Appendix 3: Species Specific Guidance for Onshore Wind Energy Facilities – Bat Species of Concern

This guidance provides supplementary information on how to assess and manage impacts from wind energy facilities on bat species listed on the Species of Concern List [see **Appendix 1**].

1. Bat Species of Concern

DEECA has assessed five bat species for inclusion on the Species of Concern list:

- Southern Bent-wing Bat (*Miniopterus orianae bassanii*)
- Eastern Bent-wing Bat (*Miniopterus orianae oceanensis*)
- South-eastern Long-eared Bat (*Nyctophilus corbeni*)
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

These bats fall into two high level categories of bats referred to in this guidance:

- Flying-foxes (Grey-headed Flying-fox)
- Echolocating insectivorous bats[10] (Southern Bent-wing Bat, Eastern Bent-wing Bat, South-eastern Long-eared Bat, and Yellow-bellied Sheathtail Bat).

These categories have different ecology and habitat requirements, as well as appropriate survey methods. For this reason, where a measure or guidance is only relevant for one category of bats, this will be indicated clearly. When it applies to all categories, the general term 'bat' is used.

2. Risk to bats from the construction and operation of wind energy facilities

Bats can be impacted by the development of wind energy facilities in a number of different ways, including:

- Habitat loss through clearance
- Disturbance
- Collision with wind turbines
- Displacement and barrier effects
- Mortality through electrocution on electricity transmission lines.

There remains a level of uncertainty regarding the precise level of risk these impacts pose at a species population level. However, species such as the Southern Bent-wing Bat and Grey-headed Flying-fox have been recorded as fatalities during post-construction mortality monitoring surveys at Victorian wind energy facilities. Research from other jurisdictions also shows evidence of changes to bat ranges and habitat use near operational wind energy facilities, in the form of either attraction to turbines, or avoidance and displacement from the area.

2.1 Important ecological features for bats, to be considered as part of site and context analysis

Roosting sites for Bent-wing Bats

Bent-wing Bat[11] species frequently congregate in large numbers at specific roosting sites. Roosts provide shelter, security and a safe area for juveniles to develop. For this reason, there is often a concentration of bats of all ages in and around roosting locations and radiating out to the surrounding landscape. Bent-wing Bats will also regularly fly between roosts and foraging areas and frequently move between roosting sites.

Roost sites vary in size and significance, with key sites like maternity caves used by larger numbers of Bent-wing Bats. In addition, there are key non-breeding sites which are regularly used by large proportions of the population.

The intent of this guidance is to focus on key roosting sites which play a critical part in the resilience and persistence of Bent-wing Bat species. 'Key roosting sites' for Bent-wing Bats are defined based on the following criteria:

- For Southern Bent-wing Bats, key roosting sites are defined as maternity roosts and non-breeding roosts that regularly contain high hundreds or thousands of bats as verified by DEECA.
- For Eastern Bent-wing Bats, key roosting sites are defined as maternity roosts and non-breeding roosts that regularly contain hundreds or thousands of bats as verified by DEECA.

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10 Echolocation is the ability to use sound waves to determine the location of objects, in this case their insect prey and to avoid obstacles.

11 This includes the Southern Bent-wing Bat (*Miniopterus orianae bassanii*) and the Eastern Bent-wing Bat (*Miniopterus orianae oceanensis*)

Risks of locating onshore wind energy facilities close to key roosting sites for Bent-wing Bats

The location of the key roosting site itself, as well as the broader foraging area around the roost which supports the population, are key risk factors for a potential wind energy facility. The concentration of Bent-wing Bat populations, importance for successful breeding, and increased flight and movement activity in the area mean that locating an onshore wind energy facility close to a key roosting site can have potentially significant impacts, including:

- Bent-wing Bats colliding with operating turbines
- both the construction and operation of a wind energy facility could cause displacement of Bent-wing Bats previously using the area
- the wind energy facility may create a barrier between key roosting sites and essential foraging areas
- the clearing of vegetation as part of constructing the wind energy facility and supporting infrastructure could reduce foraging resources.

The critical importance of key roosting sites to species persistence for Bent-wing Bats means that such impacts could present a significant risk to a high proportion of the population. Therefore, any wind energy facilities proposed within flight distance of a key roosting site may present a heighted risk to the species and should be addressed as part of assessing the impacts of the proposed project.

