BEFORE THE NEW PLYMOUTH DISTRICT AND TARANAKI REGIONAL COUNCILS

In the matter	of the Resource Management Act 1991 ("the Act")
and	
In the matter	of applications from NZTA to alter a designation and for resource consents for the Mt Messenger Bypass Project - SH 3 between Uruti and Ahititi ("the Project")

Colin Francis John O'Donnell

Evidence on behalf of the Director-General of Conservation

(Bats)

Dated: 24 July 2018

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1. QUALIFICATIONS AND EXPERIENCE

1.1. My full name is Colin Francis John O'Donnell.

1.2. I am employed as Principal Science Advisor (Ecosystems and Species) with the Department of Conservation (**hereafter termed DOC**) Biodiversity Group based at 161 Cashel Street, Christchurch.

1.3. I was awarded a BSc (Honours) in Zoology from Canterbury University (1980) and a PhD in Zoology from Otago University (1999).

1.4. I have considerable experience relevant to assessing this application including working with bats in New Zealand and internationally for over 25 years, and on numerous significance and consent assessments for 35 years. My job includes a wide range of work areas largely focused on researching forest birds, lizards, bats, wetland birds, the impacts of predators on them, and developing conservation management prescriptions, particularly for predator control, to reverse population declines.

1.5. I was employed by the NZ Forest Service in 1977-1978, when I worked in central and south Westland undertaking forest bird and vegetation surveys, the NZ Wildlife Service intermittently between 1978 and 1982 and then full time as a wildlife scientist from 1982 onwards, and by DOC since its creation in 1987. My work with threatened species includes both active research and management on a wide range of threatened species plus co-ordination and facilitation of threatened species research generally (both in, and externally to, DOC).

1.6. I have ongoing membership of three World Conservation Union (IUCN) specialist groups for threatened species, and I belong to four of DOC's threatened species Recovery Groups and two national Technical Advisory Groups (Braided Rivers and Arawai Kakariki) that advise on sites for national habitat restoration projects.

1.7. I have published >170 peer reviewed scientific papers, book chapters, best practice reports and management reports in a wide range of national and international media related to the conservation and management of New Zealand wildlife.

1.8. I have been involved in studies of bats since 1992 when I began research projects for DOC looking at factors which had caused the decline of bats and developed and tested management prescriptions for reversing their declines. I was involved in developing the first NZ bat recovery plan and subsequently became Leader of the NZ Bat Recovery Group – a role I continue in today. I have been involved in research projects on bats throughout New Zealand, which include designing automatic ways of recording bat activity, identifying sites of significance for bats, running intensive multi-year research projects in Waikato, Canterbury and Fiordland, and supervising numerous student theses throughout New Zealand, including bat studies in the Waikato region. I have also undertaken research on bats in the UK and Germany and assisted on bat projects in the Americas, Asia, Australia and Europe.

1.9. I have had experience in rating habitats for their regional, national and international significance for wildlife throughout New Zealand. This experience includes rating Sites of Special Wildlife Significance and Wetlands of International Importance for the NZ Wildlife Service between 1978 and 1987. In 2000, I was contracted by Environment Canterbury to conduct an inventory of indigenous birdlife on Canterbury's waterways. I collated an up-to-date database of the distribution of bird communities, their habitat requirements and an assessment of the significance of each river and area of open water area in the context of recording significant habitats for Resource Management Act 1991processes. Environment Canterbury published a report of my findings in 2000 entitled 'The significance of river and open water habitats for indigenous birds in Canterbury, New Zealand' (O'Donnell 2000a; Regional Council Report U0037). My report to Environment Canterbury used, for the first time in New Zealand, modern criteria that are directly relevant to assessing the significance of bird habitats in the context of section 6(c) of the RMA.

1.10. I have evaluated the significance of wildlife communities and potential impacts of development schemes in numerous cases including proposed roading, irrigation and power schemes.

1.11. Over the last 3 years I have also been a member of a steering group overseeing the New Zealand Transport Agency's (NZTA) Bats and Roads Research Programme. The aim of this project was to investigate the impacts of roading projects on bats and to develop a nationally accepted framework for strategies for avoiding, reducing, or mitigating negative effects of land transport activities on indigenous vertebrates, with bats being a high priority to guide design. The findings of the programme are summarised in the document *"Effects of land transport activities on New Zealand's endemic at populations: reviews of ecological and regulatory literature"* NZ Transport Agency research report 623, attached as Appendix 1 to my evidence. I will refer to this as the "NZTA Bat Management Framework".

1.12. I am familiar with the proposed route of the Mt Messenger Bypass generally and I viewed parts of the proposed route in March 2018.

1.13. I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. I confirm that the issues addressed in this brief of evidence are within my area of expertise.

1.14. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed. I have specified where my opinion is based on limited or partial information and identified any assumptions I have made in forming my opinions.

1.15. My opinions rely in part on the Evidence in Chief (**EIC**) and subsequent Supplementary Evidence presented by expert witnesses appearing for DOC and the Mt Messenger Alliance for the NZ Transport Agency, in particular, the evidence of:

(a) Mr Simon Chapman;

(b) Mr Roger MacGibbon;

(c) Mr Peter Roan; and

(d) Dr Laurence Barea

1.16. In addition, in preparing my evidence I have reviewed the relevant documents provided as part of the Mt Messenger Bypass Resource Consent applications, including:

(a) Mt Messenger Ecology and Landscape Management Plan (Appendix D to the Supplementary Evidence of Mr Roan) **(ELMP)**

(b) Mt Messenger Bypass Project – Updated proposed designation conditions (Annexure A to the Supplementary Evidence of Mr Roan)) **(Draft Conditions)**

(c) Assessment of Ecological Effects – Bats, December 2017 **(Chapman & Choromanski (2017))**.

(d) Ecology supplementary report – Bats **(Chapman 2018)**.

(e) Mt Messenger Bypass Investigation- Bat Baseline Survey (April 2017, Opus International Consultants), **(Opus 2017a)**.

(f) Mt Messenger Bypass: Option MC23 – Bat Survey Addendum (Opus International Consultants Limited, 2017b. Unpublished Memo dated 25 July 2017) **(Opus 2017b)**.

(g) Review of ecological aspects of the application to reroute SH3 at Mt Messenger, North Taranaki - May 2018; Contract Report No. 4402e by Wildlands to the New Plymouth District Council **(Wildlands (2018))**

(h) Assessment of Ecological Effects – Vegetation, December 2017, NSES Ltd, Technical Report 7a (**Singers (2017)**).

(i) Ecology supplementary report – Vegetation, February 2018, NSES Ltd, (**Singers (2018)**).

2. SCOPE OF EVIDENCE

2.1. My evidence will deal with the following issues in relation to the Mt Messenger Bypass:

(a) The conservation status of long-tailed bats and their specialist requirements.

(b) The significance of the area affected by the Mt Messenger Bypass for long-tailed bats.

(c) The potential adverse effects of the Mt Messenger Bypass on long-tailed bats.

(d) The adequacy of information provided in evidence to evaluate impacts of the Mt Messenger Bypass on long-tailed bats.

(e) The adequacy of proposed mitigation and conditions offered for long-tailed bats.

(f) Conclusions.

3. KEY FACTS AND OPINIONS

3.1. The long-tailed bat is classed as threatened, with it being in the category at most risk of extinction - Nationally Critical. The presence of a long-tailed bat population and the habitats it uses in the Mt Messenger Bypass Project Area is significant in the context of section 6(c) of the Act.

