Bat Survey, Assessment & Mitigation Guidelines for Onshore Wind Turbines in Ireland | 2026

Bat Conservation Ireland

Professional Disclaimer (IMPORTANT)

This document does not constitute formal NPWS policy and is not a statutory guideline under Section 28 of the Planning and Development Act. It represents a professional best-practice framework derived from authoritative sources including NatureScot (2021), NIEA (2021), BCT (2023), NPWS (2022), EUROBATS (2014/2015) and BCI (2012).

The use of this document does not guarantee planning consent and does not override site-specific instructions from statutory consultees.

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1. Introduction

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1.1 Purpose and Rationale

The Republic of Ireland currently lacks a single, contemporary national technical standard dedicated specifically to assessing the impacts of onshore wind energy developments on bats. Existing domestic guidance—most notably Bat Conservation Ireland (BCI) 2012—predates major sectoral changes including increased turbine dimensions, advances in acoustic technology, and greater availability of automated analysis tools. As a result, Irish practice increasingly requires alignment with more up to date international sources such as NatureScot (2021) and the Northern Ireland Environment Agency (NIEA) guidance (2021; updated listings 2024) (NatureScot, 2021; NIEA, 2021).

This document therefore seeks to provide a coherent, standardised framework for survey, assessment, and interpretation of bat activity at onshore wind energy developments in the Republic of Ireland. It localises recognised UK and European best practice to the Irish ecological and legislative context, complementing but not replacing the NPWS Bat Mitigation Guidelines for Ireland v2 (IWM 134) (NPWS, 2022).

1.2 The “Standard of Evidence”

A clear and consistent Standard of Evidence is necessary to reduce Requests for Further Information (RFIs), minimise planning delays, and prevent legal vulnerability at consent stage. This standard is built on three principles:

- Proportionate survey effort aligned to site-specific risk, turbine scale, and cumulative pressures, consistent with NatureScot (2021) and NIEA (2021/2024).

- Transparent data interpretation using both percentile-based tools (e.g., Ecobat or similar) and site-level metrics such as passes per hour (PPH), ensuring that changes in reference datasets do not inadvertently down-weight risk.

- Correct sequencing of Appropriate Assessment (AA): in line with People Over Wind (C-323/17), mitigation cannot be considered at AA screening, and screening must rely exclusively on the likelihood of significant effects based on objective information (CJEU, 2018).

1.3 Scope of Application

This guidance applies to all onshore wind energy developments in the Republic of Ireland, including:

- Utility-scale wind farms (defined here as projects with >1 turbine or tip heights >100m).

- Small-scale or “Auto-producer” turbines (proportional effort applies).

- Repowering projects and hybrid developments, recognising that modern turbines (>150 m tip) can introduce new vertical risk pathways that were absent in earlier schemes.

1.4 Legislative Anchor

Assessments conducted under this guidance are designed to fulfil the requirements of:

1. **EU Habitats Directive (92/43/EEC):** Specifically regarding Annex IV species (all bats) and Annex II species *(Rhinolophus hipposideros)*.

2. **Wildlife Acts 1976–2022:** Ensuring "strict protection" of bat roosts and foraging habitats.

3. **The "People Over Wind" Ruling (C-323/17):** Ensuring a clear separation between "mitigation" and "screening" within the Appropriate Assessment (AA) process.

1.4.1 Legal and Planning Framework (The 2024 Act)

This guidance is designed to assist practitioners in meeting their obligations under the Planning and Development Act 2024 and the Birds and Natural Habitats Regulations 2011 (as amended).

- The New Consent Authority: All references to "The Board" or "An Bord Pleanála" are now replaced by An Coimisiún Pleanála (the Commission).

- Mandatory Timelines: Under the 2024 Act, the Commission is subject to mandatory decision-making timelines (e.g., 48 weeks for Chapter 4 developments such as Strategic Infrastructure). Robust bat data is critical to avoid "Clock-Stops" or Requests for Further Information (RFIs) that can delay projects beyond these statutory windows.

- Design Flexibility: The 2024 Act allows for greater "Design Flexibility" regarding turbine parameters. This guidance supports this by encouraging the use of the "Source-Pathway-Receptor" model (Section 2), which allows for an assessment of a "Turbine Envelope" rather than a single fixed model.

- Continued requirement for AA and EIA to follow established best scientific practice.

- Strong emphasis on Source–Pathway–Receptor (SPR) analysis in line with OPR Practice Note PN01 (OPR, 2021).

1.5 Professional Disclaimer (IMPORTANT)

NOTICE: This document has not been formally sanctioned, adopted, or published by the National Parks and Wildlife Service (NPWS), the Department of Housing, Local Government and Heritage, or any statutory planning authority.

Until such time as this guidance receives formal endorsement, it should be treated as a Professional Statement of Best Practice. Authors of Environmental Impact Assessment Reports (EIAR) using this document do so under their own professional judgment. The use of this guidance does not guarantee planning consent and does not supersede direct instructions or site-specific requirements issued by statutory consultees.

1.6 Regional Justification

While this guidance draws upon the survey effort metrics of NatureScot (2021) and NIEA (2022), it transposes them specifically for the Irish environment. The adoption of a “10 consecutive night” minimum for static monitoring is not an arbitrary import; it is a response to the “Standard of Evidence” now required by the Irish Planning Authorities to satisfy the Strict Protection requirements of the Habitats Directive.

In Ireland, where the Leisler’s bat *(Nyctalus leisleri)* is a common and widespread high-flying species (unlike in much of the UK), a “robust baseline” must account for the high inter-night variability of Irish weather. A 10-night window ensures that even in a typical “wet” Irish week, a sufficient sample of “optimal” foraging weather is captured to allow for a defensible impact assessment.

1.7 Use of Language and Professional Judgement

This guidance is intended to establish a high national standard for bat surveys at wind energy sites. The term “should” is used throughout to denote best practice.

While this guidance allows for professional judgement and the adaptation of methods to suit site-specific conditions, any deviation from the recommended minimum effort (e.g., timing, duration, or equipment) must be explicitly identified and technically justified in the “Limitations” or “Methodology” section of the baseline survey report and/or EIAR.

Failure to provide a robust scientific justification for such deviations may lead to the survey being deemed “Inadequate” by the Consenting Authority under the Precautionary Principle.

2. Pre-survey & Site Risk Categorisation

2. PRE-SURVEY & SITE RISK CATEGORISATION

2.1 The Principle of Proportionality

In accordance with the *EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022)*, the level of survey effort must be proportionate to the scale of the development and the sensitivity of the receiving environment. This section provides a framework to categorise sites into Low, Medium, or High Risk prior to the commencement of field surveys.

2.2 Desktop Study Requirements

A desktop study is a mandatory prerequisite to characterise the site and inform the deployment of field equipment. In alignment with NatureScot (2021) and NIEA (2022), the study area for onshore wind developments is defined as follows:

- **Primary Study Area (10km):** A search for all bat records, known roosts (maternity and hibernation) and protected sites designated for bats must be conducted within a 10km radius of the proposed site boundary.
- **Cumulative Impact Assessment (CIA) Zone:** While the desktop study identifies historical records within 10km, the Cumulative Impact Assessment must extend to a 15km radius. This is scientificall justified by documented Irish foraging ranges for Leisler's bats of up to 13.4km. Under the 2024 Act, failing to assess projects within this 15km Zone of Influence (ZoI) creates a 'Data Deficit' vulnerable to Judicial Review.
- **Data Sources:** As a minimum, this must include the National Biodiversity Data Centre (NBDC) archives, Bat Conservation Ireland roost records, NPWS datasets, and local authority planning portals.

2.3 Site Risk Matrix

The following matrix shall be used to determine the "Category of Effort" required.

Feature	Low Risk	Medium Risk	High Risk
Habitat	Intensive arable; limited connectivity; no water.	Improved pasture; some hedgerows; fragmented woodland.	Ancient woodland; riparian corridors; complex karst/caves.
Annex II Proximity*	>15km from Lesser Horseshoe SAC.	5km – 15km from Lesser Horseshoe SAC.	<5km from SAC or within known Core Sustenance Zone.
Species Records	(*Pipistrellus*). species.	Leisler's activity present locally.	High Leisler's or Nathusius' Pipistrelle *(Pipistrellus nathusii)* activity/migration.
Turbine Scale	<50m tip height.	50m – 150m tip height.	>150m tip height or Repowering.

