SLR Consulting New Zealand
Level 2, 214 Collingwood Street, Hamilton 3204, New Zealand

13 March 2025

SLR Ref No.: WRC s92 response

Attention: Ceri Hills
Consents Officer
Waikato Regional Council
Ceri.hills@waikatoregion.govt.nz

SLR Project No.: 880.V11547.00001

Client Reference No.: 11547

RE: Information Requested – APP146952 Multiple Certificates for Land Remediation and Landfill Upgrade of Tokanui Hospital

---

Please find below the information requested in your Request for Further Information under Section 92(1) of the RMA dated 4 February 2025.

Erosion and Sediment Control

1. *Pumping/Dewatering Management Plan*

   Response:

   Please refer to the draft Pumping/Dewatering Management Plan in Attachment 1. While this sets out the intentions for managing effects associated with dewatering and demonstrated that these can be appropriately managed, LINZ requests that conditions of consent allow for a final version to be certified by WRC. This will retain some flexibility for contractors once they are appointed.

2. *Management of discrete areas of work*

   Response:

   The discrete areas will be managed by ensuring that all erosion and sediment controls will remain in place until works in each area are complete and the area stabilised. The principal controls are silt fences and dirty/clean water drains/bunds. These can readily be relocated if the disturbance area needs expanding so as to ensure that all "open" areas have appropriate erosion and sediment controls.

   As referred to in the Pumping/Dewatering Plan, extensive investigation works have been undertaken which have identified and delineated the horizontal and vertical extent of soil contamination across the vast majority of the site. The associated soil contamination is relatively minor and leachability tests have confirmed the leachability potential to be low for key contaminants (lead, zinc). There are however a number of specific areas that have been identified as suspected fill pockets (NBA 1-11, RAP S7.9.1 and FTL drawing R52) where remedial works could extend beyond already identified areas. Investigation of these areas indicates they appear to be relatively small and it will be relatively straightforward to shift or add additional erosion and sediment controls around them. All areas for remediation are cavities below adjacent ground levels with any upgradient runoff diverted around them, while

any rainfall that falls into the cavity will be dealt with as already covered in the ESCP and Pumping/Dewatering Plan.

Topsoil and other stockpiles will be placed at suitable locations. These stockpiles will either be grassed, hydroseeded, mulched or covered with geotextiles to prevent erosion and transport of loose soil, and be provided with appropriate perimeter controls (silt fence, small bunds (minimum 300 mm high) or filter socks). This is covered in section 6.14 of the Hospital Demolition and Remediation ESCP (Appendix Q to the Remediation Application) and in section 6.18 of the Disposal Site Repair and Upgrade Works ESCP (Appendix D to the Landfill Upgrade Application).

3. *ESCP and methodology for other works – roading and services / in-ground structures removal*

   Response:
   These works are all covered by the ESCP drawings supplied with the Remediation Application.

   The removal of services and in-ground structures is covered in the Hospital Demolition and Remediation ESCP, section 6.5.

   Roading removal and backfilling will all involve excavation below the existing ground surface, creating a similar cavity situation to services removal. The same procedure will be followed as set out in section 6.5 of the Hospital Demolition and Remediation ESCP. For residual road areas to be converted to farm tracks, only the road pavement layer will be removed in this case, with the basecourse and subbase materials retained. Well graded Farm AP40 (FAP40) will then be used to form hardfill/gravel farm tracks for ongoing use. Hence, there is expected to be little or no exposed soils during these works and hence no to minimal potential for sediment generation. If any soils were exposed, these would be small, localised cavities and managed as per section 6.5 of the Hospital Demolition and Remediation ESCP.

   We would be happy to arrange for an additional site visit with the erosion/sediment control reviewer and one of the project team if this is still considered beneficial. We note that we do have locally based team members, but if the reviewer wishes to be accompanied by our project engineer who authored the ESCP, they will need to travel from Auckland. Let us know what best suits.

Landfill Upgrade Works – Land contamination

4. ***Appendix C1 – Intrusive Investigation report, Section 5.2.1, Table 2. & Section 8.5** – It is stated that area A/C likely had a layer coal ash placed as cover once the cell was completed. If a uniform coal ash layer is encountered during stripping of current cap for repair works, will this material be removed via surface scrape? Decreasing the potential boron reservoir could reduce concentrations being leached into the Wharekorino Stream. Similarly, if large deposits of coal ash are discovered in area F, will these be excavated during medical waste removal works?*

   Response:

   The most practical approach is considered to be:

Areas A/C

- The cap in these areas is being partially stripped, but 200 mm of cap will be retained above any refuse so as to not expose the refuse. Any coal ash in the residual cap will be retained in situ, underneath the new low permeability cap.
- Within the stripped cap material, if any coal ash / burnt material is encountered, it will be retained and placed under the new low permeability cap.
- It is considered appropriate to retain the cap materials onsite including any coal ash, for the following reasons:
    - Although the extent of the boron reservoir is not well defined, the proportion of it within the cap material that is to be stripped is considered to be relatively small.
    - Furthermore, ongoing stream monitoring data shows a downward trend in boron concentrations, which supports our assumption that it is being depleted. Ongoing monitoring also shows boron levels are within adopted ANZECC guidelines in the stream. See Figures 4 and 5 in Remedial and Upgrade Works report – Appendix B to the Landfill Application.
    - The proposed landfill capping remedial works and groundwater intercept trench will reduce the potential for water to pass through the landfill material, which is likely to reduce boron leaching from the landfill and hence further reduce boron concentrations in the stream.

Area F

Inferred coal ash was present in one offal pit within Area F. However, Area F largely contained a small number of small diameter offal pits where medical syringes and unused drugs were disposed of. It is considered unlikely that large quantities of coal ash will be identified within Area F during remedial works. Given the localised nature of the offal pits, if coal ash is encountered it will likely be disposed of to a suitably licensed facility along with the medical waste.

5. ***GW cut-offs drain construction*** *- Will there be a lag time between construction of the cut-off drain and placement of refuse in the new A1 cell to ensure the cut-off drain is effectively diverting groundwater?*

Response:
The GW cut off drain will be constructed and made operational in advance of disturbance of any fill within Areas A1/2 & H. The drain discharge point can be checked as required to confirm it is effectively diverting groundwater.

6. ***Topsoil use for toe/perimeter bund*** *– please clarify whether areas where topsoil exceeds guideline/class 1 criteria will be utilised for toe/perimeter bund construction.*

Response:

Soils exceeding human health or class 1 disposal criteria will not be used for toe/perimeter bund construction. Soils from elsewhere on site that are geotechnically suitable and meet adopted soil guideline values will preferably be used, or otherwise imported suitable, cleanfill material.

7. ***Pre-capping works A1/B/C:*** *Please clarify whether similar compaction, shaping and trim works will be undertaken in areas A1/B/C (outside of the perimeter bund) as outlined for areas D/E/F in section 5.4.2, prior to construction of the new landfill cap.*

   Response:

   Similar compaction, shaping and trim works will be undertaken in areas A1/B/C (outside of the perimeter bund) as outlined for areas D/E/F in section 5.4.2, prior to construction of the new landfill cap. This will be done as part of placement of the lower quality landfill cap materials on top of refuse to form a 150-300 mm thick base layer (step A1.17 of Section 5.4.3 methodology in the Remedial and Upgrade Works report).

8. ***Quality Assurance (7.4.11)*** *– Please provide further details with respect to decontamination procedures in accordance with Section 4.3, CLMG 5.*

   Response:

   We assume the Council's question relates to S7.4.11 of the Intrusive investigation report. Further details of decontamination procedures follow.

   During the landfill intrusive investigation, Tyvek type 5/6 suits, half face respirators with P3 filters, steel toed footwear and gloves were used, gloves were doffed and disposed of between sampling locations, while suits were doffed and disposed of when they were heavily soiled or during decontamination procedures at the end of a work period (spray down with water supply, wipe masks, remove all PPE/RPE, dispose of non-reusable PPE, dispose of P3 filters after 40hrs of use). All doffed and disposed PPE was placed into asbestos waste bags and double wrapped, then goosenecked and tied off with thick tape.

   All sampling equipment was triple washed between sampling locations. 1st wash was a clean water wash, followed by a wash in a decon solution (phosphate free cleaning agent), followed by a final wash in clean water. If any stubborn debris were attached to sampling equipment, wet wipes were first used to remove the sediment to ensure the wash water wasn't loaded with sediment.

Terrestrial Ecology

9. *No actual avifauna survey was conducted, only incidental sightings/vocalisations. An avifauna survey is required in main habitat types to identify species presence/densities. Making recommendations and conclusions based on historic records and a method that is not robust and repeatable does not provide appropriate data to support effective management measure recommendations and/or outcomes.*

   Response:

   While more detailed and scientifically more robust surveys are generally always better, we do not agree that additional avifauna surveys are required in this case.

   As per Schedule 4 cl 2(3)(c) of the RMA, the methodology used for identifying avifauna at the Tokanui site *is of such detail as corresponds with the scale and significance of the effects that the activity may have on the environment*. The proposed works will have minimal impact on avifauna habitat with vegetation removal and pasture impacts avoided and minimised where practicable. Works will also be temporary and planting areas will restore habitat. Additionally, the environment included within the site is a highly modified rural area and similar to that in the wider landscape. We consider it is highly unlikely that native species that have a threat status higher than 'Not Threatened' would utilise the site in any significant way.

We determined that the level of effect on avifauna will be Very Low, therefore no effects management specific to avifauna will be required.

Undertaking surveys to identify presence/densities of avifauna on site is inappropriate as it does not correspond with the scale and significance of the effects the proposed works may have on the environment.

10. *Where are the results of the bat survey? Can we have access to the Tokanui BMP?*

Response:

As long-tailed bats are known to be present in high abundance within the Region and were identified on site as described in Section 4.2.1 of the Ecological Impact Assessment (Appendix L to the Remediation Application) it is considered the findings take into account the presence of bats to the extent necessary to assess the ecological effects of the proposal and to provide appropriate effects management recommendations for the proposed works. Appropriate effects management for effects on long-tailed bats was determined to include "A BMP specific to this site and proposed works must be prepared by a suitably qualified ecologist and include appropriate effects management measures for potential adverse effects on bats."

We note that the Bat Management Plan (BMP) is currently in draft form and is proposed to be required as a condition of consent (e.g. condition B14 in Appendix T to the Remediation Application) which sets out its objective and what it must include. A more intensive acoustic survey and on-site monitoring was conducted to inform detailed appropriate effects management within the BMP. The bat survey data has been provided to DOC and been used to inform the draft BMP. While we did not consider it necessary to provide the draft BMP to assess the ecological effects of the proposal and determine appropriate mitigation measures, we have now attached the draft BMP for your information and to provide reassurance that investigations have been done and an appropriate protocol is proposed.

11. *As buildings are no longer used/dilapidated, why were they not assessed for the presence of bats?*

Response:

The demolition of buildings did not form part of the resource consent application to Waipā DC or WRC. Therefore, no information on bat management measures for buildings is considered necessary to assess the effects of the application. Nonetheless, we advise that preliminary assessments have occurred, and buildings will be further assessed for the presence of bats before demolition so that LINZ meets its obligations under the Wildlife Act. A bat scent detector dog has been recently deployed to assess the buildings, and further acoustic monitoring is underway.

12. *General questions from the provided ecology report:*

a. Was the weather favourable during acoustic surveys?

Response:

34 of the 41 nights the ABMs were deployed were identified as favourable weather for monitoring. Further monitoring undertaken for the draft BMP by a suitably qualified bat ecologist had an additional 24 favourable weather nights.

b. What was the effort of the targeted search?

Response:

Please refer to Section 2.3.1 for all details. "Bioacoustic bat monitoring was undertaken using AR4 automatic acoustic bat monitors (ABMs) manufactured by DOC. A total of four bat recorders were deployed across the site, targeting habitat features. The date and time settings were synchronised across the ABMs and they were programmed to monitor from one hour before sunset to one hour after sunrise over a five-week survey period (14/12/2022 - 19/01/2023). All ABM recordings were downloaded, and acoustic data was analysed using the programme AviaNZ Bioacoustic Software. The location of the deployed ABMs is shown on Figure 2." Further monitoring undertaken by the draft BMP included higher effort monitoring.

c. How many hours were you on site on each day for incidental recording.

Response:

If this question is in reference to avifauna, all incidental observations were recorded on 13 and 14 December 2022 from approximately 9am – 4pm.

d. What resolution and what base map were used for mapping?

Response:

The basemap called "NZ - Imagery" within ArcGIS pro was used. The metadata for this basemap states "The map combines high resolution imagery (0.075 m - 1.25 m) that covers around 95% of New Zealand within the 10 m Aerial Imagery... this map is updated regularly with the latest high resolution imagery".

e. de Lange et al 2018 is outdated. Please use de Lange et al 2024 and update all threat status' to align with this new report.

Response:

The only species to be impacted by the report update is Kauri (*Agathis australis*) that now has a better status, changing from Threatened – Nationally Vulnerable to At Risk – Declining. We do not consider this change has any impact on the associated values assessment within the Ecological Impact Assessment.

Engagement

13. *Please provide the results of any engagement or updates to engagement undertaken or received by the applicant since the application was lodged in November 2024.*

Response:

There have been no written comments provided by iwi/hapū since the application was lodged. However, all interested parties were aware of the application being lodged and the details of the application. Since lodgement, engagement has continued, including monthly hui with Te Nehenehenui Trust, who have provided a letter of support for the proposal (Attachment 3). TAR Block (Maria Maniapoto and Robert Te Huia) was also contacted and performed a karakia ahead of enabling vegetation removal works (not requiring consent) in February 2025.

We trust this response satisfies your queries. If you do however require any further information, please do not hesitate to contact us.

Regards,

SLR Consulting New Zealand

Emily Buckingham
Principal Consultant – Planning
Emily.buckingham@slrconsulting.com

Mark Ashby
Technical Director – Planning

Attachment 1 Draft Pumping/Dewatering Management Plan

Attachment 2 Draft Bat Management Plan

Attachment 3 Letter from Te Nehenehenui Trust

Fraser Thomas Limited
21 El Kobar Drive : East Tamaki : AUCKLAND 2013
PO Box 204006 : Highbrook : AUCKLAND 2161
NEW ZEALAND
TEL +64 9 278 7078

TOKANUI HOSPITAL – DRAFT PUMPING/ DEWATERING MANAGEMENT PLAN

Date: 12 March 2025 33205

To: LINZ

Subject: Tokanui Hospital Demolition and Landfill Upgrade Works – Draft Pumping/Dewatering Plan

From: Sean Finnigan

1.0 INTRODUCTION

This draft Pumping/Dewatering Management Plan has been prepared for the Tokanui Hospital demolition works in response to a Section 92 request from Waikato Regional Council (WRC) dated 4 Feb 2025. A final version of this plan will be provided to WRC for technical certification prior to works commencing. The final plan would incorporate any further feedback from WRC and include input from the contractor who will undertake these works.

