BEFORE THE HEARING PANEL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of a Notice of Requirement to alter a designation for the HCC Central City Reservoir – Ruakiwi Road

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STATEMENT OF EVIDENCE OF DR JAMIE WILLIAM BOOTH MACKAY ON BEHALF OF HAMILTON CITY COUNCIL AS REQUIRING AUTHORITY

(Terrestrial Ecology)

Dated 19 December 2025

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INTRODUCTION

1. My full name is Dr Jamie William Booth MacKay.

2. I am a Senior Ecologist at Tonkin & Taylor Ltd (**T+T**). I have been employed as a consultant ecologist at T+T since August 2022.

3. I hold a Bachelor of Science with Honours in Ecology from the University of Edinburgh (2004), a Master of Science in Applied Ecology and Conservation from the University of East Anglia (2005), and a Doctor of Philosophy in Ecology from the University of Auckland (2011). I am currently registered as a Certified Environmental Practitioner (**CENVP**). The CENVP programme is run by the Environment Institute of Australian and New Zealand (**EIANZ**) and requires its members to act in a professional manner at all times in compliance with the EIANZ Code of Ethics and Professional Conduct.

4. My research background is in the behavioural ecology of pest mammal species in New Zealand with a focus on using knowledge of animal behaviour to improve control and monitoring methodologies. I am lead or co-author on over 20 peer-reviewed scientific publications.

5. I have over 11 years' experience as a consultant ecologist working for clients in the private and public sectors. Prior to joining T+T, I worked as a consultant ecologist at Wildland Consultants Ltd between March 2014 and August 2022. Prior to that, I worked for two years as a post-doctoral researcher at the University of Auckland.

6. My relevant experience includes many ecological investigations throughout Aotearoa New Zealand. This work has included inputs into project design, designing and implementing field surveys, preparing effects assessments, and preparation and implementation of ecological management plans. My work is largely in the field of terrestrial ecology, but I also have a good understanding of freshwater ecology. I have acted as an expert witness at Council-level hearings and have provided technical

peer review services for resource consent applications to regional and district councils.

7. A focus of my work is managing effects on indigenous fauna, particularly long-tailed bats. I am a Department of Conservation-certified bat ecologist and have extensive experience working with long-tailed bats. This experience includes planning, implementing, and analysing acoustic surveys; studying bat behaviour through radio-tracking and thermal imaging; and supervision of roost inspections and tree felling. Much of my work with long-tailed bats has been undertaken in Hamilton for roading and residential subdivision developments. In 2018 I undertook fieldwork for the Hamilton Southern Links roading project, including acoustic surveys, thermal imaging, and radio-tracking. I am also experienced in assessing and managing effects on vegetation, indigenous lizards, and indigenous avifauna.

8. I provide this evidence on behalf of Hamilton City Council (**HCC**) as the Requiring Authority (**RA**) which has issued the Notice of Requirement (**NOR**) for the Central City Reservoir – Ruakiwi Road (**Ruakiwi Road Project** or **Project**).

9. The Project includes the following four key components:

    a) Reservoirs: Two 25 megalitre water reservoirs to be located at 18 Ruakiwi Road (**the site**). Development of each reservoir is to be staged with Reservoir One to be delivered by 2028 and Reservoir Two to be delivered circa 2040.

    b) Valve chamber: 420 m^2 valve chamber located at the site, between the reservoirs, to support the operation of the reservoirs.

    c) Ancillary pipelines: Includes clean water scour/stormwater discharge pipeline to Lake Rotoroa and connections to public three water systems from the site.

d) Booster pump station: A booster pump station at 139 Clarence Street. Noting a separate land use consent has been granted for this aspect of the Project, thus, it is not subject to the NOR.

10. T+T was engaged to undertake an Ecological Impact Assessment (**EcIA**) for the Project[1], Appendix G to the NOR, which focussed on the potential impacts of vegetation removal required for construction of the reservoirs, valve chamber, and ancillary pipelines. The EcIA did not consider the booster pump station as this is not subject to this NOR. For the remainder of this report, the area assessed in the EcIA is referred to as the "Project footprint".

11. I provided technical oversight during field investigations and a technical review of the EcIA report. I have read relevant parts of the application documents, submissions, and the s 42A report.

12. I am familiar with the Ruakiwi Road site following a site visit with other technical experts on 9 May 2025.

CODE OF CONDUCT

13. I am familiar with the Code of Conduct for Expert Witnesses (Environment Court Practice Note 2023) and although I note this is a Council hearing, I agree to comply with this code. The evidence I will present is within my area of expertise, except where I state that I am relying on information provided by another party. I have not knowingly omitted facts or information that might alter or detract from opinions I express.

[1] Ecological Impact Assessment Report – Central City Reservoir Project. T+T Job Number 1097546 dated August 2025.

SCOPE OF EVIDENCE

14. My evidence covers terrestrial ecology matters in relation to the Project. In my evidence, I:

    a) Provide a summary of my key conclusions;

    b) Summarise the relevant aspects of the application with respect to ecological values, impacts, and effects management, including ecological compensation matters;

    c) Set out an assessment of the NOR with respect to anticipated ecological effects;

    d) Address relevant submissions; and

    e) Respond to the s 42A Report.

EXECUTIVE SUMMARY

15. This statement of evidence provides an assessment of terrestrial ecological effects associated with HCC's NOR for the Ruakiwi Road Project. The Project involves construction of two reservoirs, a valve chamber, and associated pipelines connecting to existing three-waters infrastructure. The ecological assessment focuses on potential vegetation and habitat loss within the project footprint and the associated effects on terrestrial ecology, particularly long-tailed bats (**LTB**).