* For lesser horseshoe, the driver of High risk is AA sensitivity and indirect effects (disturbance, lighting, connectivity) rather than rotor collision risk, given typical low flight heights. Proximity to SACs or functionally linked habitats warrants elevated planning/AA risk (NPWS, 2022; EUROBATS, 2015).

2.3.1 Minimum Survey Effort by Risk Category

Use the following minimum effort standards; apply greater effort where site-specific factors warrant it.

Risk	Ground-level static detectors	At-height monitoring	Manual surveys
Low	≥ 6 locations representative of layout and habitats; 10 consecutive nights in Summer & Autumn	Recommended if met-mast available	≥1 transect/season; PRA/roost checks as indicated
Medium	At every turbine (≤10) or 10 + one third of additional turbines (>10); 10 consecutive nights across Spring, Summer & Autumn	Required under this guidance if met-mast present; place ≥1 microphone within projected rotor-swept zone	≥2 transects/season; VP surveys recommended; NVA emergence/re-entry for potential PRF-M roost ≤200m
High	As Medium plus Autumn extension to 15 consecutive nights in Autumn for Nyctalus and related high-flying genera	Required under this guidance; consider multiple heights; deduplicate overlapping calls	VP surveys required under this guidance; NVA emergence/re-entry for potential PRF-M roosts ≤200m

2.4 Defining the "Zone of Influence" (ZoI)

The Zone of Influence (ZoI) is not a fixed radius. In accordance with OPR Practice Note PN01 (2021) and the Planning and Development Act 2024, the ZoI must be determined on a site-specific basis using the Source-Pathway-Receptor (SPR) model.

While the OPR advises against "arbitrary" distances, the 2024 Act's requirement for "Scientific Certainty" necessitates defined search areas based on the known ecological characteristics of Irish bat species. The ZoI for this guidance is tiered as follows:

2.4.1 Direct Impact Zone (The Micro-ZoI)

- **Definition:** The rotor-swept area plus a 50m buffer from the blade tip to the nearest habitat feature.

- **Standard:** This is the primary zone for direct mortality assessment. Distances must be calculated using the formula presented in Section 6.1 to ensure physical separation from commuting/foraging features.

2.4.2 Indirect Impact Zone (Ecological Connectivity)

- **Definition:** The area within which displacement or habitat fragmentation may occur.

- **Desk Study Standard:** A mandatory 10km radius search of the BCI and NBDC databases is required to identify "Pathways" (e.g., river corridors, hedgerow networks) and "Receptors" (e.g., maternity roosts) linked to the site.

- **High-Risk Species:** For Leisler's bat (N. leisleri), this zone extends to reflect their Core Sustenance Zones (CSZ). Where high-quality habitat or significant roosts are linked to the site, the assessment of indirect impacts must be scientifically robust to meet the "Reasoned Conclusion" requirement of the 2024 Act.

- For lesser horseshoe, treat lighting and corridor severance as critical indirect risks.

2.4.3 Cumulative Impact Assessment (CIA) Zone

- **Definition:** The 15km radius mandated for assessing the additive mortality risk of multiple developments.

- **Justification:** While the OPR discourages *arbitrary* distances, the 15km CIA radius for Leisler's bats is scientifically justified based on documented Irish foraging ranges of up to 13.4km (Shiel et al., 1999).

- **Legal Standing:** Under the 2024 Act, failing to assess cumulative impacts within the known foraging range of a high-risk species creates a "Data Deficit" that exposes the project to Judicial Review.

2.4.4 Statutory Screening (Appropriate Assessment)

- **Standard:** Screening for AA must identify any European Sites (SACs) where a functional link exists.

- **Distance:** The "15km catch-all" is a preliminary tool; however, the final ZoI for AA must be defined by the mobility of the Qualifying Interest (QI). For example, specific woodland flight-paths for Lesser Horseshoe bats must be tracked regardless of whether they fall inside or outside a standard radius.

Summary Table: ZoI Levels for EIAR Submission

Impact Type	Distance / Rule	Legal/Scientific Basis
Direct (Collision)	Blade Tip + 50m	NatureScot (2021) / Physical Buffer
Indirect (Desk Study)	10km Radius	BCI/NBDC Database Standard
Cumulative (CIA)	15km Radius	Leisler's Foraging Range (Shiel et al., 1999)
Statutory (AA)	Pathway-Dependent	2024 Act "Scientific Certainty"

2.5 Preliminary Roost Assessment (PRA) & Irish Seasonality

2.5.1 The Irish Survey Window

While UK-based guidance often suggests a broad summer window, the Irish climate and the specific phenology of Irish species (notably the earlier maternity clusters of lesser horseshoe and the late-summer peaks of Leisler bat) require a more focused approach.

Roost Type	Core Irish Survey Window	Rationale for ROI Adaptation
Maternity Roosts	May 15th – July 31st	To capture peak occupancy before post - lactation dispersal.
Mating/Swarming	August 15th – Sept 30th	Critical for Leisler's bats, the highest risk period for Irish wind farms (unpublished Illien report).
Hibernacula	December 1st – Feb 28th	To be conducted during sustained cold spells (<5°C).

2.5.2 Transition Periods and Irish Weather

Unlike the milder UK south coast, Irish "Shoulder Months" (April and October) are highly volatile.

- **The "April Constraint":** Emergence surveys conducted in April for wind farm EIARs are generally not acceptable as a stand-alone baseline for maternity roosts, as occupancy in Irish stone buildings and trees is often delayed by late frosts.

- **The "October Extension":** Conversely, in the South and West of Ireland, mild Octobers can see significant Leisler's activity. However, for roost *identification*, October surveys are considered "Supplementary" only.

2.5.3 Deployment of Night Vision Aids (NVA)

The use of NVAs (Infrared or Thermal Imaging) is mandatory for all roost emergence surveys at potential wind farm sites.

- **Rationale:** Manual "clicker" counts are no longer sufficient to satisfy the "Scientific Certainty" required for Appropriate Assessment in Ireland.

- **Standard:** A minimum of two surveyors (or one surveyor and two NVA cameras) must be used for any structure with multiple egress points.

3. Survey Methodology

3. SURVEY METHODOLOGY

3.1 Seasonal Windows and Temporal Effort

To capture the full range of bat activity, including maternity periods and migratory peaks, surveys must be conducted across three distinct seasonal windows.

Season	Operational Window	Minimum Static Effort
Spring	April – May	10 consecutive nights per location.
Summer	June – mid - August	10 consecutive nights per location.
Autumn	mid -August – October	10 consecutive nights per location for Low and Medium risk sites; 15 consecutive nights per location for High risk sites.

- **The Autumn Peak:** In the Irish context, the period from **mid-August to the end of September** is critical. This coincides with the peak activity of the Leisler's bat (Nyctalus leisleri), Ireland's highest-risk species.

- **Contiguity:** Surveys should aim for 10 consecutive nights. If equipment failure occurs, the deployment must be extended to ensure 10 nights of valid data are captured within the same seasonal window.

3.1.1 The "Irish Weather" Adjustment

Consultants are reminded that under NPWS IWM 134, surveys must reflect the actual activity of bats on-site. Given the volatility of the Irish climate, if a 10-night deployment yields fewer than 7 nights of weather meeting the "Optimal" criteria (Section 3.5), the deployment must be extended. A baseline that relies on sub-optimal weather data may lead to a Request for Further Information (RFI) or an assumption of "High Risk" by the consenting authority under the Precautionary Principle.

3.2 Static Detector Deployment (Ground Level)

The objective of ground-level statics is to quantify the "Baseline Activity" across the site's habitat features.

- **Detector Type:** Only Full-Spectrum ultrasonic detectors are permitted (Zero-Crossing is no longer sufficient for EIAR-level analysis).

- **Microphone Mounting:** Microphones should be mounted on a pole or tripod at 2m above ground level and angled slightly downward to prevent water ingress. They should be placed at least 2m away from any flat surfaces (e.g., turbine towers, met-masts) to avoid acoustic reflections (echoes) that distort call parameters.

- **Location Criteria:** Detectors should be placed at:

    - **Proposed Turbine Locations:** To assess the specific risk at each hub.