3.2. Long-tailed bats are Absolutely Protected Wildlife under the Wildlife Act 1953.

3.3. Long-tailed bats have a complex and specialised life style. They are long-lived and slow breeding, have a complex social structure and live in closed societies, use specialised maternity roosts that are rare in the landscape, and they are highly mobile with large range requirements. Use of sub-optimal roosts leads to reduced breeding success. It is important to conserve traditional roost sites. Reducing the number of roosts is likely to have negative consequences on population viability.

3.4. The proposed Bypass route is significant for bats. The Applicant's reports on bat surveys show that long-tailed bats are widespread and appear to be common relative to most other places in New Zealand.

3.5. The Applicant has not provided enough information to fully assess impacts of the Bypass because they have done insufficient background research on bats to identify precisely where significant bat sites occur, particularly with regard to the location of breeding roost sites and foraging habitats along the proposed route. Thus, the effects of the project are uncertain but potentially catastrophic for long-tailed bats because felling of breeding trees during road construction may lead to extinction of the Mt Messenger bat population.

3.6. Adverse effects could include loss of critically important breeding trees, killing or injuring individual bats during the construction phase while felling trees, disturbance of bats and some loss of feeding habitat. Such effects could contribute to extinction of the long-tailed bat population.

3.7. All studies of long-tailed bats indicate that breeding roosts are very rare resources in any environment (e.g. Sedgeley & O'Donnell 1999a, 1999b, 2004; Alexander 2001; Dekrout 2009; Borkin et al. 2011). Because roost trees are likely to be rare, and are occupied to fulfill specialised requirements, even felling breeding trees when bats are absent will have a significant negative effect. If bat roost trees and foraging habitat are removed it will result in a net loss of bat habitat.

3.8. In my opinion, and based on the evidence I present, the adverse effects of the Mt Messenger Bypass Project are likely to be very high for bats, and to a large degree irreversible for the Mt Messenger long-tailed bat population, unless mitigation is significant.

3.9. The most effective way to predict actual impacts is to remove significant amounts of uncertainty through rigorous identification of bat roosts and important feeding habitats followed by their protection prior to granting the consents and, if necessary, realignment of sections of the proposed bypass to avoid both roost and feeding sites, as recommended in the NZTA's 'Bat Management Framework' (Smith et al. 2017)[1].

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[1]Appendix D, D 5.3.2: *"… depending on the scale and nature of the project, baseline surveys conducted to support options assessments and preliminary impact assessment, should in most cases include* ***at least the following objectives****:*

- *Identify key resources, such as roosts and foraging habitats, so these can be avoided. Survey methods would most likely require radio-tracking or thermal imaging (refer annex DA for further information on survey design).*
- *Characterise bat activity patterns in and around those resources to predict the likely impacts of the road's development and influence options assessment and early design.*

… ."

3.10. Alternatively, suitable compensation that has a high probability of ensuring no net loss of the long-tailed bat populations at Mt Messenger provides an option. Compensation, in the form of an integrated pest control programme, would need to be of sufficient size to have a high probability of containing the colony's bat roosts and maintaining the breeding success and survival of long-tailed bats (i.e. a minimum of 5000 hectares of effective pest management in perpetuity).

3.11. The aim of the Applicant's Bat Management Plan (BMP) is "to specify procedures to avoid, remedy or mitigate adverse impacts on long-tailed bats (*Chalinolobus tuberculatus*) and central lesser short-tailed bats (*Mystacina tuberculata*) that may be affected by construction and operation of the Mt Messenger Bypass". This is in the context that the overarching ecological aim for the Mt Messenger Bypass (the Project) "to ensure, at a minimum, there is no net loss of biodiversity values, or to achieve a net benefit of biodiversity values, within the medium term." (ELMP, Section 5.1.1).

3.12. In my opinion, the Draft Conditions, and proposed Bat and Pest Management Plans (Sections 5 and 9 ELMP), specifying a Pest Management Area (PMA) of 3650 hectares, are likely to reduce the adverse effects of the project for long-tailed bats only if certain conditions are met.

3.13. The predator control actions and standards outlined in the ELMP generally appear to follow current best practice and, if successful, should be adequate to protect long-tailed bats if implemented correctly. However, I have concerns that the size of the PMA is not large enough for this purpose, and the lack of adequate buffering (sufficient width) to guard against reinvasion by pests.

3.14. The 3650 ha may have been adequate alone if the Applicant had undertaken a radio-tracking study to identify bat roosting areas to confirm their presence in locations and adequate numbers within the PMA sufficient to ensure benefits to the population. However, given this has not occurred, in my opinion a larger area (5000 ha or more) is required to provide an adequate level of confidence that the PMA does in fact protect bat habitats. However, two conditions need to be met:

(a) The proposed Pest Management Plan needs to be implemented along-side adjacent local pest control initiatives with the same pest control targets and methods (e.g. Paraninihi), with long-term certainty, so that the combined local area of pest control is > 5000 ha (to provide confidence that bats roosts are protected within the management area); and

(b) The PMA needs to be adequately buffered against reinvasion by pests to be effective; otherwise the effective area is considerably smaller than that suggested in draft Conditions (that is, c.1500-2590 ha rather than 3650 ha as suggested). In my opinion, current buffers proposed in the Pest Management Plan are inadequate for this purpose. If suitable buffering cannot be achieved, consideration should be given to implementing the PMA in a more defendable block of > 5000 hectares of forest with a remnant bat population in North

Taranaki (e.g. North Waitaanga forest, approximately 25 km north-east).

4. THE CONSERVATION STATUS OF LONG-TAILED BATS

4.1. New Zealand has two extant species of bats, both of which are only found in this country: the long-tailed bat (*Chalinolobus tuberculatus*) and lesser short-tailed bat (*Mystacina tuberculata*).

4.2. DOC administers the Wildlife Act 1953 and bats are Absolutely Protected Wildlife under the Act.

4.3. Once, bats were remarkably common in New Zealand, with early settlers and naturalists reporting them in their ‘scores’, ‘hundreds’ and ‘thousands’ (O’Donnell 2000b). The geographic range and numbers of bats have declined significantly since humans arrived in New Zealand and in many areas, declines are continuing, such that all endemic taxa are threatened with extinction (e.g. O’Donnell et al. 2010, 2018).

4.4. I lead a specialist bat group in New Zealand that assesses the conservation status of bats every five years. The long-tailed bat is classed as highly threatened, being assigned to the category most at risk of extinction (Nationally Critical) (O’Donnell et al. 2018). That is, the long-tailed bat fulfills the criterion “when the population has an ongoing trend or predicted decline of > 70% in the total population due to existing threats taken over the next 10 years or three generations, whichever is longer” (Townsend et al. 2008). We predict that there will be a 70% decline over the next three generations of bats (c. 36 years; O’Donnell et al. 2010), placing this species in the Nationally Critical category if nothing is done to restore populations. This outcome is based on studies where we found that the rate of decline was much greater than expected in unmanaged populations (5-9% per annum; Pryde et al. 2005a, 2006; O'Donnell et al. 2017).

4.5. Declines in New Zealand bats result from a combination of threats, namely predation and competition by introduced predators and browsers, habitat loss through land clearance, habitat degradation through logging and fragmentation of forests, and disturbance at roost sites. Introduced predators - rats, stoats, feral cats and possums have all been implicated in declines (e.g. O'Donnell 2000b, 2000c; Pryde et al. 2005a; O'Donnell et al. 2010; Scrimgeour et al. 2013).

