From:	Official Information
To:	s7(2)(a)
Cc:	Official Information
Subject:	Final response - LGOIMA 377248 - s7(2)(a) - Copy of reports for Consent 11.2018.6695.001
Date:	Friday, 26 January 2024 8:52:00 am
Attachments:	image001.png image002.jpg image003.jpg A17134 Amberfield Habitat Management Plan_FINAL_V1_20220519.PDF A17134 Bat Protection Plan_FINAL_20220519.PDF

Kia ora,

We refer to your information request below. Hamilton City Council provides the following response.

Your request:

> *I would like to view copies of the following management plans for the Amberfield development which have been approved by HCC Planning Guidance related to Consent number: 11.2018.6695.001*
> *"Bat Protection Plan: Amberfield. Prepared by Boffa Miskell Ltd. for Weston Lea Ltd.19 May 2022."*
> *"Habitat Management Plan: Amberfield. Prepared by Boffa Miskell Ltd. for Weston Lea Ltd. 19 May 2022".*

Our response:

Please see the two reports attached.

You have the right to seek an investigation and review by the Ombudsman of this decision. Information about how to make a complaint is available at www.ombudsman.parliament.nz or freephone 0800 802 602.

Ngaa mihi
Keeley Faulkner
Official Information Coordinator
Governance & Assurance Team | Business Services
Email: officialinformation@hcc.govt.nz

I support flexibility at work. While it suits me to send this email now, I don't expect a response outside of your own working hours.

From: noreply@hamilton.govt.nz <noreply@hamilton.govt.nz>
Sent: Tuesday, January 23, 2024 9:25 AM
To: Official Information <officialinformation@hcc.govt.nz>
Subject: OIA Request - HCC-OIA-240123-GL0OP

We've received a request for you.

This request was received on 23 January 2024 @ 9:24AM.

Here's your reference number and the request details:

UUID
HCC-OIA-240123-GL0OP

Name
s7(2)(a) [redacted]

Email
s7(2)(a) [redacted]

Phone number
s7(2)(a) [redacted]

Detailed description of request
I would like to view copies of the following management plans for the Amberfield development which have been approved by HCC Planning Guidance related to Consent number: 11.2018.6695.001

"Bat Protection Plan: Amberfield. Prepared by Boffa Miskell Ltd. for Weston Lea Ltd.19 May 2022."

"Habitat Management Plan: Amberfield. Prepared by Boffa Miskell Ltd. for Weston Lea Ltd. 19 May 2022".

Many thanks for taking the time to consider my request.

Organisation
Attachments
Created
23 January 2024 @ 9:24AM

If you have any questions in the meantime, feel free to call us on (07) 838 6699 or email our customer service team.

Hamilton City Council
260 Anglesea Street
Hamilton 3204

MANAGEMENT PLAN
Certified/Approved by
HCC PLANNING GUIDANCE
Date: 27 July 2022
Consent number: 11.2018.6695.001

Boffa Miskell

Habitat Management Plan

Amberfield
Prepared for Weston Lea Ltd

19 May 2022

Boffa Miskell is proudly a
Toitū carbonzero® consultancy

Document Quality Assurance

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Appendices

Appendix 5: Planting Timed with Conditions

1.0 Introduction

1.1 Project background

Weston Lea Limited proposes to develop a major new settlement of the Amberfield site within the Peacocke Structure Plan area of Hamilton City. The site is located in the Hamilton South area on the western bank of the Waikato River. As part of the consenting requirements a Habitat Management Plan (HMP) is required to mitigate against the potential adverse ecological effects of the large-scale development.

The riparian margins of the Waikato River are retained and a network of open spaces including neighbourhood parks, amenity open space, shared walking and cycling pathways, and an archaeological / heritage reserve are proposed.

Long tailed bats are classified as Threatened – Nationally Critical due to habitat loss and predation. Uniquely, long tailed bats frequent the urban fringes of Kirikiriroa/ Hamilton City, despite the modified environment and the absence of lowland indigenous forest that is the natural habitat of this species. Native bats are aerial insectivores, adapted to forage along bush margins, over water and above vegetation canopies for small flying insects. Long-tailed bats roost in trees with knots and loose bark, and switch roosts often. Long-tailed bats are highly mobile and may travel many kilometres between roost sites and foraging grounds.

Bat monitoring as part of ecological assessments of this and other development projects have determined that the Waikato River provides an important corridor that long tailed bats routinely use to move through the landscape. The network of incised gully systems that surround the tributaries of the Waikato River provide vegetated corridors that appear to help bats navigate the surrounding modified landscape to access habitat features such as waterbodies and forest remnants. Several years of monitoring for this project have determined that bats frequently use a narrow shelterbelt of intersecting the site as a thoroughfare, apparently to move between the Waikato River and other habitat features to the west. Monitoring recorded a relatively low frequency of bat activity across pasture areas in the wider site. Two bats were also detected solitary roosting on trees within the site during a radio telemetry study of radio-tracked bats in the wider landscape.

As part of the consenting requirements, a Habitat Management Plan (HMP) is required to mitigate potential adverse ecological effects of the development on long-tailed bats. This plan, in comparison to the Bat Protection Plan, focuses on the habitat creation through planting, protection, and management. The riparian margins of the Waikato River are retained and a network of open spaces including revegetated corridors, neighbourhood parks, amenity open space, shared walking and cycling pathways, and an archaeological / heritage reserve are proposed.

A site context map is provided as Figure 1 which provides the site boundary and the areas defined as Bat Priority Areas (BPA).

1.2 Ecological context

The site is located within the Hamilton Ecological District (HED) on a low terrace adjacent to the Waikato River. The Waikato River runs along the eastern side of the site with stepped terraces giving way to steep riverbanks. A minor gully (“the southern gully”) intersects the eastern river

terrace and western slopes in the south of the site. On the opposite side of the river to the site is the Mangaonua Gully, and the Mangakotukutuku gully is located west of the site.

The current/ predevelopment land use is predominantly agricultural with some rural lifestyle dwellings. Historic clearance has removed almost all of the original indigenous vegetation and indigenous vegetation is now restricted to the steep river and gully banks and some isolated plantings. Kahikatea-pukatea-tawa forest[1] would have dominated the site and surrounding land prior to human settlement and vegetation clearance.

Within the site there are two Significant Natural Areas (SNA) under the Hamilton City Operative District Plan: SNA 54 and SNA 48. SNA 54 is a 3.3 ha kānuka/mahoe-privet forest that runs along the Waikato River and SNA 48 is a 2.4 ha kānuka-privet-mamaku forest. As most of the SNAs in the area are associated with the Waikato River and Mangakotukutuku and Mangaonua gullies, the site is close to several of the gully complex SNAs.

1.3 Site and bat mitigation response overview

Figure 1 provides an overview of the site and areas identified for management as bat habitat ("Bat Priority Areas"). The focus of the mitigation response on the Amberfield site is, in general, within the area designated as the BPAs which cover the Waikato River Margin, including natural landscape features referred to as the North-East Terrace, Southern Gully, East-West Shelterbelt, and Knoll Park. The mitigation requirements for the site, and approach to implementation, are specified in a detailed set of conditions, which cover site controls such as construction protocols and landscape design aspects of the development, as well as direct ecological requirements.

The mitigation approach is relatively consistent through the entire BPA, however there are specific features and interventions which do differ between locations.

The general approach which is common across the BPA areas are:

- Retention, and continued protection of, existing potential roost trees.
- Retention of existing vegetation that provides a buffer to the Waikato River and/or provides buffering from proposed development.
- Lighting controls and performance standards on the boundary of the BPA and adjacent residential areas.
- Permanent fencing and temporary screening to block light and reduce disturbance.
- Pest animal control.
- Prioritised pest plant control (within the constraints of the vegetation retention above).
- Planting of native vegetation to provide long-tailed bat habitat and buffer protected habitats from development effects (artificial light primarily).
- Installation of artificial roost boxes.
- Planting of non-native trees which veteranise quickly compared to natives to provide roosting features such as knot holes.

[1] Manaaki Whenua Landcare Research: Our Environment, https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Suitability/lri_arable_suitability, accessed 24/08/2021.

- Monitoring using bioacoustic and thermal imagery methods.
- Provision of open “Meadow” spaces to create structural complexity, vegetation edges, and insect food sources for bat foraging.

Location or feature specific approaches are also employed at several locations throughout the site. These include:

- **North-East Terrace**; Sensitive habitat area of relatively high bat activity (compared to the rest of the site) and in close proximity to Hammond Park. Road and residential edge buffering required to be higher to prevent light entering Hammond Park and the Waikato River.
- **Knoll Park**; Elevated area with a cluster of old exotic trees – area included and retained as a park-like habitat with open spaces retained in many areas to encourage bat foraging and roosting in existing old trees.
- **East-West Shelterbelt**; Important linear feature comprising of an existing casuarina and alder shelterbelt which has relatively high bat activity and provides a movement corridor across the site from the river. Two internal roads bisect the feature - Roads 001 and 002. The approach includes providing a sheltered flyway on both sides (north and south) of the existing shelterbelt which is then buffered from adjacent development by planting and fencing on the northern and southern edges. The existing shelterbelt is to be underplanted to eventually replace existing non-native trees which may have a limited life span. Roads 001 and 002 are designed with plantings included to minimise any canopy gap, limit light spill into the BPA, as well as encouraging bats to fly at a height above the road surface sufficient to avoid potential collision with traffic.
- **Southern Gully**; Significant topographical feature on the site which is currently sparsely vegetated other than pasture. Has relatively low levels of bat activity compared to features further north (presumed due to the lack of vegetation and connectivity through the feature) but still utilised by bats. Has two vehicular crossings through it - one bridge and one embankment crossing which occurs at the location of an existing raised farm track. The approach in this location is widescale forest? restoration. The approach to the roads and bridge are similar as that described for Roads 001 and 002 above, with additional design/intervention on the bridge to encourage flight under/over the bridge. The bridge is designed in such a way to avoid light spill into the gully below as well as incorporating barriers to bat flight across the bridge at traffic height.

In addition to the mitigation responses in the BPA areas, multiple site controls include:

- Prevention of construction works onsite in the times where bats are most active,
- Prevention and control of access to the BPA areas by construction equipment,
- Protections and procedures to be followed during vegetation clearance, and
- Protections of potential roost trees (and all trees in the East-West Shelterbelt) in the vicinity of earthworks (but not directly impacted).

There requires a high level of understanding and awareness across the site to effectively implement and control the activities to ensure this management plan and the other supporting plans and drawings are complied with.

The following sections of this plan provide the details of the required actions in all these locations, and must be read with reference to the drawing sets and supporting plans outlined in Section 3.0 and referenced throughout the plan.

Figure 1: Amberfield site - context map. Dark and light green shaded areas are Bat Priority Areas. Dark green is existing Waikato River margin vegetation to be retained.

1.4 Plan purpose & objectives

This HMP has been developed to provide a framework to mitigate the adverse ecological effects of the proposed development and to improve the overall ecological value of the site as required by the Hamilton City Council Consents 11.2018.6695.01 & 10.2018.9853.01. This includes enhancing habitats for native fauna such as long-tailed bats (*Chalinolobus tuberculatus*) which have a threat status of Threatened - Nationally Critical (O'Donnell et al., 2018). The objectives and relevant consent conditions related to HMP is provided below in Table 1. Specifically Condition 73.

The plan identifies the pest animal and pest plant threats impacting the ecological value of the site. Recommended control measures are provided, including methods to monitor the ongoing presence of these threats. Detailed planting plans are designed for the Waikato River Margin, Southern Gully, East-West Shelterbelt and Knoll Park to improve habitats for avifauna, lizards and long-tailed bats on site. A native planting and pest animal and pest plant control schedule is also outlined in this report.

This HMP focuses on providing habitat enhancement recommendations for terrestrial habitats. Freshwater and riparian habitat enhancement recommendations are covered in an Aquatic Habitat Enhancement Plan (AHEP). We note that due to the timing of this management plan being in advance of multiple other management plans and, to some degree, engagement steps with stakeholders. We are aware that some steps, processes, or management approaches may be added to the processes outlined within this HMP.

Table 1: Relevant consent conditions required for the Habitat Enhancement Plan at the Amberfield site.

Conditions	Reference
73. The objectives of the Management Plans referred to in Condition 74 shall be as follows: a) To protect the Bat Priority Areas by avoiding adverse effects on the function of the habitat, in terms of commuting, foraging and socialisation. b) To enhance the values and attributes of bat habitat within Bat Priority Areas, including by providing a full range and extent of vegetation types, including linear features and mature trees, for the long-tailed bat and other fauna; c) To enable long-tailed bats to thrive by: i) avoiding the adverse effects of lighting and noise within the Bat Priority Areas; ii) protecting the bats from predation; iii) banning ownership of cats and mustelids within Amberfield; iv) protecting roosting sites within the Bat Priority Areas; and v) avoiding injury and/or mortality of roosting long-tailed bats during any tree removal. d) To protect native lizards and native birds during Construction Works.	General management plan condition.
84. The Waikato River Margin, Southern Gully, East-West Shelterbelt and Knoll Park shall be planted for the purpose of mitigating adverse ecological effects of the development. The planting shall be carried out and established in general accordance with: (a) For the Waikato River Margin and the Southern Gully, Boffa Miskell Drawing A17134 054 Revision N Gully and Esplanade Reserve Vegetation	Section 4.4

Conditions	Reference
Strategy 24 February 2021 (Schedule A7), Boffa Miskell Drawing A17134 081 Addendum Figure 3 North Eastern Terrace Concept Plan Rev E dated 29 March 2021 (Schedule A11), Boffa Miskell Drawing A17134_060 Revision F Cross Section Location Plan 24 February 2021 (Schedule A13), Boffa Miskell Drawing A17134 061 Cross Sections Rev D dated 23 July 2020 (Schedule A14), Boffa Miskell Drawings A17134_093a and 093b Revision C Gully Sections 24 February 2021 (Schedule A15) and Boffa Miskell Drawings A17134_094a and 094b Revision C Southern Waikato River Margin Sections DD and EE 22 February 2021 and Drawings A17134_094c and 094d Southern Waikato River Margin Sections FF and GG 22 February 2021 (Schedule A16); (b) For the East-West Shelterbelt, Boffa Miskell Drawing A17134 083a Indicative Shelterbelt Planting Strategy Plan Rev W 29 June 2021 (Schedule A9) and Boffa Miskell Drawing A17134 083b Shelterbelt Cross Section AA Rev Q 29 June 2021, Drawing A17134 083c Shelterbelt Cross Section BB Rev P 29 June 2021 and Drawing A17134 083d Shelterbelt Cross Section CC and Rev B 29 June 2021 (Schedule A10); (c) For Knoll Park, Boffa Miskell Drawing A17134_130 Knoll Park Landscape Concept Rev H dated 29 June 2021 (Schedule A20); (d) the species list set out in Schedule A17; (e) the relevant requirements in conditions 85 to 94.	
85. For indigenous plants, all plantings shall be eco-sourced (Hamilton Ecological District) plant species appropriate to the locality, and the ecosystem type being restored (i.e. the ecosystem type would have occurred at the locality under natural conditions). These indigenous species shall be represented in appropriate diversity, proportions, cover, and configuration as would be expected for natural examples of the same ecosystem types within the Hamilton Ecological District	Section 4.3.1
86. The planting shown on Boffa Miskell Drawing A17134 Proposed Early Planting Outside of Earthworks Extent Rev 9 dated 24 February 2021 (Schedule A8) within Waikato River Margin Lots 1502, 1503, 1508 and 1518 shall be established prior to Construction Works commencing and no later than the first planting season following the provision of a Commencement Notice. This planting shall be completed to address the requirements in conditions 84 and 85.	Section 4.4.1
87. The East-West Shelterbelt shall be retained and enhanced as bat habitat with corridor enhancement planting and underplanting beneath the existing shelterbelt so as to maintain a movement corridor for bats across the site that shelters the bats from the light and wind, and to provide for foraging and socialising by bats. The new underplanting of the existing shelterbelt shown on Boffa Miskell Drawing A17134 083a Indicative Shelterbelt Planting Strategy Plan Rev W 29 June 2021 (Schedule A9) and Boffa Miskell Drawing A17134 083b Shelterbelt Cross Section AA Rev Q 29 June 2021, Drawing A17134 083c Shelterbelt Cross Section BB Rev P 29 June 2021 and Drawing A17134 083d Shelterbelt Cross Section CC and Rev B 29 June 2021(Schedule A10) within Lots 1506 and 1510 shall be established prior to Construction Works commencing and no later than the first planting season following the provision of a Commencement Notice. This planting shall be completed to address the requirements in conditions 84 and 85.	Section 4.4.6.1
88. The 10m width of early planting shown on Boffa Miskell Drawing A17134 Proposed Early Planting Outside of Earthworks Extent Rev 9 dated 24 February 2021 (Schedule A8) shall be planted along all of the Waikato River Margin and along the Southern Gully to minimise light spill into the river corridor, Hammond Bush and the gully prior to Construction Works commencing and no later than the	Section 4.4.1

Conditions	Reference
first planting season following the provision of a Commencement Notice. This planting shall be completed to address the requirements in conditions 84 and 85.	
89. The following planting shall be completed no later than the third planting season following the provision of a Commencement Notice, excluding the stormwater management devices and subject to any requirements of the Aquatic Habitat Enhancement Plan (which is a requirement of the Waikato Regional Council resource consent AUTH139498.03.01): (a) the remaining planting along the Waikato River Margin north of the gully within Lots 1508 and 1518 which is outside of the earthworks extent shall be completed to address the requirements in conditions 84 and 85 and in accordance with the certified Habitat Management Plan required by condition 74; (b) the remaining planting within the Southern Gully within Lots 1507, 1509 and 1516 which is outside of the earthworks extent, excluding the planting required under condition 91, shall be completed to address the requirements in conditions 84 and 85 and in accordance with the certified Habitat Management Plan required by condition 74.	Section 4.4
90. The remaining planting along the Waikato River Margin south of the Southern Gully within Lots 1512 and 1514 which is outside of the earthworks extent shall be completed to address the requirements in conditions 84 and 85 and in accordance with the certified Habitat Management Plan required by condition 74. The planting shall be completed no later than the fifth planting season following the provision of a Commencement Notice, excluding the stormwater management devices and subject to any requirements of the Aquatic Habitat Enhancement Plan (which is a requirement of the Waikato Regional Council resource consent AUTH139498.03.01).	Section 4.4
91. The remaining planting within the Southern Gully which is within 50m of the bridge crossing and within Lots 1507 and 1509 shall be completed to address the requirements in conditions 84 and 85 and in accordance with the certified Habitat Management Plan required by condition 74 by the first planting season following practical completion of the bridge.	Section 4.4
91A. The remaining planting within the East-West Shelterbelt within Lots 1506 and 1510 and within Roads RD001 and RD002 and within Knoll Park within Lot 1517 shall be completed by the first planting season after the earthworks is completed in Stages 1, 5 and 6 to address the requirements in conditions 84 and 85 and in accordance with the certified Habitat Management Plan required by condition 74.	Section 4.4
92. The remaining planting within the earthworks extent shall be completed by the first planting season after the earthworks is completed in each construction stage to address the requirements in conditions 84 and 85 and in accordance with the certified Habitat Management Plan required by condition 74.	Section 4.4
93. Detailed planting plans and planting and maintenance specifications to address the early planting requirements in Conditions 86 to 88 shall be prepared and submitted to the HCC Planning Guidance Unit Manager or nominee for certification prior to planting commencing within each respective area. Maintenance specifications shall include weed control and pest plant control and animal control necessary to ensure the successful establishment of the plants.	Section 4.4
94. The Consent Holder shall maintain all of the ecological mitigation planting required by condition 84 until the following requirements have been met. Confirmation that the requirements have been met shall be determined by a suitably qualified ecologist who shall provide written confirmation of the same to the HCC Planning Guidance Unit Manager or nominee:	Section 4.5 and 4.6

Conditions	Reference
(a) 4 m average height and 80% canopy closure in the vertical plane for the planting comprising the “Buffer planting area located in natural ground not dependent on earthworks” as shown on Boffa Miskell Drawing A17134 081 Addendum Figure 3 North Eastern Terrace Concept Plan Rev E dated 29 March 2021 (Schedule A11) and the “Buffer”, “Gully” and “Bat Crossing” areas identified under “10m Width of Early Planting” as shown on Boffa Miskell Drawing A17134 Proposed Early Planting Outside of Earthworks Extent Rev 9 dated 24 February 2021 (Schedule A8); (b) 4 m average height and 80% canopy closure in the vertical plane for the planting adjacent to Road RD002 comprising the “Buffer planting areas to follow earthworks” shown on Boffa Miskell Drawing A17134 081 Addendum Figure 3 North Eastern Terrace Concept Plan Rev E dated 29 March 2021 (Schedule A11), which is also referenced as “buffer planting” shown on Boffa Miskell Drawing A17134 061 Cross Sections Rev D dated 23 July 2020 (Schedule A14); (c) 4 m average height and 80% canopy closure in the vertical plane for the planting on Lots 1506 and 1510 comprising the “Corridor Enhancement Planting” as shown on Boffa Miskell Drawing A17134 083a Indicative Shelterbelt Planting Strategy Plan Rev W 29 June 2021 (Schedule A9) and Boffa Miskell Drawing A17134 083b Shelterbelt Cross Section AA Rev Q 29 June 2021, Drawing A17134 083c Shelterbelt Cross Section BB Rev P 29 June 2021 and Drawing A17134 083d Shelterbelt Cross Section CC and Rev B 29 June 2021 (Schedule A10); (d) For the remaining planting, for a minimum of 5 years. If monitoring shows that a density and diversity of species has not been achieved in accordance with the certified Habitat Management Plan after 5 years, then the maintenance period shall be extended until such time as it is achieved; (e) For the planting required to be undertaken in (d) above, the Consent Holder shall provide advice in writing to the HCC Planning Guidance Unit Manager or nominee from a suitably qualified ecologist to confirm when each stage of planting has been undertaken in accordance with the certified planting plans.	
95. The Consent Holder shall submit a Planting Monitoring Report to the Planning Guidance Unit Manager and to the Bat and Habitat Enhancement Review Panel from the first stage of planting and annually thereafter for the duration of the respective maintenance periods described in Condition 94. The report shall include the following information: (a) Success rates, number and location of plants lost and replacement of dead plants; (b) Height and vertical canopy closure for the planting identified in condition 94(a), (b) and (c), along with species density and diversity; (c) Animal and weed pest control; and (d) Recommendations for changes to the Habitat Enhancement Sub-Plan (if any).	Refer to section 4.6
96. A Habitat Enhancement Sub-Plan shall be prepared to satisfy the requirements of conditions 83 to 95 and shall include:	Section 4.0

Conditions	Reference
(a) Detailed planting plans and planting and maintenance specifications for the Early Planting Prior to Construction works to address the requirements in conditions 86 to 88, as certified under condition 93; (b) Detailed planting plans and planting and maintenance specifications for the Southern Gully to address the requirements in conditions 89(b), 91 and 92, including plant species, densities and habitat design for avifauna, lizards and long-tailed bats which shall be developed in collaboration with ecologists with suitable expertise and experience in these areas and in consideration of the Gully restoration guide: a guide to assist in the ecological restoration of Hamilton's gully system. Wall, K and B.D. Clarkson 2006: Third Revised Edition, Hamilton City Council. Specific planting design measures shall be incorporated into the detailed planting plans to facilitate bat movement over or under the bridge crossing and over the culvert crossing of the Southern Gully; (c) Detailed planting plans and planting and maintenance specifications for the Waikato River Margin to address the requirements in conditions 89(a), 90 and 92; (d) Detailed planting plans and planting and maintenance specifications for the East-West Shelterbelt and Knoll Park to address the requirements in condition 91A; (e) How any planting related requirements of resource consent AUTH139498.04.01 issued by Waikato Regional Council will be met; (f) A vegetation maintenance plan for new plantings within the Bat Priority Areas. The maintenance plan shall include weed control and pest plant and animal control necessary to ensure the successful establishment of the plants and the ongoing replacement of plants that do not survive during the maintenance period. The vegetation maintenance plan shall relate to all vegetation, including the maintenance requirements for the early planting certified in accordance with condition 93; (g) Measures to reduce the risk of the spread of diseases such as Myrtle Rust and Kauri dieback; and (h) The monitoring methodology to be used to prepare the Planting Monitoring Report required by condition 95.	
97. The certified Habitat Enhancement Sub-Plan shall be implemented for the duration of earthworks and the planting for each stage of construction and for the maintenance periods described in condition 94.	Procedural condition.
111. All trees within Bat Priority Areas which are ≥ 15 cm diameter at breast height and that provide or potentially provide roost habitat and buffering of light for long-tailed-bats shall be retained, unless: (a) any such trees are within two times its height from a road, designed path or residential lot and are recommended for removal by a suitably qualified and experienced arborist due to presenting a significant danger to the public; (b) the trees are within the Waikato River Margin and are required to be removed due to being within the areas subject to Earthworks;	Refer to section 4.2.2 and BPP.