16. Field investigations identified three main vegetation types within the Project footprint: mixed exotic/indigenous treeland (0.58 ha), mown grass (1.0 ha), and a small patch of agapanthus (0.0025 ha). From a botanical perspective, all are of negligible ecological value as they are dominated by exotic species, subject to high levels of disturbance, and not representative of naturally occurring ecosystems. Treeland has an ecological value of

moderate for habitat provision due to providing foraging and nesting habitat for indigenous birds and foraging and potential roosting habitat for 'Threatened – Nationally Critical' long-tailed bats. Agapanthus has been assessed as having an ecological value of low for habitat provision due to providing potential habitat for indigenous skinks. Mown grass has an ecological value of negligible from a habitat provision perspective.

17. Because avoiding the loss of 0.58 ha of treeland is not feasible, residual effects of habitat loss were addressed using a Biodiversity Compensation Model (**BCM**). The BCM approach was selected due to the high uncertainty inherent in quantifying LTB habitat gains and losses and ensures an overall predicted net biodiversity gain. The model described in this statement of evidence incorporates feedback from the Director General of Conservation (**DOC**) and the s 42A Report, and it predicted a net gain outcome of 27% through provision of the following:

a) 0.58 ha of indigenous planting.

b) 7.4 ha of pest mammal control.

c) 1.0 ha of "no mow" grassland.

d) Protection and/or relocation of 19 existing roost features.

e) Installation of 23 artificial roost boxes.

18. DOC raises concerns about the adequacy of residual effects management and the ecological value of mown grass habitat to LTB. In order to address these concerns, the BCM was updated to include compensation for the loss of mown grass.

19. Provided recommendations to minimise the risk of killing or injuring indigenous fauna during vegetation clearance and the compensation package are fully implemented, the Project will result in a net gain in biodiversity values within the Hamilton Lake Domain.

ANALYSIS

Overview of proposal

20. HCC has received financial investment from central government under the Infrastructure Acceleration Fund (**IAF**) to facilitate development within the city. As part of this funding, two new central city reservoirs are proposed near the existing reservoir at Ruakiwi Road. A change to the existing designation boundary is required to enable the proposed reservoir development.

21. The first reservoir (**Reservoir 1**) will be constructed by 30 June 2028. The timing of construction of the second reservoir (**Reservoir 2**) is contingent on demand, but is forecast to be required 8 to 10 years after the completion of Reservoir 1. The Project also requires the construction of a valve chamber and ancillary pipelines that include a clean water scour/stormwater discharge pipeline to Lake Rotoroa and connections to public three water systems from the site.

Site Description

22. The Project is located on flat but elevated land at the Hamilton Lake Domain, just uphill of Lake Rotoroa. Hamilton Lake Domain is a recreational area comprising mown grass with large mature specimen trees scattered throughout. The surrounding area has residential housing to the east, with the lake sitting to the west of the domain. To the north of the existing reservoir is a relatively large intact area of bush. All treeland (exotic and indigenous) and bush in this Domain falls within a proposed Significant Natural Area C31 (**SNA**) within the Hamilton City Operative District Plan.

23. Vegetation within the proposed designation largely comprises mown grass with an area of exotic treeland with mown grass beneath. The Project footprint (defined as the area where vegetation clearance will be required

to construct the reservoirs and associated buildings) also includes a small patch of agapanthus (*c.*25 m^2) close to Lake Rotoroa, which will be cleared during works.

Assessment methods

24. Ecological values within the proposed designation were assessed using a combination of desktop reviews and site visits. The following site assessments were undertaken:

    a) Vegetation and habitat and mapping.

    b) Bat survey using Automatic Bat Monitors (**ABMs**). Ten ABMs were deployed for a four-week period (10 February 2025 until 10 March 2025) with six more deployed three days later (13 February 2025 until 10 March 2025).

    c) All trees scheduled for removal within the Project footprint were surveyed for potential bat roost features in May 2025. Features were identified from the ground by a suitably experienced bat ecologist[2] and then inspected by a climbing arborist.

    d) A lizard survey was conducted in areas of dense ground cover or woody debris using 37 baited lizard tracking tunnels. Tracking tunnels were deployed for two weeks from 10 February to 24 February 2025 with cards and bait replaced on 17 February 2025.

    e) No formal plant or bird surveys were undertaken. All plant and bird species observed during site work were recorded.

25. The results of desktop and site assessments were used to prepare an EcIA, which was prepared following the Ecological Impact Assessment guidelines

[2] Nicki van Zyl and Tumanako Ritchie, both of whom hold Competency Level 3.3 under the Department of Conservation bat handling competencies authorisation scheme (Bat Recovery Group, 2022).

(**EcIAG**) published by the Environmental Institute of Australia and New Zealand[3].

26. I have assessed ecological values and the level of potential effects of the Project on these values using current best practise methods as outlined in the EcIAG. The approach used for this Project is described in detail in Section 2.4 of the EcIA. The approach provides a standardised framework to determining ecological values and magnitude of effects, which in turn determine an overall level of ecological effect. Full details of site assessments, site descriptions, and impact assessments are provided in the EcIA, with summaries of key findings provided below.

Summary of ecological values

Fauna

27. LTB were detected during acoustic surveys with activity ranging from 0 to 6.9 passes per night (see **Appendix 1**). Feeding buzzes were detected at one ABM located within the treeland on the edge of Proposed Reservoir 2. LTB has a national conservation status of 'Threatened-Nationally Critical'[4] and as such, under the EcIAG framework LTB are assigned an ecological value of very high.

28. Two indigenous terrestrial bird species (pūkeko and pīwakawaka) were recorded during site visits. Both have a national conservation status of 'Not Threatened'[5] and have been assigned an ecological value of low. Based on database searches, a further three species (kererū, kotarē, and spur-

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[3] Roper-Lindsay, J., Fuller, S.A., Hooson, S., Sanders, M.D., & Ussher, G.T. (2018). Ecological Impact Assessment (2nd ed.). EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems.