The risk of these impacts likely increases the closer to the key roosting site the wind energy facility is located, noting there is currently insufficiently robust data and/or information to accurately differentiate the risk profile. However, data shows that Southern and Eastern Bent-wing Bats fly up to 85 km or more from a roost. A distance of 50km reflects an approximate mean foraging distance of Southern Bent-wing Bats.

For this reason, any wind energy facility proposed to be located within 50km of an identified key roosting site for Bent-wing Bats should assume the following:

- the key roosting site is an important ecological feature for the purposes of identifying risk factors under Criteria 3 in **Section 6.1** of the Handbook; and
- there is a heightened risk of collision, displacement, disturbance and barrier effects that the proponent will need to consider in impact assessments and manage through the application of measures under the mitigation hierarchy.

Identifying roosting sites for Bent-wing Bats

Many roosts are located on private property and therefore landholder information and privacy must be protected[12]. DEECA can provide approximate locations of all known key roosting sites for Southern Bent-wing Bat and Eastern Bent-wing Bat to proponents upon request (precise locations are not provided due to privacy and disturbance risks).

Such information will be sufficient for proponents to identify if their proposed development site for a wind energy facility is within 50kms of a key roosting site and take appropriate action to either avoid the area where practicable, or plan for necessary measures to assess potential impacts and identify measures under the mitigation hierarchy that will address those impacts.

Should additional unknown roosts be located through assessment processes or unrelated searches or research, they may subsequently be added to the list of 'key roosting sites' if they are determined by DEECA to meet the criteria outlined above.

2.2 Assessing the occurrence, or likely occurrence, of bat species on the proposed site and surrounding area

This guidance outlines options for carrying out a range of monitoring and survey techniques to inform the assessment of the proposed site and surrounding area to identify the occurrence or likely occurrence and activity of bat species.

Pre-construction surveys

The aim of pre-construction bat activity surveys is to identify key habitat features present on the site or in the surrounding area which are known to be associated with increased levels of bat activity. Pre-construction surveys of the site and surrounding area can be used to test the accuracy of any desk-top assessment and identify the presence of bat Species of Concern. Pre-construction surveys and assessments can also be used to inform risk assessments, site design and turbine location.

The following guidance is intended to assist proponents by setting out a methodology for conducting pre-construction bat surveys in a thorough and effective manner. Proponents should be aware that the characteristics of bat species can differ significantly and different methods are required for different species.

12 For the same reasons of privacy, specific locations of roost should not be included in any reports, documents or other materials that may become public.

Acoustic activity surveys for echolocating bats

Acoustic surveys using high frequency bat detectors are commonly used to survey for the presence and relative activity of echolocating insectivorous bats. This section sets out known and effective methods for detecting activity of the following Species of Concern:

- Southern Bent-wing Bat
- Eastern Bent-wing Bat
- Yellow-bellied Sheathtail Bat.

It is not currently possible to reliably distinguish the presence of the South-eastern Long-eared Bat using acoustic call identification, so acoustic surveys are not recommended for this species. If surveys for this species are needed at a site, trapping surveys would be required using harp traps or mist nets in more open areas. Proponents should consult with DEECA before undertaking these approaches. DEECA is working on developing methods to distinguish the echolocation calls of this species and advice will be updated as more appropriate methods become available.

Monitoring period

Pre-construction surveys should be used to develop an understanding of local bat activity and the species that may be present at or around the site. This includes both relative activity levels across the site and seasonal variability in activity. This can then be used to inform risk assessments and guide the application of measures under the mitigation hierarchy, such as micro-siting decisions to avoid or minimise predicted impacts or appropriate mitigation approaches to reduce collision risk.

The length of monitoring necessary to achieve this understanding will vary depending on the characteristics of the site and knowledge of the surrounding area.

For this reason, there is no prescribed length for how long a pre-construction monitoring period should be. However, in preparing an application, proponents should clearly set out their monitoring period and describe how monitoring data and any existing information for the site can support a robust risk assessment. This could include providing evidence from scientific literature or existing data that supports how the proposed approach will deliver a clear understanding of bat activity on the site and in the surrounding area and which addresses any uncertainty.

Some examples of monitoring periods are outlined below. The length of monitoring adopted should be commensurate with the level of risk posed by the proposed site. However, proponents may choose alternative approaches based on the specifics of a project.