4.6. DOC has had an active recovery programme for bats since the first Bat Recovery Plan was published in 1995. This plan assessed the recovery potential of bat taxa, developed recovery objectives, identified priorities and produced a general guide to management actions for the ten years 1995-2005. The overall goal of the Bat Recovery Programme was to "secure key populations of bat taxa from extinction, which represent the full genetic and distributional range". To date, management includes a suite of tools including:

(a) legal mechanisms for protection;

(b) general advocacy and education;

(c) developing community-based conservation;

(d) control of exotic pests particularly introduced predators, at key sites;

(e) active protection of roosts sites;

(f) protection and restoration of aquatic and terrestrial foraging habitats;

(g) potential translocations to predator free habitats.

5. SPECIALIST REQUIREMENTS OF LONGTAILED BATS

5.1. Long-tailed bats (Plate 1) have specialist requirements in terms of their breeding sites, breeding behaviour, home range and foraging needs, which make them particularly vulnerable to human induced threats. Here I discuss these specialist requirements in more detail.

Plate 1: LONG-TAILED BAT in the hand (photo: Colin O'Donnell)

5.2. Long-tailed bats can be very long lived (>20 years). They shelter and breed in trees (termed roost trees), most frequently in forest. They usually select the oldest trees in the landscape for breeding, largely because these trees are well insulated, and protect the vulnerable young when the mothers are out feeding at night. They usually avoid roosting under bark and in caves and buildings.

5.3. The cavities they select to shelter and breed in have numerous characteristics that are distinct from potentially available sites (i.e. the usual cavities you find in trees). Optimal cavities are generally very rare in the landscape even when in unmodified forest. For example, only 1.3% of cavities had optimum characteristics for breeding in the Eglinton Valley (Sedgeley & O'Donnell 1999a). Long-tailed bats usually select the oldest and largest trees for maternity colonies. In unmodified beech forest they usually select trees > 80 cm in diameter that tend to be 200 to > 600 years old (Sedgeley & O'Donnell 1999b).

5.4. Long-tailed bat breeding cavities are well-insulated compared to most cavities and these roosts provide significant energy conservation benefits compared with other potential cavities (Sedgeley 2001a). Typically, a preferred roost increases in temperature slowly through the day, so that it reaches its peak internal temperature at dusk, when lactating females leave their young alone whilst foraging. Not only that, but these high temperatures are maintained throughout much of the night until the mothers return towards dawn (Sedgeley 2001a)

5.5. Where long-tailed bats persist in modified rural landscapes such as those the edge of Hamilton and in South Canterbury, they often still select the largest and oldest trees available. For example, in South Canterbury where we studied long-tailed bats for 5 years, 64% of roosts were in exotic trees, particularly willows but also oak, acacia, black, silver and lombardy poplars, 5 species of conifer and standing dead trees (Sedgeley & O'Donnell 2004).

5.6. However, the trees long-tailed bats were forced to use in rural South Canterbury were suboptimal for breeding, were poorly insulated, and survival of young was very low (only 24%) compared to those in Fiordland where virtually all young survive to fly (Sedgeley & O'Donnell 2004; O'Donnell & Sedgeley 2006).

5.7. Long-tailed bats are classic 'edge foragers', that is they feed most efficiently along the edges and above canopies of trees rather than within the forest interior (Parsons 2001; O'Donnell 2000d, 2005).

5.8. Long-tailed bats in all study areas investigated to date form summer colonies dominated by breeding females and their young. They form highly structured subpopulations of non-random associations of individuals and three populations studied in Fiordland averaged 72-132 bats each (O'Donnell 2000e). Colonies exhibit a 'fission-fusion' structure. That is, not all members of a colony occupied the same roost on a particular night. Sub-groups averaged 34 bats and sub-components of each colony would associate and mix as they switched roosts each night.

5.9. Colonies of long-tailed bats also have large home range requirements based on radio-tracking studies. For example, in the Eglinton Valley, a colony of long-tailed bats ranged over 117 km^2 (11,700 ha) in the breeding season with individuals flying straight line distances of up to 19 km between roosting and foraging areas (O'Donnell 2001).

5.10. However, across that range, individual bats spread themselves out across the landscape and focused their feeding in relatively small clusters of habitat that they visited night after night (averaging 300-2000 ha depending on age, sex, and time of the breeding season). In addition, roost trees were concentrated in smaller areas of forest – ranging from 426-1391 ha per colony (O'Donnell 2000e).

5.11. Large home ranges are needed so that the bats can find enough resources in the landscape for both feeding and roosting and individual bats tend to space themselves in different parts of the landscape to reduce competition (O'Donnell 2001; Dekrout 2009).

5.12. Research on long-tailed bats demonstrates that not only are high-quality breeding trees extremely rare, but once bats adopt one of these roosts, they are relatively inflexible about finding new ones. If roost trees are lost at a high rate, then finding alternatives would be challenging for the bats and they would likely be forced to adopt suboptimal roosts.

5.13. Given that these bats are critically endangered already, and facing numerous accumulating threats, if bats are also forced to use poorly insulated roosts, or if bats are killed during tree felling, then the Mt Messenger colony is at risk of going extinct.

6. SIGNIFICANCE OF THE MT MESSENGER AREA FOR LONG-TAILED BATS

6.1. Contractors for the Applicant used standard bat detectors to survey for bat activity along proposed roading routes through the Mt Messenger area. The Applicant found high levels of long-tailed bat activity in areas where it is proposed many trees will be felled during construction of the proposed

Mt Messenger Bypass (Figure 1 and Opus 2017a, 2017b, Chapman & Choromanski 2017, Chapman 2018).

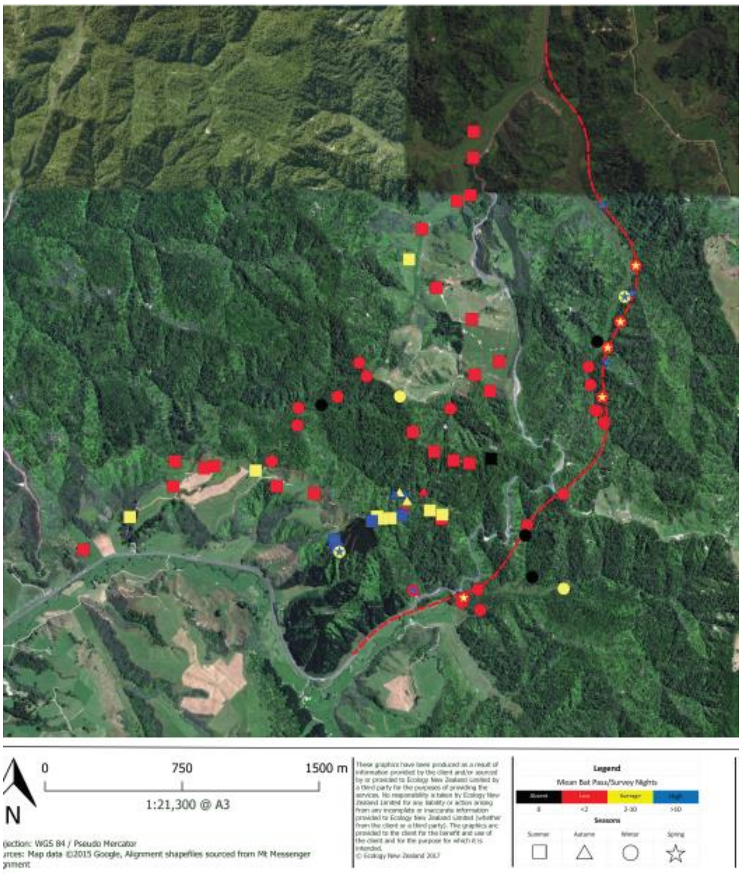
6.2. Long-tailed bats were recorded at 94% of survey locations, with activity rates of up to an average of 157 bat passes per night per station (e.g. Table 2.1, Chapman 2018).

