Ecological Impact Assessment at Pencarrow Road, Tamahere

Prepared for Waikato Thoroughbred Racing

AWA ECOLOGY
ECOLOGICAL CONSULTANTS

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BCD.0093	Brenda Bartels & Alicia Williams	Gerry Kessels (Bluewattle Ecology)	Draft	5/12/2025
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EXECUTIVE SUMMARY

BCD Group Ltd on behalf of Waikato Thoroughbred Racing have engaged Awa Ecology to prepare an Ecological Impact Assessment (EcIA) for the proposed development of the site at Pencarrow Road, Tamahere. The site is bordered by State Highway 1, Pencarrow, Hooker and Duncan Roads and is currently a working dairy farm. Areas within the farm are comprised of pasture with hedgerows, scattered trees, a remnant kahikatea stand with a small area of wetland, and a network of artificial watercourses and associated artificial wetlands. This assessment focused on identifying the terrestrial, freshwater and wetland ecological values present on the site.

Fauna ecological values range from very high for 'Threatened – Nationally Critical' long-tailed bats to low for common indigenous bird species and shortfin eel.

Across most of the proposed development site the ecological value of the vegetation and habitats range from negligible to low. However, the kahikatea 'treeland' stand and the area of natural wetland found on site are both underrepresented indigenous vegetation types and the kahikatea stand also provides habitat for bats, a threatened species. It is thus considered to meet two of the 11 criteria to be classed as a site of significant indigenous vegetation and habitats of indigenous fauna as detailed in section 11A of the Waikato Regional Policy Statement.

Potential adverse effects on biodiversity values because of the development can be addressed through the following measures:

- The kahikatea stand will be retained and restored. This area is an underrepresented vegetation type and provides a high-value habitat for bats. Restoration and management measures include fencing (if stock is likely to have access), planting and pest control. Any adverse effects can be compensated at this location, which is likely to be above and beyond what is required because of the development, resulting in a net gain. The details of this can be captured as consent conditions and/or an Ecological Management Plan (EMP)/Planting Plan.
- Minimise the effects of artificial lights through low light design with a 0.3 lux and 2700 Kelvin limit, to prevent light spillover effects from the development within 25 m of the kahikatea stand. Provisions for a 50m bat commuting corridor or 'light corridor' (with lighting restrictions) will be required between the edge of the site and the kahikatea stand. Lighting restrictions are not required throughout the rest of the site.
- A provision to ensure that the Department of Conservation 'Protocols for Minimising the Risk of Felling Bat Roosts' best practice guidelines are applied during construction where potential roosting trees for long-tailed bats are being removed.
- If large exotic high-value potential bat roost trees are felled (after following the correct pre-felling procedures), suitable replacement roosting habitat should be created within the kahikatea stand.
- Impacts to native fish, namely shortfin eel can be minimised by undertaking a site-specific fish management plan, including fish recovery in any wetted watercourse to be disturbed.
- Impacts regarding stormwater and sediment discharges to the receiving environment can be avoided by following best practice guidelines and regulations.
- Areas of bare earth will need to be immediately vegetated or covered to reduce the risk of erosion and sedimentation and weed colonisation on bare ground.
- The increase in vegetated areas (including shrubs) as a result of the restoration of the kahikatea stand and plantings surrounding the development will likely enhance habitat for native lizards over the long term.
- Implementation of these ecological avoidance, remediation and mitigation measures should be detailed in an Ecological Management Plan required for construction and ongoing operation of the horse racecourse and harness racing facilities.

1 INTRODUCTION

1.1 Scope

BCD Group Ltd on behalf of Waikato Thoroughbred Racing commissioned Awa Ecology to prepare an Ecological Impact Assessment (EcIA) for a c.160 ha block of land at Pencarrow Road, Tamahere (Figure 1). This assessment focused on identifying the terrestrial, freshwater and wetland ecological values present on the site.

The site is bordered by State Highway 1, Pencarrow, Hooker and Duncan Roads and is currently a working dairy farm comprised of pasture with hedgerows, scattered exotic trees, a maize crop, a remnant kahikatea stand with a small area of wetland, and a network of artificial watercourses and associated artificial wetlands.

The purpose of this report is to prepare an EcIA associated with the proposed development of the site into a horse racecourse, harness racing and associated facilities (see proposed site plans in Appendix 1). The purpose of the Project is to create a unique, world class greenfield racing hub designed for horse training, racing and other equine related activities, while bringing the expertise and strength of the local racing fraternity together in a centralised location.

This enables the local racing industry to be more streamlined, competitive, sustainable and future focused while bringing potential international investment and creating a 'destination' for horse racing in New Zealand, also increasing tourism opportunities for the wider region.

A key driver behind the proposed greenfield equine hub and racecourses is enabling the consolidation of four separate racecourse facilities (Te Rapa, Waipa and Cambridge thoroughbred courses, and the Cambridge harness track). These facilities duplicate assets and resources and, given their current condition require significant levels of upgrades and investment to provide fit-for-purpose facilities that meet the higher standards of the modern-day racecourse experience. The retirement of these areas also frees up significant tracts of land within existing urban areas for future development, increasing housing supply.

To support the development's financial viability and enhance the site's long-term vibrancy as a racing, entertainment, commercial and community precinct, the proposal includes a range of complementary activities on the remaining land. These include equine support services, rural residential housing, a retirement living community, a village centre and a bloodstock sales precinct.

This report:

- Describes the existing terrestrial, wetland and freshwater ecological characteristics and values;
- Describes ecological effects on these values that are expected to result from the proposed development, as well as recommending measures to avoid, remedy or mitigate effects;
- Provides mitigation, offset and compensation recommendations for addressing residual effects (as and if required); and
- Presents an overall conclusion on the level of actual and potential ecological effects of the project after all recommended effects management measures have been undertaken.

The overarching objective and intended outcome for this project is to address a No Net Loss (NNL) or preferably Net Gain (NG) standard, for more than minor residual adverse ecological effects that cannot be avoided, remedied or mitigated. This approach broadly aligns with Waikato Regional Council's

objectives and policies for indigenous biodiversity as set out in the Waikato Regional Policy Statement (WRPS)[1].

Ecological surveys of the site were undertaken in November and December 2025, using methods outlined in section 2 of this report. The results of these surveys are detailed in section 3, and an assessment of ecological value, assessment of ecological effects and effects management recommendations are presented in sections 3, 4, 5 and 6.

1.2 Site description

The property is c.160 ha in size and is situated south of Hamilton City, in Tamahere. The property is surrounded by a mix of farms and lifestyle properties and is bordered by State Highway 1, Pencarrow, Duncan and Hooker Roads. The property is positioned in the Hamilton Ecological District (ED) within the Waikato District and lowland bioclimatic zone. The Hamilton ED has been highly modified for agricultural production and little indigenous vegetation remains.

The property is surrounded by a mix of farms and lifestyle properties and is flat, with a land use of dairying with some maize cropping on the eastern boundary. The site is currently comprised of two working dairy farms with associated infrastructure including milking sheds, animal shedding, feed storage, and multiple residential properties. The site is highly modified, and farming practices include the creation of a network of artificial watercourses [2,3] (refer to Appendix 2 for classification memo details) and recontouring of some paddocks into a hump and hollow formation. Vegetation includes grazed pastoral land, a network of exotic hedgerows and scattered mature trees. There is a remnant kahikatea stand at the southern end of the property with a small area of wetland, which likely provides important habitat for indigenous species.

1.3 Ecological context

The site is located within the Hamilton ED, which covers an area of 159,344 ha (McEwan, 1987) and is located in central Waikato around Hamilton City and the surrounding basin.

The Hamilton Basin is one of the most heavily degraded management zones in the Waikato District, with only small, scattered indigenous forest remnants remaining. Historically, the Hamilton ED was covered mostly in a mixture of podocarp forest and wetlands (Singers & Rogers, 2014). The Hamilton ED has largely been cleared of its original vegetation for agricultural purposes, and only 1.2% of the district (1900 ha) remains in indigenous forest, of which 0.2% is primary forest (Leathwick et al. 1995). The site is also located within the Hamilton Basin which is comprised of four main landform units: hills, alluvial plains, gullies, and peatlands. This property is located along the alluvial plains of the Waikato Awa and was likely once dominated by kahikatea-pukatea-swamp maire forest (Clarkson *et al*., 2007).

In terms of fauna, threatened species that have been observed within the Hamilton ED include the Threatened – Nationally Critical long-tailed bat (*Chalinolobus tuberculatus*), Threatened – Nationally Increasing bush falcon (*Falco novaeseelandiae ferox*) and At Risk – Recovering North Island kākā (*Nestor meridionalis septentrionalis*). These three species are considered very mobile and often have wide feeding and home ranges. Copper skink (*Oligosoma aeneum*) is the only indigenous lizard species likely to be present in small, isolated kahikatea remnants. Although the elegant gecko (*Naultinus elegans*) (At Risk – Declining) and speckled skink (*Oligosoma infrapunctatum*) (Data Deficient) have

[1] The Waikato Regional Policy Statement. Waikato Regional Council May 2016 (updated December 2018).

[2] Pencarrow Road Watercourse classification memo October 2025 – Ecology NZ

[3] Waikato Thoroughbreds Pencarrow Road Site – Water body classification email chain with Waikato Regional Council

also been recorded within the Hamilton ED, they are highly unlikely to be found at this site, preferring mature native forest and adjacent scrubland. Threatened fish species which could be found in any waterways on site include At Risk- Declining black mudfish (*Neochanna diversus*), longfin eel (*Anguilla dieffenbachii*), giant kokopu (*Galaxias argenteus*) and inanga (*Galaxias maculatus*).

1.4 Historic imagery

Historical aerial imagery from Retrolens[1] was viewed for the subject property (Appendix 3). This imagery shows historic landcover (dating back to 1953), and how landcover at the site has evolved over the years (August 1953, February 1995, January 2008, January 2013, April 2018 and February 2025). By 1953 land clearance activities were well advanced with large areas of pasture observed and similar to what is seen in current day. The kahikatea stand at the southern end of the property was denser and more intact, which but appears to be relatively unchanged until sometime after 1995. The site in 1953 had a series of wet areas, likely overland flow paths to the northeastern area of the property, and these areas have disappeared over time. However, flow paths were still seen on imagery in 2025.

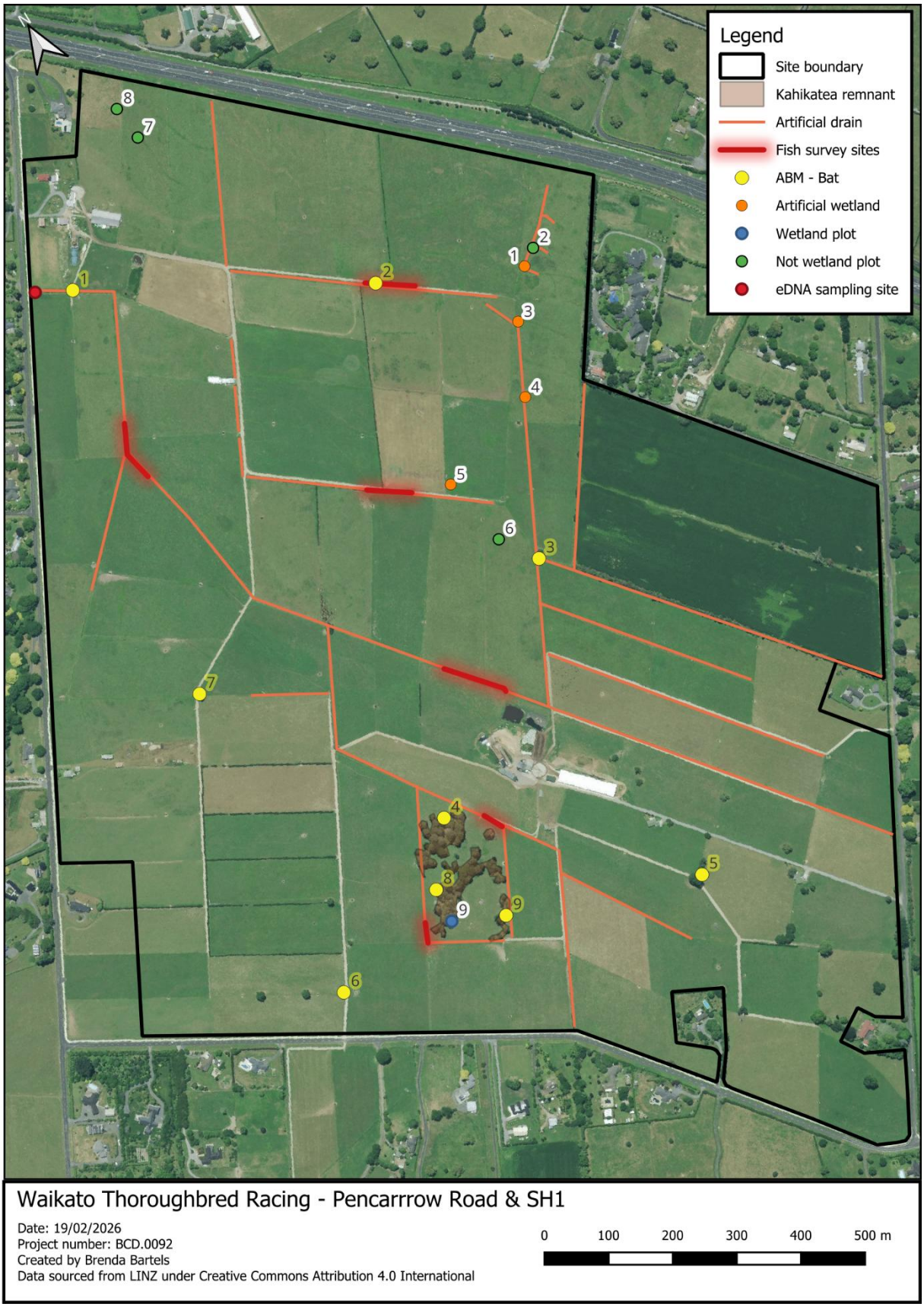

Figure 1: Waikato Thoroughbred Racing site showing features of the site.

2 METHODOLOGY

2.1 Desktop review

A desktop literature review was undertaken to determine the ecological context of the site. Resources reviewed included:

- Retrolens historic imagery[4]
- The New Zealand Freshwater Fish Database (NZFFD)[5];
- The BioWeb Database[6], and the National Bat database[7]; Waikato Regional Council bat distribution map[8]and,
- iNaturalist[9], New Zealand Birds online[10], and the New Zealand bird atlas[11].

2.2 Terrestrial Ecology - Te papa whanui

Field surveys and ecological assessments were undertaken on the 13 and 14 November 2025. During the field surveys the vegetation was assessed, classified, and mapped. All vascular plants encountered during the site visit were recorded and vegetation composition and plant communities described.

- A bat survey was undertaken in November 2025 using nine acoustic Automated Bat Monitors (ABMs).
- Notes were made of all birds seen or heard during the field surveys. These were supplemented by a desktop survey of existing database and literature sources.
- A survey for lizards was carried out in conjunction with vegetation surveying using daytime habitat searches. This method involves visual searches of habitat (using the naked eye and binoculars) for basking and/or feeding skinks and geckos, and physical search of daytime lizard retreats, e.g. tree bark, rocks, logs, standing dead trees, vegetation, leaf litter, for inactive lizards.

2.2.1 Long-tailed bat (Pekapeka-tou-roa) surveys

A long-tailed bat survey was carried out at the site, during which nine DOC type "AR4" ABMs were deployed. Six ABMs were deployed for 14 nights, from 13 November to 27 November 2025. A further three ABMs were redeployed for six nights from 27 November to 3 December 2025.

The locations of the ABMs are shown in Figure 1. The data was analysed according to the protocols described by Sedgeley et al (1999). ABMs record any sound that may be a bat call or echolocation. When the ABM is triggered by a potential bat pass it records one file for each pass. When detectors are placed close to roosts or swarming sites there can be multiple overlapping calls sequences from many bats (Lloyd, 2017). The recordings are prepared in a form of a compressed image of a spectrogram and are saved onto an SD card in the form of bitmap format images. The images were

[4] https://retrolens.co.nz/
[5] The New Zealand Freshwater Fish Database (NZFFD) administered by the National Institute of Water and Atmospheric Research (NIWA) accessed on 31 August 2023.
[6] BioWeb Database. Administered by the Department of Conservation (DOC).
[7] National Bat Database. Administered by DOC.
[8] Waikato long-tailed bat distribution (waikatoregion.govt.nz)
[9] https://www.inaturalist.org/observations
[10] http://nzbirdsonline.org.nz/
[11] https://ebird.org/atlasnz/home

viewed using BatSearch 3.12 software (DOC 2017). Most calls from long-tailed bats are search phase calls. In spectrograms of search phases calls frequencies sweeping down from 80 to 35 kHz (Lloyd, 2017). The frequency spectrum assessed ranges from 0 Hz to 88 kHz and images represent 1-6 seconds of recording.

All detectors were calibrated to have the same time and date settings (NZST) and were pre-set to start monitoring one hour before sunset until one hour after sunrise. The recorders were suspended at least 2 m above the ground to reduce superfluous detections caused by terrestrial insects (usually cicada species) and rats. Weather conditions were reasonable for bat emergence (O'Donnell, 2001) for most of the survey period and are displayed in Appendix 4.

2.3 Wetland - Repo

An initial desktop mapping assessment was undertaken using recent and historic aerial imagery before the site visit. This mapping identified areas that were likely to be wetlands and required further assessment in the field.

The entire site was walked or driven on the 13th and 14th of November 2025, and areas that appeared to support hydrophytic vegetation were assessed

2.3.1 Wetland definition

A wetland is defined in the Resource Management Act as follows:

'*Wetland includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions.*'

Any areas that appeared to support hydrophytic vegetation were assessed to determine if they meet the definition of a natural inland wetland as defined in the NPS-FM[12]:

natural inland wetland means a wetland (as defined in the Act) that is not:

(a) in the coastal marine area; or

(b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or

(c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or

(d) a geothermal wetland; or

(e) a wetland that:

  (i) is within an area of pasture used for grazing; and

  (ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the *National List of Exotic Pasture Species* using the *Pasture Exclusion Assessment Methodology* (*see* clause 1.8)); unless

  (iii) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply

[12] Ministry for the Environment (MfE) 2020a (Version January 2024): National Policy Statement for Freshwater Management (NPS-FM) 2020, approved by the Governor-General under section 52(2) of the Resource Management Act 1991 on 3 August 2020, published by the Minister for the Environment under section 54 of that Act, 75 p

2.3.2 Wetland delineation protocols

The protection of wetlands has become part of national policy, with the National Policy Statement for Freshwater Management (NPS-FM) which came into force in September 2020 (with subsequent updates). The Essential Freshwater package introduced policies and regulations to protect 'natural wetlands' with nationally consistent standards.

Wetland assessments were based on the Wetland Delineation Protocols (MfE 2020b) following requirements in the National Policy Statement for Freshwater Management (NPS-FM) (MfE 2020a). The wetland delineation protocols have been developed to give a robust method for delineating wetlands, using three criteria: vegetation, soils, and hydrology. Where wetlands were present, the extent was tracked using a handheld GPS.

Vegetations classified using the vegetation tool (Clarkson, 2013) categorise plant species, based on the proportion of coverage in a 2m x 2m plot as:

- Obligate (OBL): plant species that occur almost always in wetlands (estimated probability greater than 99 % in wetlands).
- Facultative Wetland (FACW): plant species that occur usually in wetlands (67 % to 99 %).
- Facultative (FAC): plant species equally likely to occur in wetlands or non-wetlands (34 % to 66 %).
- Facultative Upland (FACU): plant species that occur occasionally in wetlands (1 % to 33 %).
- Upland (UPL): plant species that rarely occur in wetlands (less than 1 %).

To pass the rapid test the vegetation present within the 'wetland' area across all strata must be dominated by species that are classified as OBL or FACW species. To pass the dominance test the most abundant plant species that immediately exceed 50 % of the total cover for each stratum, plus any additional species comprising 20 % or more of the total cover for the stratum must be OBL, FACW, or FAC. The prevalence test assigns a weighted index score for the species present, with score less than 3 indicating wetland vegetation. Areas can be excluded as natural wetlands if they are classified as 'artificial' or 'improved pasture'.

The hydrophytic vegetation tool on its own is a useful tool for delineating wetlands for most wetland types and can be used on its own to delineate wetlands if both the Dominance Test and the Prevalence Index pass.

2.4 Freshwater Ecology – Te wai mauri

The freshwater environments and habitats at the site were visually inspected and qualitative habitat assessment was conducted. An initial site walkover was carried out to inspect any watercourses and identify areas where water was flowing in the channelised waterways. Representative sections of each channel were walked, and the stream bed was assessed for pooling water, wet soils, and macrophyte species.

In areas where water was present, a more detailed assessment was carried out looking at channel shape, streambed type, flow, instream habitat, shading, and riparian condition.

To assess the aquatic fauna residing in the watercourses of the property, fine mesh gee minnow traps (GMTs) were deployed overnight where water depths allowed. GMTs could be deployed to ascertain fish presence, where depths were greater than 15 cm. The GMTs were deployed on the 13 November and retrieved on the 14 November. Five sites were surveyed (Figure 1) following the mudfish sampling

methodology[13]. Ten GMTs were set at each site except one where there was insufficient habitat and nine GMTs were set instead (a total of 49 GMTs were set). Given the shallow nature of the watercourses, GMTs were dug into the sediment in places. Most of the watercourses onsite were likely ephemeral (although some may retain water permanently), and trapping was undertaken during the ideal trapping time for mudfish (September to November) when detection probabilities are the highest.

