Department of Conservation
Te Papa Atawhai

Consent under the Wildlife Act 1953 for the purposes of undertaking recovery work under the Severe Weather Emergency Recovery (Waka Kotahi New Zealand Transport Agency) Order 2023

Authorisation Number: 113645-FAU

PURSUANT to an application made under **section 71** of the **Wildlife Act 1953** (as modified by cl. 45 of the Severe Weather Emergency Recovery (Waka Kotahi New Zealand Transport Agency) Order 2023) the **MINISTER OF CONSERVATION ('the Grantor')** grants **Waka Kotahi New Zealand Transport Agency ('the Consent Holder')** a Consent to take or kill any wildlife, or carry out any activity in respect of protected wildlife, in the course of carrying out recovery work at the location(s) referred to in this Consent.

This Consent is granted under **section 71** of the **Wildlife Act 1953** as modified by **clause 45** of the **Severe Weather Emergency Recovery (Waka Kotahi New Zealand Transport Agency) Order 2023.**

This consent is subject to the conditions prescribed in Schedule 4 of the Severe Weather Emergency Recovery (Waka Kotahi New Zealand Transport Agency) Order 2023

Consented activity in respect of wildlife:	To take or kill wildlife, or carry out any activity in respect of protected wildlife; or to do anything in respect of any protected wildlife, or any land forming part of a wildlife sanctuary, to the extent it relates to the Government Roading Powers Act 1949.
Term:	This consent is valid from 1 February 2024 and ending on 31 January 2026
Location(s) in which recovery work will be undertaken:	**Location:** Site located in the Brynderwyn Hills, SH1 which begins 36.080032, 174.428293 and ends at -36.080032, 174.428293 (NZTM co-ordinates: x 1727470.55 and y 6011433.3 to x 1728749.67 and y 6004365.27) Works are within road reserve and adjacent properties and do not extent more than 50 m either side of the State highway. And as shown in the map in **Schedule 1**
Species:	This consent relates to the protected wildlife species listed in **Schedule 2**.

Definitions

Advice note is guidance material developed by Department of Conservation staff during assessment of this consent application. The Grantor has included them in this consent as supplementary advice to the conditions in Schedule 4. The intention of providing this best practice advice is to further reduce the impacts of the recovery works authorised by this consent.

Guidance note is advisory material published in Schedule 4 of the Severe Weather Emergency Recovery (Waka Kotahi New Zealand Transport Agency) Order 2023. This material is part of the order and part of the Schedule 4 conditions that must be complied with.

As defined in Clause 4 of the Severe Weather Emergency Recovery (Waka Kotahi New Zealand Transport Agency) Order 2023

Agency means Waka Kotahi New Zealand Transport Agency

At-risk or threatened species means any organism (including a plant, an animal, or a fungi) categorised by the New Zealand Threat Classification System administered by the Department of Conservation as at risk or threated.

Protected Wildlife has the meaning set out in section 3 of the Wildlife Act 1953.

Recovery Work means -

(a) any activity that, because of or in connection with a severe weather event, it is necessary or desirable to undertake, without undue delay, to restore the function of an affected road route and enable it to be used fully, effectively, and safely; and

(b) includes any activity necessary or desirable to—

(i) repair or rebuild an affected road route in the same or a similar location; and

(ii) enhance the safety and improve the resilience of an affected road route

Significant Wildlife includes -
(a) at-risk or threatened species;
(b) protected wildlife;
(c) taonga species.

Conditions attached to this Consent

SEVERE WEATHER EMERGENCY RECOVERY (WAKA KOTAHI NEW ZEALAND TRANSPORT AGENCY) ORDER 2023

SCHEDULE 4: CONDITIONS FOR WAIVERS, CONCESSIONS, AUTHORITIES, AND CONSENTS UNDER CONSERVATION ACT 1987, RESERVES ACT 1977, AND WILDLIFE ACT 1953

1 – Authorised activities

(1) The conditions in this schedule apply to—

(a) a concession issued for recovery works—

(i) on land held under the Conservation Act 1987; or

(ii) in a Crown reserve managed by the Department of Conservation under the Reserves Act 1977; or

(iii) in a wildlife sanctuary, wildlife refuge, or wildlife management reserve vested in the Crown and managed by the Department of Conservation under the Wildlife Act 1953; and

(b) an authorisation or a consent, or a waiver of the requirement for an authorisation or a consent, for recovery works under the Wildlife Act 1953–

(i) to take or kill any wildlife; or

(ii) to do anything in respect of any protected wildlife, or any land forming part of a wildlife sanctuary, to the extent it relates to the Government Railways Act 1949.

(2) A copy of these conditions and any applicable management plans must be kept electronically or in hard copy on-site at all times that construction works are being undertaken.

(3) The Agency must make contractors aware of the requirement to comply with these conditions, including through the implementation of the respective management plans.

2 – Definitions

In this schedule, –

construction works means the works to be carried out as part of the project, excluding minor works and operational activities

ecological principles means the ecological principles set out in clause 5(2)

minor works means preliminary activities, including geotechnical investigations and establishment of mitigation measures, and minor upgrading and repair

operational activities means works associated with the ongoing operation and maintenance of the project following construction works

project means—

(a) any activities in paragraph (b) that it is necessary or desirable to undertake because of or in connection with the severe weather events:

(b) activities that are temporary and permanent activities for rail transport, requiring approvals under any of the enactments specified in clause 1.

3 – Stakeholder and communications plan

The Agency must provide any stakeholder and communications plan prepared under Schedule 3 to the Department of Conservation as soon as practicable after it is finalised.

4 – Affected area recovery liaison groups

The affected area recovery liaison groups set up under Schedules 2 and 3 also have the same functions in relation to recovery works undertaken under this schedule.

5 — Ecology

(1) The Agency must appoint a suitably qualified and experienced ecologist (a **project ecologist**) for the duration of the construction works to inform the design, management, and monitoring of all construction works.

Ecological principles

(2) The following ecological principles must be used to guide the project design and construction (temporary and permanent works):

(a) to avoid as far as practicable, and minimise,—

(i) permanent habitat loss (including in coastal, terrestrial, and freshwater habitats):

(ii) loss of naturally uncommon and highly depleted ecosystem types, significant indigenous vegetation, significant habitats of indigenous fauna, and habitats for at-risk or threatened species and taonga species:

(iii) habitat fragmentation or habitat barriers (including in coastal, terrestrial, and freshwater habitats):

(iv) impacts on habitat connectivity (including coastal, terrestrial, and freshwater habitats):

(v) impacts on at-risk or threatened species and taonga species:

(vi) adverse effects on water quality (including on kaimoana and mauri) from sediment:

(vii) to the extent practicable, alteration of natural hydrology patterns:

(viii) the potential for the spread or establishment, or both, of pest plants or animals (including in coastal, terrestrial, and freshwater habitats):

(ix) impacts on habitats that play an important role in the life cycle and ecology of native species:

(b) as far as practicable, to create safe habitats, especially for significant wildlife.

Ecological scoping survey

(3) Before construction works begin, 1 or more suitably qualified and experienced ecologists must, together with any suitably qualified and experienced person nominated by the relevant iwi and hapū, complete an ecological scoping survey and a subsequent ecological effects assessment of the relevant construction works area, and adjacent areas, including to—

(a) identify any naturally uncommon ecosystems; and

(b) identify any at-risk or threatened species; and

(c) identify any taonga species (*see* guidance note at clause 6) that may be adversely affected during or as a result of construction works; and

(d) identify any protected wildlife; and

(e) determine whether kauri dieback disease or myrtle rust is present or possibly present.

(4) The ecological scoping survey and subsequent ecological effects assessment must be carried out in general accordance with Appendix 1 of the National Policy Statement for Indigenous Biodiversity.

(5) The Agency must provide a copy of the final ecological scoping survey and subsequent ecological effects assessment to each member of the affected area recovery liaison group as soon as practicable after completion.

(6) For the purposes of this clause, **highly depleted** means less than 20% of indigenous cover remains in the land environment.

6 — Minimising ecological loss

(1) If any of the following are identified in the ecological scoping survey carried out under clause 5(3), the project ecologist, in association with the wider project team, must develop and implement measures to avoid, as far as practicable, or to minimise any potential adverse effects on those things, taking into account the ecological principles, including the preparation of ecological management plans, and wildlife management plans, if required:

(a) naturally uncommon ecosystems:

(b) at-risk or threatened species:

(c) taonga species:

(d) protected wildlife:

(e) kauri dieback disease:

(f) myrtle rust.

(2) Any measures taken under subclause (1) must be—

(a) recorded by the Agency at regular intervals during the term of construction; and

(b) reported by the Agency to the affected area recovery liaison group every 2 months together with any recommendations by the project ecologist, after consulting with the relevant Māori entities, to change those measures.

Ecological management plans and wildlife management plans

(3) The Agency must, as directed by the Department of Conservation, submit any ecological management plans and wildlife management plans prepared under subclause (1) to that Department for certification 5 days before the commencement of construction works.

(4) The Agency must provide a copy of any ecological management plans and wildlife management plans to the members of the affected area recovery liaison group.

(5) The Agency must implement and comply with any ecological management plans and wildlife management plans for the duration of the construction works.

(6) A wildlife management plan must include measures to ensure compliance with clauses 8 to 12 (General conditions), to the extent relevant.

Habitat loss

(7) The Agency must keep a record of any habitat identified in the following documents that is lost as a result of the project:

(a) the ecological scoping survey carried out under clause 5(3):

(b) the subsequent ecological effects assessment carried out under clause 5(3):

(c) any ecological management plans prepared under subclause (1).

Guidance note

The Agency should engage with the relevant Māori entities to identify taonga species that may be present in the project area.

Advice note

As part of their application, NZTA has set out the following additional post-construction compensation measures (italicised) to compensate for adverse effects in relation to this recovery work and ensure net adverse effects are not more than minimal.

- *To enhance the survival rates, carry out pest control for a period of 10 years (including goats, pigs, possums, stoats, weasels, rats, wasps and weeds) to maximise the chance of successful establishment of salvaged fauna throughout the 78 ha of Crown land adjacent to the works site.*

Pest control should also target ferrets, as they are a known predator of native frogs.

It is considered that a 50 x 50 m grid network of bait stations and traps is required to have the best chance of managing most introduced animal pests at this site. If mice are to be controlled, current DOC advice is that this grid needs to be even denser at 25 x 25 m. In this case, 50 x 50 m is considered sufficient if there is sufficient result monitoring. This would require many rodent tracking tunnels and/or best practice camera trap methodology. If this was done well, this may allow us to know, over time, whether this level of pest control is sufficient to be of benefit to Hochstetter's frogs. Adaptive management may be required if rodents aren't able to be consistently controlled to below 5% tracking rate; for example, the area of pest management may have to increase.

- *Provision of additional cover (constructed from natural materials originating in the impact area) at all release sites to minimise risk of predation for the released individuals.*

- *A financial contribution to be put towards a project that increases the knowledge and understanding of Hochstetter's frogs. This figure is to be agreed with DOC. NZTA would potentially contribute between $100,000 and $200,000 depending on the type and nature of the project/s that DOC puts forward for consideration.*

The proposed $200,000 will serve to fund research providing greater understanding of Hochstetter's frogs, including the impacts of relocations and outcomes. Several potential uses for this fund are being considered and will be shared with NZTA following further technical input.

In conjunction with the above, NZTA may also cover the following under the Resource Management Act 1991 application:

- *An aquatic offset package of a scale determined by application of the SEV/ECR methodologies such that the overall level of effect is reduced to minima – likely including rehabilitation of the Piroa Stream (downstream of project site) and selected adjacent wetlands by means of riparian/wetland planting, geomorphological rehabilitation and hydrological improvements.*
- *A terrestrial mitigation/offset package that satisfies the requirements of the BOAM/BCM models.*

Hydroseeding could include native species:– locally sourced manuka (*Leptospermum scoparium/Leptospermum hoipolloi*), kanuka (*Kunzea robusta*), northern rātā (*Metrosideros robusta*), pōhutukawa (*Metrosideros excelsa*) and possibly *Gahnia setifolia* (which is fruiting heavily in the vicinity at the moment, and would be a seed that would survive rough handling that might occur in machinery. Locally sourced manuka and kanuka were included in the hydroseeding mix for Mangamuka Gorge rehabilitation, so the material should be available.

Rehabilitation of over slip B5 could include carmine rātā (*Metrosideros carminea*). This species occurred on the hard rock surface in the middle of the slip prior to the cyclone occurring, and would have probably survived it, if remedial works hadn't been needed. Carmine rātā is currently ranked as Threatened–Nationally Vulnerable (de Lange et al 2018) because of its potential susceptibility to myrtle rust and would also be regionally significant if a local assessment had been undertaken.

General conditions

7 — General conditions relating to wildlife

(1) The conditions in clauses 8 to 12 apply to all projects, in addition to any specific conditions in clauses 20 to 24 that apply.

(2) The Agency must provide the Department of Conservation with a written summary of all construction works, no later than 2 months after the completion of those works.

(3) The summary must include—

(a) a general description of the works undertaken:

(b) location of the works:

(c) maps of the works:

(d) designs of any structures erected in waterways.

8 – Procedure for incidental discovery of significant wildlife

(1) The Agency must have a procedure for incidental discovery, including as part of indigenous woody vegetation management, of significant wildlife not identified in the ecological scoping survey or the ecological effects assessment.

(2) The procedure for incidental discovery must include—

(a) immediately notifying the Department of Conservation of the discovery, and compliance with any advice given, or obligations imposed, by the Department; and

(b) appointment of a suitably qualified and experienced expert approved by the Department of Conservation to develop a management plan for the discovered species, if required by the Department:

(c) an application for authority or consent in respect of the species, if applicable.

9 — Salvage, capture, handling, and relocation of native lizards and frogs, and at-risk or threatened invertebrates

(1) The Agency may only release a native lizard or frog, and an at-risk or threatened species of invertebrate, into a release site—

(a) of similar or better habitat than the source location, and capable of supporting that lizard, frog, or invertebrate; and

(b) that is within 500 m of the project footprint (or other release sites if approved by the Department of Conservation); and

(c) where the habitat for that lizard, frog, or invertebrate has been enhanced and approved by the Department of Conservation before relocation.

(2) The Agency must ensure that salvage, capture, handling, and relocation of native lizards and frogs, and at-risk or threatened species of invertebrates, is undertaken in a manner and at a time determined to be appropriate by suitably qualified and experienced experts.

(3) The Agency must ensure (except where the native lizard or frog, or at-risk or threatened species of invertebrate, is identified under the incidental discovery protocol) that the suitably qualified and experienced experts referred to in subclause (2) are at the on-site induction before construction work commences.

10 — Salvage reporting for lizards, frogs, and invertebrates relocated under clause 9

(1) The Agency must submit, to the Department of Conservation each year for the duration of the project, a salvage report for any lizards, frogs, and invertebrates that are relocated under clause 9.

(2) The salvage report must include—

(a) the species, and number of each species, of lizards, frogs, and invertebrates captured and released; and

(b) the GPS location, or a detailed map, or both, of the collection points and release points; and

(c) copies of any permits for those species; and

(d) results of all surveys and monitoring.

(3) The Agency must send completed amphibian and reptile distribution system (**ARDS**) cards for all herpetofauna sightings and captures to the Department of Conservation, within 1 week of the sighting or capture.

11 – Injury and euthanasia of significant wildlife

(1) If any significant wildlife is injured in the course of the project, the Agency must take all reasonable steps to—

(a) immediately address the injury; and

(b) rehabilitate the wildlife, in consultation with the Department of Conservation.

(2) The Agency must not euthanise an injured animal that is significant wildlife unless—

(a) a veterinarian recommends euthanasia on animal welfare grounds; or

(b) the Agency euthanises the animal under direction of the Department of Conservation.

(3) Despite subclause (2), a bat may be euthanised only by a veterinarian.

(4) The Agency must notify the Department of Conservation within 48 hours of euthanising significant wildlife.

(5) The notification must include details of the species euthanised and the personnel involved in the euthanising.

12 – Death of protected wildlife during course of project

If any protected wildlife is killed during the course of the project, the Agency must—

(a) inform the Department of Conservation within 24 hours; and

(b) comply with any requirements imposed by the Department, for example,—

(i) chilling the body if it can be delivered for necropsy within 72 hours:

(ii) freezing the body if delivery for necropsy will take longer than 72 hours:

(iii) ceasing the project for a period agreed by the Department and the Agency, after reasonable discussions, but in any event not exceeding 3 months.

13 — Indigenous woody vegetation management

(1) When indigenous woody vegetation is felled, the Agency must, as far as practicable, move the vegetation a minimal distance outside the proposed project footprint to a location of similar indigenous woody habitat.

(2) Before mulching felled indigenous woody vegetation, the Agency must, as far as practicable, identify, catch, and remove any native lizards and frogs, and at-risk or threatened species of invertebrates, that are within the vegetation.

Guidance note

The Agency may notify the Department of Conservation about incidental discovery of significant wildlife by calling 0800 DOC HOT.

The Agency must ensure that capture and handling methods (including North Island kiwi egg removal) follow those described in the inventory and monitoring toolbox at http://www.doc.govt.nz/our-work/biodiversity-inventory-and-monitoring

---

Advice note

All felled vegetation shall be piled up at the nearest suitable location and not chipped. If chipping (or moving material offsite) is deemed to be absolutely necessary, then at least 10 lizard surveys (both diurnal and nocturnal) shall occur in each pile of vegetation to be chipped or moved, over at least three weeks post-felling.

Concessions on certain lands

14 — Avoidance, remediation, or mitigation of adverse effects concessions

(1) The obligations in this clause apply in relation to any project associated with a concession on land to which the Conservation Act 1987, the Reserves Act 1977, or the Wildlife Act 1953 applies.

(2) Any project associated with a concession for construction works on land to which the Conservation Act 1987, the Reserves Act 1977, or the Wildlife Act 1953 applies must be undertaken by the Agency so as to avoid, as far as practicable, and to remedy or mitigate, adverse effects on the values for which that land is held.

Heritage and cultural impact assessment

(3) Before starting construction works, the Agency must appoint a suitably qualified and experienced heritage and cultural adviser to work with any heritage and cultural adviser nominated by the relevant Māori entity or entities to prepare a heritage and cultural impact assessment.

(4) The heritage and cultural impact assessment must—

(a) identify any heritage sites or cultural values and potential impacts on them from the proposed construction works; and

(b) identify any taonga species that are present or likely to be present.