Conditions	Reference
(c) the trees are within the Southern Gully and are required to be removed due to being: (i) within the areas subject to Earthworks; or (ii) within 5m of the outer edge of the areas subject to Earthworks and not being able to be retained due to the construction requirements to complete the Earthworks, or due to impacts on tree health or stability making their retention not possible, as determined by a suitably qualified and experienced arborist. (d) the trees are within the East-West Shelterbelt or within Lots 1503, 2015 or 2035 and are required to be removed in accordance with condition 114.	
134A. The requirements in either (a) or (b) shall be met prior to s224(c) certification for any subdivision stage containing roads which immediately adjoin the Bat Priority Areas (Stages 1, 4, 5, 6, 6A, 13, 24, 25, 26, 27 and 28): a) The Road Side Buffer Planting shown on Boffa Miskell Drawings A17134_054A Vegetation Strategy – Buffer Planting dated 18 June 2021 (Schedule A18) shall be established within the Bat Priority Areas adjoining the roads within the subdivision stage to achieve the following performance standards: i. 1.4m height and 80% canopy closure in the vertical plane for the 'Road Side Buffer Planting >1.4m High' and 'Road Side Buffer Planting 1.4m High (3.0m Wide)' and 'Road Side Buffer Planting 1.4m High (5.0m Wide)'; and ii. 1.8m height and 80% canopy closure in the vertical plane for the 'Road Side Buffer Planting >1.8m High' and 'Road Side Buffer Planting 1.8m High (3.0m Wide)'; and iii. Compliance with (i) and (ii) shall be demonstrated through a report (or reports) prepared by a suitably qualified and experienced ecologist being provided to the satisfaction of HCC's Planning Guidance Unit Manager (or nominee). b) If the Road Side Buffer Planting has not achieved the performance standards in (a) at the time of s224(c) certification, temporary screen fencing shall be established as an alternative to achieve the applicable height standards in (a)(i) and (ii). The design of the temporary screen fencing shall be suitable to prevent light from passing through the fence and shall be in accordance with the certified Bat Protection Plan. *Advice Note: For the avoidance of doubt, the Road Side Buffer Planting must also comply with the relevant requirements in conditions 84 to 94.*	Section 4.4.6.4 – Refer to Bat Protection Plan for fencing detail.
134AA. The Road Side Buffer Planting shall be designed in a way that minimises light spill into Bat Priority Areas in locations where access is required between public roads and Bat Priority Areas for pedestrian, cycling and maintenance purposes.	Section 4.4.6.4

1.5 Cultural perspective

While this management plan, as noted in the above section, is in advance of a significant body of work for the engagement and design processes for the Amberfield development, We have developed this HMP with consideration to the Tai Tumu, Tai Pari, Tai Ao and Te Ture Whaimana o Te Awa o Waikato and ensured alignment with the vision and strategies contained therein.

In general the ecological concepts within this HMP including the; planting of a significant length of the Waikato River Margin, the enhancement within the BPAs, the pest control, and the habitat designed to facilitate and encourage long-tailed bat (pekapeka) use of the area align well with the aspirations outlined within these plans.

On a more detailed level our plant selection throughout has considered the historical importance and whakapapa of the area and incorporated species that are relevant to the history and historical usage of the site. This includes the use of species that once were prolific along the Waikato River Margin (and in some cases still occur), the use of rongoa species throughout the plantings, as well as concentrating important species in accessible places such as along footpaths (for an example refer to the species mix used for roadside buffer planting in the northeast terrace which has included kumarahou, koromiko, karamu, and kanuka), and the usage of species which have given areas nearby their names such as planting kotukutuku in shady areas in the Knoll Park where we are able to in reference to the Mangakotukutuku.

2.0 Existing ecological values on site

The following provides a brief description of the vegetation, bat, lizard, and avifauna ecological values within the site. A detailed description of these ecological values is provided in the Ecological Effects Assessments report prepared by Boffa Miskell Ltd (2018). The Environment Institute of Australia and New Zealand (EIANZ) impact assessment guidelines (Roper-Lindsay et al., 2018) was used to determine the ecological values on site. A site walkover to provide a more recent ground truth of the site data was carried out in September 2021.

2.1 Vegetation

The site is dominated by exotic pasture grassland. The majority of the non-pasture vegetation features occur along the Waikato River corridor and along the Southern gully escarpments. The vegetation on site has been classified into several different vegetation types, most of which (including the non-pasture vegetation) are exotic in composition (Boffa Miskell Ltd, 2018). Though, the vegetation assemblage along the Waikato River Corridor is variable, containing a mixture of native and non-native dominated areas. The proposed development is set to result in loss of mostly low value vegetation that represents a very low level of effect (Boffa Miskell Ltd, 2018). Although potential effects of the development on vegetation within the site is very low, it has been identified that there is a significant opportunity to enhance the ecological value of the area.

2.2 Bats

Acoustic surveys conducted by Boffa Miskell Ltd (2018) confirmed that long-tailed (*Chalinolobus tuberculatus*) bats regularly commute through the site and occasionally forage around habitat features such as shelterbelts. The patterns of activity recorded indicate that the site provides habitat connectivity for bats between the surrounding Hammonds Bush - Mangaonua gully area and the Mangakotukutuku gully, all of which are key remaining landscape features for long-tailed bats. The surveys also found that the site contains potential roost habitats. Given the Threatened – Nationally Critical threat status of long-tailed bats, and the above findings on their

use of the habitats available onsite, the ecological value of the site for long-tailed bats has been assessed as Very High.

2.3 Lizards

Based on the available habitats, a review of the New Zealand Herpetofauna Bioweb database, and the land use history of the site, it is likely that the only native lizards present on site are copper skinks. The conservation status of copper skinks has recently been updated from Not Threatened to At Risk - Declining (Hitchmough et al., 2021).

Potential copper skink habitats were identified throughout the project footprint. The site was found to contain low, medium, and high-quality copper skink habitats that included dense undergrowth vegetation, natural and artificial debris, and long rank grass. The majority of the site is grazed pasture which provides negligible lizard habitat value.

Copper skinks are relatively widespread in low numbers throughout the wider Hamilton area. In addition, copper skinks are likely to be present (if at all) in very low densities and potentially below detectability levels due ongoing predation by mammalian predators. For these reasons the ecological value for native lizards on site was assessed as Low.

2.4 Avifauna

Avifauna surveys and incidental searches revealed the site is visited or inhabited by at least 25 species, comprised of 13 native and 12 exotic species (Boffa Miskell Ltd, 2018). In terms of abundance, the avifauna assemblage was found to be dominated by naturalised introduced species which are common in the agricultural landscape surrounding Hamilton such as common starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), and European goldfinch (*Carduelis carduelis*). The native birds present were all widespread and common species such as silvereye (*Zosterops lateralis*) and pukeko (*Porphyrio melanotus*). No threatened or at-risk species were detected.

At Risk - Recovering species such as North Island kaka (*Nestor meridionalis*), pied shag (*Phalacrocorax varius*) and dabchick (*Poliocephalus rufopectus*), and At Risk – Naturally Uncommon species such as black shag (*Phalacrocorax carbo*) and little black shag (*Phalacrocorax sulcirostris*) which have been found in previous Hamilton surveys (Cornes et al., 2012; Fitzgerald & Innes, 2013) could utilise the site, but are likely to be relatively rare visitors. The shag species and dab chick are likely to primarily be associated with the Waikato River.

Riparian habitats within the site have been assed as having a Medium – High ecological value for avifauna due to being potential habitat for shag species, with the reminder of the surveyed site having Low ecological value for avifauna

3.0 Management Plan Framework

There are several interrelated management plans relevant to this HEP.

The management plan structure for the Amberfield development is provided below for reference. Several Detailed Planting Plans are relevant and are referenced across multiple management plans and have been developed to provide the spatial, planting, and design information.

Habitat Management Plan (HMP):

- Habitat Enhancement Plan
    - The conflicts of bat habitat and traditional restoration
    - Threat management
    - Planting methods
    - Planting plan
    - Planting maintenance
    - Performance standards and reporting
- Avifauna Management Plan
- Lizard Management Plan
- Appendices
    - Avifauna Management Plan (Appendix 1)
    - Lizard Management Plan (Appendix 2)
    - Aquatic Habitat Enhancement Plan (required by WRC Consent) (Appendix 3)
    - Early Planting Plans and Specifications (Appendix 4)
    - Planting Timed with Conditions (Appendix 5)

Bat Protection Plan (BPP):

- Bat habitat protection
- Vegetation Removal and Protection Protocols
- Roads RD001 and RD002 Design
- Southern Gully Bridge and Embankment Crossing Design
- Temporary Screen Fencing
- Artificial Bat Roost Boxes
- Predator Control (bat related discussion – refer to HMP for methods)
- Bat Monitoring
- Bat Monitoring Report
- Long-Term Future of the Site
- Appendices:
    - Tree Fell Protocol
    - RD001 East - West Shelterbelt Layout Plan – Harrison Grierson

- RD002 East - West Shelterbelt Layout Plan – Harrison Grierson
- Northern Amberfield Development Visual Tree Inspection – Treelands
- Previous Long-tailed Bat Survey Data
- Doug Armstrong - Evaluation of bat monitoring plan for Boffa Miskell

Planting plans, designs and cross sections referred to across both HMP and BPP and supplied with this management plan:

- Amberfield Subdivision - Bat Protection Plan - Landscape Architecture Drawing Set:
  - Bat Monitor Location Plan (also maps artificial roost box location. However, ref. detailed planting plans for more detailed mapping).
  - Artificial Bat Roost - Typical Detail.
  - Temporary Screen - Typical Elevation.
  - Southern Gully Bridge Crossing – Planting Plan and Cross Sections.
  - Embankment Crossing – Planting plan and Cross Sections.
- Amberfield Subdivision - Habitat Enhancement Sub-Plan River Margin and Southern Gully;
  - Detailed Planting Plans including detailed Artificial Roost Box Location.
  - Typical Planting Plan – Roadside buffers.
- Amberfield Subdivision – Habitat Enhancement Sub-Plan - Knoll Park, RD001/RD002 and East West Shelter Belt:

4.0 Habitat Enhancement Plan

4.1 The conflicts of bat habitat and traditional restoration.

Much of the exotic vegetation within the BPAs on the Amberfield site has high ecological value due to the habitat and ecosystem services it provides to long tailed bats. There are conflicts between the objectives of this Habitat Enhancement Plan (HEP) drawn from consent conditions and conventional restoration approaches, which focus on the removal of pest plants and the restoration and recreation of native dominated vegetation resembling what would have once occurred at the location.

The primary focus of this HEP is to provide for and enhance habitat values for the long-tailed bat within the BPAs. As such, we have taken a structure, habitat, and ecosystem service emphasis over traditional revegetation-focused restoration.

In the long-term there are opportunities to transition exotic-dominated ecosystems to more indigenous communities, for example along the Waikato River Margin, where planting undertaken in accordance with this plan will ultimately take on the buffering and habitat functions the existing exotic vegetation provides. However, this transition would need to occur gradually and in a timeframe beyond that covered in this HEP and the Amberfield Subdivision

Consent[2]. Furthermore, ecological values of exotic species will still need careful consideration for example, large “pest plant” trees would still need to be retained for their value as prospective bat roosts.

Specific examples of unconventional restoration methods employed in this HEP and the rationale for this approach are outlined in the following sections.

4.1.1 Naturalised Meadows

Naturalised meadows are to be retained in the Waikato River Margin and Southern Gully. These areas are set aside as foraging habitat for long-tailed bats, and the existing pasture vegetation will be allowed to grow long without grazing, but with periodic mowing to prevent the invasion of pest plants such as blackberry and privet. These meadows will provide open areas and vegetation edges which are preferred by long-tailed bats away from the disturbance of the development.

Unimproved pasture/ rank grass supports an abundance of night flying insects, which are the main food source for bats. The key objective of this approach is therefore the creation of a habitat that provides invertebrates as a food source (rather than ecological restoration of invertebrate communities per se). This is particularly important given the transition from a primarily agricultural to an urbanised landscape will reduce such sources of invertebrates in the local area.

4.1.2 Waikato River Margin and Southern Gully

Invasive pest plants such as willow (*Salix* sp.) and privet (*Ligustrum* sp.) are common along the Waikato River Margin and within the Southern Gully. However, the requirements for this HEP and the accompanying BPP include protection of trees ≥ 15 cm diameter at breast height (DBH) that may provide potential roost habitat for long-tailed-bats and buffering of light except in limited circumstances.

Pest plants retained for bat habitat functions will nevertheless be an ongoing seed source for continued spread within the site and poses a risk to native revegetation efforts. Pest plant monitoring and management within planted areas will be a priority, particularly control of shade tolerant privet seedlings as the native revegetation begins to achieve canopy closure and shade out pasture grasses.

4.2 Threat management

The following identifies the pest animal and pest plants impacting the ecological values of the site. Control measures are provided, including methods to monitor the ongoing presence of these threats. Difficulties in managing the pest animal and pest plant threats within the increasingly urban landscape are also addressed.

4.2.1 Predator control

Pest animal control throughout all BPAs is will be implemented to protect long-tailed bats and other indigenous fauna from predation. We propose an adaptive predator control framework, to

[2] Refer to Condition 93 regarding timeframes for implementation of the HMP

be implemented in response to site wide population monitoring so that areas of higher predator activity are targeted as a priority. Monitoring will also be used to gauge the effectiveness of chosen control methods, detect development of bait or trap shyness, and enable a tactical approach to suppression of predator populations.

The pest animal control strategy assumes the wider landscape of the Peacocke Structure plan area is eventually incorporated into a cohesive pest animal control programme. We consider that pest animal control programmes aiming to protect highly mobile fauna such as long-tailed bats must carried out at a commensurate landscape level to be effective[3].

Table 2 identifies the pest animals likely present within the site, their recommended control methods, and control requirements.

To improve survival rates of any salvaged copper skinks, a targeted focus on pest animal control is required around the lizard release site located within the Southern Gully as outlined within the Amberfield - Lizard Management Plan (Appendix 2).

Animal pest control to protect native plantings will only be undertaken should monitoring determine that extensive damage is being caused to plants. Methods to control animal pests impacting on the establishment of native plantings will be determined based on the animal pest species and most practicable option for the area. We propose this adaptive approach as two years of early planting on site has been undertaken with no targeted pest animal control to protect plantings. Throughout the maintenance and monitoring periods no significant loss or damage of native plant numbers has been observed from pest animals and browsing pests do not currently appear to be a barrier to establishment of native vegetation at this site. This may change as the surrounding landscape changes.

Table 2: Animal pest control methods within BPAs for pests likely to be present within Amberfield. Control methods are based on guidelines provided by the National Pest Control Agencies.

Pest species	Method for Control	Project Pest Animal Control Requirements
Rodents (rats & mice) and possums.	Rats will be controlled using a bait station network (Philproof or similar bait stations) throughout the BPA.	Bait stations to be established at 30 - 50 m apart throughout the BPAs. The 30m intervals should be used where the width of the BPA habitat is <50m. And 50m intervals used in in a grid like pattern throughout the area where habitats are >50m wide. Toxic bait used can be any commercially available anti-coagulant bait registered for control of rodents and possums. For example, a diphacinone + cholecalciferol bait (although there may be restrictions on types of poison used in reserves). Control will initially be carried out over the spring-summer-autumn period (starting at the end of winter when rodent numbers are low) and maintaining bait availability throughout the spring, summer and autumn period. Bait stations in the initial knock down period may require weekly checks. When bait take begins to decline, checks can be extended out to once monthly (while ensuring a constant

[3] Subdivision consent conditions 142-144 require the consent holder to make monetary payments to HCC as a contribution towards a fund which may be used for this purpose.

Pest species	Method for Control	Project Pest Animal Control Requirements
		supply of bait to ensure all pests are able to access a lethal dose). All remaining bait should be collected at the end of the baiting season to prevent animals accessing a sub-lethal dose and potentially causing bait-shyness. Control methods, check frequency, toxin, station density, and control device location can be modified in response to monitoring results.
Mustelids (ferrets, weasels and stoats)	Mustelids will be targeted with a kill trap network throughout the BPAs.	A mixture of DOC 200 and DOC 250[4] (at a ratio of 4:1 respectively) traps will be deployed for controlling mustelids. Traps are to be 100m apart along the Waikato River Margin, East-West Shelterbelt, Knoll Park, and Southern Gully. Eggs can be used as a visual lure for these pests. Rabbit lure or chicken necks can also be used as a sent attractant for mustelids. Where possible, traps should be placed on drier areas, avoiding ground that is too boggy or wet. During the initial knockdown phase, traps should be checked fortnightly from October to April (when mustelids are more active), and monthly checks from May-September. When catch rates decline, these traps will be checked monthly throughout the year. Control methods, check frequency, trap density, and control device location can be modified in response to monitoring results.
Rabbits and hares	Control method to be in response to detected damage inhibiting the establishment of native vegetation and control methods are to be responsive to the damage detected.	Methods adaptive to observed plant predation or issues encountered.
Feral Cats	While the ownership of cats is not allowed within the Amberfield subdivision there remains a risk of neighbouring domestic cats entering the site. As such intervals of live trapping will be used. Capture, neuter, and release activities must <u>not</u> be permitted within the Amberfield site.	There are two required schedules/triggers to the timing of live trapping: A) Two ten-day periods of trapping with live capture traps 200m apart throughout all the BPAs. The first interval with be late October/ early September immediately prior to long-tailed bats being heavily pregnant having non-volant young in roosts, and again in late January/ early February during the period where young will start flying.

[4] Different trap types used to ensure ferrets (DOC 250) are appropriately targeted.

Pest species	Method for Control	Project Pest Animal Control Requirements
		B) Live trapping will also be carried out if a cat is seen in the BPAs during any other pest control work (or by report from public/ or other workers in or adjacent to BPAs). In this instance a high density of traps (minimum 10) should be deployed within 1000m of the sighting and checked over a period of ten days. For both trapping types trapped cats will be checked for microchips in an attempt to determine whether the captured cat is domestic or feral. However, this is not a reliable indicator as there is no regulatory microchipping requirement for cats, and engagement with the neighbours nearby will need to be carried out to encourage microchipping and identify domestic cats nearby. Any cat not able to be linked to an owner will be humanely euthanised.

4.2.1.1 Pest animal monitoring, surveillance, and method adaptation

To guide the predator control on site the ongoing monitoring and surveillance is crucial in determining the extent and intensity of pest animal control required for the site and the subsequent efficacy of control efforts.

Wax tag, chew cards, and tracking tunnels are the main monitoring techniques to be undertaken within the site. It is important to note that there are limitations associated with monitoring in relatively small habitat patches where influences of edge effect, and movement in and out of the patch cannot be controlled for. However, the monitoring techniques will nevertheless be a useful management indicator of pest presence/ relative abundance.

Chew cards

Chew cards on transect lines will be used to monitor the abundance of possums, rodents, and potentially cats. Each line will contain 10 chew cards at 20 m spacings alternatively baited/ loaded with peanut butter or cat food (jelly meat), and be spaced at least 100 m apart to minimise double-counting of individuals. The chew cards will be set up for seven consecutive nights of reasonable weather, with no heavy or prolonged rain. If heavy rain does occur during the monitoring period, then the monitoring should be started again. Once the devices have been collected, a trained operator will assess the patterns of bite or chew marks on wax tags/ chew cards and score them for presence/ absence of target pests (marks from other pests such as rats and stoats will also be recorded if detected).

Tracking tunnels

Tracking tunnels will be used for both rodents and mustelid monitoring and are to be deployed in the same pattern as the wax tag and chew cards but the monitoring should not be conducted concurrently.

The tunnels should be set out at least 4 weeks prior to the first survey to ensure any target pests are conditioned to the presence of the tunnels. When the tunnels are set up prior to the survey, they will not be baited or have tracking cards installed. During the

pest control season, the tunnels will remain in place and may remain in place permanently if required.

The survey will initially target rodents by baiting with peanut butter and deploying for one fine night (no heavy or persistent rain). Once the rodent survey is complete, tracking cards will be replaced and tunnels baited with skinned/ salted rabbit meat or equivalent commercial lure. This survey will extend over three consecutive nights of fine weather with no heavy rainfall. Once the tracking cards have been collected, a trained operator will assess the tracks and score them for presence/ absence of target pests.

Monitoring will occur annually, prior to the pest animal control season (end of August), mid-way through the control season (January), and after each pest animal control season (end of May). The first monitoring round will be used to plan the season's pest control and identify if there are any density hotspots requiring specific focus. The second round will gauge the efficacy of the control methods and target areas not under effective control. The final monitoring will indicate relative population levels and gauge success of control. Data collection and analysis will be undertaken prior to the end of the control operation, as continued high predator levels would indicate the need for an extended control season.

