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Kings Quarry, Stage 2

Ecological Management Plan

for: Kings Quarry Limited

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1 INTRODUCTION

This Ecological Management Plan (EMP) has been prepared for the Kings Quarry, Stage 2 project on behalf of Kings Quarry Limited. The Stage 2 project involves the staged development and operation of a quarry over approximately 33.125 ha of land. The Stage 2 project is designed to be an expansion of the existing Stage 1 quarry pit within Kings Quarry landholdings in Waitoki, Auckland.

The EMP encompasses a suite of management plans that sets out how actual and potential adverse ecological effects associated with the Stage 2 project will be addressed.

1.1 Purpose and Objectives of the EMP

This EMP encompasses a suite of management plans which will come into effect in the event of Kings Quarry Limited obtaining resource consents for the expansion of works. The purpose of this plan is to avoid, minimise and remediate the potential effects on native biodiversity during the expansion of the Project area. Where residual effects remain following these actions, they are addressed separately in the residual effects analysis reports for terrestrial values (Bioresearches, 2025b) and freshwater ecology values (Bioresearches 2025c). The actions required for residual effects are covered in a separate residual effects management plan (Bioresearches and Alliance Ecology, 2025).

Under the new legislative framework (National Policy Statement for Indigenous Biodiversity, 2023) effects are required to be managed under the effects management hierarchy (Figure 1):

> **effects management hierarchy** means an approach to managing the adverse effects of an activity on indigenous biodiversity that requires that:
>
> (a) adverse effects are avoided where practicable; then
>
> (b) where adverse effects cannot be avoided, they are minimised where practicable; then
>
> (c) where adverse effects cannot be minimised, they are remedied where practicable; then
>
> (d) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, biodiversity offsetting is provided where possible; then
>
> (e) where biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided; then
>
> (f) if biodiversity compensation is not appropriate, the activity itself is avoided.

Figure 1. Effect management hierarchy under the National Policy Statement for Indigenous Biodiversity.

This EMP has been prepared to identify how the project will address and manage adverse effects on the ecological values of the land within the Kings Quarry, Stage 2 footprint and its surrounds. The EMP focusses on terrestrial flora and fauna, however, it also includes some measures to address freshwater effects. Specifically, management measures relating to freshwater fauna are

included. The EMP sets out procedures for how Kings Quarry will minimise and manage adverse effects on ecological values, including:

- Vegetation Removal Management Plan
- Avifauna Management Plan
- Bat Management Plan
- Lizard and Invertebrate Management Plan
- Native Freshwater Fish Relocation Plan
- Threatened Plant Management Plan
- Kauri Dieback Management Plan
- Edge Effects and Buffer Management Plan
- Weed Control Management Plan
- Mammalian Pest Control Plan

Pest animal management is also required in relation to the Lizard and Invertebrate; Threatened Plant; and Edge Effects and Buffer management plans (Figure 2). Further, Pest plant management is an integral component of the Threatened Plant Management Plan and Edge Effects and Buffer Management Plan, and similarly the separate Remediation Plan, and have been described briefly in these sections with a comprehensive overview brought together within the Weed Control Management Plan. These requirements are described generally within each of these respective plans, with details provided within the Mammalian Pest Control Plan.

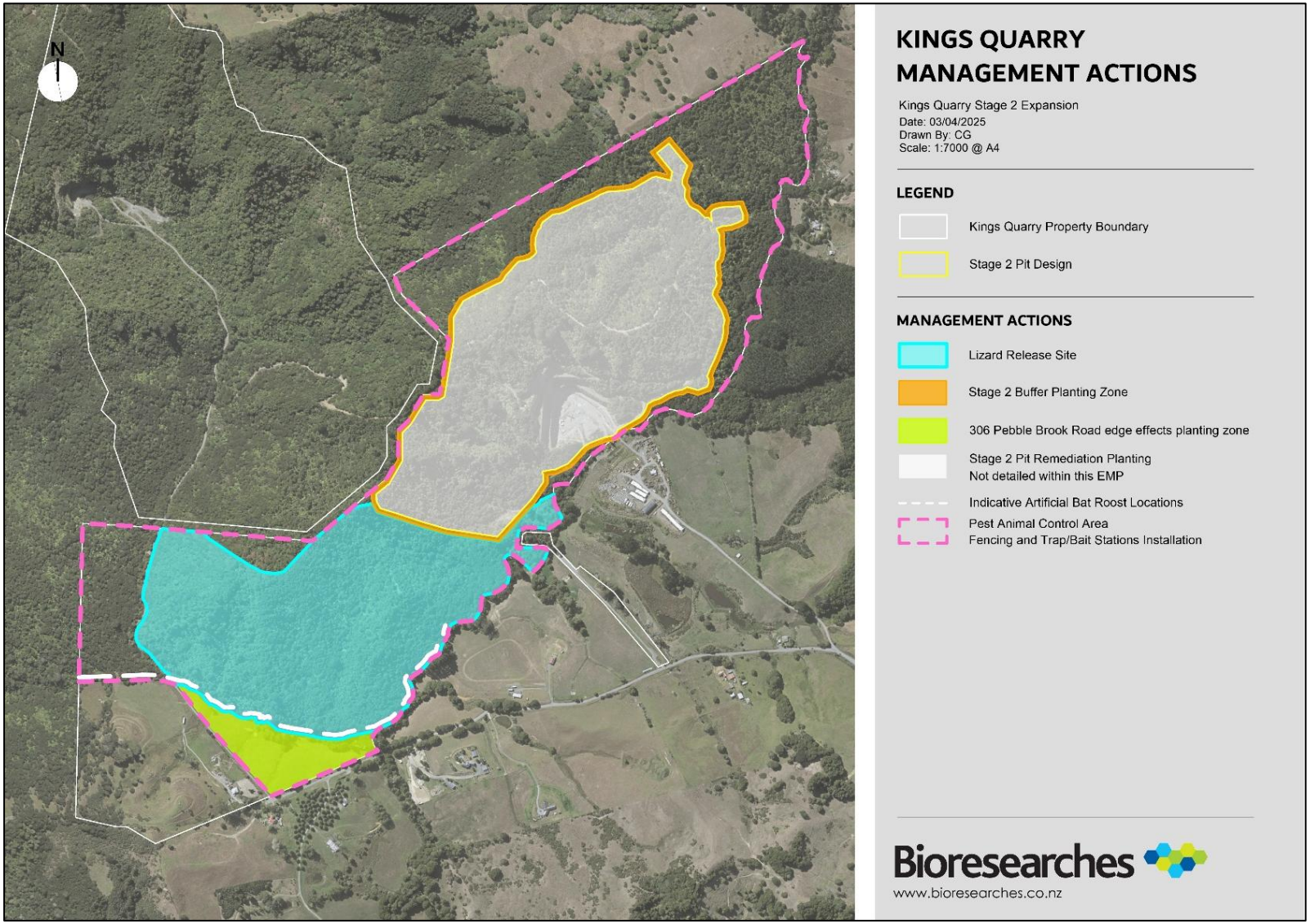


Figure 2. Map showing the location of proposed pest animal control management throughout Kings Quarry property

1.2 Responsibilities and Competencies

1.2.1 Key Personnel (SQEP)

This EMP, and each section, is required to be prepared and implemented by a SQEP (Suitably Qualified and Experienced Person(s)), in close coordination with Kings Quarry Limited. As at 2025, the following ecological leads are identified as responsible for the implementation of the EMP:

Table 1. Identification of SQEP as required by the draft resource consent conditions.

Chapter	EMP Section	Biodiversity Value	SQEP responsible
3	Vegetation Removal Management Plan	Native vegetation	Kate Feickert
0	Lizard and Invertebrate Management Plan	Lizards and inverte-brates	Chris Wedding
5	Avifauna Management Plan	Avifauna	Michael Anderson
6	Bat Management Plan	Bats	Alisha Hart
7	Freshwater Fish Management Plan	Native Freshwater Fauna	Laura Drummond
8	Threatened and At-Risk Plant Management Plan	Threatened Plants	Kate Feickert
9	Kauri Dieback Management Plan	Kauri Dieback	Kate Feickert
10	Edge Effects Management Plan	Edge effects	Kate Feickert
12	Mammalian Pest Control Plan	Pest animals	Helen Blackie

1.2.2 Staff Induction Procedures

Prior to the commencement of any staged vegetation removal and stream reclamation, all SQEP (Table 1) and any personnel working or assisting with ecological management in accordance with this Plan, shall hold a prestart meeting to discuss the location and extent of any works required, the required ecological management actions in accordance with actions identified in this Plan, any lead in times required to complete pre- vegetation clearance management actions.

A pre-start meeting must be held prior to the commencement of any streamworks activity in each year between October 1 and April 30 that the streamworks consent is exercised.

Where the final Stage 2 extent is reached following any vegetation removal works, requirements for implementation of edge-effects management (Section 10 of this EMP) shall be implemented, including physical demarcation and fencing, to ensure works and associated activities do not breach these works areas, including silt and sediment spill.

1.3 EMP Structure

1.3.1 Linked Documents

This document has been prepared in line with draft Consent Conditions 17-20 to direct actions to minimise ecological effects within and adjacent to Kings Quarry, however, should be read in conjunction with the following:

- Bioresearches (2025a). Ecological Impact Assessment: Kings Quarry Stage 2. Prepared for Kings Quarry Limited.
- Bioresearches (2025b). Residual Effects Analysis Report for Terrestrial Ecology Values: Kings Quarry Stage 2. Prepared for Kings Quarry Limited.
- Bioresearches (2025c). Freshwater Residual Effects Plan: Kings Quarry Stage 2. Prepared for Kings Quarry Limited.
- Bioresearches and Alliance Ecology (2025). Residual Effects Management Plan: Kings Quarry Stage 2. Prepared for Kings Quarry Limited.

Chapters 3-11 provide specific management plans for different biodiversity components. Each of these are provided to meet the required actions for minimisation of impacts, as part of the RMA hierarchy. The specific draft resource consent conditions that are addressed by each plan are provided in Table 2 below.

Table 2. Summary of the draft resource consent conditions that are addressed by each plan.

Chapter	EMP Section	Relevant resource consent conditions
0	Lizard and Invertebrate Management Plan	6j, 18e, 19f, 33-35
5	Avifauna Management Plan	6i, 18d, 19e, 30-32
6	Bat Management Plan	6h, 18c, 19d, 27-29
7	Native Freshwater Fish Relocation Plan	6k, 18f, 19g, 36-37
8	Threatened and At-Risk Plant Management Plan	6g, 18b, 19c, 24-26
9	Kauri Dieback Management Plan	6d, 13-16
10	Edge Effects and Buffer Management Plan	6f, 18a, 19b, 21-23
11	Weed Control Management Plan	6q, 89
2	Mammalian Pest Control Plan (Quarry Site and 306 Pebble Brook Road)	6l, 18g, 19h, 38-44

1.4 Draft Resource Consent Conditions

The Ecological Management Plan has been drafted to meet the requirements of the following recommended consent conditions. These conditions are provided to ensure appropriate ecological

management and offset, and compensation actions are applied to minimise, offset and compensate for adverse ecological effects:

Kauri Dieback Management Plan

13. The consent holder must submit to Auckland Council for certification a map that identifies kauri hygiene zones, being three times the radius of the drip line of any kauri tree. Where such trees occur, the consent holder must also submit a Kauri Dieback Management Plan (**KDMP**) for certification no less than ten working days prior to commencement of construction works or vegetation removal. The KDMP shall be prepared by a suitably qualified expert in biosecurity, plant pathology or similar.

14. The objective of the KDMP shall be to avoid or minimise risk of introducing or spreading kauri dieback disease within and beyond the Site.

15. The KDMP must provide appropriate management and monitoring protocols to avoid potential transmission of kauri dieback disease (Phytophthora species) during the construction and operational phases of the project. These protocols shall meet or exceed the latest Auckland Council Kauri Hygiene Standard Operating Procedures and Biosecurity (National PA Pest Management Plan) Order 2022.

    Advice Note:

    Further advice can be found within the guidelines titled 'Hygiene Procedures for Kauri Dieback' and 'Procedures for Tree Removal and Pruning' published by the Ministry for Primary Industries Kauri Dieback Management Programme which can be found at www.kauriprotection.co.nz or copies can be obtained from Auckland Council.

16. The certified KDMP must be kept on site at all times, and must be implemented throughout the duration of earthworks/quarry activity.

Ecological Management Plan

17. No less than ten working days prior to the commencement of any vegetation removal or earthworks, the consent holder must submit to Auckland Council for certification an overarching Ecological Management Plan (**EMP**) prepared by a suitably qualified and experienced ecologist. The objective of the EMP is to avoid or minimise the loss of ecological values prior to and during habitat disturbance and vegetation removal.

18. The EMP must include the following management plans:

    (a) Edge Effects and Buffer Management Plan

    (b) Threatened and At Risk Plant Management Plan

    (c) Bat Management Plan

    (d) Avifauna Management Plan

(e) Lizard and Invertebrate Management Plan

(f) Native Freshwater Fish Relocation Plan

(g) Mammalian Pest Control Plan (for 306 Pebble Brooke Road and Oldfield Road site)

19. The EMP must detail the methods by which the objective set out in Condition 17 must be achieved, including:

(a) Ecological management during construction and operation of the Project;

(b) Management of edge effects and buffers;

(c) Management of threatened plants;

(d) Management of effects on bats;

(e) Management of effects on avifauna;

(f) Management of effects on lizards and terrestrial invertebrates;

(g) Management of effects on freshwater fish;

(h) Mammalian pest control; and

(i) Ecological monitoring and reporting to Auckland Council prior to, during and post-construction and operation to determine if the EMP objectives and performance measures are being met.

Advice note:

Details of the roles and responsibilities of key staff responsible for implementing the EMP and procedures for training of contractors and other Project staff regarding the EMP.

20. The EMP must provide a planting plan and pest control and maintenance schedule for all newly created edges where vegetation removal will occur. The planting plan must be consistent with Auckland Council's Restoration Planting Guidelines and provide for any threatened or At-Risk Plant species within the Project footprint. The pest control must extend over the north-eastern corner of the site, shown in Figure 20 of Bioresearches' Ecological Impact Assessment (dated April 2025).

Advice note:

This plan needs to be read in conjunction with the other sections of the EMP and the REMP, which addresses offset/compensation measures.

Edge Effects and Buffer Management Plan (EEBMP)

21. The objective of the Edge Effects and Buffer Management Plan is to demonstrate how edge effects resulting from vegetation removal will be mitigated.

22. The Edge Effects and Buffer Management Plan must be prepared by a SQEP(s), require all plants to be ecosourced, and must include as a minimum:

(a) A schedule of plant species, including a schedule of plant species, provision of any threatened or at risk species identified by the Threatened and At Risk Plant Management Plan (Condition 25), as appropriate

(b) Methods for planting and maintenance

(c) The location(s) and timing of planting

(d) Weed management, including strategies to prevent or minimise spread of weed species within the edge area

(e) Success targets, methods for monitoring and reporting to determine the effective establishment of plantings, for a minimum of five years following each area of edge and buffer planting.

(f) Contingency actions and further monitoring for any targets that are not met.

23. The Edge Effects and Buffer Plan Management Plan must be submitted to Auckland Council for certification and must be implemented in full over the life of the consent.

Threatened and At-Risk Plant Management Plan (TARPMP)

24. The objective of the Threatened and At Risk Plant Management Plan is to demonstrate how potential adverse effects of the Project on Threatened and At Risk Plants will be avoided or minimised.

25. The Threatened and At Risk Plant Management Plan must be prepared by a SQEP(s), require all plants to be ecosourced, and must include as a minimum:

(a) A schedule of the threatened and at risk plant species identified within the Project and that are to be addressed by the Plan

(b) Methods for seed collection, as appropriate, planting and maintenance

(c) The location(s) and timing of planting

(d) Weed management, including strategies to prevent or minimise spread of weed species within the planting area

(e) Success targets, methods for monitoring and reporting to determine the effective establishment of plantings, for a minimum of five years following each area of planting.

(f) Contingency actions and further monitoring for any targets that are not met.

26. The Threatened and At Risk Plant Management Plan must be submitted to Auckland Council for certification and must be implemented in full over the life of the consent.

Bat Management Plan (BMP)

27. The objective of the Bat Management Plan is to demonstrate how mortality and injury to any potentially present roosting bat(s) will be avoided by vegetation removal.

28. The Bat Management Plan must be prepared by a SQEP(s) and must include as a minimum:

    (a) Timing of implementation of the Bat Management Plan,

    (b) Procedures for bat tree felling protocols or any advances in procedures since 2024,

    (c) Methods to ensure any identified active roosts within and adjacent to the buffer planting area are protected (e.g. pest control, tree bands where appropriate).

    (d) Methods to appropriately replace any identified roost, consistent with the Bat Recovery Group's artificial bat roost advisory note (2022) or any advances in procedures since 2022,

    (e) Monitoring of any provided artificial roosts for the life of the consent.

    (f) Reporting as part of other fauna management (invertebrates, lizards, Bats).

29. The Bat Management Plan must be submitted to Auckland Council for certification and must be implemented in full over the life of the consent.

Avifauna Management Plan (AvMP)

30. The objective of the Avifauna Management Plan is to demonstrate how mortality and injury to all native avifauna protected by the wildlife act, including their eggs and unfledged chicks, will be avoided during vegetation removal.

31. The Avifauna Management Plan must be prepared by a SQEP(s) and must include as a minimum:

    (a) Pre-clearance survey methods for native avifauna nests, including cavity nesting species

    (b) Methods to ensure active nests are avoided during vegetation removal, including appropriate setbacks of works and monitoring

    (c) Reporting as part of other fauna management (invertebrates, lizards, Bats).

32. The Avifauna Plan must be submitted to Auckland Council for certification and must be implemented in full over the life of the consent.

Lizard and Invertebrate Management Plan (LIMP)

33. The objective of the Lizard and Invertebrate Management Plan is to describe how potential adverse effects of the Project on native lizards and rhytid snail (*Amborhytida dunniae*) will be avoided or minimised.

34. The Lizard and Invertebrate Management Plan must be prepared by a suitably qualified and experienced herpetologist and must include as a minimum:

    (a) Pre-clearance salvaging protocols for native lizards

(b) Works management to salvage native lizards during vegetation removal activities, including construction-assisted protocols

(c) Incidental discovery protocols for any threatened or 'At Risk' lizard and invertebrate species that may be discovered incidentally at the site, including the Nationally 'At Risk' rhytid snail (*Amborhytida dunniae*).

(d) Post-works search protocols to recover any additional lizards in the cleared area

(e) Relocation protocols including relocation site(s) selection, and habitat enhancement measures to increase the likelihood of establishment and persistence of relocated individuals.

(f) Compliance monitoring and reporting requirements, including any triggers for monitoring translocation success at the release site.

35. The Lizard and Invertebrate Management Plan must be submitted to Auckland Council for certification and must be implemented in full over the life of the consent.

Advice note:

To survey capture, relocate, or otherwise disturb lizards, a Wildlife Act Authority is required from the Department of Conservation.

Native Freshwater Fish Relocation Plan (NFFRP)

36. The objective of the NFFPP is to avoid, remedy or minimise the potential adverse effects of the project on native fish and kōura.

37. The NFFRP is to be prepared by a SQEP(s) and must include as a minimum:

(a) Methodologies to recover fish within the impact streams

(b) Methods to recover kōura

(c) Methodologies to recover fish during weir removal works

(d) Fishing effort.

(e) Details of the relocation site

(f) Storage and transport measures including the best practice for prevention of predation and death during capture.

(g) Euthanasia methods for diseased or pest species.

Mammalian Pest Control Plan (MPCP) – Quarry Site and 306 Pebble Brook Road

38. The Mammalian Pest Control Plan (MPCP) addresses the management of pests at the quarry site and adjacent site at 306 Pebble Brook Road.

39. The objective of the Mammalian Pest Control Plan (MPCP) is to achieve pest control for all target species (mice, rats, stoats, ferrets, weasels, feral cats, rabbits, wasps, pigs and goats) and to maintain populations at the identified management targets.

40. The MPCP must be prepared by a suitably qualified and experienced ecologist and set out the procedures to be implemented by the Consent Holder to achieve the objectives set out in Condition 39, and, as a minimum, specify:

    (a) Target pest species, pest reduction targets and target thresholds to be achieved to enable the objectives of the MPCP

    (b) Methods to achieve target species outcomes, which will include descriptions of spatial configuration of bait lines and baiting and/or trapping details including types of baits/traps and frequency of baiting/servicing

41. A description of monitoring/surveillance proposed in accordance with standard accepted practice. Pest control shall be undertaken in accordance with the MPCP on an ongoing basis for the life of the consent.

42. The Consent Holder must ensure that the pest control management targets and management thresholds set out in Table 1 below, are met and sustained for the period specified in Condition 33. These targets will come into effect one year after commencement of the MPCP to allow for control and monitoring infrastructure to be deployed.

Table 1: Pest species, management targets and thresholds for MPCP. CCI is a chew-card index and CH refers to the number of camera hours.

Pest Species	Management Target	Threshold	Monitoring frequency
Mice (in Lizard Management Area Only)	<10% CCI	>15% CCI	Four monitors per year in February, May, August, and November
Rats	<5% CCI (Sep – Feb), <10% CCI (Mar – Aug)	≥10% CCI (Sep – Feb), >15% CCI (Mar – Aug)	
Possums	<5% CCI	≥10% CCI	
Stoats	2 detections per 2000 CH	3 detections per 2000 CH	
Ferrets	2 detections per 2000 CH	3 detections per 2000 CH	
Weasels	2 detections per 2000 CH	3 detections per 2000 CH	
Feral cats	3 detections per 2000 CH	>5 individual cat detections per 2000 CH	
Wasps	As per Vespex protocol	As per Vespex protocol	
Rabbits	Initiate control if observed	Any observation (incl. sign)	
Pigs and goats	Initiate control if observed	Any observation (incl. sign)	

43. Pest populations must be controlled to the targets specified in Table 1 above. Additional pest management will be required to meet targets if monitoring identifies that:

    (a) A target has been exceeded on two consecutive monitoring occasions; or

    (b) Pest populations have met or exceeded a threshold.

All monitoring including trap catch and bait consumption information, will be made available to the Council within three months of each monitoring survey.

Weir Removal

The NFFRP referred to in condition 36 must be implemented prior to the removal of the existing weir. The removal of the existing weir at Waitoki Stream must be undertaken to comply with Standard E3.6.1.13 of the AUP and must achieve the following:

(a) during the activity bed disturbance upstream or downstream of the structure must not exceed 10m either side, excluding the length of the structure;
(b) debris or other material must not be re-deposited elsewhere in the bed of the lake, river or stream, or within the one per cent annual exceedance probability (AEP) flood plain;
(c) the activity must not cause more than minor bed erosion, scouring or undercutting immediately upstream or downstream;
(d) the structure must be removed from the bed as far as practicable;
(e) Any remaining sections must not be a hazard to public access, navigation or health and safety; and
(f) The bed must be restored to a profile that does not inhibit water flow or prevent the passage of fish upstream and downstream in waterbodies that contain fish.

2 ECOLOGICAL VALUES AND EFFECTS SUMMARY

2.1 Project area Overview

2.1.1 Terrestrial Ecological Values

Vegetation within the Project area is a mixture of regenerating broadleaved species scrub/forest (VS5) and kānuka scrub/forest (VS2), as well as kauri, podocarp, broadleaved (WF11) forest fragments. All of these habitats were assigned a high ecological value and were identified as supporting a range of Threatened or At Risk (TAR) plant species, as part of a broad assemblage of indigenous fauna, including:

- Not Threatened invertebrate species (low ecological value);
- At least two At Risk lizard species (moderate ecological value);
- Not Threatened native bird species (moderate ecological value); and
- Threatened - Nationally Critical long-tailed bats (very high ecological value).

2.1.2 Freshwater Ecological Values

Thirteen streams were identified within the Project area (ranging from intermittent to permanent). These have been assigned low to high ecological value (Bioresearches, 2025). These streams were found to provide habitat for a range of freshwater fish species, including At Risk species. No wetlands were identified within the Project area.

2.2 Ecological Management Framework

2.2.1 General Approach and Guiding Principles

The National Policy Statement for Indigenous Biodiversity requires that identified adverse effects within Significant Natural Areas (SNAs) are avoided, except where provided for under Clause 3.11, which identifies an exception to subdivision, use, or development in an SNA if it is required for aggregate extraction that provides significant national or regional benefit that cannot otherwise be achieved using resources within New Zealand (NPSIB, 3.11(1)(a)(iii))). An explanation of the Project proposal with respect to this exception is provided with the application, however where adverse effects are managed pursuant to subclause 3, the following is required to be demonstrated:

1. How each step of the effect's management hierarchy will be applied; and
2. If biodiversity offsetting or biodiversity compensation is applied, how the proposal has complied with principles 1 to 6 in Appendix 3 and 4 and has had regard to the remaining principles in Appendix 3 and 4, as appropriate.

2.2.2 Measures to avoid, minimise and remediate potential effects

Measures to avoid, minimise and remediate potential effects are described in full within the Ecological Impact Assessment (Bioresearches, 2025a).

2.2.2.1 Adverse effects that are avoided, where practicable.

The proposed pit expansion avoids higher value, more mature forest in kauri, podocarp, broadleaved forest (WF11, Singers *et al.,* 2017) which, while within the Kings Quarry landholdings, covers a core area to the northwest of the proposed expansion. This older vegetation (WF11) has higher potential to provide roost trees for long-tailed bats and birds and is of a higher value food and habitat resource to birds, invertebrates (including At Risk *Amborhytida dunniae*) and potentially lizards.

2.2.2.2 Adverse effects that are minimised, where practicable.

Species-specific adverse effects (mortality) must be minimised through specific methodology, as addressed in management plans such as capture-relocation, propagation, translocation, habitat enhancement and pre-vegetation removal surveys to avoid nesting birds and roosting bats. Therefore, management methods are provided within this EMP to avoid and minimise these adverse effects on fauna and flora species.

2.2.2.3 Adverse effects that are remediated, where practicable

A total of 22.19 ha of the Project will be remediated sequentially, such that remediation planting will commence from year 1 as filled areas become available throughout the quarry life.

2.2.3 Level of Effect following Management Actions

The level of effects to habitats and species, without management, ranges from Low to High, noting that frogs are not considered to be impacted (Table 3). In accordance with Environment Institute of Australia and New Zealand (EIANZ) guidelines, any level of effect of moderate or above requires effects management. Effects management, including fauna controls on vegetation removal, relocation, edge effects buffer planting and ongoing remediation throughout the life of the quarry, is expected to substantially reduce effects on fauna and loss of their habitats to no more than moderate, and temporary (> 20 years).

Table 3. Magnitude and level of effect of the proposed works to terrestrial habitats and fauna – without effects management measures.

Habitat or species	Ecological value	Magnitude of effect	Level of Effect before avoidance, minimisation or remediation	Level of effect after Management
VS2 vegetation	High	Moderate	High	Moderate
VS5 vegetation	High	Moderate	High	Moderate
WF11	High	Moderate	High	Moderate
At Risk plants	High	Moderate	High	Low

Invertebrates	Low	Moderate	Low	Very low
Frogs	NIL	NIL	NIL	NIL
Lizards	High	Moderate	High	Low (temporary)
Birds	Moderate	Moderate	Moderate	Low (temporary)
Bats	Very high	Low	Moderate	Low*

* A low-level effect is expected following management, with some uncertainty

2.3 EMP Staging and Timeframes

2.3.1 Activities Prior to Vegetation Removal

A summary of the timing for management actions, in accordance with this EMP, are summarised in Table 4.

Table 4. General timing for management actions required by the EMP.

EMP Section	Management Action	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
VRMP	Vegetation removal												
AMP	Pre-felling Nest Surveys												
BMP	Bat Surveys and removal of High-Risk trees												
LIMP	Lizard and Invertebrate Salvage												
NFFRP	Fish Removal and Relocation												
TPMP	TAR Plants (seed collection and propagation)												
EEMP	Bunding/Fencing established at new edge												
KDMP	Kauri Dieback												
MPCP	Pest control												

The following activities are to be completed before any vegetation removal can take place as part of the Stage 3 Works:

Vegetation Removal Management Plan

- Accurate survey of the clearance area and clear visual demarcation of the edges.
- Fauna management as set out in the AMP, LMP and the BMP.

- Native fish management as set out in the FFMP.
- Identification by the project ecologist of forest natural resources to be salvaged as set out in the VRMP.
- Notification of local iwi that vegetation clearance is scheduled to be undertaken and opportunity provided for a representative to identify forest resources they may wish to have salvaged for their own purposes including native logs, vegetation, and soils.

Avifauna Management Plan

- Nest surveys to be undertaken from September 1 to February (inclusive) prior to vegetation clearance.
- If active nests of native birds are located, a 10m buffer around the nest is required until the nest fails, or the chicks naturally leave the natal area.

Bat Management Plan

- Local iwi representatives are to be notified and provided opportunities for involvement in bat survey and monitoring.
- Prior to each extent of vegetation removal (within 6 months of felling), all trees within the removal area are to be assessed by a DOC-accredited bat ecologist (C 3.3) to catalogue all trees which have the potential to support roosting bats (High-risk trees). High-risk trees may only be felled October to April (inclusive), and only once DOC Bat Roost Protocols have been followed to ensure no bats are actively roosting in the tree at the time of felling.
- Ten precautionary Artificial Roost Boxes (ARBs) are to be provided in nearby pest-controlled habitat prior to any vegetation clearance, 6 months in advance of high-risk tree removal.

Lizard and Invertebrate Management Plan

- Local iwi representatives are to be notified and provided opportunities for involvement in all aspects of capture, relocation, translocation of skinks and geckos, as well as any ongoing monitoring.
- From October 1 to April 30 lizard salvage will take place prior to vegetation removal.
- Nocturnal searching for lizards in standing vegetation will occur prior to felling.
- Release site occurs to the south-west of the Stage 2 pit within existing SEA vegetation.

Native Freshwater Fish Relocation Plan

- Local iwi representatives are to be notified and provided opportunities for involvement in all aspects of capture and relocation of freshwater fauna.

- Fish removal from impacted streams and relocation will take place no more than one week prior to instream works.

Threatened and At-Risk Plant Management Plan

- Local iwi representatives are to be notified and provided opportunities for involvement in all aspects of threatened plant management.
- Vegetation within each quarry stage to be searched prior to clearance (minimum one year to allow sufficient time for seed collection).
- Plants to be translocated or propagated and replanted within the 306 Pebble Brook Road, Stage 2 Pit Buffer and Oldfield Road Planting zones.

Kauri Dieback Management Plan

- Prior to clearance, each quarry stage is to be searched to identify any kauri trees present within the footprint including saplings and juveniles.
- Vehicle wash down station to be established at the Project area entrance.
- Access road to fill site and all quarry roads are to be metalled to prevent spread of PA.

2.3.2 Activities During and Immediately Post Vegetation Clearance

Vegetation Removal Management Plan

- The salvage of forest resources will be undertaken where possible for use in restoration planting and enhancement areas where appropriate. Resources include young seedlings for growing in the nursery and use as planting stock and ponga logs carrying young epiphytes for managing in the nursery.

Edge Effects and Buffer Management Plan

- As vegetation is cleared at each stage, new edges will be created.
- Buffer planting will take place sequentially along the newly created final SEA edges the first winter/plant season following vegetation removal.
- Buffer planting should be implemented at the 306 Pebble Brook Road Project area in the first planting season following the commencement of vegetation clearance.

Bat Management Plan

- Department of Conservation's Bat Roost Protocol must be implemented for high risk roost trees.

- High-risk trees must be assessed by a DOC-accredited bat ecologist using at least one of three methods (acoustic pre-felling survey, cavity checks, and/or roost watches) immediately prior to felling to confirm that they do not contain active roosts.
- High-risk trees must be checked post-felling by a DOC-accredited bat ecologist for any bat sign.
- Where roost trees (active or inactive) are confirmed and cannot be retained, additional ARBs will be deployed in suitable pest-controlled habitat nearby as directed by the DOC-accredited bat ecologist.

Lizard and Invertebrate Management Plan

- Destructive searches for lizards will take place as vegetation is being cleared.
- All felled vegetation will be stacked aside and remain in situ for at least two weeks to allow for further searches of canopy vegetation.

Kauri Dieback Management Plan

- Material removed is to be retained within the Kauri Dieback Management Zone (KDMZ) in the approved fill site. Any material requiring transport offsite must be to a Kauri Dieback approved landfill.

2.3.3 Monitoring and maintenance

A summary of the monitoring and maintenance elements of this EMP are identified here. Reporting requirements would be detailed in a single report, to be produced following each stage of vegetation removal.

Ecological Management Plan

- Adaptive Management: This EMP should reviewed and updated every 5 years, to ensure best practice is adhered to and the most up-to-date and effective techniques are being used.

Edge Effects and Buffer Management Plan

- Planting is required as a 10m buffer surrounding the edge of the new Stage 2 quarry pit, as well as at 306 Pebble Brook Road.
- All edge planting will need to be maintained to remain weed-free until full canopy closure (90%) occurs. The edge environment and all edge plantings should be checked for regrowth of pest plants quarterly for the first year after planting and at varying intervals for Years 2 – 5+.
- Weed control must also extend to the remediated quarry pit planting to prevent invasion of remaining SEA with pest plant species.

Lizard and Invertebrate Management Plan

- Success monitoring would be undertaken at release site locations where 20 or more lizards are captured and relocated, targeting ecostacks, where lizards are relocated.
- Monitoring would consist of stations of four artificial retreats and / or pitfall traps.
- Where artificial retreats are used, they would be installed at least four weeks prior to survey / capture period. Pitfall traps may be left in situ between survey years, however, will be neutralised with either an impenetrable cover, or filled to ensure any lizards can climb out.
- Survey period would provide for five trap inspections during suitable weather conditions over November-December or March-April, when lizards are most active. Artificial retreat survey / monitoring would be undertaken in accordance with Lettink (2012).

Bat Management Plan

- A completion report will detail all High-risk trees identified, and method and results of activity assessment.
- All Artificial Roost Boxes (ARBs) and anti-predator bands (where installed) are to be maintained and monitored for a minimum of 5 years. If any ARBs have bat sign, then, all ARBs are to be maintained for the life of consent, with inspection and maintenance for ARBs conducted annually between March and September (inclusive).
- Anti-predator tree bands installed on trees with ARBs will be checked and maintained on a six-monthly basis for a minimum of 15 years.
- An annual ARB maintenance report detailing inspection results and maintenance carried out must be submitted to Auckland Council within 30 days of inspection, and any maintenance/ replacement is required to be undertaken within 60 days of inspection.

Threatened - and At-Risk Plant Management Plan

- Monitoring and reporting is required of relocated and propagated threatened plants on an annual basis for a minimum of three years following planting.

3 VEGETATION REMOVAL MANAGEMENT PLAN

Vegetation removal from the Stage 2 pit area is proposed to be carried out in multiple stages to align with the overall quarry plan and development of the rock extraction area (Figure 3).

3.1 Pre-Clearance

Prior to vegetation removal in each staged area the following needs to be undertaken:

1. Accurate survey of the clearance area and clear visual demarcation of the edges.
2. Terrestrial fauna management as set out in the AMP, LIMP and the BMP.
3. Native fish management as set out in the NFFRP.
4. Identification of Kauri trees within the clearance area and establishment of any requirements under the KDMP.
5. Identification by the project ecologist of forest natural resources to be salvaged as set out in this section.
6. Notification of local iwi that vegetation clearance is scheduled to be undertaken and opportunity provided for a representative to identify forest resources they may wish to have salvaged for their own purposes including native logs, vegetation and soils.

Sufficient time needs to be allowed for these tasks to be undertaken at appropriate times of the year to ensure their success. Discussion should take place between the ecologists and the quarry manager as to what methods are to be used to clear the vegetation and how damage to native vegetation or fauna outside the clearance footprint can be minimised. Agreement needs to be reached with the quarry manager as to which forest resources can feasibly be salvaged during vegetation clearance and where resources will be placed or stored.

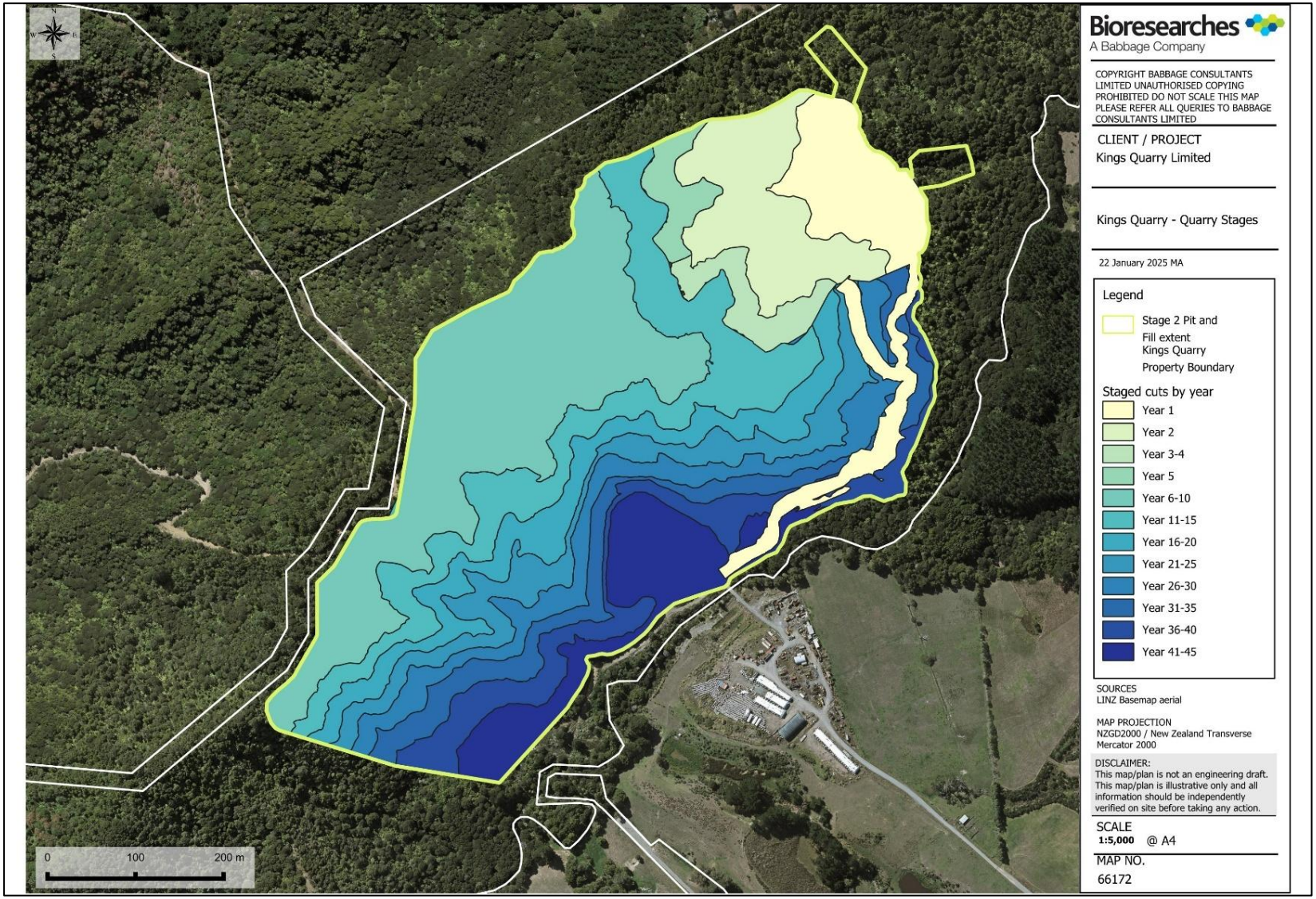


Figure 3. Indicative staging of proposed Stage 2 pit at Kings Quarry.