(5) If any heritage sites or cultural values are identified in the heritage and cultural assessment, the heritage and cultural adviser must work with any person nominated by the relevant Māori entity or entities (other than a cultural or heritage adviser), and with the wider project team, to develop and implement measures to avoid, as far as practicable, or minimise or remedy, any adverse effects to those sites or values.

Guidance note

Nothing in these conditions permits the destruction or management of archaeological sites, historic objects and artefacts, and koiwi tangata (human bones), which requires authorisation under the Heritage New Zealand Pouhere Taonga Act 2014 and the Protected Objects Act 1975. If any discovery is made that requires notification or approval under that legislation, the Agency must also notify the Department of Conservation and the relevant Māori entity or entities.

---

15 – Earthworks and construction management plan and site rehabilitation plan

(1) The clause applies to any projects associated with a concession to which the Conservation Act 1987, the Reserves Act 1977, or the Wildlife Act 1953 applies.

(2) The Agency must develop an earthworks and construction management plan for the project that provides for the following outcomes:

(a) minimising the area of indigenous vegetation clearance and disturbance:

(b) minimising the area and volume of earthworks:

(c) maximising the effectiveness of erosion and sediment control measures:

(d) minimising the adverse effects on significant wildlife during the construction and operational phases, including light and noise:

(e) controlling, as far as practicable, and mitigating the adverse effects of any dust emissions:

(f) minimising the effects, and introduction, of weeds:

(g) biosecurity management that complies with clause 23.

(3) The Agency must submit the draft earthworks and construction management plan to the Department of Conservation for certification before construction works begin and must comply with the certified earthworks and construction management plan.

Site rehabilitation plan

(4) The Agency must develop a site rehabilitation plan that includes—

(a) ecologically appropriate vegetation cover and habitat; and

(b) pest and weed control; and

(c) other site-specific actions required to rehabilitate the site and its wildlife habitat.

(5) The site rehabilitation plan may form part of the earthworks and construction management plan.

(6) The Agency must submit the site rehabilitation plan to the Department of Conservation for certification before the completion of construction works and must comply with the certified site rehabilitation plan.

Management plans for particular species

16 – Frog management plan

(1) If the ecological scoping survey carried out under clause 5(3) identifies the presence or possible presence of native frogs within the project footprint, the Agency must appoint a suitably qualified and experienced herpetologist approved by the Department of Conservation to develop a frog management plan.

(2) The frog management plan must include—

(a) capture, handling, containment, and release techniques; and

(b) actions to prevent and mitigate frog habitat damage; and

(c) details for any frog salvage operation, which must include provision for—

(i) the approved herpetologist to be on site for any salvage operation; and

(ii) a frog survey and salvage relocation to be undertaken no earlier than 2 weeks before construction works begin; and

(iii) a second frog survey and salvage relocation the day before construction works begin; and

(iv) the use of drift or exclusion fences to deter frogs from re-entering the project footprint, if appropriate; and

(v) minimisation of trampling and disturbance of frogs and their habitat outside the project footprint by—

(A) using the same marked access routes for access to and from survey and release sites; and

(B) avoiding habitats that could easily be crushed or collapse (for example, stream seepages that could collapse if disturbed); and

(C) releasing frogs using a system that avoids the risk of released frogs being disturbed or trampled.

Guidance note

Agencies can access ARDS cards at: https://www.doc.govt.nz/our-work/reptiles-and-frogs-distribution/atlas/species-sightings-and-data-management/report-a-sighting/

17 – Lizard management plan

(1) If the ecological scoping survey carried out under clause 5(3) identifies the presence or possible presence of native lizards within the project footprint, the Agency must appoint a suitably qualified and experienced herpetologist approved by the Department of Conservation to develop a lizard management plan.

(2) The lizard management plan must include—

(a) capture and handling techniques, including processes for—

(i) using live capture traps; and

(ii) sterilisation of instruments; and

(iii) temporary containment of lizards; and

(b) actions to prevent and mitigate lizard habitat damage; and

(c) details for any lizard salvage operation, including—

(i) the proposed relocation release site; and

(ii) management of the proposed relocation release site, including provisions for protection of relocated lizards; and

(iii) timing of relocation; and

(iv) how post-release monitoring will be undertaken; and

(v) actions to be followed if threatened lizard species are found within the project footprint; and

(vi) habitat enhancement; and

(vii) pest management.

18 – Bat management plan

(1) If the ecological scoping survey carried out under clause 5(3) identifies the presence or possible presence of bats or bat roost sites within the project footprint, the Agency must appoint a suitably qualified and experienced biologist approved by the Department of Conservation to develop a bat management plan.

(2) The bat management plan must include—

(a) capture, handling, containment, and release techniques; and

(b) actions to prevent and mitigate bat habitat damage, including that—

(i) bat maternity roosts must not be felled; and

(ii) trees must be searched for bats before felling.

Specific conditions for particular species

19 – Specific conditions: native frogs

(1) This clause applies when the ecological scoping survey carried out under clause 5(3) identifies the presence or possible presence of native frogs.

(2) The Agency must prevent the spread of chytrid fungus and other pathogens to, within, and between capture and release sites for native frogs.

Destructive habitat searches

(3) Where vegetation is to be removed or the ground physically disturbed, the Agency must ensure that the vegetation or ground is searched by hand using destructive habitat searches to locate Hochstetter's frogs or Archey's frogs.

(4) Any Archey's frogs that are located must be released within 24 hours of capture into suitable habitat at least 100 m outside the project footprint.

(5) Any Hochstetter's frogs that are located must be released within 24 hours of capture into a suitable habitat in a nearby stream corridor that is unaffected by the project.

Native frog injuries and euthanasia

(6) If any frogs are found injured during the project, the Agency must take all reasonable steps to immediately address the injury.

(7) The Agency may euthanise an injured frog if that is recommended by the Department of Conservation-approved herpetologist or a veterinarian.

Frog salvage reporting

(8) The Agency must submit a report to the Department of Conservation within 3 months after any frog salvage is completed.

(9) The report must include—

(a) the Agency and a description and map of the location and project; and

(b) the relevant authorisation number; and

(c) a summary of all frog surveys and salvage operations, including frog survey and salvage methodologies; and

(d) the species and number of frogs observed, collected, and released; and

(e) the GPS location of the collection points and release points for each frog; and

(f) the results of all surveys, and salvage relocations, including date, weather conditions, search effort, frog age class (sub-adult, adult), and habitat type at capture and release points; and

(g) any difficulties encountered with capture and handling of frogs; and

(h) records of any frogs injured, euthanised, or killed.

Guidance note

Frog capture and handling methods must follow those described in the Herpetofauna inventory and monitoring toolbox http://www.doc.govt.nz/our-work/biodiversity-inventory-and-monitoring/herpetofauna/

The spread of chytrid fungus and other pathogens may be avoided by following the Frog Hygiene Protocol.

Advice note

Hochstetter's frog's may 'home' back to the site they were moved from, or may as part of normal behaviour, recolonise waterways they were salvaged from. As part of the frog management plan, additional mitigation measures should be taken before works commence each day to give greater confidence Hochstetter's frogs are not present in waterways or stream-side areas that will be affected by works, in every 24-hour period. Specifically, frogs should be surveys for every morning (after sunrise) before works commence in any waterway. All frogs found shall be captured, measured (length), and photographed, then moved the proposed distance upstream.

Frog relocation protocols should include appropriate outcome monitoring to understand the fate of relocated frogs. Outcome monitoring should address challenges identifying individual Hochstetter's frogs.

Outcome monitoring may involve toe clipping (a very small amount of toe material taken from the same toe in each catchment so that frogs in different catchments can be distinguished). If these frogs are detected in future monitoring their fate will be known. Toe clipping requires support from mana whenua for this method to be used.

If toe clipping is not approved, outcome monitoring will require calculating frog density numbers and then determining whether there has been a change before and after the works.

---

20 – Specific conditions: native lizards

(1) This clause applies when the ecological scoping survey carried out under clause 5(3) identifies the presence or possible presence of native lizards.

Destructive habitat searches

(2) Where vegetation is to be removed or the ground physically disturbed as part of the project, the Agency must ensure that the vegetation or ground is searched for lizards by hand using destructive habitat searches.

(3) Any lizard species identified in a destructive habitat search must be salvaged and relocated, in accordance with the lizard management plan, to similar habitat at least 100 m outside the project footprint.

Lizard salvage reporting

(4) The Agency must submit a report on lizard salvage to the Department of Conservation each year during the project.

(5) The lizard salvage report must include—

(a) the authorisation number; and

(b) the species and number of any lizards captured alive and released; and

(c) the species and number of any lizards found dead; and

(d) results of all monitoring; and

(e) a description of how the lizard management plan was implemented, including—

(i) any difficulties encountered with capture of live lizards; and

(ii) post-release monitoring; and

(iii) details of any contingency actions undertaken.

Guidance note

Capture and handling methods for lizards must follow those described in the Herpetofauna inventory and monitoring toolbox http://www.doc.govt.nz/our-work/biodiversity-inventory-and-monitoring/herpetofauna/

Advice note

All lizards found should be attempted to be captured and moved to a site with similar habitat to a central position within the post construction pest control zone i.e. the 78 ha of Crown land adjacent to the recovery works site.

21 – Specific conditions: bats

(1) This clause applies when the ecological scoping survey carried out under clause 5(3) identifies the presence or possible presence of bats.

Vegetation felling

(2) Where vegetation is to be removed as part of the project, the Agency must ensure that all tree felling is undertaken in accordance with the tree felling protocol at doc-bat-roost-protocol-nz-Oct 2021.pdf.

Bats found during course of project

(3) If bats are found during the course of the project, or if any bat is killed or injured during the course of the project, the Agency must—

(a) immediately stop the construction works; and

(b) review the bat management plan in conjunction with the Department of Conservation and, before recommencing construction works, agree with the Department a process to prevent or minimise any further killing of or injury to bats; and

(c) take any injured bat to a veterinarian in accordance with subclause (4); and

(d) report any bat death or injury to the Department of Conservation within 48 hours.

Injured bats

(4) The Agency must ensure that any injured bat is taken to a veterinarian approved by the Department of Conservation.

(5) If the veterinarian determines that the bat is in a healthy condition, a chiropterologist approved by the Department of Conservation and appointed by the Agency may immediately release the bat.

Bat release

(6) The Agency must ensure that when bats are released, they are released—

(a) outside the project footprint; and

(b) into appropriate habitat (as determined by the chiropterologist) at least 1 hour after dusk and before midnight; and

(c) in approximate environmental conditions (little to no rain with temperatures above 12 degrees Celsius).

Bat monitoring report

(7) The Agency must provide a report of all bat monitoring data to the Department of Conservation—

(a) at the conclusion of the tree felling; and

(b) at any reasonable time during the tree felling, on request by the Department.

Guidance note

The Agency must ensure that all tree felling in areas where bats have been identified as being present or likely to be present is undertaken in accordance with the approved tree felling protocol available at doc-bat-roost-protocol-v2-oct-2021.pdf

---

22 – Specific conditions: certain birds

(1) This clause applies when the ecological scoping survey carried out under clause 5(3) identifies the presence or possible presence of kiwi or kōkako.

Kiwi

(2) The Agency must ensure that all projects undertaken in areas where kiwi are present or possibly present are undertaken in accordance with the kiwi best practice manual available at https://www.doc.govt.nz/globalassets/documents/science-and-technical/sap262entire.pdf.

(3) The Agency must ensure that kiwi are only captured using the assistance of a contracted and certified kiwi dog handler.

Kōkako

(4) If nesting kōkako or kōkako nests are observed in the project area, the Agency must—

(a) immediately stop all construction works; and

(b) immediately notify the Department of Conservation; and

(c) resume construction works only when authorised to do so by the Department of Conservation.

23 – Specific conditions: biosecurity

(1) This clause applies when the ecological scoping survey carried out under clause 5(3) identifies the presence or possible presence of kauri dieback or myrtle rust.

Kauri dieback

(2) The Agency must prevent the spread of the pest organism *Phytophthora taxon Agathis*, to the extent reasonably practicable.

(3) The Agency must ensure that all vehicles and equipment, including clothing, are thoroughly cleaned of all visible soil and that footwear once cleaned is sprayed with SteriGENE solution before they enter, and when they move between, areas where there are kauri.

Advice note

Phytophthora agathidicida (PA) is not restricted to the "top soil" and can penetrate to a depth where it is stopped by hard clay or bedrock. Soil management practices must account for this.

All kauri trees that will be impacted by the works should be tested. The complexity of any tree removal and earthworks operation may change depending on

- all trees being tested and all the results being "not detected",
- some trees only being tested and "not detected",
- and some trees being "contaminated".

If an isolated tree has not been tested it and its soil will need to be treated as contaminated. These trees and positive trees will need to follow felling and removal guidelines (Guide_Pruning-or-removing-kauri.pdf (kauriprotection.co.nz)).

There are different responses required for disposal of material that is known to be PA positive, and material where PA is not detected. Contaminated material (trunk, roosts, soil) needs a permit to move that material between sites from MPI (section 53 of the Biosecurity Act), and need to go to specific landfills (Guide_disposing-contaminated-PA-material.pdf (kauriprotection.co.nz)). The uncontaminated material can be taken to other places including the proposed landfill sites beside the highway.

All soil and organic material from within Kauri Hygiene Areas (KHA) is to be disposed on within the KHA. Disposal of material on site means within three times the radius of a tree or group of trees. If required, material is to be placed in specified disposal locations with appropriate controls within designated fill sites.

Consider doing the kauri associated soil and contaminated tree work last so the movement of that material will not impact progress/movement of trucks from other parts of the project.

All vehicles, equipment plant and machinery shall be washed with SteriGENE® 2% solution upon entry into the Project Site. Wash/hygiene stations shall be kept clean, maintained and in working order. Vehicles and equipment can be washed in water and then sprayed with SteriGENE® 2%.

Myrtle rust

(4) The Agency must prevent the spread of myrtle rust, to the extent reasonably practicable.

(5) Before starting construction works, the Agency must appoint a suitably qualified and experienced expert to complete a scoping survey to identify—

(a) whether plants that can be affected by myrtle rust are present; and

(b) whether any of those plants are affected by myrtle rust.

(6) If plants that can be affected by myrtle rust are identified in the scoping survey, the Agency must ensure that all personnel on the project site are familiar with plants affected by myrtle rust and able to identify myrtle rust signs.

(7) If plants that are affected by myrtle rust are identified in the scoping survey or during the project, the Agency must—

(a) contact MPI to report the discovery of myrtle rust, and comply with any requirements imposed by MPI; and

(b) immediately bag any clothing or materials that have come into contact with the affected plant or plants; and

(c) avoid any disturbance or handling of the affected plant or plants (including sample collection).

Advice note

There are significant freshwater species, including shortfin and longfin eel, known or predicted to be within the area of these recovery works. Schedule 4 does not contain conditions specific to these species and advice is provided here.

Timing of works should consider limiting disruption to the spawning activity of crayfish and also the key downstream migration periods for eel species (during autumn months).

Species management plans should ensure post-relocation monitoring for relocated aquatic life.

With regard to fish passage, regulation 70 of the NES Freshwater does not differentiate between species according to their ability to overcome barriers. Rather, steep culverts are a type of structure for which there are no national standard of fish passage solution.

SIGNED on behalf of the Grantor by Joel Lauterbach, Operations Manager, Whangārei

Acting under delegated authority in the presence of:

Witness Signature:

Witness Name: Stephanie Bowman

Witness Occupation: Civil Servant

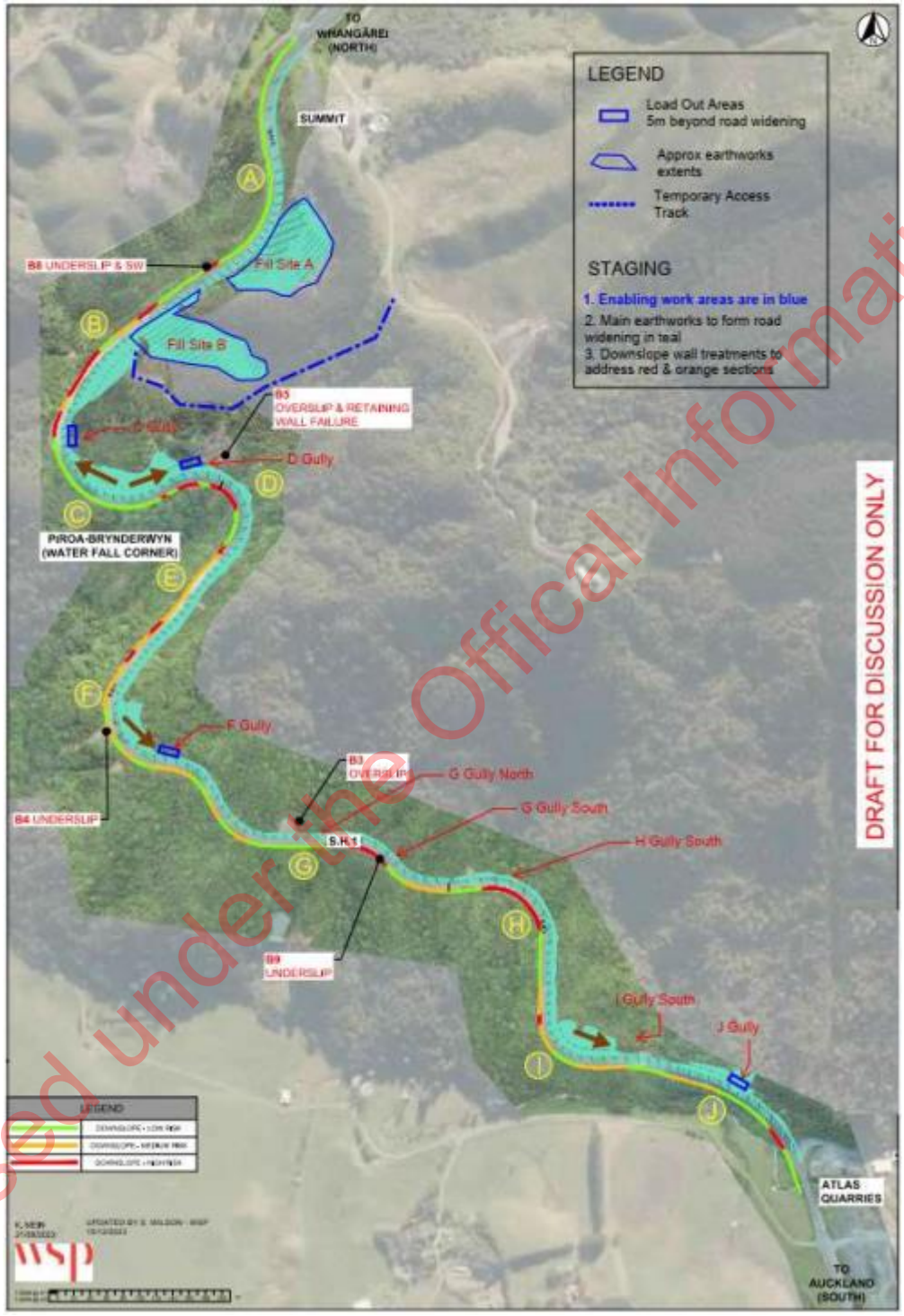
Witness Address: Hamilton

A copy of the Instrument of Delegation may be inspected at the Director-General's office at 18-22 Manners Street, Wellinton.