Table 14: Recommended pre-construction monitoring periods

Potential monitoring period	Recommended application
24 months including seasonal sampling	Where little is known about bat activity at a site, or where there may be heightened risk of impacts associated with the site, monitoring over a 24-month period with sampling in each season using the techniques set out in this guidance may be appropriate. This should capture interannual and seasonal variation. Proponents should consider this option if it is reasonably believed a bat Species of Concern is likely to be present, based on proximity to known roosting sites, modelled ranges, habitat features or other relevant information.
24 months sampling during highest activity and risk periods (November to April)	Where existing data or factors indicate risk may be reduced, an alternative is to monitor during the period from November to April over 24 months. This corresponds to periods of high levels of activity (including the breeding season) and the highest bat mortality risk at Victorian wind energy facilities. Monitoring over two seasons will allow some interannual variation to be captured. Although there is some risk that bat activity outside of this period may be more significant than average due to unforeseen local factors, this approach should still provide a good understanding of bat activity during the period shown.
12 months period including seasonal sampling	Sampling during a 12-month period may not capture interannual variation or events occurring on an annual or longer frequency that could impact bat populations, for example droughts or wetter than average seasons. However, seasonal monitoring over a 12-month period may still provide sufficient understanding of the risks if complemented by other relevant data sources.
Sampling during highest risk months of a 12 month period (November to April)	Monitoring from November to April inclusive over a single year is the shortest monitoring period acceptable and should only be used by proponents where they can demonstrate robust information and data gathered from alternative sources. Nonetheless, this approach should capture the peak period of bat activity in Victoria.

Shorter monitoring periods are associated with greater risk of missing critical information and/or failing to capture bat activity levels accurately. These limitations should be taken into account when interpretating data during the assessment and approval process.

Considerations for undertaking acoustic activity surveys

Acoustic surveys can record large quantities of information about bat activity without having to capture bats or otherwise cause disturbance to a species. For this reason, it is an internationally recognised approach that is used across many jurisdictions.

The method requires a high level of expertise and has several limitations and/or issues that need to be considered when undertaking and analysing data from acoustic surveys to ensure robust risk assessments:

- Acoustic bat detector surveys can identify species and relative activity across given time periods. However, these surveys cannot determine absolute abundance of bats as it cannot be determined how many individuals produced the calls. Data from acoustic surveys should be used for comparative purposes, for example to investigate relative changes over time or between locations, but should not be used to estimate the number of individuals at risk.
- As the detector microphones are often omnidirectional the direction of flight cannot be determined from these datasets. Data should not be used to infer flight direction.
- Where calls cannot be definitely identified and exclusively attributed to a single species, calls of species with overlapping call parameters are often grouped together into 'species complexes' for analysis. For example, the Southern Bent-wing Bat is often put into a species complex with up to three other species. Basing counts or analysis only on calls considered 'definite' risks underestimating the true number of calls and therefore local activity of a species. Therefore, where a species complex includes a bat Species of Concern and the area is located within the distribution of the Species of Concern, a precautionary approach should be applied.
  - Where any calls recorded in that complex could represent the bat Species of Concern, it should be assumed that some of these calls could be the Species of Concern and a proportion of the species complex calls should be attributed to that Species of Concern.
  - This proportion is to be determined based on the relative proportion of definite call identifications attributed to the Species of Concern for that site and monitoring period. For example, if a species complex includes four possible bat species, and the total definitely identified calls for those four species for that site and period include 25 per cent identified as Southern Bent-wing Bats, then 25 per cent of the calls that could only be identified to the species complex level should be assumed to be Southern Bent-wing Bats.
  - Post-construction monitoring in combination with an adaptive management framework can also be used to manage uncertainty related to Species of Concern activity estimates and risk assessments based on species complexes.
- Results from acoustic bat surveys only record information within the airspace in relative proximity to the detectors and activity is susceptible to being masked by wind or other sources of noise, meaning results are likely to under-represent true bat activity. It should not be assumed that survey results represent the maximum level of bat activity.
- Most bat species in Victoria have been detected as mortalities at wind energy facilities, so risk assessments should assume that any bat species detected at ground level has the potential to fly at height and be impacted at rotor swept height.

To ensure efficient and effective assessment and approval processes, proponents should demonstrate in their application documents how these issues have been considered and, where necessary, addressed.

Acoustic surveys approaches

There are two principal approaches for undertaking acoustic surveys:

- at ground level
- at height, usually done by attaching bat detectors to met-masts or other infrastructure, sometimes at a series of different heights to try to discern information about bat flight height and relative activity at these heights on the site.