3.2 Pre-start meeting and staff induction

Immediately prior to vegetation clearance, a pre-start meeting is to be held to explain to quarry staff and contractors the ecological requirements associated with the vegetation clearance. Attendees should include:

- Quarry manager
- Quarry environmental manager
- Machine operators
- Subcontractor representatives
- Project ecologists
- Local iwi representatives

The Quarry managers should explain the methods to be used to clear the vegetation, and any practical or technical precautions to be taken to minimise damage to native vegetation or fauna outside the clearance footprint. It will be explained which forest resources or taonga are to be salvaged and how this is to be achieved.

The project ecologist and local iwi representatives will provide any additional information to quarry staff and subcontractors as necessary to ensure salvaged material is appropriately managed to retain its ecological viability.

3.3 During clearance

During vegetation removal in each staged area the following must be undertaken:

1. Terrestrial fauna management as set out in the AMP, LIMP and the BMP.
2. Native fish management as set out in the NFFRP.
3. Adherence to requirements set out in the KDMP.
4. Salvage of forest resources identified by iwi and/ or the project ecologist as identified prior to clearance.

3.4 Post clearance: Edge effects management

As set out in the Edge Effects and Buffer Management Plan, edge effects within the remaining parts of the SEAs will be managed through either the planting of at least a 10 m wide buffer of native vegetation or the erecting of a permanent fence where there is insufficient space for a vegetated buffer. A permanent 1.5 m high fence and super silt geotechnical fabric will be positioned at the dripline of the forest edge, allowing space between the tree trunks and the fence.

Edge effects management, including fencing and planting is to be initiated as soon as practicable following the completion of vegetation clearance each year, at edges where the final pit boundary has been cleared.

4 LIZARD AND INVERTEBRATE MANAGEMENT PLAN

4.1 Introduction

This Lizard and Invertebrate Management Plan (LIMP) has been prepared for Kings Quarry Limited to minimise potential effects on native lizards (skinks and geckos) and invertebrates (Rhytid snails) prior to and during removal of their potential habitats as part of an expansion of Kings Quarry (Figure 4). The proposed stage 2 pit and associated fill areas (33.125 ha; hereafter referred to as the Project area) are located within the wider Kings Quarry Landholdings area, which contains vegetation that may support indigenous lizards.

Vegetation clearance is proposed to be performed in stages across the Project area (Figure 5). Lizard and Invertebrate management will need to be completed prior to each stage of vegetation removal.

Copper skink (*Oligosoma aeneum*) and forest gecko (*Mokopirirakau granulatus*) were recorded in the Project area or within habitats contiguous with the Project area following formal surveys in 2008 and 2009 (Bioresearches 2008; 2009). Elegant gecko (*Naultinus elegans*) has also been recorded within 5km of the Project area (Bioresearches, 2008) (Table 5).

The Auckland tree wētā (*Hemideina thoracica*, Not Threatened), the ground wētā *Hemiandrus pallitarsis* (Not Threatened) and the Rhytid Snail (*Amborhytida dunniae*; At Risk – Declining) have the potential to be found on site, although the latter has not previously been detected in site visits and is considered very unlikely to be present. Other terrestrial species likely to be encountered include slaters (isopoda), cockroaches (Blattodea), banded tunnel web spiders (*Hexathele hochstetteri*; Not Threatened), millipedes, landhoppers, and stick insects.

Removal of this vegetation and habitat would likely result in displacement, injury or mortality of any lizards present protected under the Wildlife Act (WA, 1953), so the purpose of this Lizard and Invertebrate Management Plan (LIMP) is to detail the management measures required to minimise adverse effects on native lizards and invertebrates associated with vegetation/ habitat clearance. Actions required to avoid adverse effects on individuals within the quarry expansion zone are Capture and Relocation, Release Site Enhancement and Post-translocation Monitoring.

Table 5. Terrestrial herpetofauna of the Auckland region, corresponding NZ conservation statuses and reported occurrence within 5 km of the Project area.

Common name	Species name	National Conservation Status*	Regional Conservation Status***	Reported within 5 km of the Project area	Likelihood of occurrence within Project area
Dactylocnemis pacificus	Pacific gecko	Not Threatened	At Risk – Regionally Declining	✓	Potential
Mokopirirakau granulatus	Forest gecko	At Risk – Declining	At Risk – Regionally Declining	✓	**Confirmed within Project area**
Naultinus elegans	Elegant gecko	At Risk – Declining	At Risk – Regionally Declining	✓	**Confirmed within wider landholdings. Likely to be present.**
Oligosoma aenuem	Copper skink	At Risk – Declining	At Risk – Regionally Declining	✓	**Confirmed**
Oligosoma ornatum	Ornate skink	At Risk – Declining	At Risk – Regionally Declining		Potential
Oligosoma striatum	Striped skink	At Risk – Declining	At Risk – Regionally Declining		Potential
Lampropholis delicata	Plague skink	Introduced and Naturalised**			Confirmed

* Hitchmough *et al*. (2021)
** Also listed as an 'unwanted organism' by MPI
*** Melzer *et al.* (2022)

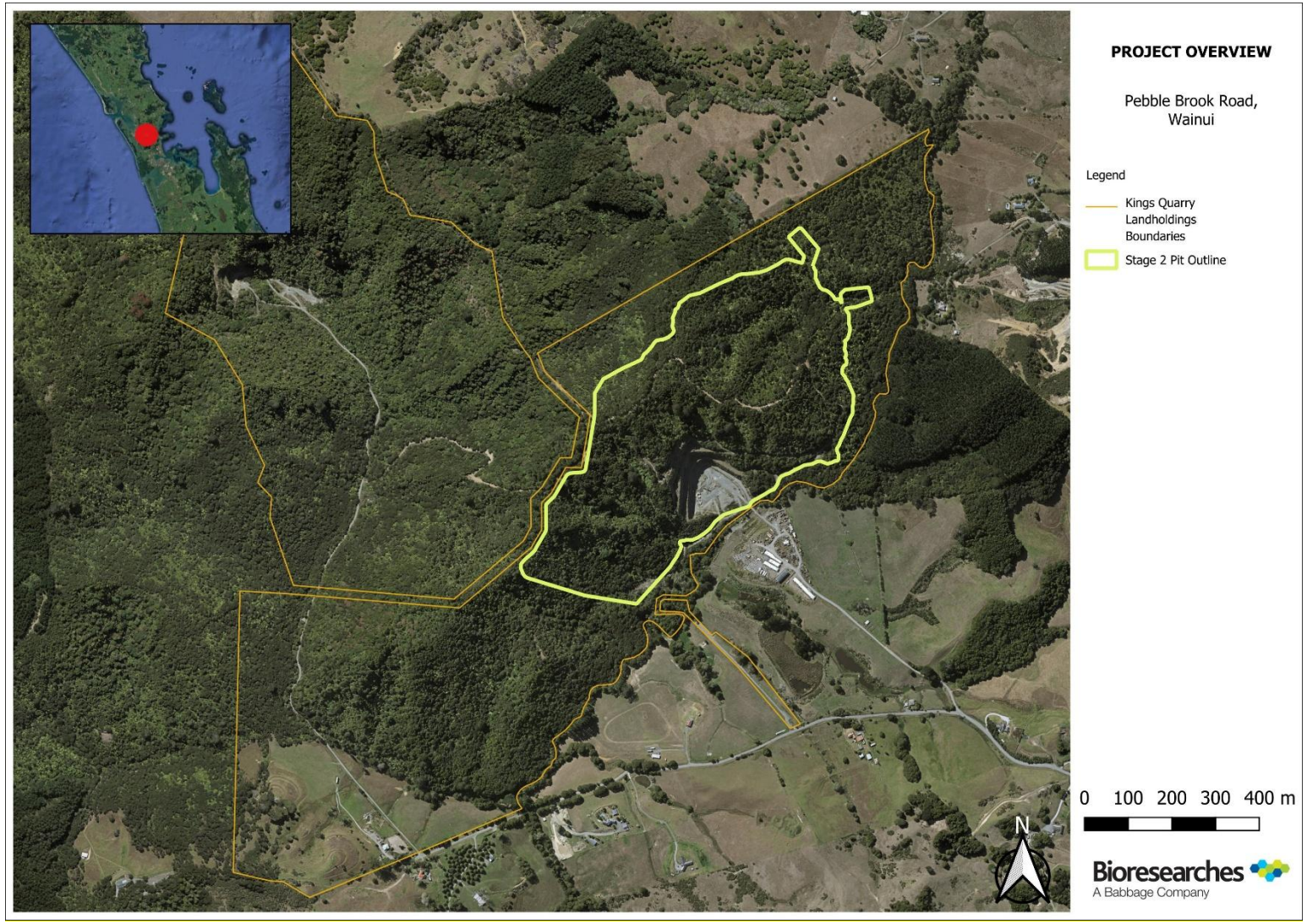


Figure 4. Proposed Stage 2 pit and fill areas within the Kings Quarry landholdings at Pebble Brook Road, Wainui.

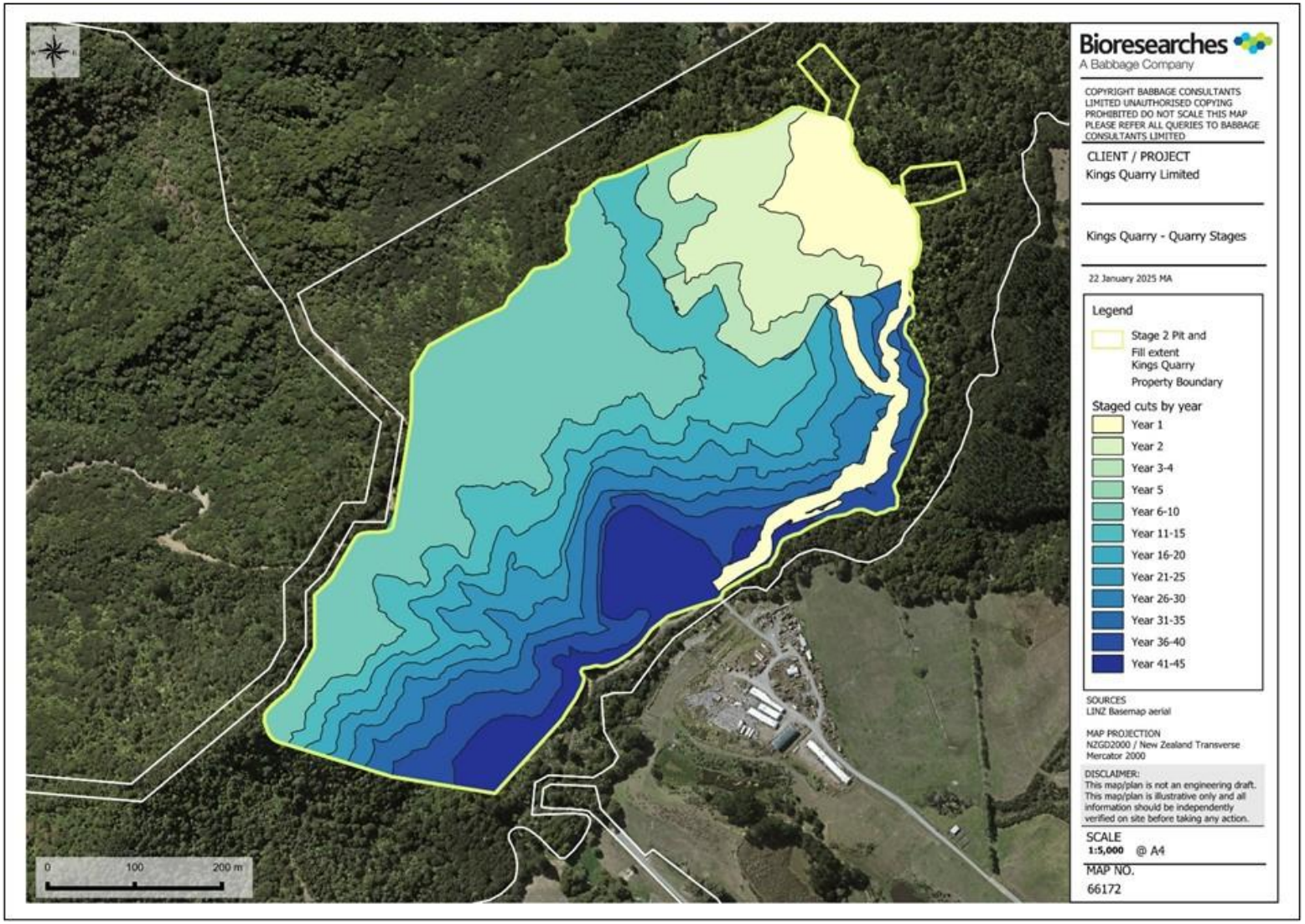


Figure 5. Map illustrating the proposed stages of vegetation clearance over 45 years.

4.1.1 Objectives

The objectives of the LIMP are to minimise potential adverse effects on native lizards and invertebrates within the construction footprint by way of capturing and relocating any indigenous lizards prior to and during vegetation removal, and providing habitat enhancement and pest control, where appropriate. Further, this LIMP aims to achieve the following:

- The population of each species of native lizard or invertebrate present on the site at which vegetation clearance is to occur (impact site) shall be maintained or enhanced, at an appropriate alternative site; and
- The habitat(s) that lizards and invertebrates are transferred to (release site) will support viable populations for all species present pre-clearance.

These objectives will be achieved by:

- Using current best practice to capture native lizards from vegetation in the footprint prior to and during vegetation clearance and relocating any captured individuals to safe and suitable habitats;
- Applying recognised surveying and monitoring protocols that are to be followed, using the Department of Conservation's (DOC) Natural Heritage Management System's Herpetofauna Inventory & Monitoring Toolbox and / or using new advances in tools and techniques not yet incorporated into the toolbox; and
- Meeting requirements of the Wildlife Act (1953) and Resource Management Act (1991).

This LIMP addresses the following:

- A summary of the affected habitat and species covered by the plan;
- Capture and relocation procedures;
- A summary of the recommended release site;
- Details of release site enhancement and relocation success monitoring (where triggered).

4.1.2 Statutory Context

Native reptiles and some invertebrates are legally protected under the Wildlife Act 1953 (and subsequent amendments), and vegetation and other features that provide habitat for these species are recognised by the Resource Management Act 1991.

Lizards comprise a significant component of New Zealand's terrestrial fauna, with 124 taxa currently recognised (Hitchmough *et al.* 2021). Of these, 96% are classified as 'Threatened', 'At Risk' or 'Data Deficient' under the New Zealand Threat Classification System (Townsend *et al.* 2008; Hitchmough *et al*. 2021).

Native Invertebrates

Most native invertebrates are not directly protected under the Wildlife Act (1953). Protected invertebrates are listed in Schedule 7 of the Act, and include various species, including the kauri snail, (*Paryphanta busbyii*) and wētāpunga (*Deinacrida heteracantha*). Both of these species occur in the Auckland Region, although have restricted distributions that do not naturally extend across the Kaukapakapa – Wainui area and are not expected within the project footprint. Other non-protected but 'At Risk invertebrates include the medium-sized Rhytid snail *Amborhytida dunniae*. *Amborhytida dunniae*, recorded from tall, mature forest to the west of the existing quarry and may be present within the footprint. Similarly, the New Zealand mantis, *Orthodera novaezealandiae*, is identified as in gradual decline, and may occupy similar habitats to native geckos.

Statutory obligations require management of populations of protected species where they or their habitats are threatened by land use changes. This LIMP may only be implemented under a valid Wildlife Authority, issued by the Department of Conservation (DOC)[1].

This Lizard and Invertebrate Management Plan would be actioned by the project herpetologist (Chris Wedding) under a valid Wildlife Act Authority issued by DOC[2].

The project herpetologist may be aided by suitably qualified and experienced ecologist(s), who would assist with aspects of the salvage/ relocation. The credentials and contact details for the project herpetologist are provided in Table 6.

Table 6. Details of Project Herpetologist.

Credentials and Contact Details of Project Herpetologist	
Project Ecologist / Herpetologist	Chris Wedding
Credentials	M.Sc.; 18 years herpetological experience
Wildlife Authority	Permit sought through FTA (20 + lizards expected)

4.2 Lizard and invertebrate salvage and relocation protocols

A lizard and invertebrate salvage and relocation operation will be carried out to avoid or minimise injury or harm to native lizards as far as practicable.

The lizard and invertebrate salvage would be implemented as two Phases, including Pre-works and Works phases. This would be carried out within each stage of vegetation clearance. Activities

[1] WAA authorisation number 98006-FAU

[2] WAA authorisation number 98006-FAU

undertaken during these phases are detailed below. A summary of the LIMP activities has been provided as a checklist in Table 7.

For each stage of vegetation removal, this Plan requires pre-clearance trapping/ searching, destructive habitat searches, and post-clearance habitat searches. All relocated native lizards shall be released into habitats that are enhanced to the satisfaction of the Project Herpetologist. To increase carrying capacity of the release site, shelter / refuge provision will be provided to the satisfaction of the Project Herpetologist. Capture and release methods are detailed below.

Table 7: Lizard and Invertebrate Management Plan Checklist.

Project start-up	**Required of:**	**Completed**
Lizard and Invertebrate Management Plan Approval	Department of Conservation	
Approved Released Sites	Landholder / Auckland Council	
Pre-works management (minimum 10 days prior to staged vegetation clearance, excluding installation)		
Pre-works lizard/ invertebrate capture and release site preparation	Herpetologist / Ecologist	
Works management		
Machine-assisted habitat searches	Herpetologist, clearance contractor	
Searches of remaining habitat and stockpiled vegetation following clearance	Herpetologist	
Post-works		
Works completion report to client, Council, and DOC	Herpetologist	
Relocation success monitoring (where triggered)	Herpetologist	

4.2.1.1 Timing of the salvage and relocation

The lizard salvage and relocation programme is expected to take place over a 2-6 week period for each stage of vegetation removal, within the generally accepted North Island 'lizard salvage season' (October to April, inclusive), on days where ambient temperatures range between 12–22°C. Invertebrate salvages are to be undertaken in conjunction with the lizard management programme.

4.2.1.2 Lizard capture

Native lizards will be captured and handled by the Project Herpetologist, or by a suitably qualified and experienced herpetologist/ ecologist nominated by the Project Herpetologist. All native lizards captured prior to and during vegetation clearance operations will be placed immediately into containment boxes and held temporarily for release. Captured lizards will be measured, sexed, weighed and photographed for identification purposes, and transferred to suitable habitat for release. The

retention of lizards in captivity for periods longer than one day should be avoided as far as practicable.

4.2.1.3 Incidental discovery

In the unlikely event that a native lizard or protected invertebrate is found in the footprint when the herpetologist is not present on-site, this incidental discovery protocol will take effect. The herpetologist will brief project contractors on incidental discovery protocols prior to the start of the works (e.g., at the pre-start meeting).

If a native lizard is observed, the contractor(s) is permitted to capture and hold the lizard in a secure container with perforated, breathable lid and leaf litter. The contractor shall then contact the Project Ecologist immediately, for identification and release.

4.2.2 Phase 1: Pre-Clearance Salvage of Native Lizards and Invertebrates

Prior to the commencement of any vegetation clearance or earthworks, a herpetologist(s) will carry out a search-and-salvage operation that will involve active searches for lizards in all identified habitats within the clearance footprint (Figure 4). These searches will be carried out over a minimum of 10 days preceding the scheduled vegetation clearance, according to stages/timings of removal and will target all native reptile species using the described methods; the use of artificial retreats, (and/or) pitfall traps (Figure 6) (and/or) gee minnow traps, systematically searching potential habitats and night searches (spotlighting).

Phase 1 efforts would include:

a. Systematic habitat searching for both lizards and invertebrates; and
b. A minimum 10 days of ground trapping (excluding installation) using baited (banana or other suitable) Gee-Minnow traps (GMTs) or pitfall traps (PTs) targeting native lizards.
c. Nocturnal spotlight searching for native lizards and invertebrates.

Phase 1 efforts will only be undertaken on days with suitable weather conditions (i.e., daytime temperatures >12 °C, precipitation-free).

All captured lizards would be processed (measured, weighed, and photographed) and relocated to identified relocation site (see Figure 11). Captured invertebrates would also be recorded and released within the identified relocation site.

4.2.2.1 Systematic Habitat Searches

Manual searches will be undertaken for lizards and invertebrates through debris piles across the site (Figure 10). Diurnal (day) searches would be undertaken throughout the extent of the clearance footprint prior to vegetation removal (Lettink and Hare, 2016[3]).

4.2.2.2 Trapping

Prior to undertaking any vegetation removal, the extent of vegetation will be mapped out and agreed with the Project Herpetologist, to provide for current survey information. Each extent will be surveyed for lizards for a minimum 10-day intensive trapping period using a combination of Artificial Retreats (ARs) (and/or) baited PTs (and/or) baited GMTs (Figure 7), as deemed suitable by the project ecologist.

- All traps shall be embedded in and furnished with vegetation to protect any captured lizards from heat and exposure during confinement.
- ARs and PTs (Figure 6) shall be installed at least three weeks prior to a minimum 5-day trapping period.
- When not in use, all PTs shall be deactivated (sealed closed or furnished to the upper rim so that lizards may escape).
- All traps shall be checked at least once in each 24 hour period while active.
- All native lizards shall be released at the designated release site as soon as is practicable following capture (see Figure 11).
- During trap checks, the Project Herpetologist (or a suitably experienced ecologist nominated by the Project Herpetologist) shall hand search all vegetation, logs and debris to capture lizards and to identify important areas that should be targeted for machine searching.

[3] Lettink, M. and Hare, K.M., (2016). Sampling techniques for New Zealand lizards. In *New Zealand Lizards* (pp. 269-291). Springer, Cham.

Figure 6. Artificial retreat (L); Pitfall trap with AR cover (R).

Figure 7. Funnel trap (L); gecko in funnel trap (R).

4.2.2.3 Nocturnal Spotlight Searches

- Nocturnal spotlight searches for geckos and invertebrates (such as rhytid snails and wētā) would be undertaken throughout all areas where vegetation removal would occur.
- A minimum of four nights of spotlight searches would be undertaken prior to any vegetation clearance.
- Following the minimum four-night searches, additional searches would be undertaken until completion of 18 person-search hours during which no geckos or rhytid snails are sighted within the Project footprint.
- If a gecko is sighted and cannot be captured (e.g., due to height), then the affected tree shall be marked / taped, and the Project Herpetologist (or a suitably experienced ecologist nominated by the Project Herpetologist) shall undertake a targeted search of that tree during vegetation removal.
- All native lizards shall be released at the designated release site(s) immediately upon capture.

4.2.2.4 Destructive Searches

Destructive searches would be undertaken during trap checks and vegetation removal, with coordination and in cooperation with the vegetation clearance contractor. Destructive searches shall:

- Involve searching through potential habitats including tree foliage and ground cover during vegetation removal;
- Small tree branches may be hand felled where arboreal lizards or invertebrates are identified so that the Project Herpetologist can capture.
- Epiphytic vegetation will be deconstructed for systematic searches.

Any lizards and invertebrates captured would be released to the approved relocation site (see 4.3 for release site description) (Figure 11) as determined by the Project ecologist.

4.2.3 Phase 2: Works Management

Phase 2 may be commenced once the Project Herpetologist is satisfied that all lizard habitat has been effectively trapped and systematically searched (day / night), such that no further lizards are likely to be captured using the methods as determined by Phase 1 trapping and searches.

Phase 2 will involve the recovery of lizards and invertebrates by the herpetologist/ ecologist(s) during and immediately following vegetation removal activities.

4.2.3.1 Machine-assisted destructive searches

In instances where debris, vegetation, or habitat structures cannot be physically searched by hand, machine-assisted searches will be required. These searches will involve coordination between the herpetologists and machine operator to carry out systematic scrapes of surface vegetation, as well as lifting heavy objects (e.g., large logs) so that lizards hiding beneath can be captured. An excavator with a toothed bucket or root-rake attachment will be required for this work (**Error! Reference source not found.**).

- Some vegetation (tree foliage, epiphytes) may need to be stockpiled for future searching (e.g., night search canopy foliage: refer to Section 4.2.3.2).
- Recoverable leaf litter substrate, woody debris and potential shelter structures (e.g., logs, rocks) will be collected and transferred to the lizard relocation site(s) by the herpetologist.
- Note that this material may be required to be recycled for use at restoration locations.

Figure 8. Machine-assisted lizard searches. Herpetologist supervising the scraping of terrestrial vegetation.

4.2.3.2 Stacked vegetation searches

Nocturnal searching of stacked vegetation would be undertaken following vegetation removal.

Stacked vegetation, particularly kanuka and manuka trees, as guided by the Project herpetologist, would be stockpiled on a flat surface accessible to the Project herpetologist.

Felled / stacked vegetation will remain in-situ for no less than two weeks, so that canopy foliage and other habitats (e.g., epiphytes) of trees can be accessed during searches (e.g., Figure 9).

Figure 9. Elegant gecko on kanuka, approximately 1 week after felling (refer red circle and inset image).

4.2.3.3 Vegetation Removal searches of felled vegetation

No vegetation will be mulched *in situ* by lowering a mulch-head directly onto standing vegetation, unless approved by the Project Herpetologist. This practice eliminates all opportunities for herpetologists to recover native lizards from the vegetation and does not allow lizards to vacate the vegetation before it is destroyed. In some instances, where standing vegetation has been thoroughly searched by a herpetologist, approval to mulch discrete areas of poor-quality vegetation (e.g., areas of gorse or other vegetation not considered to support native lizards) may be given.

Coordination and communication between the herpetologist and vegetation clearance contractors (both managers and manual labourers) is crucial and will ensure compliance with consent conditions, legal protections for wildlife and associated habitats, and to minimise health and safety risks. The herpetologist and vegetation clearance contractor will agree on a suitable methodology at a pre-start meeting.

4.2.3.4 Post-clearance searches

Post-works search of the cleared area will involve the search and recovery of any remaining lizards and invertebrates by the Project Herpetologist (or a suitably experienced ecologist nominated by the Project Herpetologist) after vegetation clearance and relocation to the approved site (Figure 10).

Figure 10 . Herpetologist supervising the search in area cleared of vegetation.

4.3 Release site

Direct transfer of salvaged lizards from the impact site to a receiving site is preferred wherever possible and the selection of an appropriate lizard relocation site is crucial to ensuring the best possible outcome for lizard salvage-relocation programmes.

The Department of Conservation's key principles for lizard salvage and transfer guidelines require consideration of the following components when selecting a receiving site(s):

1. The site must be ecologically appropriate and have long-term security;
2. The habitat at the site must be suitable for the salvaged species;
3. The site must provide protection from predators; and
4. The site must be protected from future human disturbance.

4.3.1 Release Site Description

Based on the above principles, the most suitable release site is within the pest-controlled area southwest of the quarry, along its outer western edge. This area will be enhanced with buffer planting (Figure 11) to extend existing habitats. It is considered the most appropriate site for any skinks or geckos salvaged during project works, as it supports similar indigenous forest types and will be further improved with supplementary retreats, long-term pest control, stock-proof fencing, and additional planting (Section 10). Figure 11 shows both the impact area, where lizards will be salvaged from, and the release site. The release site lies on Kings Quarry property, adjacent to the project area, and includes indigenous forest types: VS2 (Kānuka scrub/forest), VS5 (Broadleaved species scrub/forest), and WF11 (Kauri, podocarp, broadleaved forest).

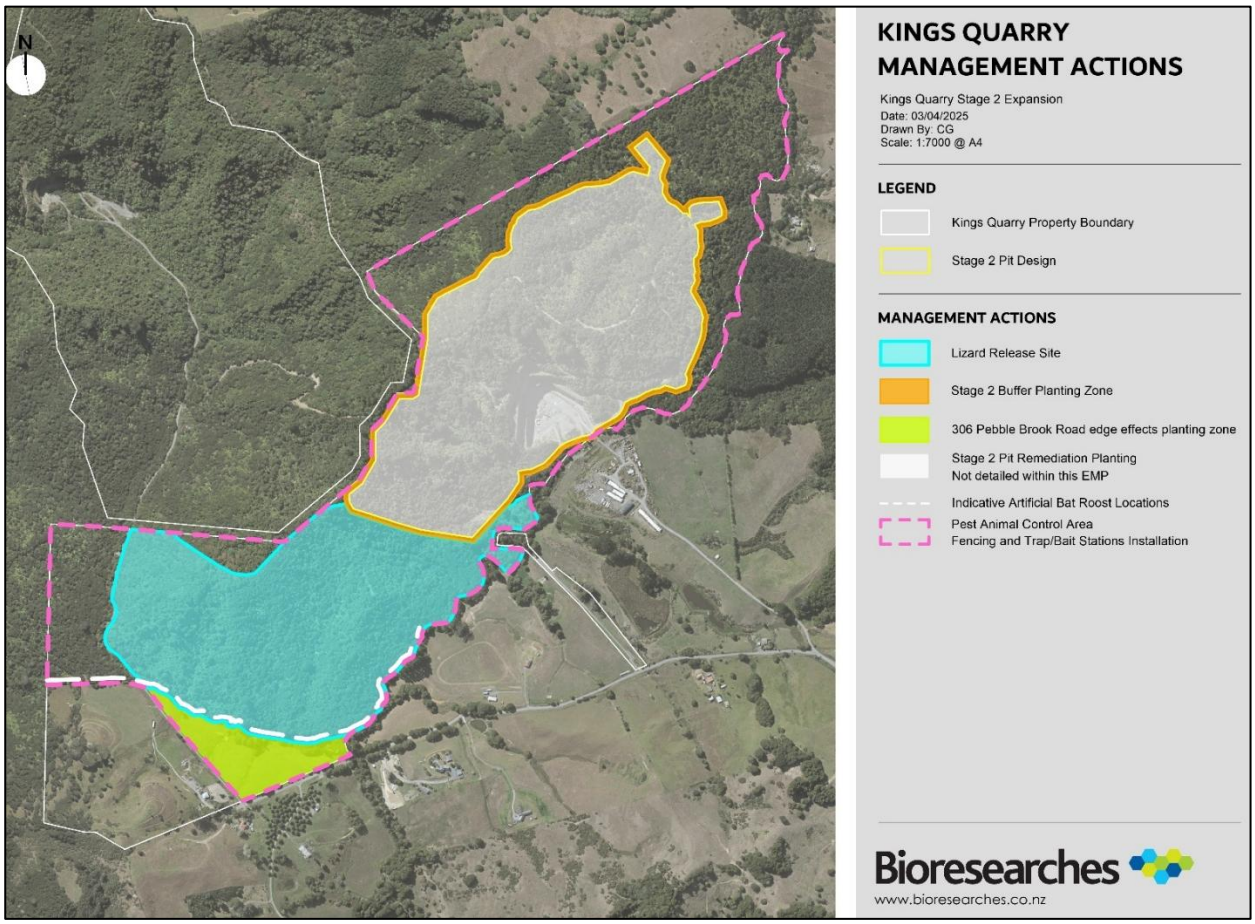


Figure 11. Map showing location of impact site (pit extent) and release site. Impact site is where vegetation will be removed and lizards will be salvaged, the release site is southwest, adjacent to the pit extent site.

4.3.2 Release Site Enhancement

This Plan acknowledges that the proposed release site may already support the full suite of species covered under this Plan. Displaced lizards have a lower likelihood of survival where the carrying capacity of adjacent habitats is stressed through increased competition for fewer resources. Further, displaced animals have a higher probability of risk of predation, and a rapid increase in lizard numbers in a given area is likely to result in a corresponding increase in predators.

At Kings Quarry, gecko and skinks are not considered to be abundant, and therefore other management provisions, including pest management, are expected to benefit resident populations and carrying capacity issues are not considered likely. However, enhancement measures at the release site are provided under this Plan, in accordance with Table 8. These measures are designed to be commensurate with the biodiversity values of the habitat that has been lost, with increasing measures required to improve the habitat at the release site, should more lizards be relocated (thus indicating that the lost habitat was of higher biodiversity value).

Table 8. Triggers for management and post-release monitoring provisions.

Trigger	Management provision	Duration of management
< 20 native lizards	• Provision of habitat cover / ecostack per lizard; and • Mammalian predator control (provided in advance of LMP implementation).	Habitat cover / ecostack provided at relocation. Predator control for a minimum of 20 years.
≥ 20 native lizards	• Above provisions; and • Success Monitoring	Post release monitoring from trigger at 1, 2, 5 years post-release and every 5 years thereafter for the life of quarry.

4.3.2.1 Additional retreats for relocated lizards

Skinks

All native skinks would be released with a small pile of wood to serve as a refuge (1 pile per individual, Figure 12), obtained from release areas or surrounding areas where they are not already providing habitat to lizards.

To ensure that captured and relocated lizards immediately have habitat available, at least one refuge / ecostack (Figure 12) must be created prior to any lizard management activities commencing, in a location within the release site.

Additional natural retreat items (logs, etc.) shall be transferred to the release site area at the discretion of the Project Ecologist.

Figure 12. Example of ecostacks: branches, logs, ponga trunks, and leaf litter to create supplementary refuges for relocated lizards.

Geckos

Native New Zealand geckos are highly cryptic and often occur at low densities, making detection rates typically low- a pattern consistent with findings at Kings Quarry. Where relocation of native geckos is required, individuals will be identified, measured, and photographed to allow for future individual recognition. At the release site, each gecko will be provided with a purpose-built artificial tree shelter (ATS) to offer a safe and temporary refuge immediately following release. These shelters will be deployed in general accordance with Turner et al. (2024), who demonstrated improved detection of arboreal geckos using tree-mounted Onduline artificial refuges. Where post-release monitoring is triggered (Section 4.3.2.3), it will involve periodic inspections of ATSs to assess survivorship of translocated geckos and potential occupancy by resident individuals, contributing to habitat enhancement outcomes.

Figure 13. Example of an Onduline Artificial Tree Shelter (ATS).

4.3.2.2 Pest Control

A pest management programme will be undertaken at the release site for a minimum of 20 years post-release. Pest animal management will include rodents, which are known predators of native lizards, as well as possum and mustelid control.

Pest animal management throughout the Kings Quarry landholdings is detailed in the Mammalian Pest Control Plan (Section 12).

4.3.2.3 Relocation Success Monitoring

Success monitoring would be initiated at the release location, whereby restoration planting is required to replace the habitats lost (as triggered by 20 or more lizards and representing very high value habitat) (Table 8). The purpose of the monitoring is to determine success by measuring / identifying:

1. Occupancy by lizards of restoration plantings, as provided for habitat replacement.
2. Occupancy by lizards of other habitat structures, as provided for habitat replacement (ecostacks, ATSs)
3. Identification of any relocated individuals, as determined by photograph records.
4. Recording any trends in numbers and species encountered within the pest managed area and adjacent, non-managed areas.
5. Presence of gravid females or juveniles.

Monitoring would consist of a grid of at least 40 artificial retreats within the relocation area (buffer planting and release site-refer Figure 11). Locations would provide for coverage of both enhanced and planted habitats. Monitoring would also ensure inspections of any ATSs installed with geckos.

Artificial Retreats would be installed at least four weeks prior to the survey period. The survey period would provide for four retreat checks on fine, non-consecutive days over November-December or March-April, when lizards are most active. Artificial Retreat survey / monitoring would be undertaken in accordance with Lettink (2012).

4.3.3 Reporting requirements

A works completion report would be prepared by the Project Herpetologist and submitted to Auckland Council within 1 month of completion of all vegetation removal, per indicative stage. The report would detail:

1. The number of lizards/ invertebrates and species captured and transferred;
2. The number and location of any stacked branch piles provided for refuge at the release site;
3. Whether any captured individuals have been encountered previously, and if so:
    a. The location of original capture, release, and recapture
4. Whether monitoring is triggered from the relocation; and
5. All information as required of an ARDS report (Amphibian Reptile Distribution Scheme, Department of Conservation).

5 AVIFAUNA MANAGEMENT PLAN

5.1 Introduction

This Avifauna Management Plan (AMP) has been prepared for Kings Quarry Limited to minimise potential effects on native birds prior to and during removal of their potential habitats as part of an expansion of the Kings Quarry pit.