Department of Conservation
Te Papa Atawhai

Schedule 1

Location of recovery works



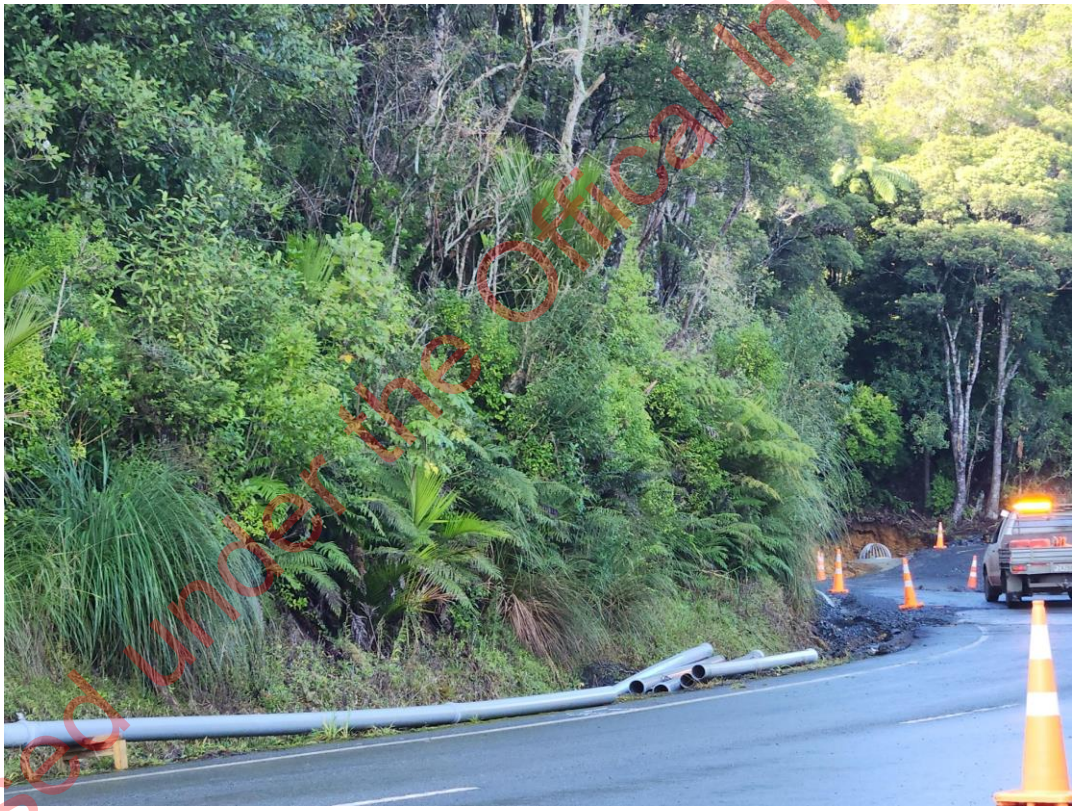
SH1 recovery works location aerial map (note Fill Sites A and B are excluded from this application and not included in this Authorisation)

Schedule 2

Protected species this consent is about

Common Name	Scientific Name	Threat Status
Rhytid snail	*Amborrhytida dunniae*	*At Risk - Declining*
Kauri snail	*Paryphanta busbyi*	*At Risk - Declining*
Forest gecko	*Mokopirirakau granulatus*	*At Risk - Declining*
Elegant gecko	*Naultinus elegans*	*At Risk - Declining*
Copper skink	*Oligosoma aeneum*	*At Risk - Declining*
Ornate skink	*Oligosoma ornatum*	*At Risk - Declining*
Pacific gecko	*Dactylocnemis pacificus*	*Not Threatened*
Hochstetter's frog	*Leiopelma hochstetteri*	*At Risk - Declining*
Long-tailed bat	*Chalinolobus tuberculatus*	*Threatened – Nationally Critical*
New Zealand pipit	*Anthus novaeseelandiae*	*At Risk - Declining*
North Island Brown Kiwi	*Apteryx mantelli*	*Not Threatened*
Australasian harrier	*Circus approximans*	*Not Threatened*
Shining cuckoo	*Chrysococcyx lucidus lucidus*	*Not Threatened*
Grey warbler	*Gerygone igata*	*Not Threatened*
New Zealand Pigeon	*Hemiphaga novaeseelandiae*	*Not Threatened*
Welcome swallow	*Hirundo neoxena neoxena*	*Not Threatened*
Tomtit	Petroica macrocephala	*Not Threatened*
Tui	Prosthemedera novaeseelandiae novaeseelandiae	*Not Threatened*
New Zealand fantail	Rhipidura fuliginosa	*Not Threatened*
New Zealand kingfisher	Todiramphus sanctus vagans	*Not Threatened*
Silvereye	Zosterops lateralis lateralis	*Not Threatened*

Draft Avifauna Management Plan
Mangamuka Slip Repairs



Prepared for:
NZ Environmental Management Limited
on behalf of the client Waka Kotahi
October 2023 (Updated February 2024)

Document Quality Assurance

Document Version	Action	Name	Signed	Date
1.0	Prepared by	Sec 9(2)(a) Kūkūwai Consulting Ltd	Sec 9(2)(a)	10.10.2023
	Technical Advice	Sec 9(2)(a)		18.10.2023
	Peer Review	Sec 9(2)(a)	Sec 9(2)(a)	02.11.2023
2.0	Updated by	Sec 9(2)(a)	Sec 9(2)(a)	21.04.2024

TABLE OF CONTENTS

1. INTRODUCTION

In July 2020 heavy rainfall caused more than 20 slips and significant damage to State Highway 1 (SH1) throughout Mangamuka Gorge Scenic Reserve (MGSR), cutting off local communities from access to Kaitaia and other parts of Te Tai Tokerau via SH1 (Figure 1). Since then, significant and on-going storm events have caused additional slips and erosion, adding further complexity to the repair operation and re-opening of the road.

In December 2022, Waka Kotahi secured funding for road repair works as part of the Far North State Highway Resilience Programme. Site investigations, planning and design work commenced early 2023, and subsequently NZ Environmental Management Ltd (NZEM) was engaged to undertake ecological assessment surveys and prepare a Biodiversity Assessment report for the project. Early assessments documented that a range of indigenous and exotic avifauna are present within vegetation and habitats in MGSR which is located within the Maungataniwha Ranges, including the potential for North Island brown kiwi (kiwi-nui, *Apteryx mantelli*) in Northland (geographically recognised as Northland brown kiwi).

Populations of Northland brown kiwi have historically declined due to increasing land pressures and predation by dogs (*Canis familiaris*), cats (*Felis catus*), stoats (*Mustela erminea*), and ferrets (*M. furo*) (Pierce *et al*., 2006; Craig, 2022). Although kiwi is no longer classed as threatened (Robertson *et al*., 2021), it is still important to monitor populations to understand more about their behaviour, where and how far they travel, and how they respond to environmental pressures such as habitat modification, predator presence and drought (NZEM, 2023).

Slip repair works are in progress, with Waka Kotahi in the process of working with Councils, Department of Conservation ('DoC'), hapū and other stakeholders to apply for retrospective Resource Consent (in areas outside of the existing roading designation) and other required permissions including Wildlife Act Authority (WAA) permits for the capture and relocation other indigenous fauna.

This Avifauna Management Plan (AMP) describes the values of vegetation and habitats at the slip sites with respect to a range of indigenous avifauna including kiwi. It presents a strategy to minimize the effects of the project on those values and presents mitigation measures to manage potential impacts on avifauna that may be using vegetation as roosting and foraging habitat.

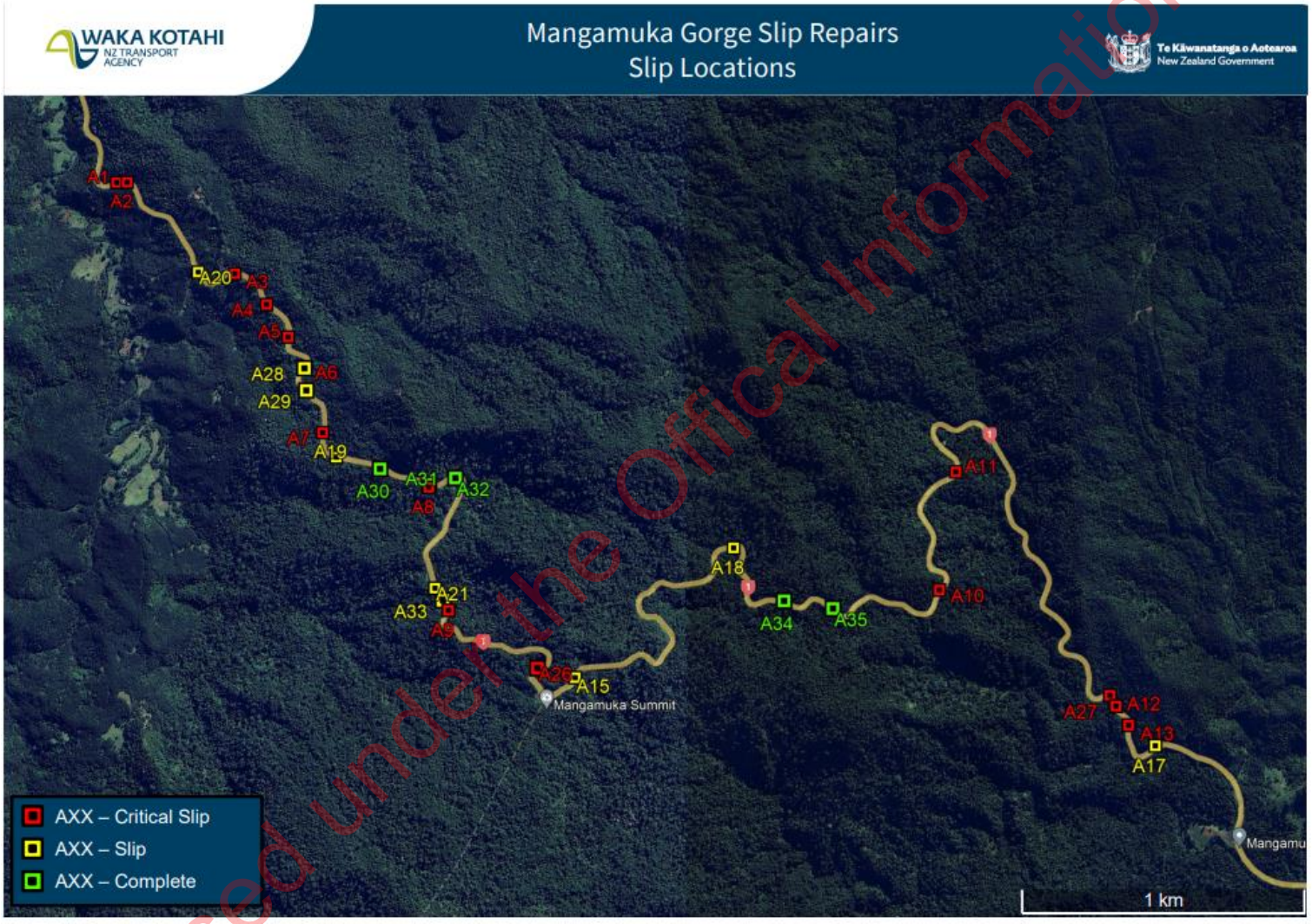


Figure 1: Map of 'critical', 'non-critical' and completed slip sites at SH1 locations in the Managmuka Gorge Scenic Reserve.
Figure Source: Waka Kotahi

2. LEGISLATIVE REQUIREMENTS

All indigenous birds and their eggs are protected by the Wildlife Act (1953), and consequently cannot be captured, handled or relocated without a Wildlife Act Authority ('WAA') permit from DoC. Bird handling and kiwi handling also have separate accreditation requirements to ensure that suitably qualified and experienced ecologists are responsible for any handling, banding and manipulation of birds. Further, the inclusion of using trained dogs as part of the kiwi survey and management process also requires accreditation and a WAA.

2.1 Accreditation and training requirements for working with kiwi

A formal accreditation system for managing kiwi has been introduced by the National Kiwi Recovery Group to ensure that best practice is followed for any activities that may impact kiwi. The following activities that may be undertaken by this project require the relevant Ecologist (hereafter referred to as the Kiwi Ecologist) to be trained and certified:

- Use of a kiwi detection dog
- Capture and handling of kiwi
- Collection of kiwi eggs
- Banding and/or attaching radio-transmitters to kiwi
- Transferring kiwi to a new location

The Kiwi Recovery Group and DoC have recently published an updated version of the 'Kiwi Best Practice Manual' (Colbourne *et al.*, 2020) and any of the above activities shall only be undertaken by a fully certified Kiwi Ecologist whose experience fulfils each of the requirements listed in the manual. All Project Ecologists assisting the Kiwi Ecologist (if required) will be under the direct supervision of the Kiwi Ecologist and be familiar with best practice techniques (noting no one but the Kiwi Ecologist will catch or handle birds or their eggs).

3. PURPOSE AND SCOPE

This AMP describes measures to detect indigenous avifauna and ensure neither they nor active nests are present within vegetation and habitats on any given day of clearance. This AMP includes the following:

a) Desktop and field assessments of habitat value to general forest avifauna and kiwi within MGSR
b) Summary of the potential effects to avifauna that arise from habitat clearance and construction activities

c) Responsibilities and competencies of the staff involved in kiwi surveys and management
d) Methods to detect kiwi and their roosts
e) Vegetation clearance protocols
f) Accidental discovery protocols and contingencies
g) Seasonality requirements
h) Health and safety considerations when working with kiwi

4. Vegetation and Habitats: Maungataniwha Ecological District

Maungataniwha Ecological District ('ED') encompasses approximately 101,900ha extending east between Kaitaia and the Herekino Forest, to the southern boundary of Raetea Forest and the head of Mangamuka River (Conning, 2002). The southern boundary lays approximately 5km south of Mangamuka township, with the boundary extending just north of Ōmahuta and Puketī forests and up to the eastern coast where it spans between Hihi and the southern point of Tokerau Beach.

Historically, much of the ED was characterised by broadleaf-podocarp-kauri forest which was subject to extensive logging. Potential fauna habitat within the Maungataniwha ED and Range is now characterised by mature forest (mainly secondary forest) comprising species such as northern rata (*Metrosideros robusta),* rimu (*Dacrydium cupressinum*), tōtara (*Podocarpus tōtara* var. *tōtara*), kahikatea (*Dacrycarpus dacrydioides*), kauri (*Agathis australis*), tōwai (*Pterophylla sylvicola*) and taraire (*Beilschmiedia tarairi*). Additional species including tawa (*B. tawa*), rewarewa (*Knightia excelsa*) and pūriri (*Vitex lucens*) are also frequent within this ED. Roadside vegetation along SH1 includes regenerating shrubland that includes the above listed species, with patches of mānuka (*Leptospermum scoparium*) and kānuka (*Kunzea robusta*) (Conning, 2002), mature towai forest, and in places, towai with mature emergent podocarps such as rimu and matai (*Prumnopitys taxifolia*).

The Maungataniwha Forest meets the criteria for an area of significant indigenous vegetation and a significant habitat of indigenous fauna (Northland Regional Policy Statement 2018, Far North District Council Operative Plan 2009). The site supports Regionally Significant, Threatened and At-Risk species (both flora and fauna). A detailed description of vegetation types, and rare and threatened flora are provided in the Draft Biodiversity Report (NZEM, 2023).

5. AVIFAUNA VALUES

5.1 Desktop Assessment

A desktop assessment of vegetation, habitats and DoC records was undertaken to better understand the landscape context, historical context and ecological context of the site with respect to general forest avifauna and kiwi.

There are no eBird records for the MGSR, and iNaturalist has a very low number of records as well with a single chaffinch (*Fringilla coelebs*) record on SH1, and a kerurū (*Hemiphaga novaeseelandiae*) record to the far northeast of the Maungataniwha Ranges (Figure 2).