6.3. Mr Chapman recorded feeding activity at several sampling stations and relatively high levels of bat activity at dawn and dusk on several consecutive nights, which he stated was potentially suggestive of bats departing a roost at dusk and returning to the roost at dawn (Chapman 2018).

6.4. Based on my experience in surveying for long-tailed bats over three decades across much of New Zealand, these findings are among the highest bat pass rates I am aware of (e.g. O'Donnell 2000b, 2000c; O'Donnell et al. 2006). These high activity rates were recorded despite the majority of the Applicant's bat surveys being conducted in winter when long-tailed bat activity is usually suppressed because of cold temperatures.

6.5. These results imply large numbers of long-tailed bats live at Mt Messenger. In addition, the Applicant has suggested that lesser short-tailed bats are likely to be present (Chapman & Choromanski 2017), although I think the latter less likely, given the Applicant's bat detector surveys have yet to find any there.

Figure 1. Locations of bat activity sampling points in the vicinity of the proposed Mt Messenger bypass (dashed red line). From Appendix E in Chapman (2018).



6.6. The New Plymouth District Council's Operative District Plan uses several criteria relevant to threatened species and their habitats to determine whether a natural area is significant under section 6(c) of the Act, four of which indicate the long-tailed bat habitat at Mt Messenger is significant:

(a) Appendix 21.1.1 Occurrence of an endemic species that is Endangered; Vulnerable; Rare; Regionally threatened; or of limited abundance throughout the country.

(b) Appendix 21.1.2 Areas of important habitat for nationally vulnerable or rare species; or an internationally uncommon species (breeding and/or migratory).

(c) Appendix 21.1.4 An area where any particular species is exceptional in terms of abundance or habitat.

(d) Appendix 21.1.5 Buffering and connectivity is provided to, or by the area.

6.7. These criteria are standard ones used widely by DOC and regional councils for assessing significance in the context of the RMA (e.g. O'Donnell 2000a; Davis et al. 2016). Criteria (c) and (d) are related to the Taranaki Regional Council criteria, which include representativeness and ecological context. I consider representativeness to indicate whether a habitat supports species typical of a particular ecological region or district and the quality of the site at representing the habitat type.

6.8. Unlike many places in contemporary New Zealand, the Mt Messenger Project Area supports a population of at least one species of bat representative of the North Taranaki Ecological District in the Taranaki Ecological Region and thus contributes to maintaining the full range of biodiversity present in a region.

6.9. In terms of ecological context, bats contribute to ecosystem functioning, particularly in their role as invertebrate predators, pollinators and seed dispersers. The fact that Mt Messenger forests are well-linked to the other forests in North Taranaki that are a focus for restoration by iwi, DOC and the community, indicates a high degree of ecological linkage and connectivity among bat feeding habitats in the district.

6.10. In any event, habitats supporting populations of threatened species are significant by definition. Relatively small populations of threatened species are significant in terms of sustaining currently reduced populations or providing opportunity for recovering the species. Every individual's potential breeding becomes crucial in maintaining populations of threatened species and buffering them against incremental loss and the possibility of extinction.

7. POTENTIAL IMPACTS OF THE MT MESSENGER PROJECT ON LONG-TAILED BATS

7.1. Internationally, Berthinussen et al. (2013) concluded that roads have been shown to have a negative impact on bats, acting as a barrier to movement and causing direct mortality due to collisions with vehicles (Lesinski 2007, Kerth & Melber 2009, Berthinussen & Altringham 2012 and numerous other references). The habitat surrounding roads may also become unsuitable for bats due to light, noise and chemical pollution.

7.2. The NZTA Bat Management Framework includes the following findings:

(a) Roads can have several effects on bats ranging from direct impacts, such as mortality through tree felling and vehicle collisions, to behavioural changes in response to the habitat changes resulting from both road construction and use.

(b) Road construction causes significant and largely permanent habitat loss; roads act as barriers and fragment the landscape.

(c) Roads affect bats by severing their flight paths and depleting roosting habitat by removing trees.

(d) New Zealand research showed a negative relationship between bat activity and night-time traffic volume.

(e) Orientation and movements through the landscape may also be compromised by light pollution around roads, and photophobic species may be deterred from normal commuting behaviours by increased artificial light levels.

7.3. The potential adverse effects of the proposed Mt Messenger bypass on long-tailed bats would be:

(a) Disturbance, direct deaths, injury and/or displacement of bats through felling of roost trees during construction.

(b) Loss and fragmentation of feeding habitat and shelter from felling of feeding habitats along the proposed route.

(c) Loss of critical breeding roosts leading to possible extinction of the Mt Messenger long-tailed bat colony.

(d) Increased noise and vibration and introduction of permanent lighting influencing feeding and risk of collisions between vehicles and bats as vehicle speeds and traffic rates increase.

(e) Impacts of construction (noise, vibration, light disturbance during night works, and operational lighting) on feeding.

7.4. These adverse effects are acknowledged by the Applicant in the ELMP (Section 2.3) and verified by Wildlands (2018).

7.5. Even if breeding females and their young are not killed directly during tree felling, the loss of even one or two breeding roosts could be catastrophic if they cannot find alternative sites. As stated, breeding success is significantly lower where bats are forced to use suboptimal roosts (O'Donnell & Sedgeley 2006; Borkin et al. 2011).

7.6. Long-tailed bats are more likely to be crushed or killed when trees are felled than flying birds because they sleep in tree cavities during the day. They often enter a state of 'torpor' (akin to what people think of as 'hibernation') at any time of the year. Thus, they can take a minimum of 15 minutes to wake even when disturbed. If bats are in torpor, then they are unlikely to wake up in time to escape when trees are felled. Until the long-tailed bat colony roosting area is identified I cannot discount the possibility that there will be direct deaths and injury of bats roosting and breeding in trees when they are felled.

7.7. The Applicant underestimates the ecological significance of some of the vegetation present in the project area that are targeted for clearance. Several of the vegetation types summarised as "low ecological value" (Singers 2017; ELMP Table 2.1) contain features that may be significant as long tailed bat habitat. 'Ecological value' is a much broader concept than that described, and the significance and ecological values of the vegetation should be viewed more widely than simply plant species composition and rarity of the plant community types. For example, during a long-tailed bat radio tracking we undertook in the Western King Country, we found 6 long-tailed bat roosts in tree ferns, and

Borkin & Parsons (2011) found long-tailed bats roosting in tree ferns in Kinleith Forest.

7.8. Although the Applicant rates manuka scrub as 'low ecological value', in a foraging study in Fiordland, we found manuka scrub provided important seasonal food supplies for long-tailed bats, particularly once young bats become independent in late summer (O'Donnell 2001; Jansma 1996). The ELMP also mentions willow removal (Section 4.6.4.3). Although many consider willows weeds, in South Canterbury at least, willows provided important breeding roosts for long-tailed bats (Sedgeley & O'Donnell 2004). Thus, manuka scrub and willows could be significant in instances where high levels of bat activity are found.

7.9. Other tree species commonly used for roosts by long-tailed bats in central North Island forests include many species affected by the Mt Messenger roading project, including kahikatea, tawa, mangeao, rimu, miro, matai and standing dead trees (Gillingham 1996; O'Donnell & Sedgeley 2006).

7.10. I consider the potential impacts of the Mt Messenger project on long-tailed bats to be major and significant.

7.11. Thus, I disagree with Mr Chapman that he has taken a "conservative, precautionary" approach by assessing "the unmitigated magnitude of effects …to be Low" and that correlates to an overall level of effects of "Moderate" for long-tailed bats.[2] . Given the uncertainty about where bats actually roost and feed in the project area, the magnitude of effects could be at least moderate if feeding areas only are cleared but very high if roosts or breeding trees are felled.