The EcIA identified a suite of non-threatened indigenous bird species and one At Risk – Declining species (kākā, potential infrequent visitor) that may nest in trees (foliage, cavities) and on the ground within the Project. The removal of their habitats would therefore be expected to result in injury and / or mortality if such species are nesting at the time of removal.

5.1.1 Plan purpose

The objectives of the AMP are to avoid (mortality) and minimise (disturbance) potential adverse effects on native avifauna associated with the construction of the proposed Stage 2 pit at Kings Quarry (Table 9).This would be achieved by identifying any active nests of native birds prior to works (habitat removal), so that nesting can be completed and chicks can naturally fledge.

Table 9. Purpose, specific objectives, performance measures and monitoring relevant to the AMP.

Criteria	Explanation
Purpose	This Avifauna Management Plan (AMP) has been prepared for Kings Quarry Limited to minimise potential effects on native birds prior to and during removal of their potential habitats as part of an expansion of the Stage 2 pit (Figure 2). The purpose of this Avifauna Management Plan (AMP) is to detail the management measures required to minimise adverse effects on native birds associated with vegetation/ habitat clearance.
Specific Objectives	The objectives of the AMP are to avoid (mortality) and minimise (disturbance) potential adverse effects on native avifauna associated with the construction of the proposed Stage 2 Pit at Kings Quarry. This would be achieved by identifying any active nests of native birds prior to works (habitat removal), so that nesting can be completed, and chicks can naturally fledge.
Performance Outcomes	This AMP includes provisions for forest and wetland bird breeding protection and effects minimisation including:

Criteria	Explanation
	(a) Seasonal constraints on felling and/or noise disturbance in habitats that are likely to have high bird values to avoid or minimise harm to eggs and chicks; (b) Proposed controls for maintaining a 30 m setback of construction works from the margin of wetlands during peak breeding season (August to March - inclusive); and (c) A process for ensuring no nesting birds are present within vegetation to be cleared if works are required during peak breeding season (August to March - inclusive). (d) Bird nest survey and checks prior to any wetland clearance from January to March inclusive.
Monitoring	Compliance monitoring and biodiversity outcome monitoring at the offset site to better understand the response of birds to the proposed residual effects management package. This includes verification of predicted likely Net Gain outcomes and adaptive management response (REMP; Bioresearches, 2025).
Reporting	A post-works compliance completion report will be provided to Auckland Council, no later than 30 working days following completion of each season of vegetation clearance. Incident based reporting will be provided to Auckland Council within five working days of an unforeseen event occurring.

5.1.2 Statutory context

Almost all native birds are legally protected under the Wildlife Act 1953 (and subsequent amendments), and vegetation and other features that provide habitat for these species are recognised by the Resource Management Act 1991. Thus, statutory obligations require that management of native birds where they or their habitats are threatened by land disturbance or development.

The New Zealand Threat Classification System lists 491 avian taxa (Robertson et al., 2021), of which 241 are classed as non-vagrant and native species. Of these, 74% are listed as either threatened, 'At Risk' or 'Data Deficient' under the New Zealand Threat Classification System (Townsend *et al.* 2008). All native birds are afforded protection except for two species: Spur-winged plovers (*Vanellus miles*) and black-backed gulls (*Larus dominicanus*).

5.1.3 Responsibilities and competencies

Table 10 sets out the roles and responsibilities in relation to the AMP. Kings Quarry Manager holds the overall accountability for the implementation of and compliance with this plan.

The project Ornithologist will implement this AMP and various phases of bird-related work on the Stage 2 Project. The project ornithologist will liaise when appropriate with arborists, vegetation clearance teams and site engineers.

Table 10. Details of Project Ornithologist

Credentials and Contact Details of Project Herpetologist	
Project Ornithologist	Michael Anderson
Credentials	PhD; 21 years of ornithological experience
Email	Michael.Anderson@bioresearches.co.nz
Contact Number	0210677453

5.2 Summary of avifauna values and effects

5.2.1 Avifauna Species present/ potentially present within proposed Stage 2 Footprint

A full desktop survey and Project area investigations were carried out as part of the EcIA (Bioresearches, 2025). A summary of the species detected, and likely present are found in Table 11. More details are provided in Section 5.2.2 for Threatened and At Risk species that are potentially present.

Table 11. Birds recorded as present or potentially present within the Project area from the EcIA (Bioresearches, 2025).

Common name	Scientific name	National threat classification (Robertson *et al.*, 2021)	Desktop study	Incidental observations	Five-minute bird counts
Australasian harrier, kāhu	*Circus approximans*	Not Threatened	✓	✓	
Grey warbler, riroriro	*Gerygone igata*	Not Threatened	✓	✓	✓
Kererū, New Zealand pigeon,	*Hemiphaga novaeseelandiae*	Not Threatened	✓	✓	✓
Morepork, ruru	*Ninox novaeseelandiae*	Not Threatened	✓		
New Zealand kingfisher, kōtare	*Todiramphus sanctus*	Not Threatened	✓	✓	✓
North Island fantail, pīwaka-waka	*Rhipidura fuliginosa*	Not Threatened	✓	✓	✓
North Island kākā	*Nestor meridionalis*	At Risk - Recovering	✓		
North Island Tomtit	*Petroica macrocephala*	Not Threatened		✓	
Pūkeko	*Porphyrio melanotus*	Not Threatened	✓	✓	✓
Shining cuckoo, pīpīwharau-roa	*Chrysococcyx lucidus*	Not threatened	✓		
Silvereye, tauhou	*Zosterops lateralis*	Not Threatened	✓	✓	✓
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened	✓	✓	✓
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	✓	✓	✓
Welcome swallow, warou	*Hirundo neoxena*	Not Threatened	✓	✓	✓

5.2.2 Threatened and At Risk species

The Ecological Impact Assessment (Bioresearches, 2025) determined that many of the Threatened or At Risk bird species recorded near the Project area during the desktop study, are not expected to be present because the Project area is lacking in their specific habitat requirements. Based on the outcomes of the EcIA, only one of these species has the potential to utilise the existing habitats on site.

5.2.2.1 North Island Kākā (*Nestor meridionalis septentrionalis*; At Risk – Recovering)

The North Island kākā is a highly mobile species (NPSIB, 2023) and is sighted throughout the Auckland Region. Kākā are rare to uncommon in mainland forests, however they are known to periodically leave the offshore islands they inhabit (e.g., Great and Little Barrier Islands, but also some mainland 'sanctuaries', including Hūnua Ranges) and disperse across mainland Auckland for foraging, primarily in winter months (Moorhouse, 2013).

The nearest recorded North Island Kākā sighting is ~6 km to the Northeast of the Site[4]. They are recorded along the east coast of Auckland much more frequently. In particular, there has been an increase in sightings of kākā near Tāwharanui Regional Park, which is ~33 km to the northeast. Therefore, there is some potential for North Island kākā to visit the Project area intermittently to forage but they are unlikely to be breeding at the Project area.

5.2.3 Breeding season of native species recorded in the Project area

Thirteen native species have been recorded in the Project area. All of these are non-threatened native species. As such, direct harm to these species, their nests, eggs, and nestlings, still need to be avoided. Table 12 (below) outlines the breeding season timelines for these species, indicating that the spring/summer months are the main breeding months for most species. On site vegetation clearance should therefore be avoided during key parts of their breeding season, from August to March (inclusive).

[4] https://ebird.org/species/nezkak1

Table 12. Breeding seasons of birds recorded within the Site from the EcIA (Bioresearches, 2024). Indicative breeding months are from New Zealand Birds online (nzbirdsonline.org.nz) and includes both egg-laying and nestling dates.

Common name	Breeding Season											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Australasian harrier, kāhu	■	■	■	■					■	■	■	■
Grey warbler, riroriro	■	■						■	■	■	■	■
Kererū, New Zealand pigeon,	■	■	■	■	■	■	■	■	■	■	■	■
Morepork, ruru	■	■	■	■	■				■	■	■	■
New Zealand kingfisher, kōtare	■									■	■	■
New Zealand pipit, pīhoihoi	■	■						■	■	■	■	■
North Island fantail, pīwakawaka	■	■	■					■	■	■	■	■
North Island Tomtit	■	■	■					■	■	■	■	■
Paradise shelduck	■	■						■	■	■	■	■
Pūkeko	■	■	■	■	■	■	■	■	■	■	■	■
Shining cuckoo, pīpīwharauroa	■	■	■							■	■	■
Silvereye, tauhou	■	■						■	■	■	■	■
Spur-winged plover				■	■	■	■	■	■	■	■	
Tūī	■	■							■	■	■	■
Welcome swallow, warou	■	■	■					■	■	■	■	■

5.2.4 Effects on avifauna

All ecosystems within the Stage 2 project (i.e., pit) area at Kings Quarry will be directly affected and there is potential for some ongoing effects to native avifauna residing within the vicinity of the Project area.

Potential immediate effects on avifauna during the construction phase include:

- Destruction of nests and/or mortality of nest contents (eggs/chicks).
- Removal of habitat used for foraging or nesting.
- The creation of habitat edge effects.
- Sediment runoff to wetlands and watercourses affecting wetland bird habitat.
- Construction noise, light and dust disturbance.

Potential ongoing effects resulting from the operation and maintenance of the Stage 2 Kings Quarry pit include:

- Effect of vehicle noise and disturbance on birds.
    - Resident birds in surrounding habitat most significantly affected during the breeding season, when noise may impact communication between conspecifics, potentially reducing breeding success.
- Mortality or injury with vehicles or construction equipment.
    - Reduced potential due to low-speed vehicle movement within quarry areas.
- Increase in exotic bird populations due to increased habitat modification.

5.3 Management of Effects

5.3.1 Vegetation Clearance

All vegetation clearance should occur outside the main native bird nesting season (August to March inclusive) to minimise any risk of disturbance that vegetation removal would have on nesting birds. If this is unavoidable, a nesting survey will be required prior to any felling.

Note that by restricting vegetation clearance to outside the main native bird breeding season the risk of disturbing nesting forest birds is significantly reduced (but not entirely eliminated), therefore vegetation should still be checked for obvious signs of nesting activity prior to clearance works being undertaken.

Vegetation clearance should not commence until approval has been received from the project ecologist/ornithologist. If active nests are located, habitat clearance should be delayed until after chicks have both fledged from the nest and are sufficiently independent to leave the natal territory with or without the parents. The nestlings of many forest bird species will fledge from the nest but will remain poor flyers and

dependent on parents to feed them for an extended period of time. This period varies by species and may require on-site evaluation by a suitably qualified and experienced person.

5.3.2 Nest Surveys

If vegetation clearance is unavoidable during the main native bird nesting season, a suitably qualified and experienced ecologist or ornithologist must visually inspect all trees and shrubs proposed for removal within 24 hours of felling to identify any active nests. This includes checking cavities and hollows for nesting birds (e.g., morepork, kingfisher, etc).

5.3.3 Nest Management

Should any nest be observed, a 10-metre buffer of vegetation shall be required to remain around the nest site until a suitably qualified and experienced ecologist or ornithologist has confirmed that the nest has naturally failed or the chicks have hatched and naturally left the natal site. Following inspection and confirmation of absence of nesting birds, the consent holder must submit a completion report to the council for approval within 30 working days of vegetation clearance finishing for a given season.

5.3.4 Accidental harm to birds during vegetation clearance

In the event of finding a dead or injured native bird during works associated with the Stage 2 pit, the following procedures will be implemented:

- Injured native birds will be taken immediately to a vet approved by DOC for assessment;
- Birds will be placed in a cool, dark, material-lined box/bag by or under the direction of a Project ecologist to ensure the bird is handled appropriately; and
- The local DOC office or DOC hotline (if after hours) will be contacted no longer than two hours after the injured or dead bird is found. The DOC hotline is 0800 DOCHOTLINE (0800 362 468).
    - The name of the contact information for approved contact in the event of native bird injury or mortality shall be advised by DOC.
    - DOC and veterinary advice shall be sought in conjunction with a suitably qualified and experienced Project ecologist when considering the rehabilitation requirements of any injured native birds (for example, legislative requirements will need to be considered).
    - Once the vet has made an assessment, the project ornithologist will, considering the advice from the vet, determine any rehabilitation action required and the longer-term future for the bird/s. If the bird is dead or euthanised by the vet, it must be taken to the local DOC office as soon as practicable.

5.4 Monitoring and reporting

5.4.1 Reporting

Following inspection and confirmation of absence of nesting birds the project ornithologist/ecologist will report to the consent holder. The consent holder will then submit a completion report to the council for approval within 30 working days of vegetation clearance finishing in a given season. The report should detail the number of active nests located and their management until nest failure or fledging and dispersal of chicks from the natal territory. The report would also detail whether any follow up pest control or monitoring is required and the timing for this. The works completion report would be submitted to Auckland Council Ecological Advice Team, Natural Environment Design, Environmental Services.

6 BAT MANAGEMENT PLAN

6.1 Introduction

This Bat Management Plan (BMP) has been prepared for Kings Quarry Limited to avoid and minimise potential effects on native bats as a result of the proposed Stage 2 expansion of Kings Quarry (Figure 18). Stage 2 (Project area) is zoned 'Special Purpose Zone: Quarry' (SPQZ) under the Auckland Unitary Plan – Operative in Part (AUP) and comprises some 28.97 ha of land which is almost entirely covered in indigenous vegetation.

An ecological impact assessment (EcIA; Bioresearches 2023) reported that long-tailed bats (LTBs; *Chalinolobus tuberculatus*) have been detected within the Project area during two separate Automatic Bat Monitor (ABM) surveys. In addition, Department of Conservation bat records show LTBs have been recorded in the local landscape.

6.1.1 Purpose of this Plan

The purpose of this Bat Management Plan is to set out procedures to:

1. Minimise the risk of harming bats during tree removal within the Project area, adopting current best practice standards as set by the Department of Conservation's (DOC) Bat Roost Protocols for minimising the risk of felling occupied bat roosts (BRP, version 4, 2024);
2. Provide alternative, suitable artificial roost habitat for bats, both as a precautionary measure and where an active or inactive roost is identified during implementation of Bat Roost Protocols; and
3. Where artificial roost provision is triggered, provide for multiple artificial roost designs, placement and monitoring to support robust research into artificial roost use by bats.

6.1.2 Long-tailed bat ecology

Long-tailed bats are found throughout the North Island and are classified as a 'Nationally Critical' threatened species under the New Zealand Threat Classification System (O'Donnell et al., 2023).

LTBs typically use forest edges and riparian areas for foraging and commuting (O'Donnell, 2000). They are highly mobile and have extensive home ranges that have been recorded to stretch 19 km and cover over 50 km^2, with individuals capable of moving tens of kilometres in one night (O'Donnell, 2001).

Roosts are often in tree cavities, epiphytes, or under loose bark (Borkin & Parsons, 2009; R. Griffiths, 1996) and change frequently, often on a nightly basis (Sedgeley, 2001). However, roost fidelity can be high on a year-to-year basis (Sedgeley & O'Donnell, 1999).

Communal roosts (2+ bats) require habitat features that are mostly supported by larger trees and are carefully selected for thermal properties that are still not well understood (Department of Conservation, 2023; Sedgeley, 2001). Thus, they are challenging to artificially replicate. Roost trees, particularly those that are used for maternity roosting (communal roosts of breeding females and juveniles), are therefore considered a valuable and limited resource for LTBs.

A summary of the New Zealand bat reproductive cycle is included below (Figure 14), to provide context to the requirements and procedures outlined in this document.

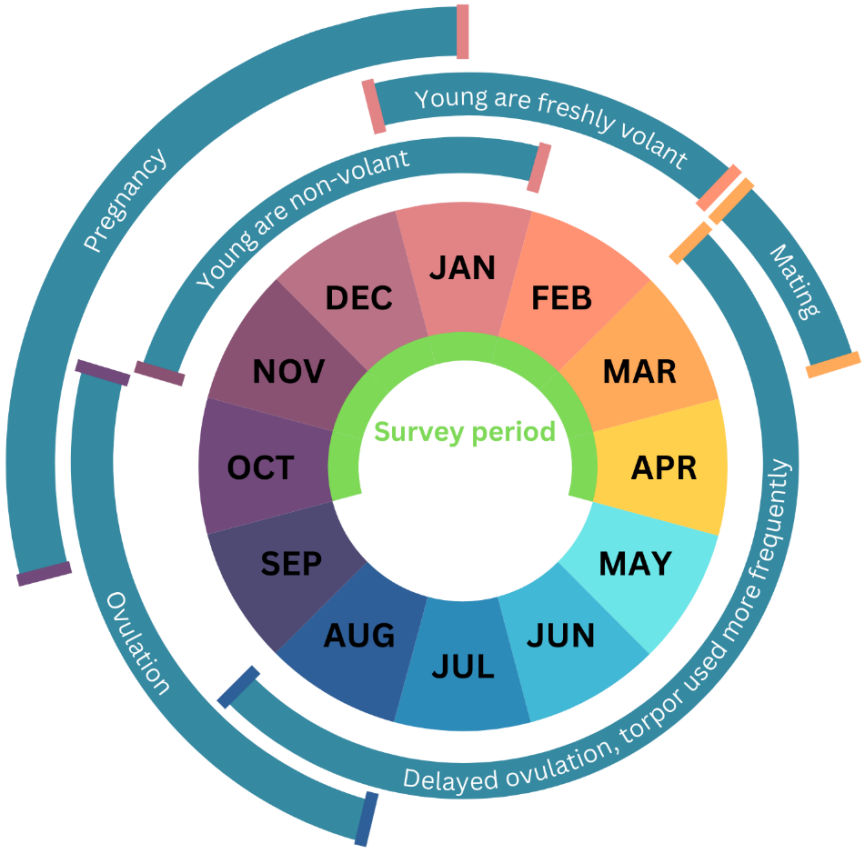


Figure 14. Visual representation of the key stages of the reproductive cycle of native bats.

6.2 Bat habitat at Kings Quarry

A summary of the high-level assessment of bat habitat within the Project area is provided here. Further details, including details about site investigations and methods used are provided in the Ecological Impact Assessment (Bioresearches, 2025), which should be read in conjunction with this report.

6.2.1 Bat records near the Project area

A summary of the assessment of bat records in proximity to the Project area is provided here. Note that long-tailed and short-tailed bats are widely cited as being capable of travelling up to 50 km (i.e. 25 km away from roosting area and back) in one night of movement, however only the closest records are detailed here as they are considered more relevant to assessing local activity.

6.2.1.1 Desktop assessment

Department of Conservation bat records were accessed within the vicinity of the Project area (Figure 15). The closest record (prior to Bioresearches surveys being undertaken and included in the database) was for a long-tailed bat, immediately outside of the southern boundary of the Kings Quarry Landholdings. Multiple other local LTB records are present in the local landscape, including:

- One location 1 km to the north of the Stage 2 footprint;
- Two locations approximately 2 km to the west (notably with 77 passes over 27 nights);
- Two locations approximately 5 km to the north-west;
- One location approximately 4 km to the east;
- Two locations approximately 6 km to the south-west.

The Kings Quarry landholdings lie approximately 7.5 km north of Riverhead Forest, which supports a known population of LTBs.

Short-tailed bats (STB; *Mystacina tuberculata*) are absent from the Auckland Region with the exception of Hauturu/Little Barrier Island, 64 km from the Project area. The closest mainland records are within the Coromandel Ranges, over 100 km away. They are considered highly unlikely to be present at the Project area, even on an intermittent basis.

6.2.1.2 Project area investigations: ABM surveys

Three surveys using ABMs (Automatic Bat Monitors) were undertaken in spring 2020, summer 2022-23 and spring 2023 (Figure 16). ABM models used were either the DOC 'AR4' units or DOC 'Otterbox' heterodyne detectors. An additional survey was undertaken by Habitat NZ from summer 2024-25 across 24 locations to provide further insight into habitat use in the Project area and surrounds, utilising Songmeter Minibat recorders (Wildlife Acoustics) with AR4s double-deployed at four locations.

Bats were detected in three of the total four surveys (spring 2020, summer 2022-23, summer 2024-25) (Table 13). Detections generally occurred at very low levels within the Stage 2 pit area, with slightly higher activity recorded immediately west and notably higher activity recorded southwest of the site (Pebble Brook Road planting area) in the most recent survey. ABM locations targeted areas considered most likely to detect bats, with different locations each survey to increase overall coverage. Differing survey locations is not expected to change inference about overall activity levels due to LTBs being highly mobile and may aid in detecting behaviour that is more localised (e.g., foraging, socialising, swarming at communal roosts).

Surveys were conducted in line with best practice/ the most up to date version of the Department of Conservation's Bat Roost Protocols (BRP). Bat activity is known to vary with environmental conditions such as air temperature, precipitation, and wind speed (Borkin et al., 2023). Weather data were obtained from local weather stations and nights with poor conditions were counted as non-valid in line with prevailing advice at the time, although all data were processed regardless of weather.

In total there were 1692 summed valid nights (excluding double deployment) of recording by the ABMs at 38 locations in and around Kings Quarry. Across all surveys there were 73 confirmed and another 3 possible bat passes detected, and an additional 187 /150 passes detected at the Pebble Brook Road planting area from the AR4/ Minibat deployed there concurrently for 7 weeks.

One pass indicated foraging behaviour and another contained social calls, both from survey location 303 which is 150 m west of the proposed Stage 2 pit area.

Information on timing of the bat passes recorded during the 2020 and 2024/2025 ABM survey was not available; however, information on the timing of passes recorded during the 2022-23 survey is presented in Table 14. At the quarry only one pass was detected within 1 hour of sunrise or sunset, which was at 2022C on the 17th of Feb, occurring 31 minutes after sunset. However, at location 5 (Pebble Brook Road planting area) a total of 16 passes (Minibat)/ 23 passes (AR4) were recorded within 1 hour of sunrise.

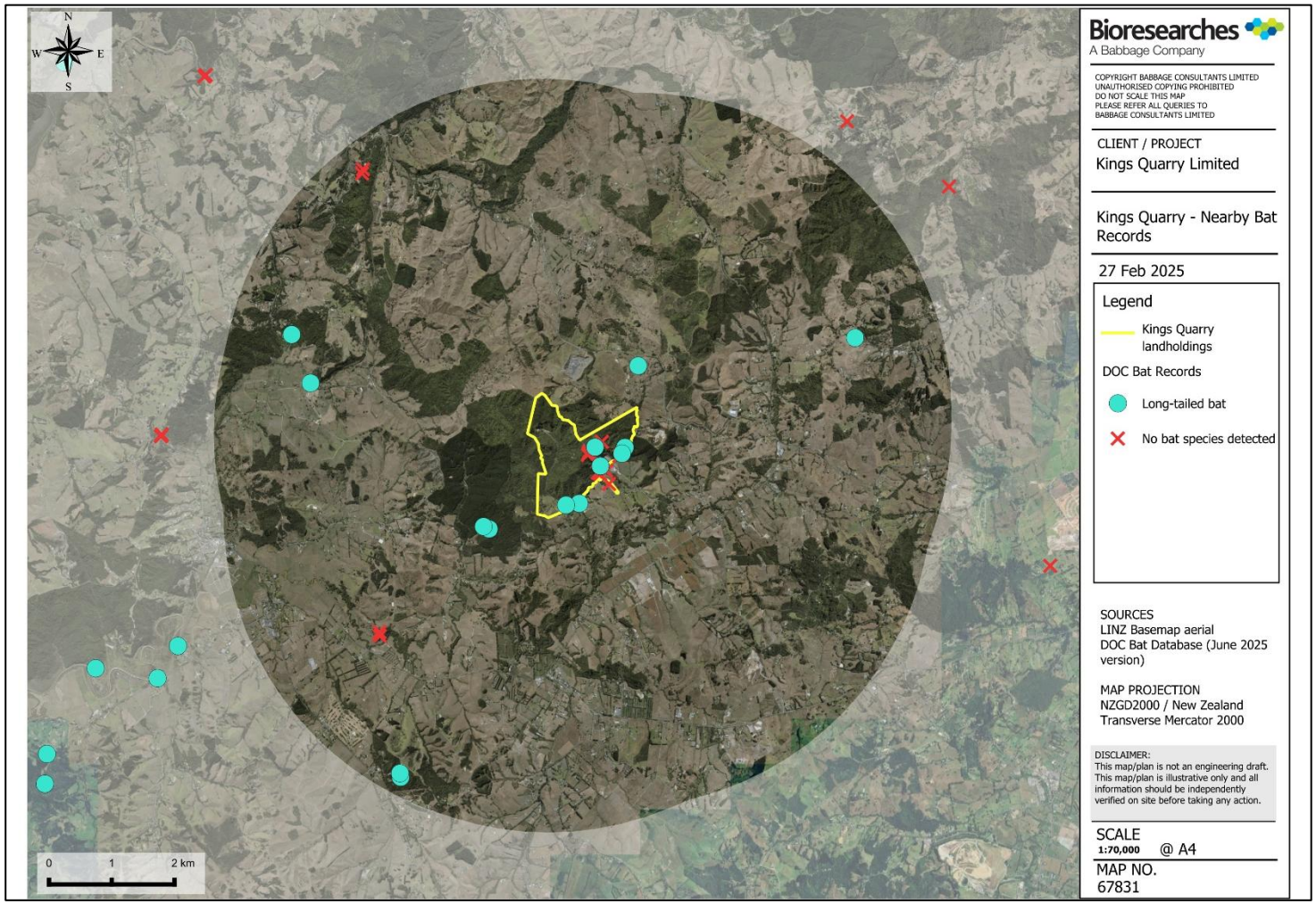


Figure 15. Bat records from the DOC database (including Bioresearches survey data) within the immediate vicinity of Kings Quarry (5 km buffer shown for context)

Table 13. Overview of bat survey results from within Kings Quarry using ABMs (see Bioresearches, 2023).

Survey	ABM	Survey timeframe	Monitor type	Valid nights	Total nights	Number of bat passes
Spring 2020	2020 A	17 November 2020 to 7 December 2020	AR4/ Otterbox	17	20	0
	2020 B	17 November 2020 to 24 November 2020		7	7	0
	2020 C	17 November 2020 to 11 December 2020		21	24	0
	2020 D	17 November 2020 to 11 December 2020		20	24	**1 possible**
	2020 E	17 November 2020 to 28 November 2020		11	11	0
	2020 F	17 November 2020 to 11 December 2020		20	24	**1 confirmed, 2 possible**
Summer 2022-2023	2022 A	16 December 2022 to 17 March 2023	AR4	85	91	**5**
	2022 B	16 December 2022 to 17 March 2023		85	91	**6**
	2022 C	16 December 2022 to 17 March 2023		87	91	**2**
	2022 D	16 December 2022 to 17 March 2023		31	91	0
Spring 2023	2023 A	Did not record – device malfunction	AR4	0	0	N/A
	2023 B	03 October to 19 October 2023		7	7	0
	2023 C	03 October to 19 October 2023		7	7	0
	2023 D	Did not record – SD card malfunction		0	0	N/A
	2023 E	03 October to 19 October 2023		7	7	0
	2023 F	03 October to 19 October 2023		7	7	0
Summer 2024-2025	5	31 December 2024 to 3rd February 2025	Minibat	49	49	**187**
	307	31 December 2024 to 18th February 2025		49	49	0
	308	31 December 2024 to 18th February 2025		49	49	0
	311	31 December 2024 to 18th February 2025		49	49	0
	312	31 December 2024 to 18th February 2025		49	49	0
	313	31 December 2024 to 18th February 2025		49	49	0
	318	31 December 2024 to 18th February 2025		49	49	**1**
	321	31 December 2024 to 18th February 2025		49	49	0
	322	31 December 2024 to 18th February 2025		49	49	**2**
	325	31 December 2024 to 18th February 2025		49	49	**6**
	327	31 December 2024 to 18th February 2025		49	49	**1**
	329	31 December 2024 to 18th February 2025		49	49	0
	330	31 December 2024 to 18th February 2025		49	49	0
	331	31 December 2024 to 18th February 2025		49	49	0

Survey	ABM	Survey timeframe	Monitor type	Valid nights	Total nights	Number of bat passes
	333	31 December 2024 to 18th February 2025		49	49	0
	334	31 December 2024 to 18th February 2025		49	49	**2**
	13	31 December 2024 to 3rd March 2025		*34	34	0
	302	31 December 2024 to 7th March 2025		66	67	**15**
	303	31 December 2024 to 7th March 2025		66	67	**21 (including 1 feeding buzz and 1 pass with social calls)**
	305	31 December 2024 to 7th March 2025		66	67	**2**
	309	31 December 2024 to 7th March 2025		66	67	**4**
	315	31 December 2024 to 7th March 2025		66	67	0
	319	31 December 2024 to 7th March 2025		66	67	0
	328	31 December 2024 to 7th March 2025		66	67	**3**
	5 b	31 December 2024 to 3rd February 2025	AR4	43	43	**150**
	13 b	31 December 2024 to 13th February 2025		44	44	0
	321 b	31 December 2024 to 13th February 2025		44	44	0
	327 b	31 December 2024 to 12th February 2025		43	43	**2**

***Note:** unit was found on ground at end of survey, detection likely compromised

Table 14. Bat pass timing for 2022-2023 survey

ABM	Date	Time of pass	Time of closest sunset or sunrise	Time difference
2022A	19 Jan 2023	04:46 AM	06:21 AM	1 hr, 35 mins
	20 Jan 2023	04:46 AM	06:22 AM	1 hr, 36 mins
	21 Jan 2023	03:39 AM	06:23 AM	2 hrs, 44 mins
		03:45 AM	06:23 AM	2 hrs, 36 mins
	23 Jan 2023	03:17 AM	06:25 AM	3 hrs, 8 mins
2022B	09 Feb 2023	22:13 PM	20:24 PM	1 hr, 49 mins
	21 Feb 2023	03:09 AM	6:57 AM	3 hrs, 48 mins
		23:12 PM	20:11 PM	1 hr, 1 min
		23:12 PM	20:11 PM	1 hr, 1 min
	22 Feb 2023	04:20 AM	6:58 AM	2 hrs, 38 mins
	03 Mar 2023	04:37 AM	07:07 AM	2 hrs, 30 mins
2022C	27 Dec 2022	00:04 AM	20:41 PM; 06:01 AM	3 hrs, 23 mins; 5 hrs, 57 mins
	17 Feb 2023	20:47 PM	20:16 PM	31 minutes

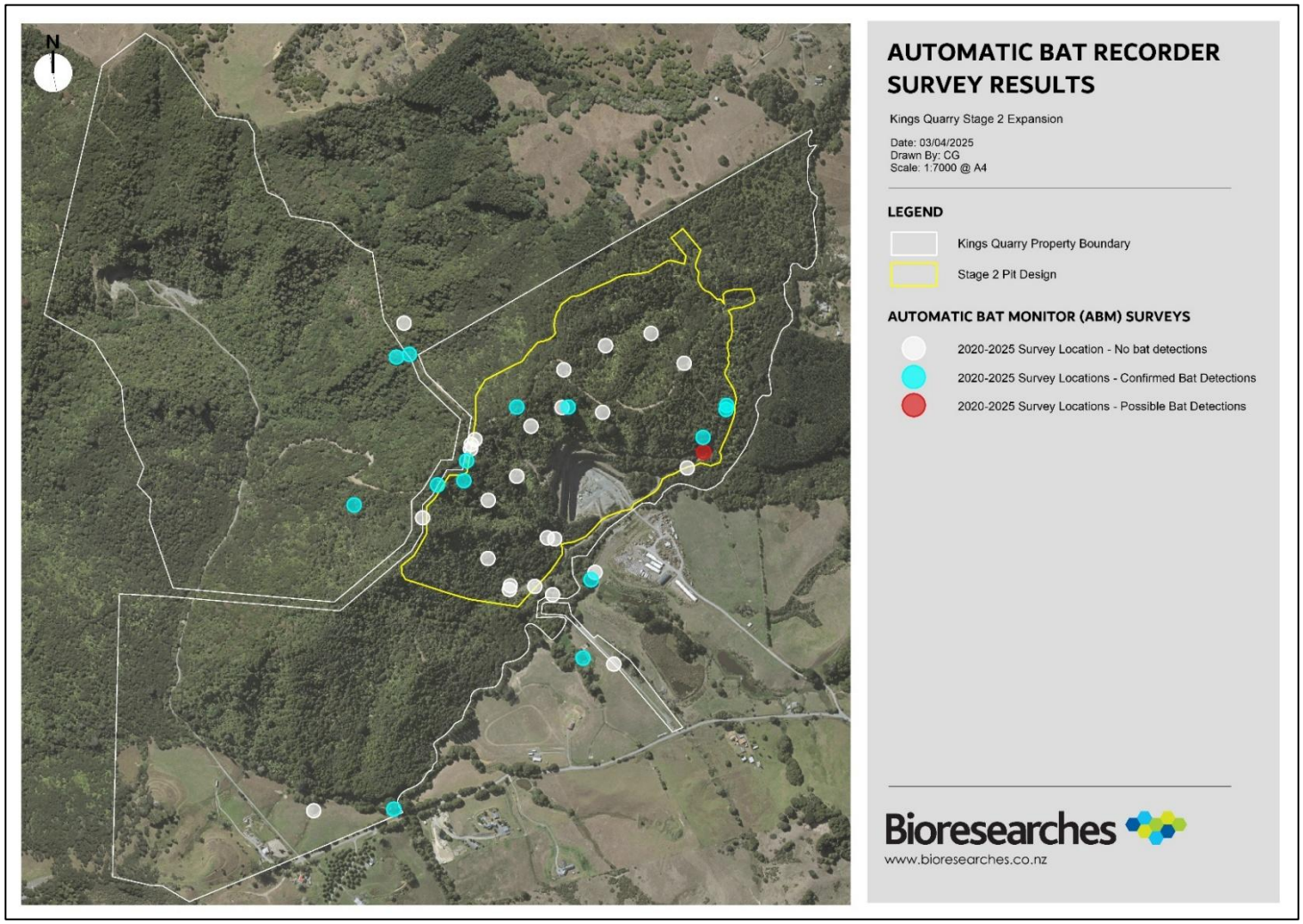


Figure 16. Bioresearches ABM survey locations and results.

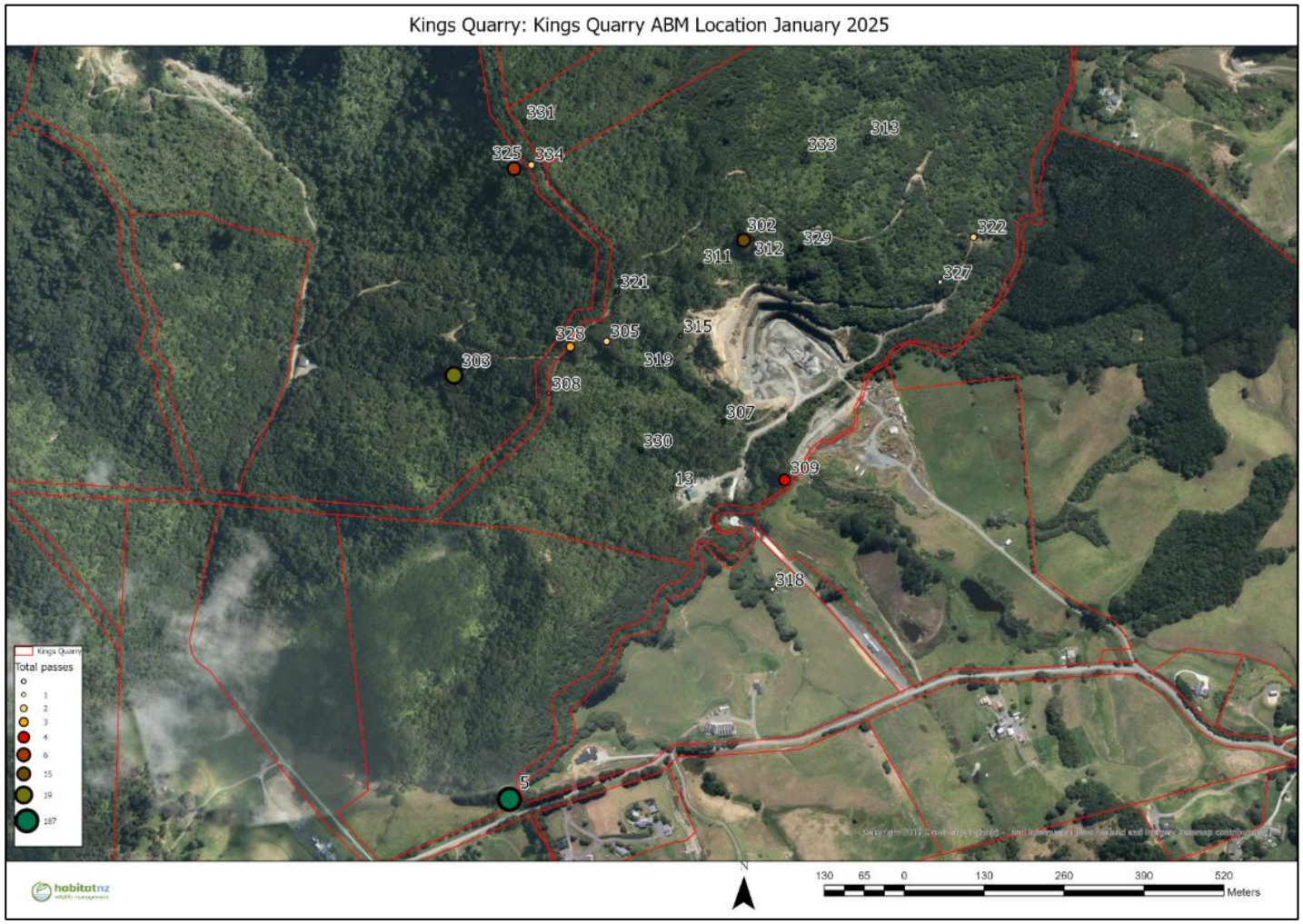


Figure 17. Habitat NZ 2024-2025 ABM survey locations and results. Map courtesy of Habitat NZ.