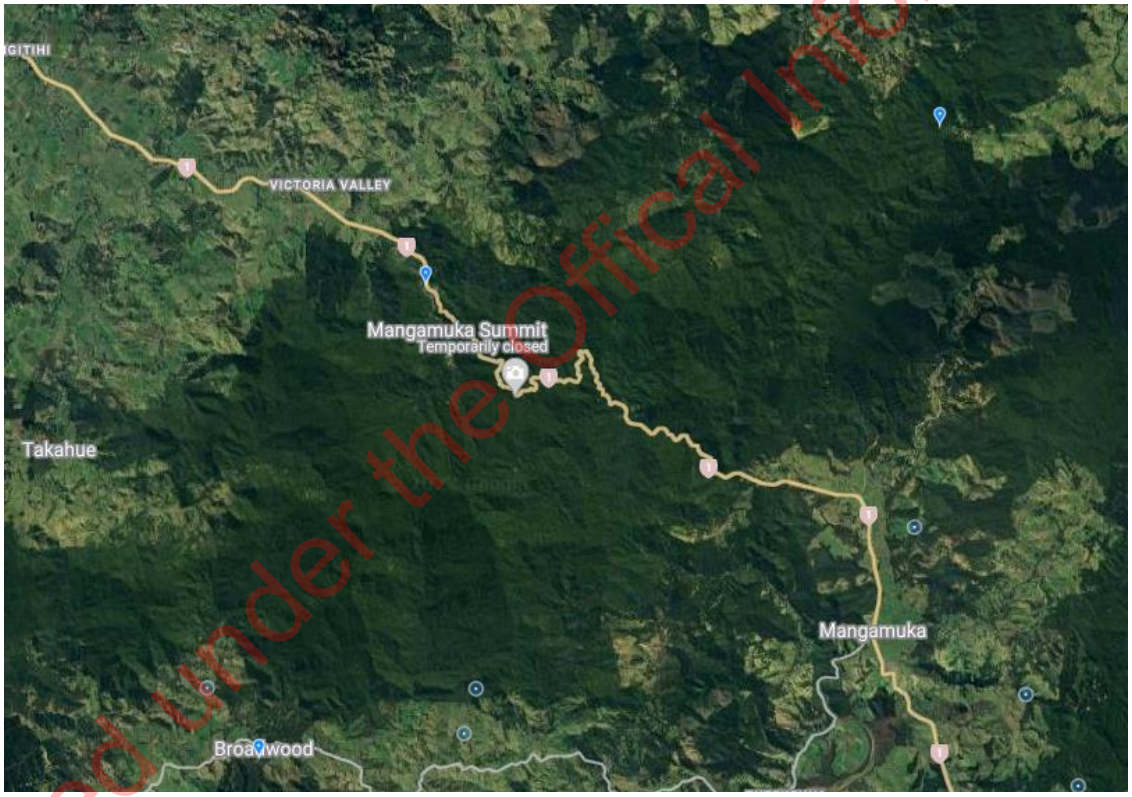


Figure 2: Screenshot of iNaturalist avifauna records for MGSR and the Maungataniwha Ranges. Bird records are depicted by blue balloon icons. *Source: iNaturalist, accessed 10.10.23.*

Historical populations of North Island kōkako were present in Raetea Forest until the 1980's; however, by the early 2000's had dwindled to a few anecdotal sightings. Similarly, North Island kaka was known to be resident in the Maungataniwha Ranges in the late 1970's, but since the 1990's only the occasional vagrant passes through (DoC, 2002). Red-crowned kakariki (*Cyanoramphus novaezelandiae*), thought to be historically present with sightings in early 2000's in Raetea Forest, are regarded as vagrant. Long-tailed

cuckoo (*Cudynamys taitensis;* koekoeā) is regularly reported from Maungataniwha during northern migration from the Pacific Islands.

Populations of kerurū have become severely depleted with a 70% decline between 1979 and 1993 (DoC, 2002). Other important food sources for kerurū include the large fruiting trees such as taraire (*Beilschmiedia tarairi*), tawa (*Beilschmiedia tawa*), porokaiwhiri (pigeonwood, *Hedycarya arborea*), hīnau (*Elaeocarpus dentatus* var. *dentatus*), and pōkākā (*Elaeocarpus hookerianus*). Kerurū are regionally significant as they are one of the few species that distribute large-fruited indigenous tree species throughout forests and landscapes (NZEM, 2023).

The Protected Natural Area Programme 'Maungataniwha Ecological District' document notes that:

"NI brown kiwi persist in a broad belt of fragmented sites across the district east from Kaitaia and are found to be utilising sites of only a few hectares in size. Such remnants are also providing a food supply for native birds, especially the NZ pigeon, which is particularly threatened in this District, and in many cases known to use these remnants"

Localised annual kiwi monitoring is undertaken for Northland brown kiwi by a wide range of volunteers, community organisations and DoC. Monitoring of local populations is undertaken in close proximity to MGSR, with six cluster stations within forest-edge habitats in the Herekino-Raetea-Pukati Forest area (Craig, 2022). Additionally, data is submitted regularly from the Honeymoon Valley Landcare Group; however, no data was received in 2021 or 2022 (Figure 3). Historical data between 2015 and 2020 show reasonably low densities of kiwi at listening stations that are the closest in proximity to SH1 habitats. Conversely, the population at Pukatī has remained relatively stable with call count data that is considered to represent 'high density' populations (i.e., average call counts >5 calls per hour) (Figure 4).

Stn No.	Station name	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
	Northern																												
1	Diggers Valley	1.1	2.4	4.1	2.5	2.1	3.3	4.1	3.8	3.0	3.9	3.9	2.7	1.3	2.0	1.7	-	2.5	-		-	-	2.8	0.9	-	-	0.6	-	-
2	Takahue	4.3	3.5	5.5	5.4	6.3	8.4	7.9	4.5	3.3	4.8	5.3	5.0	3.6	4.9	3.1	4.8	11.4	6.9	5.3	2.4	0.1	0.0	-	-	-	-	-	-
4	Gartons	5.6	5.0	1.2	-	0.8	2.0	8.6	-	1.5	4.1	4.9	7.1	1.5	1.3	0.0	0.1	0.3	0.8	0.3	0.3	0.0	0.1	-	-	-	-	0.4	-
5	Kaiaka	1.7	1.3	2.4	3.4	1.6	3.5	3.0	2.1	1.9	3.8	2.8	1.5	0.0	0.8	-	1.6	1.1	0.3	1.6	1.6	2.0	-	-	-	-	3.0	-	-
7	Puketi	6.6	5.4	2.1	3.0	6.0	7.6	6.4	3.5	5.0	3.4	1.5	2.3	0.8	3.9	4.0	6.9	9.4	6.3	6.3	5.9	5.6	5.6	9.8	8.3	7.4	4.0	5.3	**5.4**
8	Puketi SR	5.4	6.5	4.4	4.0	5.1	6.5	6.1	6.4	8.3	9.4	2.3	5.1	7.4	8.9	9.0	7.9	9.0	11.8	9.8	7.6	5.4	9.3	9.0	12.1	12.4	10.1	8.8	**12.6**
	Mangatete																												
3	Lightning Hill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.5	13.5	10.0	17.6	20.5	17.1	17.6	16.0	8.1	12.0	**14.8**
256	Baigents home drive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.0	14.1	15.4	14.8	17.5	10.4	10.1	13.9	**12.8**
	Honeymoon Valley																												
271	H-moon Valley Green Bach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	0.5	-	0.0	-	0.3	-	-
272	H-moon Valley Lost Valley track	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-	-	-
273	H-moon Valley Central Ridge of Beth's	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.6	-	-	-	-	-	-	-
274	H-moon Valley Greg's driveway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-
301	NZFRT reserve, campsite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.6	5.1	4.4	-	1.8	-	-
	Toa Toa Ridge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-

Figure 3: Kiwi call data collected by the Honeymoon Valley Landcare Group illustrating low call counts on the years where data has been submitted. *Source: Craig, 2022.*

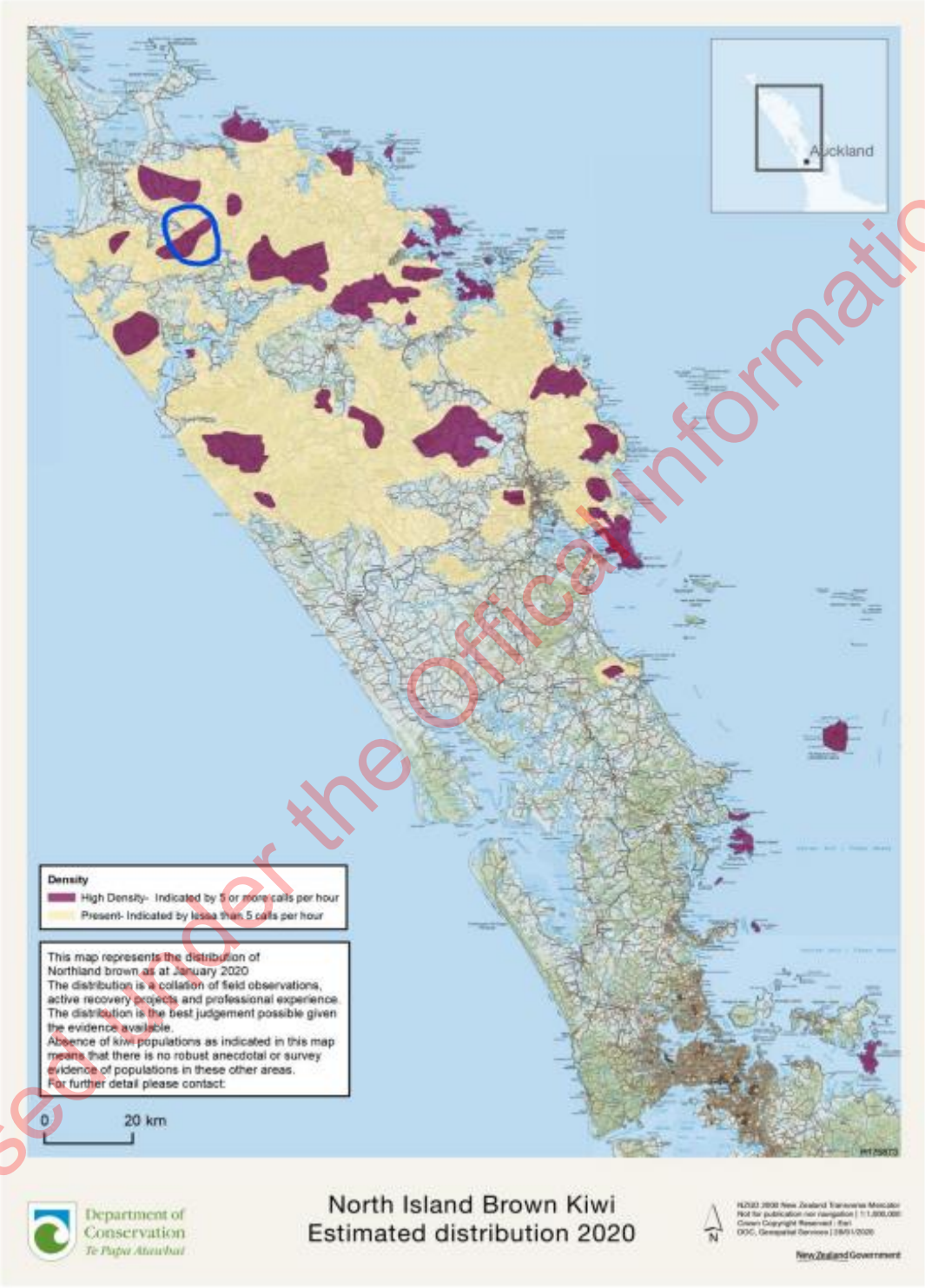


Figure 4: Map of Northland brown kiwi density and distribution – general population data for Mangamuka Gorge Scenic Reserve general area is identified in blue circle. *Source: Craig, 2022.*

5.1 Forest bird observations

Kerurū (*Hemiphaga novaeseelandiae*) is one of the species that is regularly observed flying over the forest and frequenting pūriri (*Vitex lucens*) trees on site. Tūī (*Prosthemadera novaeseelandiae*) are also regularly observed flying across SH1 and using roadside vegetation. Resident kōtare (kingfisher, *Todiramphus sanctus*) and miromiro (tomtit, *Petroica macrocephala toitoi*) individuals are observed semi-regularly occupying their habitat/territories on road edges.

A list of both exotic and indigenous avifauna species that have been observed and potentially present at the Site is included in Table 1 below and has been adapted from the Biodiversity Assessment prepared by NZEM (2023).

Table 1: Avifauna that has been observed, recorded in 5MBCs (*) or considered to be potentially present (+) at the Site (Robertson *et al*., 2021).

Latin Name	Common Name	Conservation Status
Acridotheres tristis	common myna	Introduced and Naturalised
Apteryx mantelli +	North Island brown kiwi	Endemic – Not Threatened
Callipepla californica	Californian quail	Introduced and Naturalised
Carduelis carduelis	goldfinch	Introduced and Naturalised
Circus approximans	swamp harrier, harrier hawk, kāhu	Native – Not Threatened
Chrysococcyx lucidus	shining cuckoo, pīpīwharauroa	Native – Not Threatened
Eudynamys taitensis +	long-tailed cuckoo, koekoeā	Endemic – Nationally Vulnerable
Fringilla coelebs*	chaffinch	Introduced and Naturalised
Gerygone igata*	grey warbler, riroriro	Endemic – Not Threatened
Gymnorhina tibicen	Australian magpie	Introduced and Naturalised
Hemiphaga novaeseelandiae*	kererū, kūkupa	Endemic – Not Threatened
Hirundo neoxena*	welcome swallow	Native – Not Threatened
Ninox novaeseelandiae	morepork, ruru	Native – Not Threatened
Passer domesticus*	sparrow	Introduced and Naturalised
Petroica macrocephala toitoi*	tomtit, miromiro	Endemic – Not Threatened
Platycercus eximius*	Eastern rosella	Introduced and Naturalised
Prosthemadera novaeseelandiae*	tūī	Endemic – Not Threatened
Rhipidura fuliginosa*	pīwakawaka, fantail	Endemic – Not Threatened
Synoicus ypsilophorus	brown quail, kuera	Introduced and Naturalised
Todiramphus sanctus*	kōtare, kingfisher	Native – Not Threatened
Turdus merula*	blackbird	Introduced and Naturalised
Turdus philomelos	song thrush	Introduced and Naturalised
Zosterops lateralis*	tauhou, waxeye, silvereye	Native – Not Threatened

5.1.1 Five-minute bird count surveys

At the time of preparing this AMP, five-minute bird count (5MBC) surveys have commenced; however, only a limited number of surveys have been undertaken and are restricted to slip sites A8 and A11. 5MBC's are a simple, replicable method to record forest birds and involve standing quietly for five minutes and recording all birds seen and/or heard within that timeframe. It's a rapid assessment that provides useful information on species that are present and using habitats within roadside vegetation, as well as showing long term general trends or changes in avifauna assemblages.

Species detected by 5MBCs at A8 and A11 are indicated with '*' in Table 1 above.

5.2 Northland brown kiwi

There are four geographically distinct forms of brown kiwi, of which Northland brown kiwi is the northernmost taxon. The breeding season for Northland brown kiwi spans from mid-June to late December, with one or two eggs laid that are incubated by the male partner for 75-90 days (Colbourne *et al.*, 2020). Upon hatching, juveniles will remain in the nest until they are around one week old. From there they will frequently return to the nest for up to 10 weeks before leaving the territory of their parents to establish their own (Colbourne *et al*., 2020). Kiwi are extremely vulnerable to a range of predators, including domestic pets and consequently their numbers and distribution have significantly declined.

Conservation efforts in recent years have managed to slow the rate of decline. Efforts include dedicated predator management, the creation of kiwi corridors, and education and upskilling within local communities where kiwi reside. An important component of management includes consistent monitoring using simple, replicable methods that can be undertaken by community members and citizen scientists.

To monitor and assess trends in kiwi populations, call count surveys are often used. Call count survey data is used to monitor the trends in kiwi population over time, indicating population size, and the health of a population (a stable, increasing, or decreasing population). Using call count surveys, the Department of Conservation has listed areas within the Maungataniwha Range as having kiwi both present (indicated by <5 calls per hour) and present at high density (indicated by ≥5 calls per hour) (Craig, 2022).

Kiwi in Northland are particularly vocal during the breeding season between June and July, and then again between September and November (Colbourne *et al*., 2020).

5.2.1 Preliminary habitat assessment

Shrubland and regenerating forest is an important habitat for kiwi, of equal value to mature forests with numerous small remnants known to be used (DoC, 2002). These are the habitat types that are highly representative of roadside vegetation throughout the MGSR.

The project's kiwi ecologist undertook a preliminary site visit in September 2023 to assess vegetation and habitats at two of the slip sites where works have not yet commenced (namely site A8 and A11). While much of the roadside topography adjacent to SH1 is steep, these two sites were assessed as having moderate to high potential habitat value to kiwi.

6. Summary of Potential Effects

There are a range of potential and actual adverse effects associated with vegetation clearance and construction activities. Some of these activities that can adversely impact avifauna and the potential effects associated with these activities are outlined in Table 2 below:

Table 2: Construction-related activities and their potential adverse effects to avifauna.

Activity	Potential Direct & Indirect Effects
Tree felling/terrestrial habitat removal	▪ Injury and/or mortality to nests, eggs and non-volant chicks ▪ Injury and/or mortality to roosting kiwi, eggs and chicks ▪ Reduced habitat availability ▪ Edge effects ▪ Increased competition for resources
Use of construction equipment including generators, heavy machinery, vehicles and artificial lighting	▪ Construction noise disturbance ▪ Displacement into sub-optimal habitats ▪ Abandonment of nests / roosts / breeding failure ▪ Reduction of foraging efficiency (including range and/or duration)

The risk of injury or mortality to general forest avifauna and kiwi through vegetation clearance is to be addressed by the mitigation actions described in Section 7 of this management strategy.

7. Management of Effects

Measures to avoid, minimise and mitigate the potential adverse effects on forest birds and kiwi associated with works at Mangamuka are described below, with a focus on kiwi.

7.1 Pre-clearance searches – general forest avifauna

For the months from October to February inclusive (i.e., the breeding season of indigenous avifauna) bird nest surveys shall be undertaken within two-days leading up to vegetation clearance in any given area. This shall be achieved by first searching for any nests in the canopy. If a nest is identified then it shall be observed for a period of at least one hour to determine if birds are actively flying to and from the nest, an activity that is indicative of an active nest. The identification of any active bird nest shall be a trigger for the following actions:

1. The tree containing the nest shall be flagged, together with all vegetation within a 10-metre buffer of the tree. These shall be protected from all clearance and construction activities until chicks have fledged.

2. Following identification of the nest, the project ecologist shall undertake a dawn survey to identify the relevant species if it was not previously observed or if it is not easily distinguished by nest shape and other characteristics.

3. Dawn watches shall be taken twice weekly to observe parental behaviour and determine when the chicks have fledged.

Upon confirmation of chicks having left the nest, the project ecologist may approve the vegetation to be cleared.