In addition, four replicate Environmental DNA (eDNA) samples were taken on the 24 September 2025 at the outlet of the artificial watercourse network in the northwestern border of the property (Figure 1), by Ecology NZ during an initial site visit to determine the opportunities and constraints of the site. The samples were analysed for the presence of fish species by Wilderlab.

2.5 Ecological Impact Assessment Methods

2.5.1 Assessment of Ecological Significance

Ecological significance was assessed based on the criteria outlined in Section 11A of the WRPS. The assessment of each criterion followed Table 1 of "Updated Guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region" (WRC and Wildland Consultants 2023).

In addition, the National Policy Statement for Indigenous Biodiversity (NPS-IB) was used to determine ecological significance for indigenous flora and fauna and their habitats.

2.5.2 EIANZ Assessment

The ecological effects assessment was undertaken in accordance with the Ecological Impact Assessment Guidelines (EcIA) developed by the Ecological Institute of Australia and New Zealand (Roper Lindsay, 2018). The use of the standard framework and matrix approach within these guidelines and well as professional ecological judgement provides a robust, consistent and transparent ecological effects assessment which is considered best practice.

A EcIA guidelines uses a standard framework to determine the following:

- Step one - Assessing the ecological value of the environment (Appendix 5)
- Step two - Assessment of the magnitude of ecological effect from the proposed activity (Appendix 5).
- Step three - Determining the overall level of effect to determine if further mitigation, offset or environmental compensation is required (Appendix 5).

[13] Ling, N.; O'Brien, L.K.; Miller, R.; Lake, M. 2013: A revised methodology to survey and monitor New Zealand mudfish. Department of Conservation, Wellington (unpublished).

3 DESCRIPTION OF ECOLOGICAL FEATURES

3.1 Terrestrial vegetation/habitat characterisation – Te papa whanui

The majority of the site is comprised of exotic pasture, and was dominated by common improved pasture grasses including rye grass (*Lolium* spp.), rough-stalked meadow grass (*Poa trivialis*), sweet vernal (*Anthoxanthum odoratum*), Yorkshire fog (*Holcus lanatus*) and herbs such as clover (*Trifolium* spp.), dock (*Rumex* spp.), lotus (*Lotus pedunculatus*), plantain (*Plantago* spp.) and Californian thistle (*Cirsium arvense*) (Photo 1). Wetter areas of pasture were vegetated with scattered buttercup (*Ranunculus* spp.) and water pepper (*Persicaria hydropiper*). At the time of the site visit, an area to the east had recently been planted in maize, with two large mature gum trees present in the middle of this crop.

Scattered (mostly individual) mature exotic trees were present throughout the property and included poplar (*Poplus* sp.), birch (*Betula* sp.), grey willow (*Salix cinerea*), and oak (*Quercus* sp). An extensive network of hedgerows was present around the perimeter of the property and between many of the internal paddocks and farm races. The hedgerows were predominately comprised of hawthorn (*Crataegus laevigata*) and barberry (*Berberis glaucocarpa*) (Photo 2).

Photo 1: Exotic grassland.

Photo 2: Well-maintained hedgerow along a farm race and drain.

3.1.1 Kahikatea treeland stand (0.95 ha)

A remnant kahikatea (*Dacrycarpus dacrydioides*) stand is present at the southern end of the property, near the boundary with Hooker Road (Photo 3). This area is not fenced from stock and has reduced in extent when compared to historic imagery prior to 1995, currently it is best described as a modified treeland[14]. Kahikatea is the dominant species present, however there are few scattered mature pōkākā (*Elaeocarpus hookerianus;* DBH [15] 70 cm), titoki (*Alectryon excelsus;* DBH 60 cm) and tawa

[14] "treeland" is defined as a vegetation type where the tree canopy cover is between 20% and 80%, but the canopy is discontinuous above a lower layer of non-woody vegetation (such as grass or sedges). Atkinson (1985)

[15] DBH= Diameter at breast height, measured at 1.3 metre above the ground by measuring trunk circumference at this height and divide by pi.

(*Beilschmiedia tawa*) present in the centre of the stand. A large matai (*Prumnopitys taxifolia;* DBH c.90 cm) was present in the southeastern corner (Photo 4). A pukatea (*Laurelia nova-zelandiae*), and the small leaved milk tree (*Paratrophis microphylla*) were also observed. There are a few dead kahikatea trees located within the stand, and kahikateas at the southwestern portion are more exposed to the elements and are looking stressed (leaf loss, root buttressing) (Photo 3).

The understorey within the stand is sparse, with the occasional inkweed (*Phytolacca octandra*), barberry and blackberry (*Rubus fruticosus*) present. The groundcover is dominated by pastoral grasses and herbs, such as hairy buttercup (*Ranunculus sardous*), perennial ryegrass, broad-leaved dock, creeping buttercup (*Ranunculus repens*), Californian thistle and annual poa grass (*Poa annua*).

As with many remnant kahikatea stands in the Hamilton Basin, there has been significant modification, including hydrological modification with drains following the fenceline around the stand. These drains contained shallow water at the time of the assessment.

Although this remnant has been significantly modified and degraded. This kahikatea stand is indigenous vegetation that is under-represented (20% or less of its known or likely original extent remaining), with about 1.2% of original forest remaining in Hamilton ED. Kahikatea stands are also underrepresented regionally and nationally.

Photo 3: Remnant kahikatea stand. Note the sparse leaf coverage on the kahikatea toward the right of the image.

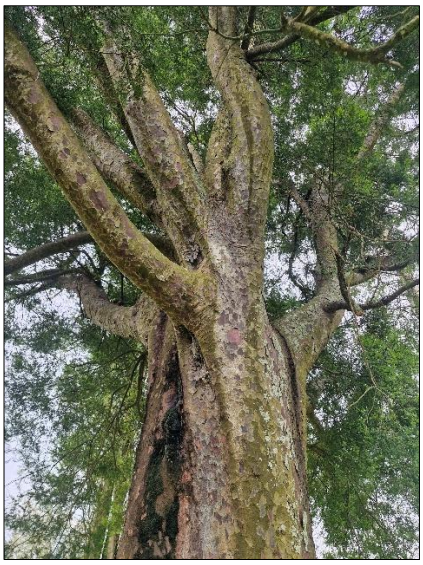

Photo 4: Large matai tree with a DBH of c.90 cm.

3.2 Terrestrial fauna

3.2.1 Long-tailed bats - Pekapeka-tou-roa bioacoustics survey results

Pekapeka-tou-roa or long-tailed bats (*Chalinolobus tuberculatus*, Threatened - Nationally Critical) (O'Donnell et al., 2022) are considered to have been in population decline for the last 150 years (O'Donnell 2000). Pekapeka-tou-roa have a threat classification of nationally critical (O'Donnell *et al*., 2018). This decline is due to on-going habitat loss, predation from introduced mammalian pests, and

an increased threat from vespulid wasps (O'Donnell *et al.*, 2018). Long-tailed bats have been recorded in the surrounding landscape[16].

During the onsite bioacoustic surveys using ABMs, bat activity ranged from low in areas of farmland to relatively high within the kahikatea stand (Tables 1 and 2; Figures 2-6).

Temperature at dusk remained suitable for bat emergence for all nights of the survey period (data from detector log device). According to MetService, Hamilton had a reasonably high month of daily rainfall, with five days exceeding 10mm of daily rain (Appendix 4). This may have affected bat emergence, particularly on 19 November and 30 November 2025 which was reflected in the data where there were no bat passes at Site 4 (Northern point of kahikatea stand) on 19 November.

3.2.1.1 Survey

Eight of nine detectors recorded long-tailed bats over the duration of survey period.

Across all survey nights and ABMs there was a total of 191 bat passes (Table 1; Figure 1). Site 4 had the highest rate of bat activity, with an average of 9.2 bat passes per night (Table 1), and seven feeding buzzes (rapid sequences of echolocation pulses during prey capture) (Table 2 and Figure 2). These results indicate a relatively high level of bat activity at site 4 (Figure 3, 4, 5 and 6). Three of the survey nights detected 19 bat passes, with bats detected every night of the survey period except the 19th, likely due to high rainfall. The majority (73) of the bat passes at Site 4 occurred between 00:00-01:00, which is around four hours after sunset (approximately 20:00). Bats are likely passing through site 4 as a commuting corridor and occasional feeding passage. There was a possible social call within the dataset (23 November at 1:50AM). Although most of the bat activity occurred during the night, after dusk, the presence of a nearby roost cannot be ruled out.

Site 9 (Southeastern point of the kahikatea stand) had a relatively high rate of bat activity, which is consistent with the surrounding Tamahere area where bat activity is above average, with an average 7 bat passes per night. This detector was deployed for 6 nights in total. Like Site 4, most of the activity was during the middle of the night (in this case between 01:00 and 02:00). Six feeding buzzes were recorded.

Table 1: Long-tailed bat survey results blue text highlights ABMs in kahikatea stand.

Site	Detector number	Night's detector was functioning	Total number of bat passes	Bat passes per night	Feeding buzz?	Notes
1	BW35	6	0	0.0	N	
2	BW26	15	1	0.1	N	
3	BW49	8	3	0.4	N	
4	BW55	14	129	9.2	Yes - see Table 2	
5	BW23	14	2	0.1	Yes - see Table 2	
6	BW51	14	6	0.4	N	
7	BW26	6	1	0.2	N	Redeployed on 27 November
8	BW55	6	7	1.2	N	Redeployed on 27 November
9	BW51	6	42	7.0	Yes - see Table 2	Redeployed on 27 November

[16] Waikato long-tailed bat distribution

Table 2: Feeding buzz register.

Site	Date	Time	Notes
4	20 November 2025	12:37 am	Possible feeding buzz
4	20 November 2025	12:39 am	
4	23 November 2025	1:27 am	
4	23 November 2025	1:55 am	
4	24 November 2025	1:33 am	
4	26 November 2025	12:21 am	
4	27 November 2025	12:43 am	
5	24 November 2025	10:30pm	
9	29 November 2025	1:11 am	
9	29 November 2025	1:15 am	
9	3 December 2025	12:58 am	
9	3 December 2025	1:03 am	
9	3 December 2025	1:07 am	
9	3 December 2025	1:31 am	

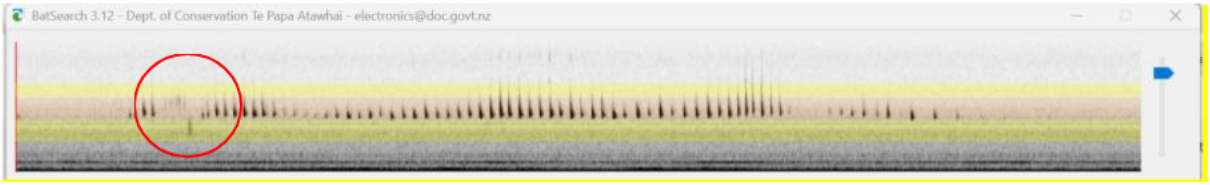

Figure 2: Example of a sequence of long-tailed bat feeding buzzes (red circle) at Site 9 on 3 November at 12:58am.

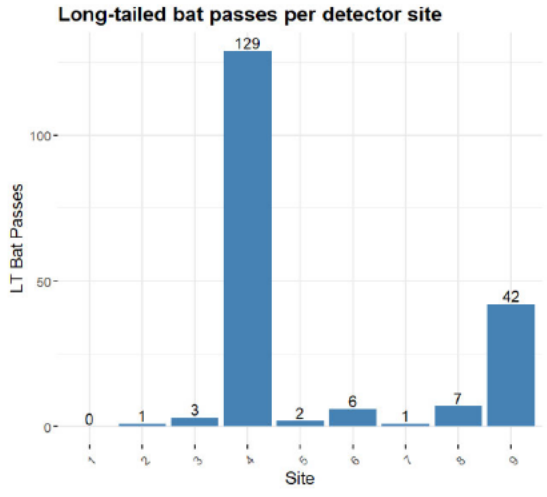

Figure 3: Total bat passes per site across the survey period.

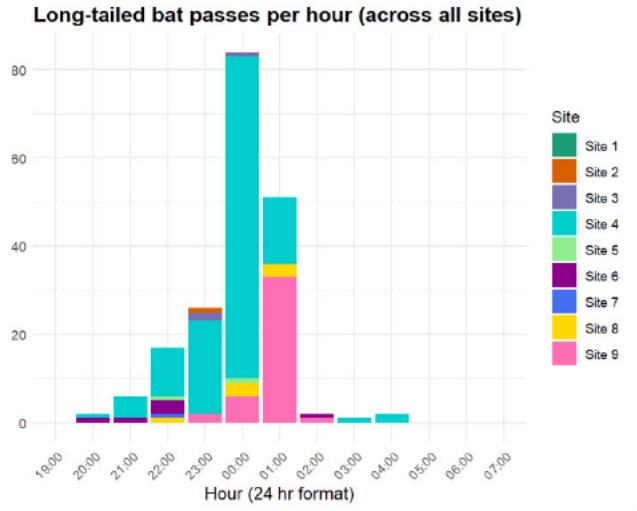

Figure 4: Total bat passes per hour, per site

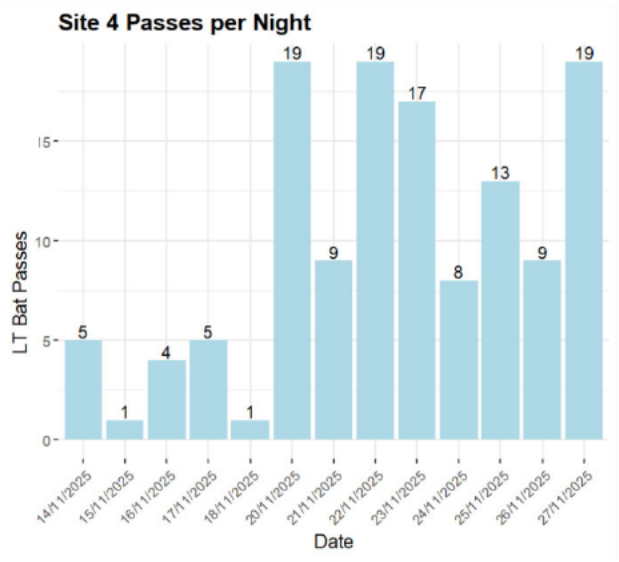

Figure 5: Total bat passes per night at Site 4.

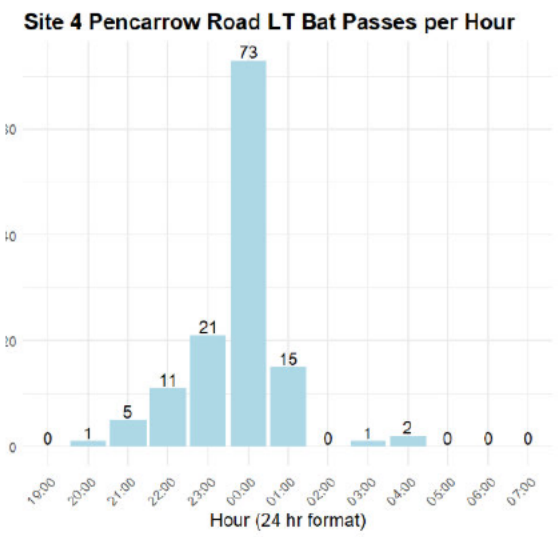

Figure 6: Total bat passes per hour at Site 4.

3.2.2 Long-tailed bats - key habitats

The key habitat at the site is likely within the kahikatea stand. In general terms, there were several trees within the kahikatea stand, particularly the dead kahikatea trees that had cavity bearing properties and these provide moderate to high potential bat roost trees (Photo 5). The open pasture areas are of lesser value with low bat activity but will still be used for foraging.

Potential bat roost trees on the site meet the following criteria of having a DBH ≥15cm and at least one identified roost feature being:

- Cracks, crevices, cavities, fractured limbs, or other deformities, large enough to suppose roosting bat(s);
- Sections of loose flaking bark (Photo 5) large enough to support roosting bat(s); and
- Deadwood in canopy or stem of sufficient size to support roost cavities or hollows.

Photo 5: Example of a dead kahikatea with bat roost potential

3.2.3 Avifauna – manu

Manu species seen and/or heard during the site visit are recorded in Table 3. Mature exotic tree species throughout the site and the remnant kahikatea stand, provides nesting and resource areas for native birds. The open grassland areas provided foraging opportunities for a range of native species such as welcome swallow, pied stilt and pukeko. The site likely provides habitat for a range of indigenous birds, from common tui, NZ fantail, swamp harrier and kereru, and may provide occasional habitat for less common species such as North Island kaka, however none of these species were observed during the site visit. Ecology NZ observed swamp harrier, pukeko and white-faced heron whilst on site in September 2025. Other bird species such as common starling (*Sturnus vulgaris*) and yellowhammer (*Emberiza citrinella*) were detected in the eDNA sampling Ecology NZ undertook in September 2025.

No species with a threat status are expected to regularly utilise the site, which is comprised of dairy farmland and is fringed by roads on all four sides, including State Highway 1. However, bird species that can travel long distances, such as North Island kaka (*Nestor meridionalis septentrionalis*; At Risk – Recovering) may occasionally visit the site.

Table 3: Manu seen/heard on-site.

Common Name	Latin Name	Threat status[6]
Pied stilt	*Himantopus leucocephalus*	Native, Not Threatened
Pukeko	*Porphyrio melanotus melanotus*	Native, Not Threatened
Welcome swallow	*Hirundo neoxena neoxena*	Native, Not Threatened
Paradise duck	*Tadorna variegata*	Native, Not Threatened
Kingfisher	*Todiramphus sanctus vagans*	Native, Not Threatened
Spur winger plover	*Vanellus miles*	Native, Not Threatened
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised
Eurasian skylark	*Alauda arvensis*	Introduced and Naturalised
Mallard duck	*Anas platyrhynchos*	Introduced and Naturalised
Rock pigeon	*Columba livia*	Introduced and Naturalised
House Sparrow	*Passer domesticus*	Introduced and Naturalised
Ring-necked Pheasant	*Phasianus colchicus*	Introduced and Naturalised
Blackbird	*Turdus merula*	Introduced and Naturalised
Song thrush	*Turdus philomelos*	Introduced and Naturalised
Chaffinch	*Fringilla coelebs*	Introduced and Naturalised

3.2.4 Lizards - mokomoko

Suitable ground-dwelling mokomoko habitat was present in the indigenous kahikatea stand itself and within dead logs on the ground as well as a fire pile (Photo 6 and 7). The open exotic grassland throughout the site and hedgerows around the property may provide cover for copper skink (*Oligosoma aeneum*, At Risk - Declining) and the now pest listed rainbow, or plague skink (*Lampropholis delicata*). The iNaturalist[17] site holds several records for copper skink at nearby properties around the site.

[17] Inaturalist.org

Lizards were searched for briefly by rolling logs in the kahikatea stand (Photo 6 and 7) and other cover that appeared potentially suitable, though no lizards were observed.

Photo 6: Fallen logs in the kahikatea stand.

Photo 7: Wood fire pile in the kahikatea stand.

3.3 Wetlands - Repo

A wetland is an ecosystem that is either permanently or intermittently saturated with water. Wetlands support a distinct assemblage of organisms that are adapted to wet conditions. Wetlands perform important ecosystem services and functions including protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, maintaining surface water flow during dry periods and carbon storage.

The entire site was walked or driven, and potential wetlands were identified by the presence of hydrophytic vegetation. Where there was uncertainty of the status of the vegetation (wetland or non-wetland) a wetland delineation plot was undertaken. A total of nine 2x2 m plots were assessed across the site.

Four plots were assessed as non-wetlands (Table 4; Figure 1) these plots (2, 6, 7 and 8) failed both the dominance and prevalence tests and had no hydrology indicators. Two of these sites were also dominated by improved pasture species. Ryegrass and clover were the dominant species in all of these non-wetland plots.

Four plots (1, 3, 4 and 5) were assessed as artificial wetlands and not natural wetlands (Figure 1). These plots met the vegetative criteria for a wetland, however, were associated with artificial drainage channels, that were dug between 1953 and 1995 based on historical imagery (See Appendix 3). These plots were dominated by creeping bent, water pepper and hairy buttercup. Lesser amounts of starwort, toad rush (*Juncus bufonius*), annual poa grass, glaucous sweetgrass (*Glyceria declinata*) and perennial ryegrass were also present. Standing water was present in plots 1, 3 and 4. Plot 5 did not have standing water and has been assessed as an artificial wetland as it is the result of land contouring (pre-1995) as part of farming practices to form a hollow. In addition, the area is bordered by a track to the south with gate access, and a water trough to the west, providing evidence of continued modifications.

Plot 9 has been assessed as a natural wetland. This plot was dominated by water pepper and starwort (*Callitriche stagnalis*) with lesser amounts of dock and rough stalked meadow grass. This area contained standing water at the time of the assessment, passing the primary hydrology test. Any kind

of artificial modification to the area cannot be seen in aerial imagery due to the presence of mature kahikatea trees, but given the fact that kahikatea are often naturally swampy wetlands it is likely that this area naturally supported a wetland. This area measures c.25 m^2.

Wetland plot photos are available in Appendix 6.

