BEFORE INDEPENDENT HEARING COMMISSIONERS
APPOINTED BY THE HAMILTON CITY COUNCIL

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

EVIDENCE-IN-REPLY OF GEORGIA THELMA ROSE CUMMINGS FOR WESTON LEA LIMITED

Dated: 1 May 2019

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SUMMARY OF EVIDENCE

1. My name is Georgia Thelma Rose Cummings and I am a terrestrial ecologist and bat specialist. I summarise my evidence, according to the key headings in this statement, as follows:

Risk of maternity roosts being removed

(a) I consider the information available is sufficient to conclude there is a low likelihood that the development footprint contains maternity roosts.

(b) I am concerned that a 'hard line' precautionary stance requiring avoidance of every mature tree may undermine collaborative efforts to conserve bats in the wider landscape.

Insufficient survey effort and uncertainty about effects on bats

(c) Results of our acoustic surveys are in accordance with the approach and findings of other surveys undertaken across the city and elsewhere in the country. I am confident that they can be applied to assign value to the features in the proposed development site and assess the potential effects of the development.

The requirement for a 100 m setback from the river margin

(d) The alternative requirement (proposed by some submitters) of a 100 m setback from the river margin to avoid effects on long-tailed bats using the river corridor is not justified.

Recommendation for buffer planting to be 15 - 20 m high prior to development

(e) The alternative requirement (proposed by some submitters) that buffer vegetation reach a minimum height of 15 m prior to development is not justified, particularly considering potential light sources will be much lower in height.

Protection of habitat retained within the proposed development site

(f) The majority of mitigation measures proposed by Dr Borkin to minimise effects of the development have already been offered by the applicant.

(g) I consider the lot deferral condition (Condition 88) provides sufficient certainty that plantings will provide adequate buffering prior to light being introduced adjacent to key habitat features.

(h) I support Dr Borkin's and Ms Pryde's recommendations for the monitoring of light levels, with minor alterations, and the use of artificial light screening as a potential adaptive management option.

Monitoring and adaptive management

(i) I support Ms Pryde's recommendation for the monitoring to be statistically robust and include the monitoring of light levels.

(j) The applicant has updated the long-tailed bat monitoring conditions to specify consultation with DOC, HCC, and the Southern Links Project team to ensure the monitoring programme is integrated with monitoring elsewhere in the PSPA (Condition 94 in Mr Serjeant's EIR).

Creating bat habitat versus 'typical' restoration plantings

(k) Long-tailed bats preferentially use edge habitat, limiting the value of conventional restoration plantings which are not designed to maximise edge habitat.

Effectiveness of proposed habitat restoration

(l) The habitat preferences of long-tailed bats are well known, and they are a highly adaptive species. I consider there is a high level of certainty that bats will use the habitat once established, particularly given the level of connectivity to the Waikato River.

Potential population-level effects

(m) I disagree with Dr Borkin's suggestion that research undertaken on the population level effects associated with clear felling in plantation forestry can be appropriately applied to the proposed development.

Cumulative effects of development in the PSPA and maintaining landscape connectivity

(n) The mitigation and monitoring put forward is designed to integrate with work already undertaken by the Southern Links Project while also providing the beginning of a network of enhanced habitat that future developers can be directed (through the consenting process) to build upon in order to provide continued connectivity to key habitats across the southern Hamilton landscape.

Predator control

(o) I consider that in the absence of ongoing and co-ordinated landscape-wide predator control, habitat enrichment through planting trees suitable for bat habitat and provision of protected (banded) artificial roosts are a more appropriate response to protect bats potentially roosting on the site than local-scale pest control.

INTRODUCTION

2. My name is Georgia Thelma Rose Cummings. My qualifications, experience and involvement in the project are outlined in my primary statement of evidence.

3. In this statement of evidence-in-reply (**EIR**), I respond to issues raised in Ms Pryde, Dr Borkin, Dr Stirnemann and Dr Barea's evidence with respect to:

   (a) The likelihood of maternity roosts being removed;

   (b) Acoustic survey effort and assigning values to features;

   (c) The width of the setback of development from the river margin;

   (d) Minimum height and width of buffer planting;

   (e) The proposed monitoring programme and potential adaptive management options;

   (f) Uncertainty around creation of long-tailed bat habitat;

   (g) The potential for population-level effects;

   (h) Cumulative effects of the future development of the PSPA area; and

   (i) Predator management.