Response to the pest monitoring data will include:

- Target anomalous high densities of pest animals in discrete locations with a greater control device density – a response monitoring events at any stage during control. If the increase in device density does not control the higher densities of pests detected in the location the method of control should be adjusted (see next bullet point) as there may be a location specific aversion to the control method. Environmental factors should also be investigated if there are persistent hot spots of pest animal density. For example are there rubbish bins, or other attractants in this location which need to be managed to prevent pest animal access..
- Lack of knockdown of pest densities or overall gradual increases between the prior to control season, midway, and end of season monitoring events will trigger changes in the methods of control to mitigate for potential trap or bait shyness or other aversion in the target pest. Change sin methods can be change of control device, toxin, or reconfiguration of the control device network.

The results of the pest animal monitoring and the responses to the data in the pest animal control methods will be reported within the reporting outlined in Section 4.6.2.

4.2.2 Pest plant threats

Pest plants are common throughout the BPAs with the majority of non-pasture vegetation being pest plant dominated. We have defined pest plants within the site as high, medium, or low priority for control. The prioritisation scores reflect constraints to controlling pest plants as outlined within Section 4.1 above, so that a species may be given a high or medium priority for control in specific locations only, such as within native plantings.

Table 3 provides control priorities for pest plants found within the site. Large exotic trees listed in Table 4 are not to be controlled as they provide potential habitat for avifauna and bats, as well as buffering/ screening of light. However, any juveniles of these exotic trees found growing are to be controlled. This will ensure that the adult exotic trees are not successfully self-recruiting. Note; these pest plant control methods and prioritisation only apply to BPA areas and

Note: No recommendations within the following sections replace the requirements for the retention of trees ≥15cm DBH or vegetation currently providing buffering/screen function except in limited circumstances. The priority is to retain potential bat habitat within the site.

High priority

High priority pest plants are present in low abundance but have the potential to spread rapidly and dominate their vegetation tier, and/ or establish under a closed canopy. High priority pest plants require urgent attention before they spread. Species that have been classified as high priority for control should be controlled with the goal of eradicating them from the site.

Due to bat habitat constraints we have not classified any pest plants recorded on the site as high priority. However, we have retained this designation as it may be applied to newly found or newly established pest plants discovered during the life of this HEP.

Medium priority

Medium priority pest plants are common within the site but have capacity to spread further, particularly under an intact canopy. Medium level priority species should be controlled outside of areas of existing vegetation including in open areas, and revegetation sites. The goal for control of medium priority species is to prevent their further spread and ensure they do not inhibit the establishment of native vegetation.

Total control is not proposed as this would require significant modification of existing vegetation that is retained for structure and habitat values. These species are also common in the wider landscape and continued spread into the site from outside sources is likely. Chinese privet (*Ligustrum sinense*) and tree privet (*Ligustrum lucidum*) are examples of medium priority control.

Low priority

Low priority pest plants are those which meet one or more of the following criteria:

- Occur so widely that further spread is unlikely.
- Have a relatively benign impact on ecological values.
- Occur only in areas which are already degraded and weedy and are not able to invade shaded or intact canopy areas.
- Control is very difficult, with sustained control across the whole site not an efficient use of resources.
- Unlikely to inhibit native plant regeneration in the long term.

Low priority pest plants are controlled in restoration zones where they inhibit revegetation. For example, gorse (*Ulex europaeus*), is a low priority pest plant that occurs in open, degraded habitats within the site but is not able to spread into and impact higher value areas.

Table 3: Pest plant species within Amberfield and their priority for control.

Common name	Scientific name	Priority of control
Bear's breeches	*Acanthus mollis*	Medium
Agapanthus	*Agapanthus praecox subsp. Orientalis*	Medium
Onion weed	*Allium triquetrum*	Low
Smilax	*Asparagus asparagoides*	Medium
Barberry	*Berberis glaucocarpa*	Medium

Common name	Scientific name	Priority of control
Great bindweed and hybrids	*Calystegia silvatica subsp. disjuncta* and *C. sylvatica* x *sepium* hybrids[5]	Medium
Pampas	*Cortaderia selloana*	Medium
English ivy	*Hedera helix*	Medium
Holly	*Ilex aquifolium*	Medium
Tree Privet	*Ligustrum lucidum*	Medium
Chinese privet	*Ligustrum sinense*	Medium
Japanese honeysuckle	*Lonicera japonica*	Medium
Willow weed	*Persicaria maculosa*	Low
Inkweed	*Phytolacca octandra*	Low
Blackberry	*Rubus fruticosus* agg.	Medium
Grey/ crack willow and cultivars	*Salix* sp.	Medium
Woolly nightshade	*Solanum mauritianum*	Medium
Jerusalem cherry	*Solanum pseudocapsicum*	Medium
Tradescantia	*Tradescantia fluminensis*	Medium
Gorse	*Ulex europaeus*	Medium
Periwinkle	*Vinca major*	Medium
Arum lily/ Green goddess lily	*Zantedeschia aethiopica / Z. aethiopica var. "*Green goddess*"*	Medium

Table 4: The large exotic trees are not suggested to be controlled. However, it is recommended that any juveniles of these tall exotic trees found growing are controlled.

Common Name	Scientific Name	Priority for control
Box elder	*Acer negundo var. negundo*	Low - only control of self-seeded juveniles
Alders	*Alnus* sp.	Low - only control of self-seeded juveniles
Camellia	*Camellia japonica*	Low - only control of self-seeded juveniles
She-oak / swamp oak	*Casuarina glauca*	Low - only control of self-seeded juveniles
Macrocarpa	*Cupressus macrocarpa*	Low - only control of self-seeded juveniles
Eucalyptus	*Eucalyptus* sp.	Low - only control of self-seeded juveniles
Ash tree	*Fraxinus* sp.	Low - only control of self-seeded juveniles
Magnolia	*Magnolia grandiflora*	Low - only control of self-seeded juveniles
Pine	*Pinus* sp.	Low - only control of self-seeded juveniles

[5] Observations onsite and nearby suggest the majority of the Calystegia in these areas is a continuous spectrum of hybrids between the native and non-native species spreading as a hybrid swarm.

Common Name	Scientific Name	Priority for control
Poplar	*Populus* sp.	Low - only control of self-seeded juveniles
Cherry tree	*Prunus* sp.	Low - only control of self-seeded juveniles
Holm oak	*Quercus ilex*	Low - only control of self-seeded juveniles
Oak	*Quercus robur*	Low - only control of self-seeded juveniles
Redwood	*Sequoia sempervirens*	Low - only control of self-seeded juveniles

4.2.2.1 Pest plant control methods

All pest plant control work is to be undertaken by a qualified contractor. Table 5 specifies suitable control methods and herbicides for pest plants known to be present within the site. These are not the only methods of herbicide that can be used to control these species, but are what we consider most useful/ appropriate for the site. Where possible, we have limited the range of herbicides used, and based selections on levels of non-target risk. Information on the herbicides detailed in Table 5 is provided in Table 6.

The recommendations for pest plant control provided in Table 5 and Table 6 should be used as a guide. Appropriate control methods for pest plants vary depending on numerous factors such as the species, surrounding vegetation (targeting of other pest plants, impact on different native species), and proximity of water.

Information on the herbicides detailed within Table 5 assumes a suitable penetrant at label rates is used in herbicide applications. A summary of the different methods recommend is as below:

- Mechanical control/pull out: cutting and removing or simply pulling the plant, including its roots, out of the ground and disposing of it.
- Cut and paste: Cutting the plant close to the ground and as soon as possible (preferably within a couple of minutes) applying a herbicide mixture or gel to the exposed cut stem surface.
- Knapsack: Applying herbicide with a backpack sprayer on the foliage of the plant.
- Gun and hose: Applying herbicide with mechanised spraying equipment, A broader cast method when compared to knapsack.
- Drill and fill: Drilling downward sloping holes, close to the ground, regularly around the trunk of a plant into just beyond the cambium layer and filling the holes with a herbicide mixture.
- Climbing plants: For plants climbing up non-target trees it is recommended to cut the vines as close to the ground as possible and again 0.3 - 0.5 m up the trunk and remove a section of vegetation around the tree trunk. Then spray the vine below the cut and where the plant grows on the ground. As this is likely to result in at least some herbicide contact with the trunk of a non-target tree a penetrant shouldn't be used in this circumstance.

Specimens taller than 3 – 4 metres should not be foliar sprayed (it is general best practise for an operator to avoid spraying above shoulder height). Cut stump and drill and fill methods are to be employed for taller vegetation. Stump cutting and drill and fill method should be done as close to ground level as practical to ensure the chemicals are absorbed by the root system. This will improve the likely hood of controlling the pest plant and minimise possible stump-regrowth.

For larger open areas of dense infestation, a knapsack (backpack spray) should be used to spray pest plants. Mechanical control such as hand pulling pest plant (including the roots) can be employed for smaller isolated individuals.

Table 5: Control methods for pest plants within the Amberfield site.

Common Name	Species	Recommend control method and herbicide.
Bear's breeches	*Acanthus mollis*	Cut and paste: metsulfuron-methyl (1g/L or premade gel). Or Knapsack spray: metsulfuron-methyl (5g/10L).
Agapanthus	*Agapanthus sp.*	Difficult to kill with herbicide. Best method: Dig out being careful to extract whole corm and roots. Can knapsack spray small regrowth. Ok method: Cut and paste: metsulfuron-methyl (5g/L or premade gel). Cut plant at ground level and dispose of plant as general waste at refuse transfer station. Least preferred: Knapsack spray: metsulfuron-methyl (5g) + glyphosate (100mL) in 10L of water. Repeat treatments will be necessary and critical.
Onion weed	*Allium triquetrum*	Best not to actively control – shade out with plantings.
Smilax	*Asparagus asparagoides*	Knapsack spray: Glyphosate (100mL/10L). Tubers will regrow and therefore repeat treatments will be necessary and critical. Do not spray against trunks of non-target trees. Refer to "Climbing plants" in section 4.2.2.1
Barberry	*Berberis glaucocarpa*	Smaller trees cut and paste: glyphosate gel. Larger trees drill and fill: glyphosate (undiluted)
Great bindweed and hybrids	*Calystegia silvatica* subsp. *disjuncta* and *C. sylvatica x sepium* hybrids	Knapsack spray: Glyphosate (100mL/10L). Rhizomes will regrow and therefore repeat treatments will be necessary and critical. Do not spray against trunks of non-target trees. Refer to "Climbing plants" in section 4.2.2.1
Pampas	*Cortaderia selloana*	Gun and hose – non-target risk low; glyphosate (2L/100L). Gun and hose – non-target risk high; haloxyfop (100mL/100L – or label rate if listed) Knapsack non-target risk low; glyphosate (100mL/10L) Knapsack non-target risk high; haloxyfop (30mL/10L)

Common Name	Species	Recommend control method and herbicide.
English ivy	*Hedera helix*	Knapsack spray: triclopyr (60mL/10L). Do not spray against trunks of non-target trees. Refer to "Climbing plants" in section 4.2.2.1 Repeat treatments will be necessary and critical.
Holly	*Ilex aquifolium*	Smaller trees cut and paste: glyphosate gel. Larger trees drill and fill: glyphosate (undiluted)
Tree and Chinese privet	*Ligustrum sp.*	Smaller trees cut and paste: glyphosate gel. Larger trees drill and fill: glyphosate (undiluted)
Japanese honeysuckle	*Lonicera japonica*	Knapsack spray: triclopyr (60mL/10L). Do not spray against trunks of non-target trees. Refer to "Climbing plants" in section 4.1.2 Repeat treatments will be necessary and critical.
Willow weed	*Persicaria maculosa*	Knapsack spray: glyphosate (100mL/10L). Unlikely to need control beyond possibly pulling out around plantings.
Inkweed	*Phytolacca octandra*	Knapsack spray: glyphosate (100mL/10L). Unlikely to need control beyond possibly pulling out around plantings.
Blackberry	*Rubus fruticosus agg.*	Knapsack spray: triclopyr (60mL/10L). Repeat treatments will be necessary and critical.
Grey/ crack willow and cultivars	*Salix* sp.	Smaller trees cut and paste: glyphosate gel. Larger trees drill and fill: glyphosate (undiluted)
Woolly nightshade	*Solanum mauritianum*	Smaller trees cut and paste: glyphosate gel. Larger trees drill and fill: glyphosate (undiluted)
Jerusalem cherry	*Solanum pseudocapsicum*	Hand pull small plants Knapsack spray: glyphosate (100mL/10L).
Tradescantia	*Tradescantia fluminensis*	Knapsack spray: triclopyr (60mL/10L). Majority of biomass can be manually removed prior to spraying if labour resources are available. Repeat treatments will be necessary and critical.
Gorse	*Ulex europaeus*	Cut and paste: metsulfuron-methyl (15g/L or premade gel) or glyphosate gel. Knapsack spray non-target risk high: triclopyr (60mL/10L). Knapsack spray non-target risk low: metsulfuron-methyl (5g/10L).

Common Name	Species	Recommend control method and herbicide.
Periwinkle	*Vinca major*	Knapsack spray: Glyphosate (100mL/10L). Repeat treatments will be necessary and critical as plant has tendency to regrow post control. Do not spray against trunks of non-target trees. Refer to "Climbing plants" in section 4.2.2.1
Arum lily	*Zantedeschia aethiopica*	Cut and paste: metsulfuron-methyl (1g/L or premade gel). Or Knapsack spray: metsulfuron-methyl (5g/10L).

Table 6: Herbicides used in recommended control methods for pest plants.

Active Ingredient	Concentration of active ingredient in product. Control advice is based on.	Active against:	Penetrant to use if required	Soil activity and Soil half life:	Solubility and mobility:	Acute Toxicity to humans:	Mechanism:	Notes
Glyphosate	360g/L Commercial gel formulations of either 120g/L or 240g/L	Non-selective, all plants.	Organosilicone.	Not soil active - 0.5-20 weeks soil half-life.	Rapidly bound to soil particles.	Low	Enzyme inhibition - Systemic	Metabolites found in soil for long periods. Possibly harmful to bacterial ecology of soil.
Haloxyfop-R-methyl Haloxyfop-P-methyl	100g/L	Grasses.	Crop oil.	Minimal soil activity – Half-life < 24 hours converted to Haloxyfop-R acid which has an average half-life of 53 days (range 6-133)	Not likely to be mobile.	Low-Moderate	Enzyme inhibition - Systemic	Useful to control grass pest plants growing amongst non-target broadleaf species.
Metsulfuron-methyl	600g/Kg (sold as water dispersible granule). Commercial gel formulations at 10g/L	Broadleaf weeds, ferns & some annual grasses.	Organosilicone	Soil active – Half-life 1-5 weeks.	Considered soluble and mobile. More mobile in alkaline soils than acidic.	Low	Non hormone - Cell division inhibitor of shoots and roots -Systemic	Can be effective at low concentrations. High potential for downhill or overspray non-target impacts when used improperly.
Triclopyr (triclopyr as the butoxyethyl ester)	600g/L	Woody and herbaceous broadleaf weeds.	Organosilicone	Reported average of 30 days. Variable with soil temperature and moisture content and can range between 4 to 314 days.	Not likely to be mobile, ester formulation binds well to soils.	Low-Moderate.	Hormone mimic (plant growth regulator) - Systemic	Ester formulation is volatile. Ensure respiratory protection used and do not use in very still conditions under a canopy as it can impact overhead vegetation.

4.2.2.2 Pest plant monitoring and surveillance

Once pest plant control has been implemented in an area, regular follow up checks will be required to assess the effectiveness of control and prevent reinvasion. Depending on the control method and pest plants targeted, it may take some time for any effects to be visible. Surveillance should be done during spring and summer before the next planting season. The surveyor is to keep a note of the effectiveness of control method, any re-growth of target pests, and if additional pest plants have established at the control site. This information will help in appropriately targeting any pest plants present within the controlled areas during the next weed control season.

Monitoring and surveillance should be focused in areas where pest plant control has been undertaken. A general walk-through will be undertaken at the beginning of the weed control season to assess any changes in pest plant abundance or composition throughout the site and to detect any new incursions.

4.3 Planting methods

Planting methods are provided within the “Amberfield Subdivision - Planting Specification”. Some additional comments on specific aspects of the approach are provided below.

4.3.1 Plant supply

All native plants are to be eco-sourced from the Hamilton Ecological District (HED). To ensure availability, plant stock should be ordered as far in advance as possible, especially for slower-growing species. Where species in planting schedules are unavailable, substitute species may be considered by a suitably qualified ecologist.

Several areas of planting within the site include non-native species for their structural habitat values, and because large grade specimens can be sourced to provide immediate height buffering functions where required. For some locations the minimum structural criteria for installation size (typically 4m tall), rather than the particular species, is stated. This approach has been taken where sourcing a number of large specimens is the primary constraint to species selection. Native species have not been specified for this purpose as the likelihood of eco-sourced species of sufficient size being available is very low. Non-native species used must fulfil the habitat requirements and have a low risk of naturalising in the HED.

All plants must be healthy specimens from the nursey, true to name and type with well-developed and well-shaped trunk or stem and head. They must be free from pest damage, disease and physiological disorders. All plant material shall be of the minimum size and grade specified in the plant schedule for the time of planting.

Myrtle rust (*Austropuccinia psidii*) is an air-borne fungus which affects plants of the genus Myrtaceae, such as manuka and kanuka (which are proposed to be planted in the site). Myrtle rust is predicted to have significant impacts on New Zealand’s native ecosystems. Symptoms of the disease are characterised by bright yellow spots appearing on leaves and stems that can turn into brown/grey rust pustules as infection matures. To minimise the risk of myrtle rust infections, The Ministry of Primary Industries (MPI) guidelines for myrtle rust should be strictly followed. Ideally, eco-sourced Myrtaceae plants will be acquired from nurseries that are

implementing the Myrtle Rust Nursery Management Protocol by New Zealand Plant Producers Incorporated (NZPPI)[6].

There is no kauri (*Agathis australis*) within the planting locations on site and this species is not recommended to be planted within the project extent. Therefore, no specific measures are necessary in regard to reducing the risk of kauri dieback disease (fast spreading and lethal disease affecting some populations of kauri in New Zealand) within the site.

4.3.2 Site preparation

Appropriate site preparation is essential for the success of indigenous revegetation plantings. Pest plant control will be undertaken during spring and summer before the commencement of the planting season. Control of pest plants shall in in accordance with the recommendations provided in Section 4.2.2. It is important that spraying does not overlap with planting, as this might result in by-kill of native species or non-target areas of retained bat habitat.

All planting areas are to be appropriately demarcated to ensure the correct plants are removed. The contractor must take care to ensure existing vegetation adjacent to planting areas to be retained shall be protected from non-target spraying and structural damage (branches, trunk, roots) through equipment use.

All spraying work must be completed by contractors that are suitably experienced and qualified and understand the requirements and risks of pest plant control. Any large branches or logs acquired from pest plant control should be relocated to the lizard release site. The quantity of these natural debris to be introduced into the lizard release site can be determined by ecologist on site.

4.3.1 Site biosecurity

To prevent the introduction of new of pest plants, it is important all equipment and machinery used in the habitat enhancement process are clean and not harbouring any seed source of exotic pests. The equipment should be cleaned prior to entering site.

To achieve compliance with machinery hygiene protocols all machinery entering the proposed planting and habitat creation areas should adhere to National Pest Control Agencies Machinery Cleaning Guidelines and Handbook (National Pest Control Agencies, 2013)[7].

4.4 Planting Plan

Planting on site is required to be completed within time constraints as defined within the consent conditions. Six planting stages are listed in consent conditions, as outlined below:

> Early Planting: Planting areas defined by Conditions 86, 87, and 89 were to be planted prior to Construction Works commencing and no later than the first planting season following the provision of a Commencement Notice.
>
> Riparian Areas: Areas of planting to be implemented through an Aquatic habitat Enhancement Plan as required by Condition 10 of the Waikato Regional Consent for the development (AUTH139498.04.01).

[6] https://nzppi.co.nz/filescust10/CMS/mr_nursery_protocols.pdf

[7] https://www.waikatoregion.govt.nz/assets/WRC/WRC-2019/Keepitclean.pdf

HEP Stage 1: Planting areas defined by Condition 89 are to be completed no later than the third planting season following the provision of a Commencement Notice.

HEP Stage 2: Planting areas defined by Condition 90 are to be completed no later than the fifth planting season following the provision of a Commencement Notice.

HEP Stage 3: Planting areas defined by Condition 91 which is within 50 m of the bridge crossing (located in the Southern Gully) is to be completed by the first planting season following practical completion of the bridge.

HEP Stage 4: Planting areas defined by Conditions 91A and 92 are to be completed by the first planting season after earthworks have been completed.

A plan showing the breakdown of areas to be planted in which stage is provided in Appendix 5.

The detail of the planting proposed throughout the site the following detailed planting plans (including planting schedules) have been developed to show the detail of the proposed planting (replicated from Section 3.0):

- Amberfield Subdivision - Bat Protection Plan - Landscape Architecture Drawing Set:
    - Bat Monitor Location Plan (also maps artificial roost box location ref. detailed planting plans for more detailed mapping).
    - Typical Detail – Artificial Bat Roost.
    - Typical Elevation – Temporary Screen.
    - Southern Gully Bridge Crossing – Planting Plan and cross sections.
    - Embankment Crossing – Planting plan and cross sections.
- Amberfield Subdivision - Habitat Enhancement Sub-Plan River Margin and Southern Gully;
    - Detailed Planting Plans including detailed Artificial Roost Box Location.
    - Typical Planting Plan – Roadside buffers.
- Amberfield Subdivision – Habitat Enhancement Sub-Plan - Knoll Park, RD001/RD002 and East West Shelter Belt:
    - Detailed Planting Plans – Knoll Park, East-West Shelter Belt (Inc. RD001 & RD002).
    - RD001 & RD002 – Cross sections.

Specific site preparation and or explanation of approach are provided in the following sections. All pest plant control should be carried out following the recommendations in Section 4.2.2.

Species specified for areas of planting should be set out and positioned consistent with the individual species habitat/environmental tolerance in a “right place, right place” approach to layout at a, within plan/individual planting extents, scale. For example, swamp maire and pukatea should only be planted within moist areas of planting areas.

4.4.1 Early planting

As per conditions 86, 87, and 88, early planting outside the earthwork extent (and within the Waikato River Margin, Southern Gully, and East – West Shelterbelt) has already been

completed. The early planting was conducted in two stages. Planting along the Waikato River Corridor and Southern Gully was implemented over two years (2020 and 2021), with under planting of the East – West Shelterbelt completed in 2021. The detailed planting plans of the early planting are provided in Appendix 4a (2020) & Appendix 4c (2021).

The specification for early planting is provided in Appendix 4b (2020) and Appendix 4d (2021) which included the first 3 years of maintenance. Ongoing maintenance of the site is required to ensure the early planting areas reach a 4 m average height and 80% canopy closure in the vertical plane to satisfy Condition 94 (a) and 94 (c). The ongoing maintenance beyond the three years covered by the specification is included in the wider site "Amberfield Subdivision - Planting Specification".