6.2.2 Project area description and potential habitat

The proposed Kings Quarry Stage 2 area comprises some 28.97 ha of indigenous vegetation that would be removed to accommodate an expansion of the existing Stage 1 pit and associated infrastructure. Two different ecosystem types would be affected (Figure 18): Kānuka Scrub/Forest (VS2, 16.51 ha) and Broad-leaved scrub/forest (VS5, 12.65 ha). The wider Kings Quarry property outside of the impact area also contains Kauri podocarp forest (WF11).

The Kings Quarry area supports suitable potential habitat for long-tailed bats, which are classified as 'Threatened- Nationally Critical' (O'Donnell *et al.*, 2017) and are protected under the Wildlife Act 1953. Given their very high threat status, areas that provide habitat to long-tailed bats are considered to be significant habitats under s 6(c) RMA 1991. Vegetation and other features that provide significant habitat for native bats are specifically recognised in the National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB). LTBs and all three subspecies of STB are listed as 'Specified Highly Mobile Fauna' in Appendix 2 of the NPS-IB.

Short-tailed bats are associated with extensive areas of old-growth native forest (Lloyd, 2001). There are no modern records of them on the mainland within the Auckland region, and Kings Quarry does not contain their preferred habitat. We consider this species is highly unlikely to be present.

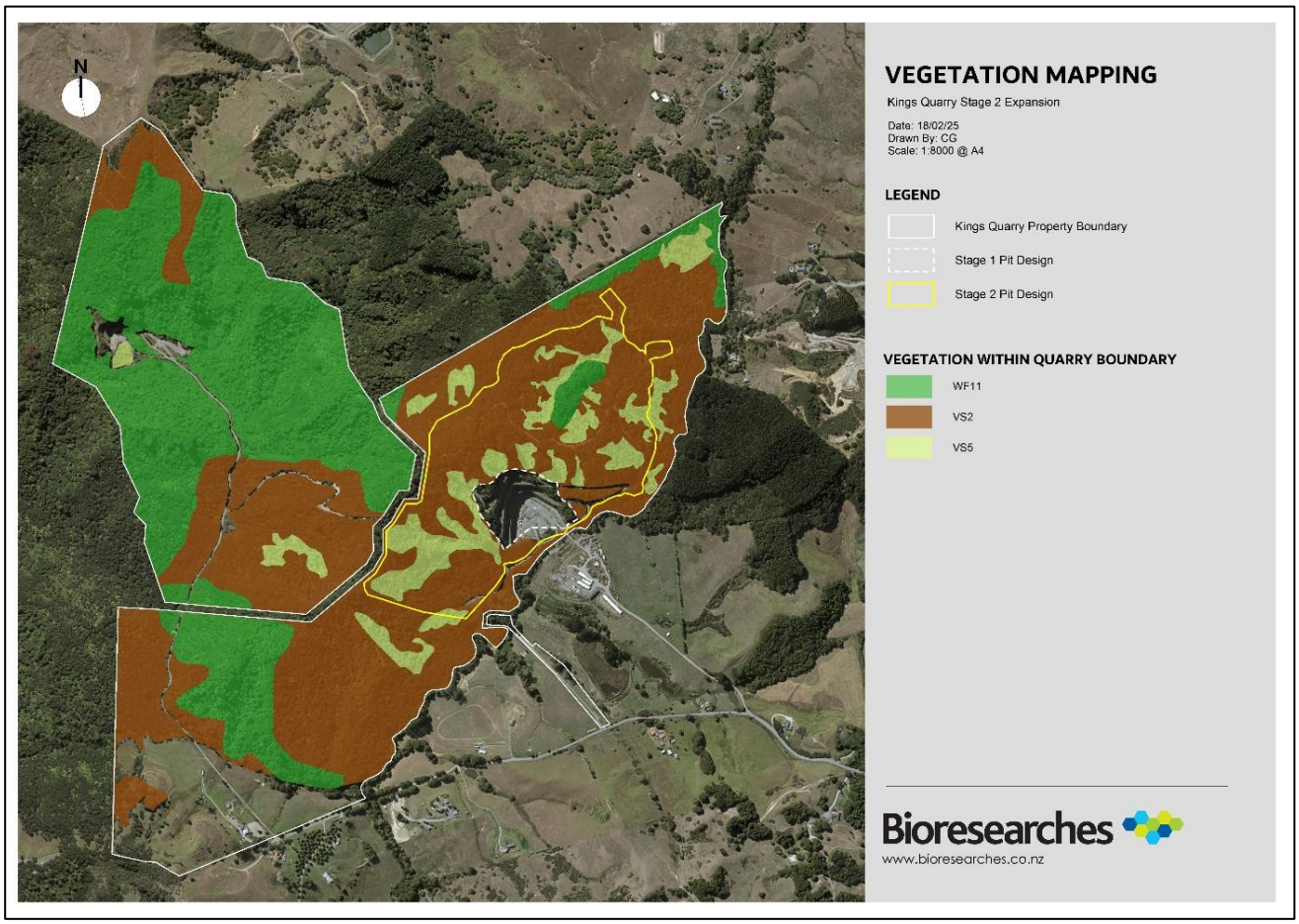


Figure 18. Kings Quarry property with proposed Stage 2 pit and affected vegetation cover.

6.2.2.1 Habitat assessment

Trees are present within Kings Quarry that have the potential to provide roosting habitat for long-tailed bats (as they have features such as cavities, flaky bark, or dense epiphytic cover). The vegetation at Kings Quarry is predominantly kānuka, tōtara, and tree fern forest. Most of the trees within this vegetation type are <15 cm diameter at breast height (DBH) and are therefore unlikely to support potential roost features, however some potential roost options such as hollow tree ferns or dense tree fern skirts are present in both the pit and fill zones. Large emergent pines and occasional multi-stemmed tōtara which have the potential to support communal roosts were noted in the Project area (Figure 19).

Historic images (Figure 20) indicate that the majority of the VS2 and VS5 vegetation originated after 1940. Some vegetation was present in 1940, which was predominantly in the gullies and slopes within the pit area. These are the locations that are most likely to have trees greater than 15 cm DBH.

Figure 19. Left: Some multi-stemmed tōtara support small cavities or hollow limbs. Middle: Emergent pines within the Project area are likely to support typical roost characteristics; Right: a large pine trunk showing signs of cavity–formation near the base.

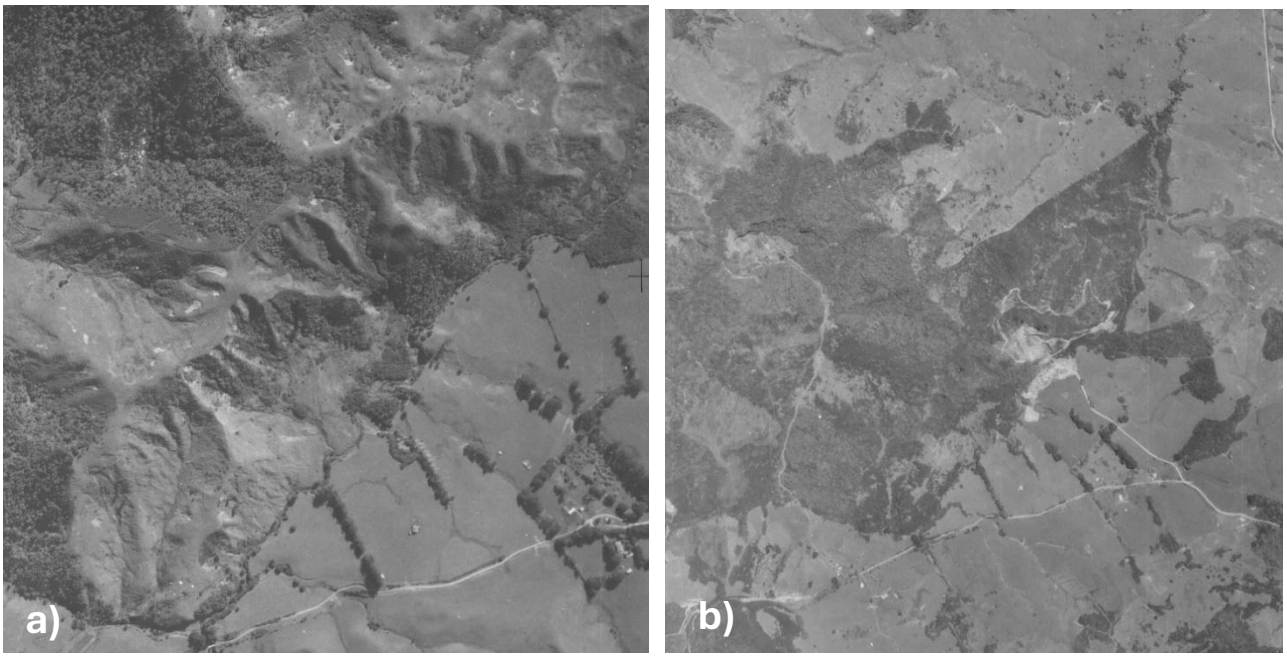


Figure 20. Historic images of Kings Quarry Project area from a) 1940 and b) 1968.

6.2.3 Ecological value

Long-tailed bats have been detected within the Project area during multiple ABM surveys. Bat activity within the Project area during the survey periods has generally been low and sporadic, but with consistent detections over longer surveys and year-to-year. One pass with social calling and one with a feeding buzz were detected immediately west of the Project area.

Most detections have been in the Jan-Feb period, when favourable weather conditions facilitate high bat activity and juvenile bats are freshly volant. Female bats at this time may exhibit reduced home ranges while lactating (O'Donnell, 2001).

Given the sporadic activity and minimal social/ foraging calls, the Project area is most likely primarily being used by bats to commute – at least during the survey periods. However, there was one detection within 31 minutes of sunset which could be indicative of nearby day-roosting behaviour, and notably a number of passes within an hour of sunrise at the nearby Pebble Brook Road planting area in the most recent survey.

Generally, potential roosting habitat for bats is considered to be present within the Project area, however due to the presence of mostly young, immature forest trees, this is limited in quality in comparison to what would be expected within mature forest. Note that this may change by the time later stages of vegetation clearance are reached, as existing forest will have had further years to mature and develop potential roost features.

In accordance with the EIANZ Guidelines, any species with a 'Threatened' conservation status is considered to have a 'Very High' ecological value. While bat activity within the Project area has been relatively low during surveys and there are limited number of potentially suitable communal roost trees available, we nonetheless consider the project to have a Very High ecological value for bats.

6.3 Effects of proposal on long-tailed bats

Long-tailed bats are likely to be impacted by the proposal both directly and indirectly. Effects include:

- Non-permanent loss of 28.97 ha of commuting, foraging, and potential roosting habitat;
- Permanent loss of Very High value existing roost trees that may, but unlikely, be present;
- Direct harm to bats via felling of occupied roost trees; and
- Potential negative physiological/ behavioural impacts of works/ ongoing operational light, noise, and vibration.

6.3.1 Management of effects

The following measures are proposed to avoid, minimise, and remedy the potential effects of the proposal on long-tailed bats:

- Minimise risk of direct harm to bats by following DOC Bat Roost Protocols during vegetation clearance;
- Minimise roost tree loss through avoiding or relocating identified roost trees/ roost features where practicable;

- Minimise potential disturbance from noise, light, and vibration by avoiding construction works overnight or within 1 hour of sunset/ after sunrise. Note no overnight artificial lighting is planned to be installed in the Project area;
- Remedy habitat loss from forest clearance by replanting cleared areas once quarrying operations have concluded (progressive as quarry areas are retired);
- Remedy habitat loss through retained habitat enhancement: namely, animal pest control across a 90.64 ha area of retained forest within the Kings Quarry landholdings (Figure 37) for the life of the consent.
- Remedy loss of potential roost trees that could be present but not detected during tree inspections for bat sign by precautionary provision of 10 Artificial Roost Boxes prior to any vegetation clearance commencing (see Section 6.8); and,
- Remedy loss of potential roost trees/ delay of future potential roost trees availability through protection (predator-proof tree banding) of existing trees along the forest edge southwest of the quarry which have the potential to support quality communal roosts;
- Remedy loss of potential roost trees/ delay of future potential roost tree availability through 3.52 ha additional indigenous planting contiguous with retained forest in the Kings Quarry landholdings (Pebble Brook Road edge effects planting zone; Section 10). The planting schedule includes species known to be utilised by long-tailed bats for roosting such as tī kōuka, kānuka, kauri, tawa, taraire, kahikatea, and kohekohe; and
- Remedy loss of any confirmed roost trees (active or inactive) through provision of additional artificial roosts in the surrounding landscape at a ratio of 6 artificial roosts to every 1 confirmed roost tree lost.

No significant residual effects on bats are anticipated, rather onsite management of impacts will be undertaken as above. However, the overall offset package detailed in the Residual Effects Management Package will provide potential benefits to long-tailed bats through:

- Protection and enhancement of 88.29 ha of existing native vegetation at the Oldfield Road offset site (26 km north of Kings Quarry) as detailed in the Residual Effects Management Plan (Bioresearches, 2025), including eradication of mammalian predators within and installation of a predator-proof fence. Additionally, another 61 ha of vegetation will be planted, providing future habitat. Note that long-tailed bat activity is well known within the immediate landscape at Dome Valley, and these habitats are well within the home range of existing bat populations.

6.4 Tree Removal Protocols

This section details procedures to be followed to give effect to the DOC protocols for removing trees that have potential to support bat roosts.

Note that where new versions of the DOC Bat Roost Protocols are released throughout the life of consent, the latest version will take precedence over the version (Version 4, 2024) detailed in this section for any remaining vegetation clearance.

6.4.1 Certified Bat Ecologist

DOC requires that only certified personnel (certified bat ecologists) may undertake high risk activities, such as identifying bat roosts within a tree in an area where bats have been identified, and that tree requires removal. When implementing this Plan, bat ecologists must be approved and accredited to the relevant Competency (C) for the activity they are undertaking (as per current BRP; DOC, 2024). A summary of the accreditation requirements for bat activities is presented in Table 15.

Table 15. Accreditation requirements for bat activities pertaining to tree felling, as per BRP.

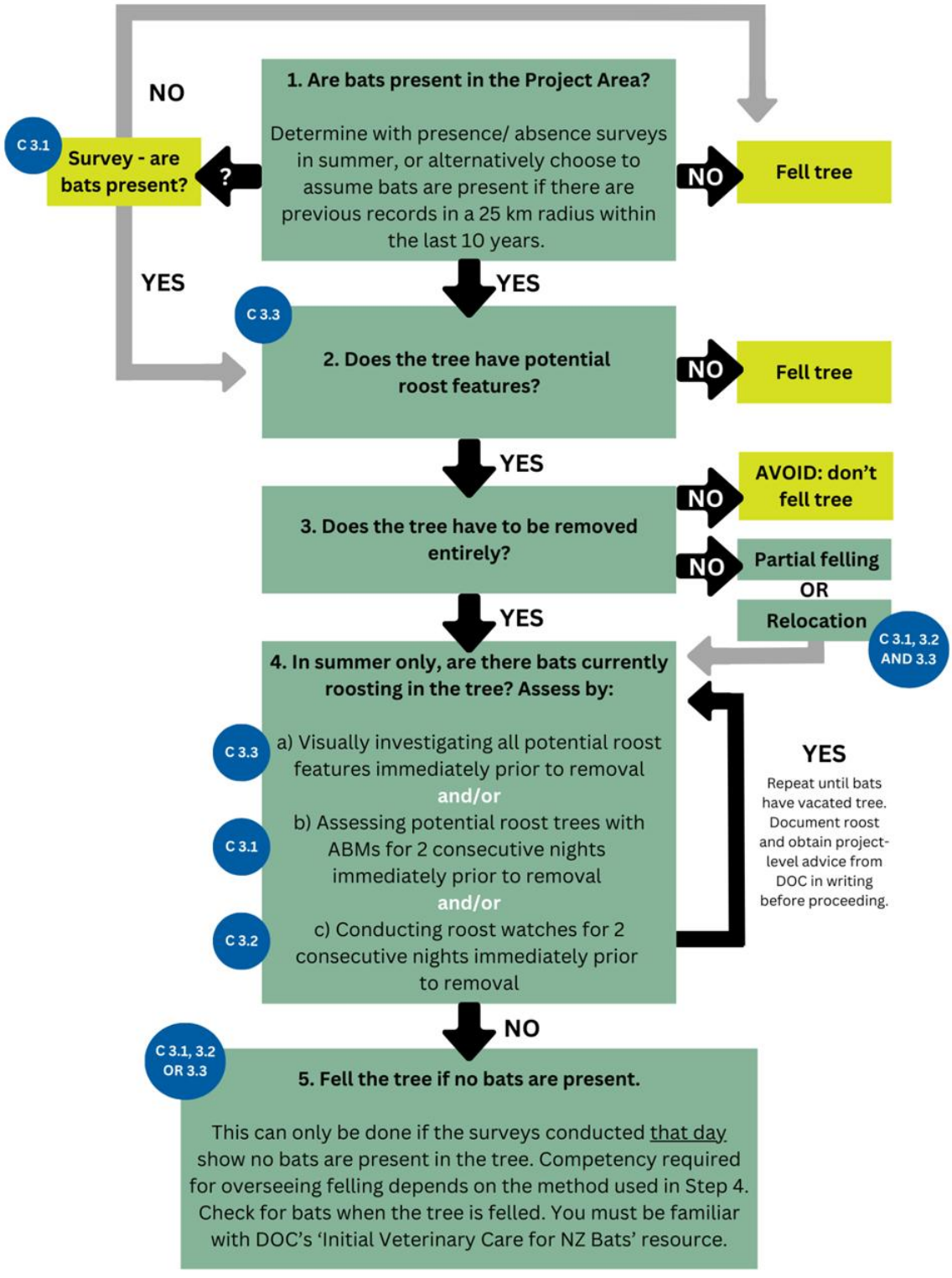
Activity	Certification required	Timing of activity
Presence/ absence survey to determine if bats are using the Project area	Must be designed by approved person accredited with **C 3.1** to determine presence around trees due to be felled/ habitat available at site.	Oct – April inclusive, and when weather criteria are met.
Identifying roost characteristics	Initial criteria (tree is ≥15 cm DBH) can be measured by any ecologist. Identification of Potential Roost Features requires accreditation at **C 3.3**.	Any time of year, but within 6 months of final tree felling.
Physical checking of potential roost features	**C 3.3**, or a certified arborist under the direction of a bat ecologist approved at C 3.3.	Oct – April inclusive, and when sunset temperature previous night is minimum 8° C.
Assessing bat activity around potential roost trees with ABMs	**C 3.1**	Oct – April inclusive, for two consecutive valid nights immediately prior to planned felling.
Assessing use of tree by roost watches	**C 3.2**, or under direct supervision of such during counts requiring multiple watchers.	Oct – April inclusive, for two consecutive valid nights (dusk AND dawn watches required for both) immediately prior to planned felling.
Overseeing tree felling	An approved person accredited with the relevant competency used to determine bat absence **(C 3.1, 3.2, or 3.3)**, and who is: • Familiar with 'Initial Veterinary Care for New Zealand Bats' (Borkin, 2019) • Physically able to check felled trees for bat sign Able to consult with DOC and someone accredited to **C 2.1** if a bat is observed.	Oct – April inclusive, and when pre-felling requirements have been met.

6.4.2 Overview of Bat Roost Protocols

Figure 21 (DOC, 2021) details the decision-making process required for implementing bat roost protocol. As bats have been detected at the Project area, Bat Roost Protocols will be followed for any vegetation removal.

This will involve detailed habitat assessment of vegetation being removed at each stage, and utilisation of at least one method to determine no bats are roosting in trees at the time of felling.

A completion report detailing all High-risk trees identified, and method and results of activity assessment, must be submitted to Auckland Council within 30 days of completion of each stage of tree felling.



Bioresearches reproduction of 'Tree removal in bat areas flow chart' and associated text from 'Bat roost protocol V4' (Bat Recovery Group, DOC, 2024)

C = Accredited at given Competency number. Note that an activity without a stated Competency may have other requirements

Figure 21. Decision tree for Bat roost protocol (from DOC BRP, version 4, October 2024).

6.4.2.1 Roost Characteristics

Prior to undertaking any vegetation removal, the extent of vegetation being removed in a given stage will be clearly demarcated to provide for detailed roosting habitat assessment. All vegetation will be assessed to identify trees supporting Potential Roost Features (PRFs) in line with Step 2 of the Bat Roost Protocols.

High-risk trees will be qualified as any trees (living or dead) that are ≥15 cm DBH (diameter at breast height) and support PRFs. PRFs include:

- Hollows
- Cavities
- Knot holes
- Cracks
- Flaking, peeling, or decorticating bark
- Epiphytes
- Broken or dead branches/ trunk
- Shelter, cavities, or hollows formed by multiple trunks/ double leaders
- Tree ferns that have dense skirts of dead fronds
- Artificial roost boxes

Trees ≥15 cm DBH that cannot be comprehensively assessed for PRFs, for example due to obscured sightlines or limited access, will be precautionarily classified as High-risk. Trees <15 cm DBH or anthropogenic structures may also be classified as High-risk at the discretion of the accredited bat ecologist.

Qualifying trees based on size may be conducted by any ecologist capable of measuring DBH, but an approved bat ecologist accredited with **C 3.3** must conduct any identification of PRFs.

Where the vegetation is not classified as High-risk as above, the vegetation may be removed (any time of year) without bat roost protocols.

Assessment of trees for PRFs is valid for six months, unless significant storm/ high wind events occur which could create new roost features, as determined by the accredited bat ecologist. High-risk trees are to be individually catalogued with a record kept of:

- Tree location (GPS coordinates)
- Tree species
- Tree height
- Tree DBH
- Potential Roost Feature(s) present and location in the tree (e.g., height and bearing, photograph)
- Assigned High-risk tree ID

All High-risk trees in areas where bats have been confirmed to be present must be assessed to confirm that no bats are currently roosting in them prior to felling. High-risk trees are to be physically marked (e.g., with flagging tape, marker spray paint) with their High-risk tree ID prior to any clearance, to facilitate activity assessment and permission to fell.

6.4.2.2 Bat Activity Assessment (High Risk Trees)

Where bats are confirmed or likely present in the Project area, and affected vegetation supports bat roost characteristics (**High-risk trees**), those trees will be assessed (between 1 October and 30 April) to determine any current activity by an accredited bat ecologist, to ensure no bats are occupying potential roosts at the time of removal. This assessment must be undertaken immediately prior to tree removal by way of at least one of the following methods:

1. Tree climbing for visual inspection of potential roosts, if possible; and/or
2. Pre-felling surveys: minimum two consecutive valid survey nights immediately prior to removal; and/or
3. Roost watches: minimum two consecutive valid nights of roost entry/ exit watches immediately prior to removal.

Where bats are confirmed present, **the tree must not be felled**. This process must be repeated on subsequent days until the bat ecologist confirms absence.

Confirmation of an active or inactive roost will trigger the procedures it a bat roost is confirmed (section 6.5) and the artificial roost provision requirements (Section 6.8) if the roost cannot be retained.

Tree Climbing

Roost features may be able to be accessed by an experienced tree climber or accredited bat ecologist (**C 3.3**). A non-certified arborist must provide information along with photographs or video footage to the accredited bat ecologist to inform the decision on whether the tree may be felled.

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

Search of tree features should be accompanied by use of a hand-held bat detector. If bats are present and not in torpor, then listening at 25 kHz (for social calls) and 40 kHz (for echolocation calls) may help to determine if long-tailed bats are present.

Pre-Felling roost ABM Surveys

Each High-risk tree must be surveyed with ABMs for a minimum of two consecutive valid nights immediately prior to felling. This must be undertaken by the accredited bat ecologist (**C 3.1**). At least two consecutive nights are required as it is possible for bats to enter or leave a roost without echolocating, or to not leave the roost for a night. If any passes are detected, regardless how many or the time of night, the tree(s) covered by the ABM in question must not be felled that day unless bat absence can be confirmed with another method (i.e., climbing to visually inspect potential roost features). A valid survey night must:

1. Begin one hour before official sunset and end one hour after official sunrise.
2. Have a temperature 8° C or greater for the first four hours after official sunset time for the North Island and 7° C for the South Island
3. Have no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with **C 3.1**.
4. No wind, or light wind within the first four hours after official sunset.

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

Roost Watches

This must only be undertaken in combination with pre-felling roost ABM surveys and be carried out by a bat ecologist accredited with **C 3.2**. Where multiple personnel are required to cover a potential roost tree, at least one must have the appropriate certification and be present for the entire duration of the watch. Watches must confirm no bat activity for two consecutive valid nights immediately prior to felling. The following weather conditions define a valid night for roost watches:

1. Be undertaken between October 1- April 30 (inclusive).
2. Maintain air temperature >8°C for the entirety of the night.
3. Ideally no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with **C 3.1.**
4. Include ABM deployment and data analysis for the same night.
5. No wind, or light wind within the first four hours after official sunset, as determined by an ecologist accredited with **C 3.1**.

Emergence watches

Each tree must be watched from at least ½ hour prior to sunset until it becomes too dark to see by sufficient people to observe all potential exit points. This must be supported using handheld detectors and a night vision aid (e.g., thermal scope, infra-red camera) which can detect bats after dark. The aim of emergence watches is to identify potential roost locations within the vegetation.

Roost re-entry watches

The time when bats return to roosts can vary based on temperature and time of year.

- Observers must then return the next morning and watch the tree to determine whether bats return to the vegetation.
- Roost re-entry watch timing should be based on patterns of activity recorded onsite with acoustic recorders, i.e., as a guide watches should begin two hours prior to when the last passes were

recorded on the ABMs on previous nights and finish one hour after official sunrise time. Where this information is not available and at minimum, watches shall begin two hours prior to official sunrise until one hour after sunrise. Infra-red and/or thermal imaging cameras will be a useful tool in this process.

6.5 Procedure if bat roost presence is confirmed

Avoidance of felling bat roost trees should be the first step in any project. If bats are sighted, or sign detected, or a roost (active or inactive) is confirmed, the approved bat ecologist, as soon as possible, shall:

- Reassess the necessity of felling the specific tree with the arborist and project manager. For example:
  - Can the tree be topped/ pruned etc. such that any component of the tree that supports roost habitat can be retained?
  - Can the tree or the roost feature be relocated? Note this requires an accredited bat ecologist with all three Level 3 Competencies (**C 3.1, C 3.2, and C.3.3**)
- If the tree and its roost features cannot be avoided, then:
  - Call the tree felling supervisor to inform them which affected tree(s) cannot be felled due to detection of bat sign;
  - Clearly mark and cordon off the tree and a 10 m radius to prevent further disturbance; and,
  - Notify the site manager, the relevant Auckland Council contact, and the local DOC office detailing the results of the survey and outlining the measures for protection or relocating the roost tree.
- A record (including photos) of any vegetation containing bat roosts shall be kept detailing the date; size, location and species of tree or other vegetation; roost type, e.g., cavity, peeling bark, broken branch; detail outlining how presence of bats was confirmed; the number of bats present; and species present, if known.
- If an active or inactive roost is confirmed, advice must be obtained at a project level in writing from DOC before felling or otherwise conducting works that will impact the roost tree. If bats are detected during or after tree-felling, this must be managed in accordance with Appendix 2 of the Bat Roost Protocols (Department of Conservation, 2024).

6.6 Accidental harm to bats during vegetation clearance

If bats are detected during tree relocation or removal, Appendix 2 of the Bat Roost Protocols (Department of Conservation, 2024) must be adhered to. This includes following these specific steps:

- If during the felling of a tree bats are detected, felling of that tree must stop immediately if safe to do so, and DOC and an approved person accredited with **C 2.1** must be consulted.
- If bats do not fly away or are potentially injured/found on the ground, felling can only re-start once permission has been obtained from DOC after consultation with an approved person accredited with **C 2.1**.
- If bats are detected once the tree has been felled, all further work must stop, and DOC and an approved person accredited with **C 2.1** must be contacted. The felled tree must be thoroughly inspected by them for further bats.
- If any bats are found on the ground or in the tree once felled, place the bat in a cloth bag in a dark, quiet place at ambient (or slightly warmer) temperature and take to a veterinarian for assessment as soon as possible i.e. that day. A maximum of two bats should be kept in one bag. After delivering the bat to the vet, contact an approved person accredited with **C 2.1** in consultation with the vet and DOC (0800 DOC HOT; 0800 362 468).
- Bats must be kept for three days under observation and must be kept out of torpor for this time. Additional detail is found at the links provided in this footnote[5]. Vets must euthanise bats whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return to the wild. The approved person accredited with **C 2.1** and the vet must consult with DOC to consider appropriate rehabilitation options where suffering is minimal and chances of return to the wild are high.
- Euthanised bats or any dead bats (or bat parts) found must be handed to DOC and is a legal requirement under the Wildlife Act. If the bat is held for longer than 12 hours, store it in a food grade safe glass jar in the freezer to preserve the bat's smell for the potential use of training conservation dogs.

6.7 Key contacts

Key contacts corresponding to this BMP (Table 16) must be identified and circulated to the on-site team of ecologists and arborists prior to removal of any High-risk Trees.

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

Table 16. Bat Management Plan key contacts.

Key contacts	Contact information
Project bat ecologists	Chris Wedding, Charlotte Garrett, Alisha Hart
Identified vets in case of injured bat recovery	Massey Wildbase Vet Hospital - 0800 738 363 Auckland Zoo Vets - 09 360 3805
DOC emergency hotline	0800 362 468 (0800 DOC HOT)
Project area manager	TBC
Tree felling supervisor	TBC

Note: Key contacts identified/ to be identified prior to vegetation clearance

6.8 Artificial Roost Provision

Roost trees, especially those used for communal roosting and specifically maternity roosting, are a valuable resource for LTBs. Therefore, any loss of such habitat is a very high-level effect on the basis of the species threat status and the probable low availability of suitable roosts in the surrounding landscape. Restoration planting will not replace high-value roosts in the short to medium term (Sedgeley & O'Donnell, 1999) therefore is unsuitable to remediate loss.

Therefore, this Plan requires provision of carved cavity roosts (CCRs) and/ or artificial bat roost boxes (ARBs), in accordance with DOC's advisory note for the use of ARBs (Department of Conservation, 2023). Utilisation of DOC's Bat Roost Protocols is expected to identify any active roosts immediately prior to felling. Inactive roosts may be identified from bat sign (guano, urine staining) when cavities are inspected during tree climbing or post-felling by the accredited bat ecologist. However, roosts used sporadically may not contain bat sign and inactive roost trees may fail to be identified during vegetation clearance. Bats may also take some time to identify and begin using new artificial roost options. It is worth noting that the vegetation at the Project area is still part of a regenerating ecosystem and may have developed higher quality roost options by the time it is reached in the planned staging. While areas will be restored in stages behind the quarry operations, this will take time to mature and offer potential roosting habitat.

Bat activity may also increase in and around the Project area over time – for example due to increased local population, maturing forest in the immediate surrounds, increase in edge habitat, or an increase in foraging habitat (e.g., over regenerating VS2 forest).

In acknowledgement of these uncertainties, a baseline number of ARBs are to be installed in vegetation contiguous with the Project area prior to vegetation clearance commencing (detailed in Section 6.8.2.1).

Where an active or inactive roost is confirmed during Bat Activity Assessment of the High-Risk Trees in this Plan and is unable to be managed in a way to maintain the roost features (e.g., by topping, tree relocation, or relocation of just the trunk/ branch section supporting the roost), additional CCRs and/ or ARBs will be installed in habitat suitable for bat roosting, as directed by the accredited bat ecologist. The number of CCRs or ARBs to be installed in this instance will be a minimum of six per identified roost tree lost.

Artificial roosts will be installed within a nearby area of protected vegetation, where bats have been detected (by survey, records, or another knowledge). Project opportunities occur within pest managed areas at Kings Quarry.

All artificial roosts will (as per advice note on the use of ARBs (Department of Conservation, 2023)):

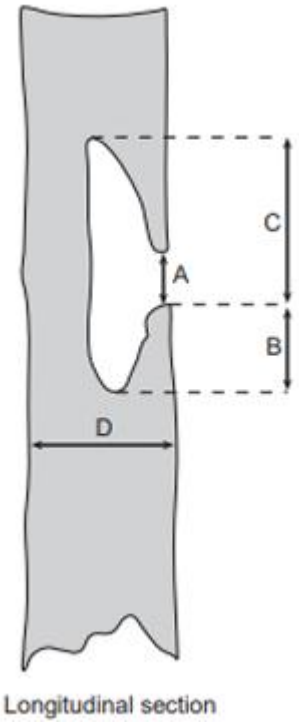
- Be deployed at a minimum height of four metres from the ground;
- Be attached securely/ carved into an appropriate tree, with no clutter within 2m of the roost opening;
- Be 'predator proofed' where practicable with metal tree bands to prevent access by rats, cats, and possums. Bands will be wrapped around the trunk above and below each artificial roost, provided that non-contiguous vegetation can be maintained between this area and surrounding trees;
- Be of multiple designs (in the case of ARBs), of variable orientation and exposure to light; and
- Be installed near to the lost roost tree to facilitate discovery, where practicable and where location won't be subject to excessive disturbance (e.g., from artificial lighting, noise, vibration, or human curiosity).

6.8.1 Carved Cavity Roosts

Creating CCRs (also known as tree veteranisation) involves carving suitable cavities by hand or with chainsaws into living or dead wood for bats to roost in. This is a very new technique in New Zealand. While it is likely that CCRs offer more thermal stability than ARBs, their attractiveness to bats, ideal dimensions, and long-term efficacy has not been tested. It is therefore proposed that where CCRs are utilised, they do not comprise more than 50% of artificial roosts provided.

CCR trials in Australia found that all vertical cavities carved into live trees had sealed over with woundwood within 2 years (Department of Conservation, 2023; S. R. Griffiths et al., 2018). Where CCRs are installed in live trees, chainsaw scoring of the tree surface around the entrance is recommended to slow cavity closure and provide a rough landing surface for bats (S. R. Griffiths et al., 2018). Carving cavities into live trees may damage them through disease/ pest introduction, interfering with/ stressing biological functions, or compromising structural integrity. These risks must be considered when selecting trees to veteranise; it is recommended that old native trees are not targeted.

A technique involving less maintenance is to carve the cavities into standing dead trees, or into trunk sections (e.g., logs from felled trees) which can then be attached to other trees at an appropriate height. Note that CCRs in logs may not be as thermally stable as those carved directly into standing trees (S. R. Griffiths et al., 2018), but are likely an improvement over standard thin-walled wooden ARBs. CCRs are to incorporate average LTB roost dimensions from Sedgeley & O'Donnell (1999) (Figure 22) and any current information available from trials underway.



Cavity characteristics: letter notation following Figure 1	Mean
Distance to nearest vegetation	7 m
Entrance Height from ground	15 m
Entrance area (height x width): A	100 cm^2 e.g., 10x10 cm. Minimum 5 cm
Internal cavity depth: B	14 cm
Internal cavity height: C	43 cm
Diameter at cavity height (DCH): D	66 cm
Inside cross section: F	405 cm^2
Wall thickness: G	24 cm
Volume	26731 cm^3

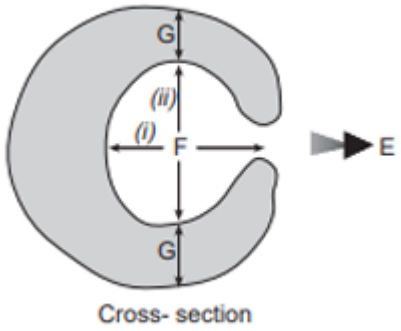


Figure 22. Average long-tailed bat roost dimensions from Sedgeley & O'Donnell (1999).

6.8.2 Artificial Roost Boxes

While information on the effectiveness of ARB designs and optimal installation position for long-tailed bats in New Zealand is limited, Hamilton City now has well over 100 ARBs installed throughout urban parks, with a study tracking use of 74 'Kent' style ARBs for 12 months (2021-2022) observing 32% of them used at some point by LTBs (Robinson et al., 2024). It should be noted that initial screening excluded ARBs that appeared unlikely to be used, however AECOM (2022) reported 41% of 80 ARBs installed in association with the Southern Links Project were being used within two years. This was likely facilitated by the Hamilton LTB population having ever-increasing exposure to ARBs beginning over a decade ago, and potentially limited alternative roost options.

In Canterbury, 96 Schwegler ARBs were installed and monitored across 12 years, with sign of LTBs only detected in 10% of boxes (O'Donnell, 2024). As the boxes were concentrated into 24 locations and were checked infrequently (1-5 years), actual rates of use by roosting bats may be underestimated.

Effects of ARB use on individual fitness and population have not been studied in Aotearoa.

Various roost box designs have been deployed in New Zealand (Figure 23). Models known to be utilised by LTBs include:

- Various timber 'Kent' bat box designs and similar bespoke inspired designs (e.g., Waikato Regional Council).
- Schwegler 'woodcrete' designs (including models 2F, 2FN, 1FF and 1FD).

Figure 23. Examples of artificial bat roost designs; a) Timber 'Kent' design (source: Treelands); b) Schwegler 2FN design (source: Schwegler); and c) Various Schwegler ARBs, flat 1FF model in front (source: A. Hart).

6.8.2.1 Baseline Artificial Roost Box provision

Ten baseline ARBs are to be installed in suitable nearby, protected habitat prior to initial clearance commencing. ARBs are specified as they have been confirmed to be used as communal roosts, including maternity roosts, while CCRs are still in early trials.

The area southwest of Kings Quarry has been identified as suitable for ARB install as it contains comparable vegetation types, will receive mammalian predator control, buffer planting at Pebblebrook Road, and additionally has a stream running along its southern edge (to support foraging/ drinking behaviour). It is in proximity to the Project area (to facilitate discovery) but also gives some distance from the quarry to avoid potential noise/ vibration disturbance from the quarry operations. Additionally, it is where the highest long-tailed bat activity has been recorded in surveys of the Kings Quarry landholdings (187 passes over 49 nights).