4. I also outline the adaptations of long-tailed bats to utilise edge habitat. Together with Mr Blayney's EIR, this assists to clarify the reasoning behind the design of the mitigation planting in response to evidence put forward by Dr Clarkson and Dr Stirnemann.

Risk of Maternity Roosts Being Removed

5. Dr Borkin (in paragraphs 45 - 49) states that the information from two seasons of acoustic surveys and four rounds of radio telemetry over two years is insufficient to assess the likelihood that the proposed development will result in the removal of maternity roosts.

6. The cryptic, wide-ranging, and roost switching behaviour of bats means it is very difficult, if not impossible, to conclude that any tree that contains potential roost features is not used by bats at some point in time. Even if more extensive radio tracking detected no more roosts on the site, the assertion that all mature trees on the site could be roost trees still stands.

7. In my opinion, the data available for the proposed development site to date provides sufficient evidence to support my conclusion that there is a low risk that the proposed development footprint will impact maternity roosts. My reasoning is:

   (a) The breeding season (when maternity colonies are formed) of long-tailed bats is short (< 3 months) between December and March (O'Donnell, 2002);

   (b) All the radio telemetry studies to date (Dekrout's (2009) research and the more recent Southern Links research) have been undertaken during the breeding season. The Southern Links telemetry sessions have tracked 24 bats each for an average of 11 nights[1] over four sessions between December and March over two years;

   (c) Furthermore, Dr Borkin (paragraph 41) estimates that the Hamilton population is approximately 61 bats. If this is the case, the recent Southern Links studies have radio-tracked close to 40% of the population over a significant proportion of the breeding season across two years. This provides information on a much larger proportion of the population than is often achieved when monitoring cryptic animals;

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[1] As summarised in Dr Borkin's evidence (paragraph 48) bats were radio-tracked on average for three full nights and eight part-nights. Full night tracking is not required when the objective is to locate day roost sites is done during the day.

(d) The proposed development site is located within the study area of both the Southern Links, and Dekrout's radio telemetry studies;

(e) In paragraph 48 of her evidence, Dr Borkin notes "...*radio-tracking in that study showed that even adult and juvenile female bats captured in close proximity to multiple maternity roosts, at the Narrows, did not always use these areas as part of their core home ranges*". Dr Borkin argues that this observation contradicts my statement that "*If an active maternity roost was present, it would be expected that the site would form part of the core habitat of multiple tracked bats*" (paragraph 32 of my EIC); I consider my statement in paragraph 32 of my EIC is supported by the Southern Links radio telemetry data as outlined in paragraphs 7(f) - 7(h) below.

(f) The recent telemetry data from the Southern Links Project (supplied 23 April 2019 and attached to this statement as **Annexure "A"**) identifies core areas[2] of radio-tracked bats. I note that only two of the 15 confirmed maternity roosts located during the study do not occur within overlapping activity cores of multiple tracked bats, and these two roosts are located within the activity core of at least one of the radio-tracked bats;

(g) Neither the Southern Links research or Dekrout's research identified the proposed development footprint as part of the core areas of activity for any of the radio tracked bats;

(h) The Southern Links radio tracking studies have identified that a small area of the North-eastern terrace, outside of the proposed development footprint, formed part of the core area for two male bats. These activity cores both appear to primarily be associated with the adjacent Waikato River. For the other 22 bats tracked to date, the proposed development site is not located in their core activity areas or even their wider home ranges;

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2 The area where bats spent most of their time. Identifying core areas is important because the bats spent most of their time in relatively small areas compared to their full home range, often rapidly dispersing across large distances between core areas.

(i) I agree that acoustic data should be used cautiously in relation to roost habitat, particularly solitary roosts. The original Terrestrial Ecological Effects Assessment (**TEEA**) acknowledged this limitation and did not rule out the potential presence of solitary roosts. This is also why Condition 92(b) (refer to Mr Serjeant's EIR) has been proposed to mitigate for currently undiscovered roost sites (paragraph 64 in my EIC). However, maternity roosts are used by multiple bats, all of which generally emerge over a relatively short period around dusk. Such activity was not recorded on the site during either acoustic survey period;

(j) I agree with Dr Borkin (paragraph 43) that adult male long-tailed bats do roost communally, but it is less common (C. F. J. O'Donnell & Sedgeley, 1999; Sedgeley & O'Donnell, 1999, 2004). Furthermore, the timing of the male bat moving into these roost trees was March. Long-tailed bat pups are generally independent by mid-February and would no longer be dependent on maternity roosts. Consequently, the confirmation of one male bat roosting on the site in March does not provide evidence that the site is likely to contain maternity roosts.

