**BEFORE INDEPENDENT HEARING COMMISSIONERS**
**APPOINTED BY THE HAMILTON CITY COUNCIL**

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| **IN THE MATTER** | of the Resource Management Act 1991 (**Act**) |
| **AND** | |
| **IN THE MATTER** | of an application for subdivision and land use consent for the Amberfield development pursuant to the Act. |
| **APPLICANT** | Weston Lea Limited |
| **CONSENT AUTHORITY** | Hamilton City Council |

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# EVIDENCE-IN-CHIEF OF STUART PARSONS FOR WESTON LEA LIMITED

**Dated: 12 April 2019**

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**SUMMARY OF EVIDENCE**

1. My name is Dr Stuart Parsons and I am zoologist specialising in bat biology. I summarise my evidence, according to the key headings in this statement, as follows:

***Relevant Ecology of the Long-tailed bat*** *(Page 9)*

(a) Long-tailed bats are one of two extant bat species found in New Zealand. They are listed by the Department of Conservation as Threatened - Nationally Critical, having a high ongoing or predicted decline and being conservation dependent. The bats are widespread in the south of Hamilton, but their numbers are likely low. They are threatened by ongoing habitat clearance and predation by introduced mammals. Despite this, they persist in highly impacted areas including peri-urban environments and plantation forest. Long-tailed bats are relatively flexible in their choice of roosts, having been found in caves, rock outcrops and a variety of native and exotic trees. They are aerial insectivores and generally hunt along the edges of vegetation.

***Historical bat activity, radio-telemetry and habitat associations in southern Hamilton*** *(Page 10)*

(b) In general, bat activity is restricted to southern Hamilton, with the Waikato River (and its riparian margins) and the associated gully systems providing essential foraging and roosting habitat. The bats appear to avoid dense urban areas and have a negative association with anthropogenic light (though these features are likely linked). Few maternity roost sites have been located, but those that have are in a variety of exotic and native trees. Recent radio-tracking studies conducted as part of the Southern Links roading project have greatly expanded our knowledge of bat movement in Hamilton and identified a number of new roosting sites. All fit the generally accepted pattern, and results agree with those of a predictive habitat model developed in 2017.

***Historical Bat Activity, radio-telemetry and habitat associations at the Amberfield site*** *(Page 12)*

(c) Little evidence exists of bats using the Amberfield site prior to investigations as part of this development. Acoustic surveys at adjacent sites such as Hammond Bush and the nearby riparian margin of the Waikato river show them to be an important site for bats. Radio-tracking studies showed that the Amberfield site fell within the broad home ranges of several bats, but their core (primary) areas did not include Amberfield. A predictive model of habitat-use by long-tailed bats showed that the majority of Amberfield is unsuitable habitat for long-tailed bats, with the exception of a few areas of mature vegetation.

***Bat activity and habitat associations at the Amberfield site, conducted as part of the consenting process*** *(Page 14)*

(d) Acoustic surveys of the Amberfield site show that bat activity over the site ranges from zero to moderate levels. The higher levels of activity are associated with the riparian margin (including the north-east terrace), southern gully, and east-west shelterbelt. The acoustic data also shows that bats periodically feed while over the site. The pattern of acoustic activity does not indicate that bats are roosting on the site, although subsequent radio-tracking work as part of the Southern Links roading project did locate three trees used by a single male bat. Two roosts were in the riparian strip while the third was on the perimeter of Knoll Park. It appears that the majority of bats are moving through the landscape to connect between habitat of high value to the east and west. These habitats include gullies and the Waikato River.

***Significance of the Amberfield site for long-tailed bats*** *(Page 14)*

(e) In my view several features of the Amberfield site are significant according to Section 11 of the Waikato Regional Policy Statement. These are the riparian margins, southern gully and east-west shelterbelt. As stated above, these features are significant in that they provide an important movement corridor, ensuring connectivity of bats through the broader landscape and periodic feeding opportunities. Other areas of the site are not preferred habitat for bats and activity

levels are low or zero. The significance of the single male bat found roosting on the site is difficult to determine at this stage. There is no evidence to suggest that Amberfield is a breeding site for bats.