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[2] Chapman EIC at [10] and [42(c)].

7.12. Although Mr Chapman acknowledges that road construction will also lead to the loss of some potential foraging habitat and roost trees may be felled, he then states that "it is unlikely roost availability is a limiting factor on the bat population in the general area".[3] Mr Chapman provides no evidence for this assertion and I am unaware of any studies of roost availability in the project area. This contrasts with the studies of long-tailed bats elsewhere in New Zealand I have referred to in section 4 of my evidence, which suggest that breeding roost sites are extremely specialised with very limited abundance in the landscape.

7.13. Mr Chapman further suggests that "…the construction of the Project will result in the loss of less than 1% of the potential habitat for bats in the wider Project area".[4] This conclusion cannot be reached as no one has mapped the actual long-tailed bat habitat in the area. The area of habitat lost could equally be substantially more than 1%.

8. THE ADEQUACY OF INFORMATION PROVIDED TO EVALUATE IMPACTS OF THE PROJECT

8.1. It seems clear that the area proposed for the bypass is significant for bats. However, there is considerable uncertainty about the importance of specific sections of bat habitat along the proposed route.

8.2. In my opinion, the Applicant has not provided enough information to assess the potential adverse effects of the Mt Messenger Bypass on long-tailed bats. At a minimum,

[3] Chapman EIC at [42(c)(i)].

[4] Chapman EIC at [42(c)(ii)].

foraging habitats will be cleared and lost. There is substantial uncertainty around whether breeding trees will be felled.

8.3. The Applicant has not undertaken a radio tracking study to determine where the actual breeding roost trees are located, even although the NZTA Bat Management Framework recommends this (I discuss the NZTA Bat Management Framework further below).

8.4. In the absence of a radio tracking study, the expert witnesses appearing for the Applicant cannot provide figures on the order of magnitude of how many bats might be killed, disturbed or displaced in the area affected by development in the proposed bypass.

8.5. If breeding and roosting trees lie within the Project Area, as suggested by the Applicant's experts (e.g. Section 4.2.1 & Table 3.1.1 Chapman & Choromanski (2017); Section 2.3.1 Chapman 2018), adverse effects will occur when trees are destroyed, even if bats are not in them at the time of felling. Long-tailed bats use traditional areas to roost and always return to them even though it may seem that there is other apparently suitable forest nearby (O'Donnell & Sedgeley 1999). They have a set number of preferred trees they move around on a regular basis in the breeding season. Frequently, they only stay in a breeding roost for one or two nights before moving on to another roost.

8.6. Having said that, they demonstrate high site fidelity to existing roosts and their specific roosting areas, and they move on a strict rotation among trees during the breeding season. They are very slow to discover new roosts in the short term and have strong homing ability (O'Donnell 2001; O'Donnell & Sedgeley 1999, 2006; Guilbert et al. 2007).

Thus, they are almost always moving around the same pool of preferred roost trees. So far, in the Eglinton Valley in Fiordland, they have been using many of the same roosts for 25 years, and likely far longer. Their routine is so strict, that they often use the same roost on the same day each year (O'Donnell & Sedgeley 2006). Although young bats seem to actively search out new trees on occasion, probably to account for occasional tree falls, they still do so within the traditional roosting home range.

8.7. Overall, the only effective way to resolve potential adverse effects is to remove significant amounts of uncertainty through rigorous identification of bat roosts and important feeding habitats followed by their protection prior to granting the consents. That would enable realignment of sections of the proposed bypass to avoid both roost and feeding sites.

8.8. The standard way to determine where roosts are located is by catching a sample of bats, attaching radio transmitters, and following them back to their roost sites. Such work should involve following a good number of bats during different seasons. Radio tracking should involve tracking both sexes and age groups because breeding females and juveniles are likely to have different requirements from males (and each other). Because bats move to new roost sites frequently, it takes time to find the true extent of the breeding trees. For our DOC radio tracking studies, we generally allocate at least a whole breeding season (October-February) to define roosting areas at a minimum because catching bats is difficult, because their echolocation calls can detect most trapping devices. For example, I tracked 60 bats over three summers to describe the roosting and foraging ranges of long-tailed bats in the Eglinton Valley (O'Donnell 2001).

8.9. The Applicant only spent 9 nights using 5 harp traps early in the summer to try and catch bats for a radio tracking study at Mt Messenger (Chapman 2018). In my opinion, the Applicant would have been very lucky to catch bats in this time with so little effort. In addition, at that time of year female bats are usually heavily pregnant and are far less mobile than normal. It is also likely that if they did their capture work later in the summer when young bats begin to fly in the first instance, they would have had a much better chance of finding good areas to catch and track from.

8.10. The Applicant defines "significant trees" as those being large and old (typically emergent) and/or relatively uncommon, and/or having significant habitat value for other flora and fauna (Singers 2017, P.10). Further, it is stated that there are 17 of them along the route (ELMP, Section 3.2, p.11).

8.11. Considerable research on New Zealand bats demonstrates that bats roost in a wide range of trees from 14 centimetres (cm) in diameter (dbh) upwards. For example, around Hamilton, long-tailed roosts ranged in size from 15.5–60 cm dbh (Dekrout 2009), in South Canterbury 18–109 cm dbh (Sedgeley & O'Donnell 2004), in Fiordland 20–222 cm dbh (Sedgeley & O'Donnell 1999a), Western King Country 14–189 cm dbh (O'Donnell & Sedgeley 2006; C. O'Donnell unpubl. data), Kinleith 15-71 cm dbh (K. Borkin, pers. comm.), Hawkes Bay, 50–140 cm dbh (Gillingham 1996), Pureora 25 -180 cm dbh, and Maruia 23-170 cm dbh (Unpubl DOC files).

8.12. In recent roading cases where DOC has been involved in permitting under the Wildlife Act (1953), parties have accepted trees >15 cm dbh as the cut off for identifying significant trees that are high risk long-tailed bat roost trees.

9. AN ASSESSMENT ON THE ADEQUACY OF MITIGATION AND CONDITIONS OFFERED FOR LONG-TAILED BATS

9.1. Overall, the proposed conditions and mitigation actions proposed by the Applicant as outlined in the ELMP to avoid, remedy or mitigate effects on long-tailed bats do not offer sufficient certainty of the Applicant's stated objectives for long-tailed bats for a "no net loss". Similarly, the actions outlined would be inadequate to ensure achievement of "a net benefit of biodiversity values, within the medium term" (proposed Bat Management Plan, Section 5.1.1) unless certain additional conditions are met.

9.2. The actions suggested in the ELMP with respect to long-tailed bats are inadequate for protecting roost trees in particular. I disagree with Mr Chapman who states that the effects will be "minor and short term".[5]

9.3. Despite the ELMP and baseline bat reports (Opus 2017a, 2017b; Chapman & Choromanski 2017, Chapman 2018) repeatedly listing a wide range of adverse effects, there appear to be no specific actions listed in the Bat Management Plan to demonstrate how the Plan will avoid, remedy, mitigate, and offset potential adverse effects in respect to long-tailed bats and:

(a) Noise, lighting and vibration during construction;

(b) Fragmentation;

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[5] Chapman EIC at [88]: *"While I consider VRPs to be effective at minimising direct effects on bats during vegetation removal, as stated above there may be some residual, albeit minor and short-term effects on bats as a result of the Project. Those potential effects stem from the loss of roosting and foraging habitat and fragmentation effects of the Project."*

(c) Loss of feeding habitat;

(d) Loss of breeding roosts;

(e) Increased collisions between vehicles and bats.