Pest plants noted in the early planting zones were limited to occasional Japanese honeysuckle, bindweed, inkweed, blackberry, pampas, Jerusalem cherry, and juvenile privet. The most problematic of these species has been the bindweed in damper areas adjacent to and within the Southern Gully which can rapidly smother planted natives.

The detailed planting plans and maintenance specifications for the early planting, which are contained in Appendix 4, have been certified by the HCC Planning Guidance Unit Manager in accordance with Condition 93.

4.4.2 Riparian areas

The detail of the planting, timing, and enhancement within the riparian areas of the smaller waterways along the Waikato River Margin and within the Southern Gully is provided with the Aquatic Habitat Enhancement Plan (Appendix 3) as required by Condition 10 of the Waikato Regional Consent for the development (AUTH139498.04.01).

4.4.3 Stage 1 planting

To meet Condition 89, the following planting areas are to be completed no later than the third planting season following the provision of a Commencement Notice.

4.4.3.1 Planting along the Waikato River Margin north of the Southern Gully

Condition 89 (a) requires planting the remaining areas along the Waikato River Margin north of the Southern Gully, which are outside the earthwork extent.

Occasional pest plants such as gorse, inkweed, Japanese honeysuckle, and juvenile Chinese privet and tree privet are present, mostly along the adjoining boundary of the Waikato River Corridor.

4.4.3.2 Planting within Southern Gully

Condition 89 (b) requires completion of planting within the Southern Gully which is outside the earthworks extent (but excludes 50 m area of the bridge crossing).

In general, medium priority pest plants such as woolly nightshade, gorse, barberry, holly, blackberry, and pampas are scattered throughout the site, predominately on the gully scarps and either side of the incised stream channel.

Specific advice for the area designated as "Waikato River Margin Planting"

The Southern Gully is dominated by exotic species with the only area of native dominant vegetation being surrounding the confluence of the Southern Gully and the Waikato River. Here

there are a range of planted native species and naturally occurring kanuka and tree ferns. Japanese honeysuckle, and tradescantia are present.

Immediately south of the native dominated section there on the northern gully scarp is a complex of gully slope, seepages, and terraces. This area is a willow, privet, barberry, and bindweed pest plant dominated patch and is the only area on site where widespread control of pest plants and replacement with native vegetation is to be undertaken. Note that several trees (mostly willow) are present which are ≥ 15cm DBH may need to be retained. The potential control of larger exotic trees within the Southern Gully is discussed below.

Small pockets of wet adapted species such as cutty grass (*Carex geminata*) and wiwi (*Juncus australis*) are present in the Southern Gully. Planting in this area incorporates a selection of wet tolerant species to enhance the seepage areas.

The lizard relocation site or sites (depending on catch rate) is located in the northern section of the Southern Gully. Therefore, any planting and pest plant control requirements within or near the relocation sites must avoid the lizard release site.

4.4.3.3 Naturalised meadows

Naturalised meadows are areas of pasture grass allowed to become rank and ungrazed. If an area of bat meadow falls within an earthwork location, seeding should follow that defined in the "Amberfield Subdivision - Planting Specification".

Maintenance of the meadows is defined within the "Amberfield Subdivision - Planting Specification" which requires an irregular mowing regime where the one half of each meadow is mown every three months. The relevant requirement is replicated below for ease of reference:

> *For subsequent mowing, and mowing of areas of existing pasture in the Bat meadows mowing should occur 3 monthly following a regular regime as follows:*
>
> *Each meadow area shall be divided into two parts with one half mowed at each mowing time. This regime will ensure that any one time there will be at least one half of the meadow unmown. Mowing of one half is to take place in October and February, the remaining half in December and April.*
>
> *Additional mowing may be required where:*
>
> - *Maximum grass height exceeds 700mm.*
> - *Identification of potential fire risk during summer due to long, dry grass particularly during summer droughts.*
> - *Prescribe regime allows pest plants such as blackberry to invade.*

4.4.3.4 Large pest plant trees in the Southern Gully

As per Condition 111 and 111a and the Bat Protection plan, trees which are ≥ 15 cm diameter at breast height and provide potential roost habitat and buffering of light for long-tailed-bats must be retained except in limited circumstances.

Control of willows and privet ≥ 15 cm diameter at breast height within the area designated as "Waikato River Margin Planting" and the remainder of the Southern Gully interior should only occur once a certified bat ecologist[8] has inspected the trees and deemed them unlikely to provide bat roosting habitat.

[8] Following the process outlined within the Amberfield - Tree Fell Protocols (BPP - Appendix 1)

Most privet trees within the interior of the gully are unlikely to have bat roost potential as they are small and typically do not have knot holes and loose bark that bats require for roosting. Large, old willow trees with senescent features are likely to provide potential bat roost habitats and must be retained.

Willow and privet trees within the gully that can be controlled (not a roost habitat or buffering of light for bats) should be drilled and filled and left standing where possible as the dead tree may provide roosting opportunities, at least temporarily as it decays. “Drill and fill” methods can result in standing dead trees remaining for extended periods hence proximity to public spaces may preclude this approach. In this instance felling the trees may be required.

4.4.4 Stage 2 planting - Waikato River Margin south of the Southern Gully

Condition 90 requires planting the remaining areas along the Waikato River Margin south of the Southern Gully, which is outside the earthwork extent, no later than the fifth planting season following the provision of a Commencement Notice. These areas are predominantly open spaces dominated by exotic grasses containing occasional pest plants.

4.4.5 Stage 3 planting - Post bridge construction planting

Condition 91 requires the remaining planting within the Southern Gully within 50 m of the bridge crossing to be completed by the first planting season following practical completion of the bridge. The detail and design of the planting adjacent to the Southern Gully bridge and adjacent to the embankment crossing further south is provided within the Bat Protection Plan.

4.4.6 Stage 4 planting - Planting post completion of earthworks

The following areas shall be completed by the first planting season after earthworks have been completed in each construction stage.

4.4.6.1 East – West Shelterbelt planting

Condition 91A requires planting the remaining areas of the East- West shelterbelt by the first planting season after earthworks have been completed in construction stages 1, 2 and 6. Currently the East- West shelterbelt is an exotic shelter belt dominated by alder trees (*Alnus* sp.) in the east and Casuarina in the west that has recently been underplanted in the Early Planting stages. Corridor enhancement planting is to take place adjacent of the existing East- West shelterbelt.

Vegetation to be planted within this area is to be native species that will achieve a 4 m average height and 80% canopy closure in the vertical plane (as per Condition 94 (c)).

The detail and design of the Road 001 and Road 002 planting is provided within the Bat Protection Plan.

4.4.6.2 Knoll Park planting

Condition 91A requires planting the remaining areas of Knoll Park by the first planting season after earthworks have been completed in construction stages 1, 2 and 6. Knoll Park, contains large non-native trees and ornamental garden species such as redwood (*Sequoia sempervirens*), eucalyptus (*Eucalyptus* sp.), magnolia (*Magnolia grandiflora*), camellia (*Camellia*

japonica), ash tree (*Fraxinus* sp.), holm oak (*Quercus ilex*), and pines. These existing large exotic trees are to be retained. Ground cover is dominated by exotic grasses, but also contains dense patches of pest plants such as bear's breeches, periwinkle, arum lily (, English ivy, and privet. Control of these pest plants is required.

The planting approach within the Knoll Park is different to all other areas as it takes a mixed planting approach which seeks to enhance habitat values while also providing amenity and recreational opportunities.

Native under planting to be used to enhancement the habitat in areas under existing trees as well as additional non-native trees added to the park to provide more habitat, structure, and light buffering.

4.4.6.3 Planting remaining areas within earthworks extent

Condition 92 requires planting the remaining areas within the earthwork extent by the first planting season after earthworks have been completed in each construction stage.

We have also included areas outside the earthwork extent, but within a 5m offset from earthwork fill areas and 3m offset from earthwork cut areas planted during the first planting season after earthworks is complete in accordance with this condition. This is to avoid planted areas being in such a close proximity to the edge of subsequent earthworks that they are damaged and have to be replanted.

Species composition to be planted in these locations are to be the same as adjacent plantings.

4.4.6.4 Roadside buffer planting

To achieve the performance standards in Condition 134A (a) (i) and (ii), roadside buffer plantings are to be established within the Bat Priority Areas adjoining roads. The performance standards require the plantings to reach a minimum 1.4 m or 1.8 m height, and 80% canopy closure in the vertical plane. Within the Northeast terrace the planting thereafter must also meet the performance criteria of adjacent planting (4m average height and 80% canopy closure in the vertical plane). To achieve the requirement, a very high-density planting (0.6m spacing) of fast-growing species is to be established within the roadside buffers with taller growth species also added within the Northeast terrace area. High density planting will quickly minimise light spill into BPA.

If the roadside buffer planting has not achieved the performance standards at the time of s224(c) certification, temporary screen fencing shall be established until the planting performance criteria has been reached for each subdivision stage.

4.5 Planting maintenance

The planting inspection, maintenance, and supplementary planting to replace any deaths should follow that outlined within the "Amberfield Subdivision - Planting Specification".

4.6 Performance standards and reporting

Performance against planting standards for the mitigation planting is important as

4.6.1 Planting assessment

Planting species density and diversity information will be collected by establishing permanent RECCE 10x10m plots (or smaller depending on the constraints of the vegetation patch size) within each planting area within the BPA with minimum of one plot per contiguous patch of vegetation and in large patches multiple plots will be established with no more than 150m between plots.

Assessment will follow standard RECCE methods as outlined within Hurst & Allen (2007) capturing vegetation cover and composition information for later reporting. Data should be collected in standard RECCE field sheets[9] with a photo point taken for all plots.

4.6.1.1 Assessing average height and vertical canopy cover

A key aspect of determining the establishment of planted vegetation and when maintenance requirements cease is whether planting achieves a 4m average height and 80% canopy closure in a vertical plane within the buffer planting areas and also 1.4 or 1.8m average height and 80% canopy closure in the vertical plane for roadside buffers as a trigger for either the requirement or removal of temporary screens (as per Condition 94 (a), (b), and (c), and Condition 134A (a), (i), and (ii)).

Note: it is not necessary to carry out the method below for all visits and it is acceptable to estimate the vegetations progress towards the performance criteria for the purposes of annual reporting. Formal survey is only necessary to establish the vegetation has met performance criteria and used as a certification process.

The following method should be implemented by a suitable qualified and experienced ecologist to measure the progress towards these performance criteria:

1) Establish transects:
    a) Within each vegetation patch, of greater than 15m wide, regular transects, running parallel to the boundary of the BPA (and therefore the nearest potential source of artificial light), 10m apart across the full width of the patch should be established. Vegetation patches surveyed, such as roadside buffers, <15m wide should have one transect established, within the vegetation, 3m from the edge of the vegetation nearest to the closest artificial light source.
2) Survey points
    a) Within each transect that is longer than 50m establish a survey point every 5m.
    b) Within each transect shorter than 50m divided the length into 10 equal measures and establish 10 survey points.
3) Canopy height and vertical cover assessment.
    a) At each survey point using a 1.4, 1.8, or 4 m pole marked in 0.2m increments (depending on the canopy height requirements within the target area) should be held vertically and at each height the surveyor must assess whether vegetation is present within a 0.25m radius (horizontally to the ground surface) of each 0.2m increment of the pole. Where vegetation is present record 1, where it is not record zero in field sheet. Record the height of the highest tier in which vegetation is recorded and do not

[9] Refer to https://nvs.landcareresearch.co.nz/Content/PermPlot_RecceSheet.pdf

measure past this point if the vegetation does not exceed 4m. If the vegetation exceeds 4m, measure or estimate the height.

4) Average height and vertical canopy cover calculation.

   a) Average height: For each transect take the sum of the height of the highest tiers where vegetation was recorded (SOH) and divide by the total number of the measurement points along the transect (TN) to derive the average height: SOH/TN=Average Height. For vegetation patches with more than one transect all transects should be averaged to derive the average height of the vegetation patch.

   b) Canopy cover in a vertical plane: For each transect take the total tiers where vegetation was recorded (VR) and number for tier measurements (TM) collected to derive the canopy cover in a vertical plane of the vegetation patch: VR/TM=Average canopy cover in a vertical plane.

A worked example of this process and example field sheet is outlined in Table 7. In this case the average height of the vegetation was assessed to be 3.76m and the canopy cover in a vertical plane was 79%. This example would be very close to, but not achieve the a 4m average height and 80% canopy closure in the vertical plane.

Once canopy cover has reached the required 4m average height and 80% canopy closure in the vertical plane, ongoing measurements are not necessary.

4.6.2 Reporting

To meet Condition 95 of the consent, an annual Plant Monitoring Report will be prepared starting once the first stage of planting under this HEP is commenced. The annual report will provide the following information:

- Success rates, number and location of plants lost and replacement of dead plants.
- Vegetation plot data including species density and diversity.
- Height and vertical canopy closure for the planting identified in condition 94(a), (b) and (c) including either estimates taken at the time of vegetation plots or the data from the formal assessment outlined above in Section 4.6.1.1.
- Animal and weed pest control carried out during the year including:
  - pest control device locations.
  - record of trap/bait station checks.
  - summary of trap captures.
  - pest animal population monitoring survey results.
- Recommendations for changes to the Habitat Enhancement Sub-Plan (if any).

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Table 7: Worked example and example data sheet for measuring vegetation against the performance standard Amberfield - vegetation performance standard of 4m average height and 80% canopy closure in the vertical plane

Amberfield - vegetation performance standard assessment.									
Date:	**##/##/##**	**Surveyor:**	Joe Blogs						
Survey location/vegetation patch:	A17134/505 - Roadside buffer	**Transect start point GPS reference:**	#########	**Transect start point GPS reference:**	#########	**Average height (m):**	**3.76**	**Canopy cover in vertical plane:**	**79%**
Transect:	**1**	**Transect length**	**46m**	**Survey point spacing**	4.6m				
Survey point 1		**Survey point 2**		**Survey point 3**		**Survey point 4**		**Survey point 5**	
Height	**Vegetation present**	**Height**	**Vegetation present**	**Height**	**Vegetation present**	**Height**	**Vegetation present**	**Height**	**Vegetation present**
Tier 1 - 0.2m	1	Tier 1 - 0.2m	1	Tier 1 - 0.2m	1	Tier 1 - 0.2m	1	Tier 1 - 0.2m	1
Tier 2 - 0.4m	1	Tier 2 - 0.4m	1	Tier 2 - 0.4m	1	Tier 2 - 0.4m	1	Tier 2 - 0.4m	1
Tier 3 - 0.6m	1	Tier 3 - 0.6m	1	Tier 3 - 0.6m	1	Tier 3 - 0.6m	1	Tier 3 - 0.6m	1
Tier 4 - 0.8m	1	Tier 4 - 0.8m	1	Tier 4 - 0.8m	1	Tier 4 - 0.8m	1	Tier 4 - 0.8m	1
Tier 5 - 1.0m	1	Tier 5 - 1.0m	1	Tier 5 - 1.0m	1	Tier 5 - 1.0m	1	Tier 5 - 1.0m	1
Tier 6 - 1.2m	1	Tier 6 - 1.2m	1	Tier 6 - 1.2m	1	Tier 6 - 1.2m	1	Tier 6 - 1.2m	1
Tier 7 - 1.4m	1	Tier 7 - 1.4m	1	Tier 7 - 1.4m	1	Tier 7 - 1.4m	1	Tier 7 - 1.4m	1
Tier 8 - 1.6m	0	Tier 8 - 1.6m	1	Tier 8 - 1.6m	1	Tier 8 - 1.6m	1	Tier 8 - 1.6m	1
Tier 9 - 1.8m	1	Tier 9 - 1.8m	1	Tier 9 - 1.8m	1	Tier 9 - 1.8m	1	Tier 9 - 1.8m	1
Tier 10 - 2.0m	1	Tier 10 - 2.0m	1	Tier 10 - 2.0m	1	Tier 10 - 2.0m	1	Tier 10 - 2.0m	1
Tier 11 - 2.2m	0	Tier 11 - 2.2m	1	Tier 11 - 2.2m	1	Tier 11 - 2.2m	1	Tier 11 - 2.2m	1
Tier 12 - 2.4m	1	Tier 12 - 2.4m	0	Tier 12 - 2.4m	1	Tier 12 - 2.4m	1	Tier 12 - 2.4m	0
Tier 13 - 2.6m	0	Tier 13 - 2.6m	1	Tier 13 - 2.6m	0	Tier 13 - 2.6m	0	Tier 13 - 2.6m	1
Tier 14 - 2.8m	0	Tier 14 - 2.8m	1	Tier 14 - 2.8m	0	Tier 14 - 2.8m	1	Tier 14 - 2.8m	1
Tier 15 - 3.0m	0	Tier 15 - 3.0m	0	Tier 15 - 3.0m	0	Tier 15 - 3.0m	1	Tier 15 - 3.0m	0
Tier 16 - 3.2m	1	Tier 16 - 3.2m	0	Tier 16 - 3.2m	1	Tier 16 - 3.2m	0	Tier 16 - 3.2m	1
Tier 17 - 3.4m		Tier 17 - 3.4m	1	Tier 17 - 3.4m		Tier 17 - 3.4m	1	Tier 17 - 3.4m	0
Tier 18 - 3.6m		Tier 18 - 3.6m	0	Tier 18 - 3.6m		Tier 18 - 3.6m	0	Tier 18 - 3.6m	1
Tier 19 - 3.8m		Tier 19 - 3.8m	1	Tier 19 - 3.8m		Tier 19 - 3.8m	1	Tier 19 - 3.8m	0
Tier 20 - 4.0m		Tier 20 - 4.0m		Tier 20 - 4.0m		Tier 20 - 4.0m	1	Tier 20 - 4.0m	1
Maximum vegetation height:	3.2	**Maximum vegetation height:**	3.8	**Maximum vegetation height:**	3.2	**Maximum vegetation height:**	4.1	**Maximum vegetation height:**	4.5
# of Tiers surveyed	16	**# of Tiers surveyed**	19	**# of Tiers surveyed**	16	**# of Tiers surveyed**	20	**# of Tiers surveyed**	20
Total of vegetated tiers:	11	**Total of vegetated tiers:**	15	**Total of vegetated tiers:**	13	**Total of vegetated tiers:**	17	**Total of vegetated tiers:**	16
Percentage canopy cover in a vertical plane	69%	**Percentage canopy cover in a vertical plane**	79%	**Percentage canopy cover in a vertical plane**	81%	**Percentage canopy cover in a vertical plane**	85%	**Percentage canopy cover in a vertical plane**	80%

5.0 Avifauna Management Plan

The Avifauna Management Plan is provided within Appendix 1 of this HMP and should be read in reference to the above HEP (Section 4.0).

6.0 Herpetofauna Management Plan

The Herpetofauna Management Plan is provided within Appendix 2 of this HMP and should be read in reference to the above HEP (Section 4.0).

7.0 Long-term Future of the Site

While this HMP outlines the requirements of mitigation and monitoring matters during the development process and for a period beyond (for monitoring etc.) as aligned with Condition 126 of the HCC consent. Ultimately the BPAs are vested with HCC who become responsible for the continued protection of these habitats as one of the reserves primary purpose. We consider that the restoration and creation of the BPAs throughout the site present a considerable ecological and social opportunity for continued protection and management.

We consider there is significant scope for the development of an Amberfield community group to be developed to be actively involved in the continued restoration and protection of the BPAs. While not within the scope of the HMP we encourage such an approach and consider that the future of the site is likely best managed by empowering the community which lives within the Amberfield subdivision to take an active involvement within the unique ecosystem on their doorstep. This could include the introduction of emergent canopy trees (such as tawa, swamp maire, and pukatea) in the planted area which are not able to be planted in the early stages of restoration, continued pest control, and maintenance and installation of roost boxes. Pest plant control will be an ongoing management requirement, many invasive pest plants on this site have been proposed to be retained due to their structural function as buffering and the habitat they provide to long-tailed bats. The prevalence of these species in the site and wider area will pose a significant barrier to the management of these species. In the long term the goal should be to progressively control species that are currently dominant along the Waikato river such as tree privet, Chinese privet, and pampas. The progressive control will need to occur with the replacement of these plants with native or non-invasive non0natives which provide screening and roosting features.

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Appendix 1: Avifauna Management Plan

Appendix 2: Lizard Management Plan

Appendix 3: Aquatic Habitat Enhancement Plan

Appendix 4: Early Planting Plans and Specifications

Appendix 5: Planting Timed with Conditions

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

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Bat Protection Plan

Amberfield
Prepared for Weston Lea Ltd

19 May 2022

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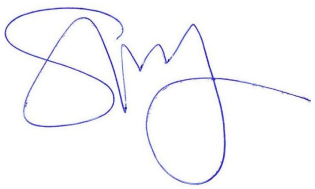
Reviewed by:	Sarah Flynn Ecologist / Principal Boffa Miskell Limited.	
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Figures

1.0 Introduction

1.1 Project background

Weston Lea Limited proposes to develop a major new settlement of the Amberfield site within the Peacocke Structure Plan area of Hamilton City. The site is located in the Hamilton South area on the western bank of the Waikato River. As part of the consenting requirements a Bat Protection Plan (BPP) is required to mitigate against the potential adverse ecological effects of the large-scale development.

The riparian margins of the Waikato River are retained and a network of open spaces including neighbourhood parks, amenity open space, shared walking and cycling pathways, and an archaeological / heritage reserve are proposed.

Long tailed bats are classified as Threatened – Nationally Critical due to habitat loss and predation. Uniquely, long tailed bats frequent the urban fringes of Kirikiriroa/ Hamilton City, despite the modified environment and the absence of lowland indigenous forest that is the natural habitat of this species. Native bats are aerial insectivores, adapted to forage along bush margins, over water and above vegetation canopies for small flying insects. Long-tailed bats roost in trees with knots and loose bark, and switch roosts often. Long-tailed bats are highly mobile and may travel many kilometres between roost sites and foraging grounds.

Bat monitoring as part of ecological assessments of this and other development projects have determined that the Waikato River provides an important corridor that long tailed bats routinely use to move through the landscape. The network of incised gully systems that surround the tributaries of the Waikato River provide vegetated corridors that appear to help bats navigate the surrounding modified landscape to access habitat features such as waterbodies and forest remnants. Several years of monitoring for this project have determined that bats frequently use a narrow shelterbelt of intersecting the site as a thoroughfare, apparently to move between the Waikato River and other habitat features to the west. Monitoring recorded a relatively low frequency of bat activity across pasture areas in the wider site. Two bats were also detected solitary roosting on trees within the site during a radio telemetry study of radio-tracked bats in the wider landscape.

As part of the consenting requirements a Bat Protection Plan (BPP) is required to mitigate potential adverse ecological effects of the development on long-tailed bats. This plan, in comparison to the Habitat Management Plan (HMP), focuses on the habitat creation through creation of roost boxes, protection mechanisms to avoid adverse effects on bats, and monitoring of bat activity onsite. The riparian margins of the Waikato River are retained and a network of open spaces including revegetated corridors, neighbourhood parks, amenity open space, shared walking and cycling pathways, and an archaeological / heritage reserve are proposed.