[4] O'Donnell, C.F.J., Borkin, K.M., Christie, J., Davidson-Watts, I., Dennis, G., Pryde, M., & Michel, P. (2023). *Conservation status of bats in Aotearoa New Zealand, 2022.* New Zealand Threat Classification Series 41. Department of Conservation, Wellington. 18 p.

[5] Robertson, H.A., Baird, K.A., Elliott, G.P., Hitchmough, R.A., McArthur, N.J., Makan, T.D., Miskelly, C.M., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A., & Michel, P. (2021). Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 p

winged plover) were also considered likely to use the Project footprint. All these species are 'Not Threatened' and have been assigned an ecological value of low; however, for the purposes of this assessment, kererū is considered to have an ecological value of moderate to reflect its role as an important seed disperser.

Vegetation

29. Three vegetation types are present within the Project footprint:

    a) Mixed exotic/indigenous treeland (*c.* 5,800 m^2).

    b) Mown grass[6] (*c.* 10,000 m^2).

    c) Agapanthus (25 m^2).

30. The treeland comprises mature and semi-mature planted indigenous and exotic tree species with mown grass beneath. The treeland forms part of a SNA (SNA C31), but it is not contiguous with the larger area of SNA to the north and it is not considered to contribute to the ecological values of the wider SNA. The treeland has been assigned a negligible ecological value from a botanical perspective under the EcIAG framework[7]. This is because it is dominated by exotic species and is not representative of a naturally-occurring ecosystem.

31. Mown grass within the Project footprint outside of the treeland has been assigned an ecological value of negligible from a botanical perspective. This is because it is dominated by exotic species, is not representative of an indigenous ecosystem, and is frequently disturbed through mowing to a low height.

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[6] This habitat type is referred to as "exotic grassland" in the EcIA. Upon reflection, this description suggests a habitat with some degree of natural character and value. I consider that "mown grass" is a more appropriate description for this habitat type.

[7] Roper-Lindsay, J., Fuller, S.A., Hooson, S., Sanders, M.D., & Ussher, G.T. (2018). Ecological Impact Assessment (2nd ed.). EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems.

32. A small area of agapanthus close to Lake Rotoroa has been assigned an ecological value of negligible from a botanical perspective.

Habitats

33. The three main habitat types within the proposed designation have been assigned an ecological value of negligible from a botanical perspective as set out above. The habitats do provide habitat for indigenous fauna species and their value from a habitat provision perspective is outlined below.

<u>Treeland</u>

34. The treeland provides potential foraging and nesting habitat for common, 'Not Threatened' indigenous bird species. I consider the habitat to have low value to birds due to lack of habitat complexity, anthropogenic disturbance, and predation by pest mammals.

35. Acoustic surveys confirmed that LTB are using the treeland habitat; however, activity levels were low with an overall average of 1.6 passes per night. The highest activity (6.9 passes per night) was recorded at an ABM within the Project footprint and the second highest (6.4 passes per night) was at an ABM just outside of the proposed designation (see map in **Appendix 1**). These activity levels are relatively low, which is to be expected given the urban nature of the site.

36. The activity levels recorded in February/March 2025 are similar to those recorded during the annual Hamilton City Bat Survey at the Hamilton Lake monitoring location over the past four years[8]:

    a) 2021 – 4.2 passes per night.

    b) 2022 – 0 passes per night.

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[8] https://www.waikatoregion.govt.nz/services/publications/

c) 2023 – 0.9 passes per night.

d) 2024 – 0.24 passes per night.

37. For comparison, sites monitored during the 2024 Hamilton City Bat Survey had average activity ranging from 0.11 to 67.57 passes per night.

38. Feeding buzzes were recorded at one of the ABMs within the treeland on the edge of Reservoir 1. LTB commonly forage along forest edges and the treeland provides good-quality foraging habitat. A recent analysis of LTB diet[9] found that small-bodied moths featured prominently in LTB diet. The larvae of these common and widespread moth species feed on indigenous and exotic trees and shrubs, and the adults are likely to be found within or on the edge of the treeland.

39. As outlined in paragraph 24c), all trees scheduled for removal within the Project footprint were surveyed from the ground for potential bat roost features. Seventeen trees had potential roost features visible from the ground and upon inspection by climbing arborists, 14 trees were confirmed to have features that could be utilised by LTB for roosting. No occupied roosts or evidence of recent occupation was observed during inspections. This does not mean that the potential roost features are not used on occasion; however, the presence of pest mammals (three possums were observed in cavities during inspections), the fact that all trees scheduled for removal are within 110 m of a well-lit road, and low activity levels means that in my opinion the trees only provide moderate quality potential roosting habitat.

40. Overall, I consider that the treeland has moderate ecological value from a fauna habitat provision for LTB.

[9] Ling, N., Tempero, G.W. and Schamhart, T., 2025. Using faecal DNA metabarcoding to determine the diet of the long-tailed bat, Chalinolobus tuberculatus. *New Zealand Journal of Zoology*, *52*(1), pp.55-62.

Mown grass

41. This section considers mown grass within the Project footprint that surrounds the treeland. Mown grass is present throughout the Hamilton Lake Domain where it forms part of a mosaic of habitats that include treeland, amenity plantings, specimen trees, and the lake edge.

42. Mown grass does not provide nesting habitat for indigenous bird species. It provides low-quality foraging habitat; however, nearby habitats such as treeland, forest, and amenity plantings provide a better food source meaning the mown grass is unlikely to be an important foraging area for indigenous birds.

43. While LTB may forage above the mown grass on occasion, research has shown that mowing causes mortality of invertebrates[10], leading to a reduced food source for insectivorous animals. Reducing mowing frequency in agricultural landscapes can increase invertebrate numbers by 41% in one year, and by up to 99% in three years later[11]. The intensive mowing regime within the Hamilton Lake Domain means that invertebrate numbers in the mown grass are likely low, and therefore mown grass is unlikely to provide a good food source. The mown grass is also subject to light spill from Ruakiwi Road further reducing its value to LTB.