9.4. **Adequacy of Pest Management Plan:** The Applicant proposes a Pest Management Plan (PMP, Section 9, ELMP) and proposed Condition 32 for compensating for adverse effects on bats. The PMP has a multi-pest species focus (rats, mustelids, possums, pigs and goats) with the intention to hold all pest species at low densities in perpetuity, sufficient to allow the permanent recovery of many indigenous plant and animal communities. Mr MacGibbon and Mr Chapman suggest in their evidence that this plan would benefit the long-tailed bat population.

9.5. I disagree with Mr Chapman that the PMP will "secure the long-term future of the long-tailed bat population in North Taranaki."[6] As I will now explain, if the PMA is large enough, it will be more likely to help one colony, but not those remnant colonies in Hutiwai and Waitaanga forests to the north of Mt Messenger.

9.6. The PMP specifies a Pest Management Area (PMA) of 3650 hectares for bats. Such an area is likely to reduce the adverse effects of the Project for long-tailed bats only if certain conditions are met.

9.7. The 3650 ha may have been adequate alone if the Applicant had undertaken a radio-tracking study to identify bat roosting areas and confirm their presence in locations and numbers within the PMA sufficient to ensure benefits to the

[6] Chapman Supplementary evidence at [13].

population. However, given this has not occurred, in my opinion a larger area (5000 ha or more) is required to provide an adequate level of confidence that the PMA would in fact protect bat habitats. For this to occur, two conditions must be met, as follows.

9.8. First, the proposed Pest Management Plan would need to be implemented, with long-term certainty, along-side other local pest control initiatives with the same pest control targets and methods, so that the combined local area of pest control were > 5000 ha.

9.9. Secondly, the PMA would need to be adequately buffered against reinvasion by pests to be effective. In my opinion, current buffers proposed in the PMP are inadequate for this purpose. If suitable buffering cannot be achieved, consideration should be given to implementing the PMA in a more defendable block of c. 5000 hectares of forest with a remnant bat population in North Taranaki, for example in North Waitaanga forest, approximately 25 km north-east of Mt Messenger.

9.10. I expand on these matters below:

9.11. **Size of the pest management area:** A compensatory pest control programme in relation to the adverse effects of the Mt Messenger Bypass has the potential to benefit long-tailed bats, but only if the pest control area is of sufficient size and quality to have a high probability of maintaining or enhancing the breeding success and survival of long-tailed bats.

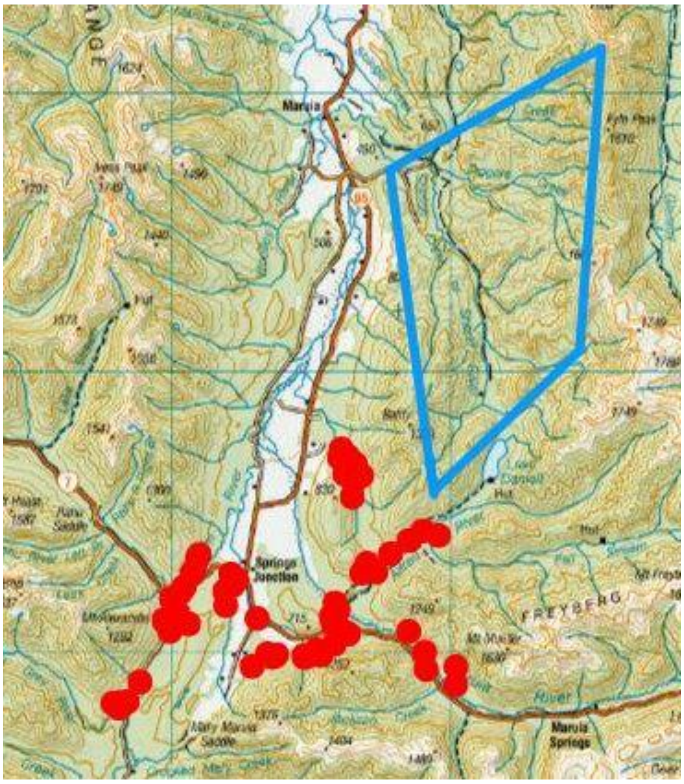
9.12. For pest control to be effective at maintaining or restoring long-tailed bat populations, annual survival of adult female long-tailed bats must be greater than 79%, as determined by mark-recapture studies. If survival is lower than this, then populations will decline (O'Donnell et al. 2017).

9.13. The PMA is not designed to the standard required to obtain benefits for bats, based on evidence from other studies in New Zealand. A pest management area for long-tailed bats should be 5000 hectares in scale at a minimum. The choice of 5000 hectares is a minimum precautionary area for protection of long-tailed bat populations and reflects the uncertainty over where exactly breeding roosts are in the landscape, the possible home range size of the local bat colony, and the strong need to have a safe core area of habitat buffered against pest reinvasion.

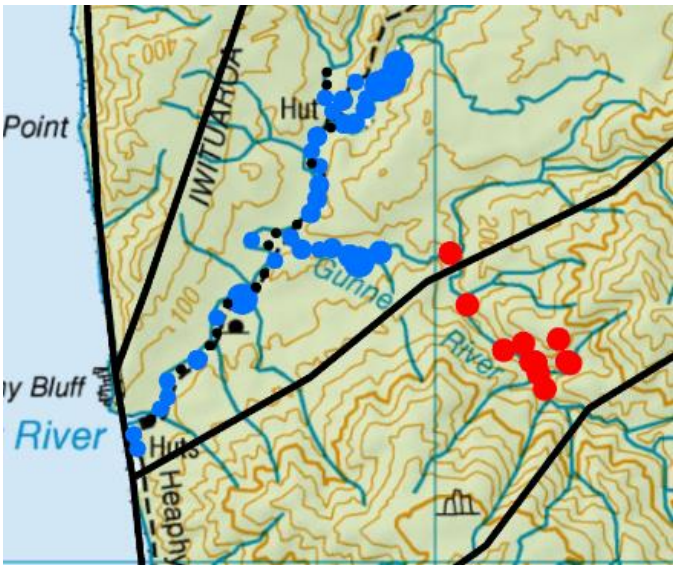
9.14. The Department of Conservation implements pest control at scales of 5,056 – 20,303 ha (average 13,674 ha) in its bat management areas in similar forest types in the North Island for these reasons. We have learnt that when we do not do radio-tracking studies we can designate management areas that are too small. For example, in the Maruia area in 2006 we designated 7942 ha for pest control (based on bat detector records). However, subsequent radio tracking over 4 seasons identified 65 roosts, none of which were in the management area (Figure 2a). The pest control programme has subsequently been increased. Similarly, in the Heaphy management unit, all but one roost was outside the original proposed management area (Figure 2b)

Figures 2a and b: Locations of bat roosts in relation to planned pest control in bat management areas Maruia and Heaphy.

(a) Maruia [red dots = bat roosts found; blue line = 2006 pest control area]



(b) Heaphy [Blue dots = records from bat detector surveys, red dots = bat roosts found subsequently] [original management area top - the lower black line represents how the management area was extended to the south].



9.15. Predator control trials for long-tailed bats in the Eglinton Valley found that control over small-sized areas (650 ha) was inadequate to benefit long-tailed bats (<60% annual survival achieved; Figure 3 below; O'Donnell et al. 2017). Similarly, pest control over c. 950 ha of short-tailed bat roosting area failed to get survival over c.50% (Figure 3; Edmonds et al. 2017; DOC unpubl. data) and an intensive bait station network at Pureora covering c.930 ha has yet to result in recovery of long-tailed bat numbers (average 74% survival from 5 seasons). These failures were primarily because the control areas and buffers were too small to prevent constant reinvasion of rats, which are a key predator. In this case, the roosting trees were all identified, and control focused on just protecting the immediate vicinity of the roosts.

