Contact Energy Limited

Southland Wind Farm
Draft
Pekapeka (long-tailed bat)
Management Plan

Bluewattle Ecology
ecological assessment + restoration

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Front cover photo: Long-tailed bat in flight – with permission from the Department of Conservation

1 INTRODUCTION

1.1 PURPOSE

This draft Bat Management Plan (**BMP**) has been prepared by Bluewattle Ecology and Davidson-Watts Ecology Ltd for Contact Energy Limited's (**Contact**) Southland Wind Farm project (**the Project**).

The BMP forms part of the Terrestrial and Wetland Ecological Management Plan (**TEMP**) which has been prepared separately by Wildlands Consultants Ltd.

The objective of this BMP is to specify the methods and procedures necessary to avoid, remedy, mitigate, and compensate for the actual or potential adverse effects of the Project on pekapeka/long-tailed bat. The BMP sets out:

- methods to minimise habitat disturbance onsite during construction;
- management and monitoring requirements of long-tailed bats within identified higher-risk areas for the species within the Wind Farm Site during its operation; and
- measures to compensate for residual adverse effects on long-tailed bats.

1.2 SCOPE OF ACTIVITIES:

1.2.1 RESPONSIBILITY

Contact, as the holder of the approvals under the Fast-track Approvals Act 2024 (**FTAA**), is ultimately responsible for ensuring that the Project is constructed and operated in accordance with the BMP and all relevant conditions set out in the approvals. The Environmental Manager is responsible for delivery of, and compliance with this BMP, liaising with [add other key persons] as required. The responsibilities of the Environmental Manager include, but are not limited to:

I. Facilitating a project start-up meeting with [add key persons] before vegetation removal and earthworks commence. The objective of this meeting will be to determine habitats scheduled for clearance each season, enabling forward planning and avoiding delays in the construction schedule and to confirm all pre-clearance requirements.

II. Contacting the [add key persons] before any clearance.

III. Maintaining clear lines of communication with [add key persons] regarding any changes in the works schedule.

IV. Briefing new personnel about the contractor's responsibilities under this BMP. This will include a site induction for all employees and contractors who are likely to remove high value bat habitat and maintain wind turbines and associated infrastructure.

1.2.2 COMPETENCIES

A suitably qualified and experienced bat ecologist (defined as a person who has met the required ethical standards to be registered as a competent, authorised bat worker by the New Zealand Bat Recovery Group for the work which they are undertaking), has prepared this BMP and will be required

to provide guidance and ensure compliance with this BMP during the construction and operational phases of the development.

Only bat ecologists certified by the Department of Conservation as 'authorised competent bat workers' are able to implement the monitoring, roost tree inspection protocols and handling requirements of this BMP – hereafter referred to as the project **'bat ecologist'**. A set of competencies has been developed by the NZ Bat Recovery Group to ensure that anyone working with bats is competent to do so. The competencies referred to in this document which a bat ecologist must have are:

2.1 Bagging storage, handling, measuring, weighing, sexing, aging, temporary marking and releasing appropriately: For long-tailed bats: 50 individuals; For short-tailed bats: 50 individuals.

3. High risk activities – Roost felling (all of these competencies include the understanding of what to do when bats are found during tree felling as per Appendix 6 of 'Initial veterinary care for New Zealand Bats"[1].

3.1 Assessing roost tree use using Automatic Bat Monitors - Demonstrate correct timing, placement, and interpretation of data for 10+ times according to DOC's Tree Felling Protocols.

3.2 Undertake roost watches/emergence counts at 10+ occupied roosts where the entrance is visible.

3.3 In at least two different forest/habitat types, including the forest/habitat type where trees are going to be assessed: evaluate 10+ potential roost features in trees (e.g., cavities, peeling bark, epiphytes).

1.3 STATUTORY REQUIREMENTS

1.3.1 RELEVANT CONSENT CONDITIONS

The consent conditions relevant to the protection of long-tailed bats at the Project site are as follows:

"*EC60 a) The Consent Holder shall engage a Suitably Qualified and Experienced Person to prepare a Bat Management Plan (BMP) as part of the TEMP. The objective of the BMP shall be to set out the management response measures necessary to avoid, remedy, mitigate, and compensate for the actual or potential adverse effects of the Project on long-tailed bats.*

b) The purpose of the BMP is to:

(i) Set out the management and monitoring requirements of long-tailed bats within identified higher-risk areas for the species within the Wind Farm Site during its operation; and

(ii) Set out the measures to achieve the requirements of Conditions EC75-EC79, including any monitoring requirements of pests and predators, to compensate for residual adverse effects on long-tailed bats.

c) The BMP shall be reviewed by the Expert Bat Panel required by Conditions EC79A – EC79G. The Expert Bat Panel shall replace the role of the Independent Management Plan Reviewer required

[1] https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Initial_Vet_Care_NZ_Bats. pdf

by Condition MP5. The Consent Holder shall make every reasonable effort to address the recommendations to the satisfaction of the Expert Bat Panel.

d) The Consent Holder shall then provide the BMP, including an explanation of any differences in opinion between the Consent Holder and the Expert Bat Panel as to the contents of the BMP, to the relevant District Council for certification as part of the TEMP, in accordance with Condition MP6.

EC62 In order to achieve the objective established in Condition EC60 above, the BMP shall, as a minimum, set out the following:

a) The methods to minimise direct habitat disturbance onsite (i.e. potential roosting sites) during construction of the Southland Wind Farm, including through the adoption of potential bat roost checks before any tall tree clearance occurs;

b) Confirmation of the key habitat for long-tailed bats within the Wind Farm Site. This information will then be used to delineate "higher risk areas" for the species within the Wind Farm Site;

c) A description of the methods to minimise the risk of bats colliding with wind turbines within higher-risk areas of the Wind Farm Site during its operation;

d) Monitoring and tree-felling protocols for high risk potential bat roost trees in order to minimise the risk of harming long-tailed bats;

e) Bat monitoring requirements during the operation of the Southland Wind Farm, including the reporting requirements; and

f) Methods to achieve the compensation measures for long-tailed bats, monitoring of pests and predators and reporting requirements."

Conditions EC 63 to EC79G provide the specific requirements for ongoing monitoring, the curtailment approach, the Bat Compensation Strategy (BCS), reporting, the role of the Expert Bat Panel and consultation/reporting requirements.

1.3.2 WILDLIFE ACT

The long-tailed bat is an 'absolutely protected' species under the Wildlife Act 1953

2 METHODS TO MINIMISE DIRECT HABITAT DISTURBANCE ONSITE DURING CONSTRUCTION

2.1 TREE-FELLING PROTOCOL IN OLD GROWTH EXOTIC TREES

2.1.1 IDENTIFICATION PROTOCOLS FOR POTENTIAL BAT ROOST TREES

There is no evidence that roosting is commonplace, if at all, within the Wind Farm Site. The risk of felling an occupied bat roost trees is thus considered to be very low provided that appropriate tree-felling protocols are adopted in specific areas where there is regular bat activity and there are stands of exotic 'old growth' trees. Old growth trees are considered to be trees older than approximately 30 years of age, which have not been included in regular planation forest harvesting regimes (they may be exotic or indigenous, but in the case of the higher risk areas defined in this BMP, they are generally exotic).