A site context map is provided as Figure 1 which provides the site boundary and the areas defined as Bat Priority Areas (BPA).

1.2 Ecological context

The site is located within the Hamilton Ecological District (HED) on a low terrace adjacent to the Waikato River. The Waikato River runs along the eastern side of the site with stepped terraces giving way to steep riverbanks. A minor gully (“the southern gully”) intersects the eastern river

terrace and western slopes in the south of the site. On the opposite side of the river to the site is the Mangaonua Gully, and the Mangakotukutuku gully is located west of the site.

The current/ predevelopment land use is predominantly agricultural with some rural lifestyle dwellings. Historic clearance has removed almost all of the original indigenous vegetation and indigenous vegetation is now restricted to the steep river and gully banks and some isolated plantings. Kahikatea-pukatea-tawa forest[1] would have dominated the site and surrounding land prior to human settlement and vegetation clearance.

Within the site there are two Significant Natural Areas (SNA) under the Hamilton City Operative District Plan: SNA 54 and SNA 48. SNA 54 is a 3.3 ha kānuka/mahoe-privet forest that runs along the Waikato River and SNA 48 is a 2.4 ha kānuka-privet-mamaku forest. As most of the SNAs in the area are associated with the Waikato River and Mangakotukutuku and Mangaonua gullies, the site is close to several of the gully complex SNAs.

1.3 Site and bat mitigation response overview

Figure 1 provides an overview of the site and areas identified for management as bat habitat ("Bat Priority Areas"). The focus of the mitigation response on the Amberfield site is, in general, within the area designated as the BPAs which cover the Waikato River Margin, including natural landscape features referred to as the North-East Terrace, Southern Gully, East-West Shelterbelt, and Knoll Park. The mitigation requirements for the site, and approach to implementation, are specified in a detailed set of conditions, which cover site controls such as construction protocols and landscape design aspects of the development, as well as direct ecological requirements.

The mitigation approach is relatively consistent through the entire BPA, however there are specific features and interventions which do differ between locations.

The general approach which is common across the BPA areas are:

- Retention, and continued protection of, existing potential roost trees.
- Retention of existing vegetation that provides a buffer to the Waikato River and/or provides buffering from proposed development.
- Lighting controls and performance standards on the boundary of the BPA and adjacent residential areas.
- Permanent fencing and temporary screening to block light and reduce disturbance.
- Pest animal control.
- Prioritised pest plant control (within the constraints of the vegetation retention above).
- Planting of native vegetation to provide long-tailed bat habitat and buffer protected habitats from development effects (artificial light primarily).
- Installation of artificial roost boxes.
- Planting of non-native trees which veteranise quickly compared to natives to provide roosting features such as knot holes.

[1] Manaaki Whenua Landcare Research: Our Environment, https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Land%20Suitability/lri_arable_suitability, accessed 24/08/2021.

- Monitoring using bioacoustic and thermal imagery methods.
- Provision of open “Meadow” spaces to create structural complexity, vegetation edges, and insect food sources for bat foraging.

Location or feature specific approaches are also employed at several locations throughout the site. These include:

- **North-East Terrace**; Sensitive habitat area of relatively high bat activity (compared to the rest of the site) and in close proximity to Hammond Park. Road and residential edge buffering required to be higher to prevent light entering Hammond Park and the Waikato River.
- **Knoll Park**; Elevated area with a cluster of old exotic trees – area included and retained as a park-like habitat with open spaces retained in many areas to encourage bat foraging and roosting in existing old trees.
- **East-West Shelterbelt**; Important linear feature comprising of an existing casuarina and alder shelterbelt which has relatively high bat activity and provides a movement corridor across the site from the river. Two internal roads bisect the feature - Roads 001 and 002. The approach includes providing a sheltered flyway on both sides (north and south) of the existing shelterbelt which is then buffered from adjacent development by planting and fencing on the northern and southern edges. The existing shelterbelt is to be underplanted to eventually replace existing non-native trees which may have a limited life span. Roads 001 and 002 are designed with plantings included to minimise any canopy gap, limit light spill into the BPA, as well as encouraging bats to fly at a height above the road surface sufficient to avoid potential collision with traffic.
- **Southern Gully**; Significant topographical feature on the site which is currently sparsely vegetated other than pasture. Has relatively low levels of bat activity compared to features further north (presumed due to the lack of vegetation and connectivity through the feature) but still utilised by bats. Has two vehicular crossings through it - one bridge and one embankment crossing which occurs at the location of an existing raised farm track. The approach in this location is widescale forest? restoration. The approach to the roads and bridge are similar as that described for Roads 001 and 002 above, with additional design/intervention on the bridge to encourage flight under/over the bridge. The bridge is designed in such a way to avoid light spill into the gully below as well as incorporating barriers to bat flight across the bridge at traffic height.

In addition to the mitigation responses in the BPA areas, multiple site controls include:

- Prevention of construction works onsite in the times where bats are most active,
- Prevention and control of access to the BPA areas by construction equipment,
- Protections and procedures to be followed during vegetation clearance, and
- Protections of potential roost trees (and all trees in the East-West Shelterbelt) in the vicinity of earthworks (but not directly impacted).

There requires a high level of understanding and awareness across the site to effectively implement and control the activities to ensure this management plan and the other supporting plans and drawings are complied with.

The following sections of this plan provide the details of the required actions in all these locations, and must be read with reference to the drawing sets and supporting plans outlined in Section 3.0 and referenced throughout the plan.

Figure 1: Amberfield site - context map. Dark and light green shaded areas are Bat Priority Areas. Dark green is existing Waikato River margin vegetation to be retained.

1.4 Plan purpose & objectives

This Bat Protection Plan (BPP) is designed to mitigate the adverse effects of the proposed development on long-tailed bats (*Chalinolobus tuberculatus*) which have a threat status of Threatened - Nationally Critical (O'Donnell et al., 2018).

The mitigation measures are outlined to satisfy the consent conditions and objectives outlined within the Condition set. Specifically, the objectives set out in Conditions 73 below in Table 1.

This BPP is part of a suite of management plans and protocols and should be read in-conjunction with the Amberfield Habitat Enhancement Plan and associated subplans – requirements within this plan and processes outlined do not preclude other requirements which also need to be followed as defined in the complimentary plans. For example, vegetation clearance will also require avifauna and lizard management processes to be followed alongside the processes outlined within the BPP. A breakdown of the management plan framework is provided in Section 3.0.

The relevant consent conditions related to this BPP is provided below in Table 1.

The plan details bat ecological values in the area. Protocols for managing the effects of the proposed development on bats are detailed in this report. In addition, long-term monitoring methods are proposed to determine the success rate of the management measures on site for bats.

We note that due to the timing of this management plan being in advance of multiple other management plans and, to some degree, engagement steps with stakeholders. We are aware that some steps, processes, or management approaches may be added to the processes outlined with this BPP. Such as the potential for incorporating heritage requirements/considerations within the vegetation removal protocol and recommended induction processes for staff and contractors.

Table 1: Relevant consent conditions required for the Avifauna Management Plan at the Amberfield site.

Conditions	**Reference (where addressed within a specific section)**
73. The objectives of the Management Plans referred to in Condition 74 shall be as follows: a) To protect the Bat Priority Areas by avoiding adverse effects on the function of the habitat, in terms of commuting, foraging and socialisation. b) To enhance the values and attributes of bat habitat within Bat Priority Areas, including by providing a full range and extent of vegetation types, including linear features and mature trees, for the long-tailed bat and other fauna; c) To provide for and facilitate the full taxonomic range of the enable long-tailed bats to thrive by: i) avoiding the adverse effects of lighting and noise within the Bat Priority Areas; ii) protecting the bats from predation; iii) banning ownership of cats and mustelids within Amberfield;	General management plan condition.

Conditions	Reference (where addressed within a specific section)
iv) protecting roosting sites within the Bat Priority Areas; and v) avoiding injury and/or mortality of roosting long-tailed bats during any tree removal. d) To protect native lizards and native birds during Construction Works.	
110. A Bat Protection Plan shall be prepared to satisfy the objective in condition 73 and address the requirements of the Vegetation Protection and Removal Protocol, Design of Roads RD001 and RD002 through the East-West Shelterbelt, Artificial Roost Box Installation and Management, Bat Monitoring and Reporting, temporary screen fencing design and maintenance, and related procedures and actions as follows.	Sections 5.0 to 14.0
111. All trees within Bat Priority Areas which are ≥ 15 cm diameter at breast height and that provide or potentially provide roost habitat and buffering of light for long-tailed-bats shall be retained, unless: (a) any such trees are within two times its height from a road, designed path or residential lot and are recommended for removal by a suitably qualified and experienced arborist due to presenting a significant danger to the public; (b) the trees are within the Waikato River Margin and are required to be removed due to being within the areas subject to Earthworks; (c) the trees are within the Southern Gully and are required to be removed due to being: (i) within the areas subject to Earthworks; or (ii) within 5m of the outer edge of the areas subject to Earthworks and not being able to be retained due to the construction requirements to complete the Earthworks, or due to impacts on tree health or stability making their retention not possible, as determined by a suitably qualified and experienced arborist. (d) the trees are within the East-West Shelterbelt or within Lots 1503, 2015 or 2035 and are required to be removed in accordance with condition 114.	Section 6.0
111A. No removal of trees which are ≥ 15 cm diameter at breast height shall occur except in accordance with the vegetation removal protocols in the certified Bat Protection Plan.	Section 6.0
112. Where Construction Works (including vehicle and machinery access and storage) are undertaken within Bat Priority Areas in compliance with a certified sub-plan of the Bat Protection Plan, all vegetated areas to be retained within the Bat Priority Areas which are within 100 metres of active Construction Works shall be physically demarcated for the duration of those works in accordance with the specific certified sub-plan of the Bat Protection Plan. The areas to be demarcated shall be determined by a suitably qualified and experienced ecologist and an arborist prior to the Construction Works within the Bat Priority Areas commencing.	Section 6.0
113. Disturbance associated with Construction Works is to be minimised around any active roosts within the site that are discovered that do not require removal.	Section 6.0
114. The final design of Roads RD001 and RD002 through the East-West Shelterbelt shall incorporate the following design features:	Section 7.0

Conditions	Reference (where addressed within a specific section)
(a) An alignment and design which minimises the number of existing trees that are required to be removed within the East-West Shelterbelt and within Lots 1503, 2015 and 2035 and is designed to ultimately maximise canopy connectivity with the adjacent shelterbelt; (b) Road RD001 shall have: i. a split carriageway; and ii. two 3.5m traffic lanes separated by a central planted median island containing either at least one existing shelterbelt tree or a new tree of at least 4.0m in height at the time of planting in the alignment of the existing shelterbelt; and iii. 2.0m wide footpaths on either side of the road width of 7.0m. and potentially separated from the road carriageway if this placement allows trees to be retained; (c) Road RD002 shall be a single-lane shared zone for vehicles, pedestrians, cyclists and micro-mobility users with a carriageway width of 4.0m, a low speed design (20kph to 30kph) and a design which ensures removal of no more than one tree within the existing shelterbelt; (d) Planting of the East-West Shelterbelt shall be in accordance with conditions 84, 87 and 170(b); (e) Lighting shall be in accordance with condition 130.	
115. The consent holder shall install and maintain 240 artificial bat roost boxes with predator control bands within the site and/or (where prior approval has been granted from Council) within Hamilton City Council reserves, where known high activity of bats occurs. The boxes shall be installed within 5 years of the Commencement Notice and each box shall be maintained by the Consent Holder for a period of 10 years from the date of its installation.	Section 10.0
116. The purpose of the bat monitoring shall be to implement the objectives in condition 73(a), (b) and (c)(i), (ii), (iv) and (v). The Consent Holder shall engage a suitably qualified bat ecologist(s) to prepare and implement a bat monitoring programme. The bat monitoring programme shall include data collection before, during and after construction in relation to the following: (a) bat movement across and within the site; and (b) bat activity in retained and restored habitats within the Bat Priority Areas and in neighbourhood reserves.; and (c) recording of any injury or mortality of bats found within the Amberfield site, including the cause (if known) and the location where found.	Section 11.0
117. The information from the bat monitoring shall be used to inform: (a) the review and improvement of management plans to implement the objectives in condition 73; (b) advice and recommendations by the Bat and Habitat Enhancement Review Panel; and	Section 13.0

Conditions	Reference (where addressed within a specific section)
(c) the review of consent conditions, if necessary.	
118. Monitoring shall include, but not necessarily be limited to, bioacoustic monitoring. Monitoring shall be carried out annually, over the long-tailed bat breeding season and peak activity period, between November and April (at a consistent time each year), for a minimum of 12 years comprising: (a) a minimum of one season of baseline monitoring prior to Construction Works commencing (in addition to considering all existing monitoring data). The intention is that there be one further season of pre-construction monitoring unless the Bat and Habitat Enhancement Panel consider there is a significant reason for requiring additional monitoring; (b) monitoring annually for the duration of the Construction Works; and (c) three seasons of monitoring following the completion of Construction Works on the final subdivision stage	Section 12.0
119. Detailed monitoring design (including sampling event duration, specific sample locations, reference sites, sample size, statistical analysis) shall be developed with input from an independent biostatistician. Monitoring shall take place within the locations identified in condition 116, as well as concurrently at Hammond Park and at least one other off-site location nearby to be determined as part of the preparation of the bat monitoring programme. Monitoring shall take place at the same sites at the same time of year, using the same methods and device (manufacturer and model) throughout the entire monitoring programme.	Section 12.0
120. If there is equipment failure or loss of data then monitoring shall be repeated until the sample size (number of sites and nights) that was recommended by the biostatistician has been collected. The raw data shall be made publicly available prior to the commencement of the following monitoring season.	Section 12.0
121. Where practicable, sampling is to be coordinated and cross-referenced with Southern Links monitoring, and other long-tailed bat monitoring that may be required in the Peacocke Structure Plan Area to provide a landscape-wide context for interpretation of data.	Section 12.0
122. Artificial bat roosts shall be inspected at least annually for signs of occupancy, and the integrity of the pest proof banding and condition of roost boxes shall be inspected and maintained where required at least twice a year. Cleaning and repairs to the artificial roosts shall be completed where required following inspections.	Section 10.0
123. The outcomes of the annual bat monitoring from the previous season's monitoring shall be provided to Council and to the Bat Habitat Enhancement Review Panel within two months of completion in the form of a Bat Monitoring Report prepared by a suitably qualified ecologist(s) detailing the results and analysis of the results and any responses and recommendations for changes to the Bat Protection Plan and/or Habitat Management Plan if changes are considered to be necessary.	Section 13.0
124. Responses to the outcome of annual bat monitoring for the purpose of addressing adverse effects identified through monitoring, which may be included in changes to the Bat Protection Plan and/or Habitat Management Plan include: (a) modification to street lighting;	Section 13.0

Conditions	Reference (where addressed within a specific section)
(b) modification to species assemblage and/or plant densities in vegetated buffers; (c) installation of temporary physical barriers (e.g. brush hedging or similar) to supplement vegetated buffers; (d) modification to proposed residential berm screen planting; (e) targeted predator control at known roost sites.	
125. The Bat Protection Plan shall be prepared to demonstrate compliance with the objectives in condition 73(a), (b) and (c) (i), (ii), (iv) and (v), and the requirements of conditions 111 to 124 and to address design and maintenance requirements for temporary screen fencing in conditions 134A and 134B. It shall include the following: (a) Vegetation protection and removal actions and procedures to achieve the outcomes in conditions 111 to 113, with the objective of avoiding injury and/or mortality of roosting long-tailed bats. The protocols shall be implemented by a suitably qualified bat ecologist and follow current best practice. (b) The identification of all trees to be removed that are ≥ 15 cm diameter at breast height and that provide or potentially provide roost habitat and buffering of light for long-tailed-bats, including: (i) trees outside Bat Priority Areas; and (ii) trees within Bat Priority Areas which are recommended for removal in accordance with condition 111. (c) The methods to ensure that disturbance associated with Construction Works is minimised around any active roosts within the site that are discovered, where the tree is identified to be removed, until such roosts are confirmed to be vacant of bats, as determined by a suitably qualified and experienced bat ecologist using current best practice and in consultation with the Department of Conservation. (d) For each specific instance where Construction Works occur within the Bat Priority Areas, a sub-plan setting out the extent and limitations of the particular Construction Works proposed, and the measures to avoid adverse effects on bat habitat and on long-tailed bats, including ensuring no temporary or permanent disruption of long-tailed bat habitat that prevents commuting, foraging and socialisation, or any disturbance to long-tailed bats particularly through noise or light. (e) A description of the fencing of Bat Priority Areas and other physical barriers and methodology of informing construction personnel as to the importance of avoiding the demarcated areas. Any Earthworks which are required within the dripline of trees to be retained shall be undertaken under the direction of a suitably qualified and experienced arborist to ensure the survival and long-term viability of the trees.	(a) Section 6.0 (b & c) Amberfield - Tree removal protocol (Appendix 1) and Section 6.0 (d & e) Section 6.0 (f) Section 11.0 (g) Section 12.0 (h) Section 12.0 (ha) Section 9.0 (hi) Covered in individual sections (example vegetation removal protocol, artificial roost box maintenance checks)

Conditions	Reference (where addressed within a specific section)
(f) Consideration of whether predator control should occur and if so the appropriate methods, intensity and monitoring. (g) Procedures and actions for the location, design and timing of installation of 240 artificial roost boxes and of their monitoring and maintenance which addresses the requirements in condition 115 and condition 122. (h) A bat monitoring programme which addresses the requirements in conditions 116 to 122. (ha) Design specifications and maintenance procedures for temporary screen fences using material which prevents light from vehicles from passing through the fence in accordance with conditions 134A and 134B until road side buffer planting achieves required performance standards. (i) Processes for keeping of records for procedures and actions undertaken pursuant to the plan which shall be made available to HCC at any time within 2 weeks following a request being made to the Consent Holder for this information.	
126. The certified Bat Protection Plan shall be implemented for the duration of earthworks for each stage of construction, for the maintenance period specified in condition 115 and for the monitoring periods specified in condition 118.	Refer to Section 14.0
134B. Any temporary screen fencing established in accordance with condition 134A(b) shall be maintained by the consent holder in accordance with the certified Bat Protection Plan until the planting requirements in condition 134A(a) for the relevant subdivision stage have been met. The consent holder shall remove any temporary screen fencing for each subdivision stage as soon as practicable once the planting requirements have been confirmed to have been met.	Refer to Section 9.0

2.0 Presence of Bats in Hamilton South

Previous bat monitoring, including radio tracking, undertaken across Hamilton City demonstrates that the rural-urban fringe to the south of the city, within which the project site is located, is core habitat for the Hamilton long-tailed bat population (Kessels & Associates Ltd, 2017; Le Roux & Le Roux, 2012; Opus International Consultants Ltd, 2016). All of the studies reviewed produced similar results, confirming that the large vegetated gullies containing tributaries of the Waikato River are key landscape features providing connectivity for bats to move through a comparatively modified landscape. However, the results of these studies often demonstrated high relative variability in activity between ABMs placed within the same gully habitat, indicating that microhabitat characteristics influence bat activity. This is possible in relation to the presence of roosts in the landscape.

Recent radio tracking surveys have also demonstrated that long-tailed bats are not limited to the gully network in Hamilton South but are also commuting overland in areas where anthropogenic disturbance is limited. Long-tailed bats are widely distributed on the Peacock structure plana

and nearby gully networks with roosting detected through the area. Key hotspots for roost appear to the Mangakotukutuku gully, the narrows area, and south of the Amberfield site in old stands of trees.

For reference the typical pattern of life stages of the long-tailed bat is outlined below in Table 2. These life stages have guided several approaches within this BPP.

Table 2: Long-tailed bat typical life stages throughout the year (Dekrout, 2009; Gillingham, 1996; Sedgeley et al., 2012).

Life cycle stage / Time of year	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Torpor used more frequently. Ovulation delayed.												
Ovulation												
Pregnancy												
Young present in roosts and non-volant												
Young begin to fly												
Mating												

3.0 Management Plan Framework

There are several interrelated management plans relevant to this BPP. The management plan structure for the Amberfield development is provided below for reference. Several Detailed Planting Plans are relevant and are referenced across multiple management plans and have been developed to provide the spatial, planting, and design information.

Bat Protection Plan (BPP):

- Bat Habitat Protection
- Vegetation Removal and Protection Protocols
- Roads RD001 and RD002 Design
- Southern Gully Bridge and Embankment Crossing Design
- Temporary Screen Fencing
- Artificial Bat Roost Boxes
- Predator Control (bat related discussion – refer to HMP for methods)
- Bat Monitoring
- Bat Monitoring Report
- Long-Term Future of the Site
- Appendices:

- Tree Fell Protocol (Appendix 1)
- RD001 East - West Shelterbelt Layout Plan – Harrison Grierson (Appendix 2a)
- RD002 East - West Shelterbelt Layout Plan – Harrison Grierson (Appendix 2b)
- Northern Amberfield Development Visual Tree Inspection – Treelands (Appendix 3)
- Previous Long-tailed Bat Survey Data (Appendix 4)
- Doug Armstrong - Evaluation of bat monitoring plan for Boffa Miskell (Appendix 5)

Habitat Management Plan (HMP):

- Habitat Enhancement Plan
  - The conflicts of bat habitat and traditional restoration
  - Threat management
  - Planting methods
  - Planting plan
  - Planting maintenance
  - Performance standards and reporting
- Avifauna Management Plan
- Lizard Management Plan
- Appendices
  - Avifauna Management Plan
  - Lizard Management Plan
  - Aquatic Habitat Enhancement Plan (required by WRC Consent)
  - Early Planting Plans and Specifications
  - Planting Timed with Conditions

Planting plans, designs and cross sections referred to across both HMP and BPP:

- Amberfield Subdivision - Bat Protection Plan - Landscape Architecture Drawing Set:
  - Bat Monitor Location Plan (also maps artificial roost box location. However, ref. detailed planting plans for more detailed mapping).
  - Artificial Bat Roost - Typical Detail.
  - Temporary Screen - Typical Elevation.
  - Southern Gully Bridge Crossing – Planting Plan and Cross Sections.
  - Embankment Crossing – Planting plan and Cross Sections.
- Amberfield Subdivision - Habitat Enhancement Sub-Plan River Margin and Southern Gully;

        - Detailed Planting Plans including detailed Artificial Roost Box Location.
        - Typical Planting Plan – Roadside buffers.
    - Amberfield Subdivision – Habitat Enhancement Sub-Plan - Knoll Park, RD001/RD002 and East West Shelter Belt:
        - Detailed Planting Plans – Knoll Park, East-West Shelter Belt (Inc. RD001 & RD002).
        - RD001 & RD002 – Cross sections.
    - Amberfield Subdivision - Planting Specification.

