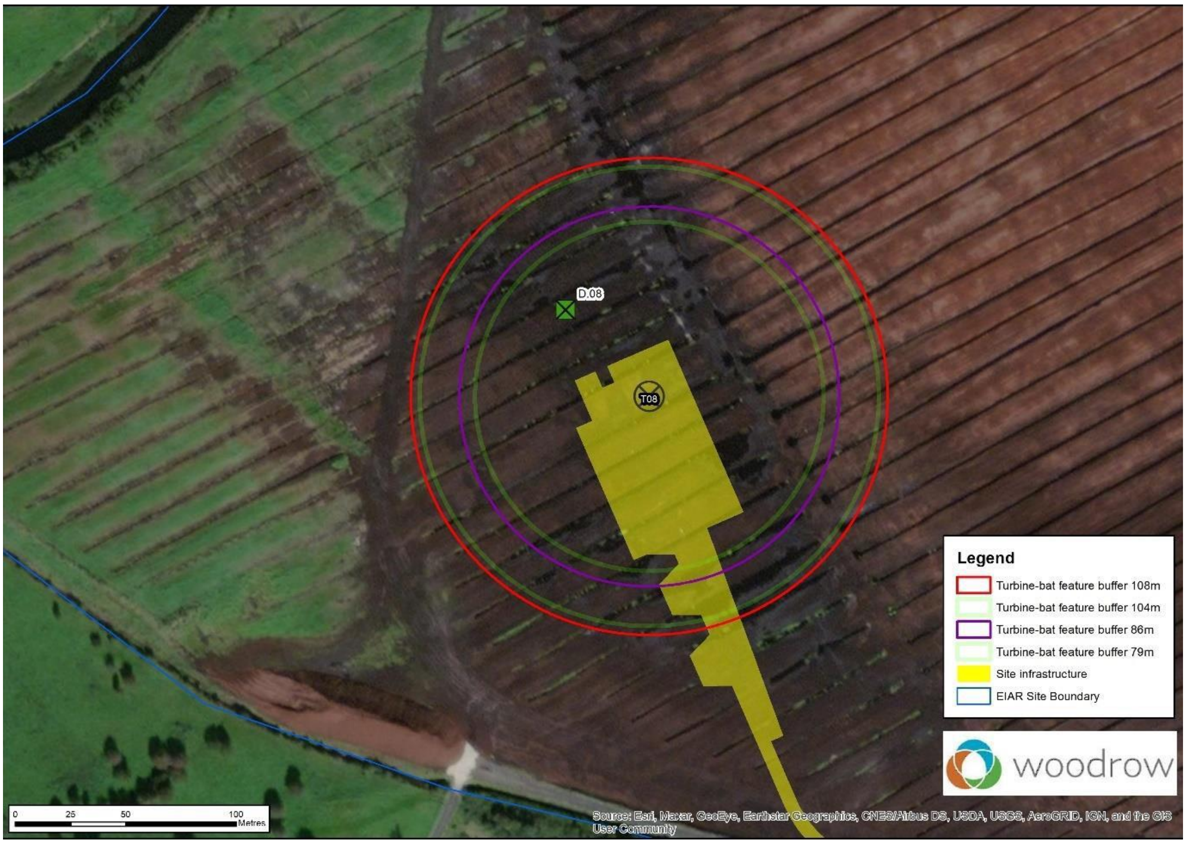
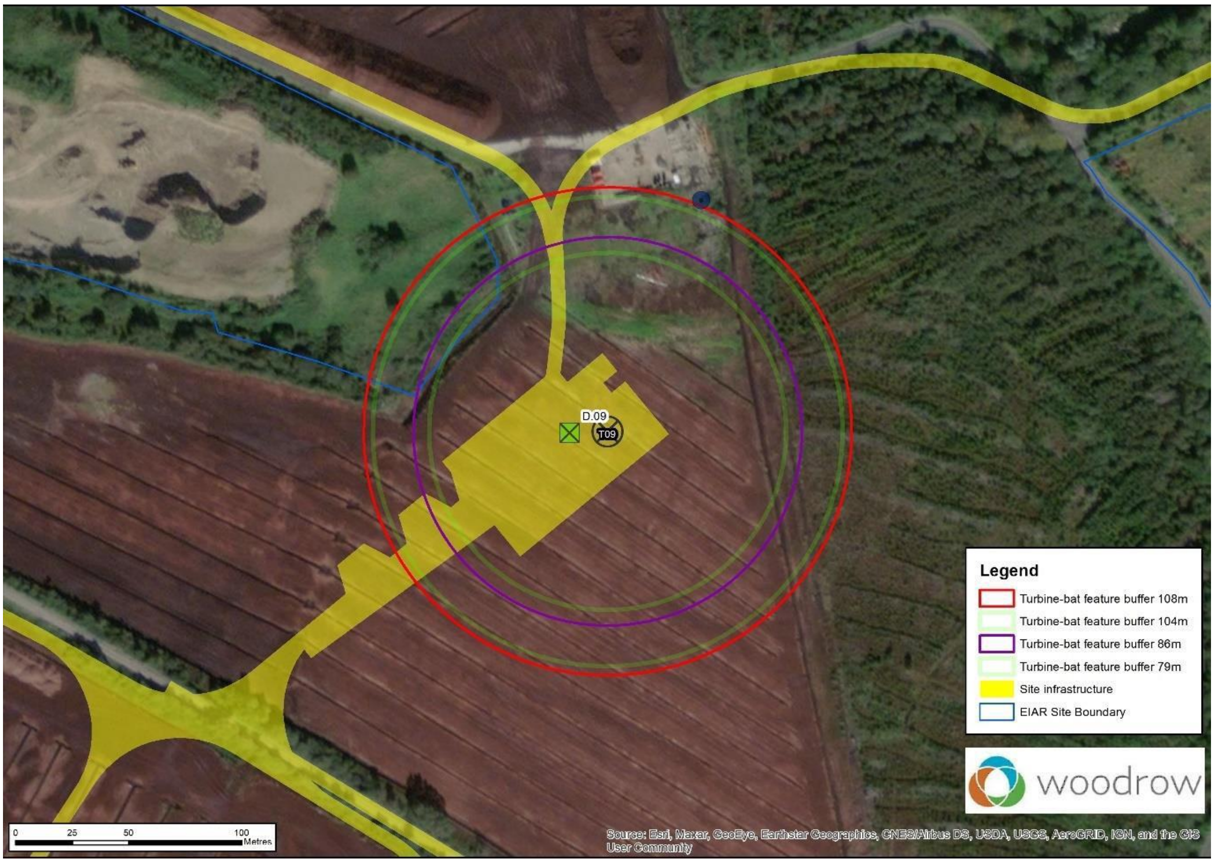
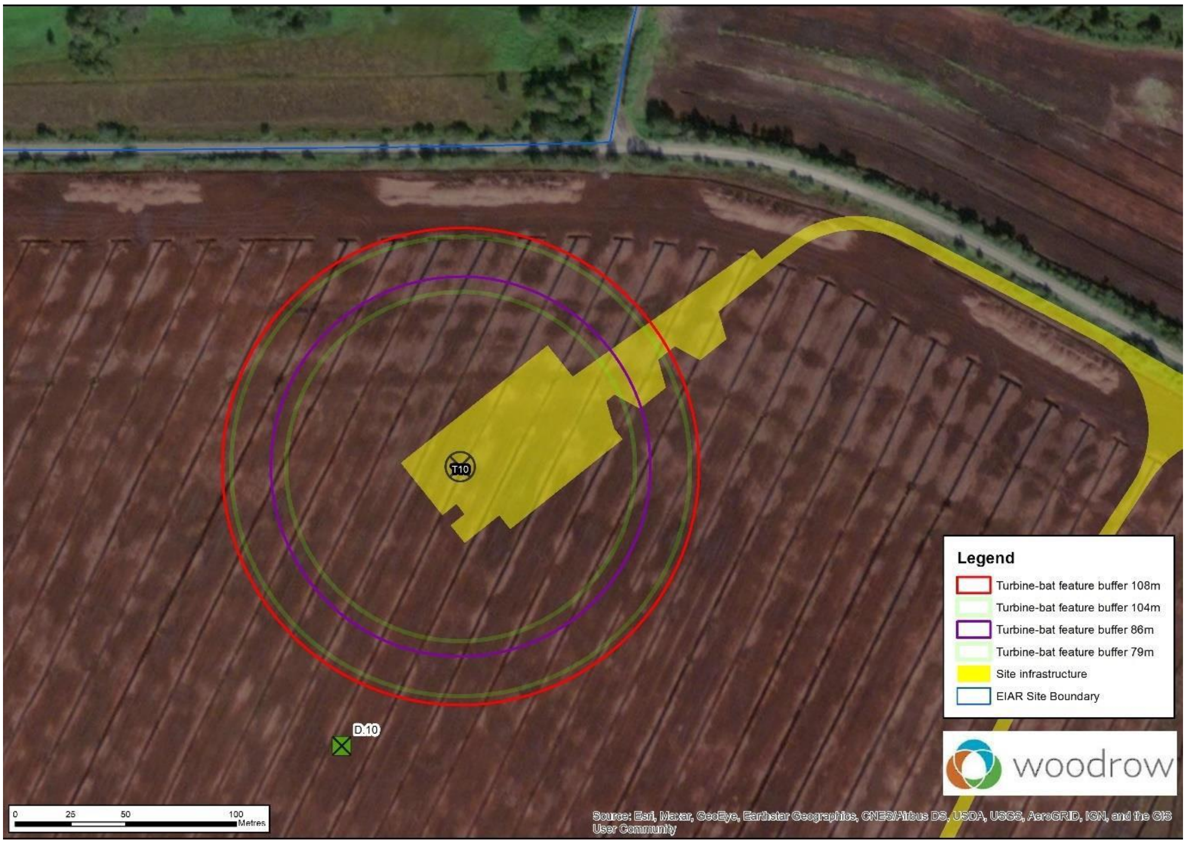
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0 25 50 100 Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