***Adequacy of the proposed mitigation package for long-tailed bats*** *(Page 16)*

(f) The mitigation proposed appropriately targets the areas of significance for bats on the site. No high-quality (for bats) indigenous vegetation will be removed, and a large area will be planted to replace low-quality vegetation (including exotics). The riparian margins will be widened and buffered from human disturbance, and other areas enhanced. This will provide an enhanced connection point with key bat habitat across the river at Hammond Bush. The southern gully will be planted using native vegetation providing additional high-quality linkages through the landscape and into the gully system to the west. The east-west shelterbelt will be enhanced and protected, thus providing a higher quality commuting corridor for the bats. Impacts of lighting will be minimised through the use of bat-sensitive lights in public spaces and setback of dwellings from sensitive areas of the riparian margin.

***Addressing evidence of Gerry Kessels*** *(Page 19)*

(g) Mr Kessels states that there is insufficient evidence available to measure the impact of the Amberfield development on bats. I disagree. As stated above, I consider that the data provided has allowed for the evaluation of the significance of the site, the potential impact on bats if effects are not mitigated, the identification of significant habitat, and the mitigation of effects. Mr Kessels considers the entire Amberfield site to be significant for bats under Section 11 of the Waikato RPS. I disagree with this broad application of the RPS criteria, because it fails to account for the biology of the bats. i.e. it assumes that all areas are equally important for the bats simply because they are detected. Data collected from the site clearly identifies the key features used by the bats, and it is those that should be considered significant. Mr Kessels also identifies residual effects that remain after the application of proposed mitigation. The primary source of these effects is the time delay between vegetation plantings

and their subsequent effectiveness as buffers and new habitat for bats. In his evidence, Mr Kessels states that the magnitude of these effects are difficult to quantify, but still suggest additional compensation or off-set is required. It is my opinion that any unanticipated adverse effects that might occur will be identified through monitoring of the bat population. Unanticipated effects should be addressed, in the first instance, through remedial action designed to avoid or mitigate the effect. If remedial action does not work, the unanticipated adverse effects should be quantified to facilitate implementation of targeted offset mitigation or compensation. It is for this reason that I suggest a 10+ year monitoring programme be undertaken, with adaptive management implemented if unanticipated adverse effects on the bats are detected. This monitoring plan is detailed in the consent conditions.

**INTRODUCTION**

2. My name is Dr Stuart Parsons.

3. I am the director of Walkingbats, an environmental consulting company specialising in bats. I am also Professor and Head of the School of Earth, Environmental and Biological Sciences at Queensland University of Technology in Brisbane, Australia.

4. I have the following qualifications and experience relevant to the evidence I shall give:

   (a) I hold a BSc (Hons) and PhD in zoology from the University of Otago;

   (b) My PhD research focused on the acoustic ecology of New Zealand bats. Following this I worked as a post-doctoral research fellow at the University of Bristol (UK), again on the biology and bioacoustics of bats;

   (c) From 2001 – 2014 I was a Senior Lecturer and then Associate Professor in Biological Sciences at the University of Auckland. Since 2014 I have been Professor and Head of the School of Earth, Environmental and Biological Sciences at Queensland University of Technology in Brisbane, Australia. My duties include strategic leadership of the school (as part of the executive team) and the Science and Engineering Faculty. I teach (undergraduate and postgraduate), conduct high-quality original scientific research, and provide services to the University and community (such as committee membership, community outreach);

   (d) I have published more than 80 peer-reviewed scientific papers, edited two books and contributed chapters to a further eight. I am currently a member of the New Zealand Department of Conservation's Bat Recovery Group, the IUCN Chiroptera Specialist Group, and the Scientific Advisory Board of Bat Conservation International;

   (e) I have 27 years' experience in studying bat biology. My areas of research expertise include the ecology and behaviour of bats in New

Zealand and overseas (including: Australia, South Africa, China, Taiwan, UK, Trinidad and Tobago, and Belize); and

(f) My experience includes the assessment of bat activity and potential effects at the site of a proposed quarry extension at Puni (near Port Waikato); the effects of a runway extension at Hamilton International Airport on the roosting site of long-tailed bats; assessing and advising on the impacts of 4 sections of the Waikato Expressway on bats as well as the Mt Messenger bypass in Taranaki; and assessing and advising on the impacts on bats of the Hauāuru mā raki Wind Farm. Many of these assessments have incorporated the development or review of research and management plans specifically for long-tailed bats.