Appropriate tree-felling protocols in these circumstances are therefore limited to old growth stands only, where the possibility of roosts is at a level that would warrant roost checks, using an adapted application of DOC's Bat Recovery Group 'Protocols for minimising the risk of felling bat roosts' (Bat Roost Protocols Version 4: October 2024) to these specifically identified old growth trees and stands of trees (**Appendix I**).

Specifically, prior to any vegetation disturbance or removal for construction purposes, between 1 October and 30 April trees within old/mature stands of exotic trees near turbines MAT-01, MAT-16/MAT-17, MAT-07 and MAT-12 planned to be removed or limbed as part of the construction with a diameter at breast height (DBH) greater than a 15 cm diameter at breast height (DBH)[2] will require identification and assessment to confirm whether they are High or Low risk Bat Roost Trees.

The criteria for determining a High-Risk Bat Roost Tree are:

- Trees deemed to pose a high risk as potential bat roosts are those within the old / mature stands of exotic vegetation discussed above (refer to Figure Bat MP – 01 below), and that exhibit one or more potential roost features including:
  - Cracks, crevices, cavities, or fractured limbs of sufficient size to accommodate roosting bat(s).
  - Sections of loose, peeling or flaking bark large enough to provide roosting space for bats.
  - A hollow trunk, stem, or branches.
  - Deadwood within the canopy or stem that is of suitable size to support roost cavities or hollows.
  - Presence of bat droppings, grease marks, or urine staining around cavities or ground.

- All trees lacking the characteristic features of a bat roost are categorised as low-risk trees. These trees can be felled without the need for further assessment or monitoring.

2.1.2 REMOVAL OF POTENTIAL HIGH-RISK BAT ROOST TREES

If any High-Risk Bat Roost Tree trees are identified, pre-felling vegetation assessments must be carried out by the bat ecologist to confirm if there are bats currently roosting in the tree.

A bat ecologist will undertake the following measures before any felling or trimming of potential bat roost trees takes place anywhere within the development site, but specifically summarised as follows:

a) Confirm, describe and GPS the location of any High-Risk Bat Roost Trees proposed to be removed two weeks prior to the removal of these trees.

b) Undertake either:

   a. bioacoustic surveys to identify bat activity of High-Risk Bat Roost Trees proposed to be removed for a minimum period of at least two valid survey nights prior to the morning of removal of these trees (see standards to achieve a valid survey night in section 4(b) of the prefelling protocols – Appendix 1); or

   b. direct visual observation of High-Risk Bat Roost trees prior to removal, ideally with a thermal camera. If the potential roost is near ground level, confirmation can be provided by the bat ecologist undertaking a visual inspection. For potential roosts

[2] Diameter at breast height, or DBH, is a standard method of expressing the diameter of the trunk or bole of a standing tree. DBH is one of the most common dendrometric measurements. DBH is measured at approximately 1.3 m above ground measures form the base of the tree trunk in question.

higher in a tree, competent tree climber may be required to undertake the visual inspect under the direct supervision of the bat ecologist. This may include the use of live audio-visual equipment and/or photographs for review by the bat ecologist and could be aided by the use of handheld bat detectors, endoscopes, cameras, thermal imaging cameras and trained bat dogs.

c) If a roost has not been found by inspection listed in (b) above then the tree or vegetation can be cleared. Vegetation removal must take place on the day of tree inspection or the day roost watches or two consecutive nights of ABM data have confirmed that there are no bats present.

d) If practical, trees are to be inspected for signs of bats once felled by the bat ecologist. Bat ecologists and arborists inspecting trees should be familiar with the Bat Care Advice document[3] and able to check/inspect tree for signs of bats once felled.

e) If during the felling of a tree bats are detected, felling of that tree must stop immediately if safe to do so, and DOC and an approved bat ecologist at Competency Level 2.1 must be consulted as to the next steps.

f) If bats are detected once the tree has been felled, all further work must stop, and DOC and an approved bat ecologist at Competency Level 2.1 must be contacted. The felled tree must be thoroughly inspected by the approved bat ecologist for further bats.

g) If any bats are found on the ground or in the tree once felled, place the bat in a cloth bag in a dark, quiet place at ambient (or slightly warmer) temperature and take to a veterinarian for assessment as soon as possible. A maximum of two bats should be kept in one bag. After delivering the bat to the vet, contact an approved bat ecologist at Competency Level 2.1 in consultation with the vet and DOC (0800 DOC HOT, 0800 362 468).

h) Bats must be kept for three days under observation and must be kept out of torpor for this time. The approved bat ecologist at Competency Level 2.1 and vet must consult with DOC to consider appropriate rehabilitation options where suffering is minimal and chances of return to the wild are high.

i) Any dead bats (or bat parts) found must be handed to DOC.

2.1.3 ACCIDENTAL DISCOVERY PROTOCOL

If during the implementation of the BMP an accidental discovery of an active/occupied bat roost is confirmed, the following actions shall be undertaken:

a) The immediate area shall be cordoned off with safety fencing and signage erected in a 25 m radius around the roost, alerting any person approaching the area that a bat roost is present and to stay clear.

a) The existence of the roost will be publicised to all works staff and work instructions for the immediate area will be updated to reflect the presence of the roost and the measures to minimise disturbance.

[3] https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Bat_Care_Advice.pdf

https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Initial_Vet_Care_NZ_Bats.pdf

b) No work will take place within 100 m of the occupied roost from one hour before dusk to one hour after dawn until a specific site roost disturbance minimisation plan is devised by the bat ecologist.

Where the tree requires felling and before the tree can be felled, evidence that bats have vacated the roost shall be confirmed by (as a minimum) either:

a) ABM surveys must continue until no bat activity is recorded for at least two consecutive valid survey nights; or

b) Visual inspections (including thermal imagery) described in Appendix 1 shall be carried out to confirm the non-occupancy of the roost.

Appendix 1 of the BMP outlines the notification and harm minimisation processes which must be adhered to in the event of a disabled, injured or dead bat found during any vegetation clearance occurring on site, irrespective of whether the clearance is in accordance the BMP or not.

2.1.4 LIGHTING REQUIREMENTS IF AN OCCUPIED BAT ROOST IS DISCOVERED

If an occupied bat roost is detected on site, the following standards to be achieved if artificial lighting is used on site. Lighting emissions measured at the outer edge of a 25 m lighting buffer from any occupied bat roosts during construction:

- Use of amber-coloured lighting (2700K, 590 nm); and
- A luminosity level less than 0.3 lux