Either method, or a combination of the two, is a valid approach. However, to maximise their effectiveness, proponents should consider the following matters when undertaking surveys. Proponents will be expected to demonstrate that they have given due consideration to these matters as part of their application process.

Undertaking ground surveys

Factors which can improve survey accuracy or confidence in ground survey results include:

- Ensuring that sampling points incorporate potential turbine locations and the various habitat types on and adjacent to the site, and that sites are selected specifically for surveying bats, rather than using sites selected for surveying birds.
- Ensuring that anyone deploying bat detectors is trained to place detectors optimally to record passing bats and reduce noise interference.
- Ensuring data from different sites is comparable by making sure settings of all detectors deployed are the same, e.g. signal duration, call frequency triggers. This will limit variability between detectors and improve accuracy in discerning differences between monitored sites.
- Conducting sampling in weather conditions conducive to successfully detecting bats, such as warmer temperatures without rainfall and during low wind conditions.
- Collecting weather data concurrently with bat calls to support data interpretation, as bat activity typically reduces with lower temperatures and higher wind speeds. High wind speeds often result in significant noise recorded in addition to bat calls, which can make it more difficult to identify calls.
- Ensuring that analyses are undertaken by an experienced practitioner familiar with the target species and geographic area variation in call characteristics, will result in more accurate identification of calls and robust data interpretation, due to the high complexity of call analysis.
- Undertaking data collection and analyses in full spectrum where feasible, rather than zero-crossing. Full-spectrum bat detectors record all information about the high frequency sound while zero-crossing reduces sound to single-points based on the strongest frequency of sound at each given point of time. Zero-crossing is more susceptible to missing bat calls due to difficulty in distinguishing calls without detail from harmonics, in the presence of wind or other noise, and when multiple species are calling simultaneously.
- Independent peer-review of call identification for target species, including of calls designated as 'possible ID' or potential species-complex.

Undertaking height surveys

Height surveys monitor part of the rotor swept area (i.e. part of the collision risk zone) which is not monitored by ground surveys, height surveys have limitations that proponents should consider before undertaking them. These limitations include:

- Higher noise to signal ratio due to higher wind and noise interference at height, which reduces the detectability of bat calls.
- Rapid geometric and atmospheric attenuation of high frequency calls means that calls are only discernible in a small airspace. Geometric and atmospheric attenuation is affected by call frequency as well as weather conditions, such as temperature, humidity and air pressure.
- Low replication due to the small number of met masts deployed resulting in a small sample size that limits interpretation and extrapolation of results.

If undertaken, the accuracy of height surveys can be improved through:

- use of measures to reduce the impact of noise on recording, including choice of mounting
- increased sample size and monitored airspace through deployment on multiple met masts
- use of full-spectrum recording format to increase the data available to support identification of calls.

Data from ground and height surveys should not be directly compared in analyses, as the different approaches and limitations would result in a comparison that is not meaningful and may result in inaccurate conclusions.

Reporting results

Where possible the reporting for acoustic bat surveys should include:

- a description of the reference library used in the identification process, noting that locally collected reference calls are required for many species
- the number of detector nights undertaken during the survey
- a description or photograph of each detector site and the surrounding environment, to assist in call analysis and data interpretation (e.g. the calls of a species can vary markedly depending on if the detector is placed in an open or cluttered environment)
- a description of all analysis tools used and decisions made, such as automated processes, filters applied or decision trees, and how calls were defined (e.g. minimum pulses and duration)

- a sample 'time versus frequency' graph of each species identified during the survey, using data from bats recorded and identified during the survey, not examples from other studies
- for species with similar call characteristics, a written description of the characteristics used to distinguish these species
- an indication of the proportion of calls identified, i.e. the total number of calls processed and the percentage of these that were identified
- a description of the quality of the data, including the proportion of noise recorded and any missing data periods
- all the call files from a survey are stored by the consultant and made available if further analysis is required.

In addition, proponents are advised to avoid providing data as pooled averages over the monitoring period. Data provided in this manner is difficult to interpret and may result in a more complex assessment process due to the resulting uncertainty. Representing results as averages or rates could mask periods of high activity through inclusion of periods when detecting bats was unlikely due to poor conditions, high noise levels or equipment malfunction.

Where long periods of sampling have been undertaken however, data can be summarised into weekly or monthly averages where measures of variability such as range and standard deviation are also included, to show the full variation in nightly activity that was recorded.