The S92 request states:

"Erosion and Sediment Control

1. *The erosion and sediment control plan (ESCP) details that there may be a significant amount of dewatering, either to sediment control structures (if there are not other contaminants) or directly off site. Section G1.1 of Auckland Council's GD05 states "Dewatering is the removal of water from excavations, tunnelling, trenches and sediment control devices. It may be the removal of either surface water or groundwater and is generally undertaken by pumping. This process can generate fine textured material that is difficult to treat and retain on site, even through use of robust sediment control devices such as those described in this guideline." GD05 also states that small volumes of sediment laden water can be pumped to a decanting earth bund (DEB), however larger volumes can be pumped to a sediment retention pond (SRP). The risk with pumping to a DEB is that DEBs (as proposed in the ESCP) are often constructed for smaller catchments and as such can be overwhelmed easily. It is also recognised that significant areas of the works proposed are potentially contaminated, and will be reliant on testing to determine the level of contamination and what can be done with the material and runoff. This increases the length of time areas are exposed, and thereby increases the sediment discharge risk. Please provide a Pumping/Dewatering Management Plan that specifies the specific dewatering procedure to be followed, documentation required (Permit to Pump or similar) to undertake the pumping/dewatering, discharge standards proposed to be met through dewatering and how this will be monitored and recorded, and contingencies should these standards be exceeded. This should also include contingencies should runoff have to be contained on site for any period of time should contamination/testing require this to occur."*

2.0 BACKGROUND INFORMATION AND RATIONALISATION OF APPROACH

2.1 ESCPs Provided to Council

The ESCPs provided to Council for the hospital demolition and landfill upgrade works were deliberately written to give the contractor a reasonable degree of flexibility as to the erosion and sediment control (ESC) devices used on-site as our experience is that contractors may propose

changes to such plans prepared by the design engineer based on their programming, experience, methodology and/or for cost saving and efficiency reasons, that often produce a better outcome in terms of worker safety and environmental protection.

2.2 Proposed Erosion and Sediment Controls

The proposed ESC measures for the hospital demolition works are shown in the FTL 33205\3000 series drawings. They are based on using a range of clean and dirty water drains, silt fences and likely a sediment retention pond in the construction yard area. Decanting earth bunds (DEBs) are included in the ESCP as an alternative measure that may be used but none are currently shown on the FTL ESC drawings.

The proposed ESC measures for the landfill upgrade works are shown in the FTL 33097\LF series drawings. They are based on using a range of clean and dirty water drains, silt and super silt fences, several DEBs and a portable silt/sediment removal device or similar for the stream diversion area (drawing LF390).

2.3 Expected Dewatering Quantities

Importantly, as outlined in section 3 of this plan, dewatering will only apply to areas where ponding has occurred in cavities (hospital demolition and landfill works), behind localised bunds (landfill works) and the resulting collected water has not soaked away or evaporated and needs to be removed for the works to progress, or where groundwater may be encountered during some of the landfill works.

The proposed methodology aims to minimise such areas through dividing the works into short duration works packages so that the dewatering required at any one time is expected to be relatively minor, rather than significant. Refer section 3 for more details.

2.4 Contaminated Soils Quantification

Extensive soil contamination investigation works have been undertaken across the site, which have identified and delineated the horizontal and vertical extent of soil contamination across the vast majority of the site. The associated soil contamination is relatively minor and leachability tests have confirmed the leachability potential to be low for key contaminants (lead, zinc). Hence, the testing referred to in the S92 request has already been done.

There are however a number of specific areas that have been identified as suspected fill pockets (NBA 1-11, RAP Section 7.9.1 and FTL drawing R52) where specific checks will be undertaken during demolition works in the vicinity of these areas to confirm whether or not the soil/fill in these areas contain more than 5% C&D waste or contaminants exceeding the site specific remedial standards. Checking for heavy metal contamination would be done in the field using an XRF which gives instant results, avoiding delays waiting for lab test results, so that works in these areas do not have to stop waiting for lab results.

Final validation is to be done using a combination of XRF and lab sampling, but it is expected that virtually all soil contamination should have been removed by this stage, so that there is minimal potential for any water entering cavities to come into contact with contaminated soils.

Accidental discovery protocols are also included in the RAP.

Hence, the contamination testing that may be required during the works is considered likely to be infrequent and small scale.

3.0 DEWATERING

3.1 Methodology – Hospital Demolition Works

The dewatering methodology is set out in Sections 6.5 and 6.12 of the Hospital ESCP and is repeated here.

Section 6.5 – Existing Underground Services: Existing stormwater, wastewater, water supply, power and telecom services and associated inground structures will be removed in accordance with Demolition Management Plan requirements – all Asbestos pipes, 800mm depth for other pipes and 1000mm for structures. These works will be undertaken in short duration work packages, undertaking excavation, removing pipes/structures and final inspections prior to starting the next package. This methodology will significantly reduce the time disturbed ground is exposed and allow permanent stabilisation measures to be taken as soon as practicable.

Trench spoil will typically be placed on the upgradient side of the trench and provision made for covering this spoil with pinned geotextile in the case of predicted wet or windy weather. Provision will also be made for placing filter socks or similar below the disturbed ground when trenching is located outside of areas serviced by silt fences. The trench will then collect any direct rainfall on to it, while the mounded trench soil will divert clean runoff around the works. Topsoil will then be spread and permanently stabilised or compacted hardfill backfill placed in areas designated for gravel farm tracks.

Any direct rainfall into trenches will be allowed to soak into the underlying ground, or if this may impede or delay the works, a portable pump will be used to pump out water collected in the trench with this being pumped into a "turkey's nest" or similar device and then allowed to disperse across adjacent grassed areas. In any locations where this is not possible, the water would be collected by sucker truck and taken to the on-site SRP for treatment or pumped out into an intermediate bulk container (IBC) for transfer to the on-site SRP or disposal off-site.

Figure 2: Top - Turkey's nest made from filter socks; Bottom left: dewatering bag and pipe sock; Bottom right: mobile "turkey's nest.

Any water trapped in buried services that are to be removed, particularly stormwater or wastewater reticulation, will be removed by sucker truck and disposed of to the nearby sewer system or as trade waste. Alternatively, it may be disposed of as stormwater, if water quality testing determines this is appropriate.

Section 6.12 – Sediment Retention Ponds: The SRP has been oversized by approximately 100m^3 so that it can accommodate some extra volume that may be generated from dewatering in other works areas.

3.2 Methodology – Landfill Works

The dewatering methodology is set out in Sections 6.6, 6.7 and 6.17 of the Landfill Upgrade ESCP and is repeated here.

Section 6.6 - Dewatering: Certain repair/upgrade works (e.g. groundwater intercept trench) will create trenches below the surrounding ground. Any direct rainfall into these cavities, or shallow groundwater ingress, will be allowed to soak into the underlying ground, or if this may impede or delay the works, a portable pump will be used to pump out water collected in the cavity, with this being pumped into a "turkey's nest" or similar device and then allowed to disperse across adjacent grassed areas. In any locations where this is not possible, the water would be pumped in to a portable sediment removal device, or collected by sucker truck and taken to the on-site SRP (in the hospital area) for treatment or pumped out into an intermediate bulk container (IBC) for transfer to the on-site SRP or for disposal off-site. This measure does not apply to any areas where rainfall is likely to come into contact with refuse.

Groundwater may also be encountered during refuse transfer, particularly from the deeper excavations in Area A2/H. Dewatering would then likely be required to facilitate the refuse transfer works. This groundwater may be contaminated from contact with refuse. The field testing approach set out in section 6.7 below will be followed in this situation.

Section 6.7 – Leachate Management: During the refuse transfer works, there will be times when old refuse is exposed temporarily. The contractor will be required to minimise areas of exposed refuse, with temporary cover being provided at the end of each working day, comprising 100-150mm thick soil barrier, polythene sheeting or alternative approved method. Temporary cover will also be provided over the refuse, where practicable, during significant rainfall.

The refuse materials that will be exposed have been in place for over 25 years and groundwater monitoring data indicates low level contamination of groundwater passing through the landfill. Hence, the potential for leachate contamination of surface runoff from contact with refuse is considered to be relatively low, with the main contaminant of concern being boron.

Localised soil bunds will be placed around exposed refuse areas to trap any gross solids or debris that may get washed off. Any runoff trapped behind these barriers will be tested using a multi-meter or similar for pH and conductivity, with this information being used as a quick field indicator of potential leachate contamination.

If any runoff overtops these bunds (from a significant storm event) or when other runoff from within the works area comes into contact with refuse and is conveyed to DEBs or portable sediment removal devices for treatment, testing of the treated water discharge would be required to check it can be discharged on-site to the natural environment. Again, it is proposed to use pH and conductivity field measurements as indicators of leachate contamination.

Some initial field trials, involving comparing field pH/conductivity measurements against corresponding laboratory testing for pH, conductivity, heavy metals, boron and ammoniacal-

nitrogen are recommended to determine appropriate conductivity trigger levels above which any runoff should be handled as leachate. (*this is explained further under section 3.6 below)*

During the works, if the field testing indicates the runoff exceeds the leachate trigger levels, then it will either need to be treated further on-site prior to discharge, or be tankered off-site for disposal as a trade waste.

Section 6.17 – Portable Sediment Removal Devices: Various suppliers provide mobile lamella clarifiers, where sediment is pumped into a tank and then passes over a baffle, with water being forced up through coalescing media where solids are settled out. Typically, these solids are then passed through dewatering bags (1T in size) to further reduce the water content to make them suitable for reuse and/or transport off-site. This system has a smaller footprint than DEBs or SRPs and may need to be used in areas where a DEB can not be installed. Some systems also provide for automated flocculant dosing and real-time Total Suspended Solids (TSS) monitoring.

Figure 4: Example of Mobile Sediment Removal Device

3.3 Additional Methodology Comments in Response to S92 request

Any open trenches or small cavities can be covered with wooden or steel plates prior to significant rainfall to reduce direct rainfall ingress into trenches, further reducing the amount of water entering such trenches/cavities and hence reducing dewatering requirements.

All turkey's nests or similar devices will be located at least 50m from the Wharekōrino Stream (receiving environment). Review of site plans shows that this is readily achievable for the majority of the site, with most works areas being at least 100m from the stream. Buildings B24 and B26 and adjacent roading areas are close to the 50m threshold (see Figure A), so any Turkey's nest required in these areas would be located on the western side of these buildings/roading and a check made that the 50m threshold is achieved.

Importantly, there will be no dewatering or pumping of potential/actual contaminated water straight to the stream. Any such water would pass through a DEB/SRP/mobile removal device first, with floc dosing being used where appropriate, and removed off site as a trade waste or discharged to the existing wastewater pump station, if the adopted discharge standards can not be met. This is explained further in sections 3.5 and 3.6 of this plan.

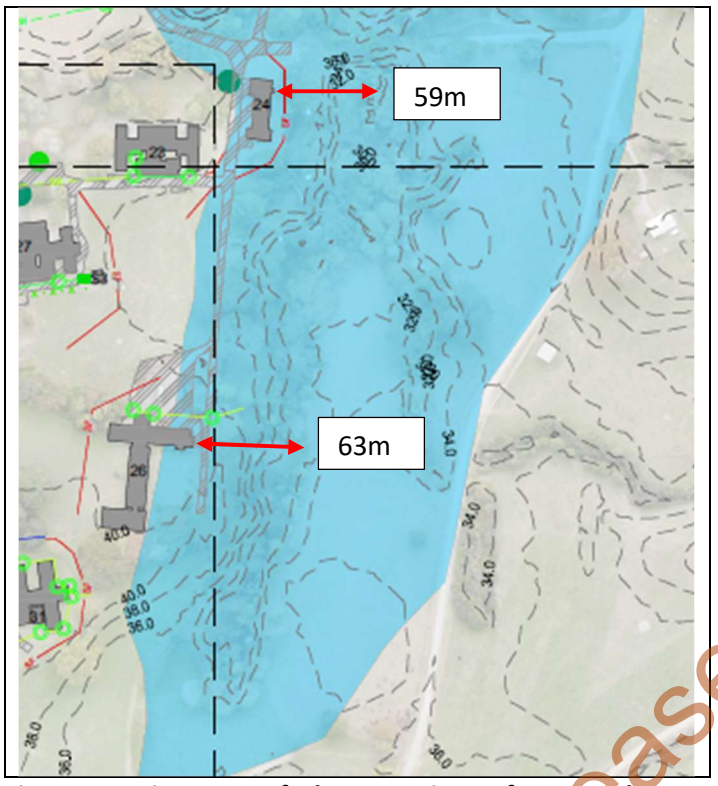


Figure A: Distances of closest points of B24 and B26 to stream (measured off FTL drawing 33205/3000)

3.4 Documentation Required

It is not proposed to have a "permit to pump" system. Instead, all contractor's staff on site will be trained in the requirements of the ESCP, while at least two people (one as backup) will be trained in monitoring discharges from the DEB/SRP/mobile sediment removal device.

3.5 Proposed Discharge Standards

The Wharekōrino Stream is the receiving environment for all stormwater discharged from the site. It is classified as "surface water (unnamed river)" under the Waikato Regional Plan water classification maps (see Figure B).

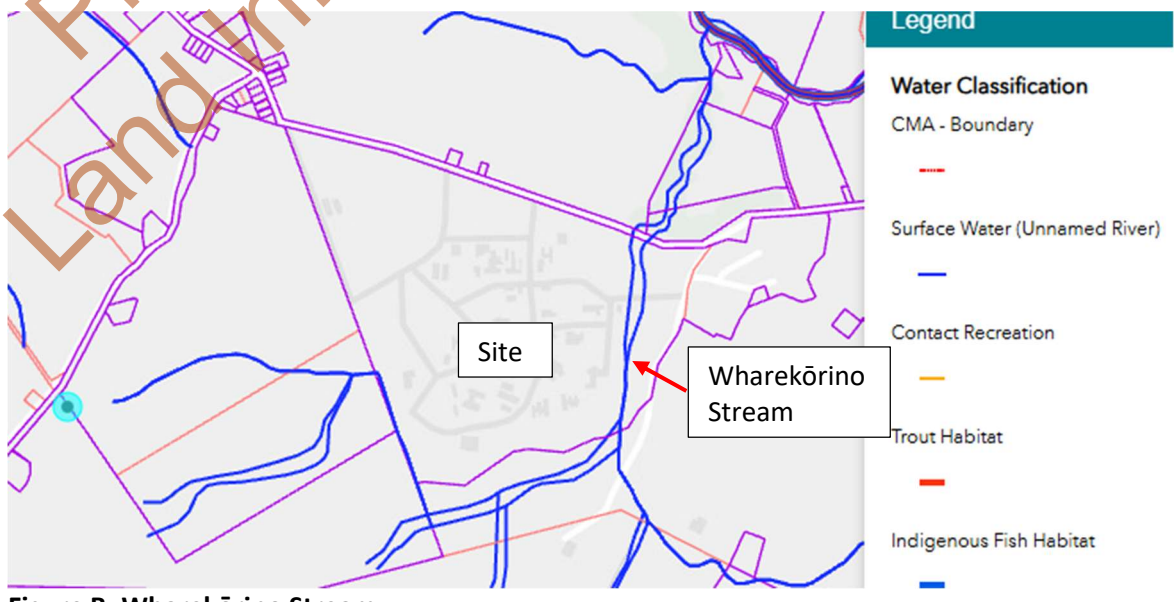


Figure B: Wharekōrino Stream

The Waikato Regional Plan discharge criteria for the "surface waters" classification refer to Total Suspended solids (TSS) being not more than 100g/m^3 in the discharge and TSS concentrations in the receiving waters shall not be increased by more than 10% and no conspicuous change in visual colour or clarity, subject to the following notes/clarification:

- The TSS standards apply, except where the suspended solids concentration in the receiving water is greater, at the time and location of discharge or of undertaking the activity, than the standards specified. In this case, there shall not be any increase (i.e. further deterioration) in the receiving water suspended solids concentration as a result of the activity or discharge.
- For TSS in the receiving waters, this shall be the point in the stream downstream of the discharge point (or site of the activity) which is no more than three times the width of the stream and which in any instance does not exceed 200 metres from the point of discharge.