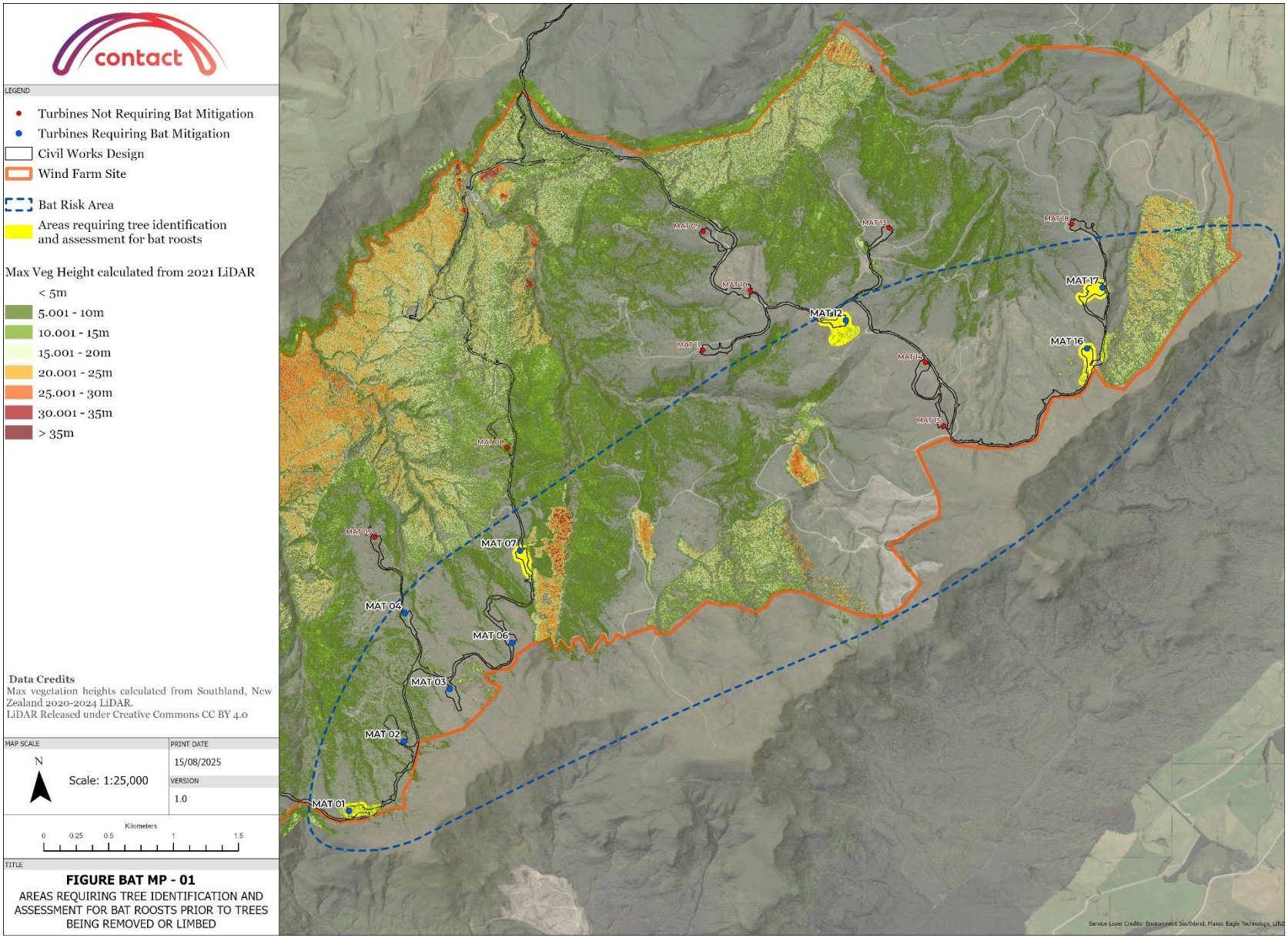
2.1.5 REPORTING

The results of the bat roost protocol implementation will be reported in a completion/compliance report in the form of a letter or memorandum, submitted within 15 working days following the completion of vegetation clearance activities required for the construction of the Project. The report will include details of the potential bat roost trees monitored including the size, location and type of potential roost trees or vegetation as well as weather data during bat roost protocol implementation. The results of all pre- and post-clearance survey effort shall be submitted to DOC for inclusion to the national bat distribution database.

2.1.6 SITE INDUCTION AND TOOLBOX MEETINGS

A site induction for all employees and contractors is required to inform them of the specific bat habitat constraints and requirements of the site. This should be completed prior to works commencing on the site and a record of inductions kept. This induction can either be stand-alone or integrated into the typical health and safety induction process. This induction should include, at a minimum:

- Vegetation removal and accidental bat discovery protocols.
- Procedures for the accidental discovery of long-tailed bats inside work areas.
- The importance of compliance with the protocols and the reporting processes for observed breaches of required potential bat roost tree removal protocols.
- Contact details for the bat ecologist, environmental compliance staff, and emergency numbers.



3 MEASURES TO MINIMISE TURBINE STRIKE RISK AT HIGHER RISK BAT AREAS

3.1 CONFIRMATION OF THE KEY HABITAT FOR LONG-TAILED BATS WITHIN THE WIND FARM SITE

The bioacoustic surveys and statistical analysis described in the *Southland Wind Farm Technical Assessment #6: Long-tailed Bats* dated 18 August 2025, prepared by Bluewattle Ecology Limited and Davidson-Watts Ecology Limited, including the bat activity index, have delineated higher risk areas for long-tailed bats within the Wind Farm Site. Those turbines are:

- MAT – 01
- MAT – 02
- MAT – 03
- MAT – 04
- MAT – 06
- MAT – 07
- MAT – 12
- MAT – 16
- MAT –17

3.2 TURBINE CURTAILMENT STRATEGY

The conditions require Contact to install a bat detection system – bioacoustic sensor(s) and frequency analyser(s) – for live curtailment at the nine wind turbines listed above. That involves:

- installing a bat detection system on the nacelle of each of these wind turbines (noting that the bioacoustic sensor(s) can be removed between 1 June to 31 August, if environmental conditions are outside its specifications);
- connecting the bat detection system to the wind turbine control system to feather and curtail the operation of the wind turbine when a long-tailed bat is detected; and
- considering use of bioacoustics sensor(s) in other locations, where these:
    - may assist in detecting bats in the rotor sweep area;
    - can be integrated into the turbine control system;
    - meet commercial and practical constraints, including maintenance requirements; and
    - can be deployed safely with agreement from Contact Energy and the turbine supplier.

Live curtailment will be trialled for a period of up to three years following commissioning of the first of the nine wind turbines subject to curtailment as follows:

If monitoring (described in Section 4 below) shows that live curtailment is effectively managing adverse effects and the technology is robust, live curtailment will continue.

However, if monitoring shows that live curtailment is not effectively managing adverse effects (including if the technology is not considered sufficiently robust), live curtailment will cease and

Contact will implement a set curtailment regime at the nine wind turbines subject to curtailment from sunset to sunrise between 15 February to 15 April when:

- windspeed is 5 m/sec or lower at hub height; and
- temperature is 8°C or higher; and
- precipitation is less than 1.5 mm/hour.

As required by consent conditions EC66 and EC67 the Expert Bat Panel will determine the applicable curtailment regime (either set or live) based on the results of the bioacoustic monitoring and Contact must implement that regime.

4 MONITORING DURING OPERATION OF THE PROJECT

4.1 PURPOSE OF MONITORING

Contact is required by the conditions to undertake post-construction monitoring to:

- confirm the effectiveness and ongoing necessity of the bat management response at the specific wind turbines identified subject to curtailment;
- provide data on long-tailed bat activity at wind turbine sites where curtailment is not required, in accordance with the methods outlined in the BMP; and
- assess the extent to which long-tailed bats are attracted to wind turbines, noting this is primarily a research output.