Exact locations are to be selected by the bat ecologist in line with DOC's advisory note for the use of ARBs (Department of Conservation, 2023), but would generally target edge habitat in proximity to the stream. An indicative area has been provided in Figure 24.

These ARBs should be installed 6 months ahead of clearance commencing.

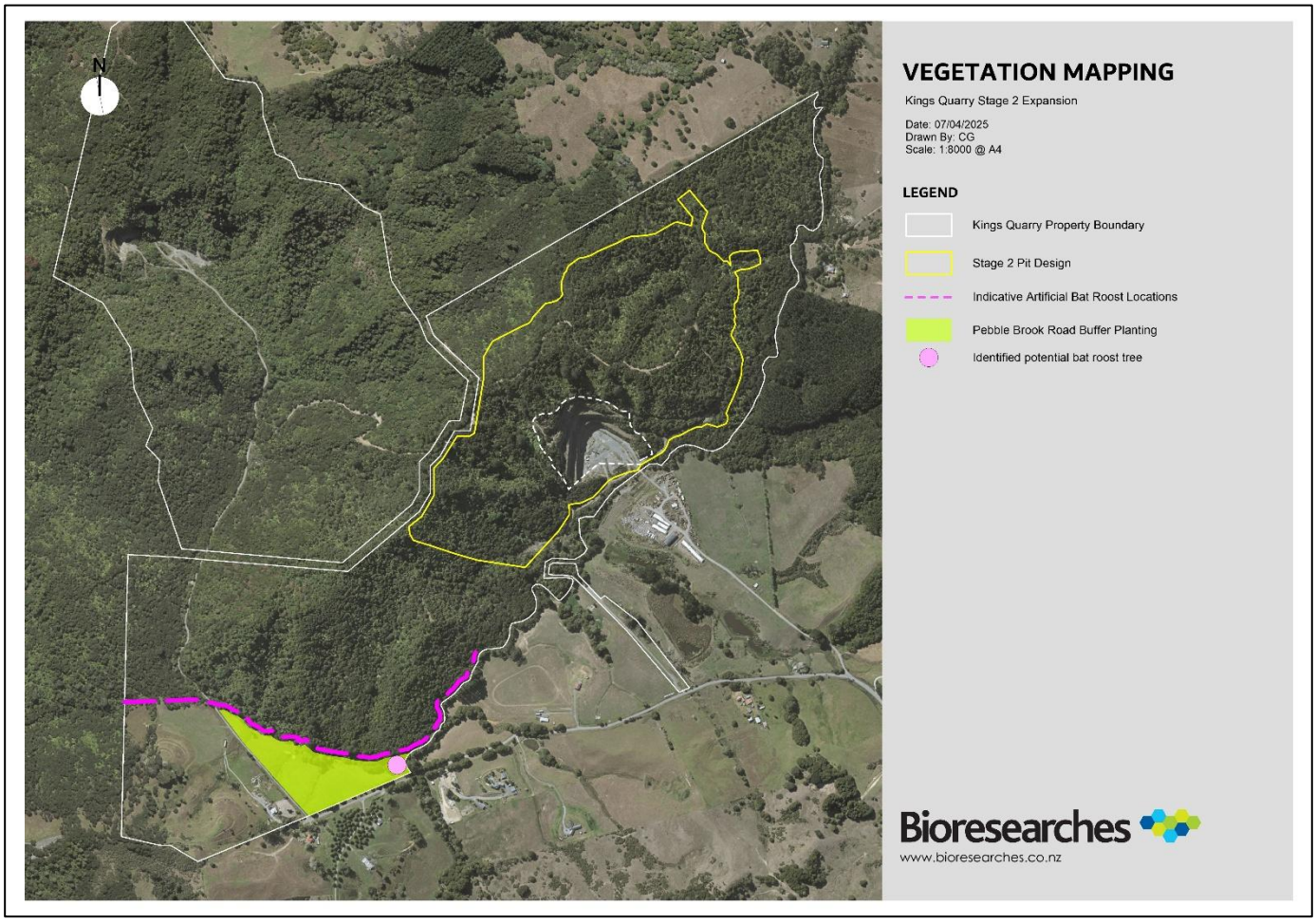


Figure 24. Indicative location of artificial bat roosts along edge of existing vegetation and the Pebble Brook Road edge effects and buffer management restoration planting.

6.9 Predator Proof Tree Bands

Potential bat roost trees have been identified within the Pebble Brook Road edge effects and buffer management restoration zone (Figure 24). In order to protect bat roost habitat within the restoration zone, potential bat roost features should be identified along the indicative artificial bat roost provision boundary (Figure 24). Where trees have bat roost characteristics, predator-proof metal tree bands should be installed surrounding the tree trunk to prevent mammalian predators from climbing trees and accessing long-tailed bat roosts.

During planting and restoration at Pebble Brook Road, exotic trees displaying bat roost characteristics that are not pest plants may be left in-situ. Pine trees pose a threat to restoration efforts via ongoing self-seeding. Pine trees over 15 cm diameter at breast height (DBH) are proposed to be drill and injected, but left standing so as to continue to provide bat roost habitat.

Figure 25: Example of metal tree band installed surrounding trunk to prevent predators from climbing trees.

6.10 Artificial roost monitoring and reporting

Where any CCRs or ARBs are installed, they will be checked annually for a minimum of 15 years by a bat ecologist accredited with **C 3.3**. At each inspection, any cobwebs, bird nesting material, or invertebrates will be removed.

Each artificial roost will be inspected for signs of bat roosting, such as guano. Additionally, eDNA surveys will be conducted at the 5-, 10-, and 15-year mark to support detection rates.

CCRs in live trees will have the bark and cambium cut back where it is encroaching on the cavity, after confirming bats are not currently present within. Anti-predator tree bands will be checked at 6-monthly intervals for a minimum of 15 years and maintained to ensure they remain securely attached to the tree. Close inspection and maintenance should occur between May-September (inclusive), to avoid sensitive months for juveniles and breeding females. If bats are determined to be present in the artificial roost, then maintenance must be postponed for a short time until the roost is vacant (e.g., to the following day).

Note that other protected indigenous fauna may utilise artificial bat roosts (O'Donnell, 2024). If a native bird is nesting in an artificial roost, maintenance must be delayed until after the chicks have fledged and left the nest or the nest has failed, after which the nesting material may be removed. Native lizards may not be handled or removed from artificial roosts. During the maintenance period, any damaged Artificial Roosts unable to be maintained (e.g., tree fall, leaking water) are to be replaced. An arborist may need to be engaged for works such as pruning vegetation that compromises the effectiveness of predator bands and maintaining carved cavity entrances. In such cases, these works must be undertaken within 30 days of the triggering inspection and the accredited bat ecologist must confirm no bats are presently occupying the Artificial Roost immediately prior to works.

An annual report detailing maintenance undertaken, artificial roost and predator band condition, and sign of occupation by indigenous fauna (including bats, birds, lizards, and notable invertebrates such as wētā) is to be sent to Auckland Council for the 15-year minimum maintenance span.

If any artificial roost use is confirmed, details are additionally to be provided to DOC to support ongoing research and technique refinement.

7 NATIVE FRESHWATER FISH RELOCATION PLAN

7.1 Introduction

Bioresearches were engaged by Barker, on behalf of their client Kings Quarry Limited, to prepare a Native Fish Management Plan. The Kings Quarry Stage 2 expansion will result in the reclamation and infilling of 2,127 linear metres of intermittent and permanent stream bed, in addition to streamworks within the Waitoki Stream including the removal of a weir. Twelve intermittent stream and one permanent stream is located within the Stage 2 expansion area (Figure 26) with good, forested riparian vegetation and stony streams which were determined to be of low to high ecological value.

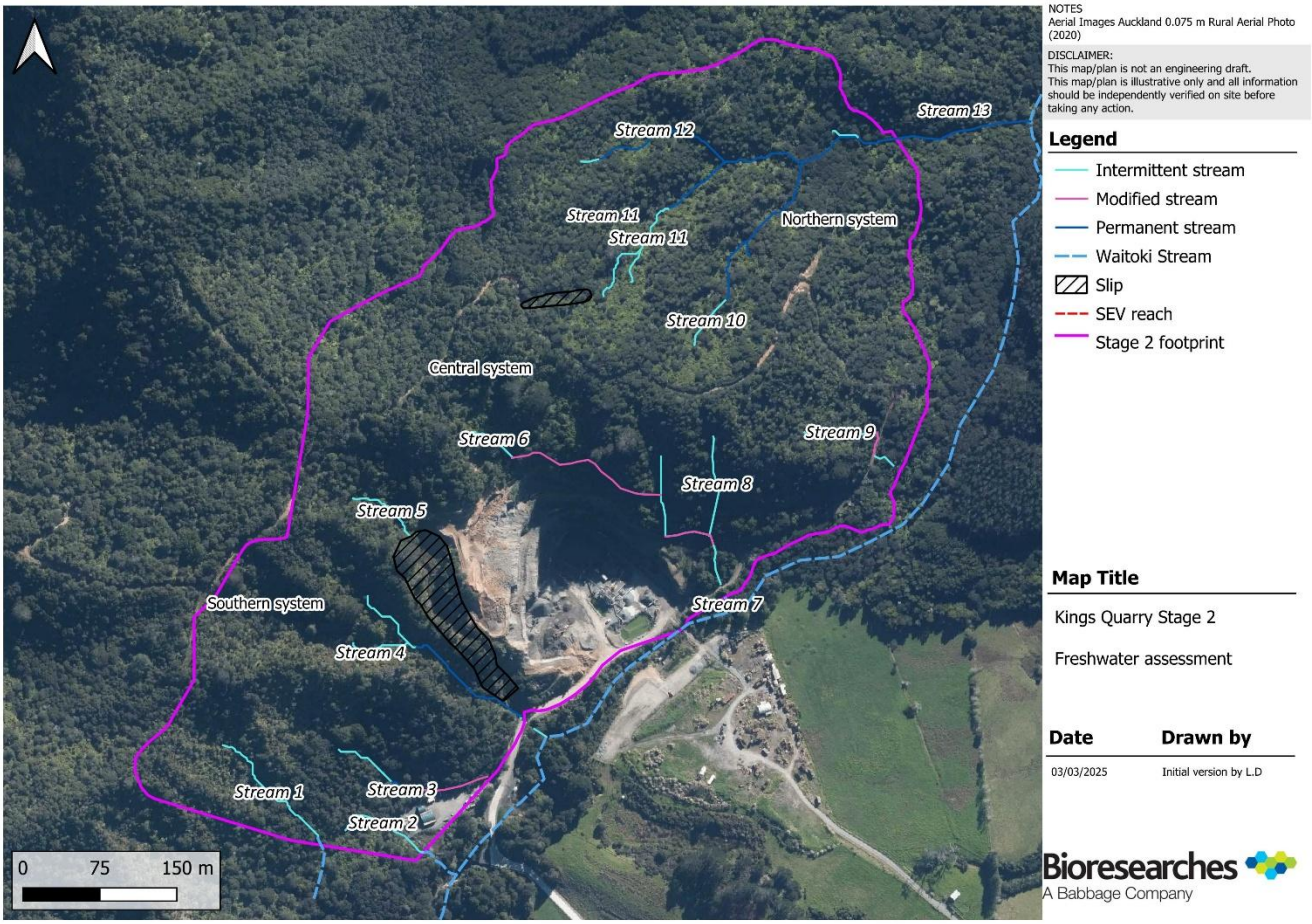


Figure 26. Map of the Project area (purple polygon) with the streams proposed to be reclaimed during the Stage 2 expansion which are subject to the NFRP.

Fish surveys were undertaken within the expansion area and Waitoki Stream, using a combination of netting/trapping and eDNA. Within streams in the expansion area, only longfin eel (*Anguilla dieffenbachii*) and kōura (*Paranephrops planifrons*) were detected. Within the Waitoki Stream, eDNA detected shortfin eel (*Anguilla australis*), common bully (*Gobiomorphus cotidianus*), redfin bully (*Gobiomorphus huttoni*), banded kōkopu (*Galaxias fasciatus*), and torrentfish (*Cheimarrichthys fosteri*). The topography of the

Project area and intermittent nature of the streams would restrict the presence and abundance of fish within the Stage 2 expansion area.

7.2 Methodology

7.2.1 Commencement of recovery plan

Fish removal and relocation will be undertaken in the days immediately prior to the commencement of any instream or where significant changes in stream hydrology is expected due to the proposed works. The fish recovery may be carried out in stages, depending upon the infringement of earthworks into recognised aquatic habitat.

7.2.2 Exclusion Screens

Prior to capturing fish, a barrier (exclusion screens) to fish movement shall be placed at the upstream and downstream areas of the potential aquatic habitats in which earthworks would be infringed upon to prevent fish from recolonising the impacted areas. Exclusion screens will be constructed from steel waratahs and shade cloth (Figure 27). The shade cloth allows water to continue to flow downstream while preventing fish passage. The exclusion screen will extend 1 m past the wetted widths of the aquatic habitat and will be embedded into the dry ground or the banks.

Waratahs will be securely hammered into the ground and evenly spaced across the aquatic habitat to effectively support the shade cloth. Where extra support is considered necessary, wire will be threaded horizontally across through the waratahs to further support the shade cloth. Shade cloth will then be fastened to the waratahs and wire supports (where applicable) using zip ties. The shade cloth will extend above the water level to an approximate height of 0.5 m. Along the stream bed the shade cloth will either be embedded and pinned, or an apron of the shade cloth will be formed and pinned.

Figure 27. Example photo of fish exclusion screens.

7.2.3 Fish Capture Methodology

The *New Zealand Freshwater Fish Sampling Protocols* (Joy *et al*. 2013) will be followed unless specified within this plan. Setting of Gee-minnow traps will also be in general accordance with *A Revised Methodology to Survey and Monitor New Zealand Mudfish Species* (Ling *et al*. 2013).

Preferably, stream reclamation will occur during the warmer dryer months where water levels within the intermittent streams would naturally recede. Suitability qualified freshwater ecologists shall conduct the fish relocation. These ecologists will be two of:

- Treffery Barnett, M.Sc (Hons), Senior Freshwater Ecologist
- Kate Feickert, PG.Dip.Sc, Senior Ecologist
- Christel du Preez, M.Sc (Hons), Senior Ecologist
- Laura Drummond, M.Sc (Hons), Ecologist

All ecologists listed have conducted multiple successful freshwater fish relocations and have electric fishing licences and have extensive experience in freshwater fish handling and ecology. At least one of them will be present on site during the relocation.

Native fish present shall be captured over at least two days using a combination of netting/trapping and electric fishing. Water levels permitting, baited Gee-minnow traps and fyke nets will be placed at intervals over the stream works area and left in place overnight. Fine meshed fykes with a separator grill will be used. All nets and traps will be set with an airspace to provide trapped fish access to atmospheric oxygen and will be set in general accordance with the *New Zealand Freshwater Fish Sampling Protocols* (Joy *et al.* 2013), with small buoys placed in the fyke nets if required. It is proposed trap densities will be set at one fyke net and two Gee-minnow traps for every 10 m of stream length. It is likely the intermittent streams will contain insufficient space/water depth for the setting of fyke nets, and as such, the density of Gee-minnow traps will be increased. The traps will be checked the following morning, prior to 9 am, with any captured fish recovered.

A minimum of two electric fishing runs within the areas will be carried out over the trapping period. One electric fishing run will be undertaken prior to setting any traps or nets and another electric fishing run will be undertaken post the last occasion of retrieving the traps or nets. Electric fishing shall be undertaken using an electric fishing machine (EFM 300). When used correctly, the EFM 300 temporarily stuns the fish, allowing them to be caught without damage.

7.2.4 Performance Standards

As a minimum performance for trapping if more than ten native fish (excluding juvenile shortfin eels) are caught during a single trapping effort within the staged area of the site then trapping will continue until numbers are depleted to the satisfaction of the project ecologist (using an 80% removal rate as a target, based on the Hayne's (1949) regression method). A single trapping effort is considered to be one night of trapping. In relation to juvenile shortfin eels (<350 mm), fishing will continue until a 50% removal rate is achieved (based on the Hayne's (1949) regression method).

Dewatering will commence provided that the electric fishing minimum performance standards have been met. Native fish, such as eels (*Anguilla* spp.), will burrow into silt substrates when they are disturbed or as water levels decrease. As a result of this, during the dewatering stage, a freshwater ecologist will be present to search through drained habitat, rocks/debris, remaining pools or thick sediment for any remaining fish. Once dewatering is completed an excavator will be used to carefully scrape out any thick layers of sediment. Any sediment removed from aquatic habitat will also be handed checked by the freshwater ecologist.

7.2.5 Fish Handling and Relocation

Fish handling will be in accordance with Section 3.9 of the *New Zealand Freshwater Fish Sampling Protocols* (Joy *et al.* 2013) and the Bioresearches MPI Special Permit 872. All native fish captured will be relocated on the day of capture to suitable alternative habitat. Ideally fish are relocated to suitable, similar habitat types within the same catchment where suitable shaded permanent water is present. Stream

information obtained from the Auckland Council GIS viewer and onsite assessments revealed suitable habitats (e.g., high shading and sufficient water levels) to be present within the Waitoki Stream.

Following capture, fish will be transferred into lidded containers of an appropriate volume for the number of fish caught and kept cool. Battery powered oxygen bubblers will be placed within each of the transfer bins to provide high dissolved oxygen into the water and reduce stress. A water conditioner (such as API Stress coat) will be added to the water to reduce further stress and restore the mucous coat of fish. Whilst contained, fish will be monitored and water will be changed every hour. If any individual captured fish shows signs of stress (loss of righting response, exuding excessive mucus, gulping air, and or mouth gaping) the water will be changed to provide more oxygen, or the fish will be moved to the relocation site immediately. Fish will be visually examined for general health (visual skin lesions or heavy fungal burdens) and if considered unhealthy by an appropriately qualified freshwater ecologist, they will be humanely euthanized in accordance with Section 20-27 of the MPI Special Permit (872).

Large eels (> 500 mm) will be contained individually to avoid injury to other smaller captured fish. Koura, if present, will also be separated into their own containers. Captured fish will be securely transported to the relocation site and gently transferred into the downstream reach within two hours of being captured. If large numbers of fish are captured, they will be distributed across multiple release points in the general area to avoid short term overstocking and predation risks.

7.2.6 Timing of Works

The initial works required by the NFRP will be undertaken no more than one week prior to any stream works commencing within the specified area, or if works outside of watercourses results in the reduction of stream flows. Ongoing maintenance of the temporary fish barriers will be undertaken until streamworks are complete within the area.

7.2.7 Biosecurity

All equipment will be thoroughly cleaned and dried prior to their use. Equipment includes but not limited to; electric fishing machine, waders, fyke nets, gee minnow traps and transfer buckets. Any pest fish caught will be humanely euthanized, and all euthanized pest fish will be disposed of in a bio secure manner to land, in accordance with MPI Special Permit 872.

7.2.8 Adaptive Management

Due to the high level of intrinsic variability in any fish recovery and relocation, this plan may be slightly modified by an appropriately qualified freshwater ecologist to ensure fish are recovered in a safe and professional manner, as well as in accordance with the *New Zealand Freshwater Fish Sampling Protocols* (Joy *et al* 2013).

7.3 Reporting and Permits

Following the relocation, a short report will be prepared detailing the fish captured (species and number of fish) during the recovery, as well as details on the relocation site. The Auckland Council shall be provided with a copy of the report within five days of completion of dewatering. Fish records will also be sent to NIWA to be included in the New Zealand Freshwater Fish Database.

Bioresearches hold a MPI Special Permit (872) to allow persons or agencies to take aquatic life and relocate it to a suitable habitat where this is necessary or required to mitigate adverse effects of habitat modification on the aquatic life. Since the capture and relocation sites are not within a conservation area and the fact that any fish captured will be relocated within the same catchment, no other permits are considered necessary.

8 THREATENED AND AT-RISK PLANT MANAGEMENT PLAN

The Stage 2 Project area comprises a mosaic of different ecosystem types described in Singers et *al*. (2017) for the Auckland Region. These are either forest ecosystems or regenerating scrub/forest ecosystems including regenerating kauri, podocarp, broadleaved forest (WF11), kānuka (*Kunzea robusta*) scrub/forest (VS2) and broadleaved scrub/forest (VS5). Plant species with a national or regional threat classification of Threatened or At-Risk are found within these ecosystem types.

The objective of this Threatened and At-Risk Plant Management Plan is to mitigate the adverse effects of the proposed Stage 2 Project on threatened flora species at the quarry.

Contents of this Plan include:

1. Threatened or At Risk (TAR) species covered by this Plan;
2. Methods and locations to propagate or relocate any rare species that occur within the Project works area;
3. Locations of replanting areas; and
4. Maintenance and reporting requirements.

Salvage of threatened plants should occur prior to the commencement of each quarry stage. Minimum one year's notification of the commencement of each quarry stage is required, to ensure seasonal requirements of seed collection and translocation are met.

8.1 Threatened Flora Species within the Stage 2 Project area

Specific searches for threatened plants within the Project footprint have been undertaken by Bioresearches in 1997-98; 2007-08; 2009; and 2020[6]. The regionally endangered mistletoe *Ileostylus micranthus* was a key species in the searches throughout the Project, however, was not identified within the Kings Quarry Landholdings.

In initial searches, three plants of at least regional TAR threat status were found throughout these searches, including the orchid *Danhatchia australis* (nationally and regionally 'At Risk – Naturally Uncommon'); a willowherb, *Epilobium nerteroides* (Regionally 'At Risk – Declining'); and a pondweed *Stuckenia pectinata* (At Risk – Naturally Uncommon). However, only the pondweed was located within the Stage 2 Project footprint.

Fennel-leaved pondweed (*Stuckenia pectinata*) is listed by Auckland Council as being present within the Significant Ecological Area (SEA) overlaying the Project area. A 1998 report by Bioresearches recorded it growing in a pond on the Wainui Quarry floor. In subsequent years, the pond has silted up and the plant

[6] Bioresearches (2025) Ecological Impact Assessment

has not been observed within the Project area since. The pond no longer provides suitable habitat for the species.

Following a further Project area walkover of the Project footprint in 2020, 13 TAR species were identified within the Stage 2 Project area.

Table 17 lists these species, as well as those not recorded but potentially present within the project footprint that are covered by this Plan.

Table 17. Threatened or At-Risk plant species identified during Project area walkover of the Project area (Biroesearches, 2025).

Botanical name	Common name	Identified within Stage 2 footprint?	Regional threat classification	National threat classification
Conifers				
Agathis australis	Kauri	Yes	At Risk - Declining	Not Threatened
Dicot herbs				
Euchiton audax		Yes	At Risk - Declining	Not Threatened
Epilobium nerteroides	Willowherb	No	At Risk - Declining	Not Threatened
Danhatchia australis	Yoania	No	At Risk - Naturally Uncommon	At Risk - Naturally Uncommon
Dicot trees and shrubs				
Kunzea robusta	Kānuka	Yes	At Risk - Declining	Not Threatened
Leptospermum scoparium var. scoparium	Mānuka	Yes	Threatened - Regionally Vulnerable	Not Threatened
Melicytus macrophyllus	Large leaved māhoe	Yes	At Risk - Naturally Uncommon	Not Threatened
Melicytus micranthus	Swamp māhoe	Yes	Threatened - Regionally Vulnerable	Not Threatened
Metrosideros perforata	Small white rata	Yes	At Risk - Declining	Not Threatened
Pennantia corymbosa	Kaikōmako	Yes	Threatened - Regionally Endangered	Not Threatened
Pomaderris kumeraho	Kūmarahou	Yes	At Risk - Declining	Not Threatened
Ferns & Fern allies				
Gleichenia microphylla	Tangle fern	Yes	At Risk - Declining	Not Threatened

Monocots				
Austroderia aff. *fulvida*	Toetoe	Yes	Threatened - Regionally Endangered	Not Threatened
Carex ochrosaccus	Forest sedge	Yes	At Risk - Declining	Not Threatened
Pentapogon inaequiglumis	Short hair plume grass	Yes	Threatened - Regionally Vulnerable	At Risk – Declining

8.2 Locations to be supplementary planted with TAR species

Kings Quarry Limited is proposing several sites for offset planting and edge effect management planting as part of required offsetting for the proposed Stage 2 pit expansion. The edge effects and buffer management planting (306 Pebble Brook Road) occurs to the south-west of the Stage 2 Project footprint within adjoining property. Offset planting is to occur at the Oldfield Road offset project area. The Pebble Brook Road project area is located immediately adjacent to the impact site and offers a good opportunity for matching habitat and localised climate conditions. The Oldfield Road project area is located north of the impact site, but within the same ecological district and provides a range of habitats for planting. Both planting sites will receive pest plant and animal management, which will support long-term plant survival as well as survival of plant pollinators and seed dispersers.

It is proposed to plant TAR species that are being relocated, or grown from seed or cuttings, as additional plantings within the Pebble Brook Road and Kings Quarry edge effects and buffer management zones. Seed collected from the Kings Quarry Project area may be utilised at the Oldfield Road Project area, providing an opportunity to establish new populations of vulnerable plant species and buffers species against the risk of survival failure should one or more sites not be successful.

Specific planting sites for each species must be selected based on a match to the particular growing conditions listed for each plant, as described in Table 19, Table 20, and Table 21. Specific planting locations must be confirmed with the project ecologist prior to planting to ensure best possible survival for each species.

8.3 Preservation and Relocation of TAR Plants

The method of threatened plant protection is variable between different species. The probability of surviving direct transfer for many species is low. Relocation is most successful for small plants, which may be able to better cope with the stressors of root disturbance. Where possible (based on habitat requirements), relocated plants should be preferentially planted within the nearby Pebble Brook Road Project area, in order to limit relocation time, reduce stress and drying risks to plants out of the ground.

Seed collection for propagation is recommended for all species, where possible, to allow replanting across multiple planting sites, ensuring the longevity of the gene pool of each species. Seeds should be collected and grown in a nursery until ready to be planted out, with a minimum size of 1L pots.

Seed collection should begin at least 1 year prior to vegetation removal, in order to ensure at least one fruiting season occurs to collect from. Seed collection should be done by the nursery responsible for growing plants for the wider offset planting in order to maintain oversight and understanding of the full planting requirements of the project.

Table 18 shows the species and required method of cultivation for relocation.

Table 18. List of threatened plant species covered by this Plan and their required protection measures.

Latin Name	Common Name	Method of Protection	Location of Re-planting
Agathis australis	Kauri	Seed collection	Pebble Brook Road; Oldfield Road
Euchiton audax	Creeping cudweed	Attempt relocation to Pebble Brook Road planting and Kings Quarry enhancement project areas	Pebble Brook Road
Epilobium nerteroides	Willowherb	Attempt relocation to Pebble Brook Road planting and Kings Quarry enhancement project areas	Pebble Brook Road
Danhatchia australis	Yoania	Unlikely to be successfully cultivated or relocated	
Kunzea robusta	Kānuka	Seed collection	Pebble Brook Road; Oldfield Road
Leptospermum scoparium var. scoparium	Mānuka	Seed collection	Pebble Brook Road; Oldfield Road
Melicytus macrophyllus	Large leaved māhoe	Seed collection or cutting	Pebble Brook Road; Oldfield Road
Melicytus micranthus	Swamp māhoe	Seed collection or cutting	Pebble Brook Road; Oldfield Road
Metrosideros perforata	Small white rata	Rooted Pieces/Cutting	Pebble Brook Road; Oldfield Road

Latin Name	Common Name	Method of Protection	Location of Re-planting
Pennantia corymbosa	Kaikōmako	Seed collection	Pebble Brook Road; Oldfield Road
Pomaderris kumeraho	Kūmarahou	Seed collection	Pebble Brook Road; Oldfield Road
Gleichenia microphylla	Tangle fern	Unlikely to be successfully cultivated or relocated	
Austroderia aff. *fulvida*	Toetoe	Seed collection/Seed head relocation	Pebble Brook Road; Oldfield Road (seed collection only)
Carex ochrosaccus	Forest sedge	Relocation and Seed collection	Pebble Brook Road
Pentapogon inaequiglumis	Short hair plume grass	Relocation and Seed collection	Pebble Brook Road

It is acknowledged that two species listed above do not have a high likelihood of successful seed propagation or relocation. *Danhatchia australis* is an orchid species that is most commonly, but not exclusively, associated with deep leaf litter in taraire and nīkau forest. While it has not been recorded within the Stage 2 footprint, which primarily consists of VS2, VS5 and regenerating WF11 forest, its presence cannot be entirely excluded. This is especially given the proximity to WF11 forest and mature taraire nearby, as well as its ability to remain underground for several years between flowerings. The protection of surrounding potential habitat outside of the Stage 2 footprint, where *Danhatchia australis* has been recorded, will provide for ongoing protection of this species.

Gleichenia microphylla (tangle fern) has been recorded within the project footprint but is also unlikely to survive seed propagation or relocation activities. Tangle fern is likely to be present within adjacent habitat throughout the Kings Quarry enhancement areas, and therefore protection of this species is also proposed through protection of habitat in non-impacted sites.

8.3.1 Relocation

Four plant species have been identified as suitable for relocation (*Euchiton audax; Epilobium nerteroides; Carex ochrosaccus; Pentapogon inaequiglumis)*. The following steps are required for plant relocation:

- Relocation does not preclude seed collection and seed collection should also be done for these species where possible.
- When relocating plants, care must be taken to ensure no damage is done to the plants' root structure.
- Plants must be dug up with a large (10 cm or greater) buffer of soil around their entire root mass.

- The soil ball must then be immediately wrapped in damp (not wet) hessian and either transferred to the replanting site or the project's designated restoration nursery.
- Where possible, plants should be relocated and planted in their new site within 24 hours of removal.
- If this is not possible plants must be relocated to the designated nursery for care within 12 hours.
- Relocation should be undertaken within the planting season, as plants are susceptible to the same pressures as revegetation planting during the drier months, while roots re-establish, and water levels are lower.
- Plants to be relocated must not be sourced from within a Kauri Hygiene Area, or within 60 m of a kauri tree with symptoms of infection.
- Plants are to be relocated to within the Kings Quarry enhancement Project areas or the Pebble Brook Road planting area. To avoid movement of potentially Kauri dieback infected soil beyond the immediate area, plants and soil are not and are not to be relocated to the Oldfield Road offset area.
- The relocation season is to be between April and August.
- Plants must only be shifted to comparable habitat that meets their specific habitat needs, including light and moisture regimes. The habitat preferences of these species are listed in Table 19 below.
- Relocation must be supervised by an experienced ecologist/ botanist, who may impose additional requirements to reduce Kauri dieback transmission at their discretion during plant relocation.

Table 19. List of species recommended to be relocated from the Stage 2 project footprint to the adjacent Pebble Brook Road planting and Kings Quarry enhancement Project areas and their habitat preferences (Bioresearches, 2025 Ecological Impact Assessment).

Botanical name	Common name	Habitat preferences for replanting
Carex ochrosaccus	Forest sedge	Coastal to lowland usually in **damp** situations within alluvial forest but also along stream banks and within coastal seepages. **Partial to full shade** required. Easily grown from division of fresh plants
Euchiton audax	Creeping cudweed	Lowland to sub-alpine grassland, forest margins and clearings, coastal sites, scrubland, rock outcrops, riverbeds, pasture, waste places. Often associated with both native and introduced grasses, and is repeatedly found in grazed pasture and **dry, open areas** such as rocky outcrops, tracks, cuttings and scrubland. **Full sun.**
Epilobium nerteroides	Willowherb	Coastal to subalpine. In riparian sites within forest and dense scrub growing on moss and liverwort encrusted rocks along watercourses. **Full shade. Damp.**
Pentapogon inaequiglumis	Short-hair plume grass	Good in **dry** clay soils. **Full sun to partial shade**.

8.3.2 Seed Collection

Following the seed collecting guidelines for each species (Table 20), nursery raised plants (once grown to a minimum of > 1 L pot size) can be planted into pioneer plantings within the Pebble Brook Road planting Project area; as well as the Oldfield Road offset project area, based on their specific habitat requirements.

Note that species listed for relocation have also been included for seed collection to increase overall and long-term plant survival success.

Table 20. List of species recommended to be seed collected from within the project footprint and adjacent forest.

Botanical name	Common name	Fruiting Time	Habitat preferences for replanting
Agathis australis	Kauri	December-May (de Lange, 2025a)	A tree species which can form its own forest type: kauri forest. Historically, kauri forest was found on river terraces and coastal plains, and it is now believed that the hill and range occurrences of kauri forest are actually relict stands located in areas where kauri logging was more difficult, rather than preferential habitats for kauri. **Free-draining soils**, ridges (particularly south facing). **Partial shade** and shelter from heavy frosts.
Austroderia aff. *fulvida*	Toetoe	October-March Seed heads can be fixed to ground and, if kept damp, will germinate (de Lange, 2025b)	Common alongside streams, lake margins, in **damp** spots within forest clearings, seepages, dunes and on hillsides, including sea cliffs. **Partial to full sun.**
Carex ochrosaccus	Forest sedge	Throughout year (de Lange, 2025c)	Coastal to lowland usually in **damp** situations within alluvial forest but also along stream banks and within coastal seepages. **Partial to full shade** required. Easily grown from division of fresh plants

Botanical name	Common name	Fruiting Time	Habitat preferences for replanting
Epilobium nerteroides	Willowherb	November – May (de Lange, 2025d)	Coastal to subalpine. In riparian sites within forest and dense scrub growing on moss and liverwort encrusted rocks along watercourses. **Full shade. Damp.**
Euchiton audax	Creeping cudweed	January – February (de Lange, 2025e)	Lowland to sub-alpine grassland, forest margins and clearings, coastal sites, scrubland, rock outcrops, riverbeds, pasture, waste places. Often associated with both native and introduced grasses, and is repeatedly found in grazed pasture and **dry, open areas** such as rocky outcrops, tracks, cuttings and scrubland. **Full sun**
Kunzea robusta	Kānuka	July-May (de Lange, 2025f)	Coastal to lowland shrubland, regenerating forest and forest margins, also present in montane forest, ultramafic shrubland and very occasionally present in subalpine shrubland (de Lange, 2025b). **Full sun**. **Free-draining soil.**
Leptospermum scoparium var. scoparium	Mānuka	Year-round (de Lange, 2025g)	Abundant from coastal situations to low alpine habitats (de Lange, 2025c) **Full sun**. Will tolerate **any soil moisture** from wet to dry.
Melicytus macrophyllus	Large-leaved māhoe	Jan-March (iNaturalist records)	Tolerant of a wide range of soil conditions and light levels. Does best when planted under taller trees. **Free-draining soil**. **Partial to full shade.**
Melicytus micranthus	Swamp māhoe	December - June (Powlesland and Loyd, 2012)	Lowland forest, scrub and forest margins, especially on drier sites and on alluvial ground. **Partial to full shade**. Alluvial, **free-draining soil**.

Botanical name	Common name	Fruiting Time	Habitat preferences for replanting
Pennantia corymbosa	Kaikōmako	February-March (de Lange, 2025h)	A forest plant that favours relatively **cool sites**, kaikōmako occurs only sporadically in the northern part of the country. Riparian and intolerant of drought. **Moist,** rich soil. **Partial shade.**
Pentapogon inaequiglumis	Short hair plume grass	August-April (iNaturalist observations)	Easy to grow from fresh seed. Prefers **dry** clay soils (edge species) (de Lange, 2025i). **Partial to full sun.**
Pomaderris kumeraho	Kūmarahou	November-January (de Lange, 2025j).	Coastal to lowland, in open, early to mid-successional habitats. Often on roadside banks, and in gumland vegetation. Occasionally seen in forested situations. Commonly present in track cuttings within the Project area. **Full sun.** Poor, acidic or clay soils. **Dry**, free-draining position.

8.3.3 Cuttings

Some species may not grow easily from seed, and therefore cuttings are likely to be the most successful form of preservation. Table 21 shows a list of species recommended to be cultivated from cuttings.

Table 21. List of species recommended to be cultivated from cuttings taken within the project footprint and adjacent forest.

Botanical name	Common name	Cutting Technique	Habitat preferences
Melicytus macrophyllus	Large leaved māhoe	Easily grown from fresh and semi-hard-wood cuttings. (de Lange, 2025k)	Lowland to lower montane forest. **Free-draining soil. Partial to full shade.**
Melicytus micranthus	Swamp māhoe	Should be grown from fresh cuttings.	Lowland forest, scrub and forest margins, especially on **drier** sites and on alluvial ground. **Partial to full shade.**

Metrosideros perforata	Small white rata	Easily grown from rooted pieces. Can be grown from semi-hard-wood cuttings, although can be difficult to establish (de Lange, 2025l)	Coastal to montane. An abundant plant of open scrub, dense forest or rock-land. In forest and scrub situations climbing on other trees but also climbing up cliff faces, on rock outcrops, and forming a "shrubland" in loose talus. **Dry or moist**, free-draining soil. **Partial shade** best but will tolerate full sun and full shade.

8.4 Quantities and Ongoing Monitoring

Due to the elevated conservation status of the listed species and the complete loss of habitat within the Project area, a conservative approach to TAR plant relocation and cultivation for restoration shall be followed. It is recommended that as much plant material as possible is collected for propagation to protect against failures and to preserve as much genetic diversity from the populations within the project footprint as possible. Many of these species are not common in cultivation, which may impact survival rates. Maintaining genetic diversity of these species is particularly important as many will have reduced populations in the ecological district. As such, it is expected that seed collection and direct relocation are the preferred methods for TAR plant species management, where possible.

8.4.1 Quantities

To ensure adequate genetic diversity of TAR species within the Project area is captured the following quantities of plant material for cultivation and translocation are required:

- For seed collection a *minimum* of 50 parent plants (or all possible individuals if less than 50 plants present).
- For cuttings a *minimum* of 50 parent plants (or all possible individuals if less than 50 plants present)
- For direct relocations all plants present within the impact site must be relocated

For seed collection and cuttings, parent plants should be sourced from all possible locations within the Project area in order to capture the widest possible genetics.