5. I have been retained by Weston Lea Limited to prepare a statement of evidence on its application for land use and subdivision consent from the Hamilton City Council (**HCC** or **Council**) for the proposed Amberfield development (**application**).

6. I am familiar with the application site having visited on 18 February 2019. I am also familiar with the surrounding landscape having conducted several studies on bats on behalf of the Waikato Regional Council, taken part in ecological assessments for the Hamilton and Cambridge sections of the Waikato Expressway, and supervised a PhD project on bats in southern Hamilton (Dr Andrea Dekrout).

7. I took part in the expert caucusing on bats held on 18 February 2019 and am a signatory on the Joint Statement of the Ecology Witnesses dated 22 February 2019.

8. In preparing this evidence I have reviewed the following documents:

(a) Amberfield – Peacocke Structural Plan: Terrestrial Ecological Assessment prepared for Weston Lea Ltd, 15 May 2018;

(b) Plans for the Application prepared by Harrison Grierson and Boffa Miskell;

(c) The Peacocke Structure Plan within the operative Hamilton District Plan (**District Plan**);

(d) Submissions on the Application;

(e) Response to section 92 Request for Further information submitted to HCC on 5 July 2018;

(f) The Long-tailed Bat Trapping and Radio Tracking Report Southern Links, prepared for AECOM by Davidson-Watts Ecology Ltd; and

(g) Scientific literature and reports associated with the biology of New Zealand's long-tailed bats.

**CODE OF CONDUCT**

9. I have read the Environment Court Code of Conduct for expert witnesses and agree to comply with it.

10. I confirm that the topics and opinions addressed in this statement are within my area of expertise except where I state that I have relied on the evidence of other persons. I have not omitted to consider materials or facts known to me that might alter or detract from the opinions I have expressed.

**RELEVANT ECOLOGY OF THE LONG-TAILED BAT**

11. The Long-tailed bat, *Chalinolobus tuberculatus,* belongs to the widespread family *Vespertilionidae*. It is one of only two bat species in New Zealand (a third is likely extinct) and is listed by the Department of Conservation as Threatened - Nationally Critical, having a high ongoing or predicted decline and being conservation dependent. There is little information on the number and distribution of Long-tailed bats in the Waikato Region, although concerted survey effort, usually associated with infrastructure projects around the Hamilton region, has located a number of populations.

12. Within native forest, Long-tailed bats roost during the day in holes and other suitable locations in trees. During the day bats go into torpor (a daily hibernation), which means trees used as roosting sites (particularly for pregnant and lactating bats) must be old enough to have developed deep knot holes or loose bark so that the bats have something to roost in, or clasp onto.

13. Long-tailed bats have been found to use a range of native and exotic tree species for roosting and have not been found to discriminate between tree species or forest types. They have been documented to roost in near-pristine, large old growth forests, in small degraded tree stands or isolated trees within an urban or agricultural setting, and in commercial pine forest. Individual bats normally have a number of trees in which they may roost on any given day and are not restricted to a single roost tree. They will also regularly change favoured roost trees. Throughout the year Long-tailed bats enter daily torpor while in their day roosts and may also go into true hibernation over the cold winter months (June to August inclusive).

14. Long-tailed bats feed nocturnally on flying insects, particularly flies and moths. Bats feed over open areas, along waterways and bush edges. They tend to use linear landscape features such as gullies, bush edges or tracks to transit between feeding and roosting sites. They prefer to hunt in more open areas since their ability to manoeuvre in dense bush is limited. Thus, Long-tailed bats foraging occurs:

    (a) along forest edges;

    (b) over low density regenerating Kanuka and Manuka;

(c) above wetlands; and

(d) over open water and along roads and clearings (lined with mature vegetation).

15. Bats have also been documented to forage and commute over open farm land where these also present linear landscape features like gullies, streams, and windbreaks.

## HISTORICAL BAT ACTIVITY, RADIO-TELEMETRY AND HABITAT ASSOCIATIONS IN SOUTHERN HAMILTON

### *Acoustic surveys and predictive models*

16. Past research, acoustic surveys, distribution modelling and anecdotal reports clearly demonstrate that the southern areas of Hamilton are important habitat for the nationally threatened long-tailed bat.