Table 4: Wetland plot results. Green shading shows non-wetland, orange shading shows artificial wetlands and blue shading is natural wetland.

Common name	Species code	Status	Plot number and coverage (%)								
			1	2	3	4	5	6	7	8	9
Creeping buttercup	RANrep	FAC	3	7	7			6		5	8
Loosestrife	LYThys	FACW	3		2		8				
White clover	TRIrep	FACU	5	5	1	1		2	4	30	
Hairy buttercup	RANsar	FAC	6	7	4	35	5	2	18	12	
Toad rush	JUNNbuf	FACW	10		6		2	7			
Annual Poa	POAann	FACU	7	25	5	15	24		2	15	
Starwort	CALsta	OBL	2		5		15	4			15
Glaucous sweetgrass	GLYdec	OBL	23	8	7	8	8				
Broad-leaved plantain	PLAmaj	FACU	1		1		1	3			
Creeping bent	AGRsto	FACW	20		14						4
Water pepper	PERhyd	FACW	20	1	19	1	10	30			40
Ryegrass	LOLper	FAC		39	24	30	5	40	70	24	
Rough stalked meadow grass	POAtri	FACU			5			6	1		10
Broad-leaved dock	RUMobt	FAC					6		3	8	4
Track rush	JUNten	FACU					1				
Californian thistle	CIRarv	FACU								3	
Hedge Mustard	SISoff								2	3	
Bare earth				8		10	15				19
Total cover			100	100	100	100	100	100	100	100	100
Improved pasture			NO	NO	NO	NO	NO	NO	YES	YES	NO
Dominance test			YES	NO	NO	YES	NO	NO	NO	NO	YES
Prevalence index			2.1	3.28	2.64	1.95	1.96	3.06	3.69	3.63	1.79
Prevalence test			YES	NO	YES	YES	YES	NO	NO	NO	YES
Soil											
Natural Wetland			**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**YES**

3.4 Freshwater – Te wai mauri

There is a network of artificial watercourses throughout the property which drain to the northwestern boundary with Pencarrow Road. This watercourse connects into the Mangaone Stream further downstream and then into the mainstem of the Waikato River. The network of watercourses is shown in Figure 1. The onsite watercourses were classified as artificial in October 2025, and this classification was confirmed in agreement with the Waikato Regional Council (see Appendix 2).

The artificial watercourses on the property range from 0.2 to 2 m wide and 0.05 to 0.2 m deep. The channels were very slow flowing, and the substrate was comprised of a mixture of deposited silt and sand. The smaller watercourses in the northern portion of the property were generally clear, however the channels in the southern portion, around the cowshed were highly turbid, likely due to farm track run off and the recently excavated artificial channels around the eastern side of the property.

Macrophytes were present within all assessed channels, with the exotic starwort, water pepper, watercress (*Nasturtium officianle*), water purslane (*Ludwigia palustris*), and the native swamp willow weed (*Persicaria decipiens*), and duckweed (*Lemna* sp.) observed. Short filamentous green algae and medium green mat were occasionally observed throughout the channels.

The watercourses had an open canopy, with shading on some channels provided by nearby hedgerows, or incised banks. There was no riparian buffer present and bankside vegetation was mostly comprised of exotic pastoral grasses and herbs. A single electric wire was usually present along the watercourses (Photos 8 and 9). The occasional native ferns, kiokio (*Blechnum novae-zelandiae*) and shaking brake (*Pteris tremula*) were observed throughout the site and pukio (*Carex virgata*), and *Juncus* sp. were noted on the banks of the watercourses surrounding the kahikatea stand.

The watercourses on the property are likely ephemeral (only flow for part of the year) and therefore dry out during summer, with some already dry during the site visit. The network of artificial watercourses is likely to be impacted as a result of the proposed development.

Photo 8: Artificial watercourses present on site

Photo 9: Watercourse surrounding kahikatea stand. Note Carex sp. present.

3.4.1 Freshwater fauna

Due to depth restrictions throughout the site, only Gee Minnow Traps (GMTs) could be deployed to ascertain fish presence. No fish or large invertebrates were captured during the fish survey in November 2025.

Previous eDNA samples were taken in September 2025 by Ecology NZ, at the outlet of the artificial watercourse network in the northwestern border of the property. The eDNA results detected the presence of shortfin eel/tuna (*Anguilla australis*).

The watercourses on the proposed site flow downstream into the Mangaonua Stream catchment and then into the mainstem of the Waikato Awa. Records from the FFDB[18] show that a range of native freshwater fish species have been recorded in the Mangaonua Stream catchment, downstream of the site. These species include the At-Risk-Declining longfin eel (*Anguilla dieffenbachii*), giant kokopu (*Galaxias argenteus*) and smelt (*Retropinna retropinna*). The At-Risk -Naturally uncommon Crans bully (*Gobiomorphus basalis*). The Threatened-Nationally vulnerable inanga (*Galaxias maculatus*), and the not threatened common bully (*Gobiomorphus cotidianus*), shortfin eel and the freshwater crayfish or koura (*Paranephrops planifrons*) (Dunn et al., 2025).

[18] NIWA administered Freshwater Fish Database (FFDB).

4 ECOLOGICAL VALUE

The ecological values of the terrestrial, freshwater and wetland habitats within the proposed development area have been assessed against the EIANZ criteria and criteria for determining the significance of indigenous biodiversity within Section 11A of the WRPS.

The remnant kahikatea stand, exotic trees and network of hedgerows likely provide habitat for several indigenous birds as well as habitat for pekapeka (long-tailed bats) and perhaps mokomoko (lizards), such as copper skink.

The kahikatea stand is not mapped as a Significant Natural Area (SNA) in the Waipa District Plan. However, it is ecologically significant as it meets at least two of the Waikato Regional Council RPS Criteria for Significant Indigenous Ecosystems (refer to section 5.1.3). Although this stand has been significantly modified and degraded and is treeland rather than forest, lowland podocarp forests remnants are under-represented (20% or less of its known or likely original extent remaining), with about 1.2% of original forest remaining in Hamilton ED. In the Waipa District context, Deichmann & Kessels (2013) found that only 7.5 % of the land containing indigenous vegetation remains. This compares poorly with many other Territorial Authorities within New Zealand, highlighted by the fact that only 0.29 % of New Zealand's Nationally Threatened Vegetation units are within Waipa (Walker et al, 2005). Primary forests (3.1 % of their original estimated extent) and wetlands (0.2 % of their original estimated extent) are particularly under-represented within the Waipa District (Leathwick et al., 1995). Kahikatea stands are also underrepresented regionally and nationally.

4.1 Component Representativeness, Rarity/distinctiveness, Diversity and Pattern,

The ecological values of the habitat present within the proposed development site vary from **high** within the remnant kahikatea stand which provides potential roosting, commuting and foraging habitat for threatened long-tailed bats to **low** in the areas of pasture and artificial watercourses. As long-tailed bats have a critically endangered national threat status, and the site is likely regularly used as habitat by a population of this species, the site has a has a **very high** ecological value ranking in accordance with the EIANZ guidelines.

The ecological values associated with fauna are provided in Table 5.

The ecological value of the habitats within the proposed development are summarised in Table 6. Habitats have also been assessed against criteria for determining significance of indigenous biodiversity within Section 11A of the Waikato Regional Policy Statement (WRPS).

Table 5: Ecological value of fauna present or likely to be present at the site using the EIANZ criteria.

Species	Threat status	Ecological Value	Ecological context
Pekapeka-tou-roa	Threatened – Nationally Critical	**Very High**	Long-tailed bats are a nationally critically threatened species, and locally rare in the Waikato Region. Bats were confirmed to occur on-site.
Copper skink	At Risk - Declining	**Moderate**	Habitat on-site is suitable for Copper skink, particularly in areas of low dense cover.
Locally common indigenous bird species (e.g., tui, fantail)	Not threatened	**Low**	There were no threatened avifauna recorded at the site, and a low diversity of native species were recorded. Habitat on-site is used by a range of commonly occurring native and exotic species.

Locally common indigenous aquatic fauna (Shortfin tuna/eels)	Not threatened	**Low**	Shortfin tuna/eels were confirmed to be present onsite via eDNA analysis. The artificial drains are likely ephemeral and dry out in summer, meaning that they provide seasonal habitat.

Table 6: Ecological value of the vegetation and habitat at the site using the EIANZ criteria.

Habitat type	Representativeness	Rarity/ Distinctiveness	Diversity & pattern	Ecological Context
Artificial wetland ***Negligible to low ecological value***	Low-Moderate – Wetlands are under-represented. Comprised of exotic species and is not representative of what would have naturally occurred here.	Negligible– Highly disturbed environment.	Low - Dominated by a few exotic species. Exhibits seasonal changes in hydrology.	Negligible – The area is considered to have low quality habitat for indigenous fauna and provides little connectivity or buffering to other habitats. Does not meet any of the WRPS significance criteria.
Remnant kahikatea stand with associated wetland ***High ecological value***	High – Kahikatea stands are under-represented and now only account for <1.2% historic cover. Also comprised of other mature indigenous species. Wetlands are under-represented. Comprised of exotic species and is not representative of what would have naturally occurred here.	High – Vegetation provides commuting and foraging and potentially roosting habitat for threatened mobile species, such as long-tailed bats. Wetland was disturbed.	Moderate – The canopy is dominated by indigenous species, with an understory of exotic grasses and herbs. Wetland was dominated by a few exotic species.	High– This vegetation provides connectivity or buffering to other habitats. Several of these large trees may provide potential bat roosting habitat. Wetland is connected to kahikatea stand and has restoration potential. Meets WRPS criteria 3 and 4 and is considered to be ecologically significant.
Exotic grassland, scattered exotic trees and hedgerows ***Negligible -Low ecological value***	Negligible - Exotic vegetation comprising grasses, herbs, hedgerows and scattered exotic trees are not representative of the vegetation that would have naturally occurred here.	Low – Moderate Exotic vegetation provides commuting and foraging and potentially roosting habitat for threatened mobile species, such as long-tailed bats, and potential habitat for copper skink.	Negligible – The vegetation is dominated by exotic species. The hedgerows comprise hawthorn and barberry which are considered weedy species[19].	Low– The area is considered to have low quality habitat for indigenous fauna. Trees are limited to scattered individuals or clusters of a few trees. Does not meet any of the WRPS significance criteria.
Artificial watercourses ***Low ecological value***	Low - Comprised almost entirely of exotic species, ephemeral in places and were artificially created.	Low – Appears to seasonally support one indigenous common species (shortfin eel)	Low - Dominated by exotic species.	Low - Moderate – Exotic habitat which provides intact connectivity or buffering to other habitats (i.e. Mangaone Stream)

[19] Weed List • Weedbusters

5 ASSESSMENT AGAINST RELEVANT POLICIES AND PLANS

5.1.1 Te Ture Whaimana o te Awa o Waikato

Te Ture Whaimana o te Awa o Waikato (Vision and Strategy for the Waikato Awa) recognises the significance of the Waikato Awa to Waikato-Tainui, with the vision, objectives, and strategies applicable to Waikato Awa tributaries and catchment. The Vision and Strategy (V&S) is acknowledged as the primary, direction-setting document for the Waikato Awa.

Through case law, the Vision and Strategy is acknowledged as the primary, direction-setting document for the Waikato Awa. This proposed development will not result in the loss of any natural wetlands or watercourses.

5.1.2 Tai Tumu Tai Pari Tai Ao (Waikato-Tainui Environmental Plan)

Tai Tumu Tai Pari Tai Ao, the Waikato-Tanui Environmental Plan (WTEP) was developed out of the Whakatupuranga 2050 long-term development approach with the key strategic objective '*to grow our tribal estate and manage natural resources*'.

To align with Tai Tumu Tai Pari Tai Ao, this development will be designed and implemented in a manner that ensures that environmental and cultural effects are protected and enhanced to ensure that the integrity of aquatic and terrestrial ecosystems is not compromised.

5.1.3 Waikato Regional Policy Statement criteria

To be identified as significant indigenous vegetation or significant habitat for indigenous fauna species in the Waikato, an area needs to meet one or more of the WRPS criteria for significant indigenous ecosystems (see section 4). The remnant kahikatea stand onsite meets criteria 3 and 4 and is considered to be ecologically significant.

5.1.4 National Policy Statement for Freshwater Management and National Environmental Standards for Freshwater

The concept of Te Mana o te Wai is about restoring and preserving the balance between the water, the wider environment, and the community. Te Mana o te Wai encompasses 6 principles relating to the roles of tangata whenua and other New Zealanders in the management of freshwater: Mana whakahaere, Kaitiakitanga, Manaakitanga, Governance, Stewardship and Care and respect.

The protection of wetlands has become part of national policy, with the National Policy Statement for Freshwater Management (NPS-FM) with regulations listed in the National Environmental Standards for Freshwater (NES-F) both of which came into force in September 2020. The Essential Freshwater package introduced policies and regulations to protect 'natural wetlands' with nationally consistent standards, whereby the loss of natural inland wetlands is avoided and their values protected.

Plot 9 was classified as a natural inland wetland and is likely covered under Regulation 53 of the NES-F. Activities which detrimentally impact the wetland are considered non-complying or prohibited depending on the level of activity. In this case, the works will enhance Plot 9 and will not result in adverse impacts to the Plot 9 wetland.

5.1.5 National Policy Statement for Indigenous Biodiversity

The National Policy Statement for Indigenous Biodiversity (NPS-IB) was published in 2023 with the main objective to maintain indigenous biodiversity across Aotearoa New Zealand so that there is at least no overall loss in indigenous biodiversity after the commencement date.

In terms of the policies within the NPS-IB significant indigenous vegetation and significant habitats of indigenous fauna are identified as Significant Natural Areas (SNAs) using a consistent approach and SNAs are protected by avoiding or managing adverse effects from new subdivision, use and development.

In terms of the NPS -IB, the criteria for identifying areas that qualify as significant natural areas (refer to Appendix 1 NPS-IB) is relevant. Applying these criteria, the kahikatea stand on site triggers criterion C-(6)(a), as it provides habitat for an indigenous species that is listed as Threatened or At Risk (declining) in the New Zealand Threat Classification System lists, by providing foraging, commuting and possibly roosting, habitat for long-tailed bats (attributes of rarity and distinctiveness).

Long-tailed bats are also listed as a 'highly mobile species' in the NPS-IB and areas outside of SNAs that support mobile fauna need to be identified and managed to maintain their populations across their natural range. In this regard the large trees onsite provide foraging and commuting habitat and may provide potential roosting habitat and will need to be managed in line with the requirements in this report.

5.1.6 Fast Track Approvals Act 2024

The Fast Track Approvals Act is a streamlined consenting pathway introduced by the NZ Government to accelerate infrastructure, housing, and development projects of regional or national significance. This proposal has been assessed in accordance with the Act. In relation to section 22(2)(a)(ix), the proposal addresses key ecological issues, including effects on long-tailed bats as well as the kahikatea stand and associated wetland. These are managed through an effects management hierarchy, including retention of the kahikatea stand and natural wetland, restoration planting, pest control, lighting restrictions and establishment of a bat commuting (light) corridor, resulting in maintained or enhanced ecological values.

In relation to section 22(2)(a)(x), the proposal is consistent with relevant regional and district planning documents as listed in this section (Section 5). Particularly those relating to the protection and enhancement of indigenous biodiversity, through avoidance of effects on high -value habitats such as the kahikatea stand and natural wetland and implementation of restoration measures.

In accordance with section 13(4)(h), potential adverse ecological effects include vegetation clearance, disturbance to bat habitat and behaviour (including lighting effects), and impacts on aquatic habitat and fish. These effects are avoided, remedied, or mitigated through avoidance, enhancement and the implementation of Management Plans.

In relation to Schedule 5, clause 2, the proposal has been assessed against relevant national policy statements and environmental standards.

6 ASSESSMENT OF ECOLOGICAL EFFECTS

6.1 Overview of Potential Adverse Effects

This section provides an overview of the actual and potential ecological effects of developing the site, followed by an assessment of ecological effects following the EcIA methodology outlined in Appendix 5.

In general terms, habitat loss associated with the development of the proposed horse racecourse and associated infrastructure has the potential to create a range of adverse effects on biodiversity values, during enabling works construction (resulting from direct physical disturbance), seasonal construction, and on an ongoing basis. These potential and actual adverse effects on biodiversity values during and after construction may include:

- Effects on terrestrial habitats;
- Effects on freshwater and wetland habitats;
- Effects on fauna due to disturbance and the ongoing land use change; and
- Effects from earthworks, sediment and stormwater.

6.2 Effects on Terrestrial Vegetation

The remnant kahikatea stand has **high** ecological value. The stand also provides important foraging and commuting habitat for long tail bats as well as potential roost habitat. Restoration and management recommendations that would provide a net positive ecological benefit in the future have been provided in Appendix 7.

All other vegetation is exotic including large the hedgerows which are comprised of weedy species, exotic wetlands and exotic trees. Outside of the remnant kahikatea stand, the remainder of the vegetation on the property has **low** ecological value.

The large exotic trees provide commuting and foraging habitat for bats (Section 3.2.2), as well as potential roosting habitat. Any clearance will need to be managed in accordance with the requirements in this report.

The creation of bare earth as a result of construction has the potential for weed colonisation, and this is highly likely given the nearby seed source of the open pastoral areas which contain predominately exotic species. Therefore, any open areas should be managed by an approved erosion and sediment control plan.

Undertaking site works in accordance with a prescribed Ecological Management Plan (EMP) will ensure that any potential adverse effects can be mitigated.

6.3 Effects on Terrestrial Fauna

Development may cause several adverse effects on terrestrial fauna (such as bird and bat) habitats, including habitat loss, habitat fragmentation, changes in microclimates, and increases in noise, and lighting (Smith et al. 2017). As the site is already surrounded by roading on four sides including State Highway 1 to the north, the native fauna present will already be adapted to some level of human disturbance. However, an increase in human presence and building densities will likely increase in the occupation of pest animals (rats, mice, mustelids and cats). These pest animals predate on indigenous

fauna, and some form of control will be required with the increase in the number of people on the site and associated livestock.

Removal of vegetation has the potential to adversely affect terrestrial fauna, through damage to habitats and the loss of individuals killed during activities associated with construction. Native fauna (bats, birds and lizards) are protected under the Wildlife Act 1953 and measures will be required to minimise direct harm to native wildlife.

Restoring and managing the kahikatea stand (as outlined in Appendix 7) will provide ecological benefits for native wildlife such as birds, bats, and lizards that use the area and would be considered appropriate mitigation. However, all works across the site should be carried out in accordance with an Ecological Management Plan (EMP) to ensure any adverse effects (such as those listed above) are effectively mitigated.

6.3.1 Long-tailed bats - Pekapeka-tou-roa

The bioacoustics survey indicates bat activity at the site ranged from low in areas of pastoral farmland with scattered trees to relatively high within the kahikatea stand.

The development of the land including the establishment of a horse race course, training facility, harness racing and associated infrastructure may cause several adverse effects on long-tailed bat habitats, including habitat loss, habitat fragmentation, and increases in noise and lighting (Smith et al. 2017). The potential effects on long-tailed bats and their habitats associated with proposed development can be summarised as:

i. Loss and modification of habitat, such as removal of potential bat roost trees and loss of pasture habitat for foraging and commuting.
ii. Severance or partial severance of connectivity through removal of stands of mature trees and shelterbelts on site, and
iii. Disturbance effects, such as an increase in artificial lighting associated with artificial outdoor lighting.

In Hamilton, Le Roux and Le Roux (2012) found that road and street light density alongside residential housing was associated with a decline in recorded bat activity. Indirect effects may include an increase in predation pressure in the landscape due to an increase in human activities and subsequently pest numbers (e.g. rats, cats).

Despite this, long-tailed bats behavioural characteristics appear to exhibit some tolerance and plasticity and if the right habitat features remain within and adjacent to the urban area (Mueller et al., 2021). In Hamilton, research indicates that bats persist in the southern fringes including Hamilton Airport and Mystery Creek (Davidson-Watts 2019), noting that the proposed development site is outside the bat utilisation and associated habitat linkages for this population (Figure 7).

Contextually, the site is surrounded on four sides by roads, including the busy SH1 on the northern boundary. The busy road is likely deterring bats from utilising the northern area of the site. Site usage is higher in the kahikatea stand near the southern end of the site.