    - For sites with <10 proposed turbines: One detector at every turbine location or representative habitat (low risk site only).

- For sites with >10 turbines: Detectors at 10 locations plus 1/3 of additional turbine sites (e.g., a 22-turbine site requires 14 detectors).

- **Connectivity Features:** At least 1-2 detectors on hedgerows, treelines, or watercourses within the rotor-swept zone to provide connectivity context.

- **Placement Flexibility:** While it is recognised that turbine design and layout may change during the planning process, detectors should be positioned, if not at the exact turbine locations, within an appropriate radius of the design-stage turbine position (professional judgement must be applied) and across a representative range of habitats within the developable area. This ensures that survey data reflects the ecological variability of the site and remains robust even if turbine coordinates are adjusted later. This approach is consistent with NatureScot (2021) guidance and is considered best practice for Irish wind farm assessments. Failure to adopt this principle may result in gaps in baseline coverage and constitute subsequent RFIs during planning review.

• **Recording Window:** Standardised from 30 minutes before sunset to 30 minutes after sunrise.

• **Key-Hole Forestry:** If turbines are located in forestry clearings, detectors must be placed both within the clearing and at the "edge" habitat to assess the impact of the newly created flight corridors.

3.3 Automated Monitoring at Height (Met-Masts & Nacelles)

Monitoring at height is required under this guidance for all sites where a meteorological (met) mast is present for characterising the risk to higher flying bats (Leisler's and Nathusius' pipistrelles).

• **Microphone Placement:** At least one microphone must be positioned within the projected rotor-swept zone (typically >50m above ground).

• **Acoustic Overlap Prevention:** As per Section 3.3.1, vertical separation between ground and at-height microphones must be sufficient to prevent double-counting of high-intensity calls.

• **Operational Validation:** For post-construction surveys, microphones must be mounted on the turbine nacelle, ensuring they are positioned away from the rear cooling fans or generator housing to minimize ultrasonic noise interference.

3.3.1 Vertical Monitoring and Acoustic Overlap

When monitoring at a single location (e.g., a meteorological mast) using multiple detectors at varying heights, the following protocol must be observed to maintain data integrity:

• **Microphone Separation:** To minimise the risk of a single bat call being registered by both units ("Double Counting"), a minimum vertical distance of 30 meters should ideally be maintained between the ground-level microphone and the lowest at-height microphone.

• **Sensitivity Calibration:** All detectors used at a single mast must be calibrated to the same sensitivity settings. High-sensitivity settings on ground units can significantly increase the vertical "detection cone," leading to overlap with nacelle-height units.

- **Data Deduplication:** If the vertical separation is less than 30m, or if species with high-intensity calls (e.g., Leisler's bat)) are recorded simultaneously on both units (within a <1 second timestamp window), the ecologist must apply a deduplication filter.

    - **Rule:** In cases of simultaneous detection, the pass should be attributed to the detector with the highest Signal-to-Noise Ratio (SNR) or the clearest call parameters, and removed from the secondary dataset to avoid overestimating the "Total Bat Passes" for the site.

- **Detection Range Consideration:** Analysts must account for the fact that species like Leisler's bats have a detection range of up to 40m with modern full-spectrum microphones, whereas *Myotis* species may only be detected within 10m. The risk of overlap is therefore species-specific and must be discussed in the "Limitations" section of the report.

3.4 Standardised Acoustic Parameters (Full-Spectrum)

All static detectors used for EIAR-level baseline surveys should be configured according to the following harmonized settings. These are optimised for the Irish species assemblage, with particular focus on the high-intensity calls of Leisler's bat and the low-intensity calls of lesser horseshoe.

Recommended Recording Settings

Parameter	Recommended Setting	Rationale for ROI Context
Sample Rate	384 kHz (Minimum 256 kHz)	High-frequency sampling is required to accurately capture *Pipistrellus* and *Myotis* harmonics.
Gain / Sensitivity	12 dB to 18 dB (Auto-adjust)	Balanced to detect quiet *Myotis* without distorting high-intensity Leisler's calls.
Min. Trigger Freq.	16 kHz	Set to exclude common Irish insect noise (crickets) while capturing low-frequency Leisler's "social" calls.
Max. Trigger Freq.	160 kHz	Covers the full range of all 9 Irish resident species.
Trigger Window	3.0 Seconds	Standardizes the "Bat Pass" duration for consistent Ecobat/Statistical analysis.
Max. File Length	15 Seconds	Prevents "infinite files" during high-activity periods (e.g., swarming).
Bit Depth	16-bit (WAV)	Standard high-resolution format for manual verification and AI classifiers.

3.4.1 Microphone Health & Validation

Under the 2024 Act's "Scientific Certainty" requirement, data from a degraded microphone is considered "Data Deficient."

• **Calibrator Checks:** Microphones should be tested with an ultrasonic calibrator (e.g., a 40kHz tone generator) regularly (at least before the start of each survey season).

3.5 Environmental & Weather Constraints

Data is only valid if collected during periods of "Optimal Bat Activity." Surveys must be paused or data excluded if the following thresholds are not met for at least 7 out of the 10 nights:

• **Temperature:** Minimum dusk temperature of > 10°C.

• **Wind Speed:** Maximum wind speed at ground level of < 5m/s (Beaufort Scale 3 or less).

• **Precipitation:** No persistent or heavy rain.

• **Acoustic interference:** Detectors must be placed away from high-frequency noise sources (e.g., running water or vibrating metal) to avoid "masking."

3.6 Manual Surveys (Emergence, Transects & Vantage Points)

Manual surveys provide the "qualitative" data (e.g., direction of flight, social behaviour) that static detectors cannot capture.

• **Emergence and Re-entry Surveys:** Required under this guidance for potential roosts within 200m of a turbine. Surveys should commence 15 minutes before sunset and continue for at least 90 minutes after sunset. Dependent on survey effort prescribed by BCT 4th Ed (2023) or updated with regards to roost suitability rating from PRA surveys (section 2.5).

• **Dusk/Dawn Transects:** At least one visit per season to identify flight paths and foraging "hotspots." Dependent on survey effort prescribed by BCT 4th Ed (2023) or updated with regards to roost suitability rating from PRA surveys (section 2.5).

• **Vantage Point (VP) Surveys:** Recommended at least one visit per season for high-risk sites to observe high-altitude flight behaviour, specifically for Nyctalus species. Dependent on survey effort prescribed by BCT 4th Ed (2023) or updated with regards to roost suitability rating from PRA surveys (section 2.5).

3.6.1 Emergence and Re-entry Surveys (NVAs)

Where potential roosts are identified within 200m of a turbine, emergence surveys should follow these parameters:

• **Equipment**: Surveys must utilise Night Vision Aids (NVA) such as Infrared or Thermal cameras.

• **Benefit of ROI Adaptation:** Because Irish maternity roosts (particularly of the Lesser Horseshoe bat) often have "cluttered" or inconspicuous exit points, the use of NVAs is considered the most reliable method to ensure "Scientific Certainty" for Stage 2 Appropriate Assessment.

- **Timing:** Surveys should commence 15 minutes before sunset and continue for at least 90 minutes after sunset.

3.6.2 Vantage Point (VP) Surveys for Leisler's

To observe the high-altitude behaviour of Leisler's bat, stationary VP surveys should be employed:

- **Location:** VPs should be situated on elevated ground with an unobstructed view of the proposed turbine airspace.
- **Duration:** Each VP session should last at least 2 hours, covering the peak emergence period.
- **Adapting to Future Best Practice:** Practitioners should monitor updates from the BCT Night Vision Working Group. If new technical standards for NVA distance or resolution are published, these should be integrated into the Irish VP methodology where they enhance detection accuracy.

3.6.3 Tree Surveys

Tree surveys should be undertaken to identify trees with bat roosting potential within 200m of proposed turbines and associated infrastructure, including access tracks, crane hardstandings, substations, grid connection routes, and turbine delivery routes. The application of a 200 m survey area reflects current survey effort expectations applied by NatureScot and NIEA for onshore wind energy developments and provides a consistent and precautionary basis for impact assessment, mitigation design, and licensing consideration.