17. The PhD research of Dr Andrea Dekrout[1] first described the distribution of long-tailed bats in Hamilton and showed them to be restricted to the southern parts of the city including the area around Hammond Bush.

18. Dr Dekrout's research showed that the bats appear to rely on the gully systems around Hamilton, and their connections to the Waikato River, for movement, foraging and roosting. She also demonstrated that bat activity was negatively correlated with housing and street-light density.

19. Later acoustic surveys of the Hamilton region identified other areas of long-tailed bat activity, but the overall trend in habitat association referred to above was reinforced.

20. A 2011-12 acoustic survey conducted on behalf of Waikato Regional Council[2] (as part of Project Echo) showed that long-tailed bats were present at 16 sites (25.8% of the total surveyed), with all restricted to southern Hamilton.

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1 Dekrout, A. (2009). Monitoring New Zealand long-tailed bats (*Chalinolobus tuberculatus*) in urban habitats: ecology, physiology and genetics. PhD thesis, University of Auckland.

2 https://www.waikatoregion.govt.nz/environment/natural-resources/biodiversity/project-echo/hamilton-city-bat-survey-2011-2012/

21. The Mangakotukutuku and Mangaonua gullies and Waikato river were again shown to be the most important habitat feature for the bats.

22. Overall, activity levels were low with 70% of acoustic detectors recording less than 10 bat passes over 5 days. Native forest and riparian margin had the highest levels of bat activity.

23. In 2019, surveys conducted as part of the Southern Links project also found bat activity in southern Hamilton, with highest activity levels (median nightly bat passes greater than 50, or sites with median total bat passes greater than zero and a 75$^{th}$ percentile greater than 100 passes per night) associated with gullies, the Waikato River and remnant forest patches[3].

24. In 2017 I co-developed a predictive model of long-tailed bat distributions in Hamilton[4]. The model used results of previous bat activity surveys, as well as information on the vegetation, topography, and level of urban development to model likely bat habitat.

25. Once again, the value of the gullies and Waikato River were reinforced, but several new potential bat habitat areas were identified. Application of the same methods in Auckland was successful in identifying new areas of bat activity, but it is unknown if the same outcome has been achieved for Hamilton.

***Radio-telemetry***

26. Dr Dekrout radio-tracked 11 bats (10 male, one female) and found the bats roosting in small forest patches in pasture. Roost trees were exotic (e.g. English Oak, pine) or native (e.g. Kahikatea), with many bats found in dead or broken tree limbs.

27. Nine of the 12 roosts located were solitary (only a single occupant). Three were communal and all were in rural areas. All communal roosts were in small,

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3 Borkin et al (2019). Baseline acoustic monitoring of long-tailed bats for the southern links roading project, Hamilton: 2017 and 2018. Wildlands.

4 Crewther, C. and Parsons, S. (2017). Predictive modelling of long-tailed bat distribution in the Hamilton area. Report prepared for Hamilton Regional Council by Walkingbats Specialist Consulting.

rural, old growth forest groves. Two roosts were in English Oak and one in Kahikatea.

28. Analysis of core areas of bat movement showed a significant aversion to pasture and a preference for river and gully habitat.

29. The Long-tailed Bat Trapping and Radio Tracking (Southern Links) project tracked 11 bats (5 between January (5 females) and March 2018 (4 females and 2 males) and located 28 roosting sites.[5]

30. The study is particularly valuable because, unlike Dekrout, the majority of bats tracked were female.

31. The study once again reinforced the importance of the gully system surrounding Hamilton, as well as stands of native trees. The Waikato River was identified as an important link in bat movement patterns.

32. Of the 28 roosts located, 23 were in exotic or exotic tree plantations; no dominant tree species were identified. Bats also used artificial roosts boxes as roosts.