44. LTB almost certainly fly across the mown grass while commuting between foraging and roosting areas and replacing mown grass with a building could lead to bats no longer using the habitat. This avoidance behaviour is caused by light and/or noise effects, which could occur during the construction and operational phases. Construction will take place during daylight hours, and any construction noise will not impact nocturnal bats. Once completed, the

[10] Steidle, J.L., Kimmich, T., Csader, M. and Betz, O., 2022. Negative impact of roadside mowing on arthropod fauna and its reduction with ‘arthropod-friendly’ mowing technique. *Journal of Applied Entomology*, *146*(5), pp.465-472.

[11] Staab, M., Keller, A., Achury, R., Hilpert, A., Hölzel, N., Prati, D., Weisser, W.W. and Blüthgen, N., 2025. Experimental reduction of land use increases invertebrate abundance but not diversity in grasslands. *bioRxiv*, pp.2025-03.

new reservoirs will not contribute any additional light spill beyond the current baseline, and operational noise will be negligible. Therefore, in my opinion, bats will not avoid flying over the reservoirs and there will be very little impact on LTB behaviour.

45. The mown grass does not provide important habitat for indigenous fauna and in my opinion it has negligible value from a fauna habitat provision perspective.

Agapanthus

46. The agapanthus provides potential habitat for indigenous skink species. It is unlikely that skinks are present; however, skinks are cryptic and it can be difficult to prove their absence without destructive surveys. As such, the small area of agapanthus is considered to have an ecological value of low from a fauna habitat provision perspective.

Effects and effects management

47. Actual and potential ecological effects have been identified as:

a) Loss of terrestrial vegetation.

b) Loss of habitat for threatened fauna.

c) Injury and/or mortality of birds, lizards and LTB during vegetation clearance.

d) Indirect habitat loss through the impacts of light.

e) Disturbance to avifauna during construction.

Loss of terrestrial vegetation

48. Loss of terrestrial vegetation is considered to have a very low level of effect from a botanical perspective.

Loss of habitat for threatened fauna

49. The treeland does not provide important habitat for indigenous bird species and the overall level of effect of removing this habitat on birds is considered to be very low, provided avifauna management is undertaken. As such, no further effects management are required for the loss of this habitat.

50. Treeland provides foraging, commuting, and potential roosting habitat for LTB. It is not possible to avoid, remedy, or mitigate habitat loss, leading to moderate overall level of effect. This residual effect is to be addressed through compensation measures. The quantum of compensation required was determined using the BCM (refer to paragraphs 57 to 64).

51. Mown grass does not provide significant habitat for LTB and removing this habitat is considered to have a very low level of effect. As such, in my opinion, there are no residual effects associated with the loss of this habitat.

Injuring or killing indigenous fauna

52. Vegetation clearance could result in indigenous bats, birds and lizards being killed or injured. The risk of killing or injuring indigenous fauna will be minimised through:

    a) Preparation and implementation of a Bat Management Plan that incorporates Vegetation Removal Protocols. This will be based on the 'Protocols for minimising the risk of felling occupied bat roosts' produced by the NZ DOC Bat Recovery Group (NZ DOC Bat Recovery

Group, 2024).

b) Preparation and implementation of an Avifauna Management Plan that details measures to ensure no adult birds, nests, eggs, or chicks are present in vegetation prior to felling.

c) Undertaking clearance of agapanthus using hand tools only and preparation and implementation of an Incidental Discovery Protocol for indigenous lizards detailing actions to be taken should a lizard be observed during vegetation clearance.

53. Implementation of fauna management will reduce the overall level of effect to very low to low.

Indirect habitat loss through impacts of light

54. Based on the concept lighting plan that has been developed for the Project by John McKensey (LDP Ltd), there will be no additional light spill beyond existing lighting along Ruakiwi Road into retained habitats. As such, the effects of lighting are not considered further.

Disturbance to avifauna during construction

55. No indigenous birds are expected to nest within the Project footprint and disturbance will be limited to birds foraging in the area. As the disturbance will be temporary and there is a large amount of similar habitat in the immediate vicinity of the proposed site, the overall level of effect is considered to be very low.

Residual effects management approach

56. As outlined in paragraph 17, it is not possible to avoid the removal of 0.58 ha of treeland, and it is not possible to remedy or mitigate this loss of foraging and potential roosting habitat for LTB, leading to an overall level

of effect of moderate. Under the EcIAG framework, residual effects of moderate or higher require management through either an offset or compensation approach.

57. A BCM was used to determine the quantum of compensation required to address the loss of habitat for LTB. LTB are cryptic, highly mobile and hard to monitor and therefore neither losses due to residual adverse effects nor gains due to offset measures can be quantified with adequate precision required for a Biodiversity Offset Accounting model (**BOAM**). Therefore, using a BCM is appropriate, as it provides a decision-making mechanism and clear justification for the choice and quantum of compensation measures that are proposed to achieve the desired net gain outcome. Unlike biodiversity offset which aims for no net loss/net gain, biodiversity compensation aims for predicted net gain to compensate for the inherent uncertainties due to inability to accurately measure losses and gains and provide greater certainty that net gain will be achieved[12].

58. Ideally, biodiversity monitoring will be undertaken to ensure that compensation measures have been successful. However, it is difficult to monitor bat uptake of roosts and new foraging areas due to their behaviour and monitoring will focus on confirming that compensation measures have been completed. To account for the inability to effectively monitor compensation outcomes, a minimum net gain of 20% was used as the basis for compensation calculations.