All trees within this 200m survey area should be subject to a preliminary roost potential assessment, undertaken in accordance with current best practice guidance (BCT 4th Ed (2023) at the time of publication). Survey effort should be proportionate and informed by tree species, age, condition, and the presence of Potential Roost Features (PRFs).

Woodland blocks and treelines differ in their ecological function for bats, with woodland generally providing greater structural complexity and higher potential for roosting and foraging, while treelines and other linear features primarily function as commuting routes and may support roosts in individual mature trees. However, both woodland trees and treeline trees can support bat roosts and therefore present a potential licensing risk where trees are lost or disturbed. For this reason, no distinction is made in defining the tree survey area, and all trees within 200 m are included in the initial assessment.

Where trees within the survey area are identified as having moderate or high roost potential, and where they may be directly affected by the proposed works or indirectly affected through disturbance, further survey effort may be required. This may include dusk emergence and/or dawn re-entry surveys, or at height endoscope inspections. The same 200m distance should be applied when defining the survey area for such activity surveys, ensuring consistency between roost identification and follow-up survey effort.

In woodland and treeline environments, trees may contain multiple PRFs and may be used intermittently by tree-roosting bat species, many of which exhibit frequent roost switching and utilise networks of trees rather than individual roost sites. In such circumstances, even where recommended levels of emergence and re-entry survey effort are applied, it may not be possible to confidently confirm the absence of roost use at individual trees. Increasing survey effort beyond standard best practice may therefore result in diminishing returns and may not materially reduce uncertainty. Where multiple trees within a woodland or treeline are identified as having moderate or high roost potential, and where the proposed works could affect these features, it may be more proportionate to consider the woodland or treeline as a roosting resource rather than attempting to identify individual roost trees through repeated emergence surveys. In such cases, impact assessment and mitigation should proceed on a reasonable worst-case basis, with measures designed to avoid or minimise impacts at the scale of the woodland or treeline.

Access tracks, grid connection routes, and turbine delivery routes are typically associated with narrower footprints and lower levels of disturbance than turbines or hardstandings. However, these elements often involve direct tree loss and may be subject to design refinement. A consistent 200m survey area is therefore retained for screening purposes, with proportionality applied to the level of follow-up survey effort rather than by reducing the survey extent.

Commercial conifer plantations, particularly those subject to regular felling cycles or recently clear-felled, generally offer lower roosting potential than native or semi-natural woodland. Nevertheless, retained mature trees, woodland edges, and individual standards within such plantations may still provide roosting opportunities and should be assessed where they fall within the defined survey area.

3.7 Fatality Monitoring (Carcass Searches)

This is the only survey that measures “Actual Impact.” Refer to Section 7 For more details.

- **Search Radius:** 0.5 times Tip Height (e.g., 80m radius for a 160m tip).

- **Canine Efficiency:** If using search dogs, the dog/handler team must undergo a Site-Specific Efficiency Trial (SEEF) at the start of each year.

- **Vegetation Management:** For human-led searches, vegetation within the search radius should ideally be kept at <10 cm during the peak August/September window to maintain searcher efficiency. If this is not possible, a “Vegetation Penalty” must be applied to the mortality estimate.

3.8 Data Loss and “Scientific Doubt” Management

The Planning and Development Act 2024 and the 2011 Habitats Regulations require that a project be proven “beyond reasonable scientific doubt” to have no adverse effect. Data gaps created by equipment failure or theft must be managed via the Precautionary Principle.

3.8.1 The “70% Validity” Threshold

For a 10-night seasonal deployment to be considered “Representative,” a minimum of 7 valid recording nights (70%) should be achieved per detector location.

- **If Data Loss is <30%:** The remaining data may be used, but must be statistically weighted to account for the missing nights.

- **If Data Loss is >30%:** The deployment is deemed “Inconclusive.” The ecologist should redeploy the unit. If the seasonal window has passed (e.g., it is now November), the ecologist must assume a “High Risk” activity level for that specific turbine location in the EIAR.

3.9 Lifespan of surveys

For the purposes of wind farm assessment and longer-term monitoring, bat survey data should be relied upon only within a clearly defined period of validity. In line with CIEEM guidance on data currency and sufficiency, baseline bat activity data must remain representative of current site conditions, with continued reliance on earlier datasets requiring explicit review and justification.

Baseline survey data are generally considered valid for the survey season in which they are collected and for the subsequent survey season, provided that their continued relevance is reviewed and, where necessary, tested through targeted or supplementary survey effort. Such follow-up surveys may be used to confirm that baseline assumptions remain appropriate, but do not in themselves extend the lifespan of baseline data indefinitely.

Where project assessment, planning or pre-construction activities extend into a third survey season following the baseline year, updated surveys should normally be undertaken to refresh the baseline, unless robust, site-specific evidence demonstrates that the existing data have been adequately validated and remain fully representative. In all cases, reliance on baseline survey data beyond two full survey seasons should be clearly justified and is not expected to extend beyond this period without a full refresh.

3.10 Future Best Practice

To ensure this guidance remains the “Gold Standard” in the Republic of Ireland, the following rule governs technical updates:

3.10.1 Dynamic Adoption of 3rd Party Standards

While this document establishes the “Minimum ROI Baseline,” practitioners are encouraged to utilise the most recent updates from NPWS, Bat Conservation Ireland (BCI), NatureScot, The Bat Conservation Trust (BCT), and NIEA.

- **Automatic Update:** Should any of the aforementioned bodies publish updated equipment specifications or analysis algorithms (e.g., a new version of statistical analysis or Guidelines), those updates are deemed automatically adopted by this guidance, provided they do not reduce the minimum seasonal effort (10 nights) or the ROI-specific species risk thresholds.

- **Conflict of Guidance:** In the event of a conflict between this document and an updated 3rd party standard, the practitioner should apply the **most restrictive** (most precautionary) standard and provide a brief justification in the EIAR “Methods” section.

4. Quantitative Analysis of Bat Activity

4 QUANTITATIVE ANALYSIS OF BAT ACTIVITY

Quantitative analysis of bat activity data is required to inform impact assessment and mitigation design for onshore wind energy developments. Simple metrics such as raw bat pass counts, when considered in isolation, do not provide sufficient context to determine the relative importance of recorded activity or the potential significance of impacts. This guidance therefore requires the use of comparative analytical approaches that place site-level activity within a broader ecological and geographic context.

Quantitative analysis should be proportionate to the scale of the proposed development, the likely impact pathways, and the quality and quantity of data collected. The objective is to support robust and transparent decision-making, rather than to achieve exhaustive characterisation or eliminate uncertainty where this is not realistically achievable.

4.1 Sonogram Analysis

Sonogram analysis should be undertaken to characterise bat activity recorded during acoustic surveys and to inform species grouping, activity patterns, and potential risk to bats from the proposed development. Analysis should be sufficient to support robust impact assessment and mitigation design, while remaining proportionate to the scale of the development and the likely impact pathways.

Recorded bat calls should be processed using appropriate analysis software, with automated classification supported by manual verification where required. Manual inspection should focus on calls that are:

- ambiguous or of higher potential risk relevance;
- associated with species or species groups considered more vulnerable to wind energy developments; or
- necessary to confirm broad species group classification.

It is recognised that the quality of recorded calls, environmental conditions, and overlap in call characteristics between species can limit the reliability of species-level identification. In many cases, particularly for Myotis species and some Pipistrellus calls, confident identification to species level may not be achievable. In such circumstances, calls should be assigned to appropriate species groups, and assessment should proceed on that basis.

The objective of sonogram analysis is not to demonstrate definitive presence or absence of individual species at specific locations, but to provide a robust understanding of bat activity levels, species composition at a functional level, and temporal patterns of activity relevant to impact assessment. Where uncertainty remains following proportionate analysis, impacts should be assessed using reasonable worst-case assumptions rather than escalating analysis effort beyond what is likely to meaningfully reduce uncertainty.

The level of sonogram analysis undertaken should be clearly documented and justified within assessment reporting, with reference to how the results have informed survey conclusions, impact assessment, and mitigation design.

4.2 Quantitative Analysis: Activity Benchmarking Framework

Raw bat pass counts are not a reliable indicator of impact significance unless interpreted relative to activity levels recorded in comparable habitats and regions. This guidance therefore requires the use of quantitative benchmarking approaches that contextualise site activity against suitable reference datasets.