7.2 Pre-clearance searches – Northland brown kiwi

Approximately one to two weeks prior to vegetation clearance in any given (and safely accessible) area, the project kiwi ecologist shall undertake a preliminary survey to determine if kiwi are using the area. The survey shall be undertaken in accordance with any of the best practice techniques as recommended in DoC's best practice manual (Colbourne *et al*., 2020). These may include any of, or a combination of the below methods, as deemed appropriate by the kiwi ecologist:

1. Nocturnal surveys listening for calls
2. Acoustic recording device surveys
    a. Appropriate times of year when kiwi vocalisation activity is peaking: April-June, September-November
    b. Minimum 10 nights, or between 100-200 hours of audio recording
3. Walk-through surveys with trained kiwi dog

7.2.1 Nocturnal listening surveys

Nocturnal listening surveys are useful, simple surveys that can be undertaken by professionals and community members. This is the main survey technique used for the annual kiwi count data that is used throughout Northland. It involves sitting quietly at a pre-identified listening location from at least 30 minutes post-dusk for approximately two hours. It can be undertaken any time of year, but where timing permits is often restricted to the months of peak calling activity: April-June, September-November. Calls are recorded on a calling card with the following general information:

- Date / time / location
- Number of kiwi seen / heard
- Sex (this can be distinguished by a repetitive high-pitched ascending whistle for males versus the coarser raspy call for females)
- Observed sign of kiwi (e.g., features, footprints, droppings)
- Observer details
- Additional notes (Colbourne *et al*., 2020)

Listening surveys should be designed according to the survey objective(s). As this AMP is being prepared to support an application to DoC for a WAA and Council for a resource consent, replicability is critical to this survey method being applied appropriately. As this is only one of the survey methods being applied at each slip site, it is recommended that a single night of nocturnal listening be undertaken during appropriate weather conditions at least 48-72 hours prior to clearance. Listening surveys will be conducted in accordance with the detailed recommendations provided in the best practice manual on pages 52-55 (Colbourne *et al.*, 2020).

7.2.2 Acoustic surveys

Acoustic surveys use ARDs that are pre-programmed to detect kiwi calls and convert them digitally into spectrogram data that can be analysed using specially developed software. ARDs can be hung in trees approximately one metre above ground and left in-situ for a few days or several weeks before being retrieved for analysis. Kiwi vocalisations have a distinctive pattern and particular frequencies. Male calls can also be distinguished from female calls, and uncertain visual patterns can also be listened to audibly to assist with species identification.

ARDs are an extremely useful survey tool that can be repeated to gain long-term population monitoring data. Acoustic surveys will be conducted in accordance with the detailed recommendations provided in the best practice manual on pages 58-59 (Colbourne *et al.*, 2020).

7.2.3 Walk through surveys with trained kiwi dog

Walk through surveys with a trained kiwi detection dog will be undertaken by the kiwi ecologist in each of the slip sites yet to be cleared.. Each slip site clearance area (and accessible, adjacent landscape) will be subject to multiple 'sweeps' to determine if any given slip site falls within a kiwi's territory, to search for burrows and to ensure if present, that an area does not have roosting kiwi on the day of vegetation clearance. The number of sweeps will be determined by the kiwi ecologist and will be initially based on habitat availability and quality, together with results of the initial search.

7.3 During-clearance searches

On any given day of clearance, a dawn survey will be conducted by the kiwi ecologist to determine whether any kiwi is active within the territory and where they have settled into their roosts for the day. Methods to be used for dawn searches will focus on using the certified kiwi detection dog (see Section 7.2.3).

7.4 Kiwi relocation

Any kiwi roosting within 50m of the clearance area will be removed from the burrow and relocated into an alternative roost within their estimated territory (at least 50 metres from the capture site). Appropriate roosts in landscapes surrounding slip site clearance areas will be pre-identified by the kiwi ecologist prior to commencing clearance.

7.5 Nesting kiwi and egg uplift

Between the months of July and February (i.e., the breeding season for kiwi), kiwi are even more vulnerable to potential adverse impacts due to females being gravid and/or males incubating eggs. Males will sit on eggs for up to 80 days and disturbance may cause him to abandon the nest and not return (Sporle, 2012). Therefore, during this timeframe if any kiwi is found to be incubating eggs then works at this site will need to stop immediately. This will allow the kiwi ecologist to try and determine how far through the developmental process the egg is. The egg may not be uplifted until it has been confirmed as being at least 10 days old, but ideally 30 days old. These timing thresholds have been determined by DoC to be in line with best practice as it is almost impossible to successfully hatch a chick in captivity that's less than 10 days but has an almost 90% success rate at 30 days (Colbourne *et al*., 2020). While the ecology team wait for the egg to mature for the appropriate duration, no works may take place within a 50m radius of the burrow. This may mean vegetation clearance and earthworks at any given slip site is required to temporarily stop for up to one month.

Any eggs removed will be immediately taken to the Whangārei Native Bird Recovery Centre where they have the Bayer Incubation Unit and are highly experienced in hatching kiwi chicks. Following successful hatching, chicks will be transferred to the nearest kiwi creche at Matakohe-Limestone Island in Whangarei. At an appropriate age, any young kiwi that have been raised on Matakohe-Limestone Island will be repatriated to Mangamuka Gorge in an area that is subject to good quality predator control. This process will be co-ordinated with hapū, DoC and other stakeholders.

Prior to commencing kiwi searches, the kiwi ecologist shall liaise with the recovery centre to ensure that they are aware of the project and the potential need to incubate eggs between now (October 2023) and February 2023, and again from July 2024 when the next breeding season shall commence.

8. Injured or Dead kiwi

In the event that an injured or dead kiwi (or egg) is detected during works then the following protocols shall be applied:

1. Works shall stop immediately at the relevant slip site while the kiwi ecologist is contacted and brought to site.
2. Injured kiwi shall be immediately transported to the Whangārei Native Bird Recovery Centre where it shall be assessed by the in-house/affiliated wildlife Veterinarian.
3. The local DoC office shall be contacted immediately and informed of what has been discovered (i.e., whether the bird is injured or dead). Any dead birds shall be handed over to the kiwi ecologist who shall place it into a box and transfer it as quickly as possible to the local DoC office in Kaitaia. If after hours, it shall be frozen overnight in site facilities and taken to DoC the following morning.

Injured kiwi shall be rehabilitated in accordance with recommendations of the wildlife veterinarian for the Whangārei Native Bird Recovery Centre, the project kiwi ecologist and DoC's in-house technical specialist for

kiwi. If it is determined that euthanasia is the best course of action then kiwi will either be returned to hapū or to the local DoC office[1]

9. Accidental Discovery Protocol

In the event that kiwi are not detected during a pre-clearance search and vegetation removal continues without the supervision of the kiwi ecologist, contractors shall be provided with an accidental discovery protocol by the ecology team prior to commencing vegetation clearance. This should broadly involve a description of what to look out for, what to do if a kiwi is seen running through vegetation and contact details for the kiwi ecologist. Similarly, if a kiwi egg is uncovered during vegetation clearance or earthworks activities, then works shall also stop until the kiwi ecologist can get to site and safely assess the egg and determine appropriate next steps.

There may also be instances where contractors observe an arboreal bird nest in vegetation that has been approved for clearance by the ecology team. In this situation contractors shall take a photograph of the nest and contact the lead field ecologist for guidance. Clearance work may not proceed until the ecologist has determined whether the nest is active and applied relevant protocols if it is active.

In all situations where kiwi, nests or eggs are accidentally discovered, work must temporarily stop until the kiwi ecologist is able to attend site, assess the situation and apply the appropriate protocols.

10. Health & Safety (when working with kiwi)

Working with kiwi can pose risk to human health and safety by way of scratches, faeces and parasites. Only the accredited kiwi ecologist shall handle kiwi in accordance with best practice; however, in some cases there may be a need for other members of the ecology team to assist. It is not appropriate to wear gloves when handling kiwi and therefore good hygiene is essential both prior to and immediately following handling kiwi (Colbourne *et al*., 2020).

11. Conclusions

Waka Kotahi is managing slip repair works on SH1 in the Mangamuka Gorge Scenic Reserve. The project is being undertaken under the Emergency provisions of the RMA, with a high priority placed on several critical slips that pose significant risk to road stability and threaten to keep communities in the Far North cut off from essential services, friends and whānau.

The MGSR and the wider Maungataniwha Ranges support significant vegetation and significant habitats of indigenous fauna, with many At Risk and Threatened flora and fauna species present. Forest bird populations appear to be somewhat depauperate; however, there is a known resident population of Northland brown

[1] At the time of preparing this AMP we request direction from DoC and hapū regarding their preference for managing any dead kiwi. It is possible that hapū may prefer having kiwi returned to them and this shall be confirmed prior to implementing kiwi management activities.

kiwi in the area. Kiwi are within and in close proximity to a landscape-scale community driven predator management programme known as the 'kiwi corridor project area' run by the Honeymoon Valley Landcare Group. This AMP is one of several documents being prepared to guide biodiversity management for the project and ensure that adverse impacts to resident avifauna are avoided, minimised and mitigated.

This AMP provides a proposed management strategy that is in accordance with the best practice manual prepared and recently updated by the Department of Conservation (2020). Provided that the protocols described in this AMP are applied appropriately, it is anticipated that risk of injuring or killing indigenous avifauna can be appropriately managed.

This AMP is likely to be subject to revisions and updates following completion of the 5MBC surveys, and consultation with the Client, DoC, hapū and relevant stakeholders.

ACKNOWLEDGEMENTS

We acknowledge NZEM, Te Paatu (hapū on the northern side) and Ngā Hapū ō Mangamuka (hapū on the southern side of the gorge) for providing site access, field support and technical advice, together with WSP, CLL, Stellar Projects, Far North Roading and Spiral Drillers Civil.

REFERENCES

Colbourne, R., Bean, E., Coad, N., Fuchs, R., Graham, I., Robertson, H., & Scrimgeour, J. (2020). Kiwi best practice manual. *Wellington, Department of Conservation*.

Conning, L., (2002). Natural areas of Maungataniwha Ecological District. *Reconnaissance Survey Report for the Protected Natural Areas Programme*. Department of Conservation, Whangarei. pp 25.

Craig, E. (2022). Call Count Monitoring Data of Northland Brown Kiwi 2022. Department of Conservation. Whangārei. Pp 50.

Department of Conservation (2002). *Natural Areas of Maungataniwha Ecological District.* Retrieved from: https://www.doc.govt.nz/about-us/science-publications/conservation-publications/land-and-freshwater/land/northland-conservancy-ecological-districts-survey-reports/natural-areas-of-maungataniwha-ecological-district/

Matakohe-Limestone Island (2023). North island brown kiwi. Retrieved from: http://www.limestoneisland.org.nz/visit_wildlife.html

NZEM (2023). Mangamuka Slip Repairs, State Highway 1, Mangamuka – Biodiversity Report. *Technical report prepared for Waka Kotahi*. Northland. Pp 64.

Operation Nest Egg (2021). Retrieved from: https://savethekiwi.nz/about-us/what-we-do/operation-nest-egg/

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

Sporle (2012). Forestry Management Guidelines: North island brown kiwi in exotic plantation forests. Department of Conservation. Retrieved from: https://www.whakatanekiwi.org.nz/wp-content/uploads/2018/04/030.092-Forestry-Guidelines_-Final.pdf

Whangarei Native Bird Recovery Centre (2023). Retrieved from: https://nbr.org.nz/

Bat Management Plan
Mangamuka Slip Repairs

Prepared for:
NZ Environmental Management Limited
on behalf of the client Waka Kotahi
July 2023 (Updated September 2023 and February 2024)

Document Quality Assurance

Document Version	Action	Name	Signed	Date
1.0	Prepared by	Sec 9(2)(a) Kūkūwai Consulting Ltd	Sec 9(2)(a)	10.07.2023
	Peer review	Sec 9(2)(a) The Ecology Studio Ltd	Sec 9(2)(a)	20.07.2023
1.1 (August update)	Prepared by	Sec 9(2)(a)	Sec 9(2)(a)	25.08.2023
1.2	Updated by	Sec 9(2)(a)	Sec 9(2)(a)	21.02.2024

TABLE OF CONTENTS

1. INTRODUCTION

In July 2020 heavy rainfall caused more than 20 slips and significant damage to State Highway 1 (SH1) throughout Mangamuka Gorge Scenic Reserve (MGSR), cutting off local communities from access to Kaitaia and other parts of Te Tai Tokerau via SH1 (Figure 1). Since then, significant and on-going storm events have caused additional slips and erosion, adding further complexity to the repair operation and re-opening of the road.

In December 2022, Waka Kotahi secured funding for road repair works as part of the Far North State Highway Resilience Programme. Site investigations, planning and design work commenced early 2023, and subsequently NZ Environmental Management Ltd (NZEM) was engaged to undertake ecological assessment surveys and prepare a Biodiversity Assessment report for the project. It was quickly determined that a range of indigenous fauna are present within vegetation and habitats in MGSR which is located within the Maungataniwha Ranges, including the potential for indigenous bats which had been anecdotally reported by local hapū. The need for targeted bat and bat habitat surveys was identified to determine if they were present and using roadside vegetation, and to identify any potential adverse effects to bats that may be associated with slip repair works.

Long-tailed bats (*Chalinolobus tuberculatus)* are classified as 'Threatened – Nationally Critical,' while the Northern lesser short-tailed bat (*Mystacina tuberculata aupourica*) is classified as 'Threatened – Nationally Vulnerable' (O'Donnell *et al*., 2023). Populations of long-tailed bats are known to inhabit numerous forests throughout Te Tai Tokerau, having recently been discovered in areas such as Mt Taīka (2022) and Pipiwai Forests (2021) in Whangārei, and in the Brynderwyns in 2019. Populations of the Northern lesser short-tailed bat are now only known to be present on Te Hauturu-o-Toi (Little Barrier Island) and in Ōmahuta and Puketī forests. Surveys by the Department of Conservation (DoC) in recent years have attempted to confirm population persistence in Warawara and Waipoua Forests after having detected small numbers of individuals several years earlier, but failed to make any detections (O'Donnell *et al*., 2023).

Slip repair works are in progress, with Waka Kotahi working with Councils, the DoC, hapū and other stakeholders to apply for retrospective Resource Consent (in areas outside of the existing roading designation) and other required permissions including a Wildlife Act Authority (WAA) permit for the capture and relocation of indigenous lizards that are specifically protected under the Wildlife Act (1953).

A Bat Management Plan ('BMP') is required to guide the implementation of DoC's approved Tree-Felling protocols by a DoC certified bat ecologist. This BMP describes the values of vegetation and habitats at the slip sites with respect to both long-tailed bats and short-tailed bats. It presents a strategy to minimize the effects of the project on those values and presents mitigation measures to manage potential impacts on bats that may be using edge vegetation as roosting and foraging habitat.

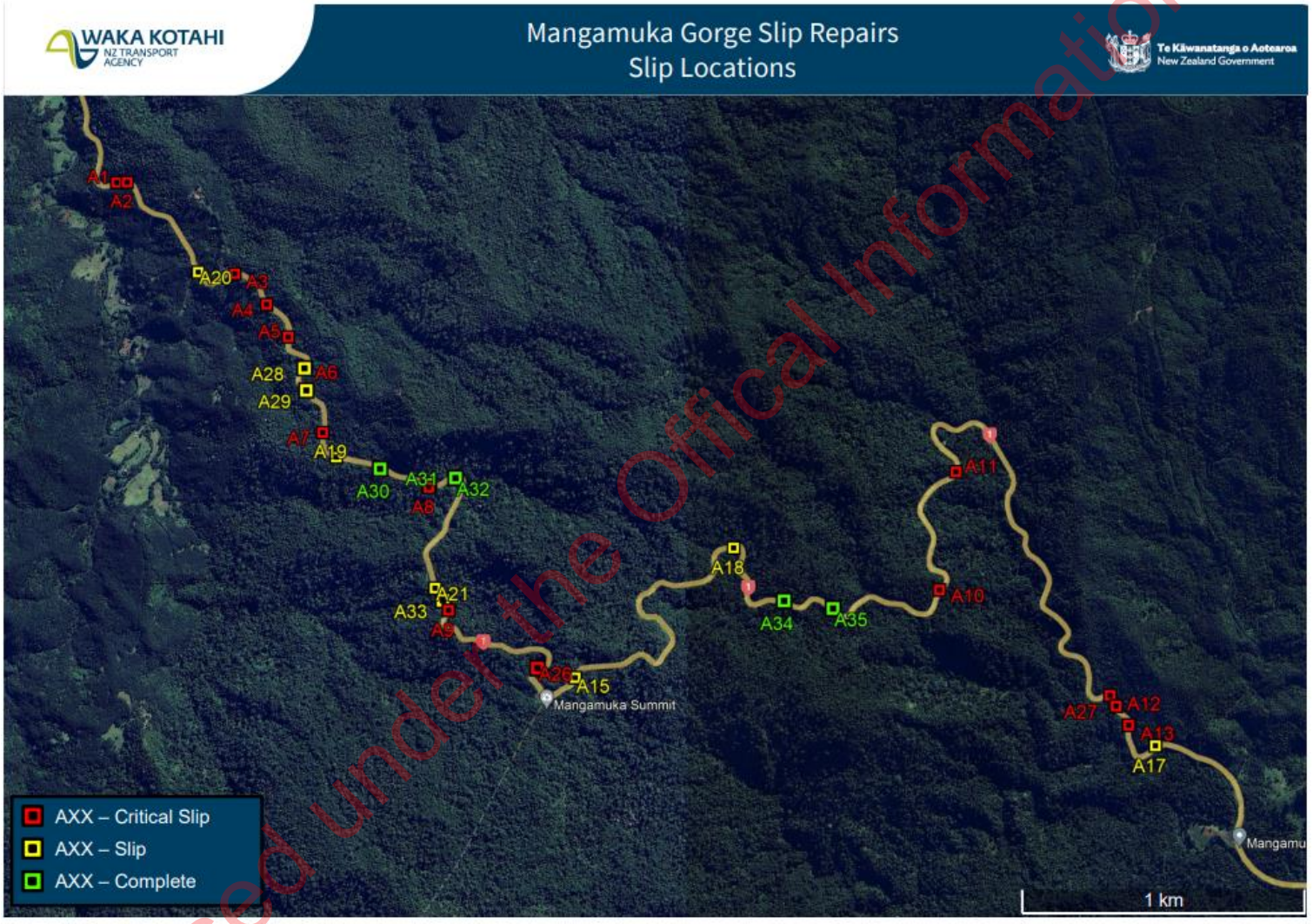


Figure 1: Map of 'critical', 'non-critical' and completed slip sites at SH1 locations in the Managmuka Gorge Scenic Reserve.
Figure Source: Waka Kotahi

2. Legislative Requirements

Bats and their habitats are protected by the Wildlife Act (1953), and consequently cannot be captured or handled without a Wildlife Act Authority ('WAA') permit from DoC. However, provided that robust survey effort and tree felling protocols are applied to a site that has confirmed bat presence, trees may be removed without the need for a WAA provided they are confirmed as being absent of bats on the day of felling. Where there is uncertainty (and consequent potential for the incidental mortality of bats), a WAA should be gained prior to implementing the BMP.