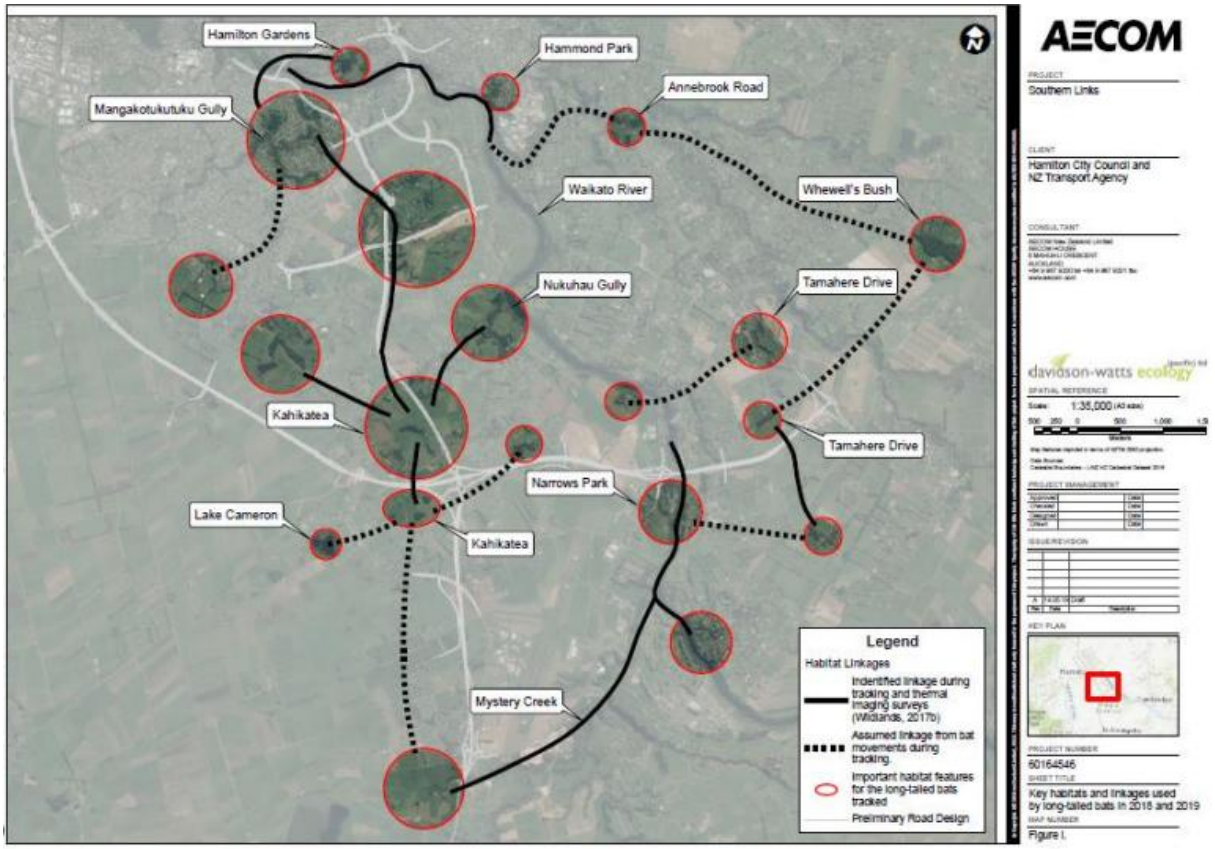

Figure 7: Important habitat features and linkages for bat movement in Hamilton City (Davidson-Watts, 2019). The proposed development site is off the map to the south-east.

6.3.1.1 Loss and modification of bat habitat

Several trees on-site, particularly the dead kahikatea trees, have characteristics suitable for bat roosting. Potential bat roost trees are those that are greater than 15 cm DBH and have one or a combination of the following: cracks, crevices, flaky bark, and cavity-bearing features. The removal of these trees and the vegetation should be avoided. If removal of bat habitat within the remnant kahikatea stand cannot be avoided, mitigation would be required to address direct loss of habitats for bats, including potential roost trees.

The removal of large exotic trees throughout the site should be minimised. Where removal is necessary, it must be timed to avoid periods when bats are in torpor (i.e., no vegetation clearance should occur between 1 May and 1 October). In addition to this, the trees should be inspected before felling using best practice tree felling protocols (as described in Appendix 8).

If the tree felling protocols indicate that a tree is occupied, felling of the roost should be avoided until the tree is vacated. If a tree containing an occupied roost cannot be retained, then consultation should be undertaken with the Department of Conservation. The Wildlife Act 1953, s63 (1c) indicates it is an offence without authorisation to rob, disturb, or destroy, or have in his or her possession the nest of any absolutely protected or partially protected wildlife. For any removal of trees occupied by bats, detailed information must be provided regarding the type of roost present. This should include the development of appropriate avoidance, remediation, mitigation, and offset or compensation measures proportional to the roost type. Examples include specifying the extent and type of planting of cavity-bearing trees, the ratio of artificial bat boxes installed per roost tree removed, and the plans for ongoing maintenance and protection.

If the tree is not occupied, it can be felled, but suitable replacement roosting habitat should be provided as mitigation of the loss of that future habitat opportunity. This can be provided within the kahikatea stand.

While research demonstrates that long-tailed bats will disperse across open grassland, this is not likely preferred habitat. Even when flying over pasture, bats appear to require structural cues, such as vegetation edges, to bounce their echolocation calls off to navigate and to forage efficiently. As an edge-adapted species, it is likely that long-tailed bats use open pasture spaces predominantly only for commuting and opportunistic foraging as shown in a habitat preference modelling undertaken by Crewther and Parsons (2017).

Consequently, the overall level of effect of the proposed tree clearance of scattered exotic trees across the site on long-tailed bats is assessed as being **low**, provided pre-felling protocols are applied in any trees assessed as High potential roosting habitat value before they are felled. This is recommended as a consent condition to ensure any potential adverse effects on bats are properly mitigated. These measures could be outlined in a supporting Bat Management Plan (BMP).

6.3.1.2 Artificial lighting effects on bats

Bats are almost exclusively nocturnal and extremely sensitive to Artificial Light At Night (ALAN) (Voigt et al. 2018). Several international studies have shown that bats alter their behaviour in the presence of artificial light sources (e.g., Bat Conservation Trust 2018). Overseas research also stresses the importance of preserving dark corridors for bats to minimise the effects of artificial light on bat activity (Zeale et al. 2018). Any level of ALAN above that of moonlight masks the natural rhythms of lunar sky brightness and, thus, can disrupt patterns of foraging and mating. Wavelength, intensity and directionality of the light all influence the presence and behaviour of bats (Schamhart et al. 2023).

As indicated by Schamhart et al. (2023), long-tailed bats exhibit sensitivity and aversion to artificial lighting. For this reason, artificial lighting restrictions should be applied within a 25m buffer surrounding the kahikatea stand.

Lighting limits will need to be controlled at the edge of the kahikatea stand (once restored) to effectively result in zero illumination at the edge. Artificial lighting strategies should establish specific limits for lighting intensity (<0.3 lux) and colour temperature (<2700 Kelvin) within 25m of the kahikatea stand (Voigt et al. 2018, Haddock et al. 2019). These standards can be achieved by measures such as deploying special lights, light source shielding, restricting illumination during peak bat activity periods, and/or minimising the duration of night-time artificial lighting (including for street lighting).

In addition, a bat commuting corridor, or "light corridor" (with lighting restrictions) should be established between the kahikatea stand and the site boundary to maintain and protect bat movement to and from the stand. The corridor is likely to be located adjacent to the large trees proposed along the main entrance from Hooker Road. This corridor should be at least 50 m wide, and artificial light spill into the area should be minimised. Appropriate lighting controls will be required, including the use of downward-facing road lighting, to reduce light spill into the corridor. Specific details will be provided in a Bat Management Plan (BMP).

Harness racing events typically take place in the evening (5 – 10pm)[20] which may impact long-tail bats that utilise the site due to increased lighting and noise during these hours. The potential effects are likely to be greater for Harness racing than standard horse racing events, because of the difference in racing schedules (i.e. night vs. day).

Lighting restrictions are not required throughout the rest of the site.

[20] Cambridge Raceway | Function Centre & Race Track | Cambridge Raceway

Ensuring these lighting performance standards are included in the consent conditions of the development will reduce the overall level of effects of artificial lighting on bats to l**ow**.

6.3.2 Avifauna - Manu

The vegetation onsite, particularly mature indigenous and exotic trees may contain native birds and clearance of this vegetation has the potential to cause injury to or death of native birds, particularly during the breeding season. Native birds within the area should be able to emigrate out of the area, unless unfledged chicks are present in nests. The site supports common indigenous species with **low** ecological values.

To reduce the likelihood of bird mortality, vegetation removal of any mature trees will include checks for nesting birds at the same time as bat pre-felling checks.. Provided this mitigation measure is implemented, this will reduce the magnitude of effects to **low**, resulting in a **negligible** overall level of effect.

6.3.3 Lizards - Mokomoko

Lizards can be difficult to detect and may be present onsite, particularly copper skink. Potential direct and indirect effects of development include habitat loss, and food resources loss. Copper skinks have an 'At Risk – Declining' threat status and are therefore habitat for this species is of have **high** ecological value. No indigenous lizards have been found to date.

To reduce the effect on lizards, pre-clearance lizard surveys/searches may be required if areas providing suitable habitat, including fallen logs and woody debris and low-growing shrubs are proposed to be cleared.

Provided any adverse effects of the development on lizards and their habitats are considered and avoided, remedied or mitigated at the time of works, the overall effect on lizards is **low**.

6.4 Effects on freshwater habitats and biota - Te wai mauri

The artificial watercourses on site are shallow and likely ephemeral. There is minimal overhead canopy cover and riparian vegetative protection, and no fish were recorded during the trapping survey. Shortfin eels were detected during an eDNA survey at the outlet of the site. The watercourses onsite are of **low** ecological value.

However, given that the watercourses do provide habitat for shortfin eels, all activities on site will need to be managed to ensure there is no adverse effect on these environments. Fish recovery will need to take place if watercourses are to be infilled or diverted, so long as water is present within the channel. A Fish Management Plan (FMP) will be designed in accordance the Waikato Regional Council guidelines, mitigating potential adverse effects to any aquatic biota present onsite.

In addition, specific measures will need to be implemented as part of any future development on the land to ensure that contaminants from the proposed development do not enter downstream waterways.

Provided a Fish Management Plan (FMP) is designed and implemented onsite during development, this mitigation will reduce any potential adverse effects on fish to **very low.**

6.4.1 Sediment and erosion

Activities undertaken as part of the development have the potential to generate sediment, which, if unmitigated, could potentially enter the receiving environment. Erosion control measures must be put

in place to ensure there is no adverse effects on downstream receiving environments, namely the Mangaonua Stream and Waikato Awa. Areas of bare earth must be vegetated or covered as soon as possible to reduce the risk of erosion and sedimentation and weed colonisation on bare ground.

It is anticipated that sediment and erosion will be adequately controlled through a sediment and erosion plan which will be designed in accordance the Waikato Regional Council guidelines, mitigating potential adverse effects to the receiving environment. This will reduce the overall effect to the receiving environment to **negligble**.

6.4.2 Stormwater

Intensification of commercial development and roading is likely to alter land surfaces to make them less permeable to water, by both compaction of land surface and increased imperviousness (e.g. roads and new buildings). This can result in increased stormwater runoff and catchment scale erosion and flooding impacts. Stormwater will be managed onsite to protect the receiving environment.

Ensuring the stormwater is treated onsite will be essential to protecting the water quality within the downstream receiving environments, which includes the Waikato Awa. It is anticipated that conveyance, treatment and detention devices will be able to mitigate any potential adverse effects as long as they are fit for purpose and designed and incorporated and following best practice guidelines and regulations. This will reduce the overall effect to the receiving environment to **negligible**.

7 SUMMARY

This EcIA report has been prepared to assess the ecological values and features of the site as well as the potential and actual effects associated with a proposed horse racecourse, training centre, harness racing and associated development at Pencarrow Road, Tamahere.

The site is a highly modified c.160 ha property and is currently comprised of two working dairy farms with associated infrastructure including milking sheds, animal shedding, feed storage, and multiple residential properties.

Fauna ecological values range from **very high** for 'Threatened – Nationally Critical' long-tailed bats, to **low** for common indigenous bird species and shortfin eel.

Across most of the proposed development site, the ecological value of the vegetation and habitats range from **negligible** to **low**. The kahikatea stand is an underrepresented habitat type, has an area of natural wetland and provides habitat for bats and has been assessed as having **high** ecological value. As part of the development this area will be avoided and measures to protect this area will include setbacks and planting to restore and screen artificial lighting and a light corridor. Any adverse effects as a result of the development can be mitigated through the restoration and management of the kahikatea stand, as detailed in Appendix 7, which is likely to be above and beyond what is required because of the development, which will likely result in a Net Gain (NG) standard.

The magnitude and level of effects after proposed measures to avoid, remedy, and mitigate have been undertaken are summarised in Table 7.

Potential adverse effects on biodiversity values as a result of the development can be addressed through the following measures:

- The kahikatea stand will be retained and restored. This area is an underrepresented vegetation type and provides a high-value habitat for bats. Restoration and management measures include fencing (if stock is likely to have access), planting, pest control and any associated compensation required from other attributes of the proposed site (i.e. exotic tree felling) could be undertaken on site, at this location. The details of this can be captured as consent conditions and detailed in an Ecological Management Plan (EMP).
- If large exotic high-value potential bat roost trees are felled (following appropriate pre-felling protocols), suitable replacement roosting habitat should be provided within the kahikatea stand.
- A provision to ensure that the Department of Conservation 'Protocols for Minimising the Risk of Felling Bat Roosts' best practice guidelines are applied during construction where potential roosting trees for long-tailed bats are being removed. Potential bat roost tree removal should take place outside of the period when bats are in torpor (1 May to 1 October).
- Minimising the effects of artificial lights through low light within 25 m from the edge of the kahikatea stand. Provisions for a 50m bat commuting corridor or 'light corridor' (with lighting restrictions) will be provided between the edge of the site and the kahikatea stand. Lighting restrictions are not required throughout the rest of the site.
- Impacts to native fish, namely shortfin eel can be minimised by undertaking a site-specific Fish Management Plan (FMP), including fish recovery measures in any wetted watercourse to be disturbed, prepared as part of the EMP.
- Impacts regarding stormwater and sediment discharges to the receiving environment can be avoided by following best practice guidelines and regulations.

- The increase in vegetated areas (including shrubs) as a result of the restoration of the kahikatea stand and plantings surrounding the development will likely enhance habitat for native lizards over the long term.
- Implementation of these ecological avoidance, remediation and mitigation measures should be detailed in an Ecological Management Plan (EMP) for the site including a separate Fish Management Plan (FMP) and Bat Management Plan (BMP).

Table 7: Summary of the activity, magnitude of effect, and overall level of effect without and with mitigation.

Activity and effect	Ecological Value	Magnitude of effect	Overall level of effect without mitigation	Overall level of effect with summary management measures
Fauna disturbance due to development and lighting - bats	Very high	Very high	High	Low – Avoid impacts to the kahikatea stand by applying artificial light requirements withing 25m of the stand. Provisions for a commuting corridor or 'light corridor' at width of 50m. Follow pre-felling protocols for potential bat roost trees. Planting roost tree habitat in the kahikatea stand should occur. Measures above to be detailed in a BMP.
Fauna disturbance due to vegetation clearance– birds and lizards	Low	Low	Very low	Negligble –Habitat enhancement of the kahikatea stand will add habitat for native birds and lizards. Undertake checks for nesting birds at the same time as bat pre-felling checks. Retain cover objects such as wood and leave within the kahikatea stand as lizard habitat. Potential salvage at the time of the work.
Kahikatea stand and associated natural wetland	High	High	High	Net gain – Avoid impacts to the kahikatea stand and undertake management and restoration (As per Appendix 7).
Fauna disturbance due to watercourse loss – shortfin eels	Low	Low	Low	Low – Develop and implement a Fish Management Plan (FMP) for any instream works, to locate, recover and translocate fish.
Stormwater and Sediment & erosion	Low	Low	Very low	Negligible – Onsite treatment of stormwater and following best practice guidelines and regulations.

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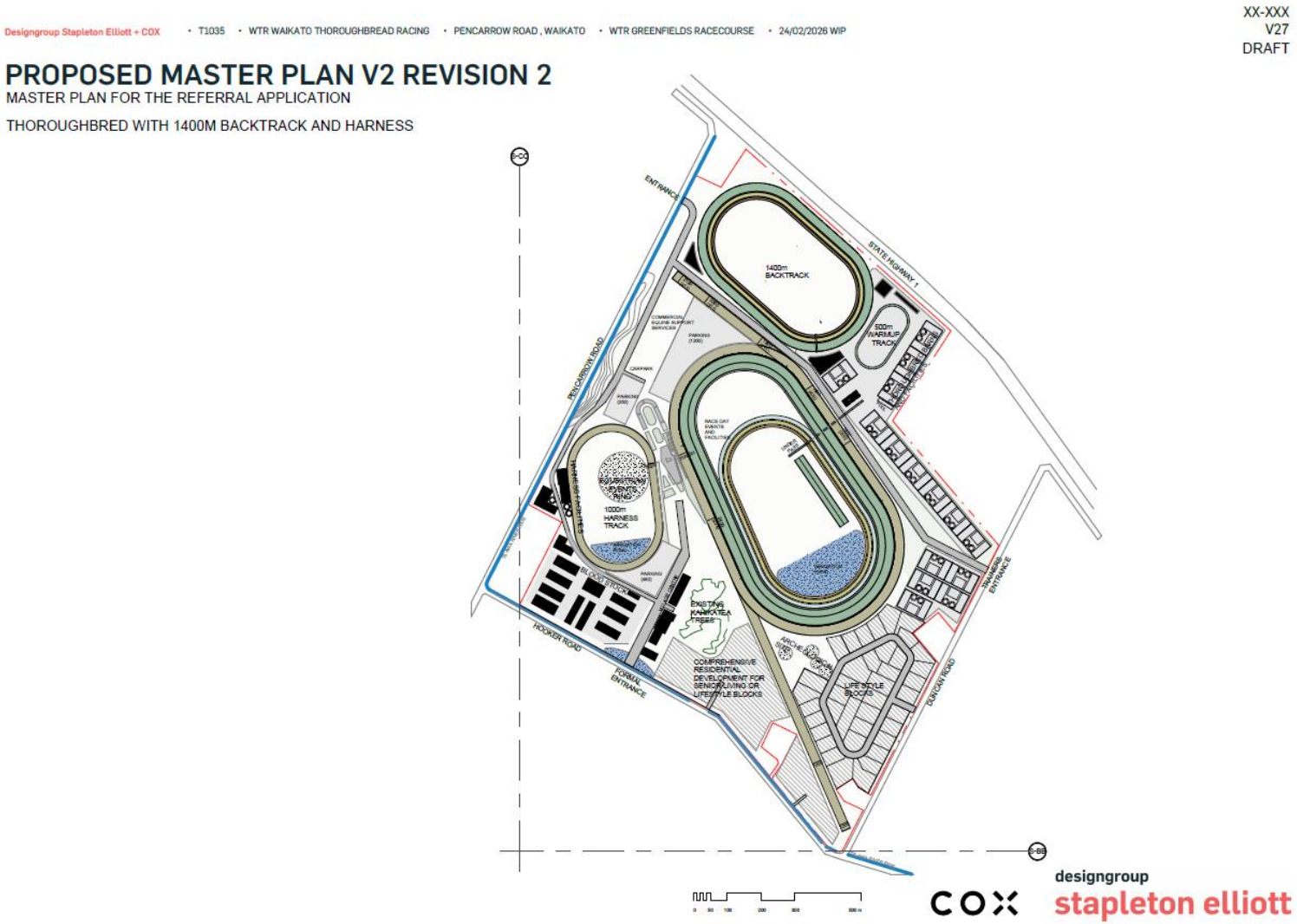
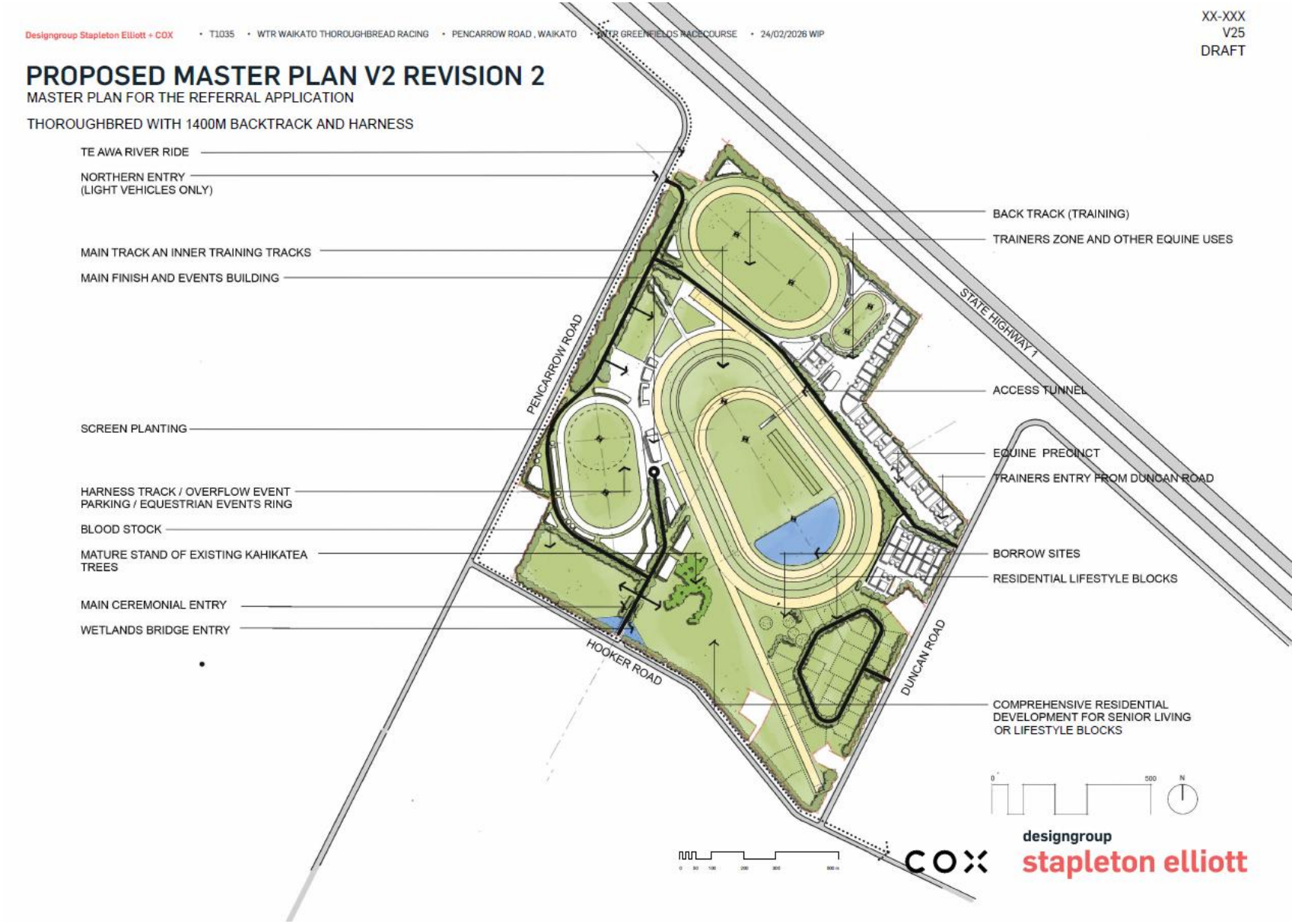
Appendix 1: Proposed site layouts