8. In my opinion, Dr Borkin's and Ms Pryde's reasoning that any mature tree could be a maternity roost because the wider landscape is used by bats, and a single male has been confirmed roosting on the site, is unreasonably conservative. I do not agree that retention of all mature trees (along with the provision for buffering and connectivity with key movement corridors that this would entail) across the entire rural area of southern Hamilton is necessary to ensure the long-term viability of the bat population.

9. I note that none of the mature trees on rural private property have any formal protection under current planning rules. I am concerned that imposing rather arbitrary development restrictions because of the presence of bats in the landscape may motivate landowners to remove potential habitat features that may be important for the population.

Insufficient survey effort and uncertainty about effects on bats

10. I disagree with Ms Pryde (paragraph 6.2 of her evidence) that the acoustic survey effort was not enough to identify the importance of microhabitats within the site.

11. It is general practice in scientific surveys to subsample representative habitats and draw conclusions across the wider site. I targeted likely favourable habitats based on generally accepted behavioural characteristics of long-tailed bats[3]. I also sampled pasture to ensure all potential habitat types were represented and relative activity levels could be compared, and values could be assigned to different features in the site.

12. Ms Pryde (paragraph 6.2) states that single trees were not surveyed. This is incorrect, sample sites B3 and C3 (see Annexure "C" of my EIC) were both placed in pasture in a single tree. **Figure 1** shows the placement of survey location C3. These sites averaged less one bat pass a night (refer to Annexure "C" in my EIC).

[3] See paragraphs 47 and 48 below.

Figure 1: Photo showing placement of monitoring device (circled in red) at location C3, located in open pasture with isolated trees present. Also note the small stature of the other isolated trees visible in the background of the photo.

13. I disagree with Ms Pryde's statement (paragraph 6.2) that high levels of bat activity were recorded around individual trees at Ruakura and therefore single trees within the proposed development are important features for bats. The data Ms Pryde refers to (Figure 4 of Ms Pryde's evidence) was collected by me and Mr Blayney. Of the 18 ABMs deployed in the Ruakura study, the ABM with the highest level of activity averaged one bat pass per night and the average across the site was 0.19 passes per night. I disagree that this constitutes high levels of activity and I also disagree with her associated rationale that more surveys of individual trees and clusters of trees are required on the Amberfield site.

14. Dr Borkin uses observations from the thermal imaging studies (Wildland Consultants Ltd, 2019b)[4] to infer that a high number of bats are crossing between Hammond Bush and the proposed development site (paragraph 37). This aligns with my observations that bats are using linear features in the site as dispersal corridors. It also supports Dr Parsons' observation that Hammond Bush is an important "jumping off" point for bats dispersing west through the site (paragraph 54 in his EIC) which I agree with. I consider that this will be appropriately addressed through retention of the East-West shelterbelt (**E-W shelterbelt**).

15. I do not agree with Dr Barea's interpretation of the thermal imaging data as an indicator that the whole site is important bat habitat (paragraph 16.4 of his evidence). Although the site recorded the most activity compared to other riverside thermal imaging locations, the number of thermal imaging sites sampled is small. Additionally, these sites were chosen based on the presence of either existing bridges or bridges proposed as part of the Southern Links Project (and corresponding control sites). These locations are not a representative sample of habitat available along the Waikato River in southern Hamilton.

16. Furthermore, the thermal imaging report discusses the limitations of identifying bats at distances of >75 m from the camera. The camera also has a limited field of view. Based on the location of the camera shown in Attachment A of Dr Borkin's evidence, the camera is approximately 105 m from proposed development footprint at its closest point. It is my opinion that caution should be used when drawing conclusions about bat activity across the entire Project area from a single fixed point some distance from the site.

17. I note that the acoustic surveys undertaken on the site to inform the TEEA support conclusions on habitat preferences drawn from other bat surveys undertaken on the Hamilton colony, other populations in modified and unmodified landscapes, and radio telemetry work undertaken in Hamilton (Davidson-Watts Ecology (Pacific) Ltd, 2018; Dekrout, Clarkson, & Parsons,

[4] Undertaken as part of the Southern Links Project to provide information of the height bats were commuting along the Waikato River and road crossings to assist in assessing effects of the proposed bridges.