9.16. When control was increased to 3350 ha, we achieved the desired survival of >80%/annum for most colonies (Figure 3), and the bat population is now increasing. Again, the predator control was specifically focused on known roosts. If the locations of roosts are not known, then the area of control needs to be larger to provide sufficient confidence that there is a large enough buffer with low pest numbers around the roosts.

9.17. Mr Chapman suggests 3350 ha is adequate for pest control at Mt Messenger based on my research (O'Donnell et al. 2017).[7] However, the context for these comments is different to Mt Messenger. In the Eglinton Valley we undertook due diligence radio-tracking to identify the bat roosts, thus the

[7] Chapman Supplementary Evidence at [14] - [18].

3350 ha of pest control was specifically focused around known roosting areas. As stated, this work has not been done in the Mt Messenger project area.

9.18. Therefore, at a site where the breeding trees have not been identified, planning must maximise the chance of the predator control area overlapping the area of the breeding trees. The larger the area, the greater the probability of protecting the breeding trees. I consider that 5000 ha is a pragmatic minimum area to maximise the chance of protecting roost trees over sufficient area, where we can be reasonably confident that survival will be ≥80% with sustained control.

9.19. Mr Chapman also suggests that the intensity of predator control proposed by the Applicant will be more effective in recovering bat populations in comparison to periodic pest control carried out in response to population irruptions as was done in my Fiordland studies.[8] In reality, the opposite is true, because the podocarp-hardwood forests of the North Island have higher numbers of predators all the time (e.g. Innes et al. 1995) as a result of more constant food supplies. Thus, North Island sites require more intensive, constant predator control to have a chance of keeping rat tracking rates at <5% tracking rates.

9.20. Mr Chapman further suggests the smaller sized PMA of 3,650ha is adequate as he states long-tailed bats have a smaller home range size in areas where habitat is fragmented and patchy.[9] This is incorrect. Mr Chapman quotes the ranges of *individual* bats in his examples, rather than area

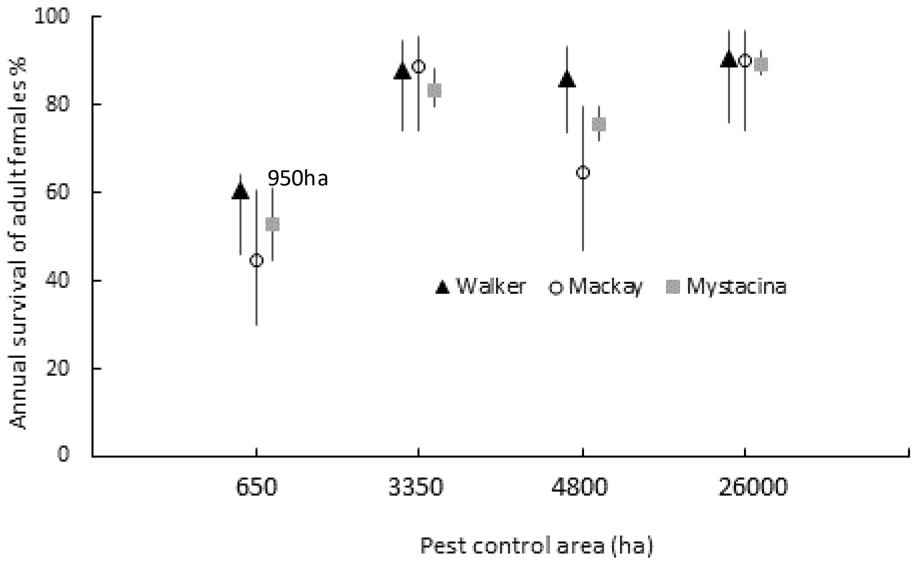
[8] Chapman Supplementary evidence at [19].

[9] Chapman Supplementary evidence at [20].

that a colony requires. While long-tailed bats in Fiordland do have the largest home ranges known, ranges of bat colonies studied in fragmented habitats in the North and South Islands are similar in size or larger to the size of the proposed PMA. Colony home range width was 12 km in similar habitat to Mt Messenger in the Piopio area to the north (C. O'Donnell, Unpublished data), 8.5 km in 2 studies of these bats in the fragmented habitats to the south of Hamilton (Dekrout 2009; Davidson-Watts Ecology 2018), and 9 km in the fragmented landscapes of South Canterbury (O'Donnell 2000c; Sedgeley & O'Donnell 2004) The maximum width of the proposed PMA is 9 km, suggesting that long-tailed bats could easily range wider than the proposed PMA in this landscape.

9.21. In summary the proposed PMP may sustain the local long-tailed bat colony, but only if it implemented, with long-term certainty, along-side adjacent local pest control initiatives (e.g. Paraninihi) with the same pest controlled targets so that the collective area of pest control is > 5000 ha.

Figure 3: Annual survival (± 95% confidence intervals) of adult female long-tailed bats (Walker and Mackay colonies) and short-tailed bats (Mystacina colony) from three colonies in Fiordland following pest control at a range of scales. Survival was lower than required to maintain populations using bait station networks of 650-950 ha but when using networks of bait stations of 3350-4800 ha or aerial broadcast toxins over 26,000 ha, survival was usually significantly higher and enough to sustain populations.



9.22. **Buffering the PMA adequately:** A large proportion of the proposed PMA is designated as buffer against reinvasion by pests, so the effective area of habitat for protection of long-tailed bats to best-practice standards is in reality <2590 ha (ELMP Section 9.3, Page 99).

9.23. Mr MacGibbon rightly points out that a buffer area is needed so that "invaders hopefully get caught before they do damage to the conservation target" .[10]

9.24. However, the shape, width and area of a buffer has to be at a scale that matches the movement distances of the predators being targeted for control if it is to achieve the desired outcome. Stoats move on scales of many kilometres (Murphy & Dowding 1994, 1995) as do cats (Pierce 1987; Gillies & Fitzgerald 2005; Recio et al. 2010). Ship rats move on smaller scales, although these can still be up to 800 metres at a time (Pryde et al. 2005b). Thus, home range widths of target predators should be used to guide the design of buffer widths. In the case of the PMA proposed as part of this

[10] MacGibbon EIC at [103].

Project, buffer widths are very narrow relative to the movement scales of stoats and cats in particular.

9.25. In some parts of the PMA, there is no buffer between the PMA and surrounding habitats (e.g. north east and south-west of the PMA).[11] Further, Mr MacGibbon notes that the buffer area for stoats is 500 metres from all the PMA's edges.[12] If this area is relied on as a buffer then this further reduces the potential area of effective predator control to something in the order of 1500 ha (rather than 3650 ha).

9.26. These buffer widths are barely wide enough to reduce reinvasion by ship rats and inadequate for stoats and cats.

9.27. As stated if suitable buffering cannot be achieved, consideration should be given to implementing the PMA in a more defendable block of c. 5000 hectares of forest with a remnant bat population in North Taranaki, for example, North Waitaanga forest, c. 25 km to the north-east.

9.28. **Vegetation removal protocols:**

9.1. The focus of the Bat Management Plan is on implementation of the bat vegetation removal protocols (VRPs) to minimise the likelihood of individual bats being killed or injured during the tree felling process. Condition 29 of the Draft Conditions refers to "Vegetation removal in accordance with NZ Transport Agency (the Transport Agency) research report 623 'Effects of land transport activities on New Zealand's endemic bat populations:

[11] Figure 1 in Mr MacGibbon's Supplementary evidence.