Designgroup Stapleton Elliott + COX • T1035 • WTR WAIKATO THOROUGHBREAD RACING • PENCARROW ROAD , WAIKATO • WTR GREENFIELDS RACECOURSE • 24/02/2026 WIP
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DRAFT
PROPOSED MASTER PLAN V2 REVISION 2
MASTER PLAN FOR THE REFERRAL APPLICATION
THOROUGHBRED WITH 1400M BACKTRACK AND HARNESS
TE AWA RIVER RIDE
NORTHERN ENTRY
(LIGHT VEHICLES ONLY)
MAIN TRACK AN INNER TRAINING TRACKS
MAIN FINISH AND EVENTS BUILDING
SCREEN PLANTING
HARNESS TRACK / OVERFLOW EVENT
PARKING / EQUESTRIAN EVENTS RING
BLOOD STOCK
MATURE STAND OF EXISTING KAHIKATEA
TREES
MAIN CEREMONIAL ENTRY
WETLANDS BRIDGE ENTRY
BACK TRACK (TRAINING)
TRAINERS ZONE AND OTHER EQUINE USES
ACCESS TUNNEL
EQUINE PRECINCT
TRAINERS ENTRY FROM DUNCAN ROAD
BORROW SITES
RESIDENTIAL LIFESTYLE BLOCKS
COMPREHENSIVE RESIDENTIAL
DEVELOPMENT FOR SENIOR LIVING
OR LIFESTYLE BLOCKS
PENCARROW ROAD
STATE HIGHWAY 1
HOOKER ROAD
DUNCAN ROAD
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designgroup
stapleton elliott

Appendix 2 – Watercourse Classification memo and email agreement from Waikato Regional Council

Ecology New Zealand Limited
800 Heaphy Terrace,
Claudelands,
Hamilton
Email: info@ecologynz.nz

MEMORANDUM

Attention: Sam Simpson – Operations, General Manager

Date: 17 October 2025

From: Dylan Smith – Senior Freshwater Ecologist

Project: 25171.1.001: 636 Pencarrow Road Watercourse Classification Memorandum

1. INTRODUCTION

The memo[1] by Ecology New Zealand Limited (ENZL) was requested by the BCD Group Limited (the Client) to provide an assessment and classification on a watercourse that runs through 636 Pencarrow Road, Tamahere, Waikato ('the site'; Figure 1). This memorandum aims to provide classification to a watercourse on site where the client is currently undertaking due diligence pre-engagement scoping to potentially pipe or divert the existing feature as part of prospective development within the property (Figure 1).

This memo aims to provide insight into current legal definitions and frameworks used to classify 'modified natural watercourses' and 'artificial watercourses', and the historical land use of the site. Correct designation of the watercourse will allow for an accurate regulatory framework to be applied for any future impacts/earthworks potentially required to further the development of the proposed racecourse.

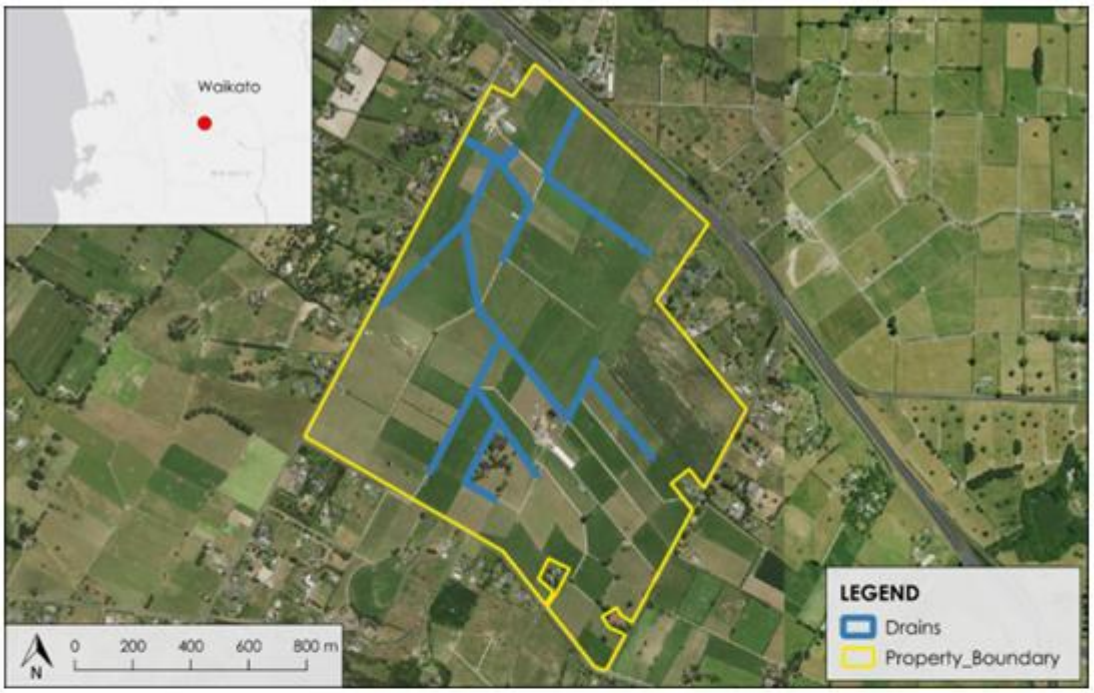

Figure 1: The watercourse (blue) within the proposed development area adjacent to Marychurch Road, Matangi.

2. LEGAL FRAMEWORK CURRENTLY APPLICABLE TO THE USE OF WATERCOURSE CLASSIFICATIONS

The National Policy Statement–Freshwater Management (NPS-FM), National Environmental Standards-Freshwater (NES-F), and the Waikato Regional Council Regional Policy Statement for Freshwater include provisions for the management of permanent and intermittent rivers. To determine if a waterway meets the definition of a 'river' under the Resource Management Act 1991 (RMA), a two-stage assessment can be undertaken. The first stage is defining whether the waterway is natural, modified, or artificial. If the waterway is considered modified or natural, then it can be assessed to determine whether its flow is ephemeral, intermittent, or permanent.

2.1. Rivers/Modified Watercourses

The Resource Management Act 1991 (RMA) defines "river" broadly to include "a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse." This means that even if a natural watercourse has been altered, it's still generally considered a "river" under the RMA, unless it's entirely artificial.

The NPS-FM further defines a River as a continually or intermittently flowing body of fresh water, and includes a stream and modified watercourse, but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal).

2.2. Artificial Watercourses

National Policy Statement for Freshwater (NPS-FM)

A drain refers to any artificial watercourse designed, constructed, or used for the drainage of surface or subsurface water, but excludes artificial watercourses used for the conveyance of water for electricity generation, irrigation, or water supply purposes.

Waikato Regional Council (WRC) – Waikato Regional Plan[2]

The following definitions have been extracted from the Glossary of Terms section of the WRP and are applicable to the classification of this watercourse:

- **Artificial watercourse:** "A watercourse that contains no natural portions from its confluence with a river or stream to its headwaters and includes irrigation canals, water supply races, canals for the supply of water for electricity power generation, and **farm drainage canals**."

Greater Wellington Regional Council (GWRC) – Watercourse Categorisation Guidance Document[3]

- **Highly modified river or stream:** "A river or stream that has been modified and channeled for the purpose of land drainage of surface or sub-surface water and has the following characteristics: a. It has been channeled into a single flow, and b. The channel has been straightened, and c. The channel is mechanically formed with straight or steeply angled banks, and d. It exhibits these characteristics for at least its entire length through the property in which the activity is being carried out.
- **Drain:** "Any artificial watercourse designed, constructed, or used for the drainage of surface or subsurface water, but excludes artificial watercourses used for the conveyance of water for electricity generation, irrigation, or water supply purposes."

This means that a "drain" is fundamentally understood as an **artificial watercourse created for the purpose of land drainage[4].**

Horizons Regional Council (HRC) – One Plan[5]

Artificial watercourse means a continually or intermittently flowing body of fresh water that does not meet the definition of river in S2 of the RMA. For the purposes of this Plan, it includes an irrigation canal, water supply race, canal for the supply of water for hydroelectricity power generation, and farm drainage canal, but excludes a non-natural lake.

Otago Regional Council [6]

[2] Waikato Regional Council: Waikato Regional Plan; Modeule 1, G-2: https://www.waikatoregion.govt.nz/council/policy-and-plans/regional-plan/

[3] Greater Wellington Regional Council. 2021. How to determine whether a watercourse is a river, ephemeral watercourse, highly modified river or stream, or artificial watercourse.

[4] https://www.waikatoregion.govt.nz/services/integrated-catchment-management/land-drainage/

[5] Horizons Regional Council. (2024). One Plan, RPS – LF – Land and Freshwater https://www.horizons.govt.nz/HRC/media/Media/One%20Plan/5-Part-2-RPS-LF-Land-and-freshwater_3.pdf?ext=.pdf

[6] Otago Regional Council. (2022). Practice note: What is 'water' and what is an 'artificial watercourse?' https://www.orc.govt.nz/media/13061/practice-note-what-is-water-and-what-is-an-artificial-watercourse.pdf

The following factors derived from case law must be considered when distinguishing between a river as described in the RMA and an artificial watercourse:

a. Whether the water is fresh water, as defined in S2 of the RMA (i.e. not water in a pipe, tank, or cistern). If the water is not fresh, then the watercourse does not meet the definition of a river and will not be a modified or artificial watercourse.
b. To be a river (including a modified watercourse), the water must be permanently or intermittently flowing.
c. If modified, whether there was a natural watercourse prior to modification.
d. Whether the bed is artificial or comprised of natural bed materials. Note: A diversion of a river through an artificial channel can remain part of the river.
e. Whether the source of the flow is natural or not.
f. The path of the watercourse – a meandering watercourse suggests a modified watercourse; however, a channelised path can also be a modified watercourse.

Bay of Plenty Regional Council[7]

Modified watercourse – a watercourse that meets any of the following criteria:

a. Is a river or stream that has been channelled or diverted.
b. Is a Land Drainage Canal (as defined in this regional plan) constructed through a wetland or swamp, that generally follows the path of a historic natural watercourse or reasonably defined natural drainage channel.
c. Is a watercourse that has a natural headwater of either a channel or spring, and generally follows the path of a historic natural watercourse or reasonably defined natural drainage channel.

Broadly speaking, it is nationally and regionally recognised that an artificial watercourse must not have originated from a natural source, must not have replaced a natural watercourse, meander, be designed for drainage and have a historic context. Additionally, it must not fall into the criteria of a River, as defined in the RMA.

3. SITE LOCATION, DESCRIPTION AND CONTEXT

Historical

The site is situated within a highly modified rural farmland area that has been subject to extensive modification in the past. The area under investigation has been historically drained for over a century and intensively farmed for agricultural purposes. Using Retrolens[8]A review of historic imagery shows that the watercourse on site has been in its present state since the earliest records available. As shown in Figure 2-3, there are natural flow paths visible within the wider catchment adjacent to it. However, the watercourse under investigation still shows characteristics considered to be indicative of a drain dating back to 1946 (Figure 3).

It appears that the gully system northwest of the site has always had its furthest extent outside of the site and never naturally occurred within the site. The gully network (red area) is connected to the site via a series of drainage channels (Red arrow - Figure 2) with existing drain networks observed from the earliest time period on record (1946; Figure 3) that have been developed over time in very flat rural areas with limited natural drainage outlets to make

[7] Bay of Plenty Regional Council. (2008). Bay of Plenty regional water and land plan. https://www.boprc.govt.nz/media/31241/Plan-100301-Operative-RWLP-Definitions.pdf

[8] https://retrolens.co.nz/

the land productive and prevent flooding. There is evidence of this happening between aerials where the drain network on-site has extended between 1946 and 1953 (Figures 2 and 3).

There is no evidence to suggest that the watercourse was a natural water body before construction, nor that it originated from a natural watercourse that became modified at a later date. Additionally, it has straightened channels dating back to 1946 and appears to have been maintained from this period to the present for the purpose of removing excess water from the land.

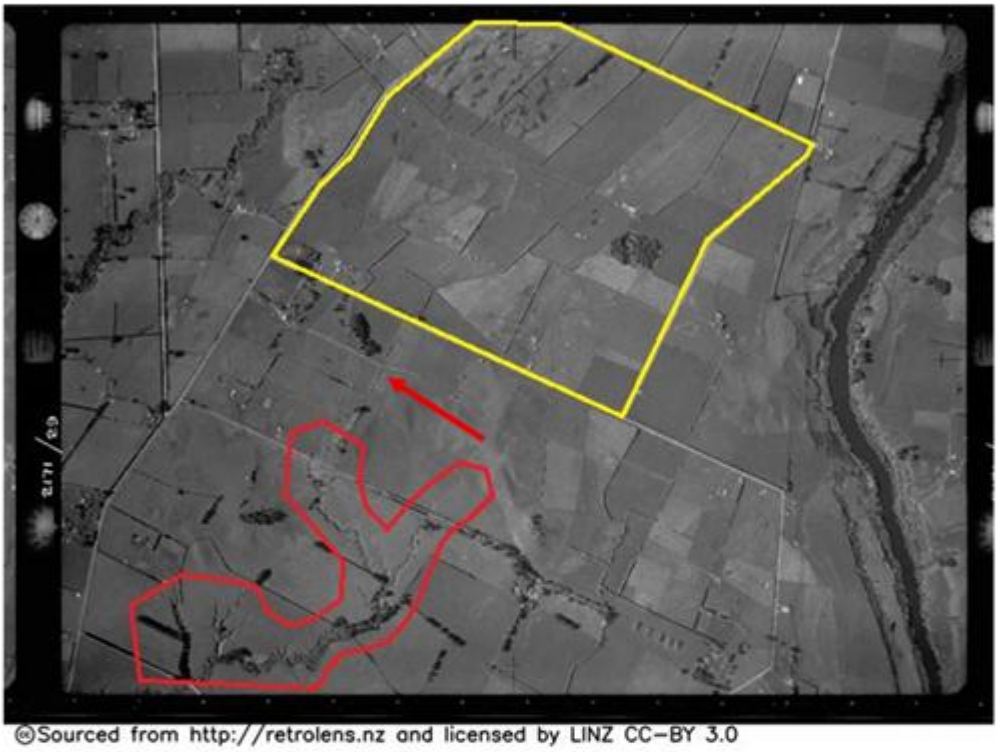

Figure 2: Clearer aerial imagery of the site and the downstream gully system the site is connected. Dated 1953, available through Retrolens.

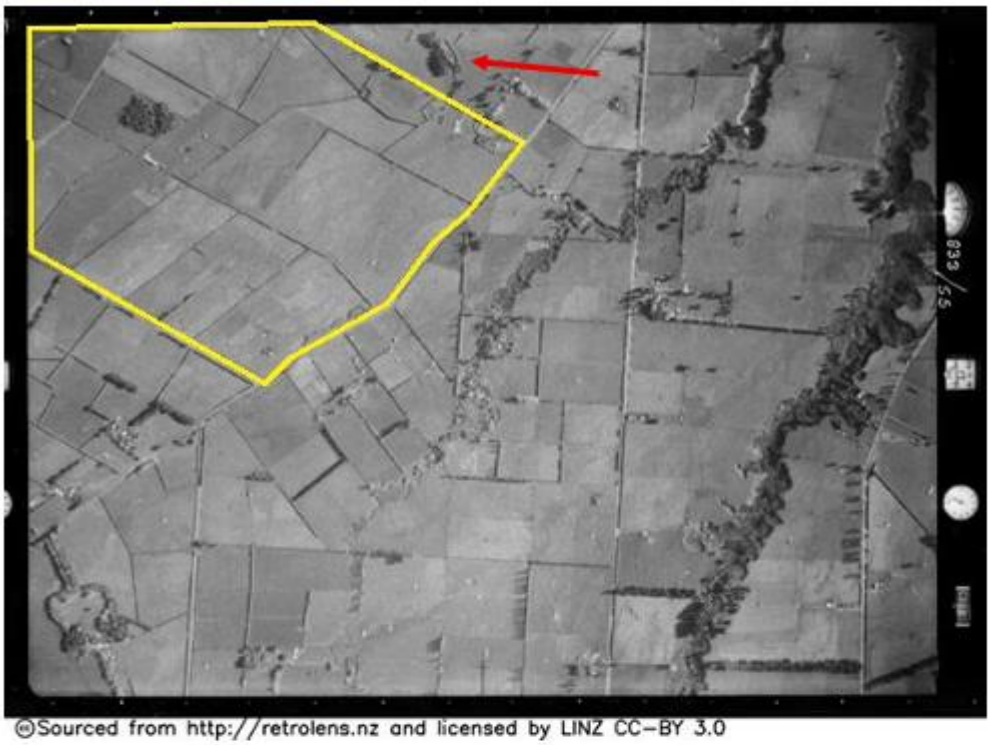

Figure 3: Earliest aerial imagery available through Retrolens (1946)of the site and exit drainage network running through 636 Pencarrow Road and neighbouring 605/613 Pencarrow Road.

Present

A site visit was undertaken on the 26th of September, 2025, to assess the channel to assist with the classification and provide some modern-day context to the historical desktop assessment.

Evidence of rooted terrestrial vegetation could be seen throughout the watercourse, even during winter when the channel experiences peak flow. This is indicative of usage for the purpose of drainage, as rooted terrestrial vegetation does not typically set in intermittent or permanent watercourses (Figure 4; Figure 5).

Additionally, no evidence of meandering or other natural processes could be observed on-site, despite the fact that the channel has been active for at least 80 years. There was evidence of substrate sorting processes, and limited amounts of woody debris were present immediately upstream/downstream of culverts, likely a byproduct of significant flow events moving large quantities of water off the road and into the channel. Additionally, there were some sparse sections of riparian vegetation contained in small patches inside the fenced areas. Native species included Wheki (Dicksonia squarrosa) and swamp kiokio (*Parablechnum minus)*

ENZL also undertook a review of the Waikato Regional Council's drainage network GIS mapping. It was identified that the site is not currently managed by WRC within its "scheme drains" land drainage areas (Figure 6). These are maintained by the council on behalf of ratepayers. A further review of the Water Classification Portal in WRC's platform found that the watercourse was classified as an unnamed river (ID: 6820488). It is unclear how this watercourse

was given the classification, as information about it cannot be found online at the time of writing; therefore, we cannot verify the accuracy of this information in any meaningful detail.

The watercourse appears to adhere to the classification of a drain outlined by GWRC:

> **Drain:** "Any artificial watercourse designed, constructed, or used for the drainage of surface or subsurface water, but excludes artificial watercourses used for the conveyance of water for electricity generation, irrigation, or water supply purposes."

Therefore, we conclude that the watercourse should be classified as an **artificial watercourse** created for purposes of land drainage.

Figure 4: Evidence of rooted terrestrial vegetation within the watercourse.

Figure 5: Upstream-facing view of the watercourse on-site taken from the edge of the roadside.