59. During evidence preparation, I updated the BCM models detailed in Section 5 of the EcIA to:

    a) Provide a more holistic approach to the compensation package by combining roost and foraging habitat loss models;

[12] Baber, M, Dickson, J, Quinn, J, Markham, J, Ussher, G, Heggie-Gracie, S, and Jackson, S. (2021a). *A Biodiversity Compensation Model for New Zealand* – A User Guide (*Version 1*). Prepared by Tonkin & Taylor Limited. Project number 1017287.0000P.

b) Clearly account for the use of protected and/or relocated roost features as a compensation measure in addition to artificial roost boxes and artificial roost features; and

c) Address the loss of 1 ha of mown grass within the project footprint.

60. The following changes were made:

a) The models for the loss of potential roosting habitat and loss of foraging habitat were combined. I chose this approach because in hindsight, pest mammal control provides benefits to LTB both through increased food availability and through reduced risk of predation at roosts.

b) Protection and/or relocation of existing roost features was added as a compensation measure in addition to provision of artificial roost boxes and artificial roost features. This compensation measure addresses concerns raised by DOC in its submission around the use of artificial roost boxes as a mitigation measure. Where possible, existing potential roost features within trees that are being removed will be sectioned out of trees and moved elsewhere in the Hamilton Lake Domain. Relocated roost features will either be strapped to existing trees or mounted on poles. Trees within the 7.4 ha pest mammal control area will be surveyed for potential bat roost features and where possible these will be protected with metal bands above and below.

c) Following review of DOC's submission and feedback provided in the s 42A report, I updated the BCM to account for the loss of 1 ha of mown grass within the project footprint. As outlined in paragraph 42 of this evidence, I do not consider that this habitat provides significant foraging habitat for indigenous fauna and do not consider that compensation for loss of this habitat is required. However, an appropriate compensation approach that provides biodiversity benefits for other indigenous taxa was identified and I supported its inclusion to provide additional biodiversity benefits.

61. The updated model parameters and model justification table are provided in **Appendix 2** and **Appendix 3** of my evidence, respectively. A net gain outcome of 27% is predicted through provision of the following:

a) 0.58 ha of indigenous planting.

b) 7.4 ha of pest mammal control.

c) 1.0 ha of "no mow" grassland.

d) Protection and/or relocation of 19 existing roost features.

e) Installation of 23 artificial roost boxes.

62. All compensation measures will take place within Hamilton Lake Domain to ensure that compensation is provided as close to the impact location as possible. The indicative locations of indigenous planting, pest mammal control, "no mow" grassland, and where bat roost features will be provided is shown in **Appendix 1**.

63. Reservoir 1 is proposed to be completed in 2028, whereas construction for Reservoir 2 may not commence until at least 2036 leading to a staged loss of habitat. However, all compensation measures will be implemented within one year of Reservoir 1 works commencing. Pest mammal control, maintenance of roost features, and provision of "no mow" grassland will be undertaken for 10 years. Maintenance of plantings will be undertaken for 5 years, by which point it will be well-established and not require further maintenance. I consider the 10 years of pest mammal control and maintenance of roost features is appropriate given the consistently low level of bat activity recorded at Hamilton Lake Domain.

64. Reports will be provided to consenting authorities documenting successful implementation of all compensation measures. The report contents and reporting frequency will be prescribed in the relevant management plans that are required as conditions of consent.

RESPONSE TO SUBMISSIONS

Submission 2 – DOC

65. The submission from DOC concludes that the NOR presents a "significant level of ecological impact that has not been adequately addressed". The submission provided a thorough description of how this conclusion was reached and, while I disagree with some of the comments made, I am appreciative of the level of detail provided. I had the opportunity to discuss the NOR, the DOC submission, and proposed updates to conditions with Ms Tertia Thurley (Bat Recovery Group, DOC) and Mr Ronan Whitelock (Resource Management Planner, DOC) on 19 November 2025.

66. Where appropriate, I have addressed comments raised by DOC and points discussed in the meeting within this statement of evidence, and I have provided a response to each of the matters raised in DOC's submission below.

67. Identification of bat habitat:

    a) DOC's submission requests that the NOR "take a precautionary approach and consider the effects not only on potential roosting trees, but also on associated grassland and surrounding mosaics."

Response

    b) As outlined in paragraph 42 of this statement of evidence, I do not consider that mown grass provides important foraging habitat for LTB due to intensive management through mowing reducing the number of invertebrates that are available as a food source. However, the RA is supportive of establishing “no mow” areas within the Hamilton Lake Domain as a way of compensating for the loss of mown grass with a habitat that will provide better food availability for LTB. I included this compensation measure in an updated BCM prepared for this statement of evidence and concluded that provision of 1 ha of “no mow” grassland was sufficient to compensate for the loss of 1 ha of mown grass within the project footprint.

c) The loss of habitat within the project footprint represents a small portion of available habitat within the Hamilton Lake Domain and following construction of the reservoirs there will still be a mosaic of habitat types available for LTB.

68. Permanent loss of potential and actual habitat for threatened fauna:

a) DOC “supports the total of trees proposed for planting and suggests, in deciding the typology of new planting, the [RA] ensures this is carried out in accordance with the Bat Recovery Group Advice Note on appropriate plant species which provide roosts.”

Response

b) Recommended species from the Bat Recovery Group Advice Note on appropriate plant species which provide roosts have been incorporated into the planting palette prepared for the Project.

69. Injury or mortality of bats during vegetation clearance:

a) DOC’s submission suggests changes to be made to the Bat Management Plan condition to provide more certainty that effects will be appropriately managed. The submission also notes that “the BMP also fails to provide the management of effects in relation to the potential bat roosts trees which are proposed to remain".

Response

b) Conditions 49 and 50 have been updated to address the first point.

c) Tree protection is addressed in conditions 27-33 and I consider the measures prescribed in these conditions will provide appropriate protection to retained trees.