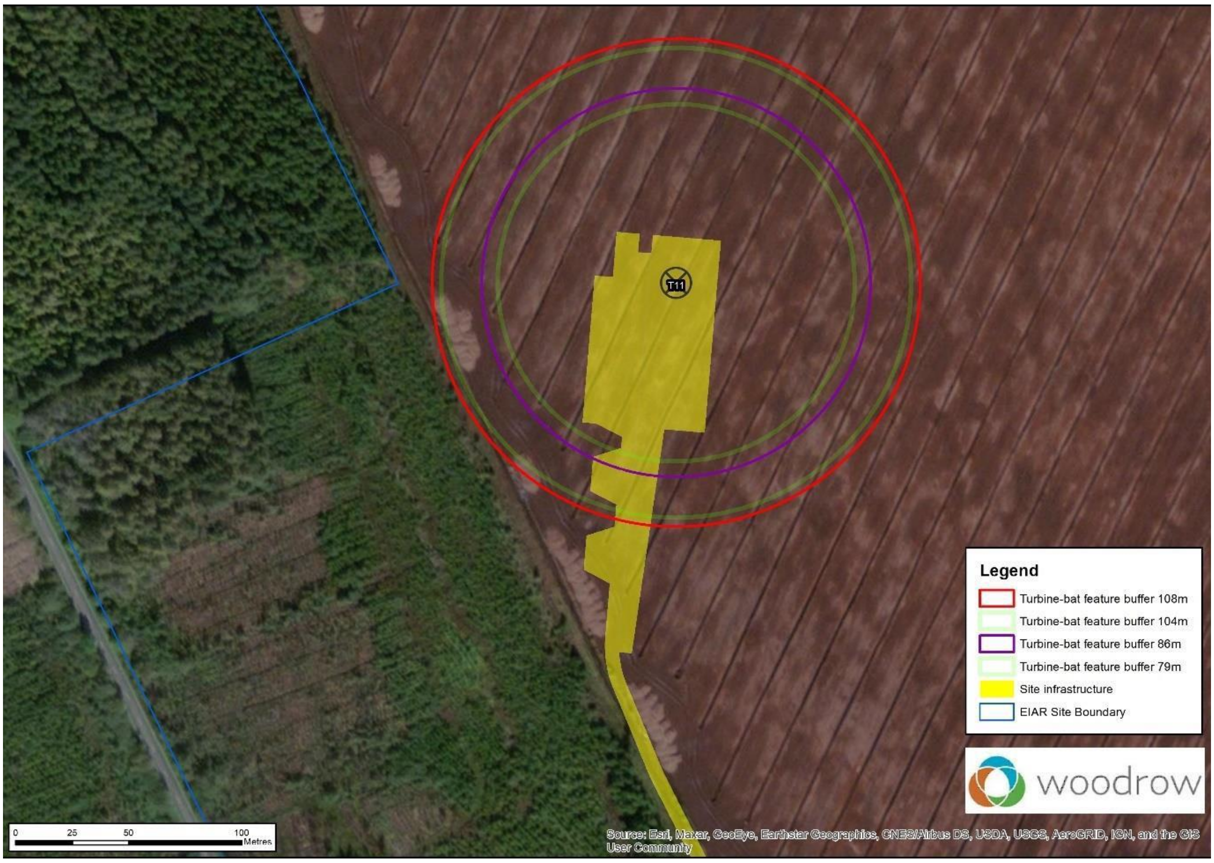

T06
D.06
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0 25 50 100 Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