Standard erosion and sediment control practice for DEBs/SRPs/mobile sediment removal devices, is that pH and water clarity are the normal parameters measured to assess that adequate water treatment has been achieved and the water is suitable to be discharged to the receiving environment. Water clarity refers to the ability of light to travel through water. Clarity reduces with increased suspended solids concentrations. Fondriest Environmental Learning Center (fondriest.com) indicates that a total suspended solids concentration below 20g/m^3 appears clear, while levels over 40g/m^3 may begin to appear cloudy. It notes that this is dependent on the size and nature of the suspended solids and hence will likely vary between sites. However, this suggests that a water clarity of 100mm should comply with the WRP surface waters 100g/m^3 discharge standard. Hence it is proposed to adopt clarity as a proxy for assessing TSS compliance in this plan.

Based on this background, proposed discharge standards to be met are categorised according to the source in Table 1.

Table 1: Proposed Discharge Standards

	Source	**Discharge Standards**	**Frequency**
A	Water from routine dewatering operations (i.e. not in contact with potential or actual contaminated soil or refuse)	Discharge via Turkey's nest or similar device on to ground, at least 50m from stream – no additional discharge standard proposed. For DEBs/SRP/mobile sediment removal device: standard **ESC water quality criteria:** 5.5 < pH < 8.5 Clarity of at least 100mm	Not applicable Weekly and after any significant storm event
B	Water from dewatering operations in contact with potential or actual contaminated soil	Pump to DEB, SRP or mobile sediment removal device and floc dose, as necessary, in accordance with Chemical Treatment Management Plan. Monitor discharge against ESC water quality criteria + conductivity (as indicator of heavy metal contamination) and implement contingency measures set out in section 3.7, if discharge standards not met.	Weekly and after any significant storm events, as explained further under "during works" in section 3.6 of this plan.
C	Water from dewatering operations in contact with refuse		

3.6 Monitoring

Pre-works commencement: water quality monitoring will be undertaken in the Wharekōrino Stream approximately 10m upstream of the Te Mawhai Rd bridge (which is approximately 50m downstream of the confluence of the site tributary and Wharekōrino Stream) for pH and conductivity on 10 occasions, including at least 5 storm events, where a significant storm event is defined as rainfall exceeding more than 25mm over 24h or more than 15mm per hr. pH and conductivity will be measured both in the field and lab. The conductivity data will be used to define a trigger level for the site, based on the mean + 3 times the standard deviation of the collected data, representing the upper limit of natural variation[1]. It is proposed that the baseline discharge standard be preliminarily defined as 2.5 times the trigger level for DEB/SRP/mobile device discharges but this would be confirmed from the site specific testing and through discussion with WRC. The discharge standard represents the limit above which the discharge is not acceptable.

During works: Routine monitoring will be undertaken of any DEB/SRP/mobile device discharges as follows:

1. Weekly for pH and clarity and after any significant storm events. Conductivity shall also be monitored for any water from sources B and C in Table 1.
2. For conductivity, the appropriateness of the baseline trigger level and discharge standard adopted from stream sampling will be assessed over the first three months of sampling (i.e. 10 sampling events including at least 3 storm events (if these occur over this period), following which these parameters may be adjusted (up or down) through discussion with WRC. This will be done by laboratory testing of DEB/SRP/mobile device discharge water quality for the following parameters:

Table 2: Lab Test Parameters

Parameter	B. Water from dewatering operations in contact with potential/actual contaminated soil	C. Water from dewatering operations in contact with refuse
pH	Yes	Yes
Conductivity	Yes	Yes
Total suspended solids (TSS)	Yes	Yes
Dissolved lead Dissolved zinc	Yes	Yes
Other dissolved heavy metals (arsenic, cadmium, copper, chromium, nickel)	No	Yes
Dissolved boron	No	Yes
Ammoniacal-nitrogen	No	Yes

Note:

1. TSS result will be compared with field clarity result to check correlation between clarity and TSS.
2. Only Lead and zinc proposed to be tested for Source B, as these were the key heavy metal contaminants found on the hospital site.
3. Other heavy metals, boron and ammoniacal-nitrogen added for Source C.

3.7 Contingency Measures

The conductivity trigger level defines the upper limit of natural variation. If exceeded, this means the contractor needs to investigate the associated source of this water for possible reasons (e.g. failed

[1] Proposed approach is same approach for defining site specific trigger level and discharge standard as used at the Bonny Glen landfill and agreed with Horizons Regional Council through expert caucusing for landfill extension in 2013.

bunds, flocculant has run out and need replenishing, etc). However, DEB/SRP/mobile device discharges can still continue, provided none of the discharge standards are exceeded.

Should one or more of the pH, clarity and/or conductivity discharge level be exceeded, the following measures will be taken:

1. The discharge shall be stopped by raised DEB/SRP decants or stopping the discharge from any mobile sediment removal device. The ESC device residual storage capacity will be assessed and a check made of forecast rainfall, to give an indication of how much time is likely to be available before any residual storage capacity is fully utilised. If this window is less than 24h, then proceed to step 2.
2. Field testing should be repeated to confirm the exceedance, 1-2 hr after the first test:
    a. If all parameters have dropped to acceptable limits, the decants can be lowered and the discharge resumed.
    b. If one or more parameters is confirmed to be elevated and less than 24h window, proceed to step 3;
    c. If one or more parameters is confirmed to be elevated and more than 24h window, proceed to step 4.
3. If less than 24h storage is available, the captured stormwater with elevated contaminant levels will:
    a. Be disposed of by a licenced liquid waste contractor; or
    b. Pumped to the nearby Wastewater pump station for discharge to the public wastewater network
4. If more than 24h storage is available, then the water will be retested after 12-24h to check if the water quality has improved, due to additional settlement that has occurred over this period. Additional floc dosing would be done at the start of this period, if the clarity is less than 100mm, provided the pH is 6.5 or greater, to promote further settlement.
5. If after 1-2 rounds of additional testing, the water quality is still above the discharge limits, then one of the actions in item 3 will be followed.
6. Investigations will also be undertaken to check for the cause(s) of contamination and appropriate remedial works will be implemented.

If the only discharge standard exceeded is conductivity and there is sufficient time, a water sample will be sent for lab testing under "urgent turnaround" (2-3 day window) for pH, conductivity, TSS, dissolved lead and dissolved zinc with testing only being done for dissolved heavy metals (and boron and ammoniacal-nitrogen in the case of landfill upgrade area discharges). If the results are within the Waikato Regional Plan permitted TSS limits and the ANZECC criteria for the protection of 80% of freshwater species, then the stormwater can be discharged off-site. For completeness, the relevant ANZECC discharge criteria are listed below:

- Dissolved arsenic: 0.36mg/L
- Dissolved Boron: 1.3mg/L
- Dissolved cadmium: 0.0008mg/L
- Dissolved copper: 0.0025mg/L
- Dissolve chromium: 0.04mg/L
- Dissolved lead: 0.0094mg/L
- Dissolved nickel: 0.017mg/L
- Dissolved zinc: 0.031mg/L
- Ammoniacal-nitrogen: 2.3mg/L

3.8 Recording

All routine inspections will be recorded along with all water quality monitoring results.

For all events, where the discharge standards are exceeded, these will be reported to WRC following the event, including details of the remedial and contingency measures implemented to deal with the exceedance.

Tokanui Hospital

Bat Management Plan

Prepared for:

SLR Consulting and Land Information New Zealand

Prepared by:

Phoenix Ecology

PHOENIX ECOLOGY

SUSTAINABLE LAND + WATER

Table of Contents

Author: Titia Schamhart
Reviewed by: Dr Hannah Mueller
Version: 1

Date: August 2024

1. Introduction

1.1. Background And purpose

Land Information New Zealand (LINZ) is seeking to remediate the former Tokanui Psychiatric Hospital, located south of Te Awamutu in the Waikato ('the site', Figure 1) to an agreed land use standard to enable the return of the land to local iwi. The disused site currently features approximately 70 abandoned buildings of various ages, roading network, and other features including underground infrastructure (pipes and cables) and contaminated soil. The proposed works to remediate the site include the removal of all buildings and other structures on site. A number of trees also require removal to enable the access, movement and operation of demolition plant during this process.

Long-tailed bats (*Chalinolobus tuberculatus*; Threatened – Nationally Critical, O'DONNEL, 2023) have been confirmed as present at the site during an initial survey (Leitch & Yates, 2023), and Phoenix Ecology Ltd have been contracted by SLR Consulting Ltd and LINZ to develop a Bat Management Plan (BMP) that provides guidance on minimising effects on bats during the demolition works.

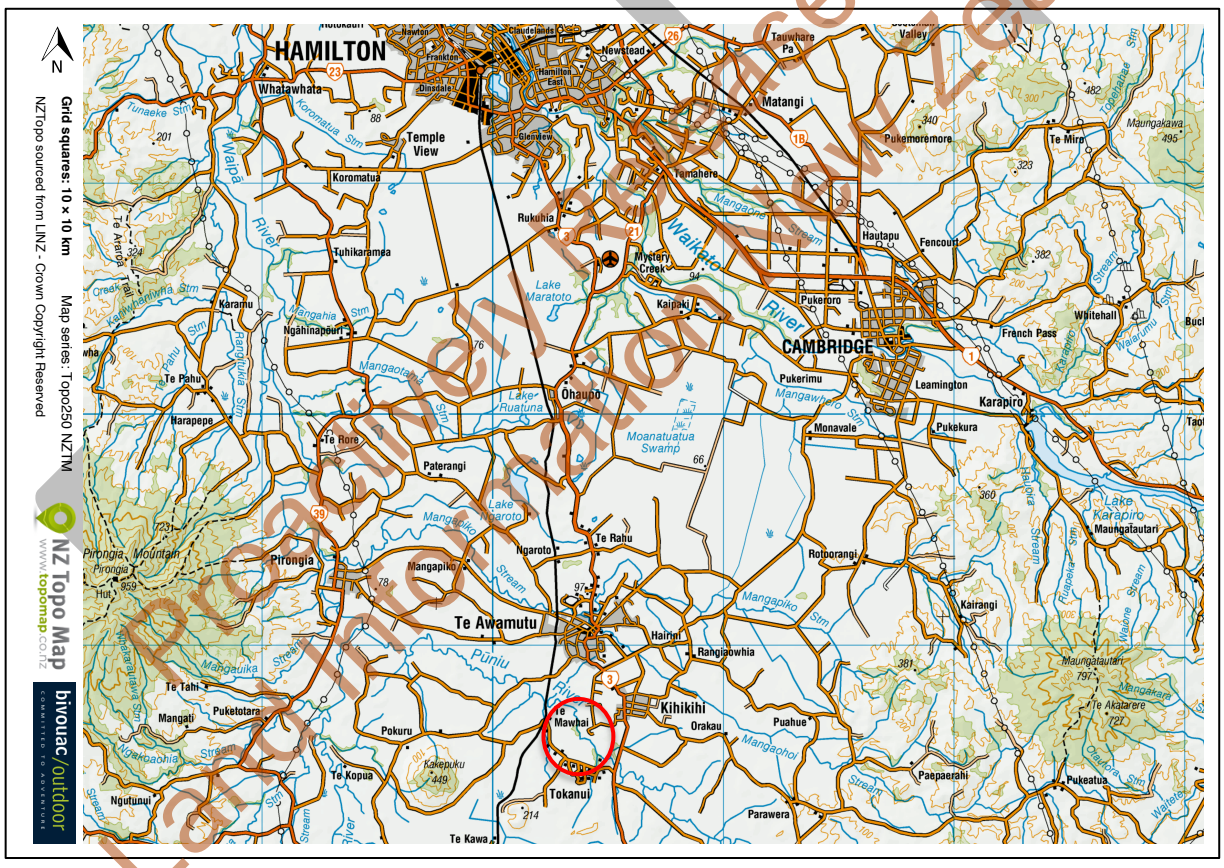


Figure 1 Site location

1.2. Landscape Context

The site is located within the Hamilton Ecological District (ED) in the Waikato Ecological Region (ER). This district is renowned for its fertile agricultural land, characterised by expansive pastures, and a network of rivers and streams, prominently including the Waikato River. The landscape features gently undulating plains and hills, interspersed with areas of native bushland that contribute to its ecological

diversity. The temperate climate, supported by ample rainfall, sustains lush vegetation throughout the year.

1.3. Site And Project Description

The Tokanui Psychiatric Hospital, established in 1912 near Te Awamutu in the Waikato region of New Zealand, is set within a rural landscape featuring vegetation characterised by a mix of mature trees, native and introduced species, and pastoral landscapes. The grounds feature mature trees such as oaks, pines, and eucalyptus, providing a dense canopy in certain areas. These trees are interspersed with open paddocks used historically for agricultural purposes.

The site also includes riparian vegetation along the Wharekōrino Stream, with willows, reeds, and other wetland plants contributing to the ecological diversity. Shrublands and grasslands are present throughout the property, supporting a variety of local flora and fauna. The site encompasses 70 abandoned buildings, extensive roading infrastructure, and downward-facing streetlights scattered throughout the grounds.

2. Regulatory Framework

2.1. Resource Management Act, 1991

The Resource Management Act (RMA) regulates the management and use of natural resources in New Zealand. The Act requires the assessment of potential environmental impacts for certain activities through processes such as environmental impact assessments and the consideration of effects on the environment.

Important elements of this are the maintenance of indigenous biodiversity and protection of significant indigenous vegetation and habitats. Ecological management plans are required to direct the management of potential adverse effects on ecosystems, fauna and habitat values.

2.2. Wildlife Act, 1953

The Wildlife Act provides statutory protection for and directs the management of indigenous fauna species, excluding those species listed in Schedules 1 to 5. This involves safeguarding them from harm, disturbance, or exploitation. The WA does not specifically extend to the protection of the habitat which supports these species.

3. Bat Competencies And Roles

A nominated and suitably qualified Project Bat Ecologist will oversee the implementation of this BMP and the associated Bat Roost Protocols outlined in Appendix III. According to the Department of Conservation's (DOC) Bat Recovery Group, bat handling competencies authorisation (Version 1.4, September 2023) (Appendix II) is required. The Project Bat Ecologist must be certified as "Competent" in the following areas:

- Competency 2.1.1: Proficient in bagging, storage, handling, measuring, weighing, sexing, aging, temporary marking, and appropriate releasing of bats.
- Competencies 3.1, 3.2, 3.3: Proficient in high-risk activities, including roost felling.

All bat management advice, inputs, and on-site work will be conducted by the Project Bat Ecologist or another bat ecologist who holds the required competencies.

4. Ecological Context And Recommendations

4.1. Methodology

Habitat Types And Tree Identification

Site visits on December 13th, 2023, April 18th, 2024, and May 24th, 2024, were aimed at assessing the suitability of the vegetation and buildings on site for potential bat roosting. This involved inspecting numerous buildings to focus on potential entry and exit points and interior spaces, as detailed in Appendix I.

In addition to assessing buildings, a randomised selection of large trees was examined to evaluate their potential as bat roosts. Key characteristics assessed included the presence of cavities, loose bark, cracks, and hollows, which provide the sheltered conditions favoured by bats (refer to Appendix I).