33. Of the 20 roost trees where bats could be seen emerging, 11 had more than 1 occupant.

34. The results of the Southern Links study agree well with my predictive model (i.e. Crewther and Parsons).

## HISTORICAL BAT ACTIVITY, RADIO-TELEMETRY AND HABITAT ASSOCIATIONS AT THE AMBERFIELD SITE

### *Acoustic Surveys and predictive models*

35. My predictive model (i.e. Crewther and Parsons) showed that much of the Amberfield site was unsuitable for bats, although sites with trees near the knoll and East-West shelter-belt were marginally suitable (a score of 70+ is deemed

[5] Long-tailed Bat Trapping and Radio Tracking Baseline Report Southern Links, Hamilton For AECOM 19 June 2018.

suitable habitat, and the Amberfield sites were rated 0.74, 0.74, 0.74 and 0.72).[6]

36. Neither Dekrout nor the Waikato Regional Council conducted acoustic surveys at the Amberfield site.

37. The acoustic surveys conducted by Wildlands for the Southern Links project did not survey the Amberfield site, but did survey 3 sites at Hammond Bush, immediately across the river from Amberfield's north-east terrace. They found moderate to high levels of bat activity at these sites.

***Radio-telemetry***

38. Radio-tracking by Dekrout showed that the Amberfield site was within the broad home range areas (assessed by 95% minimum convex polygons) of several of her individual bats, but the site did not form part of the core areas of any individuals.

39. Dekrout found no roosts at the Amberfield site.

40. The Long-tailed Bat Trapping and Radio Tracking (Southern Links) reported to date show no bats using the Amberfield site.

41. However, results from the recent radio-tracking of bats caught at Hammond Bush and Peacockes Lane (near to the Amberfield site) have not yet been released.

42. Verbal reports from Boffa Miskell staff involved in the tracking state that a single male was found to day roost (on his own) in 3 trees, one of which was on the Amberfield site. Two trees were along the river and one was on site, adjacent to Knoll Park.

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[6] See Figure 27, Page 35 of the report.

## BAT ACTIVITY AND HABITAT ASSOCIATIONS AT THE AMBERFIELD SITE, CONDUCTED AS PART OF THE CONSENTING PROCESS

43. Acoustic surveys of the Amberfield site have identified low to moderate levels of bat activity, focused mainly along the Waikato River and linear landscape features (e.g. hedgerows, windbreaks, remnant patches of trees).

44. Patterns of bat activity do not indicate that bats are roosting on the site (e.g. peak in activity up to 30 min before dusk, and then shortly after dusk). This is consistent with past radio-telemetry work.

45. Important features of the site identified through the acoustic surveys are: the riparian margins of the Waikato River (especially the section opposite Hammond Bush); the southern gully; and two linear vegetation features (one running east-west and the other north-south).

46. Relatively low levels of activity were associated with other features of the site, such as solitary trees.

47. Long-tailed bats prefer to feed along the edges of vegetation[7] where insects tend to accumulate at dusk and dawn. Long-tailed bats, and bats in general, also use linear features such as tree-lines and hedgerows for navigation when moving through the landscape[8].

48. Relatively few feeding buzzes (echolocation calls indicating a bat may be attempting to feed) were recorded.

## SIGNIFICANCE OF THE AMBERFIELD SITE FOR LONG-TAILED BATS

49. In my opinion the riparian strip, east-west shelterbelt and southern gully within the Amberfield site are significant habitat for the movement of long-tailed bats, as assessed using the Waikato Regional Policy Statement (**RPS**) (Section 11, Table 11.1, Parts 3 and 11). These features facilitate movement of bats from important habitat, east of Amberfield, to other important habitat to the west.

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7 O'Donnell et al. (2005). New Zealand Journal of Zoology, 33(2): 113-124.

8 Frey-Ehrenbold et al. (2013). Journal of Applied Ecology, 50(1): 252-261.

50. I understand from Mr David Serjeant that this does not qualify features listed above as significant natural areas under the ODP. Further assessment of this can be found in the evidence of Mr David Serjeant.[9]

51. It is my opinion the evidence to date does not suggest that the site is a significant feeding or breeding site for long-tailed bats.

52. It is my opinion that the presence of a single male roosting on the site, and the trees within which it roosted, is not important in terms of maintenance of the local population. However, the possibility of other individuals roosting on the site cannot be discounted based on the evidence at hand.

53. The Amberfield site lies between several features used by bats for foraging and roosting within southern Hamilton. These are the Waikato River and associated Significant Natural Areas, and the Mangakotukuku and Mangaonua gullies.

54. Hammond Bush forms an important "jumping off" point for bats transiting from the eastern to the western side of the river, and thus entering the Amberfield site.

55. Therefore, the value of Amberfield to the long-tailed bats is as a corridor that facilitates movement of bats between gully systems and the river.