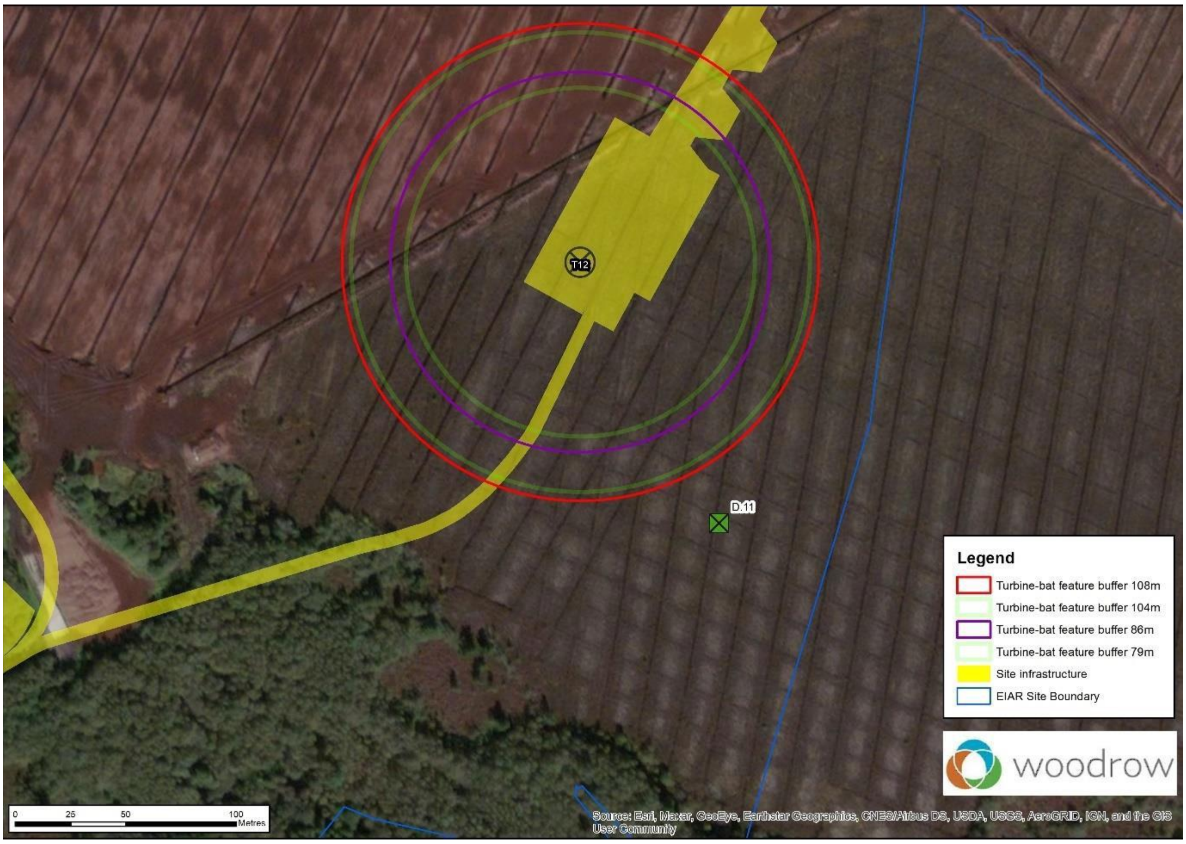

D.07
T07
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0 25 50 100 Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