4.2 MONITORING REQUIREMENTS

The conditions set the parameters of the monitoring as follows:

- Recurrence: two surveys annually for five years following the commissioning of the wind turbines, and every five years thereafter for the duration of the operation of the Project.
- Type of monitoring: bioacoustic monitoring using Automated Bioacoustic Monitors (ABMs).
- Qualifications: a Suitably Qualified and Experienced Person.
- Timeframe: between November – April (at least one survey between February and April).

4.3 REPORTING REQUIREMENTS

The results of the post-construction monitoring must be submitted to the Expert Bat Panel for review. The Expert Bat Panel will then determine whether additional monitoring is warranted or if adjustments to the on-site management strategy are necessary.

5 COMPENSATION

5.1 COMPENSATION MEASURES FOR LONG-TAILED BATS

The conditions require Contact to implement a BCS in collaboration with DOC and its Bat Recovery Group to enhance the habitat for a known population of long-tailed bats. The long-tailed bat treatment enhancement area is a 10,000ha site in the Beresford Range, Catlins, as indicated on Figure Long-tailed Bats -14 (included in Part G to the substantive application documents).

5.2 PROVISION OF FUNDING

Contact will pay to DOC:

- $300,000 as an initial payment; and
- $150,000 per annum (CPI adjusted) for the life of the Project.

The initial payment will enable DOC to purchase traps, build and maintain tracks, and employ resources to deploy the traps within the 10,000ha targeted area, to increase the likelihood of successful breeding of the long-tailed bats in the area.

The annual payment will be used to assist DOC in undertaking ongoing predator control for long-tailed bats and monitoring of Mohua / yellowhead birds (a known indicator of the overall health of indigenous biodiversity for the area) and long-tailed bats within the 10,000ha targeted area.

5.3 COLLABORATION WITH DOC AND THE BAT RECOVERY GROUP

The conditions require Contact to work with DOC and the Bat Recovery Group to:

- ensure the funding provided by Contact is primarily focussed on the Catlins Forest and/or enhancement of long-tailed bat habitats and populations (partly covered in the five yearly report to DOC); and
- foster an increased understanding of the impacts of wind turbines on long-tailed bat populations.

6 REVIEW

6.1 PARAMETERS FOR REVIEW OF THE BMP

The conditions set the parameters for review of the BMP as follows:

- **Recurrence**:
  - Initially three years following the commissioning of the wind turbines.
  - Every ten years thereafter for the duration of the operation of the Project.
- **Purpose of review**: assess the efficacy of the on-site long-tailed bat management measures.
- **Reviewers**: A Suitably Qualified and Experienced Person in consultation with the Expert Bat Panel.
- **Outcome**: Contact provides a report on the results of the review to the relevant District Council.

6.2 PROCESS FOR MATERIAL AMENDMENTS TO THE BMP FOLLOWING THE REVIEW

The conditions provide the process for any material amendments to the BMP following the review, including providing the draft amendments to Te Ao Marama Inc. (on behalf of Ngā Rūnaka Ki Murihiku) and DOC (Invercargill Office) for review and comments prior to certification.

APPENDIX I TREE FELLING PROTOCOLS

Protocols for minimising the risk of felling occupied bat roosts

(Bat Roost Protocols)

Version 4: October 2024 approved by the New Zealand Department of Conservation's Bat Recovery Group

The use of these protocols is only one step in the RMA effects management hierarchy i.e., avoid, remedy, mitigate. Avoidance of felling bat roost trees should be the first step in any project. Using this protocol only reduces the likelihood of killing or injuring bats present in roosts at the time of felling. It does not avoid, remedy or mitigate any other effects.

Purposes of this document:

1. To outline why protection of roosts is important for the persistence of New Zealand bats and why removal of known and potential roosts should be avoided.
2. Where tree removal cannot be avoided, to set out the minimum requirements and protocols for removing trees in areas where bats are present, to minimise the risk of killing bats.

This protocol does not eliminate the risk to bats of death or injury because bats or active bat roosts can be missed. The best way to eliminate risk of felling an active roost is to **avoid** felling any known or potential roosts.

Context

Bat roost protocols and the Wildlife Act 1953

Aotearoa New Zealand bats are absolutely protected species under the Wildlife Act 1953. It is an offence to catch alive or kill, hunt, possess, molest, or disturb bats under the Act. Any projects where tree or vegetation removal overlaps with the occurrence of bats, there is a risk of killing or injuring bats that may be present. Following the bat roost protocol reduces the likelihood of killing or injuring bats.

Bat roost protocols and the RMA

The occurrence of bats and bat habitat is a matter of 'significance' under Section 6(c) of the Resource Management Act (RMA). Bat roost protocols have become a standard part of bat management plans that may be required under RMA consents. Where developments require consents, and bats (a threatened species) are present, the developments should 'Avoid' impacting bats and bat habitat. Where this is not possible, the effects management hierarchy must be followed with attempts made to "remedy, mitigate, offset, and compensate" for impacts on bats and bat habitat.

Bat roost protocols are not considered an appropriate management measure to address bat roost habitat loss, as they only attempt to reduce the risk of bats being killed by tree felling. Therefore, implementing bat roost protocols where bats are present should be considered a last resort after following the RMA effects management hierarchy.

This protocol has therefore been framed following the RMA effects management hierarchy by first focusing on the avoidance of effects, helping to identify and avoid the removal of roost trees, and to minimise the risk to bats of death or injury if avoidance is not possible. This approach is usually informed by gathering data on bats in the local areas and seeking advice from someone who has been certified as competent by DOC to assess roost use by bats using bat detectors, identify potential roost features, and undertake emergence watches.

Identifying and protecting *both active and inactive (*i.e., trees used by bats at other times of year) roosts by avoiding their removal is an important step in supporting the survival and persistence of bats.

1

Effects management/compensation

If trees are felled and habitat lost, then compensation measures should be considered to address the adverse effects. What these measures should be is beyond the scope of this document. Provision of artificial roosts in the short-term and planting for the long-term are some of the methods commonly used in development projects, but their effectiveness is untested and understanding this is future research needed.

The status of Aotearoa New Zealand bats

Aotearoa New Zealand's two extant bat species (pekapeka) are classified as threatened.

Long-tailed bats are classified as 'Nationally Critical' because the species is likely to have a 70% decline in numbers within three generations.

Lesser short-tailed bats have three subspecies. The northern subspecies is classified as 'Nationally Vulnerable' because there are 1000-5000 mature individuals and the predicted decline in numbers is 10-50% within three generations. The central subspecies is 'Declining' because there are 20 000-100 000 mature individuals, and the predicted decline is 10-50% within three generations. The southern subspecies is 'Recovering' because there are 1000-5000 individuals, and the predicted increase is >10% within three generations.

Threats to bats

This document deals specifically with roost protection; however, roost protection is only part of the wider issue of habitat loss. Habitat loss through land clearance, habitat degradation, fragmentation and disturbance and loss of roosts reduces roosting, foraging and socialising areas. Individual bats and colonies are also threatened by the local felling of individual trees.

Bats have large home ranges which can include unprotected peri-urban habitat. Protecting habitat and maintaining connectivity of vegetation are crucial for bats being able to persist and flourish in the environment.