Grey-headed Flying-fox surveys

Grey-headed Flying-foxes have different ecology and habitat to echolocating insectivorous bats and so require different survey approaches. The most important input to determining the risk to Grey-headed Flying-foxes is the proximity to roost sites, known as camps.

Identifying roost/camp locations

Known locations of Grey-headed Flying-fox roosts/camps can be identified based on publicly available data including:

- Victoria's Flying-fox Map: www.wildlife.vic.gov.au/flying-foxes,
- the National Flying-fox Monitoring viewer: https://environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf.

Information on both active and inactive known Grey-headed Flying-fox camps is relevant and should be obtained, as camp usage can be regular but non-continuous, for example seasonal use of a site.

Further understanding of the how flying foxes may utilise the area can be gained by identifying foraging locations and potential flight paths.

Vegetation surveys for potential foraging locations

Mortality patterns in western Victoria have shown a relationship between Grey-headed Flying-fox mortalities and the presence of favoured food tree species (e.g. planted Sugar Gums) when they are flowering. The presence of these trees near a proposed wind energy facility could attract Grey-headed Flying-foxes into the site.

To identify potential foraging locations, surveys should be undertaken to identify potential foraging resources on or near the site, including planted wind breaks and roadside vegetation, which will inform the likely risk. Relevant tree species include flowering Eucalypts (Eucalyptus, Corymbia and Angophora), Banksia, Callistemon, Grevillia, Melaleuca and fruiting species such as Ficus (figs) and cultivated fruits.

Identify potential flight paths

Once potential foraging sites have been identified, these can be used to identify likely flight paths from any of those sites and identified roosting site. Likely flight paths can also be informed by publicly available GPS-tracking data, published research, or information available through consultation with species experts. Where no more precise data exist, it is reasonable to assume flight paths are straight lines or follow obvious landscape features such as rivers.

Where a flight path is likely to intersect with the proposed site of development, proponents should exercise caution and assume the presence of Grey-headed Flying-fox unless compelling data and/or information can be provided to disprove it.

3. Application of the mitigation hierarchy to manage impacts on bat Species of Concern

3.1 Measures to avoid or minimise impacts on bat Species of Concern

Key habitat features that are associated with high levels of bat activity include:

- identified flight paths
- areas of vegetation, both native and non-native
- water bodies.

Proponents should consider avoiding areas of the site which support or are in proximity to these habitat features when making decisions regarding micro-siting of individual turbines. Avoiding areas of concentrated bat activity or movement that are associated with the above habitat features will reduce risk of collision mortality.

Acknowledging that avoidance of all features may not be feasible or practical, proponents are encouraged to prioritise avoiding the following features, where practicable:

- Areas of native vegetation. While essential to support bat Species of Concern such as Grey-headed Flying-foxes, native vegetation also provides a host of broader biodiversity benefits to a range of species and ecosystems.
- Areas where survey monitoring has detected the highest concentrations of bat activity regardless of vegetation type. If the methods recommended in this guidance have been followed, this should allow the proponent to avoid the areas with potentially greatest impact on bat Species of Concern.

Although estimates of appropriate buffers have been made in other jurisdictions, evidence of an appropriate buffer distance for Victorian species is limited. Depending on the characteristics of the site and the particular bat species, the greater the buffer distance around a key ecological or habitat feature the greater the potential to reduce mortality impacts[13].

Proponents seeking to apply buffers to habitat features during the process of micro-siting should consult with DTP and DEECA as part of the pre-application process regarding the specifics of the site.

13 DEECA has conducted an expert elicitation process that considered several mitigation options, such as buffer distances and options for curtailment, including cut-in speeds and periods of application, and their potential effectiveness Estimating the potential effectiveness of wind farm mitigations using structured expert elicitation. The results of this work provide estimates of the possible level of mortality reduction for bat Species of Concern resulting from applying the mitigation options, noting there is uncertainty across the estimates as explained in the report. Further research is ongoing to refine this information.