56. Features within the Amberfield site that facilitate this movement are the river and its riparian margins, the east-west shelterbelt and the southern gully. All either act as - or have potential to act as - movement corridors.

57. Loss of these corridors could isolate bats from important feeding grounds, and potentially create smaller, fragmented populations that are less resilient to future disturbance. Such isolation and fragmentation may put the affected population at greater risk of extinction.

58. The development of the site avoids the loss or degradation of these significant sites, and they will be enhanced through planned vegetation work.

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[9] Evidence-in-chief of Dave Serjeant, paragraph 92.

59. Male long-tailed bats have been shown to be relatively non-selective in their roost choices[10] which may allow them to persist in more marginal habitats.

**ADEQUACY OF THE PROPOSED MITIGATION PACKAGE FOR LONG-TAILED BATS**

60. It is my opinion that the proposed package adequately mitigates for impacts of the Amberfield development on long-tailed bats.

61. The only potential unanticipated effect may be due to the presence of roosting bats on the site, in addition to the single male identified. However, evidence to support or refute their presence is insufficient.

62. Suitable mitigation for this potential unanticipated effect would be on-site pest control and erecting artificial roost boxes. Both provisions are accounted for in conditions 69(c) and 91b.

63. The potential loss of east-west connectivity due to the development of the Amberfield site represents the largest potential impact on long-tailed bats. Any degradation of the riparian corridor, either physically or through the impact of the development may also represent a threat to the bats.

64. The east-west shelterbelt is being retained, and enhanced, thus maintaining the key movement corridor (as detailed in condition 85).

65. Planting of the line of trees parallel to the existing east-west shelterbelt will enhance this movement corridor by providing an “avenue” down which the bats can move.

66. The avenue will provide the bats with shelter from the wind and from potential predators. The microclimate within the avenue of trees may also increase insect numbers, thus providing a potential food source for the bats. This is known to be preferred habitat for long-tailed bats (see para 15 above).

67. Underplanting of the shelterbelt will provide stability and longevity for the vegetation, thus assisting with the long-term preservation of the shelterbelt.

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[10] Borkin, K.M., Parsons, S. (2011). Acta Chiropterologica, 13(2): 373-383

68. The importance and positive impact of such an avenue was highlighted by long-tailed bat activity at the Lloyd property, adjacent to the Cambridge section of the Waikato Expressway, as part of work I undertook in collaboration with OPUS International on behalf of the New Zealand Transport Agency. At this site long-tailed bats exploit a parallel line of old English oak trees for movement and feeding.

69. Restoration of the southern gully will enhance the site for bats by providing an additional feature to assist the bats' east-west movement and connection to the Mangakotukutuku gully (condition 83). Gullies have clearly been identified as an important feature for bats in the Hamilton region (as detailed above).

70. The enhancement of the north-east terrace, immediately opposite Hammond Bush, will help to maintain the movement of bats on to the Amberfield site.

71. The width of the north-east terrace is similar to or larger than most natural areas on the eastern side of the river where bats are known to commute and roost. Thus, its dimensions offer reassurance that it will be effective.

72. The structure of the planting will provide several "avenues" down which the bats can move. As with the east-west shelter-belt, this will provide an environment conducive to movement.

73. Changes in the structure of the riparian strip due to weed control and planting may also have a positive impact on bat activity[11].

74. The time lag between construction-related impacts on the site and effectiveness of mitigation works (e.g. maturity of planting) represents a significant risk to the bats that must be managed.

75. Management of this time lag is detailed in the evidence of Mr David Serjeant[12], which refers specifically to a condition (condition 87) addressing the deferral of development until new vegetation is able to provide an effective buffer between bat habitat and new dwellings along the north-east terrace and the east-west shelterbelt.

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11 Threfall et al. (2016). Landscape and Urban Planning, 153: 28-39.

12 Evidence in Chief of Mr Serjeant, paragraph 96.

76. Other potential impacts on the bats caused by the development are lighting and noise.

77. Predictive models of light spill from bat-sensitive street lighting (along the riverside roads, roads adjacent to and crossing the southern gully, and those crossing the east-west shelterbelt; detailed in consent condition 86) onto the riparian margin and north-east terrace indicate that levels will be close to zero.

78. The structure of planting along the north-east terrace will also provide shelter from any residual light-spill, thus potentially enhancing bat activity[13].