2.1 Certified Bat Ecologist

Any ecologist working with indigenous bats in New Zealand must be certified in accordance with the Department of Conservation's bat handling competencies authorisation. This is a set of skills that must be attained and certified by DOC's National Bat Recovery Group and technical experts. Any ecologists that are engaged to implement this BMP must be certified in the following task competencies:

3. High risk activities: Roost felling
3.1. Assessing roost trees using ABMs
3.2 Undertake roost watches / emergence counts
3.3 Identification and evaluation of potential roost features

Bat ecologists with the above certified competencies are assumed as capable of understanding what to do if bats are found during tree felling. However, it is also preferable that the Certified Bat Ecologist ('CBE') has also achieved the following competencies:

2. Handling bats
2.1. Bagging, storage, handling, measuring, weighing, sexing, aging, temporary marking and releasing appropriately.

3. Purpose and Scope

This BMP describes measures to detect indigenous bats and ensure they are not present within vegetation and habitats on the day of clearance. This BMP includes the following:

a) Desktop and field assessments of habitat value to bats
b) Summary of the potential effects to bats that arise from habitat clearance and construction activities
c) Responsibilities and competencies of the staff involved in invertebrate salvage and relocation
d) Methods to detect bats
e) Tree-felling protocols
f) Accidental discovery protocols

4. BAT VALUES

4.1 Desktop Assessment

A desktop assessment of vegetation, habitats and DoC records was undertaken to better understand the landscape context, historical context and ecological context of the site with respect to indigenous bats.

4.1.1 Vegetation and Habitats: Maungataniwha Ecological District

Maungataniwha Ecological District ('ED') encompasses approximately 101,900ha extending east between Kaitaia and the Herekino Forest, to the southern boundary of Raetea Forest and the head of Mangamuka River (Conning, 2002). The southern boundary lays approximately 5km south of Mangamuka township, with the boundary extending just north of Ōmahuta and Puketī forests and up to the eastern coast where it spans between Hihi and the southern point of Tokerau Beach.

Historically, much of the ED was characterised by broadleaf-podocarp-kauri forest which was subject to extensive logging. Potential bat habitat within the Maungataniwha ED and Range is now characterised by mature forest (mainly secondary forest) comprising species such as Northern rata (*Metrosideros robusta),* rimu (*Dacrydium cupressinum*), tōtara (*Podocarpus tōtara* var. *tōtara*), kahikatea (*Dacrycarpus dacrydioides*), kauri (*Agathis australis*), tōwai (*Pterophylla sylvicola*) and taraire (*Beilschmiedia tarairi*). Additional species including tawa (*B. tawa*), rewarewa (*Knightia excelsa*) and pūriri (*Vitex lucens*) are also frequent within this ED. Roadside vegetation along SH1 mostly comprises regenerating shrubland that includes the above listed species, with patches of mānuka (*Leptospermum scoparium*) and kānuka (*Kunzea robusta*) (Conning, 2002).

The Maungataniwha Forest is an area of ecological significance, as demonstrated by the number of Regionally Significant, Threatened and At-Risk species (both flora and fauna). A detailed description of vegetation types, and rare and threatened flora are provided in the Draft Biodiversity Report (NZEM, 2023).

4.1.2 Bat Distribution Database

Prior to commencing work on-site, anecdotal reports of long-tailed bats being present around the summit were reported to NZEM ecologists (pers. comms Joana Unteregger), suggesting a known presence of the species in the area. However, a search of the Department of Conservation's Bat Distribution Database revealed that both endemic bat species in mainland New Zealand (long-tailed bats and the Northern lesser short-tailed bat) have been recorded within the contiguous forest tracts of Raetea Forest, Mangamuka Gorge Scenic Reserve, Ōmahuta Forest and Puketī Forest.

4.2 Automatic Bat Monitoring (ABM) surveys

In mid-April 2023 three Automatic Bat Monitors (ABMs) were deployed by NZEM in roadside vegetation for the purpose of gaining acoustic information targeting bats using edge habitat (Figure 2)[1]. This species had been anecdotally reported as present around Mangamuka Summit. ABMs were left in-situ for between two and four weeks before being retrieved and analysed using DoC's Bat Search analysis software. Nine suitable recording nights were achieved within the accepted survey season (which ends on April 30th each year) and long-tailed bats were detected.

ABM Survey suitability criteria is as follows:

- Minimum temperature of 10°C within four hours post-sunset (North Island threshold)
- Less than 2.5mm of rainfall within two hours post-sunset and <5mm within four hours post-sunset
- Mean overnight wind speed that doesn't exceed 20km/hr
- Maximum overnight wind gust of 60km/hr

Reliable survey data will assist with gaining a better understanding of bat activity around roadside vegetation during construction activities and potentially also confirm the presence of short-tailed bats in the MGSR.

Due to indigenous bats now having been confirmed as using roadside vegetation and habitats in the MGSR, a Bat Management Plan is required to guide the tree-felling removal process associated with each of the remaining slips that have yet to be cleared of vegetation. In addition to deploying ABMs for the two-night protocol (see Section 6.1.1), ABMs should also be deployed within vegetation adjacent to a clearance footprint in the lead-up to tree-felling to monitor bat activity in response to preliminary understory clearance and increased levels of disturbance.

Table 1: Example of ABM results for the 9 suitable nights in April 2023

ABM	Dates	# Suitable nights	# Long-tailed bat passes	# Possible LT bat passes	# Short-tailed bat passes
ABM08	17.04 – 30.04	9	33	5	0
ABM09 (location 1)	17.04 – 30.04	9	7	14*	0

**14 possible passes due to spectrogram reading being very faint.*

[1] One ABM was removed after two weeks and re-deployed in a new location for a further two weeks, resulting in four survey locations.

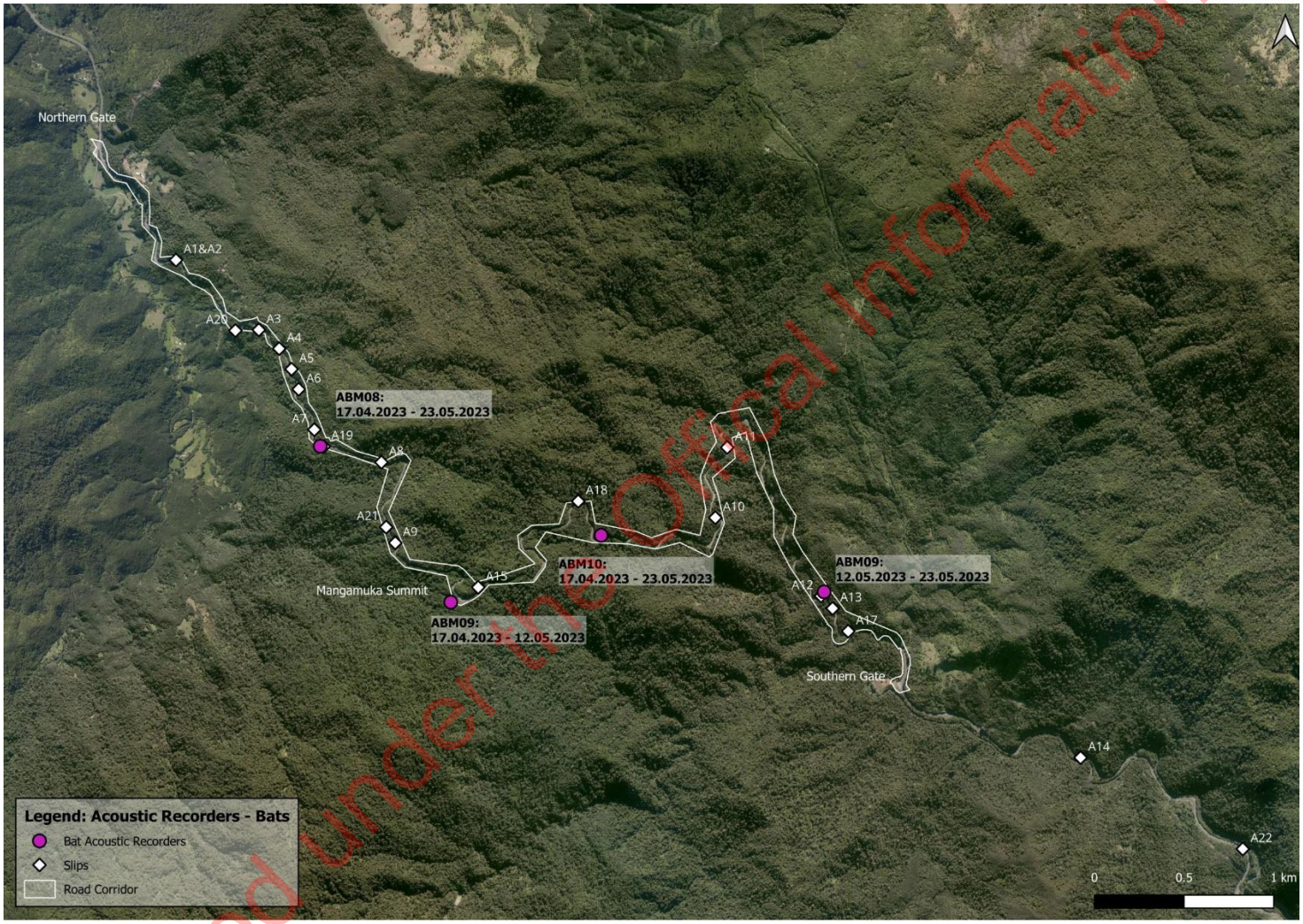


Figure 2: Deployment locations of Automatic Bat Monitors (ABMs) and slip sites relative to stream and gully networks surrounding SH1 within the Mangamuka Gorge Scenic Reserve.
Figure Source: New Zealand Environmental Management

4.3 Roost Assessment Surveys

Roosts are critical to bats as they have an influence on a range of behaviours associated with ecological and physiological requirements. Cavities in trees, as well as features including fractured and broken limbs, flaking bark and crevices all provide good quality roosting habitat for bats. Mature vegetation containing a range of epiphytes including kōwharawhara (*Astelia solandri*) provide good quality potential habitat and structural complexity to the canopy. Ponga (*Cyathea dealbata)* and mamuku (*Sphaeropteris medullaris)* are also known to provide important resources to bats by way of shedding thick fern fronds and dead standing trunks. Importantly, these features are not limited to indigenous vegetation, as a range of exotic tree species including pine (*Pinus* spp.), eucalyptus (*Eucalyptus* spp.*)* and acacia (*Acacia* spp.*)* are regularly used by both bat species.

When undertaking roost assessments, trees can be broadly categorised into the following two categories:

1. High Risk: DBH[2] >15cm and contains suitable roost features
2. Low Risk: DBH <15cm or with no suitable roost features

Trees assessed as 'High Risk' are subject to further management as described in Section 5. Trees assessed as 'Low Risk' can be felled without further management or supervision.

4.3.1 Methods

A site visit was undertaken on 12th May 2023 by the author who is a DOC certified bat ecologist. The site visit focussed on roost tree assessments at slip sites A1, A2, A3, A4, A5, A6, A7, A8 (upslope of road), A9, A12 and A13. At that point in time, slip sites A10 and A11 were not actively being worked on and therefore were unable to be assessed.

A second site visit was undertaken on 18th August 2023 to assess potential habitats at slip sites A11 and A8 (downslope of the road) as preliminary engineering designs have become available regarding vegetation clearance requirements.[3]

Each slip site was assessed for potentially suitable roosting trees within subject works clearance areas and immediately adjacent vegetation. This assessment involved visually searching for the features described in Section 4.3 above in trees with an estimated DBH of >15cm[4]. Additionally, terrestrial habitats were also looked at (where they were visible, mostly on slip sites uphill of the road) with respect to potential foraging habitats.

[2] DBH: Diameter at breast height.
[3] At the time of preparing this BMP update (22.09.23) additional surveys at sites A4, A7, A8, A11 and A27 are scheduled.
[4] As most of the roadside vegetation is physically inaccessible due to steep topography both upslope and downslope of the road, DBH could only be estimated from a distance.

4.3.2 Results

Of the 13 slip sites that were initially assessed, sites A3, A8, A11, A12 and A13 were identified as High-Risk bat trees containing potential roost features either within the clearance area, or in the adjacent landscape.

Site A3 contained three eucalyptus trees within the proposed clearance area, two of which qualified as High-Risk trees and contained features that represent suitable bat roosting habitat (Photos 1 and 2). At the time of preparing this BMP, neither of these trees require removal and can be worked around to facilitate engineering requirements. The third eucalyptus tree qualified as Low Risk as it did not contain any roost features and was therefore cleared for felling.

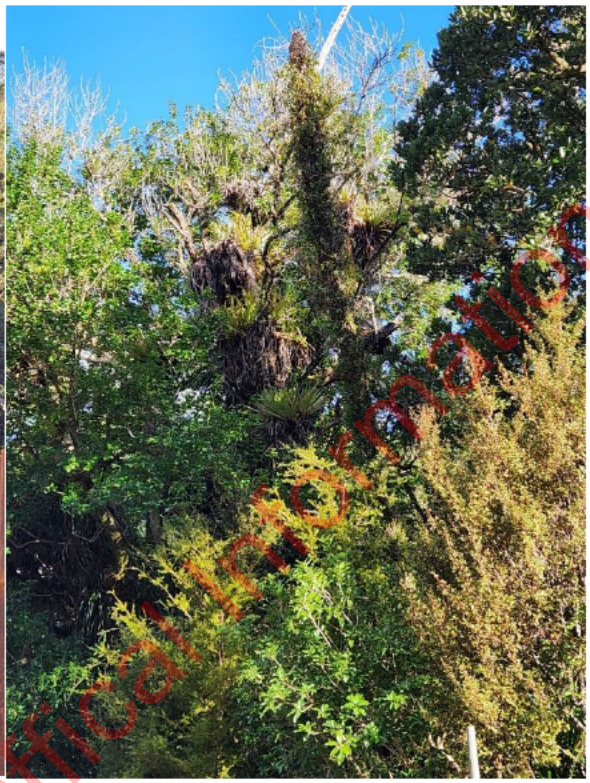
Site A8 requires the clearance of a 3-6m buffer that include several High-Risk potential bat trees, including a mature pūriri tree with multiple potential roost features and epiphyte loadings (Photo 3).

Site A11 requires up to c. 0.65ha of vegetation removed to address an area where multiple slips have occurred. Several mature trees in this area represent good quality potential bat roosting habitat with suitable features and epiphyte loadings (Photo 4).

Sites A12 and A13 are situated in adjacent sections and together comprise slip management around a section of land that drops steeply away into the deep gully of Mangamuka River. At the time of undertaking the roost assessment, vegetation downslope of the road had mostly already been lost from flooding and slip activity. All vegetation upslope of the road remained in-situ and was able to be assessed. No potential bat roost trees were identified within any of the vegetation that required clearance. Vegetation throughout the gully that is adjacent to the A12 and A13 clearance area comprises high quality roosting and foraging habitat for both bat species (Photos 5 and 6). It is likely that this gully represents a high value commuting and foraging pathway for bats.

Photos 1 (left) and 2 (right): The only two trees (*Eucalyptus spp.)* containing potential roost features within any of the proposed clearance areas – Slip site A3.

Photo 3 (left): Roadside vegetation at A8 (downslope) that requires removal.
Photo 4 (right): Area of vegetation at A11 that requires removal.

Photos 5 (left) and 6 (right): Gully vegetation that surrounds clearance areas at slip sites A12 and A13. The gully contains numerous mature indigenous trees with suitable potential bat roosting features.

5. Summary of Potential Effects

There are a range of potential and actual adverse effects to bats that are commonly associated with vegetation clearance and construction activities. To provide context to the recommended management strategy, some of these activities and the potential effects associated with them are outlined in Table 2 below:

Table 2: Construction-related activities and their potential adverse effects to bats.

Activity	Potential Direct & Indirect Effects
Tree felling/habitat removal	▪ Injury and/or mortality to individual bats, entire colonies and/or offspring ▪ Reduced habitat availability ▪ Increased competition for resources
Use of construction equipment including generators, heavy machinery, vehicles and artificial lighting	▪ Avoidance of habitats and well-established commuting/foraging pathways ▪ Disruption to echolocation (communication and foraging) ▪ Displacement into sub-optimal habitats ▪ Abandonment of roosts / breeding failure ▪ Reduction of foraging efficiency (including range and/or duration)

The risk of injury or mortality to bats through vegetation clearance is to be addressed by the following mitigation actions described below in Section 6 of this management strategy.

6. Management of Effects

At the time of preparing this updated BMP (v.1.2), a preliminary habitat assessment has been undertaken at most of the subject slip sites. This resulted in the identification of multiple High-Risk potential bat roosting features within trees at Sites 8 and 11 that require removal.

The habitat assessment also identified gullies in landscapes surrounding slip sites that contain high quality bat habitat, and these adjacent areas should also be considered in the strategy due to the potential indirect effects that operational and construction activities may have on resident bat populations.

As long-tailed bats (and potentially short-tailed bats) have already been confirmed as using habitats around SH1 roadside edge habitats, the following management strategies shall be implemented at each of the slip sites where High-Risk trees are identified either within or immediately adjacent to vegetation clearance boundaries.

6.1 Tree-Felling Protocols

There are four primary activities that can be undertaken to ensure that trees do not have bats roosting in them at the time of felling. These approaches are summarised in Table 3 below and described in detail in Sections 6.1.1 to 6.1.4.

Table 3: Management activities to ensure that potential roost trees do not contain bats prior to felling.

Management Activity	Personnel required on site	Seasonal requirements
1. Roost identification & visual observation	Certified bat ecologist	None
2. Acoustic monitoring	Certified bat ecologist	October to April
3. Roost emergence watches	Certified bat ecologist & Project ecologist	October to April
4. Tree-climbing and roost inspection	Certified bat ecologist & Climbing arborist	October to April

The following protocols will apply to any High-Risk tree within a clearance boundary that contains potential bat roosting features. Any trees immediately adjacent to clearance boundary edges shall also be inspected if there is potential that they may be knocked or damaged during the felling of adjacent vegetation.

No tree that has been confirmed as containing bats may be felled until bats have been confirmed as vacated using one or a combination of the following protocols. This is of particular importance during the breeding months between November and January (inclusive). This may require daily monitoring for several days to a week (or more).

6.1.1 Acoustic monitoring (ABMs)

Repeating ABM surveys immediately prior to tree-felling provides a low-disturbance method of minimising the likelihood of felling a tree with a bat inside a roost. Two days prior to commencing tree-felling, ABMs will be deployed throughout the area to achieve two nights of survey (comprising consecutive dusk, dawn, dusk, dawn activity periods). ABMs cover a radius of up to 30 metres, therefore a sufficient number of units must be deployed to ensure the entire proposed clearance area is adequately covered. It is recommended that one ABM is used per tree or small group of trees.