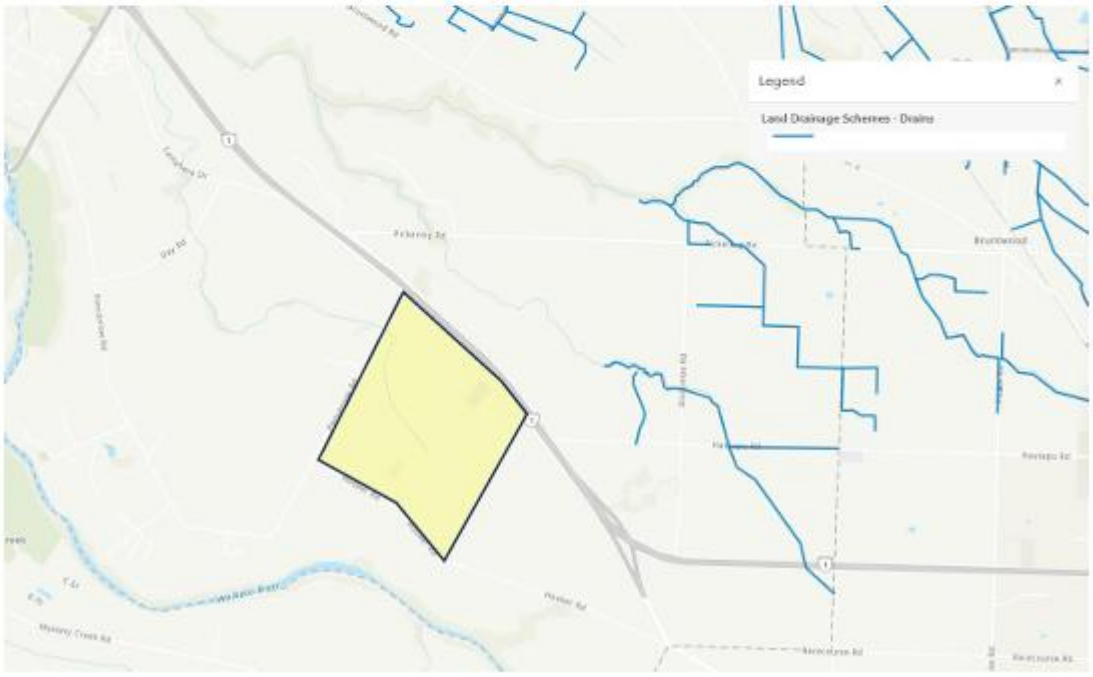

Figure 6: Figure retrieved from the Waikato Regional Maps Drainage GIS viewer[9]. The yellow polygon represents the site location.

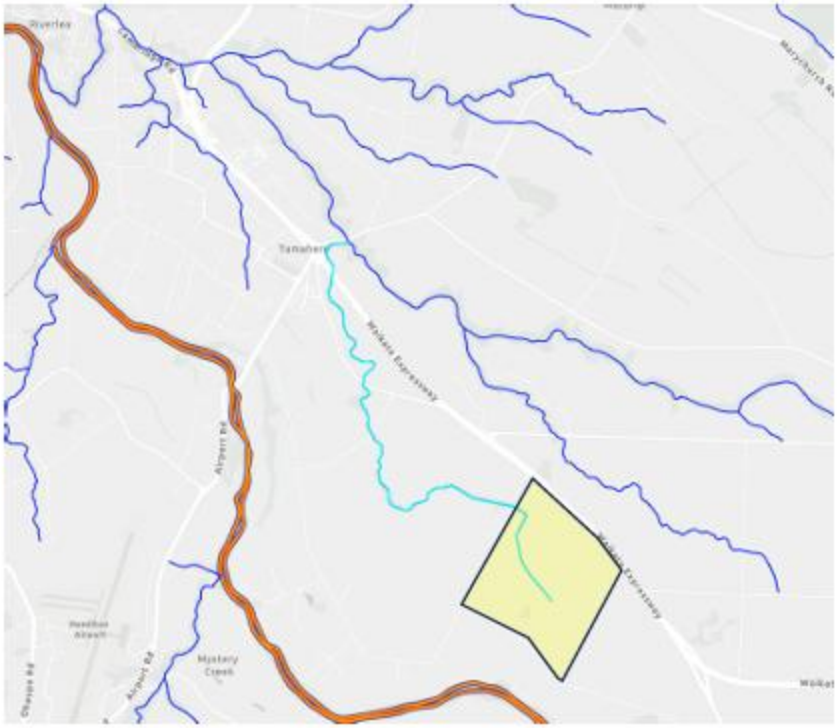

Figure 7: Water Classification Portal – Waikato Regional Council digital information: (Unnamed River): 6820488. *The yellow polygon represents the site location.*

4. CONCLUSION

Given the evidence from both historical and present-day information, we classify the watercourse on site as an artificial farm drain. There is no historical evidence to support that this watercourse was ever a natural system based upon historical imagery, and the current ecological features within the watercourse appear consistent with what would be expected to be present within a drainage system. It is our professional opinion that the watercourse located on 636 Pencarrow Road is a drain and therefore classified as an artificial watercourse accordingly.

[9] https://waikatomaps.waikatoregion.govt.nz/Viewer/?map=15b6ef59ffba4d9b9128c70da260bef3#

APPENDIX A

Report Limitations

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ii) The scope and the period of ENZL's services are as described in ENZL's proposal and are subject to restrictions and limitations. ENZL did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Report/Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by ENZL in regards to it.

iii) Conditions may exist which were undetectable given the limited nature of the enquiry ENZL was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Report/Document. Accordingly, if information in addition to that contained in this report is sought, additional studies and actions may be required.

iv) The passage of time affects the information and assessment provided in this Report/Document. ENZL's opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed ENZL to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

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vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by ENZL for incomplete or inaccurate data supplied by others.

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APP147909 Waikato Thoroughbreds Pencarrow Road Site - water body classification

Ceri Hills s 9(2)(a)
To Josh Caddigan
Cc Sam Simpson; Sharon Flintoff; info@ecologynz.nz; Brian Richmond

Hi Josh

Thanks for the updated and clarified memo. In regards to this assessment for the Pencarrow Road site, we will classify the watercourse as an 'artificial watercourse' under the Waikato Regional Plan (WRP). Therefore, please consider the relevant rules in the Waikato Regional Plan (WRP) and policies within the Waikato Regional Policy Statement (WRPS) as part of your ongoing assessment."

Kind Regards
Ceri

Ceri Hills | CONSENTS OFFICER | Resource Consents - Team 1, Resource Use
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From: Josh Caddigan s 9(2)(a)
Sent: Friday, 17 October 2025 4:06 pm
To: Ceri Hills s 9(2)(a) ; Brian Richmond s 9(2)(a)
Cc: Sam Simpson s 9(2)(a) Sharon Flintoff s 9(2)(a) ; info@ecologynz.nz
Subject: RE: APP147909 Waikato Thoroughbreds Pencarrow Road Site - water body classification

Hi Ceri,

Please see the drain classification memo updated as per your comments below.

Look forward to receiving WRC's response.

Ngaa Mihi,

Josh Caddigan
Senior Planner
Email: s 9(2)(a)
Mobile: s 9(2)(a) | **Website:** bcdgroup.nz
Ph: 0508 BCD GROUP (0508 223 47687)
Level 1, 220 Tristram Street, Hamilton, 3204
PO Box 9421, Waikato Mail Centre, Hamilton

From: Ceri Hills s 9(2)(a)
Sent: Tuesday, 14 October 2025 3:03 pm
To: Josh Caddigans 9(2)(a) Brian Richmonds 9(2)(a)
Cc: Sam Simpsons 9(2)(a) ; Sharon Flintoffs 9(2)(a) ; info@ecologynz.nz
Subject: APP147909 Waikato Thoroughbreds Pencarrow Road Site - water body classification

Hi Josh,
Thanks for this water body classification report from Ecology NZ.
We note a few points from this report that will need to be amended prior to WRC response to agree with the classification.

The Ecology NZ report refers to WRP glossary of terms on page 3 – including a "drain". WRP does not include any such definition – this is the Greater Wellington definition. This is also referred to on page 6 … "the watercourse appears to adhere to the classification of a drain outlined by WRC:".

As there is no 'drain' definition in the WRP glossary of terms, the water body is better referred to as an "artificial watercourse" under the WRP. This is the same approach we advised in Brian's email for Church Road – 16 July 2025.
We are comfortable that on an amended Ecology NZ Memo to use WRP glossary of terms (artificial watercourse) we should be in a position to agree to the classification,

Thanks
Ceri

Ceri Hills | CONSENTS OFFICER | Resource Consents - Team 1, Resource Use
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From: Josh Caddigan s 9(2)(a)
Sent: Friday, 10 October 2025 10:19 am
To: Ceri Hills s 9(2)(a) ; Brian Richmond s 9(2)(a)
Cc: Sam Simpson s 9(2)(a) ; Sharon Flintoff s 9(2)(a)
Subject: APP147909 Waikato Thoroughbreds Pencarrow Road Site water body classifciation

CAUTION: This email originated from outside of Waikato Regional Council. Do not follow guidance, click links, or open attachments unless you recognise the sender and know the content is safe.

Hi Ceri / Brian,

Thanks for your time this morning,

Please find attached the drain classification memo for Pencarrow Road.

We will be in touch next week regarding the Regional Plan assessment.

Ngaa Mihi,

Josh Caddigan
Senior Planner
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Mobile: s 9(2)(a) | **Website:** bcdgroup.nz
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From: Ceri Hills s 9(2)(a)
Sent: Wednesday, 8 October 2025 10:54 am
To: Brian Richmond s 9(2)(a) Josh Caddigan s 9(2)(a) Simpson s 9(2)(a) Sharon Flintoff s 9(2)(a)
Subject: RE: Waikato Thoroughbreds Pencarrow Road Site [Filed 08 Oct 2025 10:57]

Hi Josh
Thanks for you patience for this one. Brian and I are able to meet with you online regarding this site and consider any questions you may have. We both appear to have time on Friday morning between 9-11.30am if that would work for you?

We note this site is different from Church Road in that it is not within a WRC manged drainage scheme.

Let me know
Thanks
Ceri

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From: Brian Richmond s 9(2)(a)
Sent: Friday, 3 October 2025 1:29 pm
To: Josh Caddigan s 9(2)(a)
Cc: Ceri Hills s 9(2)(a); Sam Simpson s 9(2)(a) Sharon Flintoff s 9(2)(a)
Subject: RE: Waikato Thoroughbreds Pencarrow Road Site

Hi Josh,

Thanks for the information provided below.

We would be happy to meet on this one. However, there are a few staff away at the moment, so once they are back next week I can let you know some dates that we could meet.

Thanks
Brian

Brian Richmond | PROJECT MANAGER - DEVELOPMENT | Resource Consents - Team 1, Resource Use
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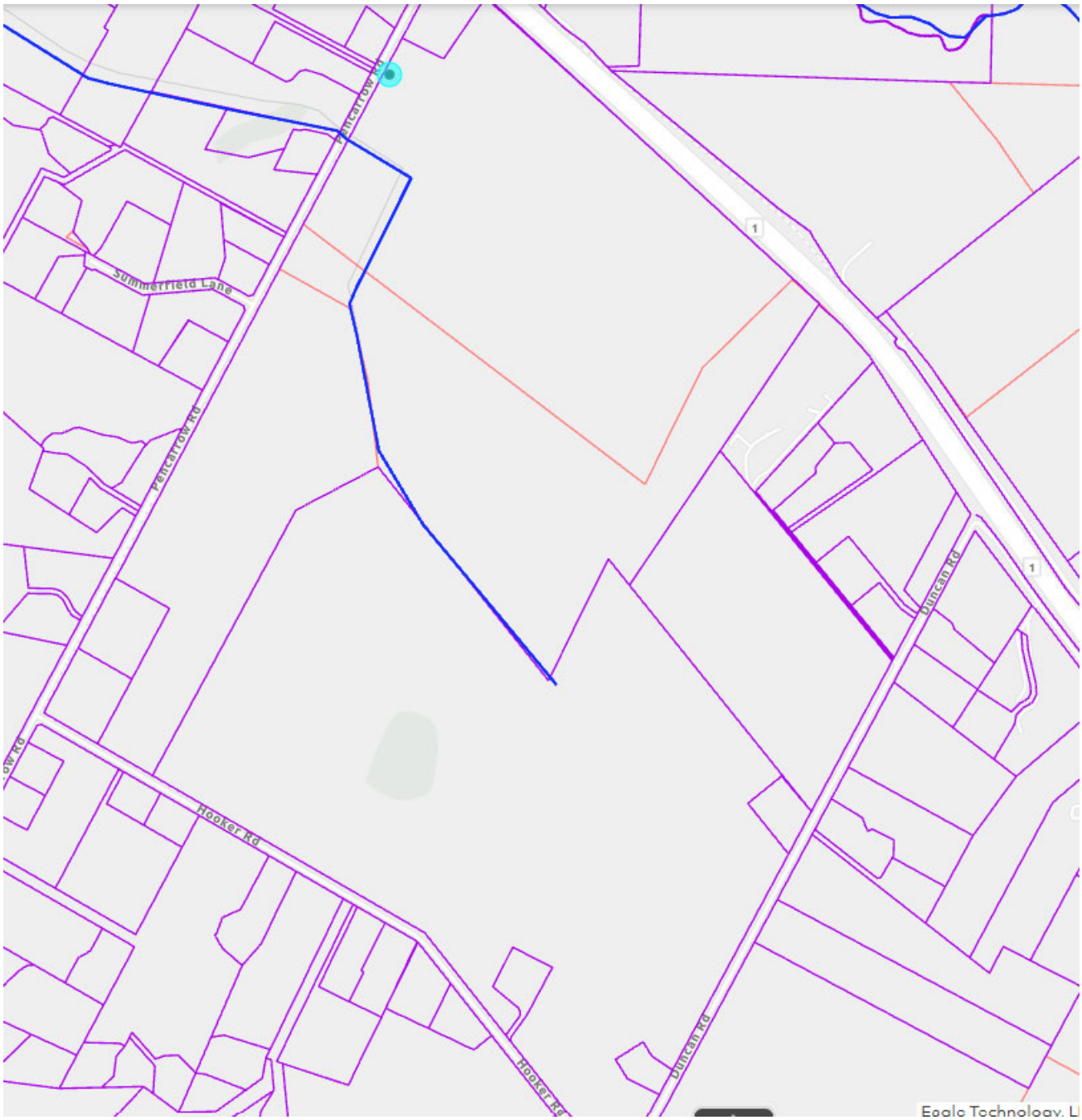
From: Josh Caddigan s 9(2)(a)
Sent: Wednesday, 1 October 2025 12:57 pm
To: Brian Richmond s 9(2)(a)
Cc: Ceri Hills s 9(2)(a) Sam Simpson s 9(2)(a) Sharon Flintoff s 9(2)(a)
Subject: Waikato Thoroughbreds Pencarrow Road Site

Hi Brian,

Hope you've had a good week,

We are now working on due diligence for another property (636 Pencarrow Road, Tamahere)

The site has stream / river identified on WRC maps within the site that we believe is a farm drain within our property.



Our key concerns to discuss would be:

1. Existing Regional Council Drainage

- Classification of this drain
- Due to future spatial planning of the site we would need to investigate either piping and building over these drains, or re-routing the drain to suit the proposed

layout – we would like to discuss WRC's appetite for this to occur if the drain is classified as an artificial watercourse.

Can we please arrange a meeting at your earliest convenience to discuss the above?

Ngaa Mihi,

Josh Caddigan
Senior Planner
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Mobile: s 9(2)(a) **Website:** bcdgroup.nz
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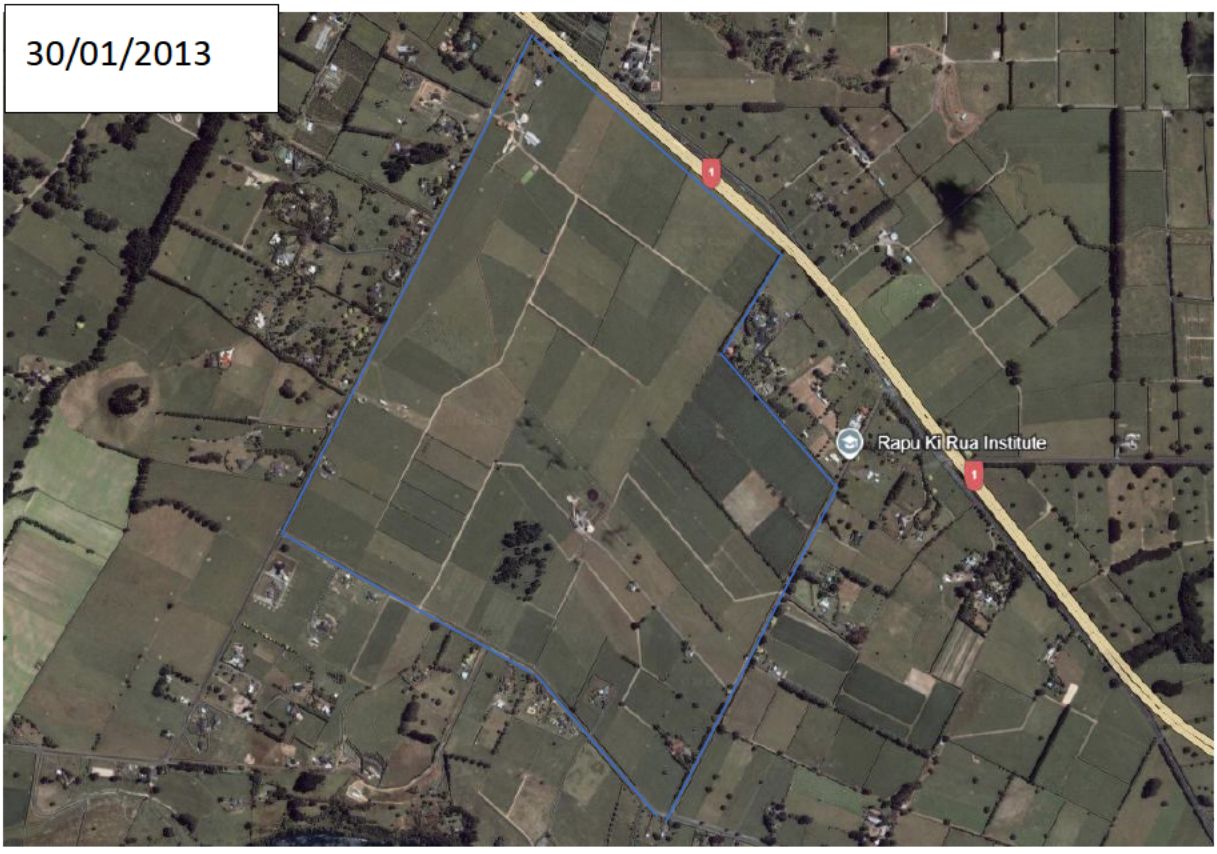
PO Box 9421, Waikato Mail Centre, Hamilton

Appendix 3: Historic and retrolens imagery


16/02/1995


10/01/2008
Rapu Ki Rua Institute


30/01/2013
Rapu Ki Rua Institute

30/04/2018

28/02/2025

Appendix 4: Weather during the bat surveys

Date	Temperature at dusk (20:00 to 00:00)	Maximum nightly temperature	Minimum nightly temperature	Daily rainfall (mm)
2025-11-13	13.3	14.8	13.1	18.6mm
2025-11-14	12.4	14.2	11.6	0.4mm
2025-11-15	10.5	14.8	9.5	5.6mm
2025-11-16	12	16.3	4.7	0.0mm
2025-11-17	14.3	16.9	6.6	0.0mm
2025-11-18	16.5	18	12.2	15.6mm
2025-11-19	16.8	17.9	15.3	35.6mm
2025-11-20	14.6	18.1	13.8	0.0mm
2025-11-21	14.6	18.3	12.1	0.0mm
2025-11-22	14.8	21.3	9.4	1.6mm
2025-11-23	13.6	17.5	12.1	0.2mm
2025-11-24	13.6	16.9	9.9	0.0mm
2025-11-25	15.2	17.8	10.8	0.0mm
2025-11-26	16.5	18.9	12.2	17.6mm
2025-11-27	17.5	19.7	14.5	0.6mm
2025-11-28	15.7	19	14.9	0.4mm
2025-11-29	14.2	21.8	9.4	0.2mm
2025-11-30	17.2	17.8	7.9	37.2mm
2025-12-01	13.5	21.1	12.1	0.4mm
2025-12-02	16.8	22.3	10.1	4.2mm
2025-12-03		19.6	15.8	

Appendix 5: EcIA Guideline Tables

Step one: Assign ecological value

Appendix I Table 1: Assigning ecological value (Roper-Lindsay et al. 2018).

Description	Value
Feature rates Very Low for at least three assessment attributes and Low to Moderate for the remaining attribute(s).	Negligible
Feature rates Very Low to Low for most assessment attributes and moderate for one. **Limited ecological value other than providing habitat for introduced or tolerant indigenous species.**	Low
Feature rates High for one assessment attribute and Low to Moderate for the remainder, <u>OR</u> The Project area rates Moderate for at least two attributes and Very Low to Low for the rest. **Likely to be important at the level of the Ecological District.**	Moderate
Feature rates High for at least two assessment attributes and Low to Moderate for the remainder, OR The Project area rates High for one attribute and Moderate for the rest. Likely to be regionally important.	High
Feature rates High for at least three assessment attributes. **Likely to be nationally important.**	Very High

Appendix I Table 2: Assigning ecological value at a species level for terrestrial and freshwater species (Roper-Lindsay et al. 2018).

Threat Class	Threat Sub-class	Value
Exotic: Introduced and Naturalised	-	Negligible
Indigenous: Common/not threatened	-	Low
Indigenous: Locally uncommon or distinctive species	-	Moderate
Indigenous: At Risk	1. Naturally uncommon 2. Relict 3. Recovering	Moderate
	4. Declining	High
Indigenous: Threatened	1. Nationally Critical 2. Nationally Endangered 3. Nationally Vulnerable	Very High

Step two: Assessing magnitude of effects

Appendix I Table 3: Assessment and criteria for describing the magnitude of effects (Roper-Lindsay et al. 2018).