79. Any lighting that shines onto a movement corridor of long-tailed bats must be avoided. Light spill from the development will be managed through the use of bat-sensitive lighting and coordinated staging of planting and building work, and is detailed in the evidence of Mr David Serjeant (conditions 86 and 87, respectively).

80. No night work is planned on site and so noise and lighting due to construction works will not affect the bats.

81. The impact of noise on long-tailed bats post-development is unclear, but unlikely to be detrimental[14, 15]. Little evidence exists of impacts of noise on foraging aerial insectivorous bats[16].

82. It should be acknowledged that the effectiveness of the proposed mitigation package is not certain as similar approaches have not been attempted in New Zealand or overseas[17]. Therefore, I recommend several measures be put in place should consent be granted.

83. First, a statistically sound acoustic monitoring programme should be designed and implemented at the Amberfield site (detailed in conditions 93-96). The

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13 Straka et al. (2019). Frontiers in Ecology and Evolution, 27(7). Doi:10.3389/fevo.2019.00091.

14 Shirley et al. (2001). Journal of Zoology, 254(3): 367-373

15 Borkin et al (2019). Baseline acoustic monitoring of long-tailed bats for the southern links roading project, Hamilton: 2017 and 2018. Wildlands.

16 Schaub et al. (2008). Journal of Experimental Biology, 211: 3174-3180.

17 Berthinussen et al (2019). Bat Conservation: Global Evidence for the Effects of Interventions. Synopses of Conservation Evidence Series. University of Cambridge, Cambridge, UK.

programme will monitor bat activity prior to, during, and after development and be able to detect an agreed decline in activity due to the development.

84. A similar programme has been agreed and developed for the Hamilton section of the Waikato Expressway, and others are being designed for the Huntly and Cambridge sections.

85. Second, should the agreed level of decline in bat activity be detected at the Amberfield site, and be attributable to the development, then an adaptive management plan should be developed and activated to attempt to remedy the decline.

**ADDRESSING EVIDENCE OF GERRY KESSELS**

86. I disagree with Mr Kessels' statement that the entire Amberfield site is significant under the Waikato RPS criteria 3.

87. In my opinion, any application of the RPS criteria must consider the biology of the species being assessed. As stated in my evidence above, the majority of the site is pasture which is not preferred habitat for long-tailed bats. This is further evidenced by the low (or zero) levels of activity in these areas, and when compared to acoustic surveys in other areas of "high value" habitat for bats in the Hamilton area (see paragraph 23 above).

88. My interpretation of the RPS criteria is based on a scientifically objective assessment of the importance of habitat, something that the criteria as written does not encourage. My approach has allowed me to use the scientific literature and my experience of long-tailed bat biology and ecology to assess the significance of landscape features on the development site.

89. I use the pasture on the development site as an example. Although limited bat activity was recorded over the pasture, I do not consider it to be significant under the RPC criteria, yet Mr Kessels does. In coming to my conclusion, I considered if the east-west shelterbelt were removed, would the pasture facilitate movement of bats across the site to a level that will maintain the integrity of the local bat population. My conclusion to this question was no. This would be the case if the pasture were lost and the shelterbelt continued

to provide connectivity. Thus, I assess the shelterbelt, and not the pasture, to be significant.

90. I do agree with Mr Kessels that the riparian margins, east-west shelterbelt and southern gully are significant habitat when assessed against criteria 3 and 11 under the RPS. This is evidenced by the levels of activity recorded at these sites.

91. These areas are being retained and enhanced.

92. Mr Kessels states that there is insufficient evidence at present to understand how the site is being utilised in its entirety by long-tailed bats,[18] and yet he acknowledges that the "survey methods undertaken by the applicant to quantify the ecological values and effects in the project area are consistent with best practice."[19]

93. The AEE has also correctly identified the riparian margins, shelterbelts and gullies as important habitat for bats, as well as the use of the site for occasional feeding. Finally, it has allowed Mr Kessels to come to his conclusions about the significance of the site under the Waikato RPS and section 6 of the Resource Management Act.

94. The addition of radio-tracking information from AECOM has allowed further insight into the value of the Amberfield site.

95. Thus, it is my opinion that sufficient information is available to understand how the site is used, and importantly for the significance of habitat on the site to be determined.