The preferred analytical approach is percentile-based activity benchmarking, whereby site-level bat activity is compared against a defined reference dataset to derive a relative measure of activity (e.g. low, moderate, or high). This approach reduces subjectivity, enables consistency between projects, and aligns with current best practice adopted by statutory nature conservation bodies, including NatureScot and NIEA.

Tools such as Ecobat represent one established implementation of percentile-based analysis and are widely used due to their standardised outputs and access to multi-source datasets. However, this guidance does not mandate the use of any single proprietary platform. Alternative analytical frameworks may be used, provided they meet the soundness and equivalence criteria set out in Section 4.1.1 and are capable of delivering an equivalent level of analytical rigour, transparency, and comparability.

Percentile-based outputs should be interpreted with reference to the quality and representativeness of the underlying reference dataset. Where regional or habitat-specific datasets are limited, percentile classifications should not be relied upon in isolation and must be supported by additional contextual information, such as temporal patterns of activity, turbine-level comparisons, and absolute activity metrics.

For consistency in reporting, the following percentile ranges are typically used where percentile-based benchmarking is applied:

- High Activity: 81st – 100th percentile.

- Moderate Activity: 41st – 80th percentile.

- Low Activity: 0 – 40th percentile.

4.2.1 Alternative Quantitative Analysis Models (Equivalence Criteria)

Where percentile-based analysis is undertaken using an alternative tool or bespoke analytical framework, the approach must demonstrate functional equivalence to established benchmarking methods. At a minimum, alternative models should:

- compare site activity against a defined and relevant reference dataset;
- allow transparent interpretation of relative activity levels;
- be reproducible and clearly documented;
- enable comparison between turbines, survey periods, and projects; and
- be appropriate to the species groups and habitats under consideration.

The choice of analytical method, underlying datasets, and any assumptions made must be clearly documented and justified within assessment reporting. Where uncertainty remains following proportionate analysis, impacts should be assessed using reasonable worst-case assumptions rather than through escalation of analytical complexity that is unlikely to materially reduce uncertainty. Species

4.3 Risk Localisation (The Irish Context)

As established in the Pre-Survey Logic (Section 2), the "Risk" of a site is a product of the Species Sensitivity and the Activity Level. In the Republic of Ireland, the following risk groups are defined: This table acts as the "Standard of Significance" for the ROI. It ensures that regardless of which *model* is used to calculate activity, the *interpretation* of that activity remains consistent across all Irish wind farms.

Species Group	Collision Risk	Population Vulnerability (PV)	Significance Filter
Leisler's Bat	**High**	High (Ireland is a global stronghold)	Impacts likely significant even at moderate activity.
Nathusius' Pipistrelle	**High**	High (Rare/Migratory in IRL)	High risk of population-level impact.
Pipistrelle spp.	**High**	Low (Widespread/Resilient)	High risk of attraction (4.3.1).
Lesser Horseshoe	**Very Low**	Critical (Annex II / Restricted range)	Any risk triggers require under this guidance a NIS / Stage 2 AA.
Myotis spp.	**Low**	Medium (Habitat specific)	Indirect impacts (displacement) are the primary focus.

4.3.1 Precautionary crosscheck

Where percentile-based benchmarking and bat passes per hour (PPH) metrics indicate differing activity levels, interpretation should be precautionary. This is particularly relevant for Pipistrellus species, for which multiple UK studies have identified increased activity and attraction to wind turbines under warm, low-wind conditions. In such circumstances, assessment should proceed on the basis of reasonable worst-case assumptions rather than attempting to reconcile divergence through disproportionate analytical refinement.

4.4 Collision Risk Matrix

The Collision Risk Matrix is the fundamental tool for determining the potential impact of a wind farm on bat populations. It provides a transparent, objective framework for cross-referencing the Activity Level (quantified via Ecobat or similar models) against the Species Risk Group (the sensitivity of a species based on its flight behaviour and conservation status in Ireland).

Collision risk interpretation is not undertaken in isolation from earlier stages of the assessment. The characterisation of habitat suitability, landscape connectivity, species sensitivity and project scale, as set out in Sections 2 and 3, provides the contextual framework within which collision risk metrics are interpreted. Activity levels at turbine height are therefore considered alongside, and not independently of, these contextual risk factors.

4.4.1 Determining Overall Risk Significance

To satisfy the requirements of "Scientific Certainty" under the Planning and Development Act 2024, every species recorded on-site must be assigned an overall risk rating using the matrix below. This ensures that mitigation strategies (such as blade feathering or curtailment) are based on a transparent and repeatable evidence framework, informed by professional judgement.

Table 4.3: National Bat Collision Risk Matrix (Ireland)

Species Risk Group	**Low Activity (0–40th Percentile)**	**Moderate Activity (41st–80th Percentile)**		**High Activity (81st–100th Percentile)**
Low Risk *(e.g. Myotis spp.)*	Low	Low		Medium
Medium Risk *(e.g. Pipistrellus spp.)*	Low	Medium	High where site/project/cumulative risk is Medium/High or where attraction/fatality evidence exists	High
High Risk *(e.g. Leisler's Bat)*	Medium	High		High

Where larger developments or developments located within high-value or highly connected habitat are proposed, lower levels of recorded turbine-height activity may still represent a meaningful collision risk, particularly for species known to exhibit attraction or repeated flight behaviour within wind farm arrays.

4.4.2 Interpreting the Results

The outcome of the matrix determines the level of mitigation required:

- **Low Risk (Green):** Impacts are considered non-significant. Standard “best practice” mitigation, such as the 50m Blade Buffer, is usually sufficient to maintain the favourable conservation status of the species.

- **Medium Risk (Amber):** Impacts may be significant. Site-specific mitigation is required. This may include precautionary blade feathering during peak activity months (August/September) or operational mitigation, such as such as automated curtailment.

- **High Risk (Red):** Impacts are considered significant. Required under this guidance operational mitigation, such as automated curtailment, is required to reduce the risk of mortality. Under the 2024 Act, failing to provide a robust mitigation strategy for “High Risk” scenarios may lead to a refusal of consent due to a failure to meet “Strict Protection” requirements.

4.4.3 The “Ireland Specific” Significance Filters

While the matrix provides the mathematical result, the following “filters” must be applied to ensure the Irish species context is respected:

1. **The Leisler’s Exception:** Because Ireland is a global stronghold for Leisler’s bats, any result that reaches a “High” level in the matrix for this species triggers a requirement under this guidance for assessment of population-level impacts within the 15km Cumulative Impact Zone.

2. **The Lesser Horseshoe Provision:** Although the Lesser Horseshoe bat has a Very Low collision risk due to its typically low-altitude flight behaviour, recorded activity at or proximate to turbine height requires careful consideration. Where credible activity is identified within or functionally connected to the rotor-swept zone such that significant effects cannot be excluded, a Stage 2 Appropriate Assessment is required, reflecting the species’ critical population vulnerability and Annex II status.

3. **The Pipistrelle Resilience Filter:** For common and soprano pipistrelles (Pipistrellus pipistrellus and Pipistrellus pygmaeus), higher levels of activity are more likely to give rise to significant effects, particularly where activity is recorded at or above the upper percentiles. However, lower or moderate levels of recorded activity do not automatically indicate low collision risk for these species and must be interpreted in the context of site-specific factors, including habitat suitability, landscape connectivity, project scale and evidence of attraction or repeated use of the wind farm area.

   Where moderate activity is recorded, habitat-based measures may contribute to risk management, but the adequacy of such measures should be considered alongside the potential need for operational mitigation where contextual factors indicate an elevated collision risk..

4.4.4 Reporting Requirements

The EIAR must include a summary table showing the matrix outcome for every species recorded at every turbine location. This level of transparency is required to allow the Commission to reach a “Reasoned Conclusion” on the environmental effects of the project. If “Professional Judgement” is used to downgrade a risk level (e.g., from High to Medium), a comprehensive technical justification must be provided.

5. Standard Practice Measures

5. STANDARD PRACTICE MEASURES

The measures set out in this section reflect established design and operational practices commonly incorporated into wind energy developments and are expected to be applied irrespective of predicted impact significance. They form part of baseline good practice in wind energy development and are already routinely embedded through planning conditions, turbine manufacturer defaults and aviation safety requirements. These measures are included to provide transparency and consistency in assessment assumptions and are not relied upon, either individually or in combination, to exclude the potential for significant effects at Appropriate Assessment screening stage.