4.0 Summary of Bat Ecological Values on Site

The following provides a brief description of the bat ecological values on site. A detailed description of the bat ecological value assessment is provided in the Ecological Effects Assessments report prepared by Boffa Miskell Ltd (2018). The Environment Institute of Australia and New Zealand (EIANZ) impact assessment guidelines (Roper-Lindsay et al., 2018) was used to assess the bat ecological value on site.

Acoustic surveys conducted by Boffa Miskell Ltd (2018) confirmed that long-tailed bats (*Chalinolobus tuberculatus*) are regularly commuting through the site and occasionally foraging around habitat features such as shelterbelts. The patterns of activity recorded indicate that the site provides habitat connectivity for bats between the surrounding Hammonds Bush - Mangaonua gully area and the Mangakotukutuku gully, all of which are key remaining landscape features for long-tailed bats. The surveys also found the site to contain potential roost habitats. Most of the potential roost trees are located within the riparian vegetation that will be maintained and buffered as part of the proposed development design. Given the Threatened – Nationally Critical threat status of long-tailed bats, and the above findings on their use of the habitats available onsite, the ecological value of the site for long-tailed bats had been assessed as Very High.

5.0 Bat Habitat Protection

The following details the bat habitat protection and enhancement requirements for the site. These requirements, which include retention of large trees, protection of roosting sites, and installation of artificial bat roost boxes within bat priority areas are important measures to mitigate against the potential adverse impact the development may have on bats.

5.1 Site induction and toolbox meetings

A site induction for all employees and contractors who are likely to operate within 100m of the BPA boundaries is required to inform them of the specific constraints and requirements of the site. This should be completed prior to access onsite and a record of inductions kept. This

induction can either be stand-alone or integrated into the typical health and safety induction process.

This induction should include, at a minimum:

- BPAs, their boundaries, and constraints of works within them.
- Work times and lighting requirements.
- Vegetation removal and protection protocols.
- Types of signage and fencing onsite, its purpose, and importance of avoiding demarcated areas.
- Machinery and vehicle storage/ parking areas.
- Approved transport routes through the East-West shelterbelt.
- Processes for works requiring access within the BPAs and who to contact to request works within BPAs.
- Procedures for the discovery of long-tailed bats, lizards, birds, or fish inside work areas.
- The importance of compliance with the protocols and the reporting processes for observed breaches of required protocols.
- Contact details for the site ecologist, environmental compliance staff, and emergency numbers for any identified issues observed onsite.
- A presentation prepared by a qualified bat ecologist morphology and basic ecology and habitats requirements of long-tailed bats.
- Introduction to the advice for first responders when bats are found[2].

5.2 Baseline requirements

There are several baseline "Construction Management" consent requirements required to be followed to protect the BPAs. These consent conditions are provided below in Table 3 for reference. These conditions must be complied with at all times and outlined within the Construction Management Plan (CMP).

Table 3: Construction management conditions relevant to bat protection. Sections have been highlighted where only subset of condition is relevant to BPP

Construction Management	
25.	Prior to the commencement of Construction Works onsite the Consent Holder shall submit a Construction Management Plan (CMP) to the Strategic Development Unit Manager or nominee for certification. The objective of the CMP is to avoid adverse effects on long-tailed bats and to manage and control off-site nuisance effects during Construction Works, including the achievement of the requirements in conditions 26 to 33. The parties identified in condition 74A(a) and (c) shall be given 20 working days to review and comment on the draft CMP and its inter-relationship and consistency with the certified Habitat Management Plan and Bat Protection Plan. Any comments made by those parties, together with any response from the consent holder, shall be

[2] https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Bat_Care_Advice.pdf Also provided as Appendix 3 of the Tree fell protocol.

	submitted to HCC along with the finalised CMP for certification.
26.	There shall be no Enabling Works or Construction Works between Civil Dusk and Civil Dawn, including associated traffic movements, to minimise potential effects on long-tailed bats.
27.	Enabling Works and Construction Works shall be actively managed to avoid or otherwise remedy or mitigate any off-site nuisance effects caused by dust, debris, silt laden runoff, noise and vibration matters.
28.	Construction Works shall be carried out in a manner which is consistent with the Ecological Management and Monitoring conditions of this consent, particularly matters specified in the certified Habitat Management Plan and Bat Protection Plan (refer to conditions 83 and 110).
29.	No construction vehicles and machinery shall be stored within Bat Priority Areas except where doing so is: (a) Necessary for the construction of wastewater pump stations and the Southern Gully bridge; and (b) Undertaken in accordance with specific certified sub-plan(s) of the Bat Protection Plan.
30.	Contractor facilities, such as a site office and ablutions, shall not be located within Bat Priority Areas.
31.	Security lighting associated with Construction Works shall not be located within Bat Priority Areas and shall be located to avoid spill of light exceeding 0.1 lux above the natural ambient illuminance between Civil Dusk and Civil Dawn measured in a vertical plane within 3m of the boundary within the Bat Priority Areas.
32.	Specific certified sub-plans providing for movements of heavy vehicles and machinery associated with Construction Works through the East-West Shelterbelt shall be limited to the use of one or more of the locations of Roads RD001 and RD002 or the existing farm track.
33.	The boundaries of the Bat Priority Areas shall be fenced at all times when Construction Works are undertaken prior to land within the Bat Priority Areas being vested in HCC as reserve to prevent access by construction vehicles and machinery into the Bat Priority Areas. This requirement shall apply to the parts of Bat Priority Areas which are within 100 metres of active Construction Works. The only exceptions shall be in accordance with specific certified sub-plan(s) of the Bat Protection Plan providing for: (a) Periods when Construction Works are required to be undertaken within or immediately adjoining the Bat Priority Areas; (b) Provision for movement of construction vehicles through the East-West Shelterbelt in accordance with condition 32; (c) Approved construction access routes through the Southern Gully for use prior to construction of the bridge and culvert crossings over the Southern Gully; or (d) To allow access to the Bat Priority Areas for the purposes of planting.
34.	The CMP shall include but not be limited to: (a) Details of the works, intended construction timetable (including construction staging) and working hours (refer to conditions 26, 57 and 58); (b) Quality assurance/quality control including but not limited to; (i) Contact details of the person in charge of Construction Works, or other persons responsible for implementing this Plan; (ii) staff and contractors' responsibilities; (iii) training requirements for employees, sub-contractors and visitors; (iv) environmental incident and emergency management (including the procedures required under regional consent conditions); (v) communication procedures; (vi) complaints management; (vii) compliance monitoring; (viii) environmental reporting; (ix) corrective action; (x) construction lighting;

(c) Methods to control dust, debris on roads and silt laden runoff during construction;
(d) Erosion and sediment control measures to avoid adverse offsite effects arising from the subdivision Construction Works;
(e) Methods to clean and inspect all machinery to be used to reduce the risk of the spread of weeds and diseases (such as Myrtle Rust and Kauri dieback disease), and ensure all seed and/or plant matter has been removed from all machinery and documented in accordance with the document titled 'KEEP IT CLEAN – Machinery hygiene guidelines and logbook to prevent the spread of pests and weeds' (June 2013) and at www.kauridieback.co.nz/how-to-guides/;
(f) Measures for the protection of treatment and soakage systems during earthworks periods to ensure sedimentation does not reduce device effectiveness;
(g) Existing network utilities;
(h) Traffic Management;
(i) General methods to mitigate and manage construction noise in order to comply with the noise limits set out in condition 56 below;
(j) Identification of any special construction activities (including any pile driving and concrete pours) that may require specific mitigation measures in order to comply with the noise limits;
(k) The methods to engage with stakeholders, including:
    (i) how the community will be kept informed of progress with works including;
    (ii) proposed hours of operation outside normal working hours;
    (iii) construction personnel contact details;
    (iv) identifying stakeholders such as landowners, road users, local community, iwi (including the Tangata Whenua Working Group), regulatory authorities, industry, network utility operators, road maintenance contractors, emergency services and the Department of Conservation;
    (v) Invitations to the Tangata Whenua Working Group to attend hui to provide an update on construction not less than once every six months during any phase of construction.
    (vi) responding to queries and complaints;
(l) Any necessary health and safety requirements;
(m) Identification of areas to be used for temporary construction facilities, storage of construction vehicles and machinery and details of any security lighting;
(mm) Measures to ensure that security lighting associated with Construction Works complies with condition 31;
(n) Measures to avoid access by construction traffic and machinery within the Bat Priority Areas and to avoid the storage of construction vehicles and machinery in the Bat Priority Areas, unless they are provided for in a specific certified sub-plan of the Bat Protection Plan;
(o) A description of the fencing and methodology of informing construction personnel as to the importance of avoiding demarcated locations within Bat Priority Areas;
(p) Specific measures for managing Construction Works in accordance with the certified Habitat Management Plan and Bat Protection Plan (including any sub-plans).

6.0 Vegetation Removal and Protection Protocols

6.1 Vegetation removal and protection protocol - Works within the identified earthworks extent.

The following vegetation removal and protection protocols outline a process for protection and ensuring no damage occurs to vegetation being retained and also the appropriate protocols are followed in areas where vegetation clearance is required. These protocols apply to all areas within the earthworks extent as designated within the following drawing sets “Amberfield Subdivision - Bat Protection Plan - Landscape Architecture Drawing Set”, “Amberfield Subdivision - Habitat Enhancement Sub-Plan River Margin and Southern Gully”, and “Amberfield Subdivision – Habitat Enhancement Sub-Plan - Knoll Park, RD001/RD002 and East West Shelter Belt”. This includes all identified areas of proposed bulk earthworks including both outside and within the BPA areas. The works should follow the protocol outlined within Table 4. Areas of works required outside of the identified bulk earthworks extent (but within BPA) should follow the process outlined within Section 6.2.

Note A: “potential roost trees” is used as an all-encompassing term for all trees >15cm diameter at breast height (DBH) with potential roost characteristics - including those that may have been previously confirmed as being used by long-tailed bats or subsequently identified as being used during tree fell protocols.

A potential roost characteristic is as follows:

- cavities,
- hollows,
- knot holes,
- cracks,
- flaking, peeling, and decorticating bark,
- epiphytes,
- broken or dean branches or trunk, and
- cavities/hollows/shelter formed by double leaders.

Note B: For the purposes of the vegetation protection protocol outlined below; any trees within the East-West shelterbelt (habitat trees) are considered the same as potential roost trees and require the same management followed in their protection.

Table 4: Vegetation removal protocols for works within defined earthworks extent.

Vegetation clearance/protection identification.	**Decision criteria**	**Who can carry out this step?**	**Timing constraints**	**Outcome**
a) Vegetation removal zone demarcation process. Identify onsite the full extent of earthworks required for the stage of works.	Is there non-pasture vegetation within the footprint of works or located in a BPA within 100m of the works?	Surveyor or construction contractor. Any uncertainty on classification of vegetation must be referred to project ecologist for resolution.	Any time	**If no:** proceed with earthworks under baseline construction management requirements (Section 5.2). **If yes:** further assessment must be done. Proceed to step b) if within the Waikato River Margin or East-West Shelterbelt. Proceed to bb) if within the Southern Gully.
b) **Waikato River Margin and East-West Shelterbelt** - Onsite demarcation of vegetation (non-pasture) clearance required.	Are there any potential roost trees or the dripline (as defined by the extent of foliage in the canopy of the tree) of any potential roost tree within the vegetation clearance zone? Determined by trees previously identified within Amberfield Tree Fell Protocol as potential roost trees (Appendix #) or trees not previously identified but are ≥15cm diameter at breast height (DBH).	Project ecologist and project arborist with assistance from surveyor and/or contractor. Confirmation of roost potential for previously unidentified trees will require a Certified Bat Ecologist as defined within the Amberfield - Tree Fell Protocols (Appendix 1).	Any time	**If no:** fence the earthworks and vegetation clearance extents where they extend into the BPA and any vegetated (non-pasture) areas to be retained and BPA boundaries within 100m of this extent following fencing requirements outlined in Section 6.1.1. Vegetation clearance can proceed under step c). **If yes:** proceed to step e) ***Note:*** for East-West Shelterbelt ensure proposed tree removal does not exceed that allowed for within Condition 114(c) for RD002 (two[3] existing shelterbelt tree).

[3] See Section 7.0.

Vegetation clearance/protection identification.	Decision criteria	Who can carry out this step?	Timing constraints	Outcome
bb) **Southern Gully** - Onsite demarcation of vegetation (non-pasture) clearance required.	Are there any potential roost trees within and/or within 5m of the vegetation clearance zone? Determined by trees previously identified within Amberfield - Tree Fell Protocol as potential roost trees (Appendix 1) or trees not previously identified but are ≥15cm diameter at breast height (DBH).	Project ecologist and project arborist with assistance from surveyor and/or contractor. Confirmation of roost potential for previously unidentified trees will require a Certified Bat Ecologist as defined within the Amberfield - Tree Fell Protocols (Appendix 1).	Any time	**If no:** fence the earthworks and vegetation clearance extents where they extend into the BPA and any vegetated (non-pasture) areas to be retained and BPA boundaries within 100m of this extent following fencing requirements outlined in Section 6.1.1. Vegetation clearance can proceed under step c). **If yes:** proceed to step d).
c) Vegetation clearance – no potential roost trees in or near clearance extent.	Is there any non-pasture vegetation within or within 10m of the earthworks extent?	Project ecologist in collaboration with surveyor and/or contractor.	Refer to outcome – timing constraints depends on habitat present.	**If no:** earthworks and pasture/topsoil clearance during any time of the year where allowed by the construction management plan (CMP) under baseline construction management requirements (Section 5.2). **If yes:** There are no bat protection requirements beyond baseline construction management requirements (Section 5.2) for these works. However, vegetation clearance must be carried out in compliance with the protocols and timing outlined with the Amberfield Avifauna and Lizard Management Plans (HMP Appendix 1 & 2). **Post clearance and earthworks proceed to step g)**

Vegetation clearance/protection identification.	Decision criteria	Who can carry out this step?	Timing constraints	Outcome
d) **Southern Gully –** potential roost trees within 5m of earthworks extent.	Identify which potential roost trees within 5m of the earthworks extent can not be retained due to the construction requirements to complete the Earthworks, or due to impacts on tree health or stability making their retention not possible	Project arborist with advice from surveyor and/or contractor on construction requirements. Confirmation of roost potential for previously unidentified trees will require a Certified Bat Ecologist as defined within the Amberfield - Tree Fell Protocols (Appendix 1).	Any time	**If no trees with 5m of earthworks extent required to be removed:** Proceed to step e). **If there are trees requiring removal within 5m of the earthworks extent:** Clearly mark trees requiring removal or pruning. Trees outside the earthworks extent requiring removal should be marked with a “X”. Trees only requiring pruning should be marked with a “O”. Once complete proceed to step e).
e) Potential roost trees within or near to earthworks extent.	Is there lizard habitat within the clearance footprint as identified within the Lizard Management Plan (HMP Appendix 2)?	Project ecologist. Vegetation clearance will require a Certified Bat Ecologist as defined within the Amberfield - Tree Fell Protocols (Appendix 1). Clearance under the Lizard Management Plan will require an Authorised herpetologist (as named within a Wildlife Act Authority for the works)	Between October 1st and April 30th only.	**If no:** clearance and/or tree pruning to occur in compliance with the Amberfield - Tree Fell Protocols (Appendix 1). and Avifauna Management Plan (HMP Appendix 1). **If yes:** clearance to occur in compliance with the Amberfield - Tree Fell Protocols (Appendix 1). and Avifauna and Lizard Management Plans (HMP Appendix 1 & 2). **Post vegetation clearance proceed to step f)**

Vegetation clearance/protection identification.	Decision criteria	Who can carry out this step?	Timing constraints	Outcome
f) Earthworks - Post vegetation clearance.	Are there earthworks going to occur within the dripline of potential roost trees?	Project arborist and project ecologist. Confirmation of roost potential for previously unidentified trees will require a Certified Bat Ecologist as defined within the Amberfield - Tree Fell Protocols (Appendix 1).	Dependent on advice from arborist.	**If no:** proceed with earthworks within the boundaries of the defined and fenced footprint of works. **Post earthworks completion proceed to step g)** **If yes:** the project arborist will assess the driplines of retained trees that overlap the earthwork footprint following. The project arborist will be required to work with the constructor on any restrictions and methods required to ensure the long-term survival and viability of the retained trees. The directions and necessary restrictions on works from the arborist must be incorporated into the works plan for the site for any works within the identified driplines. If/where the arborist indicates a need for direct supervision of works these areas must be demarcated onsite following the standard required in Section 6.1.1 to clearly define the areas of work that can only occur with arborist supervision. **Note:** where the driplines of trees overlap with required access points (such as likely in the RD001 & RD002 crossing point of the East-West Shelterbelt) to other areas of works the arborist may identify an appropriate method and/or location for traversing the area and mark this accessway with accompanying signage clearly detailing the machinery movement requirements. These restrictions should also be incorporated into construction management plans, communicated during toolbox meetings, and incorporated into the induction process for staff. **Post earthworks completion proceed to step g)**

Vegetation clearance/protection identification.	Decision criteria	Who can carry out this step?	Timing constraints	Outcome
g) Site disestablishment	Are all earthworks complete within 100m of the established earthworks extent fencing and/or vegetation within the BPA and/or BPA boundaries fencing? **Note:** the outcome for each fence or specific parts of the worksite may be different and the decision criteria should be applied to individual fences.	Site manager/ earthworks contractor with input from site ecologist and site arborist.	Any time	**If no:** Retain fencing around any vegetation within the BPA and move the earthworks extent fencing to the boundary of the BPA. Fences to be removed at a later date under nearby work stages protocols once al works occur within 100m of the BPA and/or vegetation are complete. **If yes:** remove fencing from the area.

6.1.1 Vegetation clearance fencing requirements

The following standards apply for fencing of vegetation to be retained, and BPAs as required in vegetation removal protocols (refer Section 6.1):

- Fencing of earthworks extents or BPA boundary within 100m of earthworks: fencing should follow best practice silt fencing construction in alignment with design outlined within the Waikato Erosion & Sediment Control Guidelines for Soil Disturbing Activities – TR2009/02 (Environment Waikato Regional Council, 2009) Section 3.2, 3.3, or 3.4 or equivalent as determined appropriate by the construction contractor and agreed to by the site ecologist and site arborist.
- Fencing of vegetation within 100m of works where it doesn't also form an earthworks boundary: a waratah and 2 wire fence (one wire at the top of the fence and the other approximately at half the height of the fence) of at least 600m high. The construction of the fence will follow the design requirements of the silt fencing above while omitting the need for the fabric covering and associated trenching required. The fence should be set back a minimum of 1m from the edge of any non-pasture vegetation.

  Clear signage should be attached to the fence which states "Bat Priority Area – Vegetation to be retained. No Access." This signage is to be clearly visible from any potential access route to the vegetation.
- Fencing of driplines where the project arborist has identified works can only occur under arborist supervision: Fencing to be constructed of waratahs of at least 600mm above the ground at no more than 4m spacing and 12mm electrical fence tape (or visually equivalent material) strung between the top of fence. Note: this fence is intended to be installed only for very short periods and form an indicator of areas where arborist supervision is required for works only.

All fences are to be constructed in such a way that will not damage the roots of retained vegetation or require the trimming/pruning of retained vegetation.

Fences are to be inspected weekly for integrity and any breaches, damage, and or any issues rectified immediately. If breaches of the fences are detected resulting in damage to vegetation within the BPA this is to be reported to the Site Manager who will then report this breach to HCC compliance staff along with how the breach has been rectified, any potential ecological impacts (as assessed by the project ecologist), and any proposed mitigating actions.

6.2 Vegetation removal and protection protocol - Works within the BPA but outside of the identified earthworks extent.

Areas of earthworks not already designated within the following drawing sets "Amberfield Subdivision - Bat Protection Plan - Landscape Architecture Drawing Set", "Amberfield Subdivision - Habitat Enhancement Sub-Plan River Margin and Southern Gully", and "Amberfield Subdivision – Habitat Enhancement Sub-Plan - Knoll Park, RD001/RD002 and East West Shelter Belt" that will occur within the BPA areas will be required to submit a completed assessment and plan following the template provided below in Table 5.

Works which are likely to need this assessment include, but are not limited to: benching and construction of cycle/ footpaths, construction of wastewater pump stations, stormwater ponds

and associated infrastructure, construction of the bridge/ embankment crossing within the Southern Gully, and works required under the Aquatic Habitat and Enhancement Plan (HMP Appendix 3) such as culvert removal, footbridge construction, and waterway creation.

This assessment/ plan is to be completed, checked, and signed by the site manager/construction contractor, project ecologist, and project arborist and then submitted to HCC at least 10 working days prior to works occurring within the BPA areas for approval. Works should not proceed until approval is granted by HCC.

Once approved most works can proceed using an unmodified Vegetation Removal and Protection Protocol and fencing requirements outlined within Section 6.1. Any deviations or alternative approaches should be outlined within the assessment/ plan.

Table 5: Earthworks within the BPA assessment and plan form.

Amberfield - proposed earthworks within Bat Priority Area - Assessment and Plan.
Start date of proposed works: Completion date of proposed works:
Location of proposed works description (including access to and from works site where it occurs within a BPA): Provide map as appendix to this assessment form.
Area of earthworks extent required (m^2):
Reason for works:
Description of works including machinery required within the BPA:
Identify the baseline Construction Management conditions as outlined within Section 5.2 of the Bat Protection Plan not able to be fully complied with:
Alternatives considered:
Is there any non-pasture vegetation removal required? Map vegetation removal and provide as an appendix to this assessment.
Area of non-pasture vegetation removal required:
Are there any trees that are ≥ 15 cm diameter at breast height and that provide or potentially provide roost habitat and buffering of light for long-tailed-bats required to be cleared? If yes: what consent condition is the potential roost tree being removed in compliance with?