70. Artificial light spill:

a) DOC's submission requests that defined lighting controls are provided within a Light Management Plan, and that the Light Management Plan give effect to the principles to reduce the impact/effect of artificial light on bats detailed in a Bat Recovery Group advice note.

Response

b) Conditions 74-77 address Lighting Design and specifically address the Bat Recovery Group advice note. The concept lighting plan confirms that there will be no additional light spill into retained bat habitat following construction of either reservoir.

71. Compensation planting:

a) DOC's submission states that compensation planting will "improve existing habitat rather than creating new habitat" and that there will be "residual effects because there is a permanent loss of overall habitat, and because there will be a time-lag of newly planted trees developing roost features". The submission concludes that compensation planting "does not sufficiently manage effects from vegetation removal, and hence, residual effects are inadequately unmanaged[13]".

Response

b) Compensation planting and "no mow" areas will be established within mown grass, which I consider to have negligible ecological value for LTB. As such, I consider provision of these habitat types habitat creation not improvement.

c) I acknowledge that newly-planted trees may take 20 plus years to form potential bat roost features. For this reason, the compensation package includes the provision of bat roost features in the form of artificial roost boxes, artificial cavities, and protection/relocation of existing bat roost features.

d) I consider that the compensation package provided with the NOR is sufficient and that identified residual effects will be appropriately managed. The disagreement stems from the ecological value assigned to mown grass, which DOC considers to be higher than the value of negligible that I assign it. The magnitude of effect of removing all vegetation within the proposed designation footprint was assessed in the EcIA as moderate. Even if mown grass was given an ecological value of low rather than negligible, the overall level of effect under the EcIAG framework would be low. Under the EcIAG framework, a low level of effect is defined as a minor shift away from existing baseline conditions, and no residual effects management is needed. Despite this, I have included loss of mown grass in the BCM with the provision of "no mow" grassland as a compensation measure.

72. Artificial bat boxes and roost features:

[13] I assume that "unmanaged" is a typo and that this sentence should read "....inadequately managed".

a) DOC is not supportive of the use of artificial roost boxes and artificial roost features to compensate for the loss of potential bat roosts. The submission states that consent conditions should contain additional information to provide confidence that the roost features will be installed and management correctly.

Response

b) The bat population in Hamilton has shown high uptake of artificial roost boxes, including observations of pups within the boxes suggesting they are being used as maternity roosts[14]. I acknowledge DOC's concerns around relying solely on artificial roost boxes, and this is why the compensation package includes the provision of 42 roost features comprising four different types:

(i) Artificial roost boxes with metal bands above and below.

(ii) Artificial roost features created in living trees with metal bands above and below.

(iii) Relocation of sections of tree containing potential roost features from the Project footprint to nearby locations within the Hamilton Lake Domain. Sections of tree will be mounted on poles or strapped to other trees, and where necessary be protected with metal bands above and below.

(iv) Protection of existing potential roost features within the pest mammal control area in the Hamilton Lake Domain by installing metal bands above and below cavity entrances.

c) The Bat Management Plan condition (condition 50) has been

[14] Robinson, H., Ling, N., & Tempero, G.W. (2023). *Occupation of artificial roosts by long-tailed bats (Chalinolobus tuberculatus) in Hamilton City, New Zealand.* New Zealand Journal of Zoology, 51:2, 186-199.

updated to include more prescriptive requirements as requested by DOC.

73. Predator control:

a) DOC is supportive of pest mammal control as a compensation measure, but notes that insufficient detail was provided in the NOR. DOC considers that a larger area is required to account for reinvasion of pests around the perimeter of the pest management area. Finally, DOC suggests that an increased area of pest mammal control is a more appropriate effects management measure than the provision of artificial roosts.

Response

b) In relation to the first point, pest mammal control will target rats, mustelids and possums. Due to the location of the control area, control methods will be agreed with the RA to ensure they are suitable for use in a public park located within a residential area. Target-based control of pest mammals in urban environments is difficult because standard monitoring methods do not perform well in small areas where there is high reinvasion pressure from surrounding uncontrolled areas. Instead, pest control will be undertaken year-round with an adaptive management clause allowing for additional effort in particular circumstances. Pest mammal control will be undertaken for a period of 10 years, which I consider appropriate compensation given the consistently low bat activity recorded at the site. Full details of pest mammal management prescriptions will be provided in the Ecological and Landscape Management Plan.

c) In relation to the second and third points, the goal of the compensation package was to undertake compensation actions as close as possible to the site of impact. It is not possible to undertake pest mammal control across a wider area while still undertaking compensation actions close to the site of impact.

d) Overall, I consider that the pest mammal management area being offered provides appropriate compensation for the level of habitat loss.

74. Monitoring of compensation measures:

a) DOC's submission notes that "no monitoring is proposed to ensure that appropriate compensation has been delivered" and that monitoring should "include a report prepared by a suitably qualified person, confirming that compensation planting, artificial bat boxes and roost features, and predator control have been implemented in accordance with their respective conditions".

Response

b) Relevant conditions have been updated to include monitoring and reporting conditions to address this concern.

75. Effects management is provided as an integrated package comprising multiple compensatory measures. Overall, I consider that the compensation package outlined in this statement of evidence appropriately addresses potential adverse effects.

RESPONSE TO S42A REPORT COMMENTS/RECOMMENDATIONS

76. Ms Emily Lion-Cachet's (Beca Ltd, on behalf of the s 42A report author) review of the EcIA provided in the s 42A report concluded that:

a) The effects can be managed through appropriate designation conditions, reducing adverse impacts on ecological features and values to a low or very low level, while ensuring compliance with the relevant statutory requirements outlined above.

b) Reconsideration of the scale of compensation is required to address remaining residual effects and ensure a net benefit is achieved at the site is required.