Predation and competition by introduced predators: mustelids, rats, cats, and possums have all been implicated in the decline of bats[1].

Roosts are critical to the survival of bats

Roosts are where bats gather to shelter during the day and at night. They are used to socialise, mate, give birth, and raise young. Bats have very specific requirements when they are choosing roosts and are not just choosing any tree. The specialised features of roosts make them rare and almost irreplaceable in any landscape or habitat type except over very long-time frames. People sometimes falsely suggest that "bats can just move to another tree". This is not the case, particularly where trees suitable as roosts are limited[2].

Bats demonstrate high site fidelity to existing roosts and their specific roosting areas, and they move on a rotation among these. Because roost trees are likely to be rare, and bats choose which of their roosts to occupy to fulfil specialised requirements, felling roost trees even when bats are absent will have a significant negative effect. If the number of suitable roosts and their surrounding habitat is reduced in the landscape, bats are forced to use roosts that are less thermally efficient. This means they will use more energy to survive, resulting in reductions in survival and lower reproductive success. In this way, roost removal is likely to result in higher risk of local extinction.

[1] O'Donnell CFJ; Christie JE; Hitchmough RA; Lloyd B; Parsons S 2010. The conservation status of New Zealand bats, 2009. New Zealand Journal of Zoology 37: 297– 311.

[2] Many references available, for example, Borkin KM; Parsons S. 2011. Sex-specific roost selection by bats in clear-fell harvested plantation forest: improved knowledge advises management. Acta Chiropterologica 13(2): 373-383; Borkin KM; O'Donnell CFJ; Parsons S. 2011. Bat colony size reduction coincides with clear-fell harvest operations and high rates of roost loss in plantation forest. Biodiversity and Conservation 30; Sedgeley JA; O'Donnell CFJ 1999b. Roost selection by the long-tailed bat, *Chalinolobus tuberculatus*, in temperate New Zealand rainforest and its implications for the conservation of bats in managed forests. Biological Conservation 88:261–276; Sedgeley JA; O'Donnell CFJ 2004. Roost use by long-tailed bats in South Canterbury: Testing predictions of roost site selection in a highly fragmented landscape. New Zealand Journal of Ecology 28:1-18.

Bats can roost in native or exotic vegetation – therefore it should not be presumed that exotic species such as pine trees will not support bats. Roosts, including maternity roosts, have been found in many exotic species including, but not limited to, pine, poplar, oak, and acacia species, black locust, willow, eucalyptus and Tasmanian blackwood.

Bats are at risk of being injured or killed when trees are felled

If a tree is felled with a bat in it, it is highly likely that the bat will be injured or killed, although this may not be apparent at the time because injuries, such as bruises and fractures, which would hinder bats' ability to fly well, may take time to be obvious.

The highest risk of injuring or killing bats or trapping them within their roosts is when they are heavily pregnant, when young are still dependent on the roost (late November – February) and when bats are more likely to be in torpor (a type of hibernation in May – September). Heavily pregnant bats are slower and less agile, and young bats cannot fly, and when they are new to flying are not very agile, so their chances to escape are reduced when roost trees are felled. Also, it is possible that if the larger female-dominated maternity roosts are cut down when females are raising their young to independence (October-March), a whole colony of bats could be destroyed at one time.

If trees are cut down when bats are in torpor, bats may be unable to rouse from torpor and to fly away in time to escape. Additionally, it is significantly harder, sometimes impossible, to detect bats roosting in trees during torpor. For these reasons, trees with potential bat roost features must not be cut down in winter. Bats also use torpor for short periods during summer, for example, if the weather gets cold, so the risk of killing or injuring bats that cannot escape falling trees exists at any time of the year.

Bat roost protocol

When and how to use the protocol

Whenever vegetation removal is proposed in areas where bats are potentially present and where their habitat may be impacted, follow the decision tree (Figure 1) below as a guide to what sort of action should be undertaken. The decision tree is designed firstly to avoid felling bat roost trees, secondarily aimed at moving roost trees, and only if unavoidable, felling roost trees (but only once vacated).

None of the methods of inspecting roosts described below eliminates the risk of failing to identify bats when they are present. Therefore, techniques such as filling in cavities with expandable foam are not supported as a tool. This is because there is a risk of trapping bats that have not been detected within cavities.

Definitions

Competencies: a set of competencies developed by the NZ Bat Recovery Group[3] to ensure that anyone working with bats is competent to do so. Contact bathandler@doc.govt.nz for a list of competencies and requirements to become an authorised competent bat worker.

Competencies referred to in this document:

2.1 Bagging, storage, handling, measuring, weighing, sexing, aging, temporary marking and releasing appropriately:
For long-tailed bats: 50 individuals
For short-tailed bats: 50 individuals

3. High risk activities – Roost felling (all of these competencies include the understanding of what to do when bats are found during tree felling as per Appendix 6 of 'Initial veterinary care for New Zealand Bats'[4])

- 3.1 Assessing roost tree use using Automatic Bat Monitors - Demonstrate correct timing, placement, and interpretation of data for 10+ times according to DOC's Tree Felling Protocols.
- 3.2 Undertake roost watches/emergence counts at 10+ occupied roosts where the entrance is visible.
- 3.3 In at least two different forest/habitat types, including the forest/habitat type where trees are going to be assessed: evaluate 10+ potential roost features in trees (e.g., cavities, peeling bark, epiphytes).