[12] MacGibbon Supplementary evidence at [25].

reviews of ecological and regulatory literature' (Smith et al. 2017)".

9.2. Mr Chapman states that VRPs are the "primary mitigation measure to specifically address the potential effects of the Project on bats"[13] and that mitigation of loss of breeding trees "is a potential effect that can be avoided through standard mitigation measures (i.e. VRP), and a range of other measures are being put in place to address the effects of the Project on bats".[14]

9.3. I disagree with this suggestion. VRPs are a 'last resort' action in the 'avoid, remedy, mitigate, offset, compensate' hierarchy reflected in the NZTA Bat Management Framework.[15] The primary focus on use of the removal protocols does little to guarantee the survival of the Mt Messenger bat population, largely because the consequences of significant habitat loss are not addressed by this action. Breeding roost trees are rare and specialised features of the landscape that tend to be hundreds of years old and are almost irreplaceable except over very long time frames. In addition, tree felling protocols attempt to minimise harm to

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[13] Chapman EIC at [49].

[14] Chapman EIC at [43].

[15] Appendix D. For example, refer D4.4 on page 189 setting out the mitigation hierarchy, commencing: "*Managing the impacts on bat populations should be based on a series of essential, sequential steps taken throughout a project's life-cycle in order to eliminate or limit any residual negative impacts on bats and other biodiversity values. This consists of: 1 Avoid: measures taken to avoid creating impacts from the outset. This is often the easiest and most effective way of reducing potential negative impacts, but it requires biodiversity to be considered in the early stages of a project. It places large emphasis on pre-construction bat surveys to locate potential roosts (particularly maternity roosts), feeding sites and flight paths, with particular focus on avoidance of roost destruction and disturbance, and avoidance of flight paths. This may necessitate changing the location/route/alignment or selecting a different option. …*" and Appendix DE "Impact Management Strategies".

bats, but do not guarantee this, as some bats will always remain undetected.

9.4. Nevertheless, I agree with proposed Condition 29 in relation to VRPs with three amendments.

9.5. First, in addition to trees >80 cm in diameter (dbh), I would prefer that the VRP be applied to all trees that are potential bat roosts trees between 15 cm and 80 cm diameter (dbh)(see Section 8.11 above), because there is the potential for bats to occupy these and be killed or injured. However, I would be happy for this Condition to state that the VRP should be applied to these trees at the discretion of the 'Supervising Bat Ecologist'. This is because the 'Supervising Bat Ecologist' must already have been certified by DOC as competent to assess whether trees are potential bat roosts.

9.6. Secondly, I disagree with Condition 29 (c)(i)(2) that defines the features that designate a potential bat roost as supporting "five or more nested epiphytes". The NZTA Bat Management Framework already clearly describes the features that indicate a potential bat roost (Section 5.7.5 ELMP).

9.7. Thirdly, while the draft Condition states that the VRP will follow the NZTA Bat Management Framework, several of the specifics of the tree felling protocol (Mr Chapman's EIC and Section 5.7 BMP) have been modified, jeopardise the integrity of the NZTA Bat Framework, and do not match the standards agreed by roading authorities and DOC in previous consenting and permitting applications. Specifically, the protocols must be prescriptive rather than suggestive, as their strict implementation is critical to maximising the chance of identifying trees with bats present.

"Should" or "ideally" statements should be replaced by "must do" statements. For example:

(a) Felling of high risk trees must be strictly limited to the summer months (rather than "ideally should not be removed from May-September" as stated (Section 5.7.9.1, P. 61, BMP);

(b) Temperatures for Automatic Bat Detector monitoring must be >10°C for the first 4 hours after sunset, to maximise the chance that bats are actually active during the sampling periods (rather than 'ideally' Section 5.7.7.2, P. 60, BMP);

(c) Surveys must be undertaken when humidity is >70% (rather than simply stating the optimum humidity Section 5.7.7.3, P. 60, BMP);

9.8. <u>Felling of trees limited to summer months:</u> There are considerable risks in relation to felling trees in winter. In my experience, it is virtually impossible to find torpid bats without radio tracking. They are also more likely to be spread individually across many more roost trees outside of the breeding season.

9.9. I have been involved in four studies of torpor in New Zealand bats, two on long-tailed bats (O'Donnell 2005; McNab & O'Donnell 2018), and two on short-tailed bats (Sedgeley 2001b; McNab & O'Donnell 2018). Torpor is used as an energy saving device in long-tailed bats. Winter torpor is typical in temperate zone bats. We found that use of torpor was even common in long-tailed bats during summer. Both male and female long-tailed bats when in solitary roosts used torpor 80% of the time and averaging 12 hours per day, which would make them difficult to detect when checking trees or to arouse should they be disturbed (O'Donnell 2005). They still entered torpor when roosting in groups but for less time (35% of days and averaging 9 hours per day). What Sedgeley's (2001b) study shows us is that even when a good proportion of short-tailed bats was active on winter days, another proportion were using torpor and impossible to detect without radio tracking.

9.10. Lighting effects: Evidence from studies of bats around Hamilton indicates long-tailed bats are less active in areas with higher densities of street lights (Le Roux & Le Roux 2012). The Bat Management Plan deals briefly with effects of night lighting during construction (Section 5.7.11) and Draft Conditions 39 and 40 set standards for lighting in relation to bats. These conditions seem appropriate. However, given that this area is currently unlit, I agree with Wildlands (2018) that it should remain so as far as possible to reduce the potential for unnecessary impacts on bats. If lighting is required for safety purposes, the lights should be designed (both in terms of shading and light wavelengths) so as not to attract bats to the roadway.

10. CONCLUSIONS

10.1. The Project Area contains significant habitats for a population of threatened long-tailed bats, and perhaps short-tailed bats, making the area significant in the context of section 6(c) of the RMA.

10.2. Sustaining wildlife populations requires ensuring the persistence of sufficient amounts of foraging, roosting and breeding sites for species to maintain viable populations in perpetuity. There needs to be sufficient habitat available so that the bats can disperse, and still thrive, if unfavourable conditions develop in particular habitats within the greater habitat matrix. Maintenance of foraging habitat would be meaningless without protection of a viable number of preferred roosting or breeding sites - and *vice versa*.

10.3. I identify and describe significant and major impacts that are likely to accrue, especially if the breeding roost trees and foraging habitats are affected.

10.4. The Applicant has not provided enough information to fully assess impacts of the proposed bypass because they have done insufficient research to identify precisely where significant bat sites occur, particularly with regard to the location of breeding roost sites and foraging habitats along the proposed route. Thus, the effects of the Project are uncertain but potentially catastrophic for long-tailed bats because felling of breeding trees during road construction may lead to extinction of the Mt Messenger bat population.

10.5. If breeding trees are felled, I predict reduced breeding success and/or reduced adult survival and/or fragmentation of social groups threatening population viability.

10.6. Actions in the proposed Bat Management Plan and associated draft conditions do not relate to the full suite of adverse effects identified and thus their potential benefits to sustaining the Mt Messenger long-tailed bat population, and assuring “no net loss” of long-tailed bat habitats are uncertain.

10.7. The Applicant’s proposed Pest Management Area has the potential to compensate for loss of long-tailed bats. While the predator control measures and targets proposed generally appear to reflect best practice, the size of the area proposed and adequacy of buffering is in my opinion insufficient to provide confidence that benefits for bats would be realised.

10.8. To have a sufficiently high probability of containing the Mt Messenger long-tailed bat population, and sustaining it over time, the PMA should encompass a minimum area of 5000 hectares of effective pest management in perpetuity.

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