Monitoring

Baseline bat monitoring involved deploying Acoustic Bat Monitors (ABMs), specifically omnidirectional 'FC' recorders known as "AR4," across the site in a systematic grid pattern to ensure even coverage (refer to Figure 2 for precise locations during suitable weather conditions outlined in Appendix V - Table 1). This grid deployment strategy aimed to minimise sampling bias and ensure comprehensive coverage. According to research, survey locations for bat monitoring should be spaced between 100 and 200 meters apart to avoid overlapping recordings, with the exact distance depending on the habitat (*At a Glance: NABat Stationary Acoustic Surveys*, 2018; Barataud et al., 2015). Given that our survey location was a mixture of buildings, pastures, bush, and mature trees, we opted for a spacing of 180 meters. This distance ensures comprehensive coverage while minimising the risk of duplicate recordings and taking into account the diverse habitat features present at the site.

Dusk Survey

One evening was dedicated to conducting a dusk survey for long-tailed bat emergences at the locations with anecdotal and recorded activity around buildings. This involved strategically positioning three observers equipped with handheld bat monitors at these hotspots to monitor and document bat activity as the sun set (refer to Figure 2).

Building Survey

To accurately monitor bat activity within buildings while minimising the chances of recording bat passes from outside, a detailed and systematic approach was employed. A total of 22 monitors were deployed from June 25th until July 11th. All monitors were fully charged, calibrated, and checked to ensure they were functioning correctly before deployment. The placement of the monitors was carefully planned to avoid external interferences as much as possible (refer to Figure 3). Half of the monitors were placed inside buildings, positioned away from windows, doors, and other openings to avoid recording bat passes from outside to accurately capture internal bat activity. A paired monitor

was positioned outside the building at a minimum distance of 50 meters to avoid recording the same bat while at the same time being close enough to be able to compare the data. The purpose of this external monitor was to ensure that any bat passes recorded by the internal monitor were not from bats flying outside the building. The internal and external bat monitors were synchronised to ensure accurate timestamping of recorded bat passes. Bat activity was recorded continuously during the desired monitoring period, typically from one hour before sunset to one hour after sunrise.

Due to constraints on time and season, the survey had to be conducted within a limited period. Ideally, the survey should span at least two weeks under suitable weather conditions to ensure comprehensive data collection. However, given the unique opportunity presented, we decided to proceed despite the limitations, recognising it as an invaluable chance not to be missed.

4.2. Habitat Use And Foraging Ecology Of The New Zealand Long-tailed Bat

The New Zealand long-tailed bat exhibits a diverse range of habitat use, typically favouring native forests, but also adapting to a variety of environments including exotic plantation forestry and farmland (O'Donnell, 2000). Long-tailed bats prefer roosting in tree cavities, often found in large, mature trees (refer to Appendix 1) (Sedgeley & O'Donnell, 1999). They are highly adaptable foragers, exploiting different habitat types depending on the availability of food resources. Their diet primarily consists of insects, which they catch in flight, often foraging along forest edges and over water bodies (Ling et al., 2023). The conservation of their habitats is crucial as deforestation and habitat fragmentation pose significant threats to the population (O'Donnell, 2000).

4.3. Literature Review Of Bats Roosting In Buildings

Currently, there is a lack of scientific studies or empirical evidence confirming the presence of bats roosting in buildings in New Zealand. However, anecdotal reports (C. O'Donnell & T. Thurley, personal communication, June, 2024) suggest an increasing number of such occurrences.

Overseas research shows that bats often exploit buildings as roosts, which can facilitate their use of otherwise unsuitable habitats, potentially leading to expanded geographic ranges (Voigt & Kingston, 2015). These structures provide critical shelters, including sites for digesting food and raising young. The initial use of buildings as temporary shelters can lead to more permanent occupation (Ormsbee et al., 2007; Voigt & Kingston, 2015).

Due to their long lifespans and strong social bonds, many bat species show long-term loyalty to specific roosts, forming stable colonies over many years (Kerth et al., 2011). Most bat species, including long-tailed bats, cannot construct their own roosts, relying instead on natural or artificial structures (T. H. Kunz, 1982; T. H. Kunz & Lumsden, 2003). As such, buildings often serve as important substitutes for natural roosts, which are typically in short supply (Lisón et al., 2013).

4.4. Results

Assessment Of Buildings On Site

The buildings on site are old and dilapidated, having remained unused since the 1990s. The findings from these evaluations revealed that every building on the site possesses characteristics highly conducive to bat roosting. These characteristics include structural conditions that provide adequate shelter and protection for bats. The consistent presence of these features across all assessed buildings highlights the critical importance of incorporating careful consideration and implementing appropriate mitigation measures in any proposed development or demolition activities to ensure the conservation of bat populations and compliance with relevant wildlife protection regulations. However, evidence of rats, possums, and mice was observed both inside and outside the buildings during the survey, with rat sounds recorded on the bat monitors, rat and mouse scats found, and a dead possum discovered (refer to Appendix I).

Assessment Of Vegetation On Site

The habitat assessment revealed diverse vegetation including mature trees and various shrubs that potentially support bat populations. Specific tree characteristics conducive to bat roosting—such as cavities and loose bark—were prevalent among the randomly selected trees. Shrubs provide essential foraging opportunities for bats, attracting a wide range of insects, providing a rich food source for the insectivorous long-tailed bats.

Paddocks provide excellent foraging grounds due to the variety of insects they host, particularly in warmer months. The open spaces facilitate efficient hunting through echolocation, while the edges where paddocks meet woodlands, hedgerows, or shrubbery offer productive foraging sites due to higher insect densities and transitional zones used for hunting and commuting. Additionally, paddocks near water bodies, such as ponds or streams, are valuable as they support aquatic insects and provide drinking sites for bats.

Bat Survey Findings

Weather Conditions

Analysis of an existing dataset indicates that long-tailed bat activity correlates strongly with temperature. Monitoring efforts are recommended when temperatures one to four hours after sunset exceed 8°C (Borkin et al., 2023). During the first survey period, minimum temperatures remained above 8°C on 21 nights (refer to Appendix IV). During the building survey weather conditions were only suitable for monitoring on 3 out of the 16 nights (refer to Appendix IV). The remaining 13 nights were too cold, with temperatures dropping below 8 degrees Celsius within the first four hours after sunset. These low temperatures likely limited bat activity, as bats are less active in colder conditions.

Rainfall, which had a maximum of less than 10 mm between sunset and midnight throughout both surveys, is unlikely to have significantly impacted bat emergence (Appel et al., 2019). Wind conditions were favourable on all nights during both surveys, with maximum gusts between one to four hours after sunset staying below 20 km/h (Smith et al., 2017).

Despite the suboptimal season at the end of autumn and early winter, monitoring was feasible on a total of 19 nights of the first survey, aligning with recommended best practices under these conditions (MUELLER ET AL., 2021).

Survey Results

For the first survey, a total of 27 monitors were deployed over a span of 36 nights but encountered technical issues where none of them recorded for the entire deployment period (Appendix IV, Table 1. Monitors DB17 and DB8 had the most extended recording durations (31 nights), followed by DB23 (29 nights) and BK3 (26 nights). Conversely, monitors DB5 recorded for only one night, while DB19 and DB20 recorded for two nights each, and DB14 for three nights. Out of the 22 monitors deployed during the second survey, eight monitors only successfully recorded data for a limited number of nights. Specifically, monitors DB6, DB21, DB24, BW3, DB5, DB1, DB22, and DB4 recorded data for 5, 15, 13, 3, 7, 8, 9, and 2 nights respectively. All these monitors were either new or had recently been serviced. For details on the total recorded nights for each monitor, please refer to Appendix IV, Table 2. Technical glitches, while undesirable, are not uncommon with these monitors and should be considered when interpreting the mean number of recorded bat calls.

The results of the first bat survey revealed significant variability in nightly bat activity across the monitored locations (Figure 2). Among the monitors, DB2 recorded the highest mean number of bat calls per night at 44.13, followed by DB15 with 13.83 calls. BW15 and BW23 also exhibited notable activity, averaging 12.24 and 10.27 calls per night, respectively. Conversely, monitors such as DB11, DB14, DB19, DB20, DB22, DB23, and DB5 did not record any bat calls during the survey period but have failed to record the majority of the nights. Other monitors showed low activity, with mean call counts ranging from 0.09 to 0.77 per night. These findings underscore the heterogeneous distribution of bat activity within the survey area, highlighting the influence of specific environmental factors and habitat characteristics on bat roosting and foraging behaviours.

Despite the challenges of malfunctioning monitors and suboptimal weather conditions during the second survey, the remaining monitors successfully recorded data for the entire survey period, ensuring comprehensive coverage and reliable data for most of the study duration. Additionally, monitors DB18 and DB21 each recorded one bat pass, while DB21 recorded two bat passes, highlighting some level of bat activity even with the limited recording duration and suboptimal weather conditions.

The dusk survey focused on potential emergence sites, although no specific bat activities were recorded during this observation. This survey was crucial in identifying focal areas for potential bat activity and enhancing our understanding of habitat use within the site.

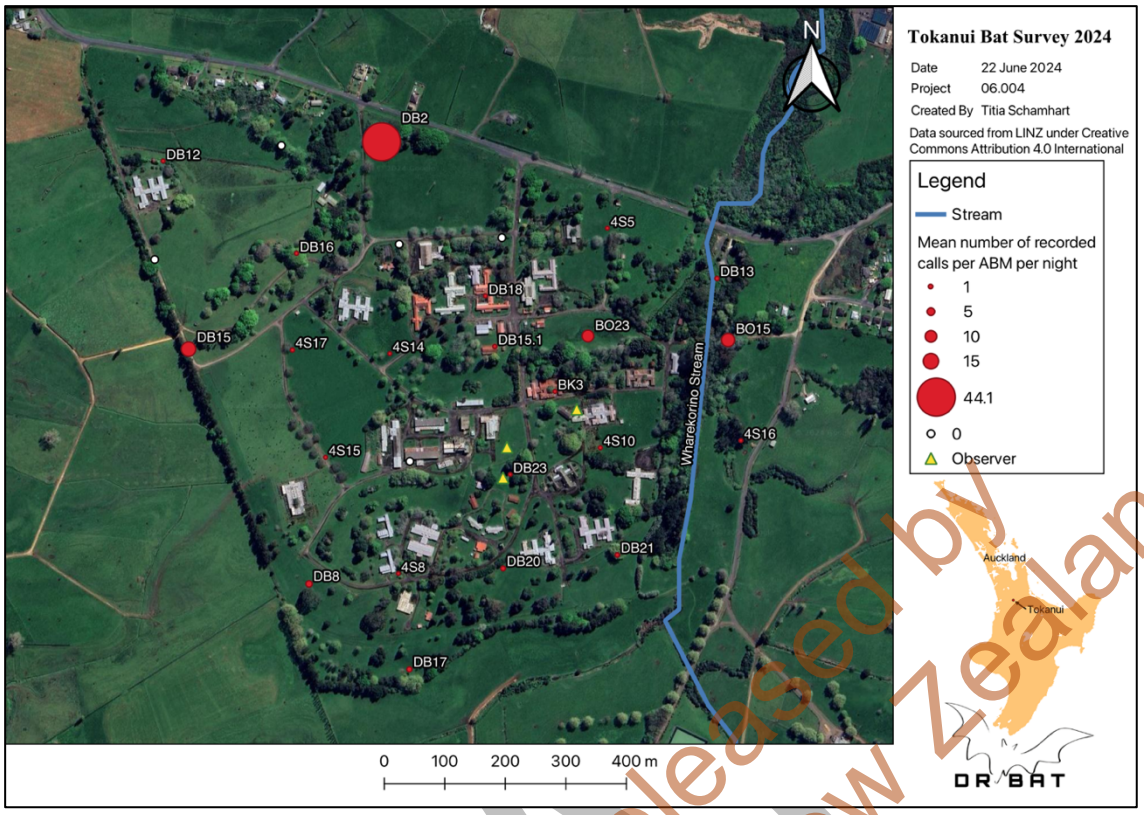


Figure 2. Mean number of bat calls recorded during the 18 April to 24 May 2024 bat survey and locations of the observers during the dusk survey at the Tokanui Psychiatric Hospital.

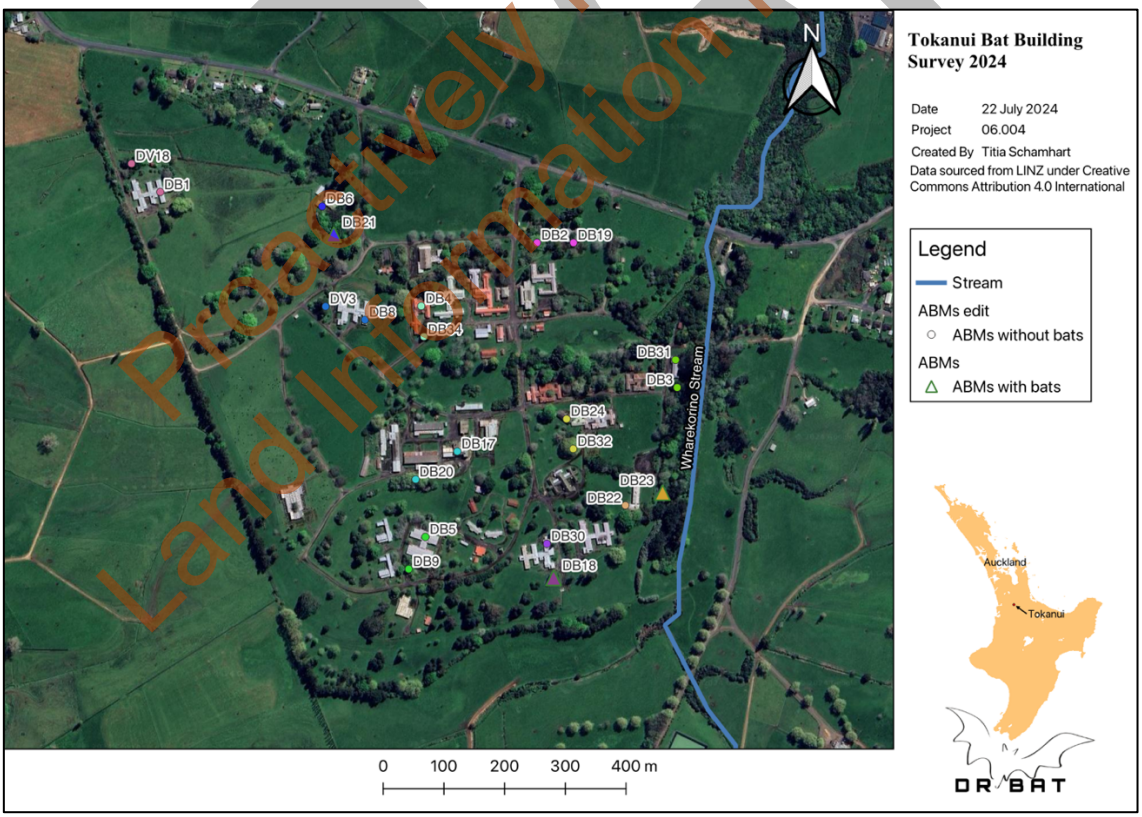


Figure 3. Monitor locations of the bats in building survey during the 25 June to 11 July 2024 bat survey at the Tokanui Psychiatric Hospital.

4.5. Recommendations – Bat Management Overview

This BMP details the practices and procedures designed to prevent, as much as possible, injury or death of bats during the demolition of all buildings, removal of underground infrastructure (pipes and cables) and felling or pruning of a number of trees at the Tokanui Psychiatric Hospital. Evaluations of the site revealed that the majority of buildings possess characteristics suitable for bat roosting, necessitating careful consideration and mitigation measures in any development or demolition to conserve bat populations.