2014; D. Le Roux S. & Le Roux, 2012; C. F. J. O'Donnell, 2000). These conclusions are:

(a) The Waikato River is an important landscape feature for the colony;

(b) Bats preferentially disperse and feed along linear vegetation edges (the highest bat activity levels recorded within the proposed development footprint were along the E-W shelterbelt which forms part of a vegetated corridor between the Waikato River and the Mangakotukutuku Gully);

(c) Bats use isolated stands of mature trees in open habitats, but activity levels were lower; and

(d) Bats will occasionally disperse and forage across open areas, but it is not a preferred habitat.

18. I have used these findings to assign value to the features across the site and put forward a mitigation package that I consider will adequately address the potential effects of the proposed development, including effects of tree removals.

19. I agree that other trees on the site may be used as solitary roosts. As stated in my EIC, removal of any yet to be discovered roosts will be mitigated through the provision of alternative roosts including the installation of artificial roosts as per proposed Condition 92(b).

20. Dr Stirnemann's statement (paragraph 12 of her evidence) that surveys did not assess feeding activity on the site is incorrect. Survey data is presented in Tables 8 and 9 in the TEEA. Feeding buzzes[5] were recorded along some of the vegetation edges while no feeding buzzes were recorded at any of the monitors in open pasture.

21. In response to these findings, most of the existing woody vegetation in the site is being retained and buffered from anthropogenic disturbance to facilitate continued use by foraging bats. Additional foraging habitat will be created in

[5] A feeding buzz is the terminal phase of an echolocation call that bats use when they are homing in on prey. As it is difficult to visually observe bat behaviour at night, feeding buzzes are used as a proxy for foraging behaviour.

the North-Eastern terrace (**NE terrace**) and the minor gully. To my knowledge, the creation of planted habitat specifically designed with the ecology of long-tailed bats in mind has not been undertaken before. Nevertheless, the principles of the design are well founded in data from the Hamilton bat colony and elsewhere, including observations of bats preferentially foraging along a single row of trees on the site. Therefore, I am confident that creation of foraging habitat on the site as proposed has a high likelihood of success.

22. Dr Barea (paragraph 18.3 of his evidence) notes that the TEEA identifies uncertainty with respect to long-tailed bat management provisions on the site. I emphasise that the assessment in the TEEA was based on the design of the proposed development at lodgement. At that point the removal of the E-W shelterbelt was not being avoided or mitigated onsite, the widened NE terrace bat habitat was not proposed and the timeframe for development did not provide an interval for buffer planting to establish.

23. To address residual effects the TEEA advised that offsite mitigation will be required. In response the applicant engaged multiple parties including; DOC, HCC, WRC and Project Echo to discuss the establishment of a trust to establish a collaborative approach to the management of effects on long-tailed bat. However, whilst there was general support for the concept of a trust, it became apparent that none of the consulted parties was prepared to take a lead on co-ordinating such an initiative.

24. Consequently, the applicant's project team revisited the options onsite and undertook a redesign of the proposed development (which includes the removal of 29 residential lots). The proposed changes were discussed with HCC, DOC and Riverlea Environmental Society Inc **(RESI)** representatives prior to the developed design occurring and prior to the revised proposal being formally submitted. The changes are outlined in Section 2.1 (page 2) of the AEEA.

25. In my opinion, the changes to the development address the potential residual impacts identified in the TEEA.

26. Since lodgement of the AEEA, conditions have been put forward stipulating the deferral of lot development as vegetation establishes and adaptive

management, which further address potential time lag effects (Conditions 88 and 98 respectively in Mr Serjeant's EIR).

The requirement for a 100 m setback from the river margin

27. Ms Pryde (paragraph 8.2 in her evidence) and Dr Clarkson (paragraph 6.3 in his evidence) have endorsed Mr Kessels' assertion (paragraphs 75 and 96 - 97 in Appendix E of the S42A report) that any development should be set back 100 m from the Waikato River. Mr Kessels offers a vague rationale for this specific width, with general references to studies undertaken by Le Roux and Le Roux (2012) and Dekrout's 2009 thesis to support this opinion (paragraph 96 to 97). I do not consider either of the referenced studies support a requirement for a 100 m development setback. I also disagree with Dr Stirnemann's opinion that bats will be excluded from areas within 200 m of development (paragraph 11 of her evidence).