5.1 Turbine Layout and Micro-siting

Turbine layout and micro-siting should seek to avoid areas of highest bat activity and key habitat features where practicable, including woodland edges, hedgerows, treelines, watercourses and other linear landscape features known to be used by commuting and foraging bats. Micro-siting decisions should take account of site-specific survey findings and be informed by an understanding of local habitat connectivity and species ecology.

5.2 Habitat Retention and Management

Existing bat habitats should be retained where possible, with unnecessary removal or severance of woodland, treelines, hedgerows and other linear features avoided. Where habitat loss is unavoidable, works should be minimised and undertaken in a manner that avoids fragmentation of remaining habitat networks. Habitat management measures implemented as part of the project should avoid creating features that increase bat activity within the wind farm array unless explicitly designed as part of a wider mitigation strategy.

5.3 Lighting Design

Lighting associated with the development should be designed to minimise attraction of insects and bats. This includes the use of lighting only where required for safety or operational reasons, the avoidance of upward-directed or continuous lighting, and the selection of lighting types and spectra that minimise insect attraction. Aviation lighting requirements should be met in a manner that seeks to reduce potential effects on bats where feasible.

5.4 Construction Timing and Working Practices

Construction activities should be programmed, where practicable, to avoid periods of highest bat activity. Vegetation clearance, tree removal and works with the potential to affect bat roosts should be undertaken outside the main bat activity season unless otherwise justified and appropriately licensed. Pre-construction checks should be undertaken where required to confirm the absence of roosts prior to works commencing.

5.5 Operational Monitoring and Adaptive Management Triggers

Post-construction monitoring should be proportionate to the level of risk identified at the assessment stage and sufficient to validate predictions made within the assessment. Monitoring results should be reviewed to determine whether predicted impacts are occurring and to inform the need for any additional mitigation measures. Monitoring undertaken as standard practice does not in itself imply the presence of significant effects but provides a mechanism for early identification of unforeseen impacts.

6. Mitigation & the Mitigation Hierarchy

6. MITIGATION & THE MITIGATION HIERARCHY

Mitigation measures are applied where the assessment identifies a risk of significant adverse effects that cannot be excluded through design and standard practice measures alone. Such measures are proportionate to the level of risk identified and are targeted to specific species, periods, or operational conditions.

6.1 Mitigation by Design: The 50m Buffer

The primary method of reducing collision risk in the Republic of Ireland is the maintenance of a physical separation between turbine blades and the habitats bats use for commuting and foraging.

In accordance with NatureScot (2021) and NIEA (2022), a minimum buffer of 50 meters must be maintained between the tip of the turbine blade and the nearest “Habitat Feature” (e.g., treeline, hedgerow, watercourse, or woodland edge).

6.1.1 Calculating the Buffer Distance

To account for the height of the turbine and the length of the blades, the horizontal distance from the base of the turbine to the habitat feature must be calculated using the following formula:

$$d = \sqrt{(h + bl)^2 - h^2}$$

Where:

- **d** = minimum horizontal distance from the turbine base to the habitat feature (m)
- **h** = hub height (m)
- **bl** = blade length (m) (equivalent to rotor radius)

Note on Irish Landscape Features: In many parts of the West of Ireland, “Habitat Features” are not limited to trees. For the purpose of this guidance, dry stone walls and low scrub in otherwise open landscapes must be treated as features requiring a buffer if they are identified as significant commuting routes in Section 3.

6.2 Operational Mitigation: Curtailment

Where the 50m buffer cannot be achieved, or where “High” activity of high-risk species (Leisler’s, Nathusius’, Soprano and common pipistrelle) is recorded, operational curtailment is required.

6.2.1 “Standard ROI” Curtailment

Curtailment involves increasing the “cut-in” speed of the turbine (the wind speed at which the blades begin to rotate and generate power) during periods of high bat activity.

Parameter	Standard Requirement
Timeframe	30 mins before sunset to 30 mins after sunrise.
Seasonal Window	April 1st to October 31st (inclusive).
Temperature Trigger	Curtailment active only when ambient temp is > 10°C.
Wind Speed Trigger	Cut-in speed increased to 6.0m/s (measured at hub height).
Precipitation	Curtailment can be suspended during periods of heavy, persistent rain.

6.2.2 Blade Feathering

Regardless of whether a site-specific curtailment speed is triggered, all turbines should be programmed to "feather" their blades (pitching the blades parallel to the wind) when idling. This prevents "freewheeling" at low wind speeds, which is a significant cause of non-essential bat mortality.

6.3 Post-Construction Validation (The "Soundness" Loop)

Consenting authorities in Ireland are increasingly requesting proof that mitigation works.
This guidance mandates:

- **Carcass Searches:** Conducted by trained teams (or canine units) during the first 3 years of operation, particularly during the August/September Leisler's peak.

- **Acoustic Validation:** At-height monitoring on the turbines themselves (nacelle-mounted) to compare post-construction activity with pre-construction predictions.

6.4 Smart Curtailment & Adaptive Management

6.4.1 Definition and Objective

Unlike "Blanket Curtailment," which applies fixed wind-speed and temperature triggers across the entire season, Smart Curtailment utilises site-specific data to create a "Risk Envelope." The objective is to target mitigation only when the risk of collision is statistically high, thereby maximising renewable energy yield without increasing bat mortality.

6.4.2 "Day-One" Smart Curtailment Pathway

A project may move directly to a Smart Curtailment schedule upon commissioning if the following Pre-Operational Evidence is provided in the EIAR:

1. **Robust Baseline:** Minimum 2 years of pre-construction data (to NatureScot/NIEA standards or above standards) showing clear, repeatable correlations between bat activity and specific meteorological variables (Wind Speed, Temp, Humidity, and Time after Sunset).

2. **At-Height Verification:** Pre-construction data must include at-height monitoring from a met-mast or similar infrastructure to accurately reflect the wind regime at the rotor-swept zone.

3. **Algorithmic Transparency:** The developer must provide the "Curtailment Algorithm" showing how the Supervisory Control and Data Acquisition (SCADA) system will integrate real-time weather data to pitch blades (feathering) or increase cut-in speeds.

6.4.3 "Three-Year Validation" Pathway (Standard Approach)

Where pre-construction data is insufficient or habitat change (e.g., key-hole felling) is significant, a Transitional Curtailment model must be used:

- **Years 1–3:** Implementation of the standard ROI Curtailment Protocol (as per Section 5.2.1).

- **The Validation Study:** During these 3 years, the site must undergo intensive monitoring, including:

    - **Carcass Searches:** Using trained teams/canines to identify the exact conditions under which fatalities occur.

    - **Nacelle-Mounted Acoustic Monitoring:** Recording activity at the source of the risk.

- **Transition to Smart Curtailment:** At the end of Year 3, the developer may submit a "Mitigation Review Report" to the Planning Authority/NPWS. If the data shows that risk is confined to a narrower set of conditions than the standard ROI protocol, the curtailment schedule may be "thinned" or "optimised" to reflect the actual site-specific risk.

6.4.4 Key Triggers for Smart Curtailment (Ireland-adapted NatureScot Model)

To be considered "smart", curtailment algorithms should utilise a multi-variable trigger system rather than reliance on a single wind-speed threshold. The parameters below reflect established approaches to smart curtailment, adapted to Irish climatic conditions and bat activity patterns.

Variable	Influence on Smart Trigger
Wind Speed	Primary trigger. Curtailment is typically applied at low wind speeds where bat activity is highest, with threshold selection informed by site exposure and turbine specifications rather than a fixed value.
Temperature	Secondary trigger. Bat activity in Ireland generally declines at lower temperatures; however, activity may still occur during mild conditions outside peak periods. Temperature thresholds should therefore be applied cautiously and in combination with other variables.
Time of Night	Risk is commonly elevated during the first two hours post-sunset and the final two hours pre-sunrise, corresponding to emergence and return periods.
Seasonality	Seasonal weighting should reflect species-specific risk periods. In Ireland, this includes late summer and early autumn for Leisler's bat, and extended activity periods for pipistrelle species during warm conditions.