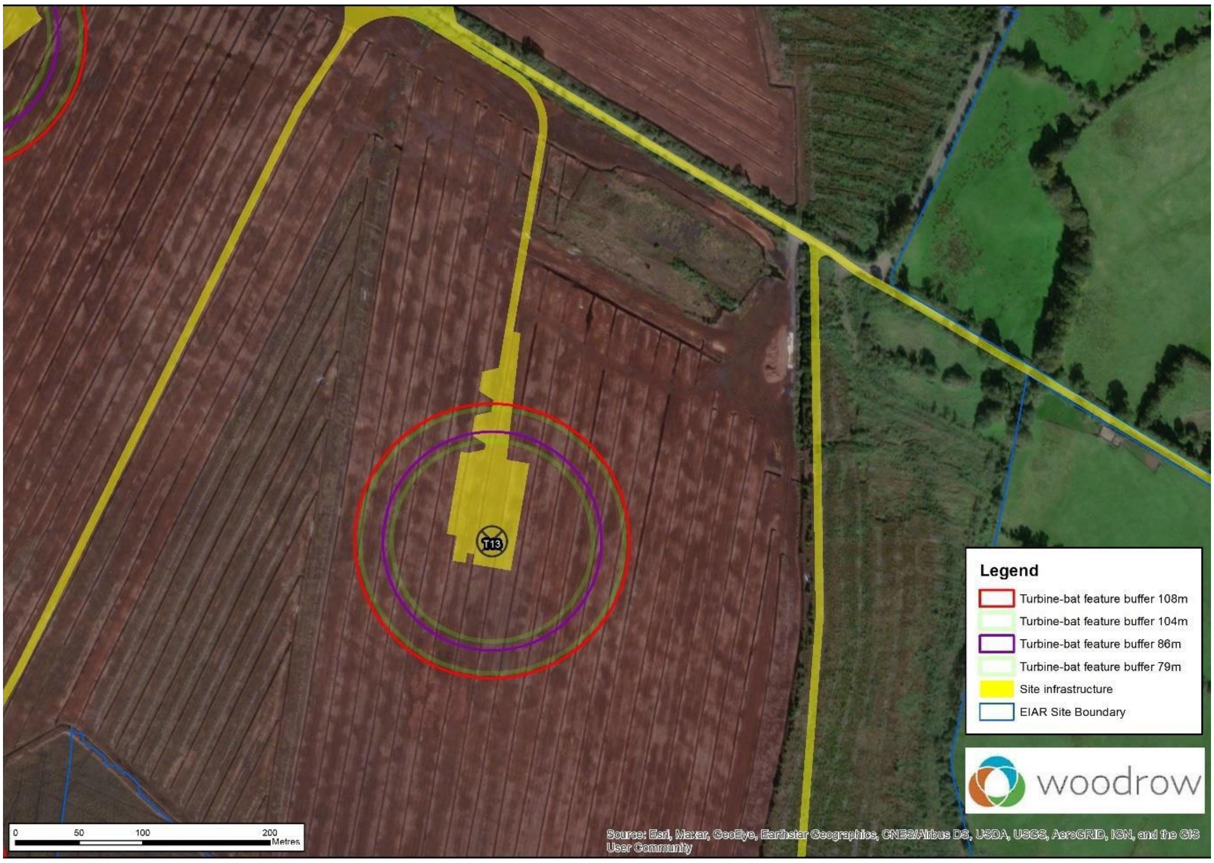

D.08
T08
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0 25 50 100 Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