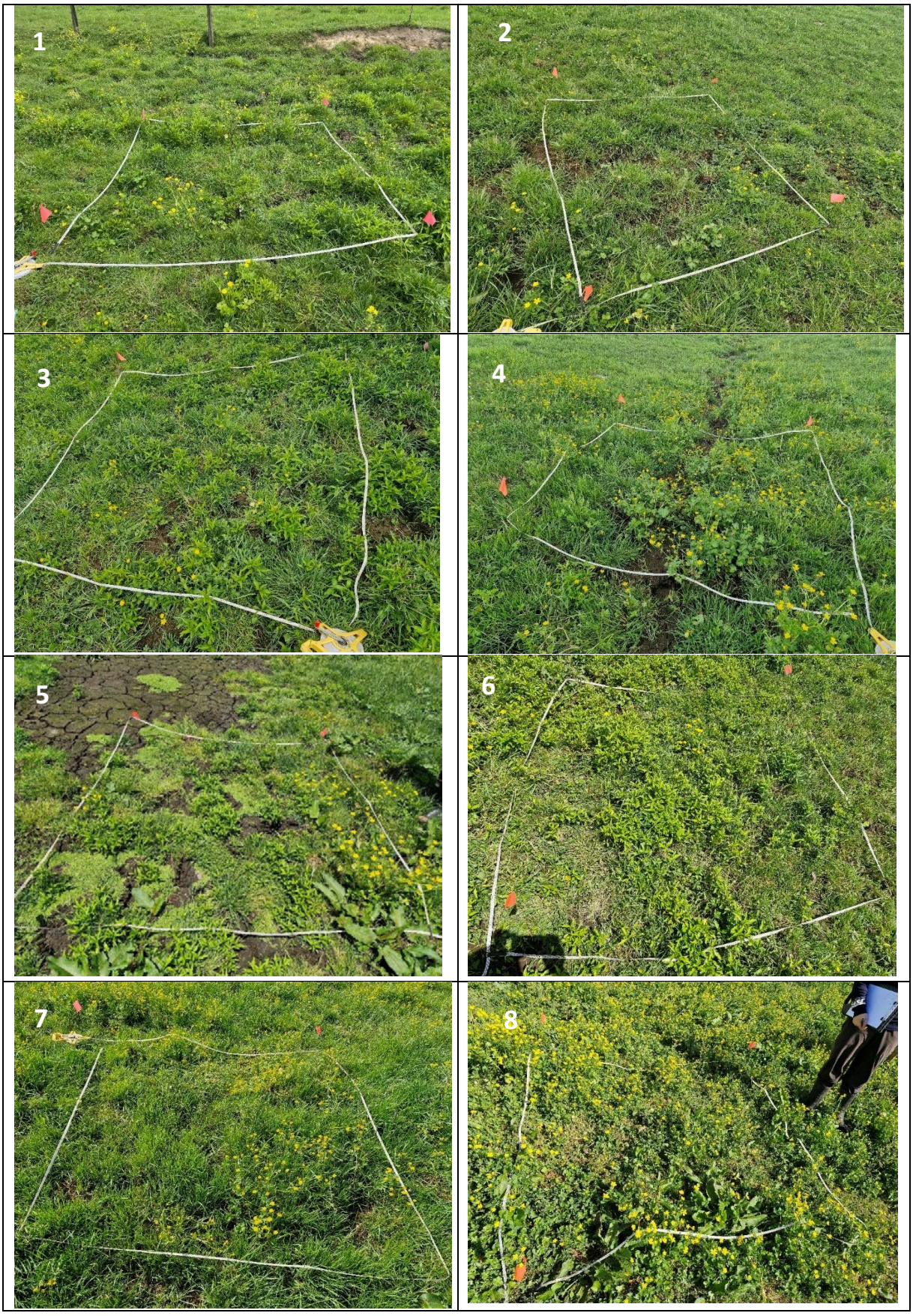
Description	
Very slight change from existing conditions. Change barely distinguishable, approximating "no change"; and/or having negligible effect on the known population or range of the feature.	Negligible
Minor shift away from existing conditions. Change arising from the loss/alteration will be discernible, but underlying attributes will be similar to pre-development circumstances; and/or having a minor effect on the known population or range of the feature.	Low
Loss or alteration to one or more key features of the existing condition, such that post-development attributes will be partially changed; and/or loss of a moderate proportion of the known population or range of the feature.	Moderate
Major loss or alteration of key features of existing conditions, such that post-development attributes will be fundamentally changed; and/or loss of a high proportion of the known population or range of the feature.	High
Total loss or very major alteration to key features of existing conditions, such that the post-development attributes will be fundamentally changed and may be lost altogether; and/or loss of a very high proportion of the known population or range of the feature.	Very high

Step three: Assessment of the level of effects

Appendix I Table 4: Matrix for determining the overall level of the described ecological impacts (Roper-Lindsay et al. 2018).

Effect Level		Ecological Value				
		Negligible	**Low**	**Moderate**	**High**	**Very High**
Magnitude of impact	**Positive**	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain
	Negligible	Very Low	Very Low	Very Low	Very	Low
	Low	Very Low	Very Low	Low	Low	Moderate
	Moderate	Very Low	Low	Moderate	High	High
	High	Very Low	Low	Moderate	Very	Very High
	Very High	Low	Moderate	High	Very High	Very High

Appendix 6: Vegetation plot photos



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Appendix 7: Restoration and Management of the remnant kahikatea stand

This restoration plan has been prepared for the restoration of the remnant kahikatea stand at the subject property. This remnant is located in the Hamilton Basin which is one of the most heavily degraded management zones in the Waikato District, with only small, scattered indigenous forest remnants remaining. These small remnants stand out as vestiges of what once was an expansive and biodiverse wetland and forest ecosystem complex. In terms of restoration and management, permanent stock exclusion and fence upgrades are required as the first step in the restoration process. Provided only cattle are present on the property a 5-wire fence with 2 electric wires is sufficient and will need to be subject to regular monitoring and maintenance. If gates are installed (to remove cattle that accidently enter the remnant) these should be padlocked closed.

Pest animal and plant control is required. Weed pressure was low to moderate throughout most of the site, with current grazing levels keeping weeds at a minimum aside from unpalatable and grazing-tolerant species such as barberry.

A guide to the restoration and management of Kahikatea Forest Fragments has been prepared by Waikato Regional Council, which provides helpful advice on how these areas may be restored [21].

The objective of the restoration is to mitigate any adverse impacts of the proposed development on resident flora and fauna. In the future this area will be largely self-sustaining habitats where animal and plant pests are largely controlled to zero density and indigenous flora, and fauna dominate the forest ecosystem.

Animal pest control

A mammalian predator and herbivore pest management programme should be developed to control herbivores (possums, hares) that will damage revegetation plantings and predators (rats, feral cats and mustelids).

Mustelid control

The best time to trap mustelids is during late spring and summer. Mustelids often follow pre-existing tracks or natural linear features with low vegetation, such as stock tracks, or along stream banks. Mustelids will investigate any tunnels and burrows encountered while hunting, and trap tunnels or covers should be used to cover the set traps. This will also prevent the capture of non-target birds and animals.

The DOC 150® and DOC 200® series traps are well proven in trapping small mustelids and rats. The larger DOC 250® is also able to trap larger ferrets. A self-setting alternative for trapping small mustelids (stoats and weasels) is the Goodnature A24® rat and stoat trap. Allow a minimum of one mustelid trap per hectare (these can be spaced around the perimeter of the wetland as access to the central part of the wetland is difficult). Setting appropriately spaced bait lines that run through the area of indigenous vegetation is another alternative setup. Bait traps with fresh fish, poultry, rabbit or an egg for mustelids. Never wash traps after they have caught a mustelid, as the scent left by the captured animal will attract others, acting as a natural lure. Check and re-bait traps fortnightly during summer and monthly during winter.

[21] Forest-Fragment-factsheet-6.pdf

Feral cats

Where feral cats appear to be frequenting these areas live capture box traps may be used to capture feral cats these need to be checked daily for legal purposes. Any captured cats should be humanly euthanised as soon as possible. Baits such as fresh fish, poultry, rabbit, or simply cat food may be used to lure feral cats into the live capture trap. This may however lead to other mammals being caught as well, and repeated attempts may be required. Live capture traps are legally required to be checked no more than 12 hours after sunrise each day.

Rats and possums

Rats and possums can be control either manually using kill traps or shooting or with chemical baits. Take extra care using poisons if you have pet or working dogs free-ranging on the property.

Rats and possums can be controlled with bait stations containing pindone, brodifacoum (Pestoff®) or cholecalciferol. The Philproof® bait station is suitable for possums and rats. Place bait stations around wetland/lake margins, spaced 50-100 m apart. Fill stations with suitable/safe toxin once and refill four weeks later. This is called 'pulse feeding' – because these baits are slow-acting, possums will consume more than is necessary if stations are refilled more often. Baiting can be done throughout the year, but possums are hungrier in winter. Four pulses per year are recommended (Aug, Nov, Jan and April). These can be deployed on the inside of posts along the fence line.

'Pulsing' bait fill in stations will maximise bait take and lower pest animal densities enough for birds and other fauna to thrive. This means filling them 3-4 times over a 4-6 week period (depending on bait take). Pulsing before and after winter, when other food sources in the environment are low, is key to restricting opportunities for pests to breed.

Kill traps can be used to control pest mammals but require more regular checking and re-setting than bait stations. Single set traps will need to be checked and rebaited weekly at first (especially for rats) until the catch rate comes down significantly. Following this initial blitz, trapping intervals can be extended to fortnightly during the spring and summer months and at least monthly for the rest of the year. An increase in catch rates indicates the need for more frequent trapping. Rat traps shall be placed at a density of two per hectare, spaced at 50 m intervals. Possum traps shall be placed at a density of one per hectare, spaced at 100 m intervals. Bait for manual traps should be species-specific and replaced regularly. Rat traps can be baited with peanut butter while possum traps are most effective when baited with a mix of cinnamon, icing sugar and flour. Goodnature® (A12s and A24s) or NZ Auto Traps (AT220s) self-resetting traps can be used to minimise the effort required. The AT220's work very well however their initial set-up cost is higher than bait stations and other types of kill trap

Hares

Numerous hares were observed at the property. Shooting hares is likely to be the best form of control, to ensure that they do not browse on recently established indigenous plants

Pest plant control

Pest plant control was low in the kahikatea due a history of grazing. The occasional inkweed, barberry and small blackberry plant were present, and these require control. Ongoing control will be required once stock are excluded and will be particularly important as the plantings are establishing.

Control methods for most of these weed species can be found on the Waikato Regional Council Biosecurity plant pest factsheet series[22] and further information on control of other species can be found on the Weedbusters website[23].

Hydrology

Drains have been dug around the perimeter of the kahikatea stand. These drains are relatively shallow and ephemeral but, along with landscape-scale drainage, will likely alter the natural hydrology of the remnant. Reinstatement of the hydrology to this area would be a difficult and complex issue as any alteration to the present hydrology would have to ensure that flooding of the nearby road and adjacent productive grazing land did not occur.

It is recommended that these drains immediately bordering the remnant are no longer maintained or dug out. If the remnants require additional water retention it may be sufficient to partially block the drains for example with the use of native plants e.g., *Carex* grasses within the drains to allow increased water retention.

Planting

The area to be restored should include all of the mature trees in the area. If the entire area/paddock that the remnant is located within (within the fenced boundary) then c.2.65 ha of area will be restored. This will equate to c.9,200 plants spaced at a density of one plant every 1.5 m. A recommended plant list for kahikatea forest remnants is provided overleaf and has been taken from the WRC forest fragment factsheet 6[16].

The use of early successional species is particularly useful to buffer the remnant from edge effects such as prevailing winds and weed intrusion. On the damp/drier areas early successional plants such as manuka, karamu, and flax will provide good ground cover and grow quickly. As the plantings mature other species, particularly large canopy trees, can be planted in the restoration area.

- Well-drained drier areas can be planted predominantly with kanuka, with species such as totara, mapou, mahoe and karamu placed among it.
- Damper areas can have manuka, kahikatea, cabbage tree, karamu, and pukatea.
- Rare plants which could be planted (if able to be sourced) include: *Syzygium maire*, *Microsorum novae-zelandiae*, *Mida salicifolia Pimelea tomentosa, Pseudopanax laetus* and *Raukaua edgerleyi.*

[22] https://www.waikatoregion.govt.nz/services/publications/biosecurity-factsheets/
[23] https://www.weedbusters.org.nz

SCIENTIFIC NAME	COMMON NAME	PLANT TYPE	DRAINAGE *Plants listed in order from wetter sites to drier sites*
'Nurse' plants - full sun in exposed sites			
Carex virgata	Purei	Sedge	Poor
Carex secta	Purei	Sedge	Poor
Coprosma propinqua	Swamp coprosma	Shrub	Poor
Coprosma tenuicaulis	Swamp coprosma	Shrub	Moderate/poor
Austroderia fulvida	Toetoe	Sedge	Moderate
Carpodetus serratus	Putaputawētā	Tree	Moderate
Coprosma rigida		Shrub	Good/moderate/poor
Cordyline australis	Cabbage tree/tī	Tree	Good/moderate/poor
Leptospermum scoparium	Mānuka	Tree	Good/moderate/poor
Phormium tenax	Flax/ harakeke		Good/moderate/poor
Dacrycarpus dacrydioides	Kahikatea	Tree	Good/moderate/poor
Coprosma robusta	Karamū	Shrub	Good/moderate
Myrsine australis	Māpou	Tree	Good/moderate
Podocarpus tōtara	Tōtara	Tree	Good
Kunzea ericoides	Kānuka	Tree	Good
Sophora microphylla	Kōwhai	Tree	Good
Planting in sheltered sites or canopy gaps			
Syzygium maire	Swamp maire	Tree	Poor
Astelia grandis	Swamp lily	Flax-like herb	Moderate/poor
Coprosma tenuicaulis	Swamp coprosma	Shrub	Moderate/poor
Gahnia xanthocarpa	Giant sedge	Sedge	Moderate/poor
Laurelia novae-zelandiae	Pukatea	Tree	Moderate/poor
Melicope simplex	Poataniwha	Tree	Moderate/poor
Streblus heterophyllus	Tūrepo	Tree	Moderate/poor
Carex dissita	Purei	Sedge	Moderate
Pennantia corymbosa	Kaikōmako	Tree	Moderate
Dacrycarpus dacrydioides	Kahikatea	Tree	Good/moderate/poor
Alectryon excelsus	Tītoki	Tree	Good/moderate
Coprosma rhamnoides		Shrub	Good/moderate
Coprosma areolata	Thin-leaved coprosma	Shrub	Good/moderate
Coprosma rotundifolia	Round-leaved coprosma	Shrub	Good/moderate
Dacrydium cupressinum	Rimu	Tree	Good/moderate
Eleocarpus hookerianus	Pōkākā	Tree	Good/moderate
Hedycarya arobrea	Pigeonwood	Tree	Good/moderate
Melicytus micranthus	Small-leaved māhoe	Shrub	Good/moderate
Melicytus ramiflorus	Māhoe	Tree	Good/moderate
Nestegis cunninghamii	Black maire	Tree	Good/moderate
Prumnopitys taxifolia	Mataī	Tree	Good/moderate
Sophora microphylla	Kōwhai	Tree	Good
Later planting under nurse plants in shaded areas			
Astelia grandis	Swamp lily	Flax-like herb	Moderate/poor
Schefflera digitata	Patē	Shrub	Good/moderate
Coprosma grandifolia	Raurēkau, kanono	Shrub	Good/moderate
Hedycarya arobrea	Pigeonwood	Tree	Good/moderate
Melicytus ramiflorus	Māhoe	Tree	Good/moderate
Alectryon excelsus	Tītoki	Tree	Good/moderate
Geniostoma rupestre	Hangehange	Shrub	Good
Beilschmiedia tawa	Tawa	Tree	Good

Note: ferns are widely dispersed and will likely turn up on their own

Planting technique

Planting should ideally be done in autumn when there is sufficient soil moisture and soil temperatures are still high enough to promote root growth. Planting can be done right through winter until around September.

Plants should be bought from a reputable grower, should be from a local seed source (ideally from the Hamilton Ecological Districts or neighbouring districts), and should be healthy and robust. Plants grown from natural populations in neighbouring districts are preferred to non-eco-sourced plants.

In the open restoration areas, plants are to be planted at a density of one plant every 1.5 m (approximately 5,000/ha) in groups of three or more. Large canopy forming trees (planted in the initial restoration phase) should be spaced approximately 3-4 m apart. Smaller trees and shrubs can be scattered throughout. Supplementary canopy enhancement species, planted after the early successional species have gained canopy closure, should be spaced approximately 10-15 m apart (approximately 115/ha to 50/ha). Spot-spraying with a glyphosate herbicide should be carried out to control weed and grass growth 28 to 14 days prior to planting. Spots should be approximately 0.3 x 0.3 m in area and spaced according to the required planting density (e.g. 1.5 m centre to centre).

In areas where soil has been compacted as the result of previous land uses, the soil can be loosened to a depth of 0.5 m using a crowbar or trenching spade. After planting, the soil level against the stem should be the same as before planting. Staking is recommended so that plants are more easily located.

The plant is to be secured in the ground by filling the space surrounding the roots with soil and lightly compressing it. Soil compression will fill any voids that might be present around the roots avoiding damage caused by water accumulation. Initial watering after planting is required.

Optimal plant stock will be used in the planting which has the following attributes:

- Healthy, vigorous, and free from obvious signs of disease and pests;
- Planter bag or pot size RRTT, PB3 - PB5;
- Of at least average size for the specified pot/planter bag size;
- Well-developed root system with high amount of new root growth; and
- Not root bound.

Planting maintenance

Planted areas should be regularly maintained to keep them weed-free and plants should be released at least three times in the first year after planting and one or two times in the subsequent four years. This involves clearing competing vegetation from around each plant, which gives them the best chance of survival and maximises growth rates. Releasing can be done with a non-residual herbicide such as glyphosate, with a brush-cutter, or manually. It is normal to expect a mortality rate of at least 10%. Additional plants should be planted in the spaces where other plants died.

Appendix 8: Bat tree felling protocols

The following protocol applies to all trees to be felled. These protocols follow industry best practice[24].

Protocols for minimising the risk of felling occupied bat roosts

(Bat Roost Protocols)

Version 4: October 2024 approved by the New Zealand Department of Conservation's Bat Recovery Group

The use of these protocols is only one step in the RMA effects management hierarchy i.e., avoid, remedy, mitigate. Avoidance of felling bat roost trees should be the first step in any project. Using this protocol only reduces the likelihood of killing or injuring bats present in roosts at the time of felling. It does not avoid, remedy or mitigate any other effects.

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 tree 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

Bat roost protocols and the Wildlife Act 1953

Aotearoa New Zealand 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 bats that may be present. Following the bat roost protocol reduces the likelihood of killing or injuring bats.

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. Where this is not possible, the effects management hierarchy must be followed with attempts made to "remedy, mitigate, offset, and compensate" for impacts on bats and bat habitat.

Bat roost protocols are not considered an appropriate management measure to address bat roost habitat loss, as they only attempt to reduce the risk of bats being killed by tree felling. Therefore, implementing bat roost protocols where bats are present should be considered a last resort after following the RMA effects management hierarchy.

This protocol has therefore been framed following the RMA effects management 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 someone who has been certified as competent by DOC to assess roost use by bats using bat detectors, identify potential roost features, and undertake emergence watches.

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.

[24] Department of Conservation. 2024. Protocols for minimising the risk of felling bat roosts (Bat Roost Protocols (BRP)) Version 4: October 2024 approved by the New Zealand Department of Conservation's Bat Recovery Group

Effects management/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 understanding this is future research needed.

The status of Aotearoa New Zealand bats

Aotearoa 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 have 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 tree. 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[2].

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 bats choose which of their roosts to occupy to fulfil specialised requirements, felling 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.

[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.

[2] Many references available, for example, Borkin KM; Parsons S. 2011. Sex-specific roost selection by bats in clear-fell 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.

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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 blackwood.

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 (a type of hibernation in May – September). Heavily pregnant bats are slower and less agile, and young bats cannot fly, and when they are new to flying are not very agile, 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.

If trees are cut down when bats are in torpor, 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 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.

Definitions

Competencies: a set of competencies developed by the NZ Bat Recovery Group[3] 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'[4])

- 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).