3.2 Measures for mitigating impacts to bat Species of Concern

Measures for insectivorous bats

Table 15: Measures to mitigate impacts on insectivorous bats

Potential approach	Description	Approaches and options
Nighttime low wind speed curtailment	Low windspeed curtailment involves raising the windspeed at which turbines begin to produce energy (the 'cut-in speed'), which is effective because insectivorous bats are more active during lower wind conditions. Bats are nocturnal; therefore, collision risk is restricted to between dusk and dawn. Any curtailment strategies aiming to reduce bat mortality do not need to be applied during daylight hours. Mortality risk varies seasonally in Victoria, with heightened risk periods occurring between the months of January and April inclusive. Average daily reduction in mortality when applying mitigation measures will be highest if applied during these periods, although continuous nighttime application throughout the year will return the highest total reduction in mortality. Species specific information, such as habitat usage, is an important consideration when selecting curtailment approaches, timing and seasonal duration of measures.	A range of approaches are available, from blanket curtailment below specified wind-speeds, to smart curtailment in response to monitored risk factors such as real-time data on environmental variables and bat activity. Smart curtailment can reduce the operational cost of curtailment while increasing effectiveness. **Cut-in speed:** Higher cut-in speeds will result in a greater reduction in bat collision mortality. **Timing:** In Victoria, peak bat activity is from September to May, with peak collision mortality recorded from January to April. Although the greatest reduction in mortality would result from year-round application of curtailment, curtailment during months associated with high activity levels or mortality rates is also likely to deliver significant reductions. Smart curtailment only at times of monitored high bat activity or other risk factors may return reduction in mortality at a similar rate to continuous dusk till dawn curtailment during low wind speeds over high activity months.
Feathering below cut-in speed	Preventing turbines from 'freewheeling' below the windspeed at which turbines begin to produce energy, shown in other jurisdictions to be effective in reducing bat mortality without impacting facility output.	Reduced risk of impacts to bats by reducing time that blades are moving through airspace without impacting facility output.
Acoustic deterrents	Use of ultrasonic acoustic deterrents mounted on turbines designed to deter bats may reduce mortality of insectivorous bats. However, there is a level of uncertainty with this mitigation measure because the approach has not been trialled in Victoria, and results from other jurisdictions are variable.	Encouraging bats to avoid the turbines through acoustic deterrence may reduce the likelihood of impacts occurring. If ultrasonic acoustic deterrents are to be trialled on proposed wind energy facilities, other proven mitigations methods should be adopted in combination to manage residual impacts to bats.
Increased turbine height	The impact of increasing the height of the rotor swept area on bat mortality is variable and has been shown to both decrease and increase the risk across different species. Therefore, while this approach may reduce mortalities for some species, some risk will remain, and potential unintended negative impacts will need to be considered.	Rotor swept areas designed to operate above certain heights may avoid impinging on the flight paths of certain bat species.

Monitoring the effectiveness of any mitigation strategy through post-construction mortality monitoring will provide evidence of effectiveness of the approach taken and can allow adjustments to the regime to be made through an adaptive management framework.

Mitigation measures for Grey-headed Flying-foxes

Although the above approaches may reduce mortalities of small insectivorous bats, their effectiveness for Grey-headed Flying-foxes, which are much larger size and have different ecology to other Victorian bat species, is yet to be trialled.

Options for mitigation measures that could be trialled for Grey-headed Flying-foxes are:

Table 16: Measures to mitigate impacts on Grey-headed Flying-foxes

Potential approach	Description	Outcome
On demand shutdown (radar)	Radar installed on site which would temporarily trigger a shutdown in real-time when a flying-fox was detected approaching a turbine and was at risk of collision.	Experts have estimated that in Victoria this approach could reduce collision mortality by approximately 50 per cent (with a high level of uncertainty).
On demand shutdown (thermal/ infrared cameras)	Thermal or infrared cameras installed on site (e.g. linked with IdentiFlight or similar system), which would trigger a temporary shutdown in real-time when a flying-fox was detected approaching a turbine and was at risk of collision.	Experts have estimated that in Victoria this approach could reduce collision mortality by approximately 25 per cent (with a high level of uncertainty).
Targeted shutdown (weather radar)	Weather radar is used to monitor numbers of flying-foxes at nearby camp/s, and flight direction and timing on fly-out. Based on this data, turbine shutdowns would occur at times that turbine collision risk is considered 'high'.	Experts have estimated that in Victoria this approach could reduce collision mortality by approximately 30 per cent (with a high level of uncertainty).

3.3 Compensation for residual risk of impacts

Some residual level of risk or impact may remain after predicted impacts have been avoided, minimised and mitigated to the maximum extent practicable. The Handbook sets out requirements for compensation of residual impacts on threatened bird and bat species from a wind energy facility. It is recommended that relevant Action Statements, National Recovery Plans, and specific needs assessments (SNA), where available, are used for impacted bat species to identify possible compensatory measures.