The vegetation assessment identified mature trees with high roosting potential and various shrubs and paddocks that provide rich foraging opportunities. Despite some technical issues and suboptimal timing, both bat surveys conducted over 19 and 3 suitable nights indicated consistent bat activity, which indicates that the site provides important habitat for the local bat population, and roosting in this locality is likely to occur at least occasionally.

Tree Removal

The latest New Zealand Department of Conservation's Bat Recovery Group Protocols to minimise the risk of felling bat roosts should be adopted for all tree removal required to enable the demolition works at the site. The current guidelines (Tree Felling Protocols - Version 2: October 2021) are included in Appendix III and have informed the management steps outlined in Section 5. Before any vegetation is disturbed or removed, a comprehensive assessment must be carried out by a qualified bat ecologist. This assessment will categorise vegetation as High or Low-Risk based on potential bat roost features, as outlined in section 4.5 and Appendix I. All assessments and procedures should follow the bat roost protocols as detailed in section 5.1.

Building Demolition

No standard protocols have yet been developed to guide the minimisation of risk to bats that may be roosting in buildings when these are modified or removed. The steps contained in this BMP (Section 5.5) have been developed based on overseas practice and experience with tree removal in New Zealand.

Ahead of demolition, assessments of all buildings with roosting characteristics should be conducted to evaluate the risk for current bat usage. This should involve a visual assessment of all buildings and mapping their roost suitability based on structural characteristics and location on the site, relative to the detected bat activity so far.

Immediately prior to removal, bat monitors and visual inspections should be employed to identify and document potential bat presence. A phased demolition approach is proposed to minimise the risk of disturbing bats, to allow for a better understanding of how risks to bats can be managed through the demolitions process (and if necessary, an adaptation of management steps) at lower risk buildings.

This approach would involve starting with the demolition of buildings that have the least potential for roosting. Before proceeding with any demolition, thorough checks will be conducted to ensure no bats are present. This method reduces the likelihood of harming bats by prioritising the removal of structures less likely to be used as roosting sites.

5. Bat Management Measures

5.1. High Value Bat Habitat

Identifying and mapping high-value bat habitat is an essential component of the BMP. This process involves conducting comprehensive surveys to locate roosting sites, foraging areas, and commuting corridors that are critical for bat populations (refer to Appendix IV, Table 3). By using GIS technology and other mapping tools, ecologists can create detailed maps that highlight these essential habitats.

This step should be informed by acoustic monitoring, and form part of the assessment of all vegetation to be removed for Potential Roost Features prior to vegetation clearance (Section 5.4).

5.2. Vegetation Retention

All existing vegetation should be retained wherever possible. This includes trees that could be used for roosting, as well as shrubs and paddocks that offer important foraging habitat for bats. The removal of mature trees and substantial undergrowth should be avoided where possible to maintain habitat continuity and support bat populations.

5.3. Noise, Light, And Vibration Mitigation

In the event that active bat roosts are discovered during construction activities, these activities in the vicinity of active roosts should be temporarily halted until the bat ecologist confirms that the roosts are vacant.

Construction activities can generate loud noises and vibrations, which may disrupt bats in occupied roosts that are unaccustomed to such disturbances. If an occupied bat roost is found on site, a noise minimisation work plan will be prepared in consultation with an experienced bat ecologist. Measures to reduce noise effects may include establishing work exclusion zones around the occupied roost until it is vacated, erecting noise barriers, using acoustic curtains, or implementing vibration-dampening techniques to minimise the impact on bats near known roost sites.

Bats are highly sensitive to artificial light, especially near their roosting sites. To prevent disorientation while commuting or foraging, and to avoid disturbing bats in occupied roosts, it is essential to minimise artificial lighting near High Value Bat Habitat (refer to Appendix IV, Table 3) and any discovered active bat roosts during construction.

No construction activities should occur within 100 meters of any known occupied roost sites from an hour before sunset until an hour after sunrise to avoid the adverse effects of artificial lighting on bats, while monitoring will be implemented to confirm if the roost site has been vacated.

If construction or security lighting is needed within 100 meters of an identified and mapped High Value Bat Habitat Area (Section 5.1) or an occupied bat roost, a bespoke bat lighting control work plan must be developed and implemented in consultation with an experienced bat ecologist, to minimise lighting intrusion into the habitat. This plan should include measures such as setting limits on lighting lux and kelvin levels within 25 meters of a High Value Bat Habitat, shielding light sources, restricting lighting during high periods of bat activity, and minimizing the duration of artificial lighting as much as possible.

5.4. Bat Roost Protocols: Trees

For all individual trees greater than 15cm Diameter at Breast Height (DBH) an individual tree or tree stand felling plan must be created or incorporated into the work plan for each specific felling stage. This work plan will outline the monitoring procedures for removing any vegetation and/or trees identified as potential bat roosts. It will also address specific measures and micro-adjustments to the infrastructure footprint to avoid or minimise the removal of mature trees and high-value bat habitats as much as possible.

The work plan will include the following measures at a minimum:

- Prior to commencing vegetation removal, identify all trees to be removed that contain Potential Roost Features, and therefore require further monitoring and management.
- Conduct bioacoustics surveys to identify bat activity three days prior to the morning of the removal of high-risk bat roost trees.
- If required, before removal, perform direct observation of high-risk bat roost trees using a thermal camera.
- To minimise potential risks, schedule vegetation removal between **October 1st and April 30th**, when bats are not in torpor.
- Implement site-specific remediation and mitigation measures if high-risk roost trees or high-value bat habitats are removed.

High-risk trees (those containing Potential Roost Features) identified during the assessment will undergo pre-felling monitoring in accordance with tree-felling protocols. To work through the process, refer to Figure 4 for the Decision Tool for Tree Removal and follow each step fully in the text. Pre-felling vegetation assessments, using either acoustic or visual methods (refer to tree felling protocols in Appendix III for specific details), must be conducted exclusively by a bat ecologist certified by the Department of Conservation (DOC) and competent in the chosen method.

No trees or vegetation identified as potential roosts may be felled or cleared without explicit approval from the project bat ecologist. High-risk potential bat roost trees can only be felled following these protocols between October 1st and April 30th of any calendar year.

Dead or Injured Bats

In the event that dead or injured bats are discovered during tree felling, immediate action is required. Injured bats should be handled with care and taken to a wildlife rehabilitation centre or the local DOC office for treatment. Dead bats should be reported to DOC for further investigation. It is important to document the incident, including the number of bats affected and the circumstances, to inform future conservation efforts and improve protocols.

Accidental Discovery Protocol

Despite thorough planning and surveys, accidental discoveries of bat roosts can still occur during tree felling. In such cases, the following protocol should be followed. By following these steps, accidental discoveries of bat roosts can be managed to minimise harm to the bats and ensure compliance with wildlife protection regulations.

1. **Immediate Halt of Activities:** Cease all felling operations in the vicinity of the discovered roost.
2. **Notification of Authorities:** Report the discovery to local wildlife authorities (DOC) or environmental consultants.
3. **Assessment by a Qualified Ecologist:** Bring in an ecologist to assess the situation and determine the best course of action.
4. **Implementation of Mitigation Measures:** Follow the ecologist's recommendations, which may include creating alternative roosting sites or modifying the felling plan.
5. **Continued Monitoring:** Monitor the site to ensure no further disturbances occur.
6. **Documentation and Reporting:** Document all actions taken and report to the relevant authorities for compliance and future reference.

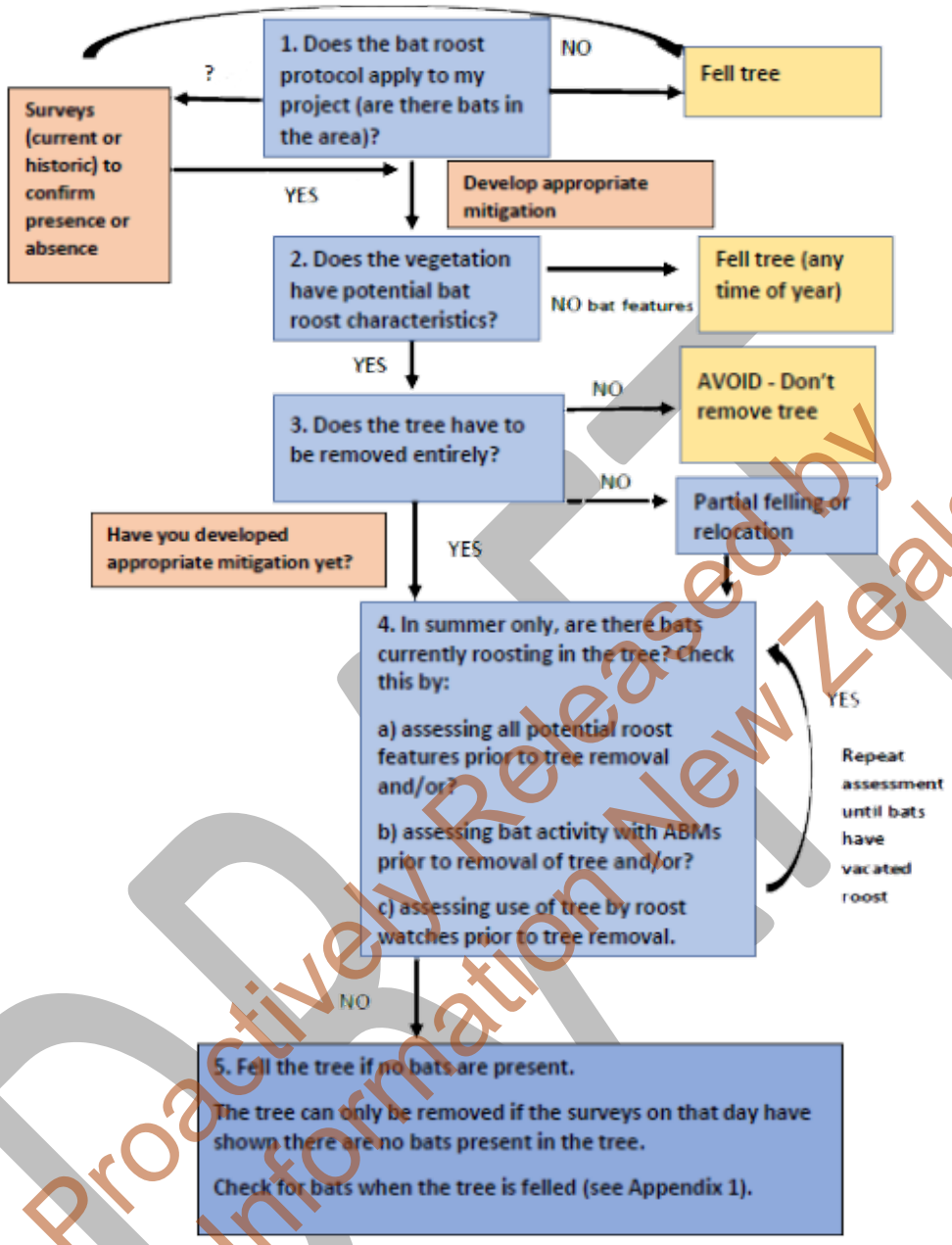


Figure 4. Tree removal in bat areas decision tool (DOC).

5.5. Bat Roost Protocols: Buildings

Pre-demolition Surveys And Inspections

Pre-demolition surveys are essential before building demolitions to minimise the risk of bat roosts being present. Trained ecologists use visual inspections, thermal imaging, and, in some cases, specially trained dogs to detect bats. Acoustic monitoring is also employed, using ABMs to capture bat calls and identify species. Monitoring should be conducted over at least three consecutive nights to account for variability in bat activity.

Emergence counts

Evening emergence counts (observations) are recommended for those buildings where prior acoustic monitoring indicates potential roost use, and/or the project bat ecologists recommends these are required for a particular building to ensure no bat roosts are present. Emergence counts are especially useful for colonies with fewer than 1,000 individuals, which is the case for long-tailed bat roosts. Roost observations should be performed over at least three consecutive evenings during suitable weather conditions and could align with the deployment of acoustics monitors (T. Kunz & Reynolds, 2003; Mueller et al., 2021).

Demolition

A phased demolition approach is proposed to minimise the risk of disturbing bats. This approach involves starting with the demolition of buildings that have the least potential for roosting, or where acoustic monitoring indicates a low likelihood. Before proceeding with any demolition, thorough checks may need to be conducted to ensure no bats are present, to be indicated by the project bat ecologists and informed by prior acoustic monitoring and inspections of the building. This method reduces the likelihood of harming bats by prioritising the removal of structures that are less likely to be used as roosting sites.

Dead Or Injured Bats

In the event that dead or injured bats are discovered during building demolitions, immediate action is required. Injured bats should be handled with care and taken to a wildlife rehabilitation centre or the local DOC office for treatment. Dead bats should be reported to DOC for further investigation. It is important to document the incident, including the number of bats affected and the circumstances, to inform future conservation efforts and improve protocols.

Accidental Discovery Protocol

Despite thorough surveys and monitoring, there is always a possibility of accidentally discovering bat roosts during construction or renovation activities. In such cases, it is crucial to have an accidental discovery protocol in place to mitigate any harm to the bats and comply with legal requirements. By following these steps, accidental discoveries of bat roosts can be managed in a way that minimises harm to the bats and ensures compliance with wildlife protection regulations.

1. **Immediate Halt of Activities:** Upon the accidental discovery of a bat roost, all construction or renovation activities in the vicinity of the roost should be immediately halted. This prevents any further disturbance to the bats.
2. **Notification of Authorities:** The discovery should be reported to the relevant wildlife authorities or environmental consultants as soon as possible. In many regions, bats are protected species, and unauthorised disturbance can result in legal penalties. Authorities can provide guidance on the next steps and any necessary permits.
3. **Assessment by a Qualified Ecologist:** A qualified ecologist should be brought in to assess the situation. They will identify the species of bats, estimate the population size, and evaluate the roost's importance. This assessment will help determine the appropriate course of action.
4. **Implementation of Mitigation Measures:** Based on the ecologist's assessment, appropriate mitigation measures should be implemented. This might include creating alternative roosting sites, timing construction activities to avoid sensitive periods, or modifying the project plan to avoid the roost.
5. **Continued Monitoring:** Continued monitoring of the site may be necessary to ensure that the bats are not disturbed further. This could involve regular checks by ecologists or the use of acoustic monitoring equipment to track bat activity.
6. **Documentation and Reporting:** All actions taken following the accidental discovery should be thoroughly documented. This includes records of the initial discovery, communications with authorities, ecologist reports, and any mitigation measures implemented. Proper documentation ensures transparency and can be useful for future reference or compliance audits.

5.6. Mitigation Options

The mitigation options below can be considered as strategies to enhance and restore bat habitat across the site. The location appears to be an important area for bats in the wider landscape, and protection of the existing values, and enhancement of them, would be of benefit to the local population.

Pest Control

Research underscores the critical importance of managing mammalian predators to ensure the long-term survival of long-tailed bats. To support this, a targeted animal pest control program should be implemented to maintain suitable bat roost habitats. This program aims to reduce the populations of rats, possums, feral cats, wasps, and mustelids using best practice methods.

The primary objective of pest control for this site is to protect High Value Bat Habitat areas within the site by consistently reducing pest populations to best practice levels throughout the year. Specific targets include achieving a mean 5% residual trap catch or less for possums within the first year and a mean 5% tracking tunnel index or less for rats within the second year.