[3] A group of bat specialists that advise on bat issues and assess bat competencies
[4] Available at www.doc.govt.nz/bat-worker-resources

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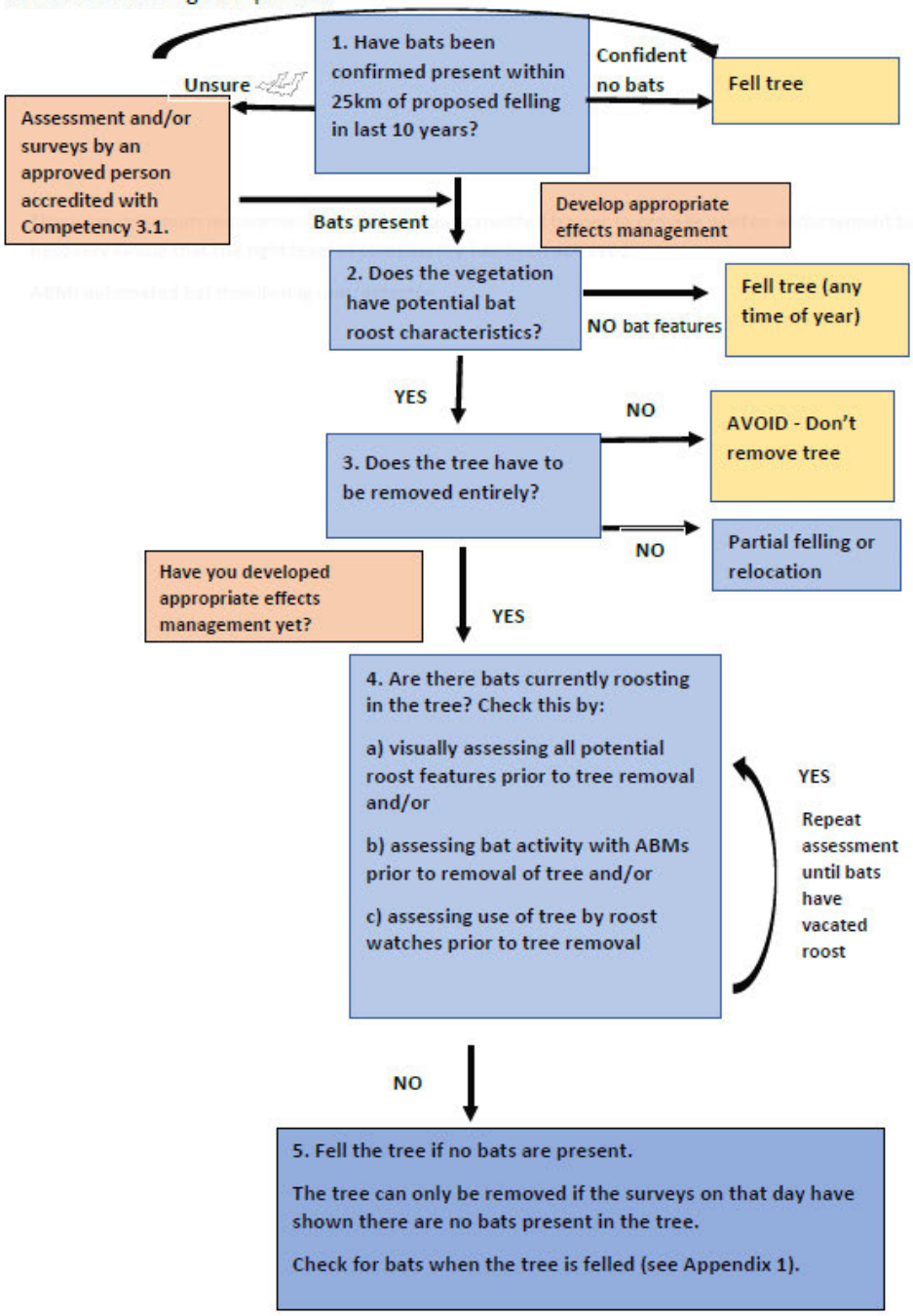
These are minimum requirements and rely on an accredited trainer to provide written endorsement to the Bat Recovery Group that the right level of competency has been achieved.

ABM: automated bat monitoring unit/detector

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.



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Step by step decision tool for tree removal in bat areas (to be used in conjunction with Figure 1).

Step 1. Does the bat roost protocol apply to my project?	Response	Who can make this assessment?	When?
a) Is there known bat activity within a radius of 25 km of the vegetation to be removed (see [5] and [6] notes below)?	a) If Yes, proceed to b If No, consider whether survey work needs to be done.	Evidence can come from on-the-ground surveys and reports from the national DOC database if within the last 10 years, consultants, and/or other credible sources. Evidence should be interpreted by an experienced bat ecologist.	Any time
b) Are bats present in the Project Area i.e. where trees are planned to be felled?	b) If Yes, go to step c If unknown, undertake comprehensive survey if bats are likely to be present. If no bats are present after comprehensive survey, you do not need to follow protocol.	If surveys are required to support the assessment, then these will need to be designed by approved person accredited with Competency 3.1. to determine presence around trees due to be felled.	Acoustic surveys to determine presence should be undertaken when bats are most active and environmental conditions are suitable (October 1st to April 30th)[7]. Surveys undertaken at other times of year are considered less reliable for determining absence.
c) Is the tree known to provide a roost location for bats? (Previous knowledge).	c) If yes, go to step 3 If no (but bats are present in the project area), go to step 2.		

Notes for Step 1

1a) Bats are a highly mobile species. Long-tailed bats can have home ranges (the areas that they regularly use) as wide as 19km, and short-tailed bats about 24km. Three colonies of long-tailed bats in the Eglinton Valley collectively had a home range of 100km².

When assessing whether bats might be present at a site you have to consider any surveys that have been done in the wider area, how long ago the surveys were done and whether more surveys are required.

[5] The largest home range span for the long-tailed bat in the Eglinton Valley was 19 km (O'Donnell 2001. J. Zool., Lond. 253, 253-264).
[6] The largest home range span for the lesser short-tailed bat in the Eglinton Valley was 23.6 km (O'Donnell et al. 1999. New Zealand Journal of Ecology 23(1): 21-30).
[7] Borkin K.M. 2010. Ecology of New Zealand's Long-tailed bat (*Chalinolobus tuberculatus*) in exotic plantation forest. Unpublished PhD thesis, University of Auckland.

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1b) If you are doing a new survey then you should design the survey to cover the project area. Examples of surveys are shown in the Bat Inventory and Monitoring Toolbox (https://www.doc.govt.nz/our-work/biodiversity-inventory-and-monitoring/bats/). See 'Bats: Counting away from bat roosts: bat detectors on line transects' and 'Counting away from bat roosts: automatic bat detectors'.

Send bat data (processed csv files and GPS locations) to batdatabase@doc.govt.nz on a standard spreadsheet available by emailing this address.

Step 2. Does the vegetation proposed to be removed have potential bat roost characteristics?	Response	Who can make this assessment?	When?
a) Is the tree ≥15 cm DBH (Diameter at Breast Height)[8]?	If yes, further assessment is required (2b). If no, the vegetation can be removed at any time. There may be roosts that have smaller DBH. If any vegetation is suspected to have a bat roost present, removal shall be halted immediately, and protocols reviewed.	Anyone who can measure a tree DBH.	Any time
b) On visual inspection, does the tree (dead or alive) have features that indicate roost potential (Potential Roost Features/PRFs)? These features include: • hollows • cavities • knot holes • cracks • flaking, peeling, and decorticating bark • epiphytes • broken or dead branches or trunk • cavities/hollows/shelter formed by double leaders • Artificial roost boxes	If yes go to step 3 If unsure i.e. cannot assess due to foliage or limited access, further assessment is required. This may include climbing inspection of the tree. If no potential roost features are present, the vegetation can be removed at any time[9], but if upon felling you find a bat follow section 5.	Approved person accredited with Competency 3.3.	Visual inspections can occur at any time of the year, but within 6 months of final felling dates. This accounts for any changes in trees that may occur over time. If there are **NO** potential roost features, felling can occur at any time of year.
Step 3. Does the tree have to be removed entirely?	**Response**	**Who can make this assessment?**	**When?**

[8] This diameter at breast height is based on dimensions of roosts used by south Hamilton long-tailed bats that were identified by Dekrout (2009, Unpublished PhD thesis, University of Auckland) - the smallest roosts were 15.5 cm DBH; but note that in South Canterbury Sedgeley and O'Donnell (2004, New Zealand Journal of Ecology 28(1): 1-18) found that 25% of long-tailed bat roosts were smaller than 18.8 cm DBH.
[9] All surveys to assess whether trees are potential roosts shall take place within 6 months of final felling dates. If felling does not take place within this time, then assessments must be repeated. This is intended to account for any changes in trees which may occur over time.

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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 (i.e. the accountable decision-maker for the project)	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 ecologist with all competencies of level 3: 'High risk activities – Roost felling'.

Advice in writing can be given on behalf of the Operations Manager of the DOC District you are working in. If you do not know the contact details for this office, you can phone 0800 ASK DOC (0800 275 362) or email info@doc.govt.nz . In emergencies, phone 0800 DOC HOT (0800 362 468).

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 reconsider whether this tree must be felled.	An approved person accredited with Competency 3.3 or an experienced tree-climber (e.g., an arborist) working with an approved person accredited with Competency 3.3. If the latter, the tree climber must provide information along with photographs or video footage, to the	October 1st to April 30th when the temperature is 7°C or greater at official sunset in the South Island or 8°C or greater in the North Island.

	Advice must be obtained at a project level in writing from DOC prior to felling the tree. If you do not know the contact details for the office, you can phone 0800 ASK DOC (0800 275 362) or email info@doc.govt.nz.	approved person accredited with Competency 3.3 who assesses and decides whether the tree can be removed. If roosts are known or confirmed through this process, then this information must be communicated to the nominated DOC or Council bat ecologist for this project.	
b) Is bat activity recorded at any time during two consecutive, valid survey nights preceding tree felling[10]? 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 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. 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 accredited with Competency 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 emerging or re-entering the tree? This involves watching roost features to identify bats returning to or exiting potential roost features. It should only be used in combination with previous ABM monitoring (4b) (see notes 4c	If yes (bats are seen at either watch), it is a confirmed roost.	An approved person accredited with Competency 3.2.	Between October 1st and April 30th only **AND** when weather parameters meet

[10] 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.

for method). At least two consecutive emergence and re-entry watches should occur at dusk and dawn immediately preceding the felling as it is possible for bats to enter or leave a roost without being detected, or to not leave the roost for a night. It is strongly recommended that a night vision aid is used for emergence watches to reduce the risk of missing bats if they leave after it becomes too dark to see.	Removal of a roost should not occur. If no bats are observed entering or exiting for two consecutive dusk and dawn watches, the vegetation can be removed on the day immediately following the final dawn watch using the method in 5.	If more than one person is required for a roost watch at a tree, a minimum of one approved person accredited with Competency 3.2 must be present on site for the duration of the roost watch to supervise.	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 [11] (South Island) or 8°C (North Island) or greater at official sunset on the night before 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. Ensure that the tree climber is provided guidance from the competent bat worker about bat identification and care required when probing endoscopes into potential roosting features which may disturb bats.
- 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? See Appendix 1.

4b) ABM survey work

ABMs are to be used to record bat calls. Location of ABMs must provide sufficient coverage to be able to determine if bat roosts are present in one or more of the trees. 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

[11] 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.

detector (S. Cockburn, Department of Conservation, pers. comm.). This is similar detection distances of other detector types. Ensure the survey design Note that rain and wind can affect detectability because the sounds can have the same frequencies as bat calls. These sounds are picked up by bat detectors, potentially obscuring bat calls.

'Valid' survey nights must have the following features:

- Begin one hour before official sunset and end one hour after official sunrise.
- Temperature 8°C or greater for the first four hours after official sunset time for the North Island and 7°C for the South Island[12].
- Ideally no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with Competency 3.1.
- No to light wind within the first four 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 8°C all night between official sunset and sunrise for the North Island and 7 °C for the South Island.
- Ideally no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with Competency 3.1.

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 from at least 1 hour prior to sunset in the South Island and from ½ hour prior to sunset in the North Island until it becomes too dark to see by sufficient people to observe all potential exit points. This must be supported using handheld detectors, and consider the use of night vision aids which can detect bats once it becomes too dark to see. The aim of emergence watches is to identify potential roost locations within the vegetation. Infra-red and thermal imaging cameras will be useful in this process.

Roost re-entry watches

[12] South Island temperatures are based upon O'Donnell (2000) as above. North Island temperatures are based on Borkin et al. 2023. Influence of weather on long-tailed bat detection in a North Island exotic forest. New Zealand Journal of Ecology, Vol. 47, No. 1.

The time when bats return to roosts can vary based on temperature and time of year.[13,14]

- 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 person with the appropriate competencies, 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 the local DOC office if an active roost is found, detailing the results of the survey and outlining the measures for protection or relocating the roost tree. Advice must be obtained at a project level in writing from DOC prior to felling the tree. If you do not know the contact details for the office, you can phone 0800 ASK DOC (0800 275 362) or email info@doc.govt.nz.
- 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 two consecutive emergence/re-entry 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**		An approved person accredited with the relevant competency (based on method used) who are familiar with the 'Bat First Aid and veterinary care' documents shown in footnote[15], and physically able to	When the inspection method chosen allows.

[13] Dekrout AS. 2009. Unpublished PhD thesis. University of Auckland, New Zealand Pp 168.
[14] 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.

[15] Initial Veterinary Care for NZ Bats UPDATED 2023.pdf (doc.govt.nz) and Bat Care Advice for first responders 2023.pdf (doc.govt.nz) available at www.doc.govt.nz/bat-worker-resources

FOLLOWING SURVEY COMPLETION (i.e., if the survey ends in morning the tree can be felled the same day only). Trees must be inspected for signs of bats once felled and before removing from the site, if safe to do so. Follow Appendix 2 if bats are detected during vegetation removal.		check/inspect tree for signs of bats once felled.	

Appendix 1. Identification of guano.

Bat droppings ('guano') will superficially look like rodent droppings, being dark in colour and a similar size and shape to a large grain of rice. Bat droppings will easily crush under pressure (e.g., when squeezed between fingers) and will disintegrate into a dusty/crumbly substance in comparison to smearing (rodents). Where beetles form part of the bat's diet, crushed droppings can look shiny/glittery due to the presence of elytra. Larger colonies may leave piles of guano at the bottom of the roosting feature (Figure 1). Where individuals or small colonies are present, it is likely that only individual pieces of guano may be found, therefore careful inspection is needed.

Figure 1: Guano at the base of communal long-tailed bat roost. Photo: M. Choromanski

Appendix 2. If bats are detected during tree relocation or removal

NB: Vegetation removal must take place on the day of tree inspection, or the day roost watches have been completed or two consecutive nights of ABM data have confirmed that there are no bats present at that time. If practical, trees are to be inspected for signs of bats once felled and before removing from site. People inspecting trees should be familiar with the Bat Care Advice document shown in footnote[16] and able to check/inspect tree for signs of bats once felled.

If during the felling of a tree bats are detected, felling of that tree must stop immediately if safe to do so, and DOC and an approved person accredited with Competency 2.1 must be consulted.

If bats do not fly away or are potentially injured/found on the ground, felling can only re-start once permission has been obtained from DOC after consultation with an approved person accredited with Competency 2.1.

If bats are detected once the tree has been felled, all further work must stop, and DOC and an approved person accredited with Competency 2.1 must be contacted. The felled tree must be thoroughly inspected by them for further bats.

If any bats are found on the ground or in the tree once felled, place the bat in a cloth bag in a dark, quiet place at ambient (or slightly warmer) temperature and take to a veterinarian for assessment as soon as possible i.e. that day. A maximum of two bats should be kept in one bag. After delivering the bat to the vet, contact an approved person accredited with Competency 2.1 in consultation with the vet and DOC (0800 DOC HOT; 0800 362 468).

[16] Initial Veterinary Care for NZ Bats UPDATED 2023.pdf (doc.govt.nz) and Bat Care Advice for first responders 2023.pdf (doc.govt.nz) available at www.doc.govt.nz/bat-worker-resources

Bats must be kept for three days under observation and must be kept out of torpor for this time. Additional detail is found at the links provided in this footnote[17]. Vets must euthanise bats whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return to the wild. The approved person accredited with Competency 2.1 and the vet must consult with DOC to consider appropriate rehabilitation options where suffering is minimal and chances of return to the wild are high.

Euthanised bats or any dead bats (or bat parts) found must be handed to DOC and is a legal requirement under the Wildlife Act. If the bat is held for longer than 12 hours, store it in a food grade safe glass jar in the freezer to preserve the bat's smell for the potential use of training conservation dogs.

[17] Initial Veterinary Care for NZ Bats UPDATED 2023.pdf (doc.govt.nz) and Bat Care Advice for first responders 2023.pdf (doc.govt.nz) available at www.doc.govt.nz/bat-worker-resources

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Examples of natural and artificial bat roosts

TREES FOR HABITATS

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Habitat creation in trees for the New Zealand environment.

Hollows occur naturally in the old grove forests, mature exotics and native trees around New Zealand, and provide an opportunity to encourage biodiversity in our environments.

Natural hollows are a direct result of physiological stress to the tree, when the heartwood is exposed to the environment. This can be caused by environmental factors, fungi, bacteria, insects, natural canopy reduction and age.

Pruning for Biodiversity

Hollows for habitat creation can also be encouraged by human intervention. Pruning for biodiversity is commonly done in Europe, America and Australia and is called habitat pruning, eco-pruning or fracture pruning.

These types of pruning involve simulating natural break-outs in the tree to leave natural-looking stumps and branch tear-outs.

The Oak below has been left in Auckland Domain and is a great example of how declining trees can be an asset in speeding up the senescence in a tree and encouraging decaying wood to harbour a bigger biodiversity.

Auckland Domain, Oak.

Natural hollow in a Kauri

FACTORS TO CONSIDER WHEN CREATING HABITATS:

- **Various entrance hole and cavity sizes which will determine the different types of wildlife that might use them**
- **Protection from predators and pests**
- **Light minimisation for nocturnal wildlife**
- **Drainage**
- **Association with food crops**
- **Introduction of guano to encourage roosting sites**
- **Use of a vegetable oil as lubrication for your chainsaw bar**
- **Protection against prevailing wind and weather**

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TREES FOR HABITATS

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Habitat Creation in Trunk Wood

By chainsawing into the heartwood, habitats can be customised for numerous wildlife species. Here is an example of habitats we created for the long-tailed bat in standing trunks. (This requires good chainsaw knowledge as many of the cuts use the tip of the bar and can promote dangerous kickback.)

LONG-TAILED BAT HABITAT:

1. Cut into the trunk horizontally with two cuts at the desired height. Bore cut the face plate out.

2. Bore into the wood and make the chosen number of chambers. Cut the chambers into a fork-shaped pattern with the horizontal cut meeting the entrance hole (as shown in the picture). The entrance needs to be on a slope so it works as drainage. The size of the sloping entrance should be 17–21mm for long-tailed bats. Make sure the chambers are smaller than the face plate so that the hollow will be sealed.

3. Drill into the face plate and then screw the face plate back on to the wood.

Pest Proofing

Pest proofing the tree is important. On the trunk of the tree, below where the habitat is to be created, it is a good idea to mound around the tree's circumference a metal, aluminium or plastic sheath that predators cannot climb above. We tend to use polycarbonate joined with aluminium as it does not visually degrade the integrity of the tree as much. Make sure to prune neighbouring trees well clear of the host tree as possums can easily jump from one tree to another. For living trees, the pest guard needs to be revisited and checked to allow the expansion of the trunk.


Pest Guard

PEST GUARD EXAMPLE

1. Measure the tree and cut out the polycarbonate (60mm wide) with a 20mm overlap for joining with the aluminium bracket.

2. Drill into the aluminium and make three holes. Match up the middle hole with the plastic and drill into the plastic.

3. Tape the plastic tight to the tree and insert the aluminium bracket underneath the plastic.

4. Pop rivet the middle hole through the aluminium bracket and plastic.

5. Pull the plastic together and match up the top and bottom drill holes in the plastic and the aluminium bracket. A piece of wood could come handy to make sure there is no drilling into the tree.

6. If the tree has a natural taper, the guard can be moved downwards to get it as tight as possible.

Human-made constructions

Human-made constructions are also an alternative. Here is a bat house made for long-tailed bats; there are endless ways to make them and numerous materials that might be used. These constructions could harbour any type of wildlife depending on construction type.

TREES FOR HABITATS

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Relocation of Habitats

Relocation of habitats is sometimes required. For example, relocation would be needed in tree failures or trees that are condemned for removal. The tree wood containing the habitat can be safely lowered to the ground by rigging and can be re-erected onto living trees. With the help of familiar pheromones, the wildlife could have a better chance of finding their way to the new roosting site. This has been shown to be successful for bats in the UK and we are now making trials in New Zealand and are excitedly awaiting results.

Many trees are being removed to ground level in urban environments due to factors such as:

- Changes in RMA
- Urban development
- Diseases and pests, such as Kauri Dieback, Dutch Elm and Cypress canker
- Declining and dying trees for public and structural safety
- Landscaping trends and poor knowledge.

By using some of the techniques discussed in this text, we could enhance biodiversity by leaving trunks as new habitats and still ensure safety for the public.

"We should always remember that the description 'dead wood' implies a static state, without consideration for the process of decay and the diversity of lifeforms involved." *(Andrew Cowan).*

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ENVIRONMENTAL, CLIMBING AND TREE CARE SERVICES

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Revegetation

For revegetation we could also apply some of these techniques to use in existing exotic trees. We might also use fast-growing exotic trees that could be transformed into desirable nesting spots to harbour many species essential to our ecosystem before the native trees reach their maturity.

As one tree species might be a problematic weed in Auckland but considered a specimen tree in the Waikato, it pays to talk to local Arborists, council, DOC or environmental organisations.

Some Factors to consider are:

- Will these trees become a weed infestation?
- What would you like to attract – invertebrates, birds or bats?
- Could the temporary exotic tree be easily be killed off after a desired period of time?
- Heavy fruiting and flowering could work as a food crop for birds but also pests.
- Will they naturally be good species to create hollows?
- What has been used in other projects around your area?

ABOUT THE LIVING TREE COMPANY

The Living Tree Company is an Auckland-based environmental arborist company with a passion for maintaining and improving New Zealand's unique natural environment. We are currently taking part in various trials for habitat creation and other ecological and arboreal projects. We believe the more work we do together the bigger and stronger the impact we can have. Please contact us with any enquiries or to share information.

This is an introduction to habitat creation in trees for the New Zealand environment. The text is prepared from an arboricultural standpoint and is to be used as an introductory discussion for ecologists.

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