96. I agree with Mr Kessel's assessment that "Applying the direct mitigation as proposed by the applicant should largely address those adverse effects."[20]

97. However, I disagree that there is evidence of a residual effect and conclude that there is not sufficient evidence that this exists. Indeed, Mr Kessels states that his temporary residual effect is difficult to quantify.

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18 Evidence in Chief of Mr Kessels, paragraph 66.

19 Evidence in Chief of Mr Kessels, paragraph 30.

20 Evidence in Chief of Mr Kessels, paragraph 71.

98. Mr Kessels identifies the time lag between vegetation planting and subsequent maturity as a potential source of residual effect. However, he also acknowledges that the proposed dwelling setbacks will reduce these effects. Management of any remaining residual effects is addressed in the draft consent conditions (condition 87). These specify deferral of development until new vegetation provides an effective buffer between bat habitat and new dwellings along the NorthEast Terrace and the East-West Shelterbelt. This will prevent any further light spill onto bat habitat.

99. I do agree with Mr Kessels that there is a lack of "sound scientific data, determining the extent of the residual effect."[21] It is my opinion that without such evidence the conclusion that additional offset is warranted is incorrect. It is my opinion that the presence (or not) of any residual effect and the mitigation of it must be evidence based.

100. It is my opinion that a monitoring scheme able to account for any unforeseen insufficiencies in the mitigation proposed or unanticipated effects is a more effective approach.

101. Should any negative impact on the population remain after mitigation, this will be detected by the proposed 10+ year monitoring programme detailed in conditions 93-96. Targeted, purposeful intervention would then be possible through the proposed adaptive management framework. Such an approach also removes the need for subjective assessment of the potential presence or scale of residual effects.

102. Through this approach, I thus agree with Mr Kessels that a wide range of offset or management activities be considered, but only once robust evidence of an effect is detected, and that long-term monitoring and funding is required (conditions 93-96).

103. My Kessels states that vegetation buffers need to be approximately 100m wide to be an effective corridor and buffer for long-tailed bats. I disagree and point to the width of many sections of the riparian margin on the eastern side of the Waikato river as evidence. Many areas of this habitat, acknowledged

[21] Evidence in Chief of Mr Kessels, paragraph 85.

by Mr Kessels as important habitat for bats, is bordered by housing and is less than 100m in width.

104. My Kessels, citing Le Roux and Le Roux (2012), states that "87.5% of confirmed habitat were classified as 'riparian margins'", which are defined as being 0 – 100m from the river (Evidence in Chief of Mr Gerry Kessels, paragraph 96). I agree with this assessment but contend that the riparian margins being preserved and enhanced on the Amberfield also meet these criteria.

**CONCLUSION**

105. In summary, I conclude that:

(a) Although bat activity levels are only moderate, it is clear that certain parts of the site are significant under sections 3 and 11 of the Waikato RPS. The ecological assessment of the Amberfield development has correctly identified specific landscape features as providing important movement corridors linking the network of sites used by long-tailed bats in southern Hamilton. These landscape features are the riparian margin (including the north-east terrace), southern gully, and east-west shelterbelt. They are significant in that they facilitate movement of bats through the site, with some periodic feeding also taking place.

(b) The mitigation package offered by the applicant targets areas of high value for bats and preserves or enhances them for their future use. Although the development of the Amberfield site will render much of it impenetrable to bats, this area is of low value to them. High value habitat the provides connectivity to the wider landscape are protected and enhanced through the maintenance of significant features.

(c) An unknown/uncertain effect has been identified in relation the potential presence of roosting bats on the site. Evidence exists for a single male bat roosting in three trees, and without further investigation it is not possible to determine the significance of this finding. Should more bats be found roosting on site, then on-site pest control and supply of artificial roosts would be appropriate mitigation.

(d) The magnitude (or source) of other unanticipated adverse effects cannot be quantified, and thus effective compensation or offset is not possible at this time. Instead, a 10+ year monitoring programme is suggested and has been included in consent conditions (conditions 93-96). This monitoring programme will have the potential to determine the magnitude of any unforeseen effects and allow for targeted adaptive management to take place. The framework for resourcing this adaptive management has been placed within the consent conditions.

**Dated this 12th day of April 2019**

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**Stuart Parsons**