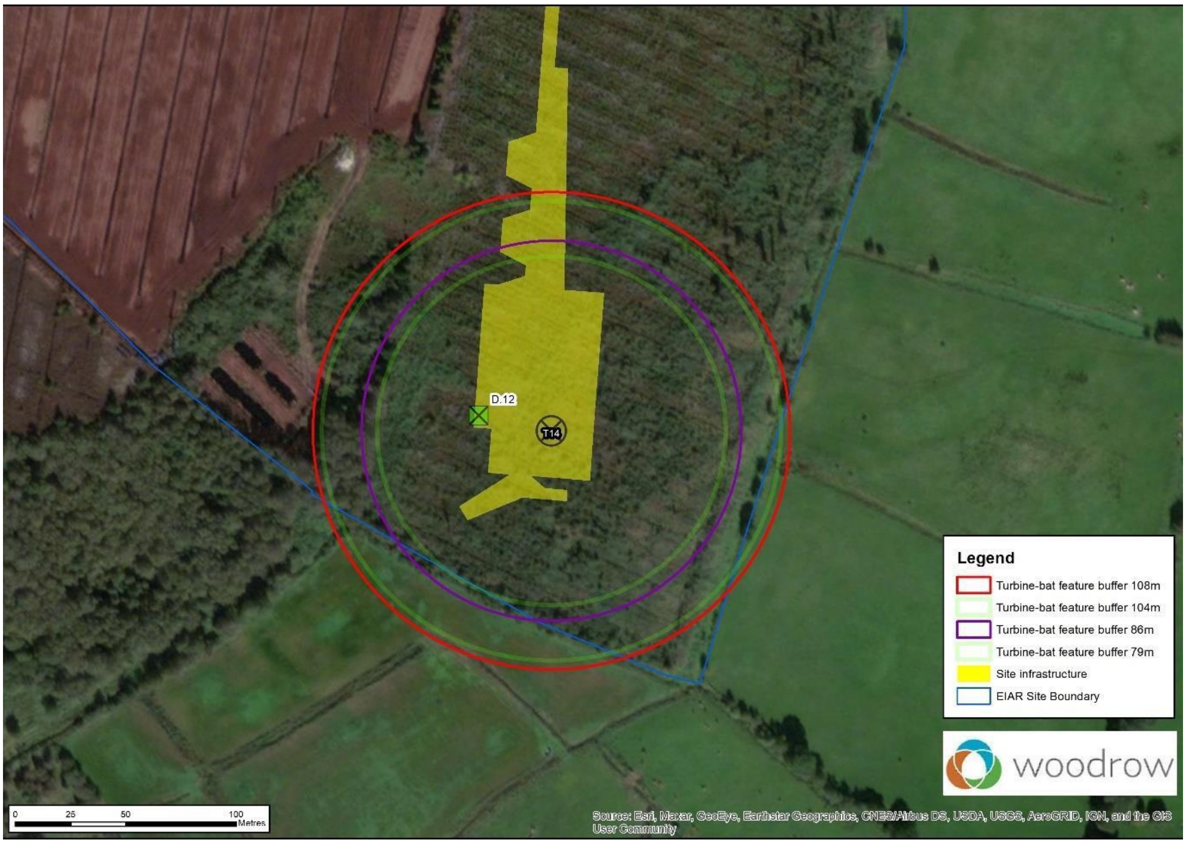

D.09
T09
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0
25
50
100
Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