Amberfield - proposed earthworks within Bat Priority Area - Assessment and Plan.
Provide a map, photos, and roost tree assessment (following the method outlined within the Amberfield - Tree Fell Protocols (Appendix 1)). **Note:** A Certified Bat Ecologist as defined by the Amberfield - Tree Fell Protocols (Appendix 1) will be required to determine roost potential of trees ≥15cm (DBH). Potential roost trees within BPAs are, with few exceptions, required to be retained.
Are there any trees that are ≥ 15 cm diameter at breast height and that provide or potentially provide roost habitat and buffering of light for long-tailed-bats whose dripline extends into the works footprint? If yes are works able to be carried out in such a way to ensure the survival and long-term viability of the tree? Note: The site arborist will be required to assess this section and provide comment on any restrictions to work required.
Are there any trees that are ≥ 15 cm diameter at breast height and that provide or potentially provide roost habitat and buffering of light for long-tailed-bats that would need to be removed under consent condition 111 a) as a result of the works? If yes: provide a map, photos, and roost tree assessment (following the method outlined within the Amberfield - Tree Fell Protocols (Appendix 1)). Note: A certified Bat ecologist as defined by the Amberfield - Tree Fell Protocols (Appendix 1) will be required to determine roost potential of trees ≥15cm (DBH). *Condition 111 a):* *All trees within Bat Priority Areas which are ≥ 15 cm diameter at breast height and that provide or potentially provide roost habitat and buffering of light for long-tailed-bats shall be retained, unless:* *(a) any such trees are within two times its height from a road, designed path or residential lot and are recommended for removal by a suitably qualified and experienced arborist due to presenting a significant danger to the public;*
Is the standard "Vegetation removal and protection protocol - Works within the identified bulk earthworks extent." And fencing requirements outlined within Section 6.1 of the Bat Protection Plan fit for purpose for these works: If no detail the proposed protocols and/or adaptations required:
Is there any planting required by consent conditions impacted and/ or will this result in a delay to planting in any area: If yes confirm that planting will be planted in the first planting season after works are complete, and the extent of this planting:
If non-pasture vegetation is required to be cleared note which management plans will be required to be followed (Tree Fell Protocol, Avifauna Management Plan, Lizard Management Plan etc.) in addition to the Vegetation removal and protection protocol and the seasonal constraints that will apply to vegetation clearance:

Amberfield - proposed earthworks within Bat Priority Area - Assessment and Plan.		
Notes or further information:		
Attach map, photos, construction plans, construction management plan, and any further relevant information to works proposed:		
Assessment carried out and confirmed by:		
Site Manager/ Construction Contractor	**Site Ecologist**	**Site Arborist**
Name: **Role:** **Contact number:**	**Name:** **Contact Number:** **DOC Certified Bat Ecologist (Competency "3.2")?** Yes/No	**Name:** **Contact Number:**
Signature:	**Signature:**	**Signature:**
Date of signing:	**Date of signing:**	**Date of signing:**
Other parties involved with assessment and plan:		

6.3 Protection of active roosts.

Any active roosts discovered during any vegetation clearance protocols are to be managed following the requirements set out in Section 4.3.3 of the Amberfield - Tree Fell Protocols (Appendix 1) whether the tree is to be felled or not. This section is replicated here for easy of reference:

If bats are confirmed to be roosting within a tree, it will not be removed until further monitoring (to minimise further disturbance to roosting bats) confirms that the bat(s) have abandoned the roost. The following actions will be taken:

a) *The immediate area will be cordoned off with safety fencing and signage erected in a 10 m radius around the roost, alerting any person approaching the area that a bat roost is present and to stay clear.*

b) *The existence of the roost will be widely publicised to all works staff and work instructions for the immediate area will be updated to reflect the presence of the roost and the measures to minimise disturbance.*

c) *No work will take place within 100 m of the roost from one hour before dusk to one hour after dawn.*

Roost trees will be clearly marked, and all relevant staff briefed to ensure the tree is not removed. The Grantor shall be informed by email with relevant information, such as photos, provided. Monitoring will continue until the roost is no longer occupied by bats. The monitoring will be confirmed by visual inspection (as per section 4.3.1) immediately prior to felling.

The protections outlined should be in place until it is confirmed, through following the processes outlined in the tree fell protocols, the roost is no longer being used. If the tree is to be retained these checks must be carried out prior to any works occurring within the 10m radius of the tree before works are started each day to ensure bats have not returned.

7.0 Roads RD001 and RD002 Design

Roads RD001 and RD002 cross the east-west shelterbelt which is identified as a key movement corridor for long-tailed bats. As such they need to be designed in such a way that bats are able to cross them safely and they do not create a barrier for movement.

The planting and layout design for Roads RD001 & RD002 are provided in the “Amberfield Subdivision – Habitat Enhancement Sub-Plan - Knoll Park, RD001/RD002 and East West Shelter Belt” with layout plans provided within “RD001 East - West Shelterbelt Layout Plan & RD002 East - West Shelterbelt Layout Plan – Harrison Grierson” (Appendix 2).

The core focus of this design and planting layout proposed are:

- Minimise the canopy gap above the road created by any necessary tree clearance.
    - At Road 001 this is achieved by locating the two lanes of the road through existing gaps between larger trees. This approach still requires tree removal however it is limited to predominantly the shorter and stunted *Alnus* sp. which occur between the larger she oaks in this location while retaining an existing large she oak (*Casuarina* sp.) in the centre island.
    - This is achieved at Road 002 by locating the road in a gap to be created by removal of two existing trees in poor health that is likely to pose a significant hazard to the public if retained (as assessed within the “Northern Amberfield Development Visual Tree Inspection – Treelands” (Appendix 3)). These two trees are the fourth and fifth alders counting from the eastern end of the shelterbelt. In addition, the road is separated from the pedestrian path to limit total road width (the pedestrian path is to pass through a gap between trees).
- Minimise the canopy gap above the carriageway in the medium to long-term by planting large grade trees (≥ 4m tall) immediately adjacent to roadsides.
- Limit light intrusion into the East-West Shelterbelt flight corridor by implementing dense buffer planting immediately adjacent to the road edges.

The proposed design for Road 002 has been prepared following close engagement between the Applicant's engineers and HCC's engineers to ensure that a safe roading environment is created. We consider the proposed solution achieves a best practicable outcome for the flyway. Detailed design of these features should include the input of a suitably qualified ecologist to ensure the considerations for bats and the guidance provided here is implemented appropriately.

8.0 Southern Gully Bridge and Embankment Crossing Design.

The southern gully area is a core mitigation area for creation of long-tailed bat habitat. The bridge and embankment in this area therefore need to be designed in such a way that bats are able to cross them safely and they do not create a barrier for movement.

The planting and layout design for Southern Gully Bridge and Embankment crossing are provided in the "Amberfield Subdivision - Bat Protection Plan - Landscape Architecture Drawing Set". Detailed design of these features should include the input of a suitably qualified ecologist to ensure the considerations for bats and the guidance provided here is implemented appropriately.

8.1 Southern Gully Bridge

Three zones of interaction have been designed to facilitate the safe passage of long-tailed bats passing the bridge in the southern gully: the fly over zone, the fly under zone and the transition zone. All of these zones are designed guide long-tailed bats to take the option of either passing over the bridge at >4m above the bridge deck (and therefore above the majority of potential traffic) or under the bridge away from traffic.

The "fly over" zone is designed to facilitate bat crossing over the bridge at >4m height above the bridge deck. This is achieved primarily through the installation of 5m wide strips of large trees (minimum of 4m tall at time of planting) on the interface between the Southern Gully planting and the bridge.

Large trees (minimum of 4m tall at time of planting) will be planted where the ground height begins to fall away from the bridge deck to extend the vegetated buffer for a short distance beyond the bridge abutment. Where the height of these trees does not extend at least 4m above the bridge deck barriers will be installed along the bridge guard rails at a minimum of 4m high above the bridge deck. This barrier will function like the tall trees in that that bats choosing to fly over the bridge are directed up and over the carriageway above traffic height. Detailed design for the barrier screens will be completed as part of the bridge design, and may be a balustrade or other visually permeable structure, but a key specification is that it feature gaps no larger than 200mm to limit the chance of bats flying through the barrier[4]. The minimum size of any dimension (thickness or width particularly) the materials used for this barrier should also be of greater than 0.01m (I.E. no fine wire/mesh) to ensure bats are able to resolve the feature using echolocation[5].

The "fly under" zone will encompass a 3m high flyway maintained below the bridge, with lower stature vegetation beneath that will reach a mature vegetation height of 2m. Note that while the design does not show piles, the bridge does require support structures below it. The specifics of these piles are to be developed during the detailed bridge design. These will be vertical

[4] The 200mm aperture size limit has been set as it represents an aperture that is smaller than the wingspan range of adult and juvenile long-tailed bats of either sex (234mm minimum wingspan recorded from a juvenile male by Gillingham (1996)).

[5] Based on the wavelength of the loudest portion of long-tailed bat call – 40 kHz. Wavelength = velocity of wave (speed of sound)/ frequency. 342m/s / 40,000Hz = 0.008575m. This provides a useful but conservative measure as experiments show bats are able to resolve smaller objects.

structures such as piles and are not likely to impede bats or deter them from using the space beneath the bridge.

An abrupt transition in vegetation height zone at the end of the fly over and fly under zones creates an unavoidable vertical canopy edge (the inside edge of the large trees) which bats are like to fly alongside, which could lead bats to cross the bridge in this area at <4m above the bridge deck, increasing the chance of vehicle strike. An extension of the barrier screen (as described for the fly over zone) to at least 5m past the tall vegetation edge[6] will create an obstacle perpendicular to the most likely bat flight path so that they either decrease height and fly below the bridge or "hop over" and continue across the bridge deck >4m high.

8.2 Embankment Crossing

Like the fly over zone for the bridge above, the embankment crossing is designed to facilitate bat crossing over the road at >4m height. This is achieved primarily through the installation of 5m wide strip of large trees (≥ 4m tall) on the interface between the Southern Gully planting and the road.

9.0 Temporary Screening Fence

Temporary screening fencing is proposed to block artificial lights from vehicle headlights, if the roadside buffer planting has not achieved the required performance standards at the time of s224(c) certification.

The location and height requirement in all locations of the temporary screening fence is provided in "Amberfield Subdivision - Habitat Enhancement Sub-Plan River Margin and Southern Gully" and "Amberfield Subdivision – Habitat Enhancement Sub-Plan - Knoll Park, RD001/RD002 and East West Shelter Belt".

The design of the temporary screen is provided in the "Amberfield Subdivision - Bat Protection Plan - Landscape Architecture Drawing Set". The screen uses a commercially available bark screening material, installed on a subframe of 2.6m waratah standards and high tensile wire. The bark screens are available in heights of 1.5m and 1.8m.

There are no specific maintenance requirements beyond monthly checking of the screens to ensure their structural integrity in maintained. Any issues noted during the monthly check should be rectified immediately.

The method for measuring vegetation performance standards (1.4 or 1.8m average height and 80% canopy closure in the vertical plane) and thus the removal of the temporary fencing is provided in the HMP.

[6] This edge is estimated 10 years after establishment, not the installed vegetation edge.

Figure 2: Mock-up of proposed screen installed on Amberfield site.

10.0 Artificial Bat Roost Boxes

A total of 240 artificial bat roost boxes with predator/pest control bands are to be installed throughout the Amberfield site. This section has been developed with reference and reliance on the information provided in the New Zealand Bat Recovery Group Advice Note – The Use of Artificial Bat Roosts (Bat Recovery Group - Department of Conservation, 2021).

10.1 Design specifications and considerations

Roost boxes constructed using primarily a modified “Kent” bat box design (Figure 3) and attached to poles will be installed at least 4 metres above the ground.

This preference for “Kent” type boxes is due to the recorded use of this type of box in the immediate area. To ensure the provision of enough variation between boxes 30 bat boxes constructed out of woodcrete will also be deployed. These woodcrete boxes will be located on every second pole installed.

Figure 3: Kent style bat box (Photo supplied; Treelands arborists)

Poles (175mm in diameter minimum) have been selected as the preferred installation method as the availability of suitable trees on the site to both install bat boxes and effectively exclude predators is very restricted. Most trees onsite that are to be retained are either too small, too low, have interconnected canopies, are in very close proximity to other trees, and/ or are very fast-growing species. The latter three considerations make predator exclusion difficult as predators can traverse other tree canopies to access the bat box and/ or jump from nearby vegetation to access the bat boxes above/ below predator exclusion bands. Fast growing species such as willow (*Salix* sp.) and alder (*Alnus* sp.), which are the most common larger trees along the Waikato River frontage of this site, are difficult to band for predator exclusion. Their fast growth requires looser predator exclusion band installation (which is less effective) as otherwise they quickly outgrow the band causing it to pop off.

Modifications to the “Kent” bat box will be the inclusion of two holes in the partitioning wood between the outside and inner chamber to allow for bats to move between the chambers without breaking from the full cover of the bat box if the chamber the bat is in has become too hot. All timber will be untreated, of a naturally weather/ rot resistant timber, a minimum of 25mm thick. All fasteners will be either galvanised suitable for outdoor use or stainless steel (304 grade stainless or better corrosion resistance). A hinged lid will be included on all boxes to facilitate future research into occupancy.

In total 60 poles will be installed throughout the BPAs across the site. As little is known about what leads long-tailed bats to favour certain artificial roosts over others, each pole will have 4 artificial roost boxes attached to it which each box at a different aspect. The aspect of the roost boxes will alternate from the northern most pole to the southernmost pole between a north, east, south, and west arrangement and a north-east, south-east, south-west, and north west arrangement. This will provide 30 bat boxes throughout the site available for each different aspect. All artificial roost boxes will be numbered with a unique identifier and labelled in such a way that individual boxes can be identified from the ground. For the woodcrete type boxes

deployed on every second pole they will be similarly varied in their aspect, replacing a Kent type bat box in alternating aspects on each pole.

Poles will be erected and firmly anchored, and a predator band installed around the pole below the lower most extent of the bat boxes leaving at least 0.3m of space between the top of the predator exclusion band and the bottom edge of the lower most bat box. This will allow for a safe landing area directly below the installed bat boxes. A roof will also be installed on top of the pole to both exclude the chance of perching birds defecating directly on the bat boxes and to provide shading throughout the hotter periods of summer when the sun is directly overhead. The roof should be a minimum of 0.3m above the upper most extent of the highest roost box to prevent a tight gap being used by birds for nesting (although this is still likely as swallows may make use of the sheltered ledge over the top of the bat boxes).

Pole installation will include pruning any vegetation within 2.5m vertical distance of the top of the installed predator band and 3m of horizontal distance to any area of the pole above the predator exclusion band. This vertical distance will exceed the maximum jumping height of a cat at 1.8+ metres, and create a safety margin of approximately 50% jumping distance from surrounding vegetation (Day & MacGibbon, 2007)[7]. Within this context the height requirement of bat boxes being installed at 4m above the ground is stated as a minimum, installation height should be responsive to the site-specific installation location and current vegetation. For example, where there is tall established vegetation existing the boxes should be at a height that assists in providing a clear area around the bat box to prevent predators having access to the box. The height should also be chosen to ensure there are clear flight lines to the box. For example, if the dense canopy of the existing vegetation occurs at 3.0-4.5m above the ground the box should be placed above this height to ensure clear flight lines to the box rather than placing the box nested amongst a dense canopy. Conversely if there is a higher canopy over a more open sub canopy it might be more appropriate to place the box at a height of at least 4m but within the sub-canopy. This will be considered on a site by site basis during construction and installation of the bat boxes and poles.

For the safety of inspectors, there will be provision for the appropriate securing of both a ladder and fall arrest equipment above the predator band. This is likely to require two or more securing points around the pole for inspecting each bat box from a ladder. Consultation with the site arborist (or the person whose role it will be to carry out the maintenance if not the site arborist) should occur at the time of construction to ensure an appropriate design for these securing fixtures.

A detailed typical design of the proposed bat box/pole layout and installation is provided within “Amberfield Subdivision - Bat Protection Plan - Landscape Architecture Drawing Set”.

10.2 Locations and installation timing

The proposed locations of the artificial roost box poles are mapped within “Amberfield Subdivision - Habitat Enhancement Sub-Plan River Margin and Southern Gully” and “Amberfield Subdivision – Habitat Enhancement Sub-Plan - Knoll Park, RD001/RD002 and East West Shelter Belt”. These plans indicate the approximate location of the artificial roost box poles. The final locations will be determined onsite by the Site Bat Ecologist in conjunction with the

[7] No scientific study was found for the horizontal distance jumping ability of a cat (all studies found focused primarily on the jumping height ability and supporting morphology). However, the Guinness World Record for “Longest Jump by a Cat” is recorded at 2.13m: https://www.guinnessworldrecords.com/world-records/111847-longest-jump-by-a-cat Accessed on 28/10/21.

installing contractor and are to consider the criteria detailed below at a site specific and finer detail.

The three broad areas of artificial roost box installation are to be along the Waikato River Margin, within the Southern Gully, and within Knoll Park. The Waikato River Margin will receive most of the roost boxes. We recommend that the East-West Shelterbelt is area is not used for artificial roost boxes as the medium to long-term design of the planting here is to provide a tight avenue of vegetation which wouldn't allow the necessary clearance around the artificial roost boxes, and vegetation clearance to achieve this would be inappropriate for the primary purpose of the shelterbelt which is to facilitate movement of bats across the site.

The criteria for the location of the roost boxes locations considered were the:

- patterns of bat activity in previous surveys;
- proximity to potential light sources;
- proximity vegetation edges;
- proximity to proposed paths;
- ability to install the poles;
- ability to maintain access for inspection and maintenance; and
- proximity of existing vegetation that may need to be cleared to ensure predator exclusion.

For these reasons the greatest aggregation of proposed bat boxes is in the north-east terrace area adjacent to proposed meadows. Most poles are also therefore located within a short distance from a proposed pedestrian/ cycle track, meadow, or grass reserve, to allow for access to the poles by an inspector with a ladder.

Proposed locations are also predominantly on the edge of or within areas either recently planted or proposed to be planted, so the scale of necessary vegetation clearance during both the installation process and maintenance period is limited. This variation in micro-siting of the bat boxes is to ensure the boxes provide a variety of environmental conditions across the site.

Poles and associated bat boxes must be installed within 5 years of the commencement of consent, prior to planting being carried out in the installation location and ideally during the construction of nearby walking tracks (to coordinate disturbance and machinery access, etc.).

The final pole locations will be confirmed and map using GPS. The following data is to be captured for each artificial roost box:

- Roost box number
- Pole number
- Date installed
- Installer
- Aspect (N, E, S, W, NE, SE, SW, NW)
- Notes on location – potential shading, surrounding landscape, and exposure etc.

10.3 Maintenance and inspections

10.3.1 Artificial roost box occupancy inspection

Artificial roost boxes are to be inspected once yearly for occupancy during the month of December (the time of year when non-volant young are most likely to be present). This inspection will not include climbing or potentially disturbing the pole or bat boxes and should be carried out by a certified bat ecologist. During this inspection data as outlined in Table 6 should be collected.

Table 6: Amberfield Artificial Roost inspection record.

Amberfield Artificial Roost occupancy		
Date:	Inspector:	Pole Number:
Roost box 1		
Artificial roost box #:	Bats present? Ground check: Yes/No If yes number seen?: Ladder check: Yes/No If yes number seen?:	
If bats are present what sort of individuals are present (if able to be determined) adult, adult non-volant young, juvenile single individual, communal roost?: Evidence of bat use?		
Note any maintenance that might be required:		
Roost box 2		
Artificial roost box #:	Bats present? Ground check: Yes/No If yes number seen?: Ladder check: Yes/No If yes number seen?:	
If bats are present what sort of individuals are present (if able to be determined) adult, adult non-volant young, juvenile single individual, communal roost?: Evidence of bat use?		
Note any maintenance that might be required:		
Roost box 3		
Artificial roost box #:	Bats present? Ground check: Yes/No If yes number seen?: Ladder check: Yes/No If yes number seen?:	

Amberfield Artificial Roost occupancy	
If bats are present what sort of individuals are present (if able to be determined) adult, adult non-volant young, juvenile single individual, communal roost?: Evidence of bat use?	
Note any maintenance that might be required:	
Roost Box 4	
Artificial roost box #:	Bats present? Ground check: Yes/No If yes number seen?: Ladder check: Yes/No If yes number seen?:
If bats are present what sort of individuals are present (if able to be determined) adult, adult non-volant young, juvenile single individual, communal roost?: Evidence of bat use?	
Note any maintenance that might be required:	
Pole, predator band, and vegetation	
Pole stability or other concerns:	
Predator band condition and any maintenance actions required:	
Notes on vegetation around the pole and any vegetation clearance needed:	
General notes	
If maintenance is required that wasn't able to be completed at the time of the inspection note this below:	

Amberfield Artificial Roost occupancy
Urgency of required maintenance: complete within a week (risk to bats or public) / complete within next maintenance visit (minor repair required) **Note:** If a significant risk to either the public or bats is discovered alert the Consent Holder immediately and secure the site as appropriate (including taping off area with hazard tape if there is a potential risk to public).

10.3.2 Maintenance and maintenance inspections

Maintenance should be carried out during the period between May to October with at least one maintenance inspection to occur (additional to the occupancy inspections above) during this period. This maintenance period seeks to avoid times of the year where long-tailed bat females are potentially heavily pregnant or when dependent, non-volant (unable to fly) young may be present. If urgent maintenance requirements are identified by the occupancy survey in December, the certified bat ecologist will be required to check whether bats are present prior to maintenance being carried out in accordance with the following process.

Before inspections and maintenance can begin the inspector should approach the pole quietly and, without disturbing the pole or boxes, an infrared camera[8] will be used to check the inside of all bat boxes on the poles. If bats are present note the artificial roost boxes being used, how many bats are visible, and return at a later date during the maintenance period.

If bats are found to be present during three attempted maintenance visits, a through visual inspection from the ground should be undertaken to identify any maintenance issues. This occurrence should be reported to the site bat ecologist along with any potential maintenance concerns. The bat ecologist will inform on the next steps if critical maintenance is required, that may endanger roosting bats, and bats occupy the artificial roost for an extended period.

Once the inspector has confirmed, from the ground, bats are not present, they should use a ladder to access the roost boxes and carry out the following checks:

1. Check the security and stability of the pole in the ground; if the pole is not secure do not climb it.
2. For each bat box check for bats again – if bats are found descend the ladder carefully and follow the advice above on what to do if bats are found.
3. Check for general condition of bat boxes; rusting fasteners, structural integrity, rot, weathertightness of joins, etc.
4. Check for material that may block or take up roost space; bird nesting material[9], spiderwebs, any other debris.
5. Ensure bat boxes are securely attached to the pole.

[8] Or whatever is best practise at the time of inspection – allowing for development and improvement in both thermal and infrared technology.

[9] Contact the site ecologist if a bird is found actively nesting (and/or its eggs or young) within or near an artificial roost before proceeding to remove nesting material. Further maintenance should be delayed until advice on next steps is received.

6. Ensure roofing material is secured and weather tight.
7. Check the predator band and ensure it remains tight and well secured.
8. Check for evidence of use by bats including dark staining, scratches, smell, and guano on or near the pole.
9. Check surrounding vegetation is not within a 2.5m vertical distance of the top of the installed predator band and/or 3m of horizontal distance to any area of the pole above the predator exclusion band.

For every pole checked the data within Table 7 should be collected and provided to the Consent Holder and the Site Ecologist (for later reporting).

Table 7: Amberfield Artificial Roost maintenance record.