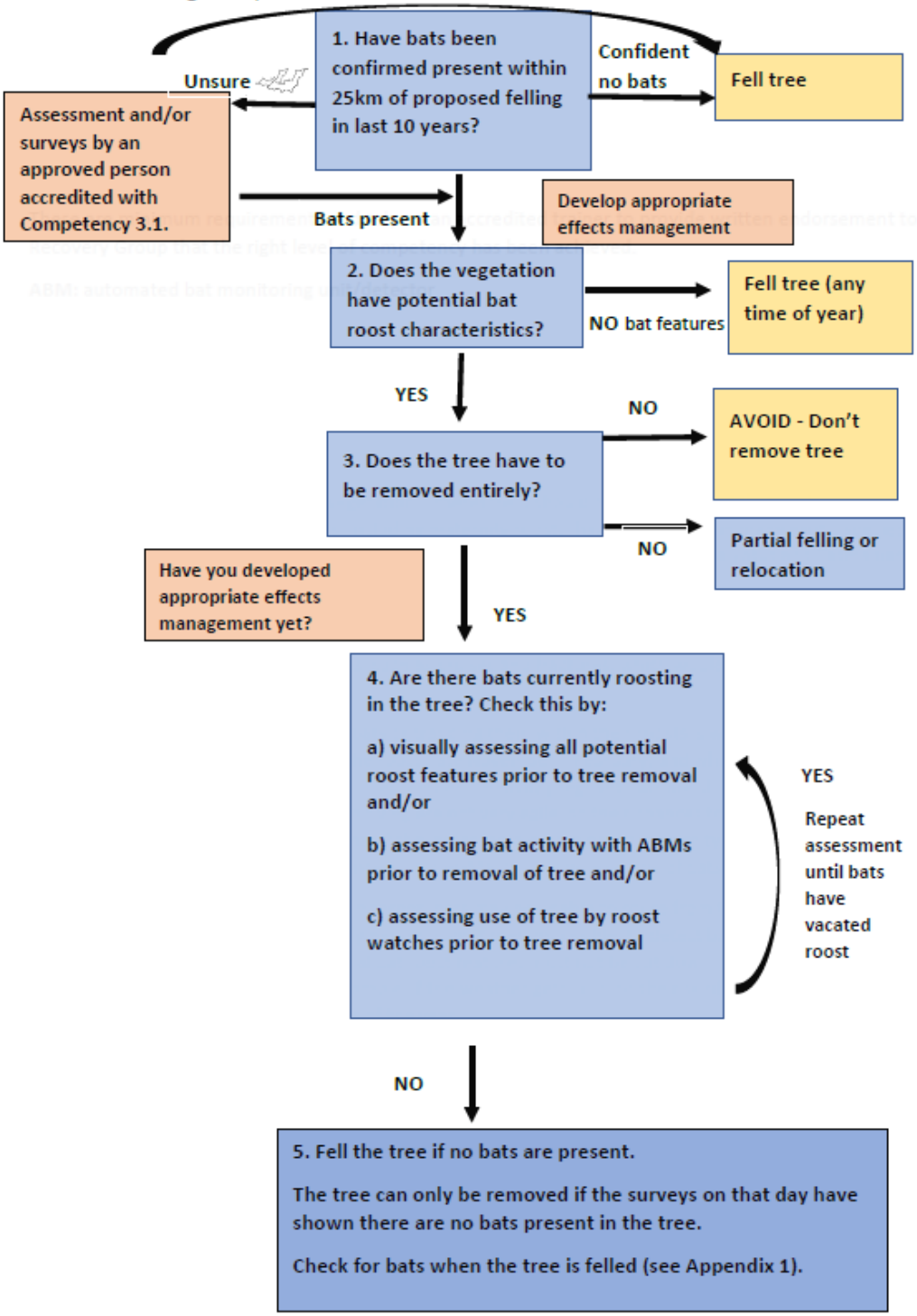
[3] A group of bat specialists that advise on bat issues and assess bat competencies
[4] Available at www.doc.govt.nz/bat-worker-resources

These are minimum requirements and rely on an accredited trainer to provide written endorsement to the Bat Recovery Group that the right level of competency has been achieved.

ABM: automated bat monitoring unit/detector

Figure 1. Tree removal in bat areas flow chart

Each numbered step relates to a step in the Decision Tool for Tree Removal. Follow each step fully in the text to work through the process.



Step by step decision tool for tree removal in bat areas (to be used in conjunction with Figure 1).

Step 1. Does the bat roost protocol apply to my project?	Response	Who can make this assessment?	When?
a) Is there known bat activity within a radius of 25 km of the vegetation to be removed (see [5] and [6] notes below)?	a) If Yes, proceed to b If No, consider whether survey work needs to be done.	Evidence can come from on-the-ground surveys and reports from the national DOC database if within the last 10 years, consultants, and/or other credible sources. Evidence should be interpreted by an experienced bat ecologist.	Any time
b) Are bats present in the Project Area i.e. where trees are planned to be felled?	b) If Yes, go to step c If unknown, undertake comprehensive survey if bats are likely to be present. If no bats are present after comprehensive survey, you do not need to follow protocol.	If surveys are required to support the assessment, then these will need to be designed by approved person accredited with Competency 3.1. to determine presence around trees due to be felled.	Acoustic surveys to determine presence should be undertaken when bats are most active and environmental conditions are suitable (October 1st to April 30th)[7]. Surveys undertaken at other times of year are considered less reliable for determining absence.
c) Is the tree known to provide a roost location for bats? (Previous knowledge).	c) If yes, go to step 3 If no (but bats are present in the project area), go to step 2.		

Notes for Step 1

1a) Bats are a highly mobile species. Long-tailed bats can have home ranges (the areas that they regularly use) as wide as 19km, and short-tailed bats about 24km. Three colonies of long-tailed bats in the Eglinton Valley collectively had a home range of 100km².

When assessing whether bats might be present at a site you have to consider any surveys that have been done in the wider area, how long ago the surveys were done and whether more surveys are required.

[5] The largest home range span for the long-tailed bat in the Eglinton Valley was 19 km (O'Donnell 2001. J. Zool., Lond. 253, 253-264).
[6] The largest home range span for the lesser short-tailed bat in the Eglinton Valley was 23.6 km (O'Donnell et al. 1999. New Zealand Journal of Ecology 23(1): 21-30).
[7] Borkin K.M. 2010. Ecology of New Zealand's Long-tailed bat (*Chalinolobus tuberculatus*) in exotic plantation forest. Unpublished PhD thesis, University of Auckland.

1b) If you are doing a new survey then you should design the survey to cover the project area. Examples of surveys are shown in the Bat Inventory and Monitoring Toolbox (https://www.doc.govt.nz/our-work/biodiversity-inventory-and-monitoring/bats/). See 'Bats: Counting away from bat roosts: bat detectors on line transects' and 'Counting away from bat roosts: automatic bat detectors'.

Send bat data (processed csv files and GPS locations) to batdatabase@doc.govt.nz on a standard spreadsheet available by emailing this address.

Step 2. Does the vegetation proposed to be removed have potential bat roost characteristics?	Response	Who can make this assessment?	When?
a) Is the tree ≥15 cm DBH (Diameter at Breast Height)[8]?	If yes, further assessment is required (2b). If no, the vegetation can be removed at any time. There may be roosts that have smaller DBH. If any vegetation is suspected to have a bat roost present, removal shall be halted immediately, and protocols reviewed.	Anyone who can measure a tree DBH.	Any time
b) On visual inspection, does the tree (dead or alive) have features that indicate roost potential (Potential Roost Features/PRFs)? These features include: • hollows • cavities • knot holes • cracks • flaking, peeling, and decorticating bark • epiphytes • broken or dead branches or trunk • cavities/hollows/shelter formed by double leaders • Artificial roost boxes	If yes go to step 3 If unsure i.e. cannot assess due to foliage or limited access, further assessment is required. This may include climbing inspection of the tree. If no potential roost features are present, the vegetation can be removed at any time[9], but if upon felling you find a bat follow section 5.	Approved person accredited with Competency 3.3.	Visual inspections can occur at any time of the year, but within 6 months of final felling dates. This accounts for any changes in trees that may occur over time. If there are **NO** potential roost features, felling can occur at any time of year.
Step 3. Does the tree have to be removed entirely?	**Response**	**Who can make this assessment?**	**When?**

[8] This diameter at breast height is based on dimensions of roosts used by south Hamilton long-tailed bats that were identified by Dekrout (2009, Unpublished PhD thesis, University of Auckland) - the smallest roosts were 15.5 cm DBH; but note that in South Canterbury Sedgeley and O'Donnell (2004, New Zealand Journal of Ecology 28(1): 1-18) found that 25% of long-tailed bat roosts were smaller than 18.8 cm DBH.
[9] All surveys to assess whether trees are potential roosts shall take place within 6 months of final felling dates. If felling does not take place within this time, then assessments must be repeated. This is intended to account for any changes in trees which may occur over time.

a) Is the only option to remove the tree entirely?	If yes, continue to step 4 If no, consider leaving the tree in place, cutting off specific limbs only or relocating the tree. If any felling, partial felling (where the part to be felled has potential bat roost features) or tree relocation takes place you **MUST** proceed to step 4. If a roost (active/inactive) is confirmed, then advice should be obtained at a project level in writing from DOC before proceeding.	Project leader (i.e. the accountable decision-maker for the project)	Any time

Notes for Step 3

Trees must only be relocated when bats are absent and when standard automated bat monitoring unit (ABM) weather conditions are met (see notes section 4b for appropriate weather conditions), and in consultation with an ecologist with all competencies of level 3: 'High risk activities – Roost felling'.