28. Le Roux and Le Roux (2012) state most habitat confirmed to be used by bats in their study occurred within 100 m of the Waikato River. Of these confirmed habitats, several including Hammond Bush, Sandford Park, Fitzroy Park, Te Anau Park, Dillicar Park, Soldiers Memorial Park, and Hamilton Gardens are directly adjacent to residential areas.

29. Chapter 2 of Dekrout's thesis also highlights a positive relationship between bat habitat and proximity to the Waikato River. However, land-cover type, housing density and streetlight density were not significantly related to bat activity. Of the potential effects associated with urbanisation, only roading density was significantly related to bat activity.

30. This assertion that a 100 m setback is required also ignores the patterns of habitat use currently exhibited by the long-tailed bat colony. Multiple core areas used by the colony are directly adjacent to residential areas (Davidson-Watts Ecology (Pacific) Ltd, 2018). Areas of Hammond Park measure less than 50 m in total width and it is directly adjacent to residential areas.

31. Ms Pryde (paragraph 8.2) and Dr Barea (paragraph 22.2) both use the Crewther and Parsons (2017) model to support their recommendations for a 100 m buffer. The model specifies a higher likelihood of bats being present within 100 m of gullies (not just the Waikato River) but does not identify a

negative association between residential development and bats (in fact, it predicts the reverse outcome, though this is recognised as likely to be due to sample bias in data used to create the model).

Recommendation for buffer planting to be 15 - 20 m high prior to development

32. Dr Stirnemann (paragraph 9.1) recommends that buffer planting needs to be >15 m high prior to development but provides no supporting evidence to support this recommendation. I note that light sources from street lights and one or two storey houses will be significantly lower than 15 m.

33. Condition 88 proposed by the applicant (refer to Mr Serjeant's EIR) includes a deferral of lot development adjacent to key features until the buffer planting has reached a minimum of 4 m in height and 80 – 90% canopy closure. I consider a minimum of 4 m in height appropriate because research in Hamilton has demonstrated that more activity is recorded at monitors placed between 4 – 6 m from the ground compared to canopy height > 15 m (Le Roux, Le Roux, & Waas, 2014).

Protection of habitat retained within the proposed development site

34. I agree with Ms Pryde (paragraph 7.1 of her evidence) and other submitters that several studies show a correlation between increased anthropogenic disturbance associated with urbanisation and decreased bat activity. I agree with Dr Borkin's summary (paragraphs 63 – 75) of the different aspects of anthropogenic disturbance that bats appear to respond negatively towards. I agree that these are currently poorly understood but light appears to be more of a deterrent than noise. I also note that long-tailed bats are not completely excluded from urban areas with core areas of activity occurring in areas surrounded by housing on the urban fringe of southern Hamilton (Davidson-Watts Ecology (Pacific) Ltd, 2018).

35. Dr Borkin recommends mitigation measures for the impacts in paragraphs 65 and 72. I note that except for the last point in paragraph 72, "*Turning off lights when the area is not in use*", all these mitigation measures have already been proposed by the applicant. While I agree that the recommendation quoted above would further decrease ambient light generally, I do not consider further

lighting control necessary because the measures already proposed will effectively eliminate light spill over a short distance (12.2 m).

36. Further to the recommendations above, in paragraph 71 Dr Borkin recommends a 50 m buffer between light sources and potential bat habitat. This recommendation is based on the Azam et al. (2018) study which found that light trespass was above 0.1 lux for between 25 – 50 m from streetlights. The proposed bat sensitive street-lighting regime will reduce light spill to 0 lux within 12.2 m without buffer planting. Thus, I do not consider a 50 m buffer necessary.

37. In paragraph 71 Dr Borkin also recommends the use of artificial light buffers. I consider that such buffers are appropriate to include as an option for adaptive management if monitoring shows average lux levels above 0.5 adjacent to key features and there is a corresponding decrease in bat activity.