Requirement for SCADA Integration: For smart curtailment to be valid, turbines must be capable of automated response through SCADA systems, with blades feathered (pitched to approximately 90°) when curtailment thresholds are met. Freewheeling blades at sub-cut-in speeds are not considered an acceptable alternative, as evidence indicates that rotating blades under such conditions may continue to pose a collision risk.

6.4.5 Post-Implementation Audit

Any site operating under a Smart Curtailment schedule must undergo a Re-Validation Audit every 5 years, including Static Detector Deployment (Ground Level) (Section 3.2) Automated Monitoring at Height (Met-Masts & Nacelles) (Section 3.3) and Fatality Monitoring (Carcass Searches) (Section 3.7). This ensures that the algorithm remains effective as local bat populations or regional weather patterns shift due to climate change.

6.5. Relationship Between Standard and Smart Curtailment

The Standard ROI Curtailment Protocol represents the minimum operational mitigation requirement for all Medium and High-Risk sites where significant collision risk cannot be excluded. This protocol applies unless and until the developer demonstrates, through a validated Smart Curtailment dataset (as described in Section 6.4), that a narrower set of meteorological or temporal conditions is responsible for elevated bat collision risk. Smart Curtailment may therefore refine or focus mitigation measures but cannot reduce the level of protection below the Standard ROI Curtailment thresholds without a minimum of three years of robust post-construction evidence (or, in rare cases, pre-construction evidence meeting the criteria in Section 6.4.2). In cases of uncertainty, inconsistency, or incomplete data, the Standard ROI Curtailment Protocol must be applied as the precautionary default.

7. Post-Construction Monitoring (PCM)

7. POST-CONSTRUCTION MONITORING (PCM)

7.1 Rationale and Objectives

Post-construction monitoring is required under this guidance for all projects categorised as Medium or High Risk (see Section 2.3). The primary objective is to evaluate the effectiveness of the mitigation strategy and to ensure that the “Favourable Conservation Status” of local bat populations is maintained, as required under Regulation 54 of the 2011 Birds and Natural Habitats Regulations.

PCM consists of two integrated components:

1. **Carcass Searches:** To quantify actual mortality.

2. **Acoustic Monitoring:** To assess changes in activity patterns or displacement.

7.2 Fatality Monitoring (Carcass Searches)

Traditional human-led searches often under-report fatalities in the Irish landscape due to dense vegetation and high scavenger rates (e.g., foxes Vulpes vulpes and Hooded Crows Corvus cornix).

- **Canine Search Teams:** This guidance strongly recommends the use of professionally trained bat-detection dogs. In blinded trials (Mathews et al., 2013), dogs located 73% of carcasses compared to just 20% for humans. On sites with tall vegetation (upland bog/forestry edges), canine teams are the “Standard of Evidence.”

    - Due to the density of Irish upland habitats (e.g., gorse and heather), Canine Search Teams are mandatory for post-construction mortality monitoring at all Medium and High-Risk sites. Human-led searches are only permitted as a secondary option where Searcher Efficiency (SEEF) trials can prove a detection rate of >80%, which is rarely achievable in typical Irish wind farm contexts.

- **Search Radius:** Searches must cover a radius of half the turbine tip height (e.g., for a 150m tip height, a 75m radius must be searched).

- **Frequency:**

    - **Peak Season (mid-Aug to Oct):** Weekly searches are required to capture the Leisler’s migratory/mating peak.

    - **Standard Season (April to mid-Aug):** Fortnightly searches.

- **Searcher Efficiency (SEEF) Trials:** If human searchers are used, mandatory “efficiency trials” using trial carcasses (e.g., brown mice as proxies for bats) must be conducted to calculate a site-specific “Correction Factor.”

7.3 Carcass Persistence (Scavenger) Trials

To account for carcasses removed by scavengers before a search occurs, Persistence Trials must be conducted at each site.

- A minimum of 10 trial carcasses must be placed and monitored (via camera trap or daily checks) to determine the “Mean Persistence Time.” This data is used to adjust the final mortality estimate.

7.4 Post-Construction Acoustic Monitoring

To validate the Smart Curtailment or Standard ROI Curtailment schedules:

- **Nacelle-Mounted Detectors:** At least 1 in 3 turbines must be fitted with an ultrasonic detector on the nacelle (positioned to avoid acoustic interference from the generator).

- **Comparison:** Activity levels recorded at-height during operation must be compared against the pre-construction baseline (Section 3) to identify if bats are being “attracted” to turbines or “displaced” from the area.

7.5 Duration and Reporting

- **Standard Duration:** PCM must be conducted for a minimum of 3 years post-commissioning.

- **The “Stop/Go” Review:** At the end of Year 3, a synthesis report must be submitted to the Planning Authority. If mortality is below the “Significant Threshold” (defined by the ecologist in the EIAR), monitoring may cease. If mortality remains high, the Curtailment Protocol (Section 5.4) must be tightened, and monitoring extended for a further 2 years.

8. Repowering & Hybrid Developments

8. REPOWERING & HYBRID DEVELOPMENTS

8.1 The "Scale-Shift" Principle

Repowering is rarely a "like-for-like" replacement. Modern turbines often reach into higher altitude airspace (150m–200m+ tip heights) compared to decommissioned models (60m–100m).

• **Vertical Risk Shift:** Larger turbines may interact with high-flying species (specifically Nyctalus leisleri) that were previously flying "over" the smaller, older turbines.

• **Methodological Requirement:** Consequently, a "Full Baseline" survey effort (as per Section 3) should be required for all repowering projects. Historical data from the original application (e.g., from 15–20 years ago) should be treated as "Contextual" only and is not a substitute for new, standardised field data.

8.2 Redefining the Zone of Influence (ZoI) for Repowering

For repowering projects, the ZoI should be dynamically recalculated based on the new turbine dimensions using the Source-Pathway-Receptor model (Section 2.4).

• **The "Decommissioning Gap":** The ZoI should include the footprint of the old turbines (during their removal) and the new turbines.

• **Bat "Attraction" Factor:** If post-construction monitoring of the *old* site showed high activity, the ZoI should be scrutinised for "attraction" features (e.g., internal heat or insect concentrations) that must be designed out of the new layout.

8.3 Hybrid Developments (Mixed Repowering and New Structures)

Where a project involves a mix of existing turbine upgrades and the expansion into "Greenfield" areas (new structures), the following rules should apply:

1. **Unified Survey Standard:** The entire site should be surveyed to the highest risk category identified (Section 2.3). You should not apply a lower survey effort to the repowered section and a higher effort to the new section.

2. **Comparative Baseline:** Static detectors should be placed at both the "Old" operational turbine locations (to understand the current operational baseline) and the "New" proposed turbine locations.

3. **Cumulative Risk:** The EIAR should specifically model the "Transition Phase", the period where old turbines are still spinning while new ones are being constructed, as this represents a peak cumulative collision risk.

8.4 Utilising Operational Data for Repowering

The only "shortcut" allowed for repowering is the use of existing monitoring data to refine the Smart Curtailment algorithm:

- **Evidence-Based Design:** If 10+ years of carcass data or nacelle monitoring exists for the old turbines, this should be used to inform the "Risk Envelope" for the new turbines.

- **Proportionality:** If historical data shows zero fatalities over a decade for a specific species, the ecologist may use their Professional Judgment (Section 1.7) to justify a more targeted survey focus, provided the change in turbine scale is mathematically accounted for.

8.4.1 Requirement for Decommissioning-Phase Fatality Data

To utilise historical presence as a basis for reducing survey effort or refining mitigation on a repowered site, a Validation Baseline should be established.

- **Pre-Decommissioning Carcass Searches:** Ideally, at least one full season (April–October) of standardised carcass searches (Section 7) should be conducted on the existing turbines before they are decommissioned.

- **Methodological Standard:** These searches should follow the same rigor as Post-Construction Monitoring (Section 7), including the use of canine teams and persistence trials.

- **The "Evidence Gap" Rule:** If no standardised mortality data exists for the decommissioning site, the ecologist should not assume a "Low Risk" baseline. Instead, the site should be treated as a "Greenfield" site for the purpose of risk categorisation (Section 2.3), as the impact of the larger, repowered turbines remains an unknown variable.