Advice in writing can be given on behalf of the Operations Manager of the DOC District you are working in. If you do not know the contact details for this office, you can phone 0800 ASK DOC (0800 275 362) or email info@doc.govt.nz . In emergencies, phone 0800 DOC HOT (0800 362 468).

Step 4. Are there bats currently roosting in the tree? (Follow a or b or c or a combination)	**Response**	**Who can make this assessment?**	**When**
a) Are potential features being used by roosting bats? A tree climber may be required to check all features (see notes for 4a below). If roost is occupied repeat 4a another day until roost is vacated.	If yes, **THE TREE MUST NOT BE FELLED UNTIL BATS HAVE VACATED IT.** If no, the tree can be removed on the day of the tree inspection following step 5. If bats continue to use the roost, then the tree must not be cut down until the bats leave the roost. At this point reconsider whether this tree must be felled.	An approved person accredited with Competency 3.3 or an experienced tree-climber (e.g., an arborist) working with an approved person accredited with Competency 3.3. If the latter, the tree climber must provide information along with photographs or video footage, to the	October 1st to April 30th when the temperature is 7°C or greater at official sunset in the South Island or 8°C or greater in the North Island.

	Advice must be obtained at a project level in writing from DOC prior to felling the tree. If you do not know the contact details for the office, you can phone 0800 ASK DOC (0800 275 362) or email info@doc.govt.nz.	approved person accredited with Competency 3.3 who assesses and decides whether the tree can be removed. If roosts are known or confirmed through this process, then this information must be communicated to the nominated DOC or Council bat ecologist for this project.	
b) Is bat activity recorded at any time during two consecutive, valid survey nights preceding tree felling[10]? At least two nights are required as it is possible for bats to enter or leave a roost without echolocating, or to not leave the roost for a night.	If yes (bats are detected), survey must continue until no bat activity is recorded for two consecutive nights (to indicate bats have left the area) prior to felling **OR** roost features of each tree must be visually assessed via climbing. If bat activity is consistent in the area and 2 nights with zero bat passes cannot be obtained, Go to 4c or 4a. If no bats are detected for two consecutive nights, the vegetation can be removed on the day immediately following the survey nights using the method in 5.	An approved person accredited with Competency 3.1	October 1st to April 30th and when conditions meet the requirements for standard ABM weather conditions (see 4b notes).
c) Are bats observed emerging or re-entering the tree? This involves watching roost features to identify bats returning to or exiting potential roost features. It should only be used in combination with previous ABM monitoring (4b) (see notes 4c	If yes (bats are seen at either watch), it is a confirmed roost.	An approved person accredited with Competency 3.2.	Between October 1st and April 30th only **AND** when weather parameters meet

[10] Le Roux et al (2013) found that in and around Hamilton "The longest consecutive monitoring period without bat detections at each site was three nights during winter." Le Roux et al 2013. New Zealand Journal of Zoology (2013): Spatial and temporal variation in long-tailed bat echolocation activity in a New Zealand city, New Zealand Journal of Zoology, DOI: 10.1080/03014223.2013.827125.

for method). At least two consecutive emergence and re-entry watches should occur at dusk and dawn immediately preceding the felling as it is possible for bats to enter or leave a roost without being detected, or to not leave the roost for a night. It is strongly recommended that a night vision aid is used for emergence watches to reduce the risk of missing bats if they leave after it becomes too dark to see.	Removal of a roost should not occur. If no bats are observed entering or exiting for two consecutive dusk and dawn watches, the vegetation can be removed on the day immediately following the final dawn watch using the method in 5.	If more than one person is required for a roost watch at a tree, a minimum of one approved person accredited with Competency 3.2 must be present on site for the duration of the roost watch to supervise.	the roost watch requirements.

Notes for Step 4.

4a) Tree climbing and inspection

Care must be taken while climbing trees to avoid disturbing, removing or destroying tree features with bat roost potential such as sections of loose bark or cavities in dead wood. Using mobile elevated platforms can be a good option. Bats are less likely to be active over colder periods, so climbing to check whether bats are present in potential roost features must take place between October 1st to April 30th when the temperature is 7 °C [11] (South Island) or 8°C (North Island) or greater at official sunset on the night before inspection.

A tree climber may be required to check all potential bat roost features.

- Can bats be seen? An endoscopic camera should be available for this step and every possible corner of each potential roosting feature inspected, i.e., cavity/crack etc. Cracks, holes, and splits may lead to cavities or may be superficial. A cavity may be wet indicating no/low potential as a bat roost. Ensure that the tree climber is provided guidance from the competent bat worker about bat identification and care required when probing endoscopes into potential roosting features which may disturb bats.
- Can bats be heard? Search of tree features should be accompanied by use of a hand-held bat detector. If bats are present and not in torpor, then detection of presence listening at 25 kHz (for social calls) and 40 kHz (for echolocation calls) may help to determine if long-tailed bats are present. Short-tailed bat social calls are often audible or detected at 25-27 kHz.
- Is guano present or urine staining? See Appendix 1.

4b) ABM survey work

ABMs are to be used to record bat calls. Location of ABMs must provide sufficient coverage to be able to determine if bat roosts are present in one or more of the trees. Department of Conservation-manufactured AR4 bat detectors are considered likely to detect long-tailed bats only over short distances i.e., up to 30-60 m distant from the

[11] O'Donnell CFJ 2000. Influence of season, habitat, temperature and invertebrate availability on nocturnal activity of the New Zealand long-tailed bat (*Chalinolobus tuberculatus*). New Zealand Journal of Ecology 207-221.

detector (S. Cockburn, Department of Conservation, pers. comm.). This is similar detection distances of other detector types. Ensure the survey design Note that rain and wind can affect detectability because the sounds can have the same frequencies as bat calls. These sounds are picked up by bat detectors, potentially obscuring bat calls.

'Valid' survey nights must have the following features:

- Begin one hour before official sunset and end one hour after official sunrise.
- Temperature 8°C or greater for the first four hours after official sunset time for the North Island and 7°C for the South Island[12].
- Ideally no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with Competency 3.1.
- No to light wind within the first four hours after official sunset.

Prior to the commencement of surveys, ABMs must be checked for correct operation at a site where bat activity is known to be regular, or by using the DOC – Bat Recorder Tester (Tussock Innovation Ltd) phone app made for this and available from Google Play Store. Faulty or suspect ABMs must not be deployed, and ABMs must be redeployed if faults occur.