8.4.2 Monitoring, success targets, and contingencies

Monitoring of TAR species helps to contribute to knowledge about their habits and survival in the Auckland region. Increased understanding of these plant species can support conservation efforts and must be shared with interested parties when requested.

Monitoring of TAR plants must involve:

- Records must be kept of plant sourcing (numbers of parent plants and relocated individuals for each species, where in the Project area they were collected from and any other relevant information).

- Relocated plants must be marked (a stake with coloured marking is adequate) at time of planting.
- Survival rates of plants grown from seed and cuttings in the nursery must be recorded.
- Numbers of plants planted must be recorded, along with location details.
- Plants must be checked for survival for a minimum of five years post planting.

This information, and any additional relevant information about TAR cultivation, planting, successes and failures gained as part of this project's works, shall be reported once per year, for a minimum of five years following the final planting. This report shall be issued to Auckland Council and the project ecologists.

Where the survival rate of any planted TAR species falls below 65% within the 5-year monitoring period, and the project ecologist is not satisfied that the species has successfully established and is self-propagating within the planting area, a report is to be prepared by a suitably qualified and experienced botanist and provided to Auckland Council within 30 days of the triggering monitoring event, outlining:

- The TAR plant species that has not met the 65% survival rate target and suspected reason; and
- Measures to be taken to protect the survival of/ improve presence of the TAR species in the local area. This might include:
    - Increasing the frequency/ intensity of pest plant or animal control efforts;
    - Taking additional seed or cuttings to propagate and later plant;
    - Extension of monitoring, pest plant, or pest animal control periods;
    - Additional protection of mature specimens in proximity to the planting areas, to support local seed sources; and/ or
    - Providing seed/ cuttings to local botany/ community groups, plant nurseries, or the Botanic Gardens to ensure preservation of genetic material.

9 KAURI DIEBACK MANAGEMENT PLAN

9.1 Introduction

Bioresearches has been engaged by Kings Quarry Limited to prepare a Kauri Dieback Management Plan in order to minimise the spread of Kauri Dieback Disease, or *Phytopthora agathicidia* (PA).

The property is considered to support kauri (*Agathis australis*), at least at the north-western edge of the Stage 2 Quarry Footprint and as saplings further into the project footprint. Kauri is also present in adjacent, contiguous parts of the property, including mature individuals. As kauri (and soil and material surrounding them) may contain the pathogen that causes PA, strict hygiene procedures are required when works occur on or around kauri trees to avoid the spread of kauri dieback.

All of the excavated material from the Stage 2 pit is proposed to be disposed of on-site within the Stage 2 Fill area. No material is proposed to be removed from the Project area (Figure 28), excepting small amounts of soil when translocating TAR plants as outlined in the TPMP.

All management plans within this report requiring access in the KDMZ should adhere to the hygiene protocols outlined in this plan.

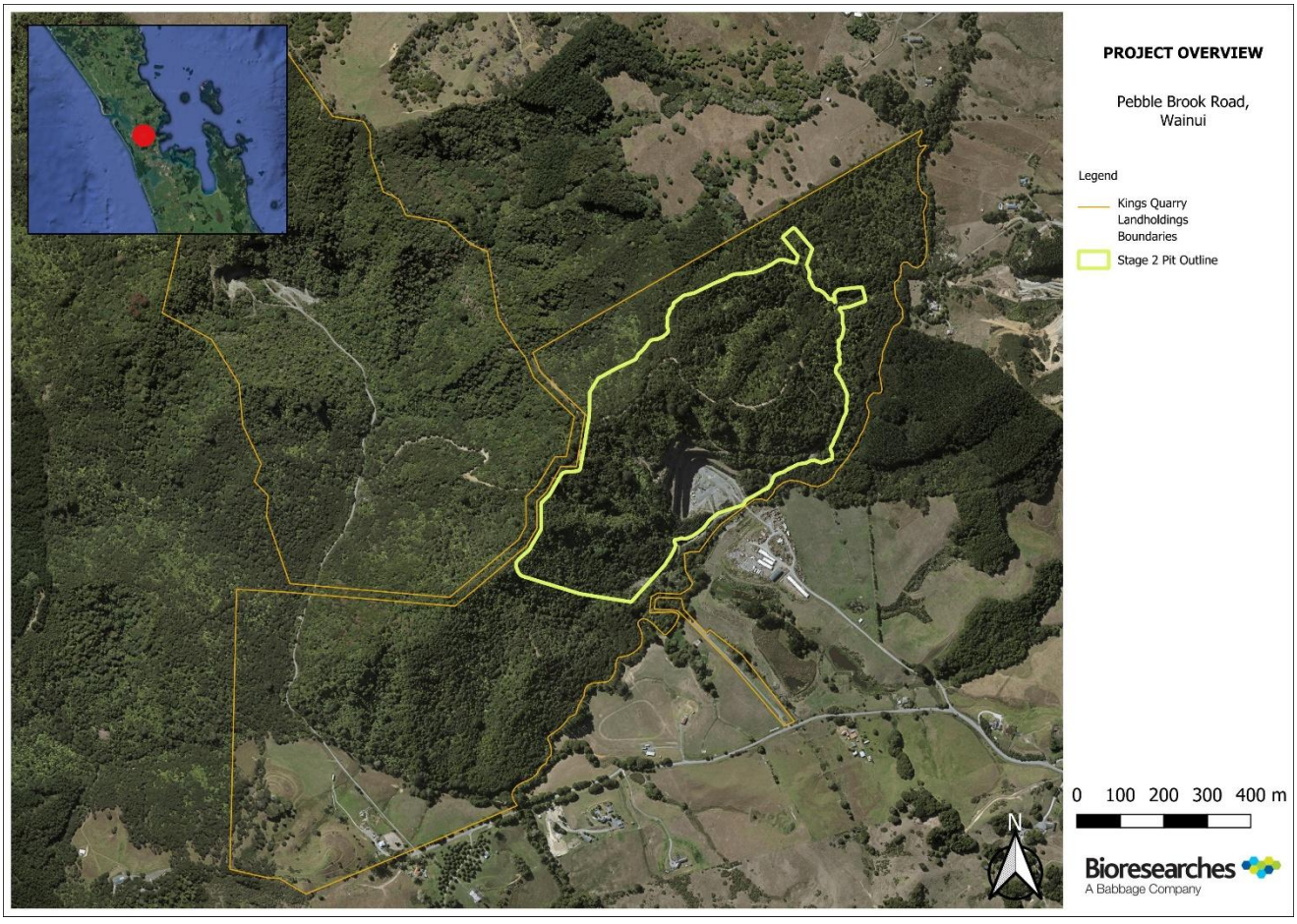


Figure 28. Map showing the Stage 2 pit design, with the northern fill area to contain all of the extracted pit material.

9.1.1 Kauri Dieback

Kauri dieback is a soil-borne disease caused by a fungus-like organism, *Phytophthora agathidicida* (PA). Unlike fungi, PA is made of cellulose, rather than chitin, and forms a motile 'tail' which allows for free movement in soil and water. The disease is spread primarily through the movement of contaminated soil and kauri are infected through root contact. Human related activities such as foot- or vehicle-traffic (i.e., soil carried on footwear, equipment, and vehicles) and land disturbance (e.g., earthworks) are principal avenues for the dispersal of this organism. In addition, feral and domestic animals have also been implicated in the spread infected soils.

Infection of a kauri with PA causes damage to the vascular tissues, preventing the tree from accessing the water and nutrients that it requires. Infected individuals may display symptoms of stress, including leaf yellowing and loss, branch loss, and eventually, death (Figure 29). It can take many years for kauri dieback symptoms to be expressed in the canopy or the trunk, so determining whether a tree is infected or not through gross examination is often unreliable.

Figure 29. Signs of PA include gummosis (left; photo by Zoe Lyle) and branch dieback/eventual tree death (right; photo by kauridieback.co.nz).

There is no known cure for PA, although there has been some success with extending tree life post-infection by injecting phosphorus directly into the tree trunk (Horner & Arnet, 2020[7]). Because of the high risk and cost of PA to kauri and potentially other species across New Zealand, it is extremely important to minimise risk of spread. Currently the only way of controlling the spread of kauri dieback is to not move potentially contaminated soil and root material to new sites.

Due to its slow maturation, the extent of historical declines and a high predicted rate of future decline, and an absence of a suitable cure for PA, kauri is now classified as a 'Threatened – *Nationally Vulnerable*'

[7] Horner & Arnet (2020). Phosphite large tree treatment trials: brief report April 2020.

under the New Zealand Conservation Threat Classification system (Townsend *et al.*, 2008[8]; de Lange *et al.* 2018[9]). Kauri forest also falls within an "*Endangered*" ecosystem type under the Regional IUCN threat classification system (Singers et al., 2017).

9.1.2 Statutory Context

The following statutes have guided the contents of this plan. This plan has also been written with reference to the Kauri Dieback Programme (KDP) guidelines.

9.1.2.1 Biosecurity (National PA Pest Management Plan) Order 2022

According to section 19 of the Biosecurity Order 2022 (Plan rule 5), an occupier must not undertake earthworks in a kauri hygiene zone unless they 'have, and operate in accordance with, an earthworks risk management plan that is approved for that land by the management agency, an inspector, or an authorised person.' The objective of an earthworks risk management plan is to manage and mitigate the risk of the spread of PA by earthworks (Biosecurity (National PA Pest Management Plan) Order 2022).

9.1.2.2 Biosecurity Act 1993

PA is listed as an 'unwanted organism' under the Biosecurity Act 1993. In accordance with section 52 of this Act, no person shall knowingly communicate, cause to be communicated, release, cause to be released, or otherwise spread the organism. Thus, all efforts should be made to prevent and minimise the transmission of PA.

9.1.2.3 Auckland Unitary Plan Operative in Part (AUP OP)

The Objectives and Policies of the AUP OP address the management and control of kauri dieback disease under *E11. Land disturbance – Regional* (i.e., kauri hygiene is required as a General Standard in Section E11.6.2 (6)).

> ***E11.3. Policies [rp]***
>
> *(6A) Recognise and provide for the management and control of kauri dieback disease as a means of maintaining indigenous biodiversity.*
>
> ***E11.6.2. General standards***

[8] **Townsend, A.J.; de Lange, P.J.; Duffy, C.A.J.; Miskelly, C.M.; Molloy, J.; Norton, D.A. (2008).** New Zealand Threat Classification System manual. Department of Conservation, Wellington. 35 pp.

[9] **de Lange, P.J.; Rolfe, J.R.; Barkla, J.W.; Courtney, S.P.; Champion, P.D.; Perrie, L.R.; Beadel, S.M.; Ford, K.A.; Breitwieser, I.; Schonberger, I.; Hindmarsh-Walls, R.; Heenan, P.B.; Ladley, K. (2018).** Conservation status of New Zealand indigenous vascular plants, 2017. New Zealand Threat Classification Series 22. Department of Conservation, Wellington. 82 p.

(6) To prevent the spread of contaminated soil and organic material with kauri dieback disease, vehicle and equipment hygiene procedures must be adopted when working within 3 times the radius of the canopy drip line of a New Zealand kauri tree. Soil and organic material from land disturbance within 3 times the radius of the canopy drip line must not be transported beyond that area unless being transported to landfill for disposal.

9.1.3 Purpose of this Plan

The purpose of this Plan is to prevent and minimise any Project-mediated transmission of PA. It provides measures to:

- Prevent transmission of PA as a result of the proposed development and construction phase of the Project, and
- Minimise future transmission as a result of increased proximity of human activity to the sensitive ecosystem.

This Plan follows protocols described in a variety of guidance documents, including:

- Auckland Council's Kauri Hygiene Standard Operating Procedures (Version 3.0, March 2021) (AC SOP, v3, 2021 [Paschke, 2021][10]);
- Biosecurity (National PA Pest Management Plan) Order 2022 (NZ Government, 2022);
- Kauri dieback building knowledge: Review of operational research undertaken by the Kauri Dieback Programme from January 2009 to June 2020 and related research for biology, surveillance, vectors, control, and decision support (Froud, 2020)[11];
- Auckland Council's Standard Operating Procedures for Kauri Dieback (2017) (AC SOP, 2017);
- Auckland Unitary Plan Standard Conditions Manual (June 2020);
- Kauri Dieback Programme: Best Practice Guidelines. Land disturbance activities (including earthworks) around kauri (October 2017);
- Kauri Dieback Programme: Best Practice Guidelines. Hygiene procedures for kauri dieback (December 2018); and
- A recent review of PA detection methods (Singh et al., 2017).

[10] Paschke, P. (2021). Kauri Hygiene Standard Operating Procedures Version 3.0. March 2021.

[11] Froud, K J (2020). Kauri dieback building knowledge: Review of operational research undertaken by the Kauri Dieback Programme from January 2009 to June 2020 and related research for biology, surveillance, vectors, control, and decision support. A report prepared for MPI and the Kauri Dieback Programme by Biosecurity Research Limited.

[11]Singh, J., Curran-Cournane, F., Waipara, N., Schwendenmann, L. and Lear, G., (2017). Comparison of methods used to detect the organism responsible for kauri dieback, *Phytophthora agathidicida*, from soil samples. Auckland Council technical report, TR2017/019.

The procedures set out in this document apply to anyone who enters, moves around, or undertakes activities within a sensitive kauri zone. This area is defined as the Kauri Dieback Management Zone (KDMZ). Within the KDMZ, Kauri Hygiene Areas (KHA) will be identified where they occur within three times (3 x) the maximum radius of the canopy dripline of a kauri tree (Figure 30).

This Plan also addresses measures to prevent future spread of PA within the Project area as far as practicable. It should be noted that feral and domestic animals may continue to spread infected soils, and these organisms present a limitation to on-going PA management on-site.

This plan will cover:

- A map of:
    - Kauri Dieback Management Zone (KDMZ)
    - Kauri Hygiene Areas
- Associated mitigation measures;
- Procedures and practices for limiting the spread of PA;
- Guidelines for managing organic waste; and
- Reporting requirements.

9.2 PA Management

A Kauri Hygiene Area (KHA) is defined in this Management Plan as “an area equal to three times (3 x) the maximum radius of the canopy dripline of a kauri tree” (AC SOP, v3, 2021) (Figure 30). However, areas potentially at risk of PA transmission may extend further, possibly as much as 30–50 m from a confirmed PA site (point location) depending on the topography of surrounding landscape (AC SOP, 2017; Froud, 2020).

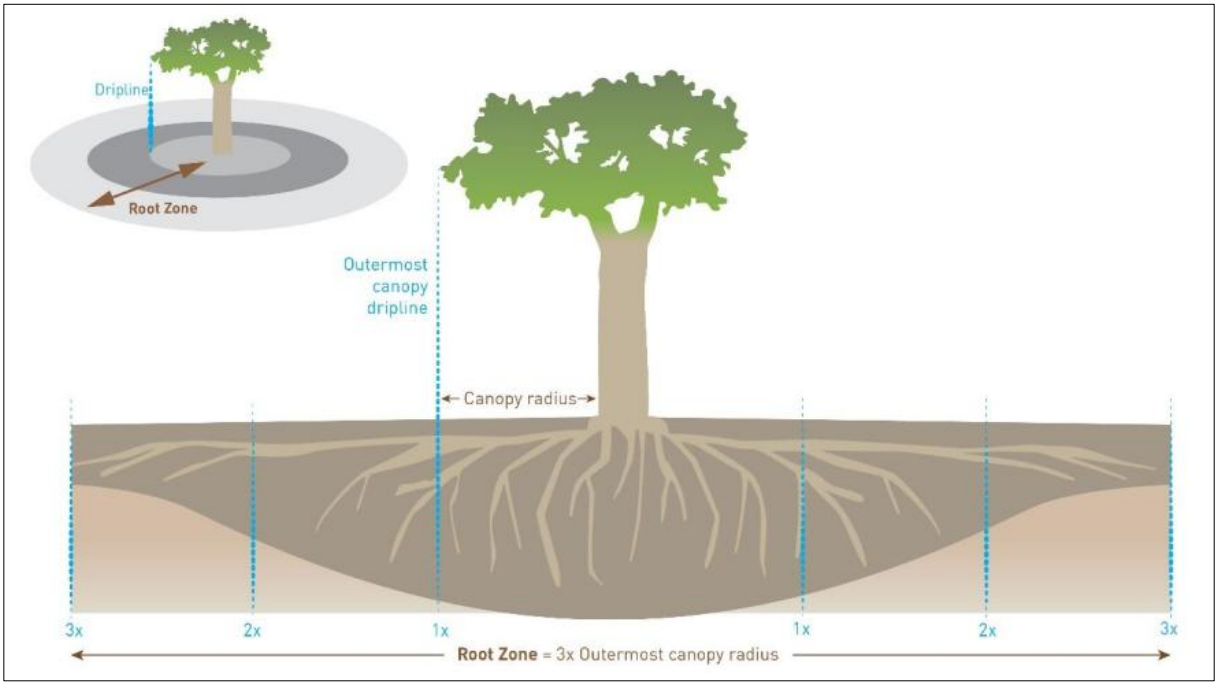


Figure 30. Kauri Hygiene Area (Source: Auckland Council).

9.2.1 PA Management On-Site

Due to the potential presence of kauri saplings within the Stage 2 footprint, and the surrounding kauri, podocarp, broadleaf (WF11) forest within the wider environment, the entirety of the Stage 2 pit footprint will be regarded as the Kauri Dieback Management Zone (KDMZ).

As outlined in Section 3 of this report, prior to the commencement of each stage of vegetation clearance, on-site identification of kauri trees within the clearance area is required. These must be marked to ensure correct disposal of removed kauri tree material and identification of any additional KHAs.

An access road beginning at the existing Project area entrance will be constructed to the site in Year 1 (Figure 31). Following this, the pit will be cleared in stages, utilising the northern fill area for all extracted material (Figure 28). No material is proposed to be removed offsite.

Kauri have been identified along the north-western edge of the footprint of the Stage 2 expansion of King's Quarry. The Kauri Hygiene Areas (KHAs) of these trees extend into the Stage 2 pit area (211 m^2; Figure 32).

Kauri are also likely present within the Stage 2 footprint, in the form of saplings or very young trees.

A map showing the access route into the Stage 2 pit, along with cleaning stations/vehicle washdown points, and identified mature kauri trees can be found in Figure 32.

In order to prevent the introduction or spread of kauri dieback on site, it will be necessary to metal access roads to reduce soil movement. Cleaning stations must be established at the entrances to the road, as shown in Figure 32. The contents of cleaning stations can be found in Appendix II.

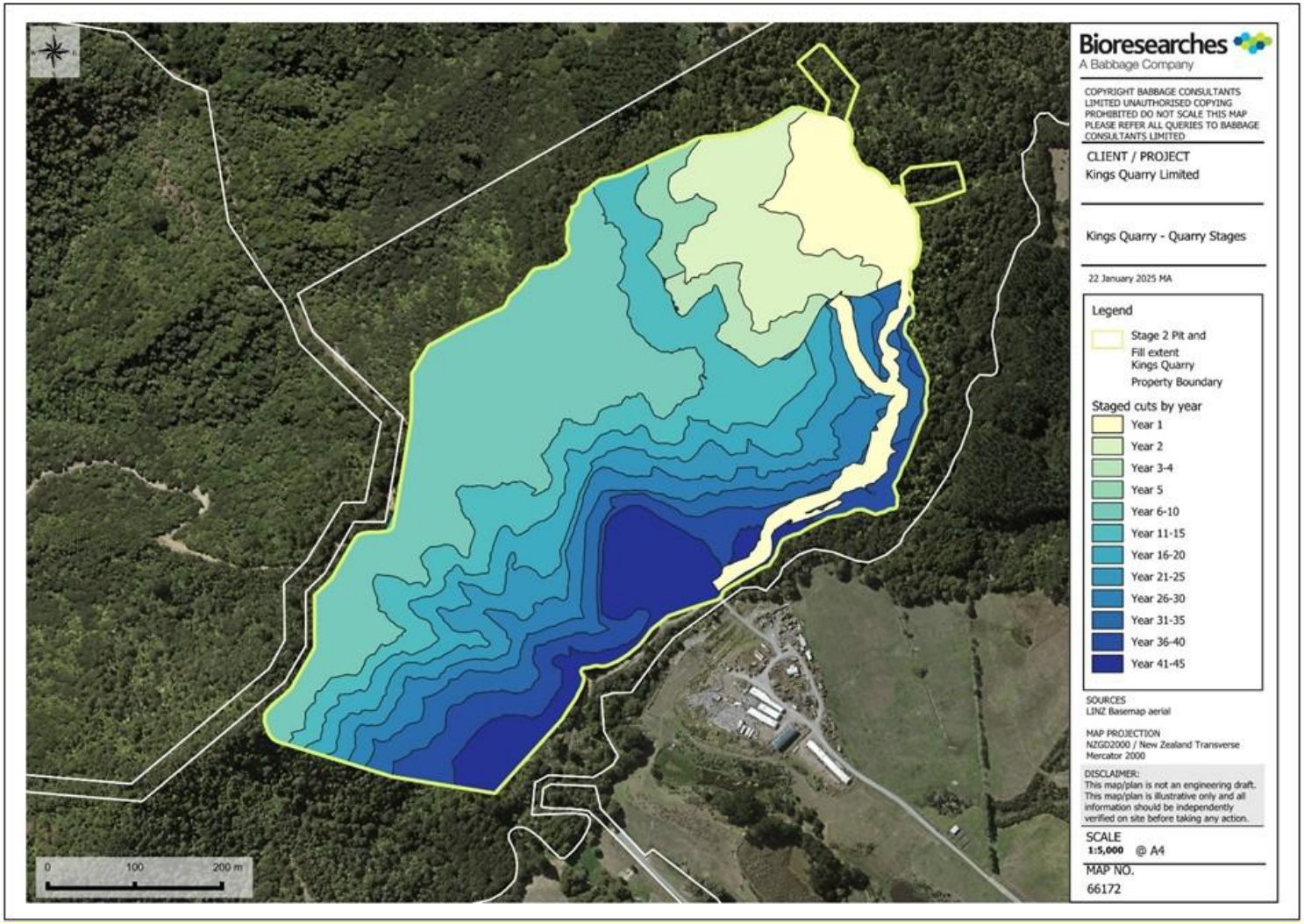


Figure 31. Map showing the proposed staging over the 45-year life of the Stage 2 pit, with an access road to Pit A the first construction activity.

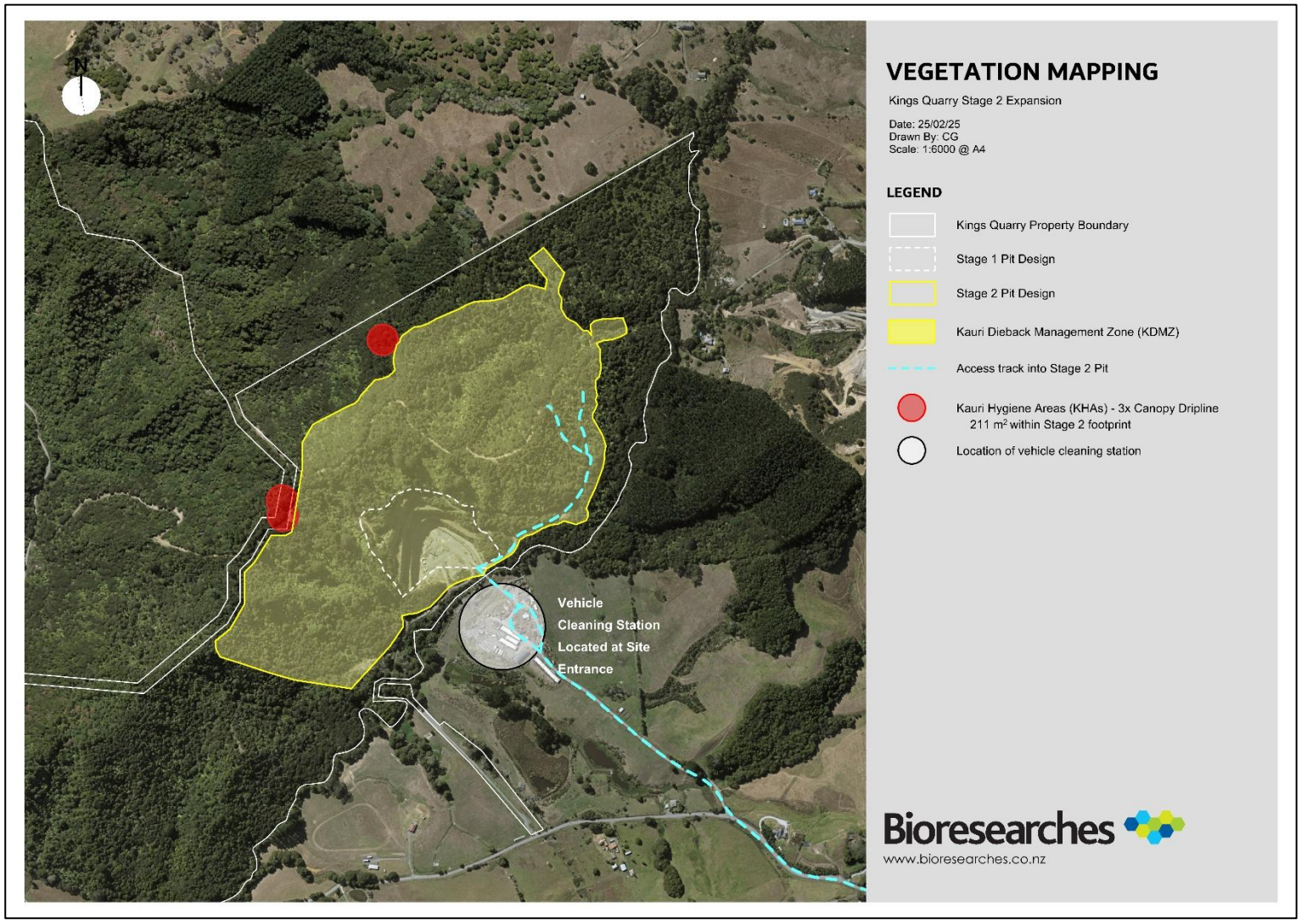


Figure 32. Map showing location of the KDMZ, KHAs, access roads and cleaning stations.

9.3 Operation Procedures within the KDMZ

The following Operating Procedures have been adapted from AC SOP, 2021 and a review of PA detection methods (Singh et al., 2017). Although PA infection has not yet been identified on-site, the Project area is known to support kauri trees, and the Project area lies within the recognised "contaminated area". Therefore, the Operating Procedures must be complied with during all vegetation removal, earthworks, soil disturbance, or longer-term maintenance within the KDMZ to meet the purpose of this plan.

9.3.1 Planning Considerations

- Where practicable, all vehicles should restrict their movements to formed tracks and roads.
- All vehicle access into and within the quarry will be metalled to minimise vehicles tracking over soil.
- Where vehicle plant or other equipment storage on-site is required, a metalled parking area will be formed to prevent vehicles tracking over and/ or parking on soil.
- All tools, machinery and other equipment must be soil free on arrival, and when leaving a site, and sterilised using a solution of 2% Sterigene. Tools, machinery, and other equipment previously used in a "contaminated area" must not be used in any other area unless they have been steam-cleaned and subsequently sterilised first.
- Cleaning stations, supporting kauri dieback phytosanitary kits, will be established at all site entry and exit locations during site set up and prior to any earth works or vegetation removal within the KDMZ. All contractors and personnel entering the Project area and entering a recognised KHA must pass through a cleaning station and adhere to the necessary protocols.
- Kauri dieback phytosanitary kit must consist of a solution of 2% Sterigene in clean water, a scrub brush, and a kauri dieback hygiene procedure information sheet (Appendix II) will be maintained and clearly visible to all personnel entering or working on the Project area.
- Wheeled or tracked machinery must be soil-free when entering and exiting the Project area and areas where kauri are present and must remain on-site for the duration of the works or be soil-free and washed down with a solution of 2% Sterigene prior to leaving the KDMZ.
- If movement between different areas and/or catchments on-site is necessary, it is recommended that works in low-risk areas (those not recognised as KHAs) occur first, followed by works in high-risk (KHA) areas.

9.3.2 Awareness and Signage

- Project area offices shall additionally provide maps clearing showing the KDMZ, visible to all Project area workers and visitors.
- This KDMP shall be available to all Project area workers and visitors in hard copy on-site throughout Project works.

- Clear signage informing PA hygiene requirements will be provided for at Project area entry, Project area offices, and at each of the four identified KHAs (Appendix I, II, III).

9.3.3 Personnel Responsibilities

- The Project area Manager shall be responsible for ensuring implementation of this Plan, including requirements of KHAs, Project areas workers and visitors.
- All personnel entering the Project area shall be informed of their responsibility to reduce the likelihood of spread of kauri dieback during operations and all phytosanitary measures listed below will be carried out.
- All vehicle drivers shall be responsible for ensuring their vehicles are clean of loose soil prior to entering and leaving the Project area and KDMZ.

9.3.4 PA Hygiene Protocols

- Avoid work in wet conditions and areas containing kauri that are prone to flooding or ponding.
- All personnel effects (e.g., footwear), equipment, machinery and vehicles will be cleaned of soil and organic material on an area of hard ground/concrete outside of the buffer zone prior to entering and after leaving the KDMZ (Figure 32). Once cleaned, the machinery, shoes, etc. are to be sprayed with a 2% Sterigene solution.
- Where any vehicles and heavy machinery are taken off site, they must be cleaned in a wash-down facility prior to departing the Project area.
- TAR plant species to be relocated to the Pebble Brook Road planting area and Kings Quarry enhancement area must not be sourced from within KHAs. Note as these areas are adjacent to the Project area, they are expected to have comparable kauri dieback exposure from human and animal movement in the area. TAR plants and soil are not to be relocated to the Oldfield Road offset site.
- Other than as outlined in the TPMP and VRMP, no soil or potentially contaminated materials (any vegetation including kauri saplings) shall be moved from the KDMZ to any other locations on-site and where removal off-site (beyond the Kings Quarry landholdings) is required, the material must be transported directly to a Kauri Dieback approved landfill.

9.3.5 Works within KHAs

- All plant material (such as weeds, vegetation, roots, trunk, bark, and by-products produced during pruning or removal, for example sawdust) from within the KHA must remain within the KDMZ (Stage 2 fill site; Figure 28), excepting as required in the TPMP and VRMP.
- If removal is necessary, transport off-site must be in secure containment (to prevent potential PA spread during transport) and disposal must be to an approved landfill (see Appendix 5 of AC SOP, 2021).

- Any soil excavated within a KHA must be left on-site within the KDMZ. If removal is necessary, transport off-site must be in secure containment (to prevent potential PA spread during transport) and disposal must be to an approved landfill (see Appendix 5 of AC SOP, 2021).
- Any material (including soil) to be removed to an approved landfill facility must then be buried within the ground. Where the material is to be loaded onto the back of an open top vehicle, the material must be covered with a tarpaulin (or similar) to prevent the material from leaving the vehicle whilst it is in motion. After the material has been emptied from the truck, the areas of the truck which were previously exposed to the material and the tarpaulin must be thoroughly washed with Sterigene (or other suitable agent) prior to the truck or tarpaulin being used for the transportation of any other material.
- Any soil, vegetation, or fill materials to be brought on-site would require prior approval from the Auckland Council Kauri Dieback Team. All landscaping and vegetation supplies must be obtained from a source known to be free of kauri dieback disease.
- A clearly marked set of footwear dedicated to KHAs work must be worn when undertaking activities in PA management areas.
- If removing equipment from KHAs, it must be dry-brushed and contained for transport. Any soil removed from the equipment must be left on-site, within the specific KHA from which it originated.
- Equipment, including pest control equipment, used in KHAs must not be re-used in any other KHAs or areas where kauri are present unless it has first been steamcleaned and subsequently sterilised.
- Once installed within a KHA, pest control equipment such as traps, bait stations, and monitoring equipment must be serviced on-site and not be moved within Project area or off-site, without appropriate cleaning and sterilisation (see Appendix 6 of AC SOP, 2021).
- No planting is to be undertaken in a KHA unless the plants are ecosourced and grown in the area, or sourced from an Auckland Council approved supplier[12].

9.3.6 Managing Spread of PA near Waterways

Kauri Dieback is spread through the movement of soil and water. Therefore, limiting the movement of contaminated materials from KHAs to waterways is essential in limiting the spread of Kauri Dieback.

To minimise the potential for excess fine sediment entering the catchment, an Erosion and Sediment Control Plan (ESCP) has been prepared and will be implemented by an appropriately

[12] An approved supplier is any supplier certified under the New Zealand Plant Producers Incorporated (NZPPI) Biosecurity Scheme core standard and kauri dieback schedule https://nzppi.co.nz/BIOSECURITYSCHEME/19750/

qualified professional using the industry best practice. The plan details methods on managing sediment in discharges of water as well as dust. No works should occur without the ESCP recommendations being in place. Sediment run off generated by the quarry activities should not enter the Waitoki Stream as appropriate erosion and sediment controls will manage the generation of sediment and prevent this sediment from entering the Waitoki.

9.4 Felling and Pruning Kauri

Juvenile and sapling kauri may be present within the Stage 2 footprint.

All equipment and personal effects should be cleaned with Sterigene at the cleaning station before removing kauri.

Ground-based equipment should be based on well-drained ground and set to a low ground pressure configuration.

All personal effects including footwear, equipment and vehicles must be cleaned of soil and organic matter and sterilised with Sterigene before leaving the Kauri Hygiene Area/root zone, at the assigned cleaning station. If equipment cannot be cleaned on-site, then it must be contained to prevent soil loss before being taken to a cleaning depot with soil containment facilities.

Disposal of kauri material should follow the Auckland Council guidelines (see Appendix 5 of AC SOP, 2021). All kauri material should be treated as 'contaminated', regardless of the health of the tree, in accordance with E15.6.A1 of the Auckland Unitary Plan.

9.5 Minimisation

The proposed works for the Stage 2 expansion of King's quarry will necessitate the removal of vegetation within the Project area footprint. This may result in the loss of juvenile trees within the Stage 2 footprint. This removal has been accounted for as part of the Residual Effects Management Plan (Bioresearches, 2025). Residual effects planting will occur at the Oldfield Road Project area. The species composition of the offset planting will include kauri, podocarp, broadleaved forest (WF11).

In addition, planting is proposed as part of the Edge Effects and Buffer Management Plan (section 10 of this report) at 306 Pebble Brook Road. Kauri trees as part of a WF11 planting mix will also be incorporated at this Project area.

In accordance with the Threatened Plant Management Plan (section 8.1 of this report), kauri seedlings are proposed to be collected from the Kings Quarry landholdings, to maintain the genetic population at the replanting sites.

9.6 Reporting

The Biosecurity Order 2022 requires reporting to the management agency, inspector or authorised person on the implementation of, and compliance with, this plan.

Reporting must include:

- An annual report on the compliance with the plan, until works have been completed;
- Immediate reporting when there is significant non-compliance with the plan; and
- Procedures to ensure that the management agency, inspector or authorised person is notified at the start and end of the earthworks.

9.7 Appendix

9.7.1 Appendix I: Kauri Dieback Warning Signage

Sourced from: Kauri Dieback Programme (kauridieback.co.nz). Note – This image has been retrieved from the Kauri Dieback Programme website and remains the intellectual property of Keep Kauri Standing (2016).

9.7.2 Appendix II: Contents of Cleaning Station Kits (Adapted from AC SOP, V3, 2021)

Portable (Personal) Kauri Hygiene (Phytosanitary) Kit

Any person undertaking activities in areas that are owned or managed by Auckland Council or its CCOs

where kauri are present must carry a portable (personal) cleaning kit at all times. As a minimum, this

kit should include:

- 1 x 500 ml (or larger) spray bottle containing 2% solution of Sterigene.
- 1 x hard brush for removing soil (prior to spraying with Sterigene).
- The kit should be contained in a sealable plastic bag.

Small Equipment Kauri Hygiene (Phytosanitary) Kit

Any person using small, hand-held equipment such has trowels and/or scientific equipment that

penetrates the soil must carry a portable equipment cleaning kit. As a minimum, this kit should include:

- A small squirt bottle containing methylated spirits.
- Wet wipes.
- A bag for collecting used wet wipes.
- The kit should be contained in a sealable plastic container with secure lids.

Standard Kauri Hygiene (Phytosanitary) Kit for Vehicles

Vehicles that are routinely used for people and equipment transport to areas where kauri are present

should carry a range of cleaning tools and supplies to enable thorough cleaning, especially if any of the

visited areas are within a Contaminated Area. As a minimum, the standard phytosanitary vehicle kit

should include:

- Sturdy plastic bags or bins for the storage of footwear, to prevent the interior of the vehicle becoming a source of contamination.
- A selection of hard brushes for removing soil.
- 40 l plastic bin.
- 1 x 1 litre Sterigene concentrate.
- 2 x 1 litre spray bottles containing 2% Sterigene solution.
- 1 x 4 litre jerry can of 2% Sterigene solution.
- 1 x 4 litre jerry can of water.
- 1 x plastic funnel.

- 1 x measuring gauge.
- The kit should be contained in a sealable plastic container with secure lids.

9.7.3 Appendix III: Kauri Dieback Hygiene Procedure Information Sheet

HYGIENE PROCEDURES FOR KAURI DIEBACK

Kauri dieback is a soil-borne disease that spreads through the movement of contaminated soil and soil water. It is possible that it also spread by streams and rivers particularly in times of flooding. By following hygiene guidelines you are helping to stop the spread of kauri dieback.

Ensure equipment is clean

Clean your gear before AND after leaving kauri forests:

- All footwear, tools and equipment and machinery must be totally soil-free when entering a forest area containing kauri. We recommend cleaning at the beginning and end of each day.
- Wheeled or tracked machinery, vehicles and ATVs pose a high risk and must be cleaned thoroughly to remove soil.
- Where possible, machinery and vehicles should remain on site for the duration of a job or project.
- All machinery should be clean before leaving the depot for a new work site.
- When you are in the field, all equipment should be cleaned before moving from one area of kauri into another.