Response

c) In my opinion there will not be any residual adverse effects. The compensation package proposed in the NOR appropriately addressed potential adverse effects with an estimated net gain outcome of 25.7%. In my opinion, the loss of mown grass has an overall level of effect of very low under the EcIAG framework and compensation for the loss is not required. However, this loss has been included in the updated BCM leading to an estimated net gain outcome of 27.0%.

Recommended changes to conditions

77. The RA's updated set of conditions appended to Mr Dawson's evidence have been updated in response to submissions, s 42A report comments, and direct discussions with DOC and Ms Lion-Cachet. No further changes are recommended.

CONCLUSIONS AND RECOMMENDATIONS

78. The potential adverse ecological effects of vegetation removal required for construction of the Project were assessed. Most effects of vegetation removal within the Project footprint can be managed, but removal of treeland was identified as resulting in residual effects on LTB.

79. There are no ways to avoid, remedy, or mitigate the loss of treeland and a BCM was used to determine the compensation actions required to meet a minimum net gain target of 20%. The model predicted a net gain outcome of 27% through provision of the following:

a) 0.58 ha of indigenous planting.

b) 7.4 ha of pest mammal control.

c) 1.0 ha of “no mow” grassland.

d) Protection and/or relocation of 19 existing roost features.

e) Installation of 23 artificial roost boxes.

80. All compensation measures will take place within Hamilton Lake Domain to ensure that compensation is provided as close to the impact location as possible. Planting will be monitored for a period of 5 years. Pest mammal control, provision of “no mow” grassland, and monitoring and maintenance of roosts will be undertaken for a period of 10 years.

81. Provided recommendations to minimise the risk of killing or injuring indigenous fauna during vegetation clearance and the compensation package are fully implemented, the Project will result in a net gain in biodiversity values within the Hamilton Lake Domain.

Dr Jamie William Booth MacKay
19 December 2025

APPENDIX 1

Map

\\ttgroup.local\corporate\Hamilton\Projects\1097546\WorkingMaterial\IAF_Reservior\IAF_Reservior_1306.aprx Layout: P1097546_TTNZA4_BatSurveyResults 2025-Dec-10 12:51 pm Drawn by DSMI

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NOTES:
OSM_AU_Highways: © OpenStreetMap contributors. LINZ NZ Place Names - Suburbs: . World Topographic Map (Vector Tile): Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community. NZ Imagery: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

REVISIONS	NO.	BY
Updated December 2025 (10/12/2025)	1	DSMI

PROJECT No.	1097546.0000	
DESIGNED	DSMI	DEC.25
DRAWN	DSMI	DEC.25
CHECKED	JORB	DEC.25
APPROVED		DATE

CLIENT **HAMILTON CITY COUNCIL**
PROJECT **IAF HCC RESERVOIR - ECOLOGY**
TITLE 2025 BAT SURVEY RESULTS - IAF HCC RESERVOIR

SCALE (A4) 1:2,500 FIG No. FIGURE D.2 REV 1

APPENDIX 2

BCM model

Model Inputs

Input descriptors	Input data				
Project/reference name	IAF HCC Reservoir				
Biodiversity type	Long-tailed bats				
Technical expert(s) input	PADY,SHEG, JAWM				
Benchmark	5				
How many habitat types OR sites are impacted	3				
Number of proposed compensation actions	5				
Net gain target	20%				
Habitat/Site Impact(s)	**Treeland**	**Mown grass**	**Roosts (impact area)**		
Impact risk contingency:	4	4	4		
Impact uncertainty contingency:	2	2	2		
Areal extent of impact (ha):	0.58	1	14		
Value score prior to impact:	3	1	2.5		
Value score after impact:	0.001	0.001	0.001		
Compensation Action(s)	**Planting**	**Pest mammal control**	**No mow**	**Roost features**	**Artificial roosts**
Discount rate:	3.0%	3.0%	3.0%	3.0%	3.0%
Finite end point (years):	20	1	1	3	3
Compensation confidence contingency:	2	3	2	3	3
Areal extent (ha) of compensation type:	0.58	7.4	1	19	23
Value score prior to compensation:	0.5	2.5	0.5	2.5	0.001
Value score after compensation:	3	3.5	2	3.5	3.5

Model outputs

	Total impact score	Treeland	Mown grass	Roosts (impact area)		
Impact score	-9.95925	-0.45921	-0.26374	-9.23630		
	Total compensation score	Planting	Pest mammal control	No mow	Roost features	Artificial roosts
Compensation score	12.65026	0.13247	0.89806	0.24029	2.17346	9.20598
Net gain outcome	27.0%					

This Biodiversity Compensation Model (BCM) and the accompanying User Guide has been developed by:
M. Baber, J. Dickson, J. Quinn, J. Markham, G. Ussher, S. Jackson and S. Heggie-Gracie

APPENDIX 3

BCM justification table

Model input factor	Explanation and justification
Biodiversity type	Long-tailed bats
Technical expert(s) input	Paul Dyer (Terrestrial Ecologist), Sam Heggie-Gracie (Competent Bat Ecologist[15]), Dr Jamie MacKay (Senior Ecologist, Competent Bat Ecologist[16]).
Benchmark	A benchmark of 5 is always used to equate to a pre-human impact state.
Habitat types impacted	3 – treeland that provides foraging and potential roosting habitat, mown grass that provides foraging habitat, and potential roost features in trees.
Number of proposed compensation actions	5 – planting, pest mammal control, no mow grassland, and provision of artificial roosts, protection of existing roost features.
Net gain target	20% - In general terms, the greater the assigned Net Gain outcome target, the greater the likelihood that No Net Loss or preferably Net Gain outcomes will be achieved. Bats are known to be active in the area. A higher Net Gain Target to achieve 20% exceedance of No Net Loss provides greater certainty that that Net Gain will be achieved.
Habitat impacted	Long-tailed bat habitat
Impact risk contingency	4 – Very High risk/value The risk was assessed as 'Very high' because long-tailed bats are classified as Threatened - Nationally Critical. This equates to a 'Very high' ecological value under EcIAG (Roper Lindsay *et al*. 2018).
Impact uncertainty contingency	2 – moderate risk/value Moderate habitat complexity, exotic dominated habitat, good knowledge of adverse effects, however unknown whether bats roosted in the habitat, although they were detected commuting and foraging.
Areal extent of impact (ha)	0.58 ha of treeland, 1 ha of mown grass, and 14 trees with potential roost features
Value prior to impact	Treeland – 3. Reasonable potential foraging habitat, bats have been detected using the area for