4c) Roost watches

The following weather conditions define a valid night for roost watches:

- Temperature greater than 8°C all night between official sunset and sunrise for the North Island and 7 °C for the South Island.
- Ideally no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with Competency 3.1.

Roost watches should include the deployment of ABMs and analysis of data for the night of the roost watch.

Emergence watches

- Each tree must be watched from at least 1 hour prior to sunset in the South Island and from ½ hour prior to sunset in the North Island until it becomes too dark to see by sufficient people to observe all potential exit points. This must be supported using handheld detectors, and consider the use of night vision aids which can detect bats once it becomes too dark to see. The aim of emergence watches is to identify potential roost locations within the vegetation. Infra-red and thermal imaging cameras will be useful in this process.

Roost re-entry watches

[12] South Island temperatures are based upon O'Donnell (2000) as above. North Island temperatures are based on Borkin et al. 2023. Influence of weather on long-tailed bat detection in a North Island exotic forest. New Zealand Journal of Ecology, Vol. 47, No. 1.

The time when bats return to roosts can vary based on temperature and time of year.[13,14]

- Observers must then return the next morning and watch the tree to determine whether bats return to the vegetation.
- Roost re-entry watch timing should be based on patterns of activity recorded onsite with ABMs, i.e., as a guide, watches should begin two hours prior to when the last passes were recorded on the ABMs on previous nights and finish one hour after official sunrise time. Where this information is not available and at minimum, watches shall begin two hours prior to official sunrise until one hour after sunrise. Infra-red and/or thermal imaging cameras may be useful as a supplementary tool in this process.

The methods above (Climbing and inspecting; ABM use and roost watches) can be implemented as in steps 4.

If bats are sighted, or sign detected, or a roost (active/inactive) is confirmed, the approved person with the appropriate competencies, as soon as possible, shall:

- Call the tree felling supervisor to inform them which affected tree(s) cannot be felled due to detection of bat sign.
- Send an email to the site manager, and the local DOC office if an active roost is found, detailing the results of the survey and outlining the measures for protection or relocating the roost tree. Advice must be obtained at a project level in writing from DOC prior to felling the tree. If you do not know the contact details for the office, you can phone 0800 ASK DOC (0800 275 362) or email info@doc.govt.nz.
- A record (including photos) of any vegetation containing bat roosts shall be kept detailing the date; size, location and species of tree or other vegetation; roost type, e.g., cavity, peeling bark, broken branch; detail outlining how presence of bats was confirmed; the number of bats present; and species present, if known.

Step 5. Fell the tree if no bats present	**Response**	**Who can make this assessment?**	**When**
NB: Vegetation removal must take place on the day of tree inspection or the day immediately following two consecutive emergence/re-entry surveys that confirm that there are no bats present.			
a) If you have undertaken a visual inspection of the vegetation (following step 4a, then the vegetation can be removed **ONLY ON THE DAY OF INSPECTION** and meets the valid weather conditions (defined in notes 4c) at official sunset the day prior to inspection. If you have undertaken ABM surveys or roost watches 4b or 4c the vegetation can be removed **ONLY ON THE DAY IMMEDIATELY**		An approved person accredited with the relevant competency (based on method used) who are familiar with the 'Bat First Aid and veterinary care' documents shown in footnote[15], and physically able to	When the inspection method chosen allows.

[13] Dekrout AS. 2009. Unpublished PhD thesis. University of Auckland, New Zealand Pp 168.
[14] Griffiths R. 2007. Activity patterns of long-tailed bats (Chalinolobus tuberculatus) in a rural landscape, South Canterbury, New Zealand. New Zealand Journal of Zoology, 34:3, 247-258, DOI: 10.1080/03014220709510083.

[15] Initial Veterinary Care for NZ Bats UPDATED 2023.pdf (doc.govt.nz) and Bat Care Advice for first responders 2023.pdf (doc.govt.nz) available at www.doc.govt.nz/bat-worker-resources

FOLLOWING SURVEY COMPLETION (i.e., if the survey ends in morning the tree can be felled the same day only). Trees must be inspected for signs of bats once felled and before removing from the site, if safe to do so. Follow Appendix 2 if bats are detected during vegetation removal.		check/inspect tree for signs of bats once felled.	

Appendix 1. Identification of guano.

Bat droppings ('guano') will superficially look like rodent droppings, being dark in colour and a similar size and shape to a large grain of rice. Bat droppings will easily crush under pressure (e.g., when squeezed between fingers) and will disintegrate into a dusty/crumbly substance in comparison to smearing (rodents). Where beetles form part of the bat's diet, crushed droppings can look shiny/glittery due to the presence of elytra. Larger colonies may leave piles of guano at the bottom of the roosting feature (Figure 1). Where individuals or small colonies are present, it is likely that only individual pieces of guano may be found, therefore careful inspection is needed.

Figure 1: Guano at the base of communal long-tailed bat roost. Photo: M. Choromanski

Appendix 2. If bats are detected during tree relocation or removal

NB: Vegetation removal must take place on the day of tree inspection, or the day roost watches have been completed or two consecutive nights of ABM data have confirmed that there are no bats present at that time. If practical, trees are to be inspected for signs of bats once felled and before removing from site. People inspecting trees should be familiar with the Bat Care Advice document shown in footnote[16] and able to check/inspect tree for signs of bats once felled.

If during the felling of a tree bats are detected, felling of that tree must stop immediately if safe to do so, and DOC and an approved person accredited with Competency 2.1 must be consulted.

If bats do not fly away or are potentially injured/found on the ground, felling can only re-start once permission has been obtained from DOC after consultation with an approved person accredited with Competency 2.1.

If bats are detected once the tree has been felled, all further work must stop, and DOC and an approved person accredited with Competency 2.1 must be contacted. The felled tree must be thoroughly inspected by them for further bats.

If any bats are found on the ground or in the tree once felled, place the bat in a cloth bag in a dark, quiet place at ambient (or slightly warmer) temperature and take to a veterinarian for assessment as soon as possible i.e. that day. A maximum of two bats should be kept in one bag. After delivering the bat to the vet, contact an approved person accredited with Competency 2.1 in consultation with the vet and DOC (0800 DOC HOT; 0800 362 468).

[16] Initial Veterinary Care for NZ Bats UPDATED 2023.pdf (doc.govt.nz) and Bat Care Advice for first responders 2023.pdf (doc.govt.nz) available at www.doc.govt.nz/bat-worker-resources

Bats must be kept for three days under observation and must be kept out of torpor for this time. Additional detail is found at the links provided in this footnote[17]. Vets must euthanise bats whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return to the wild. The approved person accredited with Competency 2.1 and the vet must consult with DOC to consider appropriate rehabilitation options where suffering is minimal and chances of return to the wild are high.

Euthanised bats or any dead bats (or bat parts) found must be handed to DOC and is a legal requirement under the Wildlife Act. If the bat is held for longer than 12 hours, store it in a food grade safe glass jar in the freezer to preserve the bat's smell for the potential use of training conservation dogs.

[17] Initial Veterinary Care for NZ Bats UPDATED 2023.pdf (doc.govt.nz) and Bat Care Advice for first responders 2023.pdf (doc.govt.nz) available at www.doc.govt.nz/bat-worker-resources

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