Operators are expected to carry out their own inspections and cleaning, but these may be checked by local Department of Conservation (DOC) or council staff.

Avoid leaving formed areas

Vehicles and personnel should remain on roads and tracks where possible, particularly in wet conditions. If you are moving onto or off tracks, you must use portable phytosanitary packs to ensure that kauri dieback is not carried onto the track from surrounding kauri or between high risk areas. Phytosanitary kits must be used when leaving an area showing symptoms of kauri dieback disease.

Avoid work in wet conditions

Carry out operations under dry soil conditions where possible.

Avoid work around kauri

Select work sites, track routes and bait-lines which are away from kauri and watercourses where possible. Preferentially select sites which are down-slope of kauri areas.

Avoid sites prone to flooding or ponding in kauri areas

Streams pose a risk for transporting kauri dieback disease. When entering or exiting a stream system, you must use portable phytosanitary packs to ensure kauri dieback is not carried into the stream from surrounding kauri or between high risk areas.

Ensure raw materials are disease free

Do not source raw materials (soil/substrate/gravel) from kauri areas. Supplies for landscaping, track construction and revegetation work in kauri areas should come from a 'clean' source not containing kauri.

Contain vegetation and use low impact vegetation control methods around kauri

Use vegetation control methods that do not disturb the soil, such as mowing, slashing or herbicide application, in preference to grubbing.

If diseased kauri and vegetation (including weeds and native vegetation in diseased zones) are trimmed or cleared they must be left in-situ, composted for use on site, or disposed of at an appropriate landfill site. They must not go to green waste or into community weed bins. Please contact your local authority for further information.

If any soil/plant material is to be removed from a "controlled area"' this must be managed with biosecurity approval. Please contact your local authority for further information.

10 EDGE EFFECTS AND BUFFER MANAGEMENT PLAN

10.1 Introduction

10.1.1 Project Background

This plan sets out planting locations, guides and schedules of species to manage edge effects caused by vegetation removal for the Stage 2 pit expansion of King's Quarry. The pit expansion will result in the removal of existing kānuka scrub forest (VS2), broadleaved scrub forest (VS5), as well as kauri, podocarp, broadleaved forest (WF11), resulting in an abrupt edge to the remaining vegetation surrounding the quarry Project area.

In order to mitigate the impacts of edge effects, weed control is required at the completion of each Stage 2 pit quarrying stage, along each new edge created.

Permanent activities will include the sequential planting of a 10 m wide buffer of native vegetation surrounding the final Stage 2 pit footprint. Planting surrounding the Stage 2 pit edge will be undertaken as final pit edges are exposed, in accordance with the quarry staging and the staging of the remediation planting of the final Stage 2 pit (Barkers, 2025).

The final area to be planted adjacent to the Stage 2 footprint is detailed in orange within Figure 33.

In addition, planting has been proposed within the adjacent Project area at 302 Pebble Brook Road. The planting adjoins existing forest to be retained within the Kings Quarry property landholdings. The planting at 302 Pebble Brook Road will aid in buffering the remaining vegetation at Kings Quarry, reducing edge effects on remaining forest and providing a wider network of connected habitat. This planting will be enhanced with seed collections and propagations from the Stage 2 footprint, allowing the preservation of genetic material from within the impact zone. The location of the 302 Pebble Brook Road planting can also be found in Figure 33.

Pest animal management will be undertaken throughout the planting sites and along each new quarry edge in accordance with the Mammalian Pest Animal Control Plan.

A summary of the edge effects and buffer management actions described in this plan are provided below:

- Pest plant control of each newly created Stage 2 pit edge;
- Planting of the final Stage 2 pit edge as the final edge is exposed;
- Planting and pest plant control at 306 Pebble Brook Road;
- Ongoing pest plant control of the remediated Stage 2 Pit (planting outlined in Barkers (2025) separate Remediation Plan).

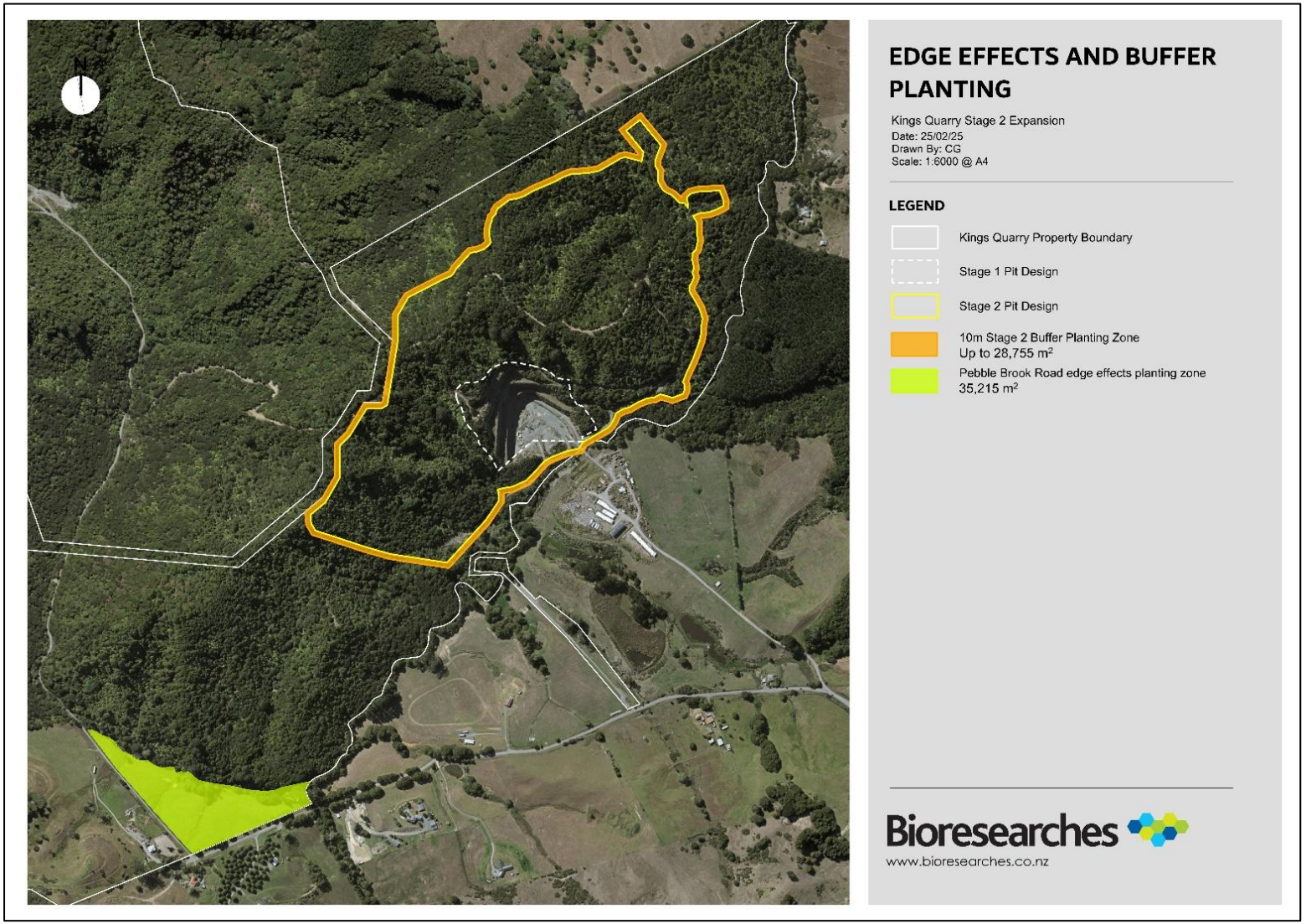


Figure 33. Map of Stage 2 pit expansion Project area showing buffer planting area marked in grey.

10.1.2 Edge Effects

Edge effects is the term used to describe a range of biotic and abiotic impacts on the edges of a particular ecosystem, usually caused by disturbance or removal of vegetation around a periphery. Forest ecosystems typically have internal conditions, such as temperature, light levels, humidity, wind and airborne particle levels, that are not subject to much fluctuation from day to day. The edges of ecosystems are the areas that are exposed to the greatest changes in these factors. Invasive species are also most likely to establish around the edge of an ecosystem due to dispersal from outside.

When a section of vegetation is removed or cut back, this creates an abrupt edge and exposes habitat that was buffered from external conditions to new stressors. Many of our native forest species are not tolerant of high light levels and prefer a cool, damp climate. Sudden exposure to higher light levels, warmer temperatures, drier air and increased dust and pollutants from an abrupt edge may be intolerable for some species and reduces the integrity of the vegetation in this margin.

The vegetation removal that is required for the Stage 2 pit expansion will result in an artificial edge to the forest, exposing what is currently internal forest to external climate conditions and a greater risk of exotic weed incursion. Light, temperature, and dust levels will be higher along this edge than they were before the vegetation was removed and humidity levels will reduce, all of which may compromise the resilience of the vegetation along the new edge.

10.2 Management of Edge Effects: Buffer Planting

This plan details the planting requirements for the edge effects and buffer management of the Project area, including the 10 m buffer surrounding the final Stage 2 footprint, and 306 Pebble Brook Road.

Weed control is also detailed in this plan, and applies to each of these planting zones, as well as the successive quarry edge as the pit expands. The final quarry pit is proposed to be remediated via planting (Barkers, 2025). The weed control guidelines for the buffer plantings and the quarry pit remediation planting are detailed in the Weed Control Management Plan (Section 11).

Pest animal control of the Stage 2 buffer planting and Pebble Brook Road planting has been detailed in a separate Mammalian Pest Control Plan (Section 12).

A multi-staged approach is adopted by this plan to ensure the survival and establishment of plantings and successful buffering of edge effects:

- **Stage 1 –** Summer/ autumn: prior to the winter restoration planting, site preparation involves removal of any exotic weeds within the enhancement and revegetation sites.
- **Stage 2** – Late autumn/ winter: Planting within revegetation site.
- **Stage 3** – Autumn/ winter: Infill planting of gaps (after approximately three years).

10.2.1 Planting

10.2.1.1 Stage 2 Final Pit Buffer Planting

Edge effects can be mitigated surrounding the final Stage 2 pit extent by planting a buffer of edge-adapted species to shelter the interior of the forest from outside conditions following the final quarry stage. Fast-growing, bushy species that are tolerant of the range of conditions that the edge area is likely to be exposed to, should be selected. Creating a dense barrier of tolerant vegetation will protect the remaining vegetation and prevent negative impacts from edge effects.

As the area requiring planting to mitigate edge effects is at the periphery and within the first ten meters of the bush edge, pioneer species will be utilised to quickly infill light gaps and reduce edge impacts.

In place of enrichment planting, infill/replacement planting of pioneer species should be undertaken to ensure that no gaps are left in the bush margins, and a dense barrier is forming to protect the forest interior.

The area requiring buffer planting to manage edge effects is shown in Figure 33. The total area to be planted is 2.88 ha.

Table 22 provides a species list and specifications for spacings and numbers of plants to be planted within the Stage 2 final pit buffer planting zone. Some of the species are required to be salvaged or propagated from the Stage 2 footprint, where vegetation clearance/seed and cutting collection, and final pit edge creation timing are appropriately aligned, as part of the Threatened Plant Management Plan (TPMP).

Table 22. Species list for the final Stage 2 pit buffer planting.

Botanical Name	Common Name	Container size	Spacing (m)	Composition (%)	# Plants	# Plants + 10%
Aristotelia serrata	makomako	PB3 / 1L	1	5	1438	806
*Austroderia fulvida**	toetoe	PB3 / 1L	1	5	1438	5804
Brachyglottis repanda	rangiora	PB3 / 1L	1	5	1438	806
Coprosma lucida	shining karamū	PB3 / 1L	1	5	1438	322
Coprosma robusta	karamū	PB3 / 1L	1	10	2876	1290
Corynocarpus laevigatus	karaka	PB3 / 1L	5	2	115	29
Entelea arborescens	whau	PB3 / 1L	1	8	2300	1290
Geniostoma ligustrifolium	hangehange	PB3 / 1L	1	5	1438	806
Hoheria populnea	houhere	PB3 / 1L	1	8	2300	1290
*Kunzea robusta**	kānuka	PB3 / 1L	1	10	2876	1290

Macropiper excelsum	kawakawa	PB3 / 1L	1	5	1438	11608
Melicytus ramiflorus	māhoe	PB3 / 1L	1	10	2876	1290
Myrsine australis	māpou	PB3 / 1L	1	5	1438	806
*Pennantia corymbosa**	kaikōmako	PB3 / 1L	1	5	1438	806
*Pentapogon inaequiglumis**	short-hair plume grass	PB3 / 1L	0.5	5	2876	7256
*Pomaderris kumeraho**	kūmarahou	PB3 / 1L	0.5	2	1150	2902
Veronica stricta var. stricta	koromiko	PB3 / 1L	1	5	1438	7256
				100	**30308**	**45657**

**Sourced via propagation or salvage and transfer from the Stage 2 pit footprint where possible – numbers subject to seed propagation success*

Kūmarahou (*Pomaderris kumerahou)* and toetoe (*Austroderia fulvida*) should be planted closest to the edge in open sites, as these plants prefer high light levels. All other plants should be mixed throughout the buffer area.

Euchiton audax (creeping cudweed); *Epilobium nerteroides* (willowherb); *Carex ochrosaccus* (forest sedge) and *Pentapogon inaequiglumis* (short hair plume grass) are also required to be translocated from the Stage 2 pit zone and can be incorporated within the final pit edge planting in accordance with the Threatened Plant Management Plan. The number of individuals to be translocated cannot be determined until the translocation has taken place.

Additional plants are required to be propagated from seed/cutting within the Threatened Plant Management Plan. These may be incorporated at any stage into the buffer planting, in accordance with their habitat preferences outlined within the TPMP.

10.2.1.2 306 Pebble Brook Road Planting

The 306 Pebble Brook Road planting Project area is gently sloping towards the Waitoki Stream and is currently within exotic pasture. Three streams occur throughout the planting site, which will benefit from the addition of riparian planting (Figure 34). Planting will be undertaken following the completion of the offset/compensation planting at the Oldfield Road Project area, which is scheduled to take 12 years. The Stage 2 pit quarry activity is scheduled to commence predominantly at the north-eastern end, furthest from this planting site, so immediate planting is not necessary. Planting within this zone totals to 3.52 ha.

The pioneer planting for this site will include a mix of broadleaved species including māhoe, mapou, kōhūhū and karamū. A riparian planting zone (5m from stream edge) has been created. Species such as toetoe and kūmarahou, which are to be seed collected from the Stage 2 footprint, should be planted within this riparian zone.

The enrichment planting will include canopy species reminiscent of kauri, podocarp, broad-leaved forest (WF11). The specified enrichment plant list has been specified at 60%, with more infill expected from seed propagation in accordance with the TPMP (such as *Melicytus macrophyllus* and *M. micranthus;* and *Metrosideros perforata*. Plants propagated should be incorporated into the enrichment planting in accordance with their habitat and shelter preferences outlined in the Threatened Plant Management Plan. Table 23, Table 24 and Table 25 provide a species list and specifications for spacings and numbers of pioneer plants for buffer, riparian and enrichment planting at 306 Pebble Brook Road.

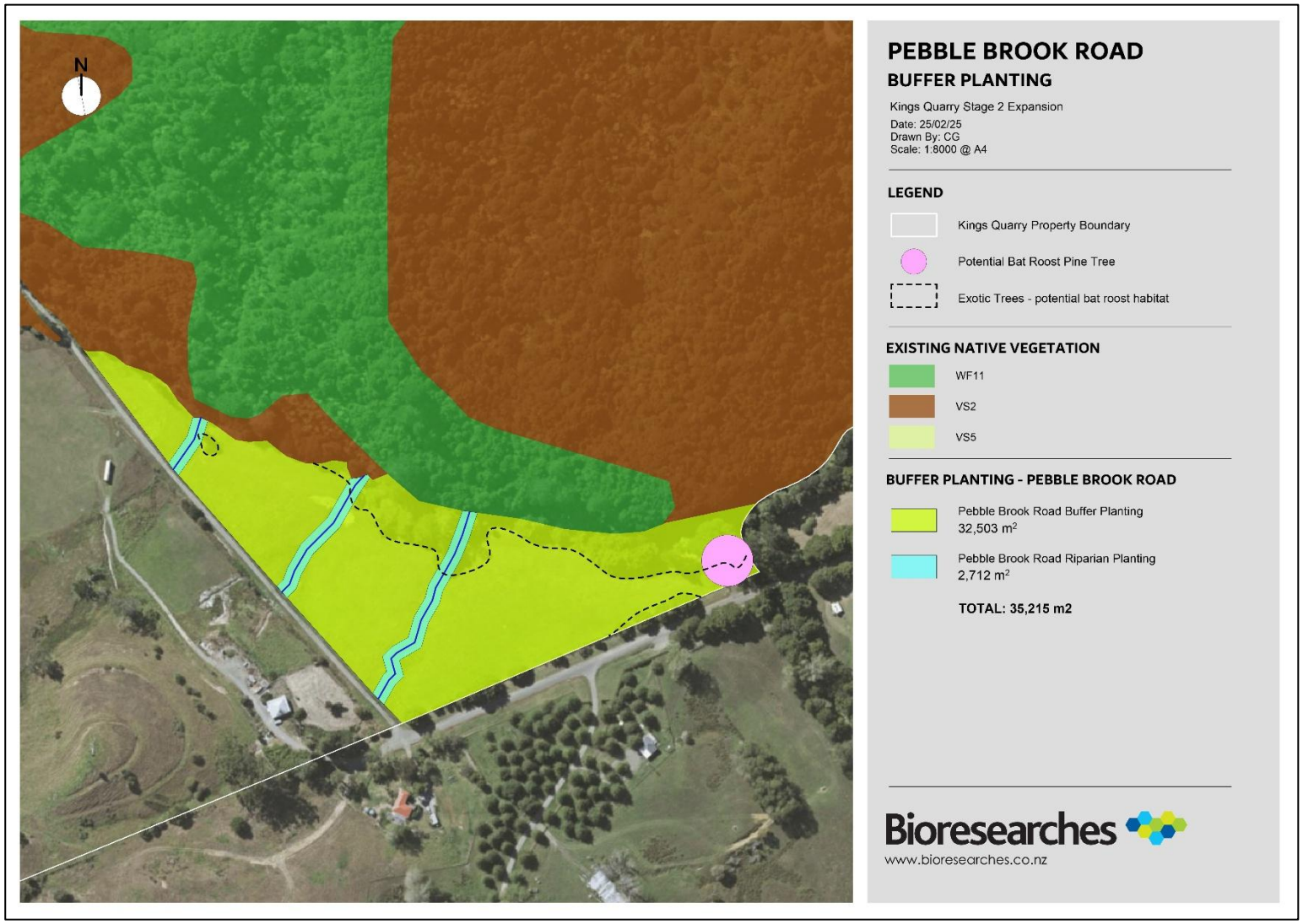


Figure 34. Map showing the composition of planting at 306 Pebble Brook Road.

Table 23. Pioneer plant list for the 306 Pebble Brook Road buffer planting zone.

Botanical Name	Common Name	Container size	Spacing (m)	Composition (%)	# Plants	# Plants + 10%
Aristotelia serrata	wineberry	PB3 / 1L	1	5	1625	1788
Brachyglottis repanda	rangiora	PB3 / 1L	1	5	1625	1788
Coprosma arborea	māmāngi	PB3 / 1L	1	5	1625	1788
Coprosma lucida	shining karamū	PB3 / 1L	1	10	3250	3575
Coprosma robusta	karamū	PB3 / 1L	1	10	3250	3575
Cordyline australis	cabbage tree	PB3 / 1L	1	10	3250	3575
Hoheria populnea	lacebark	PB3 / 1L	1	5	1625	1788
*Kunzea robusta**	kānuka	PB3 / 1L	1	10	3250	3575
*Leptospermum scoparium**	mānuka	PB3 / 1L	1	10	3250	3575
Melicytus ramiflorus	māhoe	PB3 / 1L	1	10	3250	3575
Myoporum laetum	ngaio	PB3 / 1L	1	5	1625	1788
Olearia furfuracea	akepiro	PB3 / 1L	1	5	1625	1788
Pittosporum tenuifolium	kōhūhū	PB3 / 1L	1	10	3250	3575
				100	**32503**	**32178**

**Sourced via propagation or salvage and transfer from the Stage 2 pit footprint – numbers subject to seed propagation success*

Table 24. Pioneer plant list for the 306 Pebble Brook Road riparian planting zone.

Botanical Name	Common Name	Container size	Spacing (m)	Composition (%)	# Plants	# Plants + 10%
Aristotelia serrata	makomako, wineberry	PB3 / 1L	1	5	136	149
*Austroderia fulvida**	toetoe	PB3 / 1L	1	10	271	298
Carex secta	Pūrei	PB3 / 1L	1	10	271	298
Coprosma robusta	karamū	PB3 / 1L	1	7.5	203	224
Cordyline australis	cabbage tree, tı kōuka	PB3 / 1L	1	10	271	298
Hoheria populnea	lacebark, houhere	PB3 / 1L	1	5	136	149
*Kunzea robusta**	kānuka	PB3 / 1L	1	5	136	149
*Leptospermum scoparium**	mānuka	PB3 / 1L	1	10	271	298
Melicytus ramflorus	māhoe	PB3 / 1L	1	10	271	298
Myporum laetum	Ngaio	PB3 / 1L	1	5	136	149

Olearia furfuracea	akepiro	PB3 / 1L	1	5	136	149
*Pomaderris kumeraho**	kūmarahou	PB3 / 1L	0.5	2.5	136	149
Pseudopanax arboreus	whauwhaupaku, five finger	PB3 / 1L	1	10	271	298
Sophora microphylla	kōwhai	PB3 / 1L	5	5	136	149
				100	**2780**	**3058**

**Sourced via propagation from the Stage 2 pit footprint – numbers subject to seed propagation success*

Table 25. Enrichment planting list for the Pebble Brook Road edge effects planting.

Botanical Name	Common Name	Container size	Spacing (m)	Composition (%)	# Plants	# Plants + 10%
*Agathis australis**	kauri	PB3 / 1L	5	7.5	528	581
Beilschmiedia tarairi	taraire	PB3 / 1L	5	10	704	775
Beilschmiedia tawa	tawa	PB3 / 1L	5	7.5	528	581
*Dacrycarpus dacrydioides***	kahikatea	PB3 / 1L	5	2.5	176	194
Didymocheton spectabilis	kohekohe	PB3 / 1L	5	10	704	775
Hedycarya arborea	pigeonwood	PB3 / 1L	5	7.5	528	581
*Pennantia corymbosa**	kaikōmako	PB3 / 1L	5	5	352	387
Phyllocladus trichomanoides	tānekaha	PB3 / 1L	5	10	704	775
				60	**4226**	**4648**

** Sourced via propagation or salvage and transfer from the Stage 2 pit footprint – numbers subject to seed propagation success*

***To be planted closest to stream edge (requires damp soil)*

10.3 Planting Preparation

Within the Project area at 306 Pebble Brook Road, planting is primarily occurring into pasture grass. Planting may occur directly in pasture if it is first mown or slashed back surrounding each plant. Planting in open pasture should be spaced at 1 m in accordance with AUP Appendix 16. The use of biodegradable mulch mats surrounding each new plant is recommended within pasture plantings to reduce maintenance costs of hand-releasing plants.

Several pine trees (*Pinus sp.*) are also present within the south-west edge of existing bush within the Pebble Brook Road planting Project area. Pine can hinder restoration efforts through self-seeding and outcompeting native plants for canopy space. However, it is noted that some of these trees may be presently providing roost habitat for long-tailed bats.

Pine trees within restoration areas should receive standing control (e.g., drill and injected as per Section 11). This will allow continued protection of bat habitat, whilst preventing the continual spread of pine trees throughout restoration and enhancement areas. Large exotics that are not pest species should be retained due to the potential for these trees to provide bat roost habitat (such as *Macrocarpa* sp.).

10.4 Planting Procedure

The planting season runs from May through to August.

During planting, the following procedures should be followed to ensure maximum survival of plants and optimal growth and health:

- Prior to planting, ensure all plants are thoroughly watered and have been allowed to drain out of direct sunlight.
- Set the plants out on site according to the recommended spacing. Aim to follow a randomised planting layout rather than straight lines, to achieve a "natural" rather than uniform look. Plant species should be mixed to avoid large single-species groupings.
- Dig a hole 1.5 – 2 times wider than the plants' root ball. Ensure the edges of the hole are roughened, especially in clay soil, to avoid a "pot effect" and the drowning of plants. Back-fill with a small amount of soil to cover the base.
- Add a potassium-based fertiliser such as Potash to the base of the planting hole, at the recommended dosage per plant according to the packaging.
- Carefully remove the plant from the bag. Do not disturb the root ball. Place plant within planting hole.
- Back-fill the hole with part new soil and part existing soil. Break up clumps of existing soil with a shovel as much as possible. As you fill, avoid stomping firmly on the soil, as this may over-compact the ground and restrict root growth. Some moderate firming with your foot or by hand once planted is adequate.
- Fill the planting hole until the top of the root ball sits exactly level with the ground surface. If the plant is planted too deep (plants sitting in indentations) water will pool and the plant may rot. If the plant is planted too high (plant is sitting in a mound) water will pick up through the soil and the plant will dry out.

10.4.1 Plant Sourcing

All plants must be eco-sourced from within the ecological district of the planting site (Rodney / Eastern Northland district (9.01)). Eco-sourcing protects the genetic lineage of plants in the area and ensures plants are adapted to their specific regional climatic conditions. In line with the Threatened Plant Management Plan, some species are required to be sourced from the Stage 2 footprint wherever possible. Many plant species not Threatened or At Risk also occur within the Stage 2 footprint and may also be seed sourced for planting within the edge effects and buffer planting zones.

Plants should be ordered from an appropriate eco-source nursery as early in the project as possible (giving one year or more notice) to ensure that the appropriate species and numbers are grown on to be ready for planting.

All plantings from the Myrtaceae family (for example kānuka and mānuka) shall be sourced from a nursery that is a signatory to the Myrtle Rust Nursery Management Declaration V6, 11 October 2017, certifying that the plant producer has implemented the New Zealand Plant Producers Imported Myrtle Rust Nursery Management Protocol (Myrtle Rust Nursery Management Protocol – V6, 11 October 2017).

10.4.2 Physical Protection

New seedlings are susceptible to grazing by pests such as goats, possums and rabbits, and therefore adequate measures need to be taken to ensure plants are protected. As livestock are present on-site, fencing will be required to prevent the trampling of new and existing plants, both within the revegetation and enhancement areas. The use of plant guards is recommended.

10.4.2.1 Plant Guards

Rabbits and pūkeko can compromise restoration efforts by consuming the young foliage on new plantings. To protect vegetation during the first two-to-three years of establishment, it is recommended that environmentally-friendly plant guards are installed. See Figure 35 below for an example of bio-degradable plant guards and bamboo stick, respectively.

Figure 35. Example of biodegradable planting guard to prevent browsing pressure on restoration planting.

Figure 36. Installation of plant guard using bamboo stick.

10.4.2.2 Fencing

Fencing is required at the 306 Pebble Brook Road planting sites to ensure ongoing protection of the new planting from pest animals.

Fencing is required to be installed surrounding the roadside edges of the planting zone, to reduce invasion by animal predators such as goats. Fencing has been implemented as part of the Mammalian Pest Control section of this plan.

Fencing should be installed surrounding the outer boundary of the planting areas to protect from stock, and is to be of a stock-proof standard – timber post and wire design. Fencing should:

- Consist of a minimum 5 horizontal wires, preferably 7;
- Be built with timber round or half round posts, spaced at 3 to 5 m apart;
- On rolling hills (>7 °gradient), posts to be installed max. 3 m apart;
- Potentially with battens running vertically on the wires; and
- Be electrified to further deter goats and pigs.

Fencing should be inspected annually and maintained to a stock-proof standard should damage be observed.

10.5 Maintenance Plan

The maintenance plan of this report details the required plant aftercare, including replacement plants and weed control (Section 11). Successful planting indicators including 90% canopy closure and a minimum survival density of 90% of the original density at both planting sites maintenance should occur for a minimum of five years, but until the planting reaches 90% canopy closure (whichever is first).

In the instance that planting targets are not being met (i.e., plants continue to fail despite replacement planting), a substitute species may be used subject to the approval of a consulting ecologist. Replacement plants should be at least of the same size (relative to surrounding plants).

10.5.1 General Activities

Maintenance will include:

- Manually removing weed species should they re-establish;
- Fertilising and watering new plants if considered essential; and
- Replacing any plants that do not survive during the 5-year period.

Plant maintenance is to occur quarterly for the first year (or for 12 months after planting). Thereafter, the planting areas shall be maintained three times per year for years 2-4 after initial planting, and twice per year in year 5 if planting targets are being met.

Successful planting targets include at least a 90% canopy closure, and a minimum survival of 90% of the original density of plants specified.

A sample schedule of the plant maintenance and management activities required at the revegetation planting and enhancement areas are presented in Table 26 below.

Table 26. Sample Planting and Maintenance Activity Schedule.

Time	Activity	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Year Zero	Initial weed control												
	Initial planting												
	Fence and pest control installation												
Year One	Plant maintenance												
Year two	Plant maintenance												
Year three	Plant maintenance												
Year four	Plant maintenance												
Year five +	Plant maintenance												

10.5.1.1 Summer Activities

Summer (late November - late March) activities should include weeding, and watering plants if necessary, during periods of drought.

10.5.1.2 Autumn and Winter Activities

Autumn and winter (April – September) activities should include continued weeding (spraying may become inappropriate due to rain and wind), and the replacement of any dead plants. Plant replacement should be of the same species and eco-sourced. Should a particular species continue to fail, a substitute species may be used subject to the approval of a consulting ecologist. Replacement plants should be at least of the same size (relative to surrounding plants).

10.5.1.3 Spring Activities

Weeding becomes important with Spring growth.

11 WEED CONTROL MANAGEMENT PLAN

Weed management is required for the life of the consent within:

- The final Stage 2 pit buffer planting area;
- The 306 Pebble Brook Road Planting area;
- The edges of the Stage 2 pit as it expands during quarry works; and
- The remediated final Stage 2 quarry pit planting.

Disturbed edge environments and high-light pioneer plantings are good habitat for many aggressive invasive weed species such as pampas *(Cortaderia selloana*), woolly nightshade *(Solanum mauritianum*), privet *(Ligustrum lucidum* and *L. sinense*), moth plant (*Araujia hortorum*) and gorse *(Ulex europaeus*). Care should be taken not to damage any native seedlings that have begun to grow since vegetation clearance has occurred. Native species that have a similar appearance to weedy species (such as toetoe) should be carefully identified to prevent accidental misidentification and removal.

11.1 Weed Removal Methods

It is recommended that, within planting sites, weeds are removed by hand or using small machinery wherever possible. The use of herbicides should be avoided or minimised wherever it is practical to do so and avoided within 3 m of stream edges.

It is recommended that large weeds reinvading the quarry pit edge or remediation planting receive standing control (foliar sprayed, drilled and injected, or ring barked) as opposed to being removed entirely, in order to reduce the risk of bank instability which may pose a health and safety threat to weed control contractors.

Error! Reference source not found. lists the chemical removal process for weed species found within the Project area if complete removal of the plant and root system is not feasible, or large weeds occur within the remediated pit planting or on the immediate quarry pit edge.

Table 27. Table of common edge weed species and their chemical removal methodology.

Botanic Name	Common Name	Weed Control Method
Rubus fruticosus	blackberry	Cut and paste stumps with glyphosate gel (small patches only). For larger patches, spray with metsulfuron-methyl 7.5g/15L
Pinus radiata	monterey pine	Smaller trees – cut and paste stump with metsulfuron gel Trees > 10cm Diameter at Breast Height may be providing bat roost habitat. Trees should be drill and injected and left standing to prevent injury or mortality to native long-tailed bats.
Ligustrum lucidum/sinense	privet	Smaller trees – cut and paste stump with metsulfuron gel

Botanic Name	Common Name	Weed Control Method
		Trees > 10cm Diameter at Breast Height may be providing bat roost habitat. Trees should be drill and injected and left standing to prevent injury or mortality to native long-tailed bats.
Ulex europaeus	gorse	Cut across trunk and immediately paste the stump with metsulfuron or glyphosate gel
Cortaderia selloana	pampas	Spray with glyphosate (20ml/L) during extended dry periods and with a minimum 3 m distance from watercourses OR Cut foliage back to base and immediately paste the stump with glyphosate gel
Solanum mauritianum	woolly nightshade	Fell and immediately paste stump with 1-2mm layer of double strength glyphosate gel ensuring rim of stump is pasted
Araujia hortorum	moth plant	Remove plant from native plants prior to spraying. Spray with metsulfuron 0.5g per litre, with penetrant 1ml per litre. OR If stem is green, apply metgel direct to stem. If stem has bark, scrape bark for 30cm then apply metgel
Asparagus scandens *Asparagus asparagoides*	climbing asparagus bushy asparagus	Foliage spray with glyphosate 20mL / L, with penetrant 1 mL / L Remove plant from natives before spraying
Cenchrus clandestinus	kikuyu	Spray with glyphosate 20 mL / L during extended dry periods and with a minimum 3 m distance from water bodies.

11.1.1 Drill and Inject Methodology

Drill and inject methodology would employ the use of metsulfuron-methyl at 600 g/kg formulation per litre of water (Biosecurity New Zealand, 2025[13]). On multi-stem trees, each stem should be treated as a separate tree.

Holes should be drilled at even spaces around the trunk to ensure an even distribution of the chemical throughout the tree. Holes should be drilled into the base of the tree and prominent feeder roots as near to the ground as possible.

Holes should be drilled on a downward angle (45 degrees) to a depth of 4-8 centimetres excluding bark. Each hole should be deep enough to contain 10ml of herbicide formula. Herbicide should be applied immediately at 10ml of formula (600 g/kg metsulfuruon-methyl per litre) per hole.

The number of holes per stem required varies depending on the DBH of the stem and is outlined in the table below.

[13] Biosecurity New Zealand. (2025). Ground-Based Herbicide Injection – 'Drill and Fill'.

Table 28: Table from Biosecurity New Zealand (2025): Above: DBH of tree stems and below: number of holes required per stem for drill and inject methodology

10	20	25	35	50	80	100	105	110	120	125	135	140	160
1	1	2	3	4	6	8	8	8	9	10	11	12	13

11.1.2 Chemical Control Guidelines

This section provides guidelines and restrictions regarding the application of chemical control substances which are to be followed where chemical control is required.

Herbicides should only be applied in fine, dry conditions, and when rainfall is not forecast within 24 hours. This prevents run-off into watercourses, and the herbicide rapidly draining into ground-water. In addition, the following general guidelines apply when using herbicide control methods:

- Identify plants that will need to be retained prior to commencing weed removal activities;
- Hand-release native plants from weeds prior to foliar spray application to avoid accidental overspray onto native plants;
- Avoid use of residual herbicides (such as metsulfuron-methyl) in areas of native vegetation, unless required for targeted stump control (e.g., cut and paste, drill and inject);
- Refrain from spraying directly next to watercourses;
- Utilise a 'lowest common toxicity' methodology where the least exotoxic/ broad spectrum herbicide and lowest rate that will achieve effective control is utilised; and
- The herbicide applicator(s) are to be suitably qualified and experienced, such as holding a GrowSafe certificate.

Always follow the manufacturer's instructions carefully and use the recommended safety pre-cautions to protect the user and water health. A wetting agent, such as Boost™, should be used to better adhere the spray adhere to the plant, allowing an increased efficacy of kill. Avoid spray-ing herbicide on windy days, when the droplets are likely to drift beyond the target area.

Maintaining up-to-date records of agrichemical usage is a legal requirement for the management of agrichemicals as set under the Hazardous Substances and New Organisms (HSNO) Act and specified in the New Zealand Standard for Management of Agrichemicals (NZS 8409:2021). Risks associated with the use of agrichemicals are required to be managed as indicated on the label and other product information so that adverse environmental effects are avoided.

A diary must be kept of all weed control, planting, and pest control work carried out.

11.2 Remediation planting area

Remediation planting is to occur in the Stage 2 pit area in stages, as pit areas are retired. Planting schedules, areas, timing, and maintenance has been detailed in the Remediation Planting Plan (Appendix 12; Barker & Associated Ltd, 2023). Additional considerations apply to this area for weed control around access and safety.

As the remediation areas include a series of steep rock cut slopes with carmine rātā (*Metrosideros carminea*) planted at the base to climb it over time, there will be large, sun-exposed areas of rock prone to invasion from pampas. These areas will be difficult to safely access as they are steep and are anticipated to range 10-15 m in height. Where weed control on these faces cannot be safely undertaken from the base of each slope, ropes access or drone spraying may be required for effective control.

If the carmine rātā is not growing sufficiently to prevent weed establishment on these faces over time, consideration of alternative weed exclusion methods is recommended. Additional vigorous climbing species (whether native or non-weedy exotic) may be considered for planting, such as kōhia (*Passiflora tetrandra*).

11.3 Schedule and timing of weed control

Weed management shall initially be undertaken in accordance with the maintenance schedule for any planting areas, and thereafter as below (Table 29).

Table 29. Weed control requirements for each management area across the life of consent

Management area	Initial maintenance as detailed in	Weed control following maintenance period
Final Stage 2 pit buffer planting area	Section 10 (EEBMP)	Annual spring control for the life of consent
306 Pebble Brook Road planting area	Section 10 (EEBMP	Annual spring control for the life of consent.
Edges of the Stage 2 pit as it expands during quarry works	NA	Twice-yearly control (spring and autumn) for duration the given edge persists, up to the life of consent/ final Stage 2 pit area.
Remediated Stage 2 quarry pit planting	Appendix 12 Remediation Plans (Barker & Associates Ltd, 2023)/ Consent Condition 87	Annual spring control for the life of consent.