All pest control activities must be carried out by qualified and certified contractors to ensure adherence to industry standards. Regular monitoring of pest numbers and distributions will be conducted at least annually to assess the program's effectiveness and ensure ongoing compliance with best practice standards.

Restoration Planting

Restoration planting could be employed to enhance availability of bat habitat in retained areas. In order to create favourable roosting conditions for bats within the revegetated areas, this could involve planting canopy species with cavity bearing properties suitable for creating roosting opportunities for bats as they mature. These tree species should be chosen based on their ability to provide preferred roosting features such as cavities, crevices, and appropriate microclimates. By intentionally including these species in the revegetation process, the aim is to establish an environment that supports bat populations by offering them suitable places for resting, breeding, and rearing their young. The selection of these tree species should take into consideration their compatibility with the local ecosystem and their known suitability for bat roosting.

Artificial Bat Roosts

To address the loss of roosting habitat from vegetation clearance, artificial bat roost boxes can be installed as temporary replacements until new trees mature (refer to Figure 5). These boxes should ideally be placed within 150 meters of waterways, mounted at least 15 meters high with predator bands around the tree to deter mammals. A survey of all trees requiring removal will determine the number needed, and installation will occur before removing high-risk trees. For at least 5 years, annual inspections will ensure the boxes and predator exclusion bands are maintained in good order and assess whether they are occupied, with reports submitted to the council on their usage.

Figure 5. Artificial Bat Roost

6. Reporting

The BMP will undergo an annual review to ensure its relevance and effectiveness. Adjustments will be made as necessary to reflect any changes in findings during previous bat management on site, the construction schedule, design, or operational status of the site. All amendments and reporting requirements will comply with the relevant consent conditions.

In addition to the reporting requirements outlined for Waipa District Council, the results of each annual bioacoustics survey will also be submitted to the Department of Conservation (DOC) for inclusion in the national bat distribution database.

As specified in Section 5.1 and 5.2, the outcomes of the bat roost protocol implementation will be documented and reported to Waipa District Council in the form of a completion/compliance report, typically delivered as a letter or memorandum. This report will be submitted within 20 working days following the conclusion of vegetation clearance and building demolition activities and will include detailed information about the monitored potential bat roosts. The report will cover aspects such as the size, location, and type of these potential roost trees or buildings, as well as the weather conditions recorded during the implementation of the bat roost protocol.

7. References

Appel, G., Bobrowiec, P., & Lopez-Baucells, A. (2019). *Temperature, rainfall, and moonlight intensity effects on activity of tropical insectivorous bats .pdf*. 1–12.

At a glance: NABat Stationary Acoustic Surveys. (2018). NABat - North American Bat Monitoring Program. https://www.nabatmonitoring.org/collect-data

Barataud, M., Tupinier, Y., & Limpens, H. (2015). *Acoustic ecology of European bats: Species identification, study of their habitats and foraging behaviour*. Biotope Méze, France. https://sciencepress.mnhn.fr/en/collections/inventaires-biodiversite/acoustic-ecology-european-bats-1

Böhm, S. M., Wells, K., & Kalko, E. K. (2011). Top-down control of herbivory by birds and bats in the canopy of temperate broad-leaved oaks (Quercus robur). *PLoS One*, *6*(4), e17857.

Borkin, K. M., Giejsztowt, J., McQueen-Watton, J., & Smith, D. H. (2023). Influence of weather on long-tailed bat detection in a North Island exotic forest. *New Zealand Journal of Ecology*, *47*(1), 3546.

Jones, G., Jacobs, D. S., Kunz, T. H., Wilig, M. R., & Racey, P. A. (2009). Carpe noctem: The importance of bats as bioindicators. In *Endangered Species Research*. https://doi.org/10.3354/esr00182

Kalka, M. B., Smith, A. R., & Kalko, E. K. V. (2008). Bats limit arthropods and herbivory in a tropical forest. *Science*, *320*(5872), 71–71.

Kerth, G., Perony, N., & Schweitzer, F. (2011). Bats are able to maintain long-term social relationships despite the high fission–fusion dynamics of their groups. *Proceedings of the Royal Society B: Biological Sciences*, *278*(1719), 2761–2767. https://doi.org/10.1098/rspb.2010.2718

Kunz, T. H. (1982). Roosting Ecology of Bats. In T. H. Kunz (Ed.), *Ecology of Bats* (pp. 1–55). Springer US. https://doi.org/10.1007/978-1-4613-3421-7_1

Kunz, T. H., & Lumsden, L. F. (2003). Ecology of cavity and foliage roosting bats. *Bat Ecology*, *1*, 3–89.

Kunz, T., & Reynolds, D. (2003). Bat Colonies in Buildings. *Monitoring Trends in Bat Populations of the United States and Territories: Problems and Prospects*, *19*. https://digitalcommons.usf.edu/kip_articles/6676

Lausen, C. L., & Barclay, R. M. R. (2006). Benefits of living in a building: Big brown bats (*eptesicus fuscus*) in rocks versus buildings. *Journal of Mammalogy*, *87*(2), 362–370. https://doi.org/10.1644/05-MAMM-A-127R1.1

Leitch, K., & Yates, C. (2023). *Tokanui Psychiatric Hospital—Ecological Constrains and Opportunities*. 4Sight Part of SLR.

Ling, N., Tempero, G. W., & Schamhart, T. (2023). Using faecal DNA metabarcoding to determine the diet of the long-tailed bat, *Chalinolobus tuberculatus*. *New Zealand Journal of Zoology*, *0*(0), 1–8. https://doi.org/10.1080/03014223.2023.2240711

Lisón, F., Palazón, J. A., & Calvo, J. F. (2013). Effectiveness of the Natura 2000 Network for the conservation of cave-dwelling bats in a Mediterranean region: Cave-dwelling bats and the Natura 2000 Network. *Animal Conservation*, *16*(5), 528–537. https://doi.org/10.1111/acv.12025

Maas, B., Clough, Y., & Tscharntke, T. (2013). Bats and birds increase crop yield in tropical agroforestry landscapes. *Ecology Letters*, *16*(12), 1480–1487. https://doi.org/10.1111/ele.12194

Mueller, H., Davidson-Watts, I., & Kessels, G. (2021). *Peacocke Structure Plan Area Change – Long-tailed bat report* (Consultancy Report Prepared for Hamilton City Council).

O'Donnell, C. F. J. (2000). Conservation status and causes of decline of the threatened New Zealand Long-tailed Bat *Chalinolobus tuberculatus*. *Mammal Review*, *30*(2), 89–106.

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* (41; New Zealand Threat Classification, p. 18). the Department of Conservation.

Ormsbee, P. C., Kiser, J. D., & Perlmeter, S. I. (2007). Importance of night roosts to the ecology of bats. *Bats in Forests: Conservation and Management. Johns Hopkins University Press, Baltimore, MD*, 129–151.

Patterson, B. D., Dick, C. W., & Dittmar, K. (2007). Roosting habits of bats affect their parasitism by bat flies (Diptera: Streblidae). *Journal of Tropical Ecology*, *23*(2), 177–189.

Patterson, C. R., Seddon, P. J., Wilson, D. J., & van Heezik, Y. (2021). Habitat-specific densities of urban brushtail possums. *New Zealand Journal of Ecology*, *45*(2), 1–9.

Sedgeley, J. A., & O'Donnell, C. F. J. (1999). Factors influencing the selection of roost cavities by a temperate rainforest bat (Vespertilionidae: *Chalinolobus tuberculatus*) in New Zealand. *Journal of Zoology*, *249*(4), 437–446. https://doi.org/10.1111/j.1469-7998.1999.tb01213.x

Smith, D., Borkin, K., Jones, C., Lindberg, S., Davies, F., & Eccles, G. (2017). *Effects of land transport activities on New Zealand's endemic bat populations: Reviews of ecological and regulatory literature October 2017*. 249.

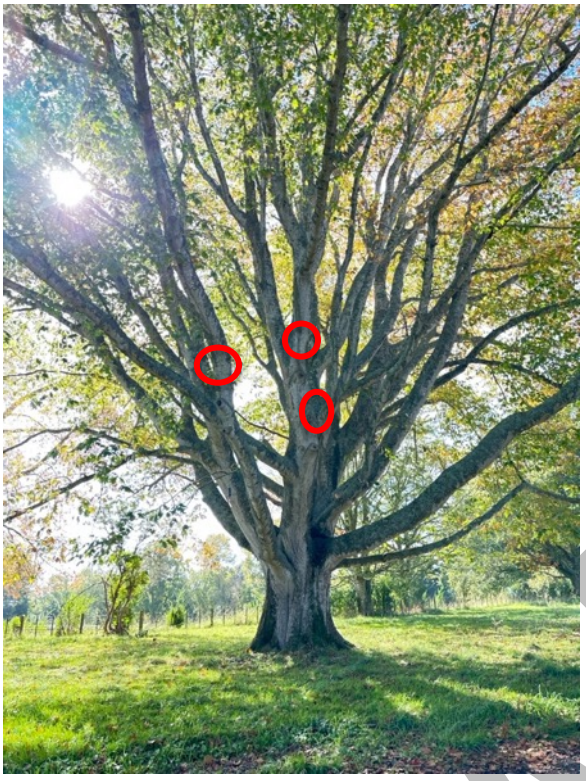
Voigt, C. C., & Kingston, T. (2015). *Bats in the anthropocene: Conservation of bats in a changing world*. Springer Nature.

Williams-Guillén, K., Perfecto, I., & Vandermeer, J. (2008). Bats Limit Insects in a Neotropical Agroforestry System. *Science*, *320*(5872), 70–70. https://doi.org/10.1126/science.1152944

Appendix I: Site photos

Buildings with potential roosting features

Trees with potential roosting features



Appendix II: Bat Handling Competencies

Bat handling competencies authorisation

Version and Date: V 1.4, 20/9/2023

Revision date: 20/9/2023[1]

Approved by: Bat Recovery Group

1. Context:
   - Certification by the NZ Bat Recovery Group is required for any permits that require handling bats (for NZ Wildlife Act 1953 Authorisations).
   - New Zealand bats, which are threatened species, are small, delicate and thus vulnerable to injury if handled incorrectly. Therefore, anyone that handles them must have levels of competency that ensure they are handled ethically. A competent handler will know how to catch, hold and release appropriately, understand if a bat is in torpor or not and adjust their handling appropriately, and when and how to attach monitoring devices.
   - Bat workers can reach a level of competency in up to 27 skills described below.
   - Each skill is represented by a separate competency.
   - Details of skill requirements are outlined in the NZ Bats Best Practice Manual:

     http://www.doc.govt.nz/Documents/science-and-technical/inventory-monitoring/im-toolbox-bats/im-toolbox-bats-doc-best-practice-manual-of-conservation-techniques-for-bats.pdf).

2. Purpose:
   To outline the ethical standards required to be registered as competent, authorised bat workers by the NZ Bat Recovery group.

3. Definitions and registration processes:
   - **Registered Bat Trainee:** A person who has registered with the Bat Recovery Group as a Trainee.
   - **Bat Banding Trainee:** A person who has registered with the NZ Banding Office as a Level 1 bat bander.
   - **Trainee Log:** A logbook of all training sessions undertaken, with each session signed by an Authorised Trainer. Logbooks are available from bathandler@doc.govt.nz or from DOC—6228629).
   - **Competent bat worker:** A person who has been certified as 'Competent" in a particular skill by the NZ Bat Recovery Group.
   - **Authorised Trainer:** A person who is registered as competent in a particular skill AND has been authorised by the Bat Recovery Group to teach and supervise Registered Trainees in that skill (but only if they are working under an existing Research or Collection Permit and Wildlife Act Authority or if they are a Department of Conservation Trainer). The Trainer **must** be present for all training and inspect all competency activities.

4. Training:

[1] This revision changes the wording of competency 3.1 to better reflect the intention of the competency

- Once a competency or competencies has/have been signed off by the Bat Recovery Group, the bat worker can work independently with respect to that skill(s) (if they have the appropriate permits).
- The Trainee will keep a logbook that describes experience in each competency (DOC-6228629). This needs to be signed by an Authorised Trainer(s).
- The Trainee must have read and understood the NZ Bats Best Practice Manual (see link above).
- Trainees can be certified either in individual competencies or multiple competencies. Like bird banding in New Zealand, it is envisioned that for most trainees it may take several years to achieve all competencies because opportunities for hands-on bat work are limited.

5. Application for competency:
   - When trainees reach target handling levels described under each competency, they may apply to the Bat Recovery Group, via bathandler@doc.govt.nz, for certification in that competency. However, reaching the target level does not automatically give the applicant certification and an application for competency must be accompanied by a letter of endorsement in writing from at least one Authorised Trainer.
   - Applicants can apply for certification for single or multiple competencies.
   - Applications must include a short summary of bat handling experience, copies of signed training logs, and the names of two bat trainers that can attest to the applicant's competency.
   - Applications will be reviewed by the Recovery Group at its monthly meeting.
   - Applicants will receive confirmation of competency from the Recovery group within 2 months of applying.
   - If competency for banding long-tailed bats is sought then the Trainee must apply to the Department of Conservation Banding Office for Level 1 Bander registration (bandingoffice@doc.govt.nz) after filling in the appropriate form (Level 1 banders; https://www.doc.govt.nz/our-work/bird-banding/how-to-become-a-certified-bander/).

6. Rescinding competency:
   - The Bat Recovery Group may rescind certification if practitioners are no longer considered competent or do not follow Best Practice.

7. Authorised trainers:
   - Competent bat workers may apply in writing to the Bat Recovery Group, via bathandler@doc.govt.nz, to be Authorised Trainers.
   - Authorisation is at the discretion of the Recovery Group and discussion with the Recovery Group is recommended before applying.
   - Applicants can apply for authorisation for training against single or multiple competencies.
   - Authorised Trainers must be able to demonstrate:
     a. A deep understanding and experience of the ecology of New Zealand bats.
     b. Considerable experience well beyond competency levels in catching, handling and manipulating bats.
     c. A strong aptitude for, and experience of, teaching others about bats.

b. Considerable experience well beyond competency levels in catching, handling and manipulating bats.
c. A strong aptitude for, and experience of, teaching others about bats.
d. A clear understanding of teaching standards.
e. Knowledge of the Wildlife Act and Wildlife Regulations as they apply to working with bats.
f. Effective communication skills, understanding of Health & Safety requirements, and administration of records.

List of competencies:

Catching bats

1.1 Use of mist nets

1.1.1 Extract, bag and store correctly a total of 30 individuals of either species

1.1.2 Demonstrate correct mist net placement, set up, smooth operation, appropriate mist net attendance, assessment of risks and safe extraction and handling on 10+ different nights

1.2 Use of harp traps (free standing)

1.2.1 Lead identification of appropriate harp trapping sites and set up and monitor trap(s) on 10+ different nights

1.2.2 Extract 10+ bats appropriately from free standing traps

1.2.3 Demonstrate harp trapping protocols (animal welfare considerations, trapping in the breeding season, rain, repair and maintenance etc)

1.3 Use of harp traps (at roost entrances)

1.3.1 Lead set up and monitoring of trap(s) on 10+ different nights

1.3.2 Extract 10+ bats appropriately from traps hoisted up trees

1.3.3 Demonstrate harp trapping protocols at roost entrances (safe trapping at tree roosts (risk management), predation risks, disturbance risks, animal welfare considerations, trapping in the breeding season, rain, repair and maintenance etc)

2. Handling bats

2.1 Bagging, storage, handling, measuring, weighing, sexing, aging, temporary marking and releasing appropriately:

2.1.1 For long-tailed bats: 50 individuals

2.1.2 For short-tailed bats: 50 individuals

2.2 Banding long-tailed bats:

2.2.1 50 individuals

2.2.2 Demonstrate knowledge of how to remove bands safely (2 methods; demonstrate on model bat)

2.3 Pit-tagging insertion in short-tailed bats:

- 2.3.1 Pit-tag insertion to short-tailed bats
- 2.3.2 Bat handling for pit tagging

Note that that transponder skills require exacting standards and specialised training from a select few people, and if people need this skill, they should contact the Bat Recovery Group to apply to get trained.