8.5 Integrating the "Old" and "New" Data

Where pre-decommissioning search data is available, it should be used to:

1. **Calibrate the Risk Matrix:** If specific turbines in the old layout were "mortality hotspots," the new layout should be adjusted to increase buffers in those specific zones.

2. **Inform Smart Curtailment:** The weather conditions (wind speed/temp) associated with any found carcasses on the old turbines should form the "starting threshold" for the new turbines' curtailment algorithm.

9. Ancillary Infrastructure & Emerging Technologies

9. ANCILLARY INFRASTRUCTURE & EMERGING TECHNOLOGIES

9.1 Battery Energy Storage Systems (BESS) & Substations

While smaller in footprint, ancillary infrastructure can create localised “Ecological Sinks” or “Barriers.”

- **Ultrasonic Noise Mitigation:** Inverters, transformers, and cooling fans in BESS units must undergo a verified audit for ultrasonic noise emissions (20kHz – 100kHz). If emissions are detected at levels that could interfere with bat echolocation, acoustic housing or baffles should be utilised.

- **The “Dark Corridor” Rule:** To protect light-sensitive species (e.g., *R. hipposideros* and *Myotis* spp.), artificial lighting at substations should be:

    - **Motion-Activated:** Only triggered for essential maintenance or security breaches.

    - **Directional:** Fully shielded (0% upward light ratio) and directed away from boundary habitats.

    - **Lighting Contours:** Lighting must utilise Warm LEDs (<2700K). EIAR submissions must include light-spill contour maps demonstrating that illumination on boundary features is maintained at <0.5 Lux.

- **Buffer Zone:** A minimum 10m buffer of dark, unlit habitat should be maintained between any BESS/Substation fence line and the nearest ecological corridor.

9.2 Alternative At-Height Monitoring (AAHM)

Where a meteorological mast (met-mast) is not present or cannot be consented, at-height data should still be sought to characterise the risk to high-flying species. The following technologies while recognised are new and need to be considered for viability on a project-specific basis:

- **Tethered Drones (UAS) / Balloons (Helikites):** These allow for static detectors to be suspended at hub height. To be comparable to met-mast data, they should be deployed during the same 10-night windows and must be stable enough to avoid “microphone swing” noise.

- **UAVs (Drones):** While currently limited by battery life, drones equipped with ultrasonic recorders are acceptable for qualitative sampling (e.g., 30-minute transects at 100m altitude). They are not yet a substitute for the “10-night consecutive” quantitative baseline but can be used to justify a site’s risk profile.

- **Laser/Lidar-Based Detection:** Emerging remote sensing technologies that detect wing-beat frequencies should be considered on a “Trial Basis.” If used, the data should be cross-referenced with ground-level acoustic data to ensure species identification is accurate.

9.2.1 Planning Status under the 2024 Act

The 2024 Act replaces the old "Section 5" declaration process with a more streamlined but high-stakes Exemption Declaration system.

- **Section 9 Exemptions:** Under the 2024 Act, temporary works for the purpose of environmental monitoring (such as tethered drones/balloons for a 10-night baseline) generally remain Exempted Development, provided they screen out for Appropriate Assessment (AA). If a Stage 1 AA Screening indicates a likely significant effect on a European site, an exemption cannot be claimed, a Natura Impact Statement (NIS) must be prepared, and the survey method must undergo a full planning application process.

- **The "Drone Base" Clause:** Note that while the drone itself is a temporary tool, the Regulation of Drones Bill 2025 and the 2024 Act suggest that any "permanent launch base" or ground-tethering station used for more than 28 days may require permission. Since our survey is only 10 nights, we remain within the "Temporary Use" exemption.

- **Technical Declarations:** If a local objector challenges a tethered drone, the developer should seek an Exemption Declaration. Under the 2024 Act, the Planning Authority must decide this within 4 weeks. This provides the "Scientific Certainty" now required to protect projects from Judicial Review.

9.2.2 Impact on Technical Methodology

Because the 2024 Act emphasises **"Best Scientific Knowledge,"** a tethered drone is no longer just a "handy alternative", it is a legal safeguard.

- **Airspace Hierarchy:** The 2024 Act aligns with the National Policy Framework for Unmanned Aircraft Systems (2025). This means tethered drones at heights >120m (hub height) must be operated by a pilot with a "Specific Category" authorization from the IAA. The guidance must state that any at-height data collected without this authorization may be deemed "Inadmissible" in an EIAR.

- **Data Integrity:** The 2024 Act moves toward fully digital planning services. As such, acoustic data from tethered drones should be time-stamped with GPS coordinates to allow for digital verification by *An Coimisiún Pleanála*.

9.3 Adaptive Technology

To ensure this guidance remains the primary reference point for Irish Wind Energy:

1. **Future Advisory Notes:** This guidance acknowledges that technology (both in turbines and survey tools) moves faster than policy. Bat Conservation Ireland reserves the right to issue Technical Advisory Notes (TANs) to supplement this document.

2. **Innovation Justification:** If a practitioner wishes to use a technology not listed here (e.g., AI-driven real-time identification or satellite-linked sensors), they should include a "Methodological Soundness Statement" in their EIAR explaining how the new technology meets or exceeds the data quality of the current standards.

10. REFERENCES AND TECHNICAL STANDARDS

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Northern Ireland Environment Agency (NIEA) (2022). Guidance on Bat Surveys, Assessment & Mitigation for Onshore Wind Turbine Developments.

NPWS (2022). Bat Mitigation Guidelines for Ireland (v2). Irish Wildlife Manual No. 134.

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

Shiel, C., Shiel, R.E., and Fairley, J.S. (1999). “Foraging habits of Leisler’s bat Nyctalus leisleri in the north-west of Ireland, as revealed by radio-tracking.” Journal of Zoology, 248(2), pp. 227-232.

Appendix

APPENDIX

1.Survey Effort & Seasonality

Note: Any “Justified Deviation” (JD) must include a robust technical explanation to avoid planning delays under mandatory timelines.

Technical Requirement	Minimum Standard	Status (C / JD / N/A)	EIAR Section Ref.	Summary of Technical Justification (Required for JD)
10-Night Static Rule	Minimum 10 consecutive nights per season (Spring, Summer, Autumn)			
Peak Leisler’s Window	Surveys must include the mid-Aug to end-Sept window			
Weather Compliance	>10°C, winds <5m/s for >70 of recording nights			
At-Height Monitoring	Data captured within rotor-swept zone via met-mast or Tethered UAS			
NVA Implementation	Night Vision/Thermal used for all roost emergence within 200m of turbine location			

2. Analysis & Impact Assessment

Technical Requirement	Minimum Standard	Status (C / JD / N/A)	EIAR Section Ref.	Summary of Technical Justification (Required for JD)
16 kHz Trigger Rule	Minimum trigger frequency set to 16 kHz to capture Leisler's social calls.			
Acoustic Deduplication	Simultaneous ground/height passes filtered via SNR or timestamp.			
Model Transparency	Ecobat or equivalent benchmarking used with Irish reference data.			
Cumulative Search	15km radius search for all wind and grid projects (Leisler's CSZ).			
Desk Study Radius	10km radius search of BCI and NBDC databases.			

3. Mitigation & Monitoring

Technical Requirement	Minimum Standard	Status (C / JD / N/A)	EIAR Section Ref.	Summary of Technical Justification (Required for JD)
50m Blade Buffer	NatureScot formula applied to all features (including stone walls/scrub)			
Blade Feathering	Programmed for all turbines below cut-in speed			
Canine PCM	**Mandatory** use of search dogs for all Medium/High-risk sites			
BESS Infrastructure	<0.5 Lux spill and documented 20kHz – 100kHz noise audit			

4. Example Professional Declaration of Soundness[1]

Project Name: ______________________________

Lead Ecologist: ______________________ **CIEEM No (If applicable):** __________

”I hereby certify that the bat assessments for this project have been prepared with reference to the National Technical Guidance for Bat Survey & Mitigation (2026). I confirm that where ‘Professional Judgment’ has been used to deviate from the recommended standards, a scientific justification has been provided to meet the requirements of the Planning and Development Act 2024. In my professional opinion, the data provided is sufficient to allow An Coimisiún Pleanála to reach a reasoned conclusion on the significant effects of the project.

Signed: ______________________________ **Date:** __________

(1) This declaration will need project specific legal review before inclusion with a planning application.

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