[15] Sam Heggie-Gracie holds competencies 3.1 and 3.3 under the Department of Conservation Bat Handling Competencies (dated 29 July 2022), approved by the Bat Recovery Group.

[16] Dr Jamie MacKay holds competencies 3.1, 3.2, and 3.3 under the Department of Conservation Bat Handling Competencies (dated 29 July 2022), approved by the Bat Recovery Group.

	foraging/commuting. However, activity levels are low, the site is within a disturbed urban environment, and management of grass beneath the trees by mowing for recreational purposes reduces value. Mown grass – 0.5. Foraging habitat, but unlikely to provide an important invertebrate resource due to regular mowing and maintenance for recreational purposes. Potential roost features in trees – 2.5. Good potential roosting habitat; however, no sign of roosting was observed during inspections and uncontrolled pest mammal numbers reduce value.
Value after impact	0.001 - Effectively no habitat remaining after clearance.
Compensation type 1	0.58 ha revegetation
Discount rate	3% (the default discount score as per Maseyk et al. (2015); Baber et al. (2021a)). The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s).
Finite end point	20 - Vegetation at 20 years will provide good foraging habitat (noting that gains will likely be observed sooner as habitat complexity develop).
Compensation confidence contingency	2 - High confidence that planting will provide good foraging habitat after 20 years.
Areal extent (ha) of compensation type	0.58 ha of planting is required to achieve a Net Gain Target of at least 20%.
Value score prior to compensation	0.5 - Indigenous plants will be planted into mown grass that currently provides limited food resource.
Value score after compensation (planting)	3 - Planting is expected to provide good-quality foraging habitat within 20 years.
Compensation type 2	7.4 ha pest mammal control
Discount rate	3% (the default discount score as per Maseyk et al. (2015); Baber et al. (2021a)). The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s).
Finite end point	1 - Pest mammal control is expected to benefit bats within one year.
Compensation confidence contingency	3 - Pest mammal control is expected to benefit bats through reducing predation pressure at roosts and reducing compensation for food resources.
Areal extent (ha) of compensation type	7.4 ha of pest mammal control is required to achieve a Net Gain Target of 20%. Pest mammal control will be undertaken within existing vegetation within the Lake Domain.
Value score prior to compensation	2.5 - Existing vegetation provides foraging and potential roosting habitat, however, the value is reduced due to uncontrolled pest mammal populations.
Value score after compensation	3.5 - Pest mammal control will lead to an increase in the value of foraging and potential roosting habitat.
Compensation type 3	1 ha no mow grassland

Discount rate	3% (the default discount score as per Maseyk et al. (2015); Baber et al. (2021a)). The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s).
Finite end point	1 - Allowing grass to grow is expected to provide an increase in food resource for bats within 1 year.
Compensation confidence contingency	2 - High confidence that unmanaged grassland will provide more food for bats than current mown grass.
Areal extent (ha) of compensation type	1 ha is required to achieve a Net Gain Target of 20%. No mow areas will be established within the Lake Domain.
Value score prior to compensation	0.5 – existing mown grass currently provides limited food resource.
Value score after compensation	2 – grass that has not been mown provides a better invertebrate food resource for bats.
Compensation type 4	Protection of 19 existing roost features
Discount rate	3% (the default discount score as per Maseyk et al. (2015); Baber et al. (2021a)). The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s).
Finite end point	3 – bats may already be using existing features; however, an end point of 3 years has been selected to align with research into occupancy of artificial bat roosts in Hamilton (Robinson 2022).
Compensation confidence contingency	3 - artificial bat roost boxes are known to have been used by bats in Hamilton; however, to the best of our knowledge no studies have investigated bat use of existing roosts that are increased in value through removal of predation pressure.
Areal extent of compensation type	Protection of 19 existing roost features is required to achieve a Net Gain Target of 20%.
Value score prior to compensation	2.5 – existing roost features provide potential habitat; however, uncontrolled pest mammals reduce their value.
Value score after compensation	3.5 – protecting existing roosts through installation of metal bands above and below, and pest mammal control, will increase the value by removing predation pressure.
Compensation type 5	Provision of 23 artificial roosts/roost features
Discount rate	3% (the default discount score as per Maseyk et al. (2015); Baber et al. (2021a)). The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s).
Finite end point	3 – Studies of artificial bat roost boxes/features in Hamilton suggest that bats can take up artificial roosts as early as 12-18 months (Robinson 2022). Three years has been used as a conservative measure
Compensation confidence contingency	3 - Moderate confidence - artificial bat roost boxes are known to have been used by bats in Hamilton, however, not all roost boxes are used and there is a lack of research into how roost boxes can best meet bats needs
Areal extent of compensation type	Provision of 23 artificial roosts/roost features is required to achieve a Net Gain Target of 20%.
Value score prior to compensation	0.001 – artificial roosts/roost features will be installed in trees that do not currently provide bat roosting

	habitat, hence low score.
Value score after compensation	3.5 – Artificial bat roost boxes + artificial roost features that are protected with metal bands are expected to provide new roosting habitat for bats within 3 years of implementation.