2.4 Attaching radio transmitters (should first be competent in 2.1 and/or 2.2):

- 2.4.1 For long-tailed bats: watch 5 individuals having radio transmitters attached by a Competent Bat Worker or Authorised Trainer
- 2.4.2 For long-tailed bats: attach radio transmitters to 5 individuals correctly under supervision
- 2.4.3 For short-tailed bats: watch 5 individuals having radio transmitters attached
- 2.4.4 For short-tailed bats: attach radio transmitters to 5 individuals correctly under supervision
- 2.4.5 Demonstrate understanding of reasons for attaching transmitters, Animal Ethics issues, (risk management and animal welfare considerations, trapping)

2.5 Taking wing biopsies

- 2.5.1 Watch 5 individuals having biopsies taken by a Competent Bat Worker or Authorised Trainer
- 2.5.2 Take biopsies from 10 individuals under supervision
- 2.5.3 Understand and follow the Standard Operating Procedure (available on request from Bat Recovery Group Leader)

3. High risk activities – Roost felling (all of these competencies include the understanding of what to do when bats are found during tree felling as per Appendix 6 of 'Initial Veterinary Care for New Zealand Bats' Initial Veterinary Care for NZ Bats

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

Appendix III: Tree Felling Protocols

Protocols for minimising the risk of felling bat roosts

(Bat Roost Protocols (BRP))

Version 2: October 2021 approved by the New Zealand Department of Conservation's Bat Recovery Group

The use of these protocols should be a final step in the avoid/remedy/mitigate hierarchy. Avoidance of felling bat roost trees should be the first step in any project.

Purposes of this document:

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

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

Context

The status of New Zealand bats

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

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

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

Threats to bats

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

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

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

Roosts are critical to the survival of bats

Roosts are where bats gather to shelter during the day and at night. They are used to socialise, mate, give birth, and raise young. Bats have very specific requirements when they are choosing roosts and are not just choosing any

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

tree[2]. The specialised features of roosts make them rare and almost irreplaceable in any landscape or habitat type except over very long-time frames. People sometimes falsely suggest that "bats can just move to another tree". This is not the case, particularly where trees suitable as roosts are limited[3].

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

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

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

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

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

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

Bat roost protocols and the RMA

The occurrence of bats and bat habitat is a matter of 'significance' under Section 6(c) of the Resource Management Act (RMA). Bat roost protocols have become a standard part of bat management plans that may be required under RMA consents. Where developments require consents, and bats (a threatened species) are present, the developments should 'Avoid' impacting bats and bat habitat. Bat roost protocols only attempt to minimise the number of bats killed by tree felling, therefore implementing bat roost protocols where bats are present should be considered a last resort after following the RMA hierarchy of "avoid, remedy, mitigate, offset, compensate".

---

[2] Whilst we use the word tree frequently in this document, we acknowledge that bats also use non-tree vegetation as roosts and the terms tree and vegetation should be considered as interchangeable in the context of this document. We acknowledge that there are also non-vegetation roosts that are used and require protection. These include rocky bluffs, caves and occasionally buildings.

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

This protocol has therefore been framed following the RMA hierarchy by first focusing on the avoidance of effects, helping to identify and avoid the removal of roost trees, and to minimise the risk to bats of death or injury if avoidance is not possible. This approach is usually informed by gathering data on bats in the local areas and seeking advice from a competent bat ecologist.

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

Bat roost protocols and the Wildlife Act 1953

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

Bat roost protocol

When and how to use the protocol

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

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

Definitions

Competencies: a set of competencies developed by the NZ Bat Recovery Group[4] to ensure that anyone working with bats is competent to do so. Contact bathandler@doc.govt.nz for a list of competencies and requirements to become an authorised competent bat worker.

Competencies referred to in this document:

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

3. High risk activities – Roost felling (all of these competencies include the understanding of what to do when bats are found during tree felling as per Appendix 6 of 'Initial veterinary care for New Zealand Bats' https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Initial_Vet_Care_NZ_Bats.pdf)

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

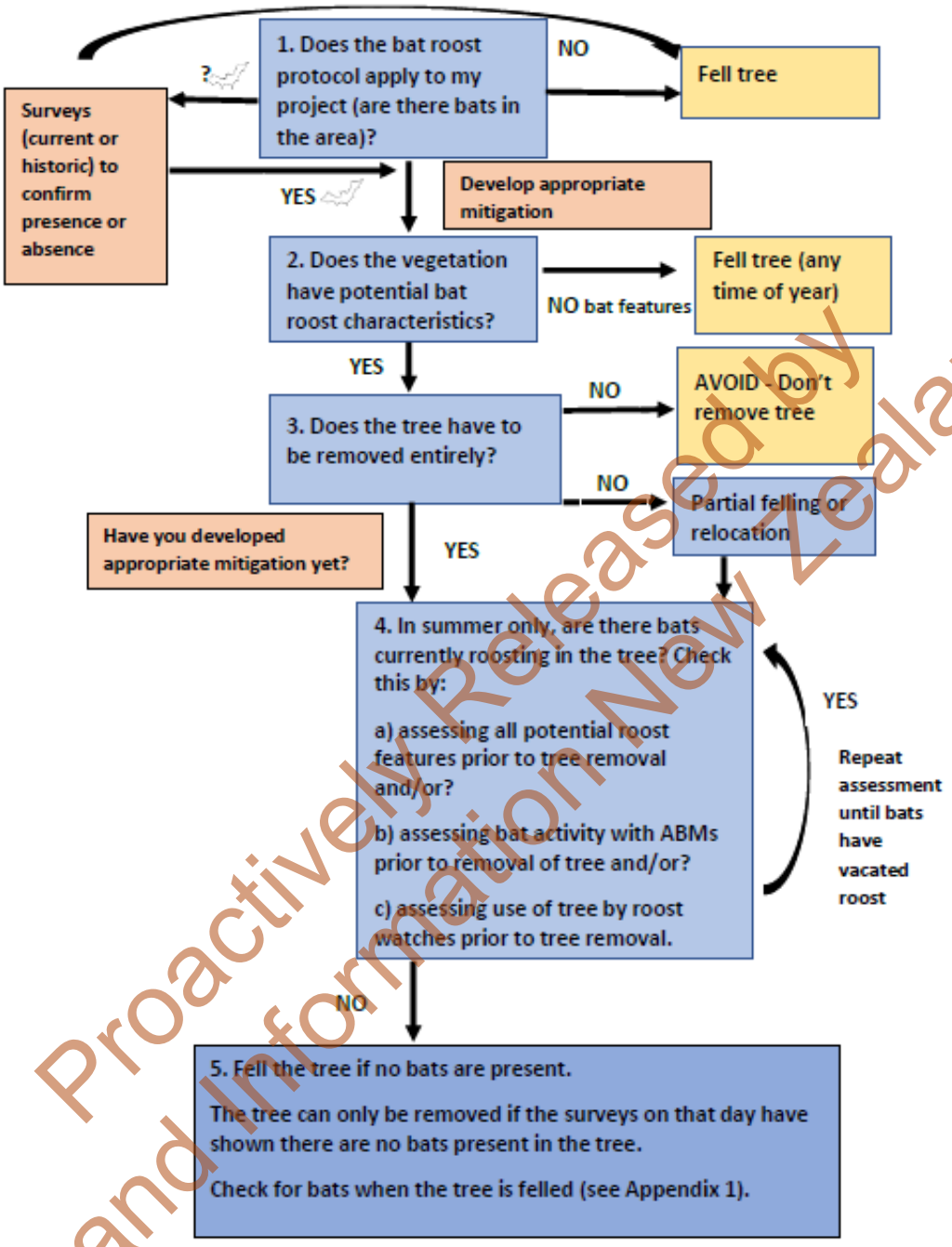
Authorised competent bat worker: A bat worker who has met the required ethical standards to be registered as a competent, authorised bat worker by the New Zealand Bat Recovery Group for the work which they are undertaking.

ABM: automated bat monitoring unit/detector

[4] A group of bat specialists that advise on bat issues and assess bat competencies

Figure 1. Tree removal in bat areas flow chart

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



Mitigation/compensation

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

Step 3. Does the tree have to be removed entirely?	Response	Who can make this assessment?	When?
a) Is the only option to remove the tree entirely?	If yes, continue to step 4 If no, consider leaving the tree in place, cutting off specific limbs only or relocating the tree. If any felling, partial felling (where the part to be felled has potential bat roost features) or tree relocation takes place you **MUST** proceed to step 4. If a roost (active/inactive) is confirmed, then advice should be obtained at a project level in writing from DOC before proceeding.	Project leader	Any time

Notes for Step 3

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

Step 4. Are there bats currently roosting in the tree? (Follow a or b or c or a combination)	Response	Who can make this assessment?	When
a) Are potential features being used by roosting bats? A tree climber may be required to check all features (see notes for 4a below). If roost is occupied repeat 4a another day until roost is vacated.	If yes, **THE TREE MUST NOT BE FELLED UNTIL BATS HAVE VACATED IT.** If no, the tree can be removed on the day of the tree inspection following step 5. If bats continue to use the roost, then the tree must not be cut down until the bats leave the roost. At this point re-consider again	An approved person at Competency Level 3.3 or an experienced tree-climber (e.g., an arborist) working with an approved person at Competency Level 3.3. If the latter, the tree climber must provide information along with photographs or video footage, to the approved person at Competency Level 3.3 who assesses and decides whether the tree can be removed.	October 1st to April 30th when the temperature is 7°C or greater at official sunset in the South Island or 10 °C or greater in the North Island.

	whether this tree must be felled. Advice must be obtained at a project level in writing from DOC prior to felling the tree.	If roosts are known or confirmed through this process, then this information must be communicated to the nominated DOC bat ecologist for this project.	
b) Is bat activity recorded at any time during two consecutive, valid survey nights preceding tree felling[13]? At least two nights are required as it is possible for bats to enter or leave a roost without echolocating, or to not leave the roost for a night.	If yes (bats are detected), survey must continue on subsequent nights[14] until no bat activity is recorded for two consecutive nights (to indicate bats have left the area) prior to felling. **OR** roost features of each tree must be visually assessed via climbing as in 3. If bat activity is consistent in the area and 2 nights with zero bat passes cannot be obtained, Go to 4c or 4a. If no bats are detected for two consecutive nights, the vegetation can be removed on the day immediately following the survey nights using the method in 5.	An approved person at Competency Level 3.1	October 1st to April 30th and when conditions meet the requirements for standard ABM weather conditions (see 4b notes).
c) Are bats observed entering the vegetation? This involves watching vegetation to identify bats returning to or exiting roosts. It should only be used in combination with previous ABM monitoring (4b) (see notes 4c for method). At	If yes (bats are seen at either watch), it is a confirmed roost. Removal of a roost should be avoided to minimise effects	An approved person at Competency Level 3.2[15].	Between October 1st and April 30th only **AND** when weather parameters meet

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

[14] Subsequent nights may be those immediately following bat detection or later dates.

[15] If more than one person is required for a roost watch at a tree, a minimum of one approved person at Competency Level 3.2 must be present on site for the duration of the roost watch to supervise.

least two nights are required as it is possible for bats to enter or leave a roost without being detected, or to not leave the roost for a night.	of vegetation removal on bats. Techniques used previously to ensure previously active roosts are no longer active have included the following: Watches must continue on subsequent nights until no bats are observed entering or exiting the roost for two consecutive nights (to indicate the roost is no longer active) prior to felling. If no bats are observed entering or exiting for two consecutive nights, the vegetation can be removed on the day immediately following the survey nights using the method in 5.		the roost watch requirements.

Notes for Step 4.

4a) Tree climbing and inspection

Care must be taken while climbing trees to avoid disturbing, removing or destroying tree features with bat roost potential such as sections of loose bark or cavities in dead wood. Using mobile elevated platforms can be a good option. Bats are less likely to be active over colder periods, so climbing to check whether bats are present in potential roost features must take place between October 1st to April 30th when the temperature is 7 °C [16] (South Is) or 10 °C (North Is) or greater at official sunset on the night previous to inspection.

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

- Can bats be seen? An endoscopic camera should be available for this step and every possible corner of each potential roosting feature inspected, i.e., cavity/crack etc. Cracks, holes, and splits may lead to cavities or may be superficial. A cavity may be wet indicating no/low potential as a bat roost.

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

- Can bats be heard? Search of tree features should be accompanied by use of a hand-held bat detector. If bats are present and not in torpor, then detection of presence listening at 25 kHz (for social calls) and 40 kHz (for echolocation calls) may help to determine if long-tailed bats are present. Short-tailed bat social calls are often audible or detected at 25-27 kHz.
- Is guano present or urine staining?

4b) ABM survey work

Bat activity is to be recorded using ABMs. Location of ABMs must provide sufficient coverage to be able to determine if bat roosts are present in one or more of the trees[17]. 'Valid' survey nights must have the following features:

- Begin one hour before official sunset and end one hour after official sunrise.
- Temperature 10°C or greater for the first four hours after official sunset time for the North Island and 7°C for the South Island[18].
- Precipitation < 2.5 mm in the first 2 hours after official sunset, and < 5 mm in the first 4 hours after official sunset.

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

4c) Roost watches

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

- Temperature greater than 10°C all night between official sunset and sunrise for the North Island and 7 °C for the South Island.
- Precipitation < 2.5 mm for each two-hour period between official sunset and sunrise

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

Emergence watches

- Each tree must be watched initially from sunset until it becomes too dark to see by sufficient people to observe all potential exit points. This must be supported by the use of handheld detectors. The aim of emergence watches is to identify potential roost locations within the vegetation. Infra-red and thermal imaging cameras may be useful in this process.

[17] Department of Conservation-manufactured AR4 bat detectors are considered likely to detect long-tailed bats only over short distances i.e., up to 30-60 m distant from the detector (S. Cockburn, Department of Conservation, pers. Comm.). This is similar to detection distances of other detector types.

[18] South Island temperatures are based upon O'Donnell (2000) as above. North Island temperatures are based on data collected in Kinleith plantation forest, centred around Tokoroa, Central North Island; Smith D, Borkin K. 2017. Appendix B: Influence of climate variables on long-tailed bat activity in an exotic conifer plantation forest in the central North Island. P 136-145. In: Smith, D, K Borkin, C Jones, S Lindberg, F Davies and G Eccles (2017). Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature. NZ Transport Agency research report 623. 249pp.

Roost re-entry watches

The time when bats return to roosts can vary based on temperature and time of year.[19,20]

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

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

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

- Call the tree felling supervisor to inform them which affected tree(s) cannot be felled due to detection of bat sign.
- Send an email to the site manager, and a bat ecologist representing the council and DOC detailing the results of the survey and outlining the measures for protection or relocating the roost tree.
- A record (including photos) of any vegetation containing bat roosts shall be kept detailing the date; size, location and species of tree or other vegetation; roost type, e.g., cavity, peeling bark, broken branch; detail outlining how presence of bats was confirmed; the number of bats present; and species present, if known.