38. I have recommended 0.5 lux as the maximum average lux levels as this is based on the Wildland Consultants Ltd. (2019a) report which specifically monitored the response of long-tailed bats in Hamilton to differing lux levels (see paragraph 67 in Dr Borkin's evidence). Conversely, the 0.1 lux level referred to by Dr Borkin and Ms Pryde is based on international research on multiple species of bats in Europe (Azam et al., 2018), some of which were significantly more sensitive to light than others. These species have different behavioural characteristics to long-tailed bats as they are slow flying bats that feed in cluttered areas. Conversely, other fast-flying, open foraging bats recorded increased activity at lux levels between 1 – 5 lux compared to <1 lux. Long-tailed bats occupy an intermediate niche between the open foraging bats that are more tolerant of light and clutter adapted bats that are sensitive to light and inhabit the forest interior.

39. Ms Pryde states that the lighting of housing and pathways should been taken into account in addition to street lighting (paragraph 8.5). The shared paths within reserves will not be lit.

40. I consider using vegetation to buffer existing features from adjacent development is the most appropriate form of mitigation as it will filter both light and noise as well as provide a physical barrier between roads and traffic. In

my view this is preferable to placing conditions on household lighting which would be difficult to enforce.

41. I agree that the street lighting design should be a collaborative process between a bat specialist and a lighting specialist. I do not consider the street lighting design to be experimental as it has been developed with appropriate data and specialist input.

Monitoring and adaptive management

42. Ms Pryde provides recommendations for the monitoring of effects on bats in paragraph 8.8 of her evidence. I agree that the monitoring programme needs to be statistically robust, but I disagree that any such condition should specify the consultant who must be involved, as she has suggested.

43. As stated in Section 1.3 (page 3) of the Southern Links draft EMMP "*The survey and monitoring data collected by the Project will be shared with developers [in the PSPA] as will the approach to mitigation*." I support collaboration with the Southern Links project team and HCC to ensure the monitoring programme for the proposed development integrates with the already established monitoring framework. This will assist in identifying changes in activity levels within the proposed development site while also considering landscape-wide influences.

44. As per paragraph 37 above, I agree with Dr Borkin's recommendations for monitoring of lux levels[6] adjacent to retained vegetation features and the river corridor. This information will be useful for assigning potential causes to changes in activity if these are observed and will assist in focussing an adaptive management approach.

45. Such management could include the installation of artificial light barriers as recommended by Dr Borkin (paragraph 71 in her evidence) if an immediate remedy were to be required for light spill. Adaptive management is designed to be responsive to the effect and options will be outlined during the

[6] Although as noted in paragraph 38 above, it is my opinion that the maximum light level of 0.5 lux more accurately reflects studies undertaken on the response of long-tailed bats to light (Wildland Consultants Ltd, 2019a).

development of the LTBMMP (refer to Conditions 82 – 98 in Mr Serjeant's EIR).

46. I support the information gathered from the monitoring and management being supplied to HCC, DOC and the Southern Links Project to inform appropriate management of future development across the PSPA.

Creating bat habitat versus 'typical' restoration plantings

47. Long-tailed bats are edge specialists. Their wing morphology and the structure of their echolocation calls are adapted for foraging along edges and gaps (O'Donnell, 2000; Parsons, Thorpe, & Dawson, 1997). This behaviour has been demonstrated in both modified and unmodified habitats. In old growth forest of the Eglington Valley, Fiordland long-tailed bats are most active along the forest edge and along roads through the forest (O'Donnell, 2000). They are also often observed flying above the canopy and over open water, using these features as a horizontal edge.

48. Long-tailed bats are not adapted to focus their activity in highly cluttered environments such as regenerating scrub. Consequently, to promote the use of the restoration plantings by long-tailed bats we are creating edges within these plantings that will be buffered from the adjacent proposed development.

49. Creating internal edges is particularly important in this circumstance as the canopy will be more exposed to anthropogenic disturbance such as light spill. Long-tailed bats are insectivorous and internal edges are particularly important because insects often congregate in these areas as they are protected from the wind. The lower wind speeds and higher temperatures associated with buffered corridors, such as the ones created by roads, is hypothesised to be why long-tailed bats preferentially use roads within mature forests (Borkin & Parsons, 2009).

Effectiveness of proposed habitat restoration

50. I am not aware of any examples where deliberate bat habitat enhancement and associated research into its effectiveness has been implemented. However, there are several successful examples of "unintentional habitat enhancement" in the existing landscape (i.e. bats extensively using areas such as Sandford Park).