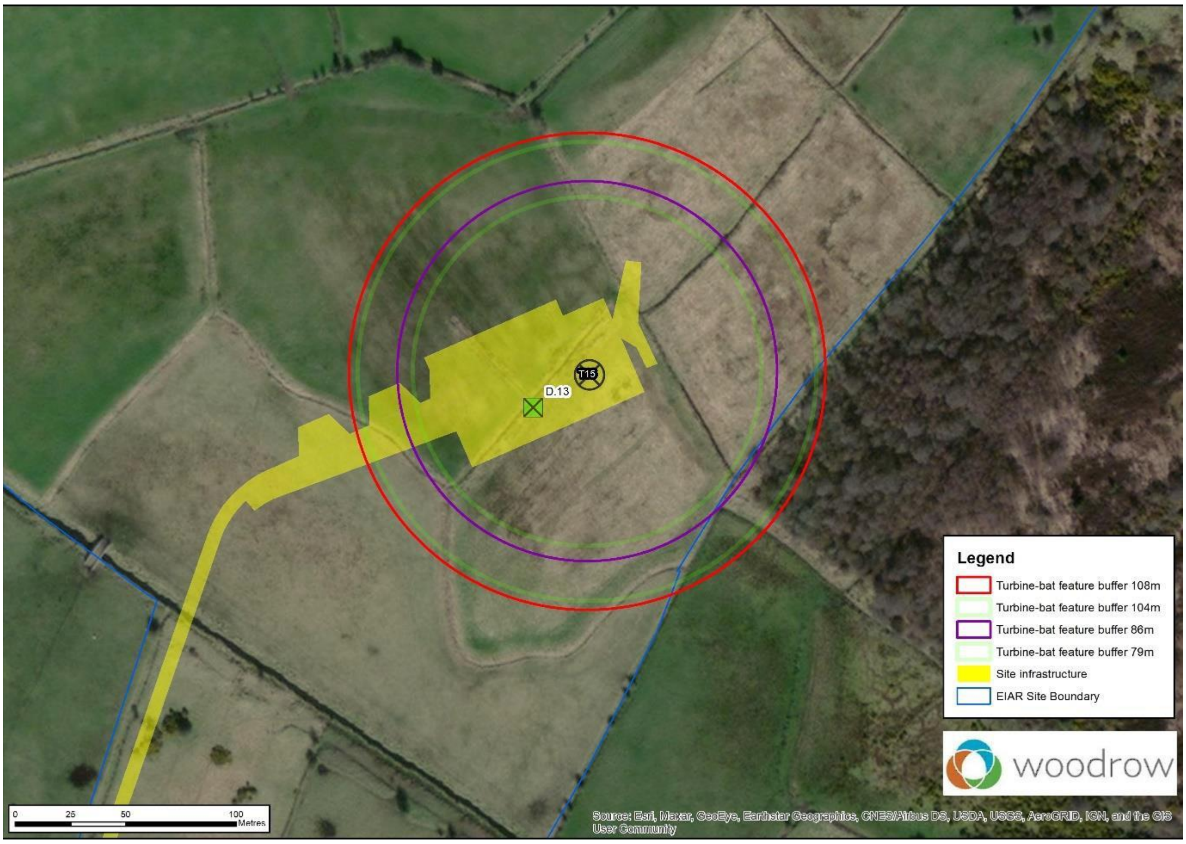

T10
D.10
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0
25
50
100
Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


T11
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0
25
50
100
Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


T12
D.11
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0
25
50
100
Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


T13
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0 50 100 200 Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


D.12
T14
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0 25 50 100 Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


T15
D.13
Legend
Turbine-bat feature buffer 108m
Turbine-bat feature buffer 104m
Turbine-bat feature buffer 86m
Turbine-bat feature buffer 79m
Site infrastructure
EIAR Site Boundary
woodrow
0
25
50
100
Metres
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community