Each morning of tree felling the CBE will analyse ABM data from the previous two nights.

If bat passes are not detected by ABMs for two consecutive nights that both fulfil the 'survey suitability' criteria as outlined in Section 4.2, then trees may be felled that day only. However, if all relevant trees within the radius of each ABM (and with a DBH of >15cm) are unable to be felled in a single day, the ABM will need to be re-deployed and re-analysed the following morning again to ensure that the trees have not become occupied again.

If bat passes are detected on any given ABM, no trees may be felled within the radius of that ABM (i.e., 30 metres) the following day, unless:

1. They have a DBH of less than 15cm, and/or
2. They have been assessed for roost features and do not contain any potential roosting habitat for bats, as determined by the CBE, and/or
3. Roost features have been inspected by a qualified climber and confirmed as empty (see Section 6.1.2 below).

It's important to note that if general bat activity levels on site are moderate to high, then achieving two consecutive nights without passes is unlikely and therefore this method should be discontinued in favour of undertaking roost emergence watches and/or physical inspections.

6.1.2 Roost inspections

Where ABM activity is consistent and/or there is any uncertainty by the CBE as to whether bats are using a roost, then it will be necessary to undertake physical inspections of roosts immediately prior to felling. This involves engaging an experienced arborist to climb the tree and inspect the cavity/crevice/other roost feature for the presence of bats under the direct supervision of the CBE. They may need to take a photograph or use an endoscope (a long flexible tube with a lens at one end and a camera at the other) to illuminate and record the inside of the roost. Arborists should also inspect for other signs associated with roost usage (such as guano or urine stains), or a lack of suitability such as a wet cavity/crack. Once the arborist has communicated their findings to the CBE, a decision will be made on whether that tree may be felled that day.

As with ABM monitoring, roost inspection results are valid for the same day only, and any trees unable to be felled that day will need to be re-inspected the following day to ensure they are still clear of bats. In the event that bats have (re)occupied a roost overnight, then the surveillance and inspection protocols shall be continued daily until it has been confirmed that a tree is vacant.

Where feasible, the tree may be 'de-risked'[5] to remove potential roosting features. This may be possible in scenarios where branches containing the potential feature could be selectively felled, removing the risk of roosting.

6.1.3 Roost emergence and roost return watches

Roost emergence and return watches are the alternative option if a climber cannot be arranged (due to being the most labour intensive). They may also be undertaken concurrently with the two-night ABM surveys in situations where the tree is visible, and it is practical. This process involves sitting near to a specific tree or set of trees that contain roost features at dusk and again the following dawn in an effort to observe bats leaving and returning to the roost. Specifically, these activities should only be implemented under suitable weather conditions as per the 'survey suitability' criteria[6]. If deemed suitable, this survey method involves the following protocol:

1. Roost Emergence: Trees should be observed from 1 hour prior to sunset until 1 hour after sunset (or until it is too dark to observe activity).

   Roost Return: Trees should be observed from 2 hours prior to sunrise until 1 hour following sunrise.

2. If all roosts in a tree cannot be observed by a single observer (i.e., roosts on opposite sides of a large tree), then a secondary or multiple observers will be required for the survey.

3. Surveys should be supported by hand-held detectors that will alert the ecologist(s) to bat activity in the target area. This can indicate impending nocturnal emergence or bats returning to roost at dawn.

4. If available, thermal/infrared cameras may also be used to supplement these surveys. This tool can be particularly useful by detecting heat signatures that radiate from potential roosts, and by detecting bats when visibility is limited by darkness.

If no bats are observed exiting and (re)entering the target roost(s) then that tree may be felled on the same day as the dawn survey only.

Conversely, if bats are observed exiting the roost at dusk, but no bats are observed (re)entering the roost at dawn then the protocol shall default to being physically inspected by the climbing Arborist, under the supervision of the CBE.

If bats are observed entering the roost during the dawn surveys, then the tree must not be felled until bats vacate the roost and have been absent for a minimum of two consecutive days/nights.

If there is any uncertainty whether a bat has exited/entered a roost then a physical inspection must be undertaken before the tree can be felled.

[5] De-risking a tree involves removing a potential roost feature after confirmation it is not occupied by a bat. This may comprise cutting individual limbs with features or removing large epiphytes in their entirety. This ensures the tree will not be used as habitat by bats going forward, thus allowing it to be removed at any time without supervision by the CBE.

[6] Note: When undertaking roost watches, night temperatures must be 10°C or greater all night between dusk and dawn in the North Island.

6.1.4 Tree-Felling

Once the above pre-felling protocols have been successfully applied and a tree has been approved for felling by the CBE, it must be removed on the same day, under the supervision of the CBE.

Immediately following tree felling, the CBE will need to undertake their own inspection of all roosts to search for any sign of bat presence that may have gone undetected. A handheld bat detector will be used during these searches to listen for distressed bats. If an injured or dead bat is located during these final inspections, Section 7 below discusses the protocol that must be applied.

7. Injured or Dead Bats

If a bat is found during post-felling inspections, they may only be handled by the CBE who will apply the 'Initial Veterinary Care for New Zealand Bats' protocols (Wildland Consultants, 2019). This document was prepared specifically to provide guidelines for situations such as during tree-felling that may result in the injury and/or mortality of indigenous bats.

It is recommended that the CBE contact the nearest appropriate Wildlife Veterinarian in advance of tree-felling if bats are determined to be present. The veterinarian can ensure they are adequately prepared, and the guideline document may be emailed to them to familiarise themselves with it if they haven't reviewed it. There are several veterinarian practices in both Kaitaia and Kerikeri; however, these all mainly specialise in domestic and rural animals and don't specify any expertise in indigenous wildlife. Therefore, if it is possible, it is recommended that an injured bat be transported as quickly and efficiently as possible to Auckland Zoo for assessment and treatment by an experienced, specialised Wildlife Vet.

The protocols should be reviewed prior to commencing tree-felling by the CBE but can be summarised as follows:

- If practical, the CBE should wear at least one thin disposable glove on the hand that is securing the bat before handling any injured bats.
- The bat should be placed in a cloth bag in the dark in a warm, quiet room and taken to the veterinarian as soon as possible.
- When transporting the bat, be mindful of keeping the drive as smooth and quiet as possible (i.e., no loud music and avoiding metal roads where possible).
- Have a colleague record important details regarding the bat's location and condition.
- The Department of Conservation's nearest office should be contacted and informed, and this must be done promptly if a bat is found injured or dead in a felled tree.
    - If injured, the Veterinarian shall liaise with DOC to discuss the injuries and prognosis and seek guidance on the preferred rehabilitation requirements or euthanasia option.
    - If dead, the bat shall be returned to the nearest DOC office as soon as possible.

Any bats that are assessed by the veterinarian as 'uninjured' shall be kept until dusk when it will be released into an area agreed upon by the CBE and the local DOC office.

8. Accidental Discovery Protocol

In the event that bats are not detected, and tree-felling continues without the supervision of the CBE, arborists shall be provided with an accidental discovery protocol by the CBE prior to commencing tree-felling. This should broadly involve a description of what to look out for (signs such as guano that may have been missed during the assessments), together with the CBE's contact details. Work should stop immediately until the CBE is able to attend site and assess the situation. The CBE shall contact relevant staff at both Council and DOC so that together they can determine an appropriate course of action.

This may involve repeating ABM surveys, tree inspections and/or applying the Veterinary Care for New Zealand Bats protocols.

9. Seasonality Requirements

Bat work is restricted seasonally, with certain activities only being able to be undertaken during certain times of year as follows:

- Roost assessments: Unrestricted.
- ABM Surveys: October – April
- Tree felling (of individual trees confirmed as roost trees, subject to the tree-felling protocol): October – April

It is advised that tree-felling in areas where bats are confirmed as present are avoided during the months of November, December and January if possible. This is because females are heavily pregnant making them less mobile, and non-volant young are unable to fly and confined to roosts until at least February. If a maternity roost is suspected, it may take up to four or more days (less than a week) for offspring to be moved to a different roost and to clear a tree for felling.

10. CONCLUSIONS

Waka Kotahi is managing slip repair works on SH1 in the Mangamuka Gorge Scenic Reserve. The project is being undertaken with urgency, with a high priority placed on several critical slips that pose significant risk to road stability and threaten to keep communities in the Far North cut off from essential services, friends and whānau.

Biodiversity values throughout the MGSR and the wider Maungataniwha Ranges are significant, with several At Risk and Threatened flora and fauna species having already been identified, including long-tailed bats and potentially the Northern lesser short-tailed bat.

This BMP provides a proposed management strategy that is in accordance with the recommendations of the Department of Conservation (2021). At the time of preparing this BMP update, 4 of the 11 active slip sites being addressed have been assessed as containing potential bat roost habitat within or immediately adjacent to the identified vegetation clearance areas (A3, A8, A11, A12 and A13). Neither of the two trees at A3 containing bat roost features required removal and were able to be 'worked around' to achieve engineering requirements. Sites A12 and A13 did not require the removal of bat roost habitats; although the surrounding gully vegetation represents high-quality bat commuting, foraging, and roosting habitat and it is likely that bats in this area could be impacted to some degree by construction activities at these sites. Several potential high-risk trees have been identified at A11 and A8 and these sites are commencing works from March 2024. It is recommended that ABMs be deployed within habitats adjacent to each remaining slip site from commencement of works until potential bat trees are felled. This may provide insight as to whether construction-related disturbances are deterring bats from using roost trees within the clearance footprint in the lead-up to felling.

Provided that updated ABM surveys, roost inspection and tree-felling protocols are applied appropriately, it is anticipated that this BMP will minimise the risk of injuring or killing indigenous bats should they be utilizing habitat within the site. It is anticipated that over the coming months more slip sites will have their remediation works designed and that several of these will impact High-Risk bat habitat. The assessment, survey and mitigation protocols outlined within this BMP shall apply to all slip sites prior to vegetation removal.

This BMP may be subject to updates following consultation with the Client and relevant stakeholders.

ACKNOWLEDGEMENTS

We acknowledge NZEM, Te Paatu (hapū on the northern side) and Ngā Hapū ō Mangamuka (hapū on the southern side of the gorge), DOC's Technical Specialist for providing site access, field support and technical advice, together with WSP, CLL, Stellar Projects, Far North Roading and Spiral Drillers Civil.

REFERENCES

Burgar, JM, MD Craig and VL Stokes (2015) The importance of mature forest as bat roosting habitat within a production landscape. Forest Ecology and Management 356: 112–123

Conning, L., (2002). Natural areas of Maungataniwha Ecological District. *Reconnaissance Survey Report for the Protected Natural Areas Programme*. Department of Conservation, Whangarei. pp 25.

Crawford, R. D., Dodd, L. E., Tillman, F. E., & O'Keefe, J. M. (2022). Evaluating bat boxes: design and placement alter bioenergetic costs and overheating risk. Conservation physiology, 10(1), pp. 27.

Dekrout AS, Clarkson BD, Parsons S 2014. Temporal and spatial distribution and habitat associations of an urban population of New Zealand long-tailed bats (Chalinolobus tuberculatus). New Zealand Journal of Zoology 41: 285-295.

Department of Conservation (2021). Protocols for minimising the risk of felling bat roosts (Bat Roost Protocols (BRP)). Technical Document prepared by the Bat Recovery Group. Wellington, NZ.

Jones C., Borkin K., Smith D. 2019: Roads and wildlife: the need for evidence-based decisions; New Zealand bats as a case study. *New Zealand Journal of Ecology DOI*: https://dx.doi.org/10.20417/nzjecol.43.26.

NZEM (2023). Mangamuka Slip Repairs, State Highway 1, Mangamuka – Biodiversity Report. *Technical report prepared for Waka Kotahi*. Northland. Pp 64.

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

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

O'Donnell, C. F., & Sedgeley, J. A. (2001). Guidelines for surveying and monitoring long-tailed bat populations using line transects. Wellington: Department of Conservation.

O'Donnell, C. F., Pryde, M. A., van Dam-Bates, P., & Elliott, G. P. (2017). Controlling invasive predators enhances the long-term survival of endangered New Zealand long-tailed bats (Chalinolobus tuberculatus): implications for conservation of bats on oceanic islands. Biological Conservation, 214, 156-167.

Pryde, M. A., O'Donnell, C. F., & Barker, R. J. (2005). Factors influencing survival and long-term population viability of New Zealand long-tailed bats (Chalinolobus tuberculatus): implications for conservation. Biological conservation, 126(2), 175-185.

Sedgeley, J., O'Donnell, C., Lyall, J., Edmonds, H., Simpson, W., Carpenter, J., Hoare, J. McKinnes, K. (2012). DOC best practice manual of conservation techniques for bats. Version 1.0. Wellington: Department of Conservation.

Smith, D, K Borkin, C Jones, S Lindberg, F Davies and G Eccles (2017) Effects of land transport activities on

New Zealand's endemic bat populations: reviews of ecological and regulatory literature. NZ Transport Agency research report 623. 249pp.

Wildland Consultants 2019: Initial veterinary care for New Zealand Bats. *Wildland Consultants Ltd Contract Report No. 4984*. Prepared for Department of Conservation, Wildlife Society of the New Zealand Veterinary Association, and New Zealand Transport Agency. 66 pp.

Invertebrate Management Plan
Mangamuka Slip Repairs

Prepared for:
NZ Environmental Management Limited
on behalf of the client Waka Kotahi
August 2023 (Updated September 2023 and February 2024)

Document Quality Assurance

Document Version	Action	Name	Signed	Date
1.0	Prepared by	Sec 9(2)(a) Kūkūwai Consulting Ltd	Sec 9(2)(a)	23.08.2023
	Peer review	Sec 9(2)(a)	Sec 9(2)(a)	24.08.2023
2.0	Update by	Sec 9(2)(a)	Sec 9(2)(a)	21.02.2024

Cover image: Empty shell of a kauri snail found at Mangamuka Gorge Scenic Reserve.

TABLE OF CONTENTS

1. INTRODUCTION

In July 2020, heavy rainfall caused more than 20 slips and significant damage to State Highway 1 (SH1) where it crosses the Maungataniwha Range and Mangamuka Gorge Scenic Reserve (MGSR). The damage caused the closure of SH1, cutting off local communities from access to Kaitaia and other parts of Te Tai Tokerau via SH1 (Figure 1). Since then, significant and on-going storm events have caused additional slips and erosion, adding further complexity to the repair operation and re-opening of the road.

In December 2022, Waka Kotahi secured funding for road repair works as part of the Far North State Highway Resilience Program. Site investigations, planning and design work commenced early 2023, and subsequently NZ Environmental Management Ltd (NZEM) was engaged to undertake ecological assessment surveys and prepare a Biodiversity Assessment report for the project. It was quickly determined that indigenous fauna of conservation concern was present within the vegetation and habitats of MGSR, including an abundant population of endemic and protected kauri snails (*Paryphanta busbyi busbyi;* At Risk-Declining).

Slip repair works are in progress, with Waka Kotahi working with Councils, the DoC, hapū and other stakeholders to apply for retrospective Resource Consent (in areas outside of the existing roading designation) and other required permissions including a Wildlife Act Authority (WAA) permit for the capture and relocation of indigenous invertebrates that are specifically protected under the Wildlife Act (1953).

An Invertebrate Management Plan ('IMP') is required to provide guidance on the rescue and relocation requirements of kauri snails, *Amborhytida dunniae* (hereafter referred to as rhytida snails) which are also locally abundant, and any other 'At Risk' invertebrates. Other indigenous invertebrates will likely be found during salvage works, and these will also be caught and relocated. These include wētā species within the ground, tree and cave wētā groups, stick insects, giant earthworms, spiders, at least two species of leaf-vein slugs, 'megascolecid' earthworms, and potentially also peripatus (*Peripatoides sp.* also known as ngaokoeoke or velvet worms). It is also possible that the Northland tusked wētā (*Anisoura nicobarica;* At Risk-Declining) is present.

This IMP describes the values of habitats at the slip sites with respect to kauri snail and other indigenous invertebrate fauna. It presents a strategy to minimize the effects of the project on those values and describes mitigation measures to manage potential impacts on invertebrates.