12 MAMMALIAN PEST CONTROL PLAN

12.1 Introduction

This Mammalian Pest Control Plan (MPCP) has been prepared for Kings Quarry Limited to detail the control and monitoring methods to achieve successful management of mammalian pests at the quarry Project area and adjacent Project area at 306 Pebble Brook Road, hereafter called the Kings Quarry Pest Management Area (PMA), over the area identified in Figure 37. Pest control will occur over this 90.64 ha area for the life of the consent.

Pest management and elimination regimes for the Oldfield Road Project area (the offset site 26 km north of the quarry), are addressed separately in the Residual Effects Management Plan. This separate Project area is referred to as the Oldfield Road Pest Management Area (PMA).

This plan also outlines proposed pest targets and thresholds for control, which are known to provide for a high certainty of biodiversity benefit. Mammalian pest management is also required in relation to the following plans:

- Lizard and Invertebrate Management Plan;
- Bat Management Plan;
- Threatened Plant Management Plan; and
- Edge Effects Management Plan.

The Project area currently receives no widespread or coordinated pest control. Based on the known habitat preferences for pest species, possums, rats, mice, feral cats, hedgehogs, wasps, and mustelids are likely well established and reasonably abundant across the Project area and in the surrounding landscape. Goats and pigs are also known to be present and causing browsing impacts.

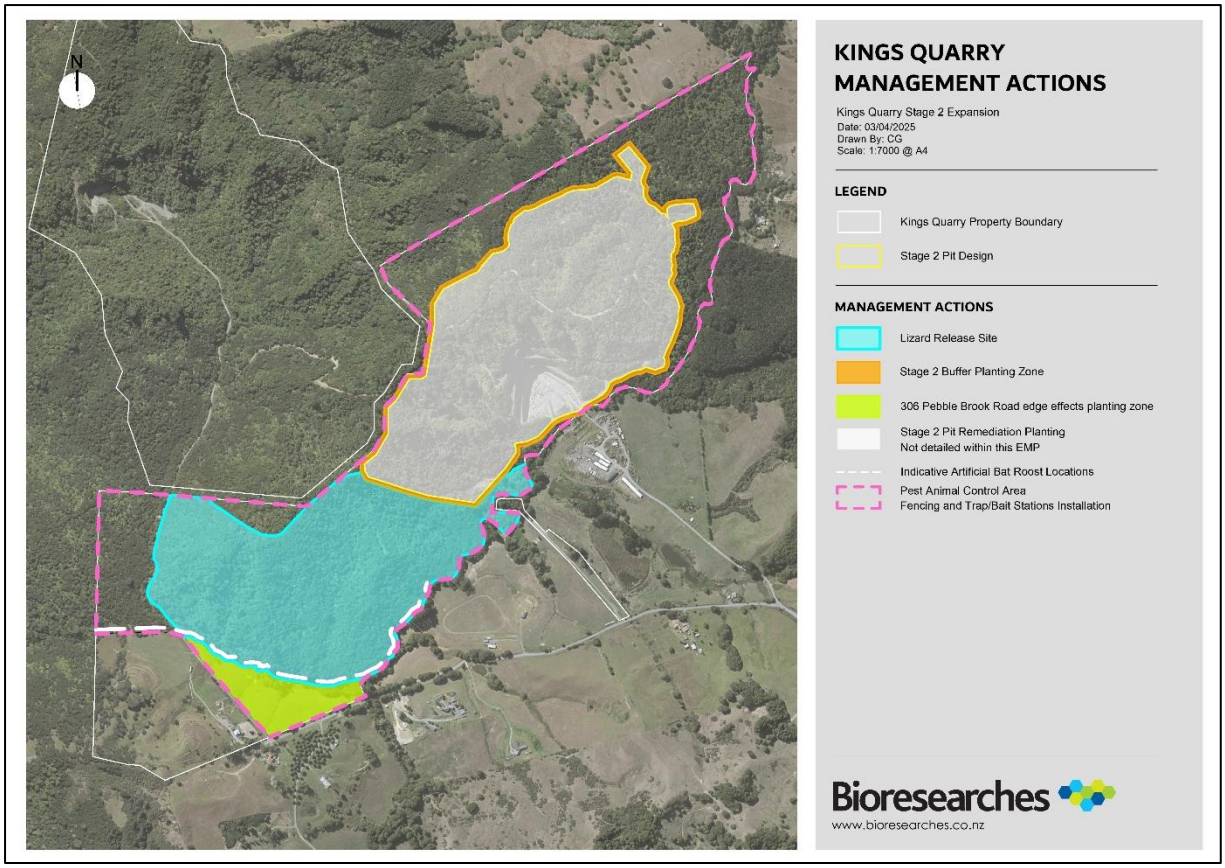


Figure 37. Map showing the location of proposed pest animal management. The pest animal management zone is to be fenced and will incorporate the buffer and edge effects management planting, the lizard release site, and the artificial long-tailed bat roost habitat.

12.2 Benefits of pest management

Introduced mammalian pests are well documented as a primary threat to New Zealand's native flora and fauna. Consequently, controlling their populations is known to result in substantial benefits for native biodiversity. For example:

- Native bird abundance has been shown to significantly increase following possum population suppression to low densities (MacLeod et al., 2015; Saunders & Norton, 2001; Spurr & Anderson, 2004);
- Native vegetation also benefits from ongoing possum control (Byrom et al. 2016);
- Stoat control has been shown to increase the survival and nesting success of birds (Steffens et al. 2022, Kemp et al. 2018, Moorhouse et al. 2003);
- The control of rats (particularly black rats, rattus rattus) has resulted in documented increases of many forest bird species including tūī, North Island robin, and North Island kererū, as well as increases in the fruiting of canopy dominants (Armstrong et al. 2006 Fitzgerald et al. 2021, Baber et al. 2009; Binny et al. 2021; Fea et al.2020, Gillies et al.2003).

In addition to direct biodiversity benefits, a recent report by Forest & Bird (Hackwell and Robinson 2021), estimated that the equivalent of nearly 15% of New Zealand's 2018 net greenhouse gas emissions per year — 8.4 million tonnes of CO_2 — could be locked into native ecosystem carbon sinks if feral browsing animals were controlled to the lowest possible levels.

Effective pest control is therefore expected to have an immediate benefit on native fauna, including decreasing predation pressure on populations of birds, lizards, bats, and invertebrates, increasing reproductive success due to lower instances of nest predation, and decreasing the impact of browse on native flora (thus increasing availability of food resources). The control of browsing pests is also crucial for enabling plant growth and establishment when revegetation is occurring. However, in order to be effective, pest control needs to be comprehensive and maintained at regular intervals on an ongoing basis.

12.3 Target pest animal species

12.3.1 Rats

There are three rat species present in New Zealand, with Norway rats (*Rattus norvegicus*) and ship rats (*R. rattus*) being the most common on the mainland. Rats are generalist omnivores; their diet includes seed predation and preying on small animals such as invertebrates, reptiles, bats, amphibians, and juvenile birds. They compete with native birds for nests and burrows, and have been implicated in the decline of a number of threatened birds, particularly seabirds (Auckland Council, 2019). Although rats are not as wide-ranging as mustelids, they are capable of invading areas quickly over short distances and have a high reproductive rate.

Rat control will be undertaken using a combination of traps and bait, with results monitored via chew cards.

12.3.2 Mice

There is evidence to suggest mice are predators of native lizards, frogs, and invertebrates (Egeter et al., 2015; Norbury et al., 2014; Wedding, 2007), and mouse populations may increase when larger predators (particularly rats, mustelids, and feral cats) are removed from an area.

Mouse control will be undertaken in the lizard release site alongside rat control (using a combination of traps and baits), and both mice and rats will be monitored simultaneously using chew cards.

12.3.3 Possums

In New Zealand, possums are both a predator of native wildlife and a heavy browser of many species of native trees. Although possums are mainly herbivorous and feed on flowers, fruit, and leaves, they will also opportunistically eat eggs, chicks, bats, and invertebrates. Predation by possums on the eggs and nestlings of native bird species such as kōkako, kiwi, and kereru is widespread throughout New Zealand (James & Clout, 1996). Possums also disrupt ecological

processes such as flowering, fruiting, seed dispersal and germination. In addition, they also serve as vectors of bovine tuberculosis (TB).

Possums will be controlled via an initial population knockdown using a toxin suitable for both rats and possums (e.g. Double Tap or cholecalciferol) and can be maintained at low densities via ongoing trapping. They will also be monitored with chew cards (alongside rat and mouse monitoring).

12.3.4 Mustelids

Three species of mustelids are present in New Zealand, all of which are likely to be present in the area. Stoats (*Mustela erminea*) and ferrets (*M. furo*) are particularly well-documented for their devasting impacts on native fauna. There are currently few adequate control options for weasels (*M. nivalis vulgaris*), the smallest of the mustelids in New Zealand, although some may be caught with the tools used for targeting rats and other mustelids.

Mustelids will be controlled across the proposed pest area, primarily via trapping. Populations will be monitored via the use of trail cameras.

12.3.5 Hedgehogs

Hedgehogs are mainly insectivorous but have proven to be a major predator on eggs and have been known to kill and eat chicks of a variety of ground-nesting birds as well as native lizards (Department of Conservation, 2021). Hedgehogs are commonly captured in single-set trap networks targeting rats and mustelids, which also means that traps triggered by hedgehogs are no longer available to these target species until the trap is checked and cleared. Reducing the hedgehog population will consequently increase the effectiveness of the trap network as well as reducing predation pressure on some native fauna. There is currently no established protocol for monitoring hedgehogs.

12.3.6 Goats

Goats (*Capra hircus*) are a major pest browser at the Project area. They are social animals, typically travelling in small groups comprising one male and a group of smaller females. Goats are generalist herbivores that browse a wide variety of plant species but do prefer to feed on a small number of favoured species. Similar to feral pigs, goats destroy the understorey of vegetation and, when combined with possum damage to the upper canopy, can cause severe deterioration of native forests, often with associated pest plant invasion.

Feral goats will be eliminated within the pest-managed area following construction of a goat-proof fence to prevent reinvasion.

12.3.7 Pigs

Pigs can have devastating impacts on local flora and fauna, particularly regenerating forest understorey or areas of revegetation by uprooting trees and saplings and eating native plants and invertebrates. Feral pigs eat a wide variety of food including grasses, roots, seeds, and other plant material, as well as carrion, invertebrates, and ground-nesting birds.

Feral pigs will be eliminated within the pest-managed area following construction of a goat- proof fence to prevent reinvasion.

12.3.8 Rabbits

Rabbits (*Oryctolagus cuniculus*) and hares (*Lepus europaeus*) are agricultural pests, and can also cause severe impacts to ecological and cultural values. They are browsers of native vegetation and problematic when revegetation is occurring. Rabbits will be controlled in the replanting area to ensure plant survival is high.

12.3.9 Wasps

While not a mammalian pest, German and common wasps (*Vespula germanica, Vespula vulgaris*) have established in immense numbers across New Zealand since their introduction in the 1900s, resulting in New Zealand now having the highest density of wasps in the world (Barlow & Goldson, 2002). Wasps outcompete a range of birds, lizards and invertebrates for nectar sources and also predate on native fauna during late summer. In some cases Vespulid wasps have been indicated to cause a decline in abundance of several bird species as a result (Beggs, 2001).

Wasps will be controlled in the Lizard Release Site to reduce their impacts on these species.

12.4 Pest management areas

Pest management protocols and targets in this MPCP cover the following areas within the Kings Quarry PMA (Figure 37**Error! Reference source not found.**):

1. **Lizard Release Site** – the area selected for release of any lizard species captured during project works. In order to support lizard population recovery, all target pest species including mice and wasps will be controlled in this area, with the exception of rabbits.
2. **Edge Effects Planting Area and remaining area subject to pest control** – includes control of all target species excluding wasps and mice on the reminder of the pest management area. Planting areas will also undertake rabbit control (until plants are well established and no longer subject to rabbit browsing pressure).

It is recognised that the area subject to pest management will be subject to ongoing reinvasion (due to unprotected boundaries), and as such pest management has been designed to be undertaken on an ongoing, continuous basis throughout the duration of the consent.

12.5 Control methods – kill traps

A kill-trap, by definition, must kill the target animal and do so quickly and consistently. Traps that have passed testing under the guidelines laid out by the National Animal Welfare Advisory Committee (NAWAC) are considered to be humane for that species. An up-to-date list of traps that have been tested under NAWAC guidelines and either passed or failed can be obtained from https://www.bionet.nz/rules/performance-trapshttp://www.bionet.org.nz/.

Rats, mustelids, hedgehogs, possums, and feral cats can all be effectively controlled by trapping if appropriate trap type, spacing, and lures are used. A mixture of trap types for each species is generally the best approach as individual animals will respond differently to different trap types and there will always be some animals that will avoid one trap type but may go into another.

Multiple new traps have been developed recently, or are currently under development, including AI self-resetting kill traps. Resetting kill traps offer multiple benefits, including offering constant control between services and reducing the amount of servicing required (decreasing costs and reducing any target avoidance of traps due to human scent left during frequent servicing). AI-triggered traps also allow for a more open trap housing to overcome neophobia of target species, and thus potentially increasing trap rates while nearly eliminating risk to non-target species.

Live capture traps are highly effective for capturing mustelids, feral cats, and possums, while any captured non-target animals can be released unharmed. All residents/ landowners within 1 km of live capture traps targeting cats need to be informed at least two weeks prior to the start of the control period. Any cats that are identifiable as a domestic pet with an owner (i.e. those with a microchip and/or collar) will be released and the owner informed. All live capture traps need to be checked within 12 hours of sunrise on the day after they were set to meet animal welfare guidelines (i.e. once per day for the duration of the live-capture trapping pulse). The only exception is if MPI has approved the use of a remote notification surveillance system. All captured target animals must be killed humanely by a competent operator.

Target species	Suitable approved traps	Suitable approved toxins	Recommended spacing
Rats (ship and Norway)	DOC200 Double-set DOC200 DOC250 Re:wild F-Bomb D-rat pro CSL Multi-trap* AT220* (NAWAC approved	DoubleTap (diphacinone and cholecalciferol) or cholecalciferol.	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 50 m intervals along these lines. Perimeter line stations at 50 m spacing.

	for ship rats only)		
Mice	D-rat pro (mouse setting) CSL Multi-trap* Toxin in bait station	DoubleTap (diphacinone and cholecalciferol).	50 m grid of bait stations in Lizard Release site only.
Possums	SA2 Kat trap Flipping Timmy AT220 CSL Multi-trap	DoubleTap (diphacinone and cholecalciferol) or cholecalciferol.	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 100 m intervals along these lines. Perimeter line at 50 m spacing
Mustelids	DOC200 Double-set DOC200 DOC250 CSL Multi-trap* Re:Wild F-bomb	n/a	Mustelid-capable traps at 100 m intervals on the grid. Perimeter line at 50 m spacing
Hedgehogs	DOC200 Double-set DOC200 DOC250 CSL Multi-trap* Re:Wild F-bomb	n/a	Hedgehog capable traps at 100 m intervals on the grid.
Rabbits	n/a	Pindone	n/a – based on locating areas where rabbit damage, fresh scratching and faecal pellet heaps are evident
Feral cats	Live-capture trapping	n/a	200 m spacing on grid lines.

*Denotes a resetting trap (as opposed to a single-set trap).

outlines kill traps which are recommended for each target species, and it is recommended that traps are selected from this list. Figure 38 shows the approximate location and spacing of the trap and bait station network. However, each trap location will need to be micro-placed upon deployment (i.e. refined on a fine scale within several metres in the field, based on the broad-

scale locations in Figure 38). This ensures each trap is placed within suitable micro-habitat for the target species to maximise capture success.

Most of the target predators are attracted to cover, so traps should be placed under cover, such as under trees or shrubs. The trap entrance needs to remain clear, so any vegetation around it needs to be cleared. Rats and mustelids also tend to move along waterways and linear features such along habitat boundaries, tracks, and fence lines.

Table 30. Summary of control tools and spacing for each target species at Kings Quarry. These tools should be updated as new technology becomes commercially available.

Target species	Suitable approved traps	Suitable approved toxins	Recommended spacing
Rats (ship and Norway)	DOC200 Double-set DOC200 DOC250 Re:wild F-Bomb D-rat pro CSL Multi-trap* AT220* (NAWAC approved for ship rats only)	DoubleTap (diphacinone and cholecalciferol) or cholecalciferol.	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 50 m intervals along these lines. Perimeter line stations at 50 m spacing.
Mice	D-rat pro (mouse setting) CSL Multi-trap* Toxin in bait station	DoubleTap (diphacinone and cholecalciferol).	50 m grid of bait stations in Lizard Release site only.
Possums	SA2 Kat trap Flipping Timmy	DoubleTap	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 100 m intervals along these lines. Perimeter line at 50 m spacing

	AT220 CSL Multi-trap	(di-phaci-none and chole-calcif-erol) or chole-calcif-erol.	
Muste-lids	DOC200 Double-set DOC200 DOC250 CSL Multi-trap* Re:Wild F-bomb	n/a	Mustelid-capable traps at 100 m intervals on the grid. Perimeter line at 50 m spacing
Hedge-hogs	DOC200 Double-set DOC200 DOC250 CSL Multi-trap* Re:Wild F-bomb	n/a	Hedgehog capable traps at 100 m intervals on the grid.
Rab-bits	n/a	Pin-done	n/a – based on locating areas where rabbit damage, fresh scratching and faecal pellet heaps are evi-dent
Feral cats	Live-capture trapping	n/a	200 m spacing on grid lines.

*Denotes a resetting trap (as opposed to a single-set trap).

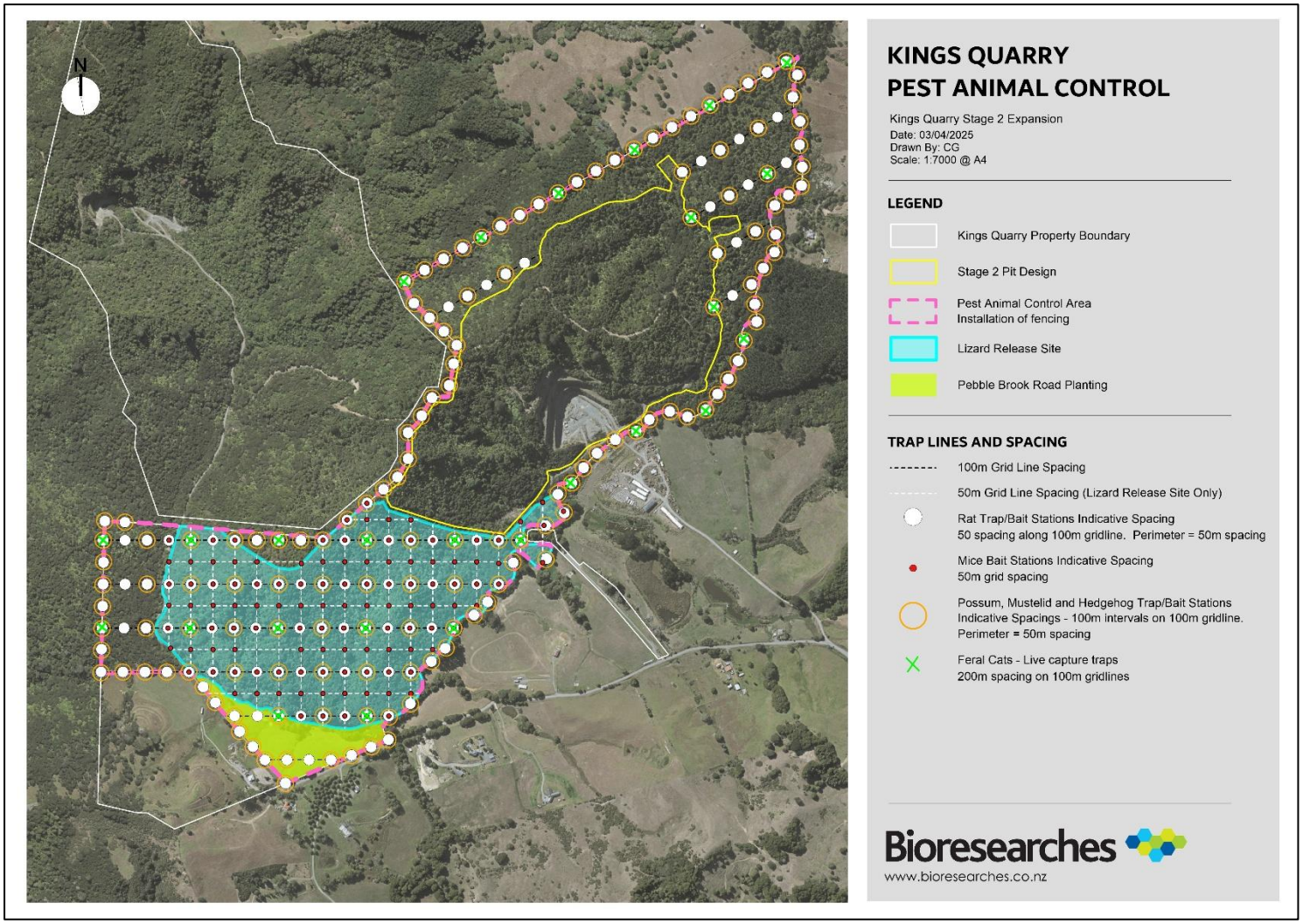


Figure 38: Map showing location of pest animal control methods within the Kings Quarry pest control area

12.6 Control methods – toxins

A permanent bait station network will be established across the Project area, targeting rodents and possums, and supplemented by the permanent trap network. Recommended bait station locations are described alongside the trap spacings in

Target species	Suitable approved traps	Suitable approved toxins	Recommended spacing
Rats (ship and Norway)	DOC200 Double-set DOC200 DOC250 Re:wild F-Bomb D-rat pro CSL Multi-trap* AT220* (NAWAC approved for ship rats only)	DoubleTap (diphacinone and cholecalciferol) or cholecalciferol.	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 50 m intervals along these lines. Perimeter line stations at 50 m spacing.
Mice	D-rat pro (mouse setting) CSL Multi-trap* Toxin in bait station	DoubleTap (diphacinone and cholecalciferol).	50 m grid of bait stations in Lizard Release site only.
Possums	SA2 Kat trap Flipping Timmy AT220 CSL Multi-trap	DoubleTap (diphacinone and cholecalciferol) or cholecalciferol.	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 100 m intervals along these lines. Perimeter line at 50 m spacing
Mustelids	DOC200 Double-set DOC200 DOC250	n/a	Mustelid-capable traps at 100 m intervals on the grid. Perimeter line at 50 m spacing

	CSL Multi-trap* Re:Wild F-bomb		
Hedge-hogs	DOC200 Double-set DOC200 DOC250 CSL Multi-trap* Re:Wild F-bomb	n/a	Hedgehog capable traps at 100 m intervals on the grid.
Rab-bits	n/a	Pin-done	n/a – based on locating areas where rabbit damage, fresh scratching and faecal pellet heaps are evi-dent
Feral cats	Live-capture trapping	n/a	200 m spacing on grid lines.

*Denotes a resetting trap (as opposed to a single-set trap).

and shown in Figure 38. Baiting for rats and possums should adhere to the following specifications:

- To continue to suppress the resident rodent and possum population, both of these species will be targeted using tree-mounted Philproof bait stations containing either DoubleTap (diphacinone and cholecalciferol) or cholecalciferol. Neither of these toxins require a Controlled Substance License to use, and both are low residue and are effective for these target species. Cholecalciferol, where used, will require pre-feeding for best effect.
- Each toxic control operation should last until bait take has ceased (not including any pre-feeding, if required). After toxic bait is deployed on day 1, the amounts of bait in each bait station should be checked between days 6 - 10 (as per label instructions), and topped up if required (cholecalciferol operations may require more frequent top-ups if bait take is high to ensure target animals are able to ingest a lethal dose). Bait should then be checked and refilled (if required), after another 3 – 4 weeks. After each toxic control operation has ceased, all remaining bait will need to be brought in to reduce the risk to non-target species and the risk of target species receiving a sub-lethal dose and becoming bait-shy. If mice, rat or possum numbers exceed the thresholds outlined in

Target spe-cies	Suitable approved traps	Suita-ble ap-proved toxins	Recommended spacing
Rats (ship and Nor-way)	DOC200 Double-set DOC200 DOC250 Re:wild F-Bomb D-rat pro	Dou-bleTap (di-phaci-none and chole-calcif-erol)	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 50 m intervals along these lines. Perimeter line stations at 50 m spacing.

	CSL Multi-trap* AT220* (NA-WAC ap-proved for ship rats only)	or cho-lecal-ciferol.	
Mice	D-rat pro (mouse setting) CSL Multi-trap* Toxin in bait sta-tion	Dou-bleTap (di-phaci-none and chole-calcif-erol).	50 m grid of bait stations in Lizard Release site only.
Pos-sums	SA2 Kat trap Flipping Timmy AT220 CSL Multi-trap	Dou-bleTap (di-phaci-none and chole-calcif-erol) or cho-lecal-ciferol.	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 100 m intervals along these lines. Perimeter line at 50 m spacing
Muste-lids	DOC200 Double-set DOC200 DOC250 CSL Multi-trap* Re:Wild F-bomb	n/a	Mustelid-capable traps at 100 m intervals on the grid. Perimeter line at 50 m spacing
Hedge-hogs	DOC200 Double-set DOC200 DOC250 CSL Multi-trap* Re:Wild F-bomb	n/a	Hedgehog capable traps at 100 m intervals on the grid.
Rab-bits	n/a	Pin-done	n/a – based on locating areas where rabbit damage, fresh scratching and faecal pellet heaps are evident
Feral cats	Live-capture trapping	n/a	200 m spacing on grid lines.

*Denotes a resetting trap (as opposed to a single-set trap).

- , an additional toxic control operation will need to be conducted.

For rabbit control in areas where planting is occurring, pindone baits in bait stations should be used as per the following protocol:

- Apply bait (in bait stations) in all areas where rabbit signs are found. Avoid long grass and scrub. Provide sufficient bait to allow rabbits to feed over two or three nights.
- If all the bait is gone after the first night, more needs to be provided. In this instance, a second application of bait will be required four days after initial baiting to ensure all rabbits receive a lethal dose.

12.7 Control frequency & timing

Trapping and baiting should occur year-round across the Kings Quarry PMA. However, the frequency of trap checks and baiting varies depending on trap type and the time of year.

- Any single-set kill traps should be checked once per month between April and July (inclusive) and at least once every two weeks between August and March (inclusive). This increased level of trap checking during August to March is to ensure that these target pest mammal species are effectively controlled immediately before and during the breeding season for native birds and bats.
- Any self-resetting kill-traps need to be checked at least once per month year-round to ensure the trap is still functional, replace the lure/battery (if required), record the number of kills on the counter (if used), and collect and dispose of any carcases in the vicinity. Many of the newer trap designs remotely report to the user the battery level, remaining lure, number of target kills and undertake of a self-check on functionality. If this communication is received, traps can be serviced as identified or at a minimum every two months.
- For live-capture traps, at least two pulses lasting one week each (5 consecutive days) should occur each year: once prior to the bird breeding season in early spring and again in mid-summer.
- In the first year, a toxic operation should occur three times: in August, December, and end March/early April (~4 months apart), see Table 31. This timing aims to knock down target populations before and during the main native fauna breeding season, and to further reduce population numbers of survivors before winter (offering the maximum

biodiversity benefits for the required effort). An initial knock-down operation helps to suppress pest numbers in subsequent years, when effort may be able to be reduced.

- In all subsequent years, toxic control operations will occur twice per year in spring and autumn. This timing aims to suppress target populations before (or early in) the main native fauna breeding season, whilst reducing the burden of toxins on the environment.
- For pindone operations, bait should be used when rabbit sign is evident (i.e. via sign of plant browse, burrows and scat).
- Wasp control timing is outlined in the following section.

12.8 Wasp control

Control of wasps is limited to poisoning nests, toxic baiting and biological control (Potter-Craven et al., 2018). For large-scale operations, sustained control via toxic baiting is most effective. Fipronil (Vespex) is highly effective at reducing wasp numbers while having low non-target species risks, and is endorsed by DOC. For small-scale and direct control upon locating a nest, powdered insecticides containing permethrin (e.g. NO Wasps Eliminator) applied at the entrance of the nest are used to exterminate it.

Vespex bait for large-scale control is used with Wasptek bait stations, which are specialised for wasps and are attached to trees. The bait is left out for 3 - 8 days and then removed.

Figure 39. Application of Vespex wasp bait in Wasptek bait stations.

To determine if wasp activity is high enough to undertake control, fish bait, plain raw chicken meat, or rabbit meat can be placed on a container lid, around noon on fine days, with 5 m intervals between bait. After 1 hour, the presence of wasps can be inspected and recorded at each lid. If more than 10 wasps are present per 20 lids, control will be undertaken.

- Bait station locations should adhere to the following specifications:
- Bait stations will be spaced at 50 m intervals along tracks and existing trap and bait station locations for other target species within the Lizard Release site.
- Wasptek bait stations will be nailed onto a tree approximately 100-150 cm above the ground, so it is easy to check and service on following visits. Using gloves, 20-30 g of Vespex bait will

be placed into bait wells, using the indicator line on the bait well for indication of 20 g amount. The bait well will then be placed into the Wasptek bait station.

- Bait will be left in the well for 3-8 days, depending on wasp activity. Baiting will occur between late January and late February for effective control. Control can be repeated annually or twice annually to include control in early April, or four weeks after first application if high wasp activity persists. Bait will be left for a maximum of 8 days before remaining bait is collected and disposed of in an approved landfill.

12.9 Goat and pig control

Goat and pig populations will be managed through construction of a fence (refer to 10.4.2.2 for minimum fence standards). Following construction, any goats and pigs within the fenced area will be removed by a professional hunter using ground hunting/shooting. The fencing will protect the area from both livestock and goats and is to be of a stock-proof standard (timber post and wire design), as well as electrified to prevent pig ingress. Fencing design is detailed in see section 10.4.2.2. The fencing should be inspected and repaired as required, annually for the life of Stage 2 of the Quarry.

12.10 Pest animal monitoring

Ongoing monitoring and adaptive responses are key to effective predator management. Well-established monitoring tools will be used to monitor pest presence and assess their densities against the intended targets (see Section 12.11). Further control will be initiated if particular thresholds are exceeded.

12.10.1 Chew cards

For rodents and possums, chew cards are a common, cost-effective, and sensitive detection and monitoring tool suitable for providing a coarse index of relative abundance of a range of pests, including rats, mice, and possums. Protocols for the use of chew cards (as per National Pest Control Agencies, 2015), will be followed including:

- Chew card lines will contain 10 chew cards spaced 20 m apart (i.e. along 180 m-long lines), as per best practice for possums (National Pest Control Agencies, 2015).
- The same chew card lines are to be used year to year to enable trend monitoring and comparisons. However, lines may be repositioned in future if, for example, access becomes difficult.
- Chew card monitors (of three nights each) will be repeated four times per year (simultaneously with camera trap surveys): in February, May, August, and November. The three-night monitoring period is as recommended by Ruffell et al. (2015) for monitoring both

rats and possums, and also matches the best practice monitoring for possums (National Pest Control Agencies, 2015).

- Any bite marks recorded on the chew cards need to be identified to species level and CCI calculated to gain an estimate of relative population abundance for each target species.

12.10.2 Camera trap methods

Camera traps have become an increasingly used tool in the past five years, particularly as cameras are much more effective for detecting the larger pest species (cats, ferrets and stoats) (Norbury et al., 2017).

Note: DOC's best practice guidelines for camera trapping (and potential indices from camera trap data for key target species) are currently under development and expected to be completed in 2025. Camera trap methods and targets outlined in this document are based on the draft recommendations (Department of Conservation, 2023) and should be updated based on the final guidelines as they become available.

- For monitoring feral cats and mustelids, four cameras should be deployed along lines with each camera spaced 200 m apart in areas of preferred habitat for cats and mustelids.
- Timing and frequency: Camera trapping along each line should occur four times each year, in February, May, August, and November. This information will help to determine pest presence and assist with determining where to focus control efforts (i.e. location of additional efforts).
- On each instance, cameras should be deployed for 21 nights when fine weather is forecast.
- All camera images need to be manually viewed and scanned for appearances of target predator species (in particular stoats, ferrets, and feral cats). Cameras should be set to take three rapid-fire still photos per trigger event to increase the likelihood of capturing a clear, identifiable image. As such, animals captured in one or more image within the photo burst should only be counted as a single capture during analysis.
- The camera trap index of relative abundance for feral cats and mustelids is expressed as the mean number of detections per 2000 camera hours (2000 CH) per camera trap line (Department of Conservation, 2023). Calculations are available in the DOC camera protocol guidelines (Department of Conservation, 2023).

12.11 Proposed pest control and monitoring schedule

A summary of the pest control and monitoring is provided in Table 31, below. Rabbit control is excluded as that should be undertaken as and when rabbit sign is identified.

Table 31. Summary of timings of pest animal control and monitoring operations detailed in this Mammalian Pest Control Plan. NOTE: If pest animal thresholds are exceeded, additional control will occur in addition to this schedule.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Control operations												
Single-set kill trap checks servicing	Every 2 weeks	Every 2 weeks	Every 2 weeks	Monthly	Monthly	Monthly	Monthly	Every 2 weeks	Every 2 weeks	Every 2 weeks	Every 2 weeks	Every 2 weeks
Resetting kill trap servicing *	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Live-capture trapping	x								x			
Toxic operation (Yr 1)			x					x				x
Toxic operation (Yrs 2+)			x						x			
Wasp baiting**	x	x										
Monitoring												
Chew card monitor		x			x			x			x	
Camera trap monitor		x			x			x			x	

*If resetting traps have remote communications fitted, then this servicing interval can be adjusted based on trap information received.
** Initiation of control and duration should be based on monitoring results.

12.12 Proposed control targets

Management targets in pest control relate to the "maximum allowable residual pest abundance targets" which allow native species to recover (Brown et al., 2015). That is, the management target for each species is the ideal goal that the control actions aim to achieve. The proposed management targets for rodents, possums, cats, and mustelids, as well as the thresholds for initiating additional control measures, are based on the Chew Card Index (CCI) or camera trapping index (CH) for each target species. If monitoring identifies that the targets are not met (on any single monitor), this will trigger a requirement for further control (such as an additional toxin pulse or trap check).

Rabbit, pig, and goat control should be undertaken if this species (or their impacts) are observed within the PMA. Wasp control targets and thresholds should follow the Vespex protocol as outlined in section 11.8.

Table 32. Pest management targets and thresholds for proposed pest management areas. CCI is a chew-card index and CH refers to the number of camera hours.

Pest Species	Management Target	Threshold	Monitoring frequency
Mice	<10% CCI	>15% CCI	Four monitors per year in February, May, August, and November
Rats	<5% CCI (Sep – Feb), <10% CCI (Mar – Aug)	≥10% CCI (Sep – Feb), >15% CCI (Mar – Aug)	
Possums	<5% CCI	≥10% CCI	
Stoats	2 detections per 2000 CH	3 detections per 2000 CH	
Ferrets	2 detections per 2000 CH	3 detections per 2000 CH	
Weasels	2 detections per 2000 CH	3 detections per 2000 CH	
Feral cats	3 detections per 2000 CH	>5 individual cat detections per 2000 CH	
Wasps	As per Vespex protocol	As per Vespex protocol	
Rabbits	Initiate control if observed	Any observation (incl. sign)	
Pigs and goats	Initiate control if observed	Any observation (incl. sign)	

12.13 Data management & reporting

All control data (including both trapping and toxic control), and all monitoring data need to be entered into a single, cohesive data management system as soon after field work as possible. TrapNZ is the recommended platform, as it is widely used across New Zealand, user friendly, and can record spatial distribution of traps and catches.

The data management system needs to be set up as soon as possible. The GPS waypoints of all ground-truthed traps and their type need to be entered into the system. This includes traps that are either pre-existing or those deployed as per this plan.

All contractors and other persons undertaking pest control need to record all trapping data on the selected system. Each person/group that needs to access the system, will need an account and be instructed on how to enter the required information correctly.

For each trap check, all data needs to be accurate and complete, as per the minimum information to be recorded below:

- Date of servicing;
- Name of the trap/toxin servicer;
- Device location, unique identifier, model type and model name;
- Lure type and whether the lure was refreshed;
- Whether the trap has been triggered (trap status)/ strike count for self-resetting traps;
- Trap catch (species); and if possible/relevant: sex and age of individual, number of individuals, or record trap catch as zero if nothing is caught;
- Bait type and quantity deployed (for bait stations); and
- General comments (e.g. if trap needs fixing or replacing, if bait is gone).

Maintaining accurate and precise records of both pest control and pest monitoring are crucial to evaluate the success of predator control at each site. Spatial and temporal trends in pest populations and catch rates can be identified in the analysis of this data, which can then inform future pest management decisions.

An annual pest management report will be prepared and provided to Auckland Council. Each annual report (submitted by end of June each year) needs to include:

- A summary of all pest control activities undertaken in the preceding 12 months, detailing dates, and methods of each control activity:
- Maps of control devices/area, labelled by type;
- Summaries of trap catch statistics by species (both target and any non-target catch), including by trap type, trap location, lure type as well as CCI and CCH of rats, possums, and mustelids, with comparison to management targets and thresholds for additional control;
- Summaries of results of toxic control operations, including target species, bait type and bait take;
- Any trends in the data, such as high-catch/high bait-take locations, the main species caught and comparisons to previous years; and
- Any challenges/issues encountered in undertaking control or monitoring, and how these difficulties were overcome or if they remain ongoing.

Pest control tools, technologies, and methods are evolving at a rapid rate, with many new tools coming into the market. These new tools will greatly enhance the efficiency of predator control regimes. A review of emerging pest management tools and technology should be undertaken annually. Any new tools should be incorporated into the following years' pest management practice if suitable. The tools recommended for use in this plan are based on those currently available at the time of writing. However, they should be supplemented or replaced with improved tools with proven efficacy as those come to market, where there is benefit in doing so.

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APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

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Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

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