51. I disagree with Ms Pryde's statement (paragraph 2.10) that it will take upwards of 50 years before the replacement habitat will be viable for foraging or roosting. The species mix of the plantings has been specifically selected to include a large proportion of fast-growing species that will reach mature stature in well under 50 years. Long-tailed bats are known to forage and roost in shrubland in a similarly modified landscape in South Canterbury (Griffiths, 2007; Sedgeley & O'Donnell, 2004).

52. I agree the proposed plantings will not provide roost habitat in the short-term. Condition 92(b) (refer to Mr Serjeant's EIR) specifies the provision of alternative roosts if roost trees are identified. I recommend artificial roosts are installed in this instance as their use by bats has been confirmed in Hamilton. I recommend artificial roosts are installed as far in advance of land development as possible. This is also specified in Condition 92(b).

Potential population-level effects

53. In paragraphs 76 – 78 of Dr Borkin's evidence she uses a study on the effects of the clear felling of plantation forestry blocks to support the opinion that the removal of potential roost trees in the proposed development site could have population level effects for long-tailed bats. However, in my view the effects of large-scale forest clearance are not comparable to removal of a small number of trees in a pastoral landscape.

Cumulative effects of development in the PSPA and maintaining landscape connectivity

54. Ms Pryde discusses landscape connectivity in paragraph 8.4 of her evidence. I agree that landscape connectivity is key for the bat colony. Accordingly, the E-W shelterbelt has been retained, and the enhancement of the minor gully and the NE terrace are proposed because they are connected to the Waikato River and Hammond Bush (via the river). The position of the NE terrace adjacent to the Waikato River and opposite Hammond Bush means it is a high value area to enhance.

55. Further evidence from Dr Borkin's infrared camera studies have also shown the NE terrace to be an important dispersal point from Hammond Park,

providing further support that it as a good location for habitat enhancement (see paragraph 37 of Dr Borkin's Evidence).

Predator control

56. Dr Flynn addresses the constraints to site-wide predator control in her evidence, and I concur with her comments. I support incorporation of the project site into a future co-ordinated and large-scale effort between multiple stakeholders. However, in the absence of effective predator control that includes both the site and surrounding areas, I consider that increasing the number of 'safe' roost sites on the site through installation of protected artificial roosts is the most beneficial measure available for minimising bat predation by wild predators and domestic cats.

CONCLUSION

57. I conclude that:

(a) The survey effort on site in combination with the information provided by the Southern Links Project is sufficient to assess the value of features within the site.

(b) I consider that mitigation measures proposed in Consent Conditions provide sufficient certainty that bats will use the high-value habitat features and will not abandon the site or adjacent Waikato River corridor.

(c) The mitigation and monitoring put forward is designed to integrate with work already undertaken by the Southern Links Project while also providing the beginning of a network of enhanced habitat that future developers can build upon to provide continued connectivity to key habitats identified across the southern Hamilton landscape. I consider that a protected network of high-quality bat habitats is key to the long-term viability of the Hamilton bat population.