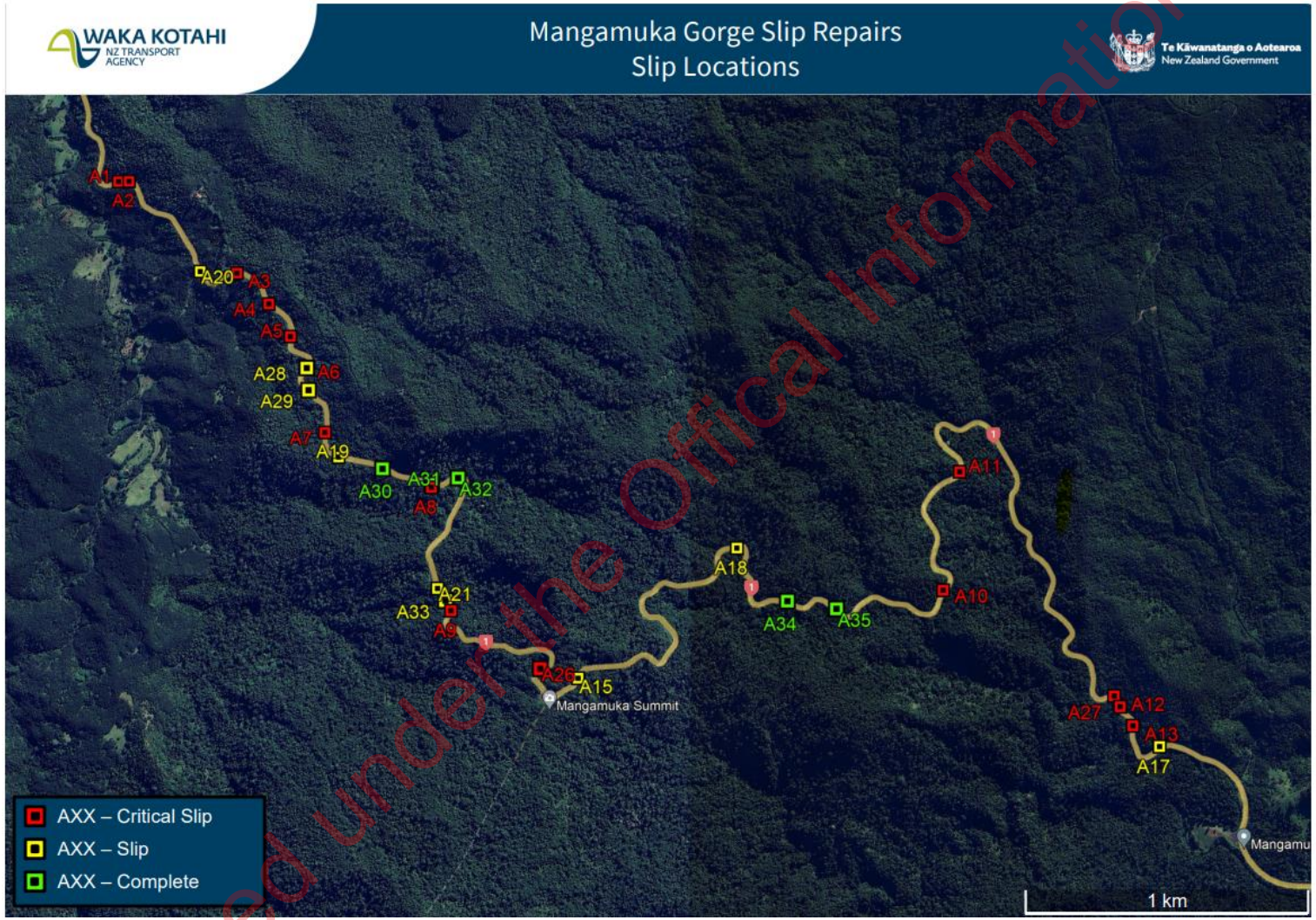


Figure 1: Map of 'critical' or 'non-critical' slip locations in the Mangamuka Gorge Scenic Reserve.
Figure Source: Waka Kotahi

2. Legislative Requirements

Kauri snail is the only known invertebrate on site that is protected under the Wildlife Act. Capturing and relocating kauri snails should not be undertaken prior to gaining a Wildlife Act Authority ('WAA') permit from DoC, or without gaining written permission from DoC. This IMP is being prepared alongside an application to gain a WAA. This WAA will enable protected invertebrates to be safely removed from impact areas and relocated into areas of forest that are subject to predator management in the wider, contiguous landscape.

3. Purpose and Scope

This IMP describes measures to salvage and relocate indigenous protected invertebrates within areas of vegetation and habitat clearance. This IMP includes the following:

a) Desktop and field assessments of habitat value to kauri snails and other invertebrates
b) Summary of the potential effects to invertebrates that arise from habitat clearance
c) Target species
d) Responsibilities and competencies of the staff involved in invertebrate salvage and relocation
e) Salvage protocols
f) Relocation site description
g) Reporting requirements

4. Invertebrate Values

4.1 Desktop Assessment

A desktop assessment of vegetation, habitats and iNaturalist records of kauri snails, rhytida snails and Northern tusked wētā were undertaken to better understand the historical and ecological context of the site with respect to indigenous invertebrates included in this plan. Numerous records of kauri snail are held on iNaturalist around the MGSR and the surrounding contiguous forest tracts of Raetea Forest, Ōmahuta Forest and Puketī Forests. The nearest records of Northern tusked wētā are in and around Waitaruke, approximately 25km from Mangamuka Summit. The nearest iNaturalist record of *Amborhytida dunniae* is 20km from the summit in Taipa, although numerous specimens have already been identified in roadside habitats throughout the MGSR by the Project Ecologist.

These sparse records should not be considered as representative of these species distributions, but rather likely reflect the lack of official surveys, and access to records held by Councils and DOC.

4.1.1 Vegetation and habitats: Maungataniwha Ecological District

Maungataniwha Ecological District ('ED') encompasses approximately 101,900ha extending east from Kaitaia and the Herekino Forest, to the southern boundary of Raetea Forest and the head of Mangamuka River (Conning, 2002), and eastwards almost to Kaeo Valley. The southern boundary lays approximately 5km south

of Mangamuka township and just to the north of Ōmahuta and Puketī forests. The northern boundary is formed by eastern coast, from the southern point of Tokerau Beach in the west to Hihi in the east.

Historically, much of the ED was characterised by broadleaf-podocarp-kauri forest which was subject to extensive logging. Potential bat habitat within the Maungataniwha ED and Range is now characterised by mature forest (mainly secondary forest) comprising species such as northern rata (*Metrosideros robusta),* rimu (*Dacrydium cupressinum*), tōtara (*Podocarpus tōtara* var. *tōtara*), kahikatea (*Dacrycarpus dacrydioides*), kauri (*Agathis australis*), tōwai (*Pterophylla sylvicola*) and taraire (*Beilschmiedia tarairi*). Additional species including tawa (*B. tawa*), rewarewa (*Knightia excelsa*) and pūriri (*Vitex lucens*) are also frequent within this ED. Roadside vegetation along SH1 mostly comprises regenerating shrubland that includes the above listed species, with patches of mānuka (*Leptospermum scoparium*) and kānuka (*Kunzea robusta*) (Conning, 2002).

The Maungataniwha Forest is an area of ecological significance, as demonstrated by the number of Regionally Significant, Threatened and At-Risk species present. A detailed description of vegetation types, and rare and threatened flora are provided in the Draft Biodiversity Report (NZEM, 2023).

4.2 Field surveys

Field surveys were undertaken in the Autumn of the 2022-2023 field season to guide the Biodiversity Assessment report (NZEM, 2023). Although targeted invertebrate surveys were beyond the scope of that report, it does provide some records for indigenous invertebrates, and these are listed below:

- Leaf-veined slugs (*Athoracophoridae sp.*)
- Giant earthworms (*Anisochaeta gigante*)
- Cave wētā (*Rhaphidophoridae sp.*)
- Banded tunnelweb spider (*Hexathele hochstetteri*)
- Water spider (*Dolomedes aquaticus*)
- Giraffe weevil (*Lasiorhynchus barbicornis*)
- Pseudoscorpion (*Pseudoscorpionida*)
- Pūriri moth *(Aenetus virescens)*
- Mānuka beetle (*Pyronota festiva*)

5. SUMMARY OF POTENTIAL EFFECTS

There are a range of potential and actual adverse effects to invertebrates that are commonly associated with vegetation clearance and construction activities. Some of the activities that can adversely impact invertebrates, and the potential effects associated with these activities, are outlined in Table 1 below.

This IMP specifically addresses the risk of injury or mortality to kauri snails and other invertebrates through vegetation clearance, with Section 8 providing a strategy to minimise and mitigate the risk (Table 2). Activities to address the remaining potential impacts are not addressed within this plan.

Table 1: Construction-related activities and their potential adverse effects to invertebrates

Activity	Potential Direct & Indirect Effects
Clearance of vegetation and habitat	▪ Injury and/or mortality to invertebrates ▪ Reduced habitat availability ▪ Deterioration of forest interior habitats associated with newly created edges and edge effects
Relocation into habitats outside of the impact areas	▪ Displacement ▪ Increased competition for resources ▪ Increased vulnerability to predation

The risk of injury or mortality to invertebrates through vegetation clearance is to be addressed by the mitigation actions in Section 8 of this management plan. In the absence of effective mitigation measures, the potential level of effect is considered as 'High' to localised populations of kauri snails and other 'At Risk' or 'Threatened' invertebrates in accordance with the EIANZ framework (2018). However, provided that mitigation activities are applied in accordance with best practice, the overall level of effects are assessed as Low (Table 2).

Table 2: Level of effects based on EIANZ assessment criteria (2018)

Species	Ecological value of species	Effect	Timescale of effect	Magnitude of effect	Level of ecological effect (pre-mitigation)	Level of ecological effect (post mitigation)
Kauri snail	High	Injury & mortality	Temporary	Moderate	High	Low
At Risk invertebrates	High	Injury & mortality	Temporary	Moderate	High	Low

6. Targeted Species: Brief Descriptions

6.1 Kauri Snail

Kauri snails are one of New Zealand's large, endemic, carnivorous snails. Historically widespread throughout many areas from the Far North to Warkworth, their former range has been severely restricted by human-related disturbance, land clearance and habitat loss, and high levels of predation by mammals including feral pigs (*Sus scrofa)* and possums (*Trichosurus vulpecula)*. Two populations outside of Northland and North Auckland occur in the Waitakere Ranges and the Kaimai Ranges where they have been introduced and established successfully. Kauri snails belong to the *Rhytididae* family of land snails that occur in South Africa,

Australia, Pacific Islands and New Zealand (Parrish, Sherley & Aviss, 1995). Their shells can reach up to 80mm in diameter and they can live up to 25 years, reaching maturity at around three years old. Kauri snails eat a variety of invertebrates and can reach high densities when soils are fertile and prey species are abundant. Mating takes place from autumn to winter, egg litters are laid in August and September, and hatching occurs from summer till winter (Stringer & Montefiore, 2000). Eggs are laid deep within leaf litter and are approximately 12x10mm in size (Parrish *et al*., 1995).

6.2 Amborhytida dunniae

Amborhytida dunniae is a much smaller endemic land snail with a shell up to 30mm in length. Like kauri snail, this species is carnivorous and occupies a similar range of micro-habitats that kauri snail is found in. This species is widely distributed throughout the Northland and Auckland regions.

6.3 Northern tusked wētā

Northern tusked wētā is the smallest of the three tusked wētā species with adult body length measuring between 25 and 32mm (Biodiversity Threats Unit, 1998). This species is endemic to the northern half of Northland. Unlike the other two species which are ground burrowers, the northern tusked wētā is arboreal and behaviourally is more like tree wētā, living in tree holes (Trewick & Morgan-Richards, 2004). Most specimens having been found in vegetation dominated by mānuka and/or kānuka.

7. RESPONSIBILITIES AND COMPETENCIES

Implementation of this IMP will be undertaken by the appointed Project Ecologist(s). It is the responsibility of the appointed Project/Site Manager to ensure clear and consistent information is relayed to the Project Ecologist(s) regarding proposed vegetation and habitat clearance activities. The Project Ecologist(s) must be suitably qualified and experienced in the basic techniques required to search for and safely handle kauri snails and other invertebrates. A good understanding of the habitat requirements of each type of invertebrate being relocated should be gained prior to commencing salvage activities. It is important that all key project team members are familiar with the requirements and protocols of this IMP to ensure that appropriate mitigation (i.e., salvage) is able to be implemented both prior to, and where appropriate during, habitat clearance.

The responsibilities of the Project / Site Manager include but are not limited to:

- Review of this IMP, with a clear understanding of what comprises potential habitat for kauri snails.
- Liaising with the Project Ecologist on a weekly basis with clear communication of any/all proposed works that require vegetation clearance the following week (to the greatest extent possible).
- Ensure that hapū representatives are also contacted and given advance notice regarding participation and supervision of invertebrate salvage activities.
- Maintaining clear lines of communication with the Project Ecologist(s) regarding changes to the works schedule.

8. Management of Effects

Salvage and relocation are the main activities being undertaken to mitigate the adverse effects of vegetation and habitat clearance on terrestrial invertebrates. The following methods describe how invertebrates are to be detected, handled and released.

8.1 Visual observation (Spotlighting searches)

Across the wider works area, kauri snails are rescued from the middle of the road (SH1) on an almost daily basis in the early mornings when contractors arrive on site prior to 7am. Protocols are in place to safely relocate snails back into roadside vegetation away from slip sites; however, it is possible that these snails are simply 'homing' back to their habitats and repeating the process. Therefore, on the day of salvage, ecologists will arrive on-site at least 30 minutes prior to sunrise to search for kauri snails that are still out foraging on road edges. Attention will be made to scan the road with white-light or red-light torches for crossing snails, and all snails detected will be collected for relocation, even if they are not near the specific slip site that is being cleared that day.

8.2 Systematic hand-searching

At least two days prior to planned vegetation clearance at any given area, destructive hand-searching will be undertaken throughout the clearance footprint. This will involve using hands and fingers to gently sift through leaf litter and loose debris to find kauri snails and other invertebrates. Terrestrial vegetation including grasses and mosses will be pulled away from the soil surface to search beneath vegetation layers, and all objects providing potential refuge such as rotting logs and liftable rocks will be inspected. Wherever possible, leaf litter and vegetation will be raked back to the edges of the footprint in an effort to remove all kauri snail habitat and minimise the risk of recolonisation.

It is anticipated that egg litters of kauri snail may be detected throughout the field season (September till May) and these are likely to be located at a depth of 0.5cm or more in the leaf litter. A precautionary approach will be taken during these months to also search for eggs during all systematic searches for kauri snails (Figure 2).

Where possible, at least two ecologists will undertake this searching process, using a type of 'double observer' technique that ensures each clearance area has been thoroughly searched twice.

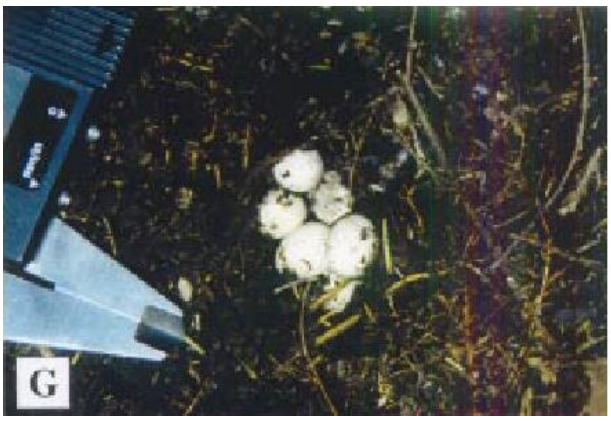


Figure 2: Egg litter of *P. busbyi watti* as an example of the appearance of *P. busbyi busbyi* eggs (Stringer & Montefiore, 2000).

8.3 Tree inspections

Fronds of tree ferns that collect around the bottom of the trunk forming 'fern skirts' will also be searched thoroughly, together with flaking bark on tree trunks (particularly for species like tōtara) where juvenile kauri snails are known to reside arboreally. Northern tusked wētā (along with tree wētā) will also be searched for in cavities and crevices of trunk wood and limb wood as they are known to reside arboreally in the same way as tree wētā do. These tree inspections will be made both prior to and immediately post-felling.

8.4 Data collection

Each captured kauri snail will have the following information recorded:

- Date and slip site
- GPS location (both capture and relocation)
- Habitat type (i.e., leaf litter, rotting log, tree bark)
- Shell diameter (mm)
- Photograph and assignment of ID number to link data to photo
- Any other relevant information (e.g., cracked shell, distinguishing shell markings etc).

Any other invertebrate that is opportunistically collected will have basic species data, a photograph, and notes on capture and relocation microhabitats recorded.

8.5 Handling and transport

All captured invertebrates will be handled gently and placed immediately into a bin or bucket filled to the top with damp leaf litter. Snails and wētā will be stored in separate containers, with each container secured with a lid and stored in the shade for no more than four hours before being released. An additional container will be kept for any opportunistic invertebrate captures of other species. Containers will be washed and

sterilized between each slip site. All handling and transport will be in accordance with requirements of the Animal Welfare Act (1999).

8.5.1 Kauri snail egg litters

If detected, eggs will be gently collected and placed into a small, ventilated container with the adult kauri snail that they are found with (if found together or in close proximity). The container will be filled with moist soil and placed within the larger kauri snail relocation container. If found together, adult snails and their eggs will be relocated together into individual release refuges at the appointed release site.

8.5.2 Opportunistic daily rescue protocol

Opportunistic rescue of kauri snails is an almost daily occurrence at MGSR due to their tendency to detected in the middle of the road in the early morning when contractors begin arriving on-site. To date, the protocol has been for the snails to be simply relocated back into habitats on the side of the road, away from any immediate slip areas or construction works. This protocol will continue, with a preference to relocate snails as closely as possible to road-edge habitats they are closest to at the time of detection.

8.6 Vegetation management

8.6.1 Felled vegetation

Where possible, felled vegetation will be relocated into the understorey of adjacent vegetation that sits outside of the clearance footprint. Mānuka, kānuka, ponga, mamaku and other cut material with obvious holes will be prioritised due to the potential for tusked wētā, peripatus and other protected fauna (including arboreal geckos) to be residing within cavities that can't be searched properly.

Felled trees of the above species must not be chipped, but rather stacked into the understorey of adjacent vegetation outside the zone of impact.

The logistical challenges associated with this project mean that most other vegetation will be chipped immediately on site as there are no on-site storage areas that felled vegetation can be transported to and left in-situ. The Project Ecologist and Site Manager shall liaise on a site-by-site basis to determine how vegetation may be managed in a practical manner that is able to preserve critical habitat for invertebrate fauna.

9. INVERTEBRATE RELEASE LOCATIONS[1]

The Mangamuka works site is divided into two areas: north of the summit and south of the summit. All salvaged invertebrates will be released on the same side of the summit as they were caught in a location as close to the capture site as possible. Prior to undertaking salvage in any new slip, an area between 10 and 50 metres (i.e., safe and accessible) from the clearance area will be identified as the dedicated release site for that slip. The area will be flagged, GPS'd and individual release sites will be sprayed with pink dazzle to ensure they are not stood on during any subsequent releases in the same area. As the Mangamuka Gorge sits within a scenic reserve and a much larger landscape of contiguous forest, the habitat in general is suitable anywhere for release if it fulfils the following criteria:

- Relocation areas have deep leaf litter and an abundance of woody debris, rotting materials and areas of mossy cover.
- Relocation is upslope or adjacent to the slip sites that are either currently active or yet to be addressed by the works.

9.1 Habitat enhancement

To ensure that they are released into microhabitats that are free of competition, all snails will be released beneath a large log or piece of wood (hereafter referred to as 'snail refuge') or debris and have a dense layer of damp leaf litter built up around it. A selection of snail refuges and quality leaf litter plus moss will be gathered from the release site and used to create competition-free release refuges for each individual snail being released. All other invertebrates that are opportunistically salvaged from slip sites will be released into the same type of terrestrial or arboreal habitat that they were salvaged from.

10. INCIDENTAL INJURY OR MORTALITY (KAURI SNAILS)

If an injured kauri snail is discovered the Project Ecologist shall be called to site immediately. An initial assessment as to the scale of injury shall be made in consultation with DOC's Technical Specialist for land snails who will be called and sent photos immediately. If there is significant damage to the shell and/or obvious injury to the body (including head and foot of snail) the Project Ecologist shall have the authority to humanely euthanize the snail in accordance with best practice and methods recommended in Gilbertson and