Step 5. Fell the tree if no bats present	**Response**	**Who can make this assessment?**	**When**
NB: Vegetation removal must take place on the day of tree inspection or the day immediately following night surveys that confirm that there are no bats present.			
a) If you have undertaken a visual inspection of the vegetation (following step 4a, then the vegetation can be removed **ONLY ON THE DAY OF INSPECTION** and meets the valid weather conditions (defined in notes 4c) at official sunset the day prior to inspection. If you have undertaken ABM surveys or roost watches 4b or 4c the vegetation can be removed **ONLY ON THE DAY IMMEDIATELY FOLLOWING SURVEY COMPLETION** (i.e., if the survey ends in morning the tree can be felled the same day only).		People who are familiar with the document shown in footnote[21], and physically able to check/inspect tree for signs of bats once felled.	When the inspection method chosen allows.

[19] Dekrout AS 2009. Unpublished PhD thesis. University of Auckland, New Zealand Pp 168.
[20] Griffiths R. 2007. Activity patterns of long-tailed bats (Chalinolobus tuberculatus) in a rural landscape, South Canterbury, New Zealand. New Zealand Journal of Zoology, 34:3, 247-258, DOI: 10.1080/03014220709510083.
[21] https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Bat_Care_Advice.pdf

Appendix IV: Visual Data Representation and Analysis

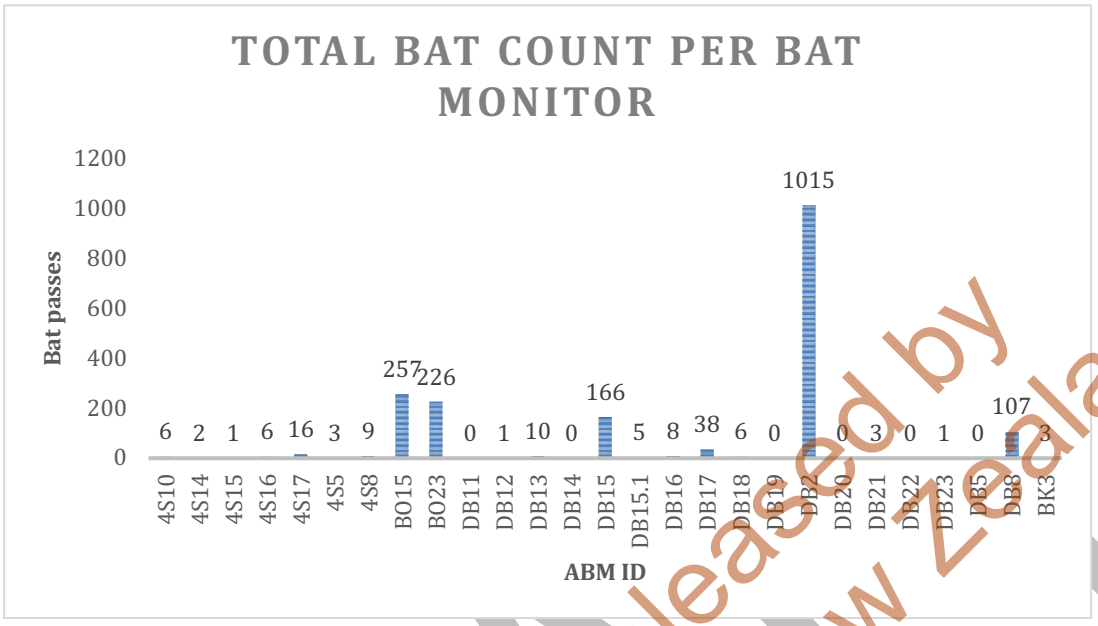


Figure 6. Total bat calls recorded during the 18 April to 24 May 2024 bat survey at the Tokanui Psychiatric Hospital.

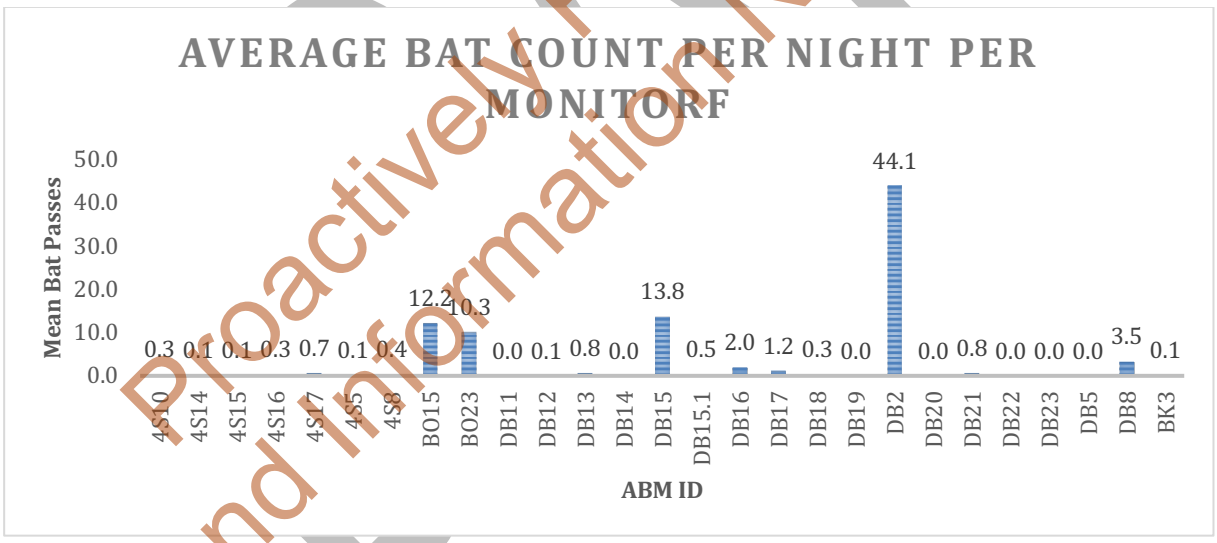


Figure 7. Mean number of bat calls recorded per monitor per night during the 18 April to 24 May 2024 bat survey at the Tokanui Psychiatric Hospital.

Table 1. Results of the 18 April to 24 May 2024 bat survey at the Tokanui Psychiatric Hospital.

ABM ID	Nights deployed	Nights Recorded	Total no. bat calls over period deployed	Mean no. of bat calls per night (± SEM)	No. of nights with bat calls	% of nights with bat calls
4S10	36	24	6	0.3	4	17%
4S14	36	23	2	0.1	2	9%
4S15	36	10	1	0.1	1	10%
4S16	36	23	6	0.3	6	26%
4S17	36	23	16	0.7	7	30%
4S5	36	25	3	0.1	3	12%
4S8	36	25	9	0.4	8	32%
BO15	36	21	257	12.2	19	90%
BO23	36	22	226	10.3	18	82%
DB11	36	13	0	0.0	0	0%
DB12	36	16	1	0.1	1	6%
DB13	36	13	10	0.8	6	46%
DB14	36	3	0	0.0	0	0%
DB15	36	23	166	13.8	17	74%
DB15.1	36	11	5	0.5	4	36%
DB16	36	4	8	2.0	2	50%
DB17	36	31	38	1.2	18	58%
DB18	36	19	6	0.3	4	21%
DB19	36	2	0	0.0	0	0%
DB2	36	23	1015	44.1	18	78%
DB20	36	2	0	0.0	0	0%
DB21	36	4	3	0.8	2	50%
DB22	36	4	0	0.0	0	0%
DB23	36	29	1	0.0	1	3%
DB5	36	1	0	0.0	0	0%
DB8	36	31	107	3.5	25	81%
BK3	36	26	3	0.1	2	8%

Table 2. Results of the 25 June to 11 July 2024 bats in buildings survey at the Tokanui Psychiatric Hospital.

ABM ID	Nights deployed	Nights Recorded	Total no. bat calls over period deployed	Mean no. of bat calls per night (± SEM)	No. of nights with bat calls	% of nights with bat calls
DB1	19	8	0	0	0	0%
DB3	19	19	0	0	0	0%
DB4	19	2	0	0	0	0%
DB5	19	7	0	0	0	0%
DB6	19	5	0	0	0	0%
DB8	19	19	0	0	0	0%
DB9	19	19	0	0	0	0%
DB17	19	19	0	0	0	0%
DB18	19	19	1	0.05	1	5.26%
DB19	19	19	0	0	0	0%
DB2	19	19	0	0	0	0%
DB20	19	19	0	0	0	0%
DB21	19	15	2	0.05	1	5.26%
DB22	19	9	0	0	0	0%
DB23	19	19	1	0.05	1	5.26%
DB24	19	13	0	0	0	0%
DB30	19	19	0	0	0	0%
DB31	19	19	0	0	0	0%
DB32	19	19	0	0	0	0%
DB34	19	19	0	0	0	0%
DV3	19	3	0	0	0	0%
DV18	19	19	0	0	0	0%

Appendix V: Weather data

Table 3. Weather data (station 23899) between dusk and midnight between the 18 April to 24 May 2024 bat survey at the Tokanui Psychiatric Hospital with numbers in bold indicating conditions exceeding the recommended weather conditions for surveying.

Date	Max Speed (km/h) for the first 4 hours after sunset	Min Temp (°C) for the first 4 hours after sunset	Max rain (mm/h) for the first 4 hours after sunset
18-Apr	4	9.2	0
19-Apr	1.8	11.6	0
20-Apr	2.9	15.2	0.5
21-Apr	7.6	12.5	0
22-Apr	7.6	9.8	0
23-Apr	7.2	**5.7**	0
24-Apr	4	11.1	0
25-Apr	3.6	13	0
26-Apr	5.8	7.2	0
27-Apr	4	**4.9**	0
28-Apr	1.4	**4.4**	0
29-Apr	1.4	11.2	0
30-Apr	6.8	**6.8**	0
01-May	3.6	10	0.6
02-May	4.7	**6.1**	0
03-May	2.9	**5.4**	0
04-May	1.4	**4.8**	0
05-May	1.4	**5.5**	0
06-May	3.2	11.9	1
07-May	3.6	**2.6**	0
08-May	8.3	**1.8**	0
09-May	13.7	**4.8**	0
10-May	4.7	**1.3**	0
11-May	3.6	**0.3**	0
12-May	1.4	**4.6**	0
13-May	2.2	**6.9**	0.1
14-May	1.1	9.5	0
15-May	2.9	9.1	0.1

16-May	7.6	11.6	0
17-May	6.8	10.5	0
18-May	4	**5.8**	0
19-May	1.8	**3.7**	0
20-May	2.2	9.9	3.8
21-May	1.8	10.8	0.2
22-May	8.3	8.1	0
23-May	2.2	**7.1**	0

Table 4. Weather data (station 23899) between dusk and midnight between the 25 June to 11 July 2024 bat survey at the Tokanui Psychiatric Hospital with numbers in bold indicating conditions exceeding the recommended weather conditions for surveying.

Date	Max Speed (km/h) for the first 4 hours after sunset	Min Temp (°C) for the first 4 hours after sunset	Max rain (mm/h) for the first 4 hours after sunset
25/06/24	15.5	12.2	0
26/06/24	18.4	11	0
27/06/24	13.3	**3.9**	0
28/06/24	6.5	**3.8**	0
29/06/24	4.3	**5.2**	0
30/06/24	4.3	**6.8**	0
01/07/24	10.1	11.8	5.3
02/07/24	4.7	**5.6**	1
03/07/24	7.2	**1.8**	0.2
04/07/24	4.3	**0.8**	0
05/07/24	5.4	**2**	0
06/07/24	4.7	**1.6**	0
07/07/24	4.7	**6.3**	0
08/07/24	2.5	**4.5**	0
09/07/24	4	**3.6**	0.2
10/07/24	5	**4.1**	0

Appendix IV: High Value Bat Habitat

Table 5. High Value Long-tailed Bat Habitat Characteristics

Mature Trees for Roosting and Breeding	Long-tailed bats are adapted to roost in mature native tree species, and they exhibit higher breeding success in these environments[1]. In the absence of native trees, they rely on exotic trees. Each roosting tree is crucial, selected by bats for its specific thermal qualities. In fragmented landscapes, suitable roosting trees are limited.
Darkness	Bats avoid brightly lit areas, such as those with streetlights and high-density housing[2]. Even a modest increase in housing density, from one house to around five per hectare, can result in a 42% decline in bat activity[3].
Productive Foraging Grounds	Bats forage on insects over water bodies, along linear landscape features like shelter belts, and across night-dark pastures [4].
Flyways	Bats commute between resource patches when there is landscape connectivity, which includes roost trees for resting, linear features for sheltered flying, and darkness. The extent of connectivity needed and the major barriers to it remain somewhat uncertain.
Large, Integrated Landscapes	Long-tailed bats require large landscapes that integrate these features. In and around Hamilton, the home range of individual female bats can be up to 1,600 hectares or more. Bats exhibit strong fidelity to their home ranges, rarely relocating even when large parts are disturbed or lost due to tree felling or habitat disturbance [5].

[1] Sedgeley J.A. and O'Donnell C.F.J. 2004. Roost use by long-tailed bats in South Canterbury: examining predictions of roost-site selection in a highly fragmented landscape. New Zealand Journal of Ecology 28(1): 1-18

[2] Schamhart, T., Browne, C., Borkin, K. M., Ling, N., Pattemore, D. E., & Tempero, G. W. (2024). Detection rates of long-tailed bats (Chalinolobus tuberculatus) decline in the presence of artificial light. New Zealand Journal of Zoology, 51(2), 200-210.

[3] Le Roux D.S. and Le Roux N.N. 2012. Hamilton City-Wide Bat Survey 2011/12. Unpublished report prepared for Project Echo by Kessels and Associates, Hamilton. https://www.waikatoregion.govt.nz/assets/WRC/WRC-2019/2193861_Hamilton_Citywide_Bat_Survey_Report_2011_2012.pdf

[4] Davidson-Watts 2019. Long-tailed bat trapping and radio tracking, baseline report 2018 and 2019 Southern Links, Hamilton. Report prepared for AECOM by Davidson-Watts Ecology (Pacific) Ltd.

[5] Borkin K.M, and Parsons S. 2014. Effects of clear-fell harvest on bat home range. PLoS ONE 9(1): e86163. doi:10.1371/journal.pone.0086163

RE: Tokanui Hospital Remediation Works Support Letter
10 March 2025

To whom this may concern,

We are aware that LINZ are seeking resource consents regarding the remediation works for the Tokanui Hospital as set out in Part 9 of the Property Redress Schedule of the Maniapoto Deed of Settlement.

Waipā District Council applications LU/0231/24: Removal of horizontal infrastructure, building foundations and culvert 2, repair trunk stormwater pipe, and remediate contaminated land at the former Tokanui Psychiatric Hospital

LU/0232/24: Utilise the closed landfill at the former Tokanui Psychiatric Hospital to dispose of contaminated soil from remediation works on-site and repair and upgrade the landfill Waikato Regional Council application APP146952.

On behalf of Te Nehenehenui, we would like to offer this letter of support to the project and resource consents however this is not formal written approval and TNN wants to reserve the ability to make a formal submission and appear at any hearing.

LINZ have actively engaged with Te Nehenehenui throughout this process which involved a visit onsite, and the development of a cultural impact assessment developed by Tangata Whenua roopu TAR.

We look forward to the continued engagement and working relationship with LINZ on this project.

Nāku noa nā

Sam Mikaere Group CEO
Te Nehenehenui Trust

49 Taupiri Street, Te Kūiti 3910
PO Box 36, Te Kūiti 3910
https: www.tenehenehenui.iwi.nz