Amberfield Artificial Roost maintenance record		
Date:	Inspector:	Pole Number:
Roost box 1		
Artificial roost box #:	Bats present? Ground check: Yes/No If yes number seen?: Ladder check: Yes/No If yes number seen?:	
Maintenance notes:		
Evidence of bat use?		
Roost box 2		
Artificial roost box #:	Bats present? Ground check: Yes/No If yes number seen?: Ladder check: Yes/No If yes number seen?:	
Maintenance notes:		
Evidence of bat use?		
Roost box 3		
Artificial roost box #:	Bats present? Ground check: Yes/No If yes number seen?: Ladder check: Yes/No If yes number seen?:	
Maintenance notes:		

Amberfield Artificial Roost maintenance record	
Evidence of bat use?	
Roost Box 4	
Artificial roost box #:	Bats present? Ground check: Yes/No If yes number seen?: Ladder check: Yes/No If yes number seen?:
Maintenance notes:	
Evidence of bat use?	
Pole, predator band, and vegetation	
Pole stability or other concerns:	
Predator band condition and any maintenance actions:	
Notes on vegetation around the pole and any vegetation clearance carried out:	
General notes	
If maintenance is required that wasn't able to be completed at the time of the inspection note this below: **Urgency of required maintenance:** complete within a week (risk to bats or public) / complete within a month (minor repair required) **Note:** If a significant risk to either the public or bats is discovered alert the Consent Holder immediately and secure the site as appropriate (including taping off area with hazard tape if there is a risk to the public).	

11.0 Predator Control

Effective predator control within narrow habitats adjacent to urban and peri-urban land uses is a difficult undertaking. While benefit can be gained through the suppression of predator numbers, the significant edge to area ratios means re-invasion is rapid and consistent. Also, traditional methods for monitoring the efficacy of predator control and determining success against performance criteria such as residual tracking indices and residual trap capture rates are not appropriate to use in such predator control regimes. They do still provide useful information for adapting control regimes.

We consider there is significant potential benefit in the implementation of a predator control programme within the BPAs as we expect bat usage of the site to increase over time. With this increased usage it is likely that roosting within natural roosts, unprotected by predator bands, will become more common throughout the site.

The detailed methods for predator control proposed are provided within the HMP.

We note for clarity: while we have proposed predator population monitoring, this does not serve as a performance measurement for consent compliance, but as an indicator of areas where pest animals may be increasing or maintaining high densities. This will allow an adaptive predator control framework to be implemented where, over time, patterns of density and areas of higher predator abundance are able to be targeted with greater density of control devices or more frequent checking/ servicing. These areas may change over time and the intention is that the predator control and monitoring regime is adaptive and responsive to predator population fluxes, to achieve predator population suppression throughout the BPAs. This monitoring will also inform if the chosen methods of control are no longer working due to bait or trap shyness so methods can be adapted to better target predator populations.

12.0 Bat Monitoring

Monitoring of long-tailed bat activity will be carried out throughout the Amberfield site to determine whether bat activity remains within the restored habitats and neighborhood reserves, and whether patterns of bat movement across the site continue as development progresses. The main focus of bat activity monitoring is within bat priority areas, which include retained and restored habitats and reserves.

There exists a considerable amount of survey data from this site already collected since the summer of 2017/18. This baseline data will be used to compare pre and post development activity and add to the base of understanding of the changes in bat activity over time.

12.1 Monitoring questions

The monitoring throughout the site seeks to answer the following questions:

- Do long-tailed bats continue to use the BPAs onsite during and post development/construction of the residential areas?

- Does the level of activity in the BPAs remain consistent from pre and post development levels?
- Do long-tailed bats continue to use the Waikato River corridor as a movement corridor?
- Are bats able to continue traversing along the east-west shelterbelt once Roads 1 & 2 are constructed?
- Do the culverted crossing and bridge within the southern gully present a barrier to bat movements through the Southern Gully?
- Does the long-tailed bat activity onsite and offsite follow the same patterns year to year? Or is the activity onsite changing in a way not consistent with activity in areas monitored offsite?
- If bats are crossing Roads 1 and 2, the Southern Gully bridge, and the Southern Gully embankment crossing are they flying at height above the traffic or under the Southern Gully Bridge, as intended by the design in these locations or are they flying at an altitude that would put them at risk from colliding with traffic.

12.1.1 Bioacoustic survey locations/targets

. The Amberfield bat survey locations noted are mapped in the “Amberfield Subdivision - Bat Protection Plan - Landscape Architecture Drawing Set”. Surveys will target six sites for sampling bat activity/ movement. The monitoring questions above have driven the locating of monitoring sites as outlined below:

- Waikato River Corridor: The Waikato River adjacent to the site. Detector locations noted as WR#. Note: In some areas of the site (predominantly south of the confluence of the Southern Gully and Waikato River) safe access to the river is prevented by steep drop offs/ cliffs to the Waikato River. Detector locations have therefore been placed in areas where safe access is possible.
- East-West Shelterbelt: Across the east-west shelterbelt/ Roads 001 and 002 and beyond to the western side of Peacockes Road. Detector locations noted as EW#.
- Southern Gully: Through the southern gully and over/under the bridge and embankment crossing. Detector locations noted as SG#.
- Reference Sites: Two reference sites as aligned with the November 2019 survey in Hammond Park and south of Amberfield along the Waikato River. Detector locations noted as HP# and WRS# respectively.
- BPAs: monitoring of activity in general across the BPAs throughout the whole site. This target will use all detector data from the above targeted surveys as well as additional detectors located within the BPAs. Detector locations noted as BPA#.
- Reference sites urban areas: reference sites to monitor bat activity in pasture areas which are to be later developed into an urban land use. These can be used as reference datapoints for future effects assessments in the Peacock Structure Plan Area (PSPA) and integrate within the wider monitoring framework for the PSPA. Notes: in some years earthworks will be active in these locations and they will not be able to be surveyed – surveying should resume as soon as possible once earthworks are complete to provide a pre-construction and post construction/urbanisation data set. Detector locations noted as R#.

12.2 Previous survey data

Full site surveys have been undertaken in December 2017, March 2018, November 2019, and February/ March 2020. The summarised locations of survey and survey results for each of these surveys is provided in Appendix 4. All surveys followed the standard bioacoustic methods as outlined within Section 12.3 below. The raw, summarised, and analysed data are available from Boffa Miskell Ltd for all previous surveys.

The survey locations within the Amberfield site used during the 2019 and 2020 surveys will largely inform the continued survey locations once development has commenced.

12.3 Bioacoustic monitoring methods

Bat surveys are to be undertaken using AR4 automatic bat monitors (ABMs) manufactured by the Department of Conservation (DOC) which passively record both long-tailed bat (at 40 kHz) and short-tailed bat (*Mystacina tuberculata*) (at 28 kHz) echolocation calls on two concurrently operating frequency channels. The ABMs operate remotely by recording and storing each potential echolocation call (bat pass) along with the date and time of the occurrence of the potential bat pass. The model and version of detectors should be consistent throughout the survey periods and not changed unless a robust comparison between models is undertaken.

Long-tailed bat activity is influenced by overnight weather conditions such as temperature, rainfall, wind speed and moonlight. To ensure data collected is standardised with surveys both within and outside the site, unsuitable overnight weather conditions are to be excluded from the analysis.

Suitable conditions are defined for the purpose of this survey report as follows:

- Air temperature does not drop below 10°C from sunset until four hours after sunset;
- Rainfall of no more than 2.5 mm occurs in the first two hours after sunset;
- Mean overnight wind speed does not exceed 20 km/h;
- Overnight wind gusts do not exceed 60 km/h; and
- Nights where there is not a full moon or one night either side of a full moon[10].

The conditions are further constrained that that outlined within the tree fell protocols to ensure, as far as possible, comparable environmental conditions between years/monitoring rounds.

Hourly weather data from the survey period is to be sourced from the nearest weather station available in New Zealand's National Climate database.

All ABMs set are to have the same date and time settings and programmed to monitor from one hour before sunset to one hour after sunrise. All ABM recordings will be downloaded and acoustic data from all nights is to be analysed using BatSearch 3.12, a programme designed by

[10] In December 2019, DOC released updated guidelines on weather conditions suitable for automatic bat monitoring (primarily for determining roost occupancy rather than for survey), including nightly temperatures to not exceed 17°C and relative humidity to be above 70%. However, this would render a large proportion of the summer season unsuitable for bat monitoring in the Waikato, Bay of Plenty, Auckland, and Northland regions due to the current prevalence of warmer and drier weather during the summer months. Consequently, for the purpose of this survey we have not considered humidity in the determination of fine weather nights nor were these maximum temperature or relative humidity factors considered in previous surveys.

DOC for use with their ABMs. This software converts the potential bat echolocation calls (bat passes) into spectrograms that are visually analysed.

Detectors are to be hung on trees where a tree is available at least 2m (preferably greater in areas where there is public access) above the ground in such a way that any small foliage or branches is not able to interfere with the recorder. Minor clearance of foliage around the detector is acceptable. If a tree is not available deployment on a waratah (minimum height of deployment should be 1.2m) or fence line (if already present).

12.4 Survey timing, duration, and survey effort

Surveys will be carried out annually during the months of February and March. This allows an approximately eight-week period each year to complete the survey and work around weather and moon phase or equipment malfunction where required.

This survey period has been selected to target a period;

- of the life cycle of long-tailed bats where they are moving around the most through the landscape and potentially most sensitive to barriers to dispersal within and across the site;
- where, due to the young leaving the roost and dispersing, bat activity is at a peak;
- where the weather is more consistent year to year;
- where insect activity is high; and
- best aligns with the most recent comparable survey carried out on site.

Detectors are to be deployed for a period of at least 21 nights. Survey effort during this deployment should achieve at least 14 fine weather nights for all detectors.

Where a detector fails to record, stops recording prematurely or encounters any other issue that reduces the survey effort below 14 fine weather nights at that location the survey location should be resurveyed immediately (within the eight week period) to achieve sufficient survey effort for a total of 14 fine weather nights. Subsequent deployments due to equipment malfunction do not have a minimum deployment time but are only required to supplement what data was captured to achieve the minimum survey effort within the eight-week survey period.

If it is practicable to coordinate with other surveys occurring within the Peacocke Structure Plan area, and data is suitable for incorporation into the statistical analysis, the survey period can be shifted to align with other surveys. However, preference is for subsequent surveys within the area to align with the survey period of the Amberfield survey for consistency.

12.5 Data summarisation

All call data is required to be summarised to a level that provides a mean (± SE) of bat activity per night, the temporal distribution of bat activity across the night (with mean ± SE) (example see Figure 4), the total number and percentage of feeding calls able to be identified, and the total number and percentage of social calls able to be identified. This data summarisation provides an ability to visually present spatial distribution of bat activity for each monitoring period but is not necessarily the data granularity that will be used for statistical analysis.

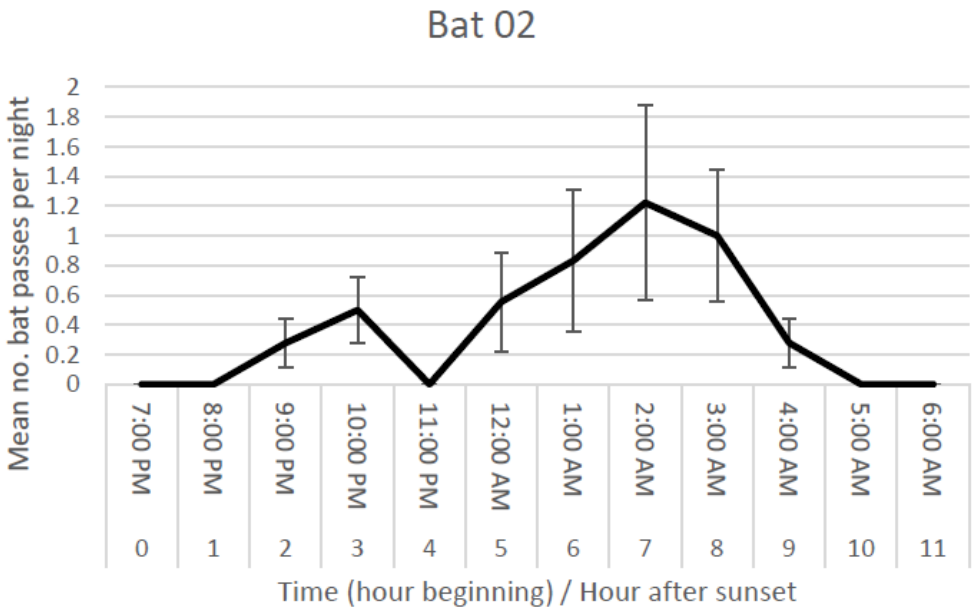

Figure 4: Example of graph of temporal distribution of bat activity across the night (with mean ± SE).

12.6 Observational data exploration

12.6.1 Avoided areas

Sample data will be routinely summarised and reviewed to describe observations and trends between sample intervals, as distinct from analysis intended to make inferences about overall population dynamics.

In particular, data will be reviewed to determine whether there are any indications of changing activity levels in specific areas where bats have typically been recorded during prior surveys, or where results inconsistent with other detectors in similar habitats observed at the same time. For example, low activity in a single detector along the Waikato Riverbank compared to others to the north and south may indicate a localised environmental issue that needs investigating.

12.6.2 Bat interaction with roads

Observations of bat activity in areas of the site where roads intersect bat habitats will be closely reviewed to glean information about bat behaviour at these crossing points. While acoustic monitoring data has some limitations (e.g., two different bats at two different detectors are indistinguishable from a single bat passing two detectors) careful notation of the timing and frequency of activity recorded at points in the immediate vicinity of road crossings will provide useful insight and may and indicate areas of concern or identify features worthy of further exploration/ survey. The following comparisons will made within the data:

East-West Shelterbelt – comparisons between bat activity detected either side of RD001, RD002, and either side of Peacockes Road will explore whether there are clear signs of avoidance of the road crossings. For example, if activity was lower at EW 02/03 than EW01/04. Note: no assumption of likely travel direction should be made as bats could be moving in either direction (east to west or west to east).

The time stamps of activity across EW 01 to EW 06 will also be explored to detect whether there are indications of linear progression of individual bats[11].

Southern Gully – as per the East-West Shelterbelt for the bridge and embankment crossing and transit through the gully. Previous surveys have observed diminishing activity with distance away from the Waikato River confluence, and very low activity occurring at or beyond the location of the proposed bridge. This should be considered when interpreting results as the Southern Gully revegetation and habitat begins to develop.

12.6.3 Action required in the event of observable avoided areas or barriers to movement

In the event that areas of avoidance or clear, unexpected drops in activity levels, are detected, both daytime and night-time onsite investigations will be undertaken to observe whether there are any obvious differences (e.g., visible light spill) in the location. Any such investigations will draw on all relevant available data, including light level measurements undertaken in accordance with the lighting consent conditions if light spill is a potential cause.

These areas should also become a focus in the infrared monitoring required within Section 12.7 to visually observe behaviours in the location to attempt to determine the driver behind avoidance.

12.7 Behavioural survey – thermal and or/ IR imaging

Thermal imaging surveys will be employed to observe the flight behaviour of long-tailed bats in their interactions, specifically if bats are at risk of collision with traffic, with the following features onsite:

- Roads 1 and 2
- Southern Gully bridge
- Southern Gully embankment crossing
- Areas where observation data analysis has detected an area of avoidance and no apparent reason is able to be seen through daytime and night-time inspections (ref Section 12.6.3).

These surveys will occur at the same time as the bioacoustic surveys and also be accompanied by handheld bat detectors (set to 40kHz) to provide warning/indication of a bat passing (note periods where no echolocation is detected should still be reviewed).

We recommend that initially these surveys are carried out three times post construction of the feature being surveyed biannually (every second year). This allows a spectrum of growth of plantings (design and installed to facilitate passage of long-tailed bats past these features) to be surveyed. Monitoring may be recommended through reporting and from the analysis of bioacoustic data to be carried out more frequently or extended based on observations of avoidance or apparent lack of activity in areas that require these features to be traversed to get to.

[11] Note: ABMs are manually time set and time set accuracy is likely to be ± 1 minute. Therefore, during data exploration, the analyser must consider activity within a reasonable period of time across recorders.

An exception to the recommended biannual survey will occur if a feature targeted by this survey is constructed as part of the completion of construction works on the final subdivision stage (or within three years of this occurrence) and there have, or will have been, 12 years of bioacoustic surveys by the end of this three year period. In this instance survey timing should ensure there are at least three surveys in three separate years at the feature prior to the discontinuation of bioacoustic surveys by the developer (as per Condition 118c).

Methods for this survey should follow the Thermal Imaging: Bat Survey Guidelines (Williams, 2021) developed by the UK Bat Conservation Trust, or the most applicable best practise available at the time of the survey[12]. The methods should align with those outlined for Activity surveys (Section 5.5 of the guidelines). Aligned with these methods the surveys should occur from sunset for two hours over two consecutive nights at each feature. Weather should be above 12˚C at the start of the survey period, not raining, and at least three nights away from a full moon (before or after).

Thermal/ IR cameras should be stationary and oriented in such a way to provide a clear view of the feature being surveyed. The key information being sought is how are the reacting to the features and what height are bats flying through/past these features. Therefore, where bats are detected in the survey their behaviours will be categorised into the following classifications (classifications adapted from Southern Links thermal imaging monitoring (Wildland Consultants Ltd, 2019)):

Flight behaviour at feature:

- Turns around – bat turns around close to the feature and flies away – either out of sight or a minimum of 5m away from the turning point.
- Turns and flies along feature – bat approaches the feature and then turns approximately 90˚ flies either out of sight or for more than five metres along the feature.
- No change of direction – bat flies over or under the feature being monitored.

Height of flight through, along, or near the feature:

- Within traffic envelope[13] (0-2m from road surface)
- Within traffic envelope (2-4m from road surface)
- Above traffic envelope (4m + above road)
- Under bridge (Southern Gully bridge only)

If the bat observed travels through multiple flight height tiers note for each what percentage of time was spent in each.

All detections will be accompanied with the time of detection, the length of time the bat was observable, whether the bat was detected by either handheld bat detector or stationary acoustic monitor deployed at the location.

The analysis/interpretation of the data gathered during this survey is primarily observational in nature and the response to the data should likewise be observational. Reporting should include the summaries of the data collected but also interpretive/observational commentary where the ecologist is able to see or infer behaviour changes in response to the planting/structure design in each location. Potential important and useful information could also be explored where the

[12] Technology in this space is changing rapidly and we consider it inappropriate to define a set method for surveys which may begin in some locations in several years time.

[13] Traffic envelope is consider within the road surface foot print to 4m high.

planting/design varies between features and whether the behavioural response of the bats is observably different.

12.8 Statistical data analysis

The goal of statistical analysis with respect to bat monitoring in and around the Amberfield site is to test the prediction that bats will continue to use protected flyways and foraging habitats as the surrounding landscape is progressively urbanised over time.

Analysis will incorporate datasets from previous monitoring intervals, while the sampling design will be finalised following completion of a review by an independent biostatistician to confirm the suitability of the sampling framework for quantitative analysis and identify opportunities and constraints to achieving a well-balanced design with adequate statistical power to robustly evaluate temporal and spatial trends in bat activity within the Amberfield site.

A statistical framework to assess the influence of fixed and changing landscape variables on bat activity patterns will be developed following a review of options for statistical analysis of data, including coordination with other (current and future) monitoring projects throughout south Hamilton to provide a landscape-wide context for interpretation of data.

Doug Armstrong has been engaged to develop the models and carry out the statistical analysis fo this project as has reviewed the monitoring plan within this BPP (Appendix 5)

13.0 Bat Monitoring Report

Reporting of the results of bat monitoring and the artificial roost inspections shall be prepared by suitably qualified ecologist/s (will require competency in both bat ecology and habitat restoration) and provided annually to Council and to the Bat Habitat Enhancement Review Panel within two months of survey completion (therefore likely to be provided in May-June).

This report should include the following information:

- Bat monitoring data, analysis, and observation results as outlined in Section 12.5 to 12.8.
- Any onsite observations undertaken as a result of observations of potential avoidance behaviour detected and issues rectified or proposed to be rectified if able to be detected.
- Any results of thermal imagery surveys and/or the identification of triggering levels of bat activity and timeframes and methods for planned thermal imagery surveys in subsequent monitoring seasons.
- The results of the artificial roost box inspections conducted within December the previous year and the maintenance inspections the previous year.
- Any injured bats or dead bats detected since the previous bat monitoring report. Note: any injured or dead bats found should be reported immediately as well as in the annual report.

Accompanying the above information, the report should make an assessment of:

- Whether bats are actively moving across the site and any potential barriers to this movement identified and in a similar capacity the activity of bats around road and bridge crossings.
- The trends of bat activity within the BPAs compared to previous years.
- Patterns of artificial roost box occupancy and if trends are emerging for preferred locations and/or aspects.
- The data and observations from any thermal imagery survey which occurred during the period.
- Whether there are any recommended changes to the BPP and/or HEP including:
    - modification to the monitoring methods and/or regime;
    - modification to street lighting;
    - modification or addition to the vegetated buffer plantings;
    - installation of temporary physical barriers (e.g. brush hedging or similar) to supplement vegetated buffers;
    - modification to proposed residential berm screen planting; and/or
    - modification to predator control regime.

14.0 Long-term Future of the Site

While this BPP outlines the requirements of mitigation and monitoring matters during the development process and for a period beyond (for monitoring etc.) as aligned with Condition 126 of the HCC consent. Ultimately the BPAs are vested with HCC who become responsible for the continued protection of these habitats as one of the reserves primary purpose. We consider that the restoration and creation of the BPAs throughout the site present a considerable ecological and social opportunity for continued protection and management.

We consider there is significant scope for the development of an Amberfield community group to be developed to be actively involved in the continued restoration and protection of the BPAs. While not within the scope of the BPP we encourage such an approach and consider that the future of the site is likely best managed by empowering the community which lives within the Amberfield subdivision to take an active involvement within the unique ecosystem on their doorstep. This could include the introduction of emergent canopy trees (such as tawa, swamp maire, and pukatea) in the planted areas which are not able to be planted in the early stages of restoration, continued pest control, and maintenance and installation of roost boxes. Pest plant control will be an ongoing management requirement, many invasive pest plants on this site have been proposed to be retained due to their structural function as buffering and the habitat they provide to long-tailed bats. The prevalence of these species in the site and wider area will pose a significant barrier to the management of these species. In the long term the goal should be to progressively control species that are currently dominant along the Waikato river such as tree privet, Chinese privet, and pampas. The progressive control will need to occur with the

replacement of these plants with native or non-invasive non0natives which provide screening and roosting features.

15.0 References

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Appendix 1: Amberfield - Tree Fell Protocols

Appendix 2: RD001 East - West Shelterbelt Layout Plan & RD002 East - West Shelterbelt Layout Plan – Harrison Grierson

Appendix 2a: RD001 East - West Shelterbelt Layout Plan – Harrison Grierson

Appendix 2b: RD002 East - West Shelterbelt Layout Plan – Harrison Grierson

Appendix 3: Northern Amberfield Development Visual Tree Inspection - Treelands

Appendix 4: Previous Long-tailed Bat Survey Data

Appendix 4a: December 2017 Bat Monitoring Results Map

Appendix 4b: March 2018 Bat Monitoring Results Map

Appendix 4c: November 2019 Bat Monitoring Results Map

Appendix 4d: February to March 2020 Bat Monitoring Results Map

Appendix 5: Doug Armstrong - Evaluation of bat monitoring plan for Boffa Miskell

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

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