Dated this 1st day of May 2019

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Georgia Cummings

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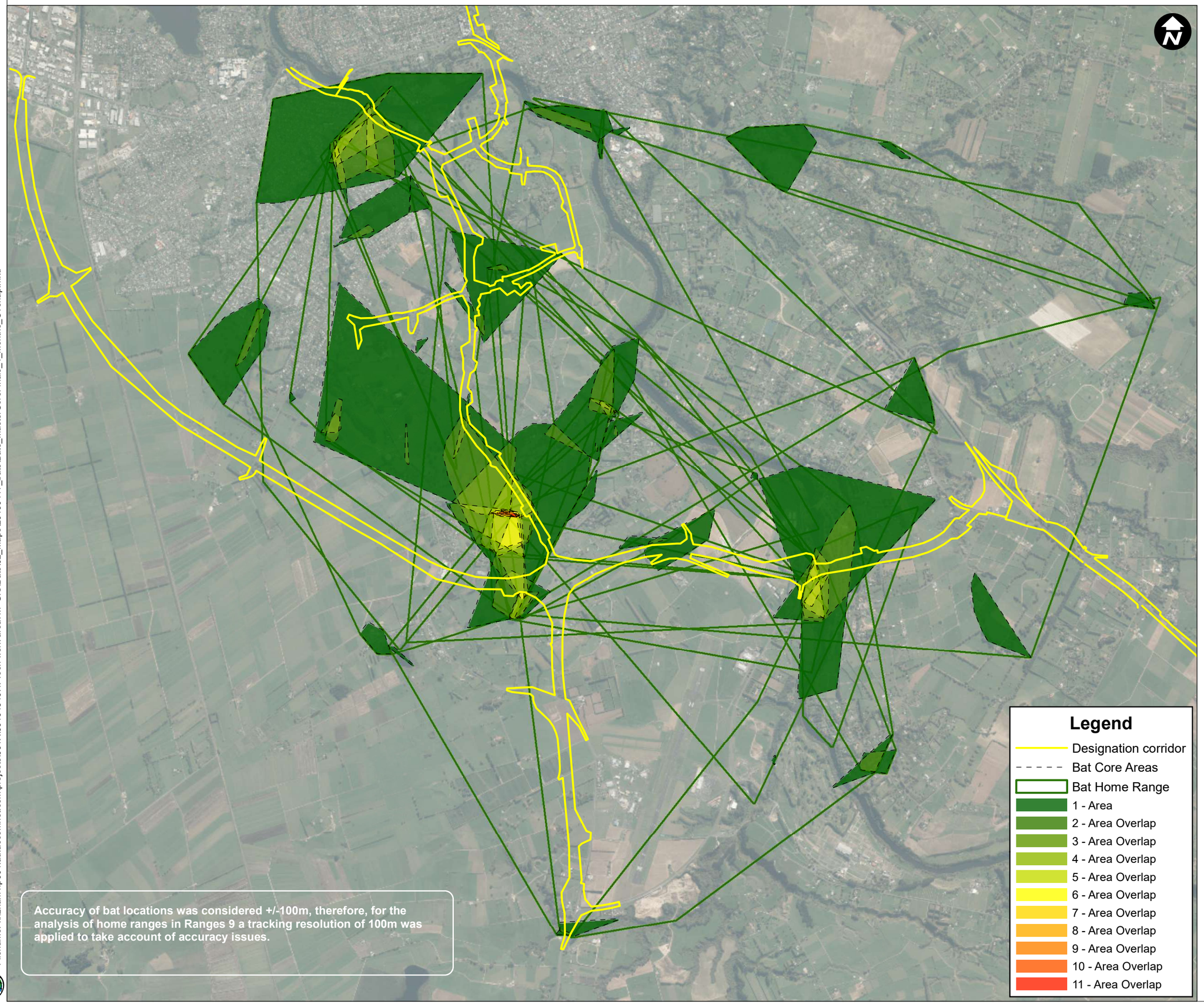
ANNEXURE "A"

Map Showing Core Areas and Home Ranges of Bats - January, March, December 2018 & Feb 2019. Supplied by the Southern Links Project.

ISO A3 297mm x 420mm

Last saved by: SERGEY.SOKOLOV (2019-04-24) Last Plotted: 2019-04-24
Filename: \\nzham1fp001.au.aecomnet.com\projects\601X\60164546\4. Tech work area\4.7 GIS\Bats\02_Maps\20190417_bats\Bats_MasterCoreFinals_4_Months_Overlap.mxd



Accuracy of bat locations was considered +/-100m, therefore, for the analysis of home ranges in Ranges 9 a tracking resolution of 100m was applied to take account of accuracy issues.

AECOM

PROJECT

Southern Links

CLIENT

Hamilton City Council, New Zealand Transport Agency and Department of Conservation.

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SPATIAL REFERENCE

Scale: 1:35,000 (A3 size)

500 250 0 500 1,000 1,500
Meters

Map features depicted in terms of NZTM 2000 projection.

Data Sources:
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2016

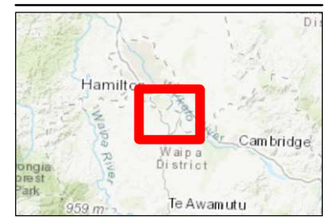
PROJECT MANAGEMENT

Approved		Date	
Checked		Date	
Designed		Date	
Drawn		Date	

ISSUE/REVISION

Rev	Date	Description
A	24/04/2019	Draft

KEY PLAN



PROJECT NUMBER

60526419

SHEET TITLE

Core Areas and Home Ranges of Bats - January, March, December 2018 & Feb 2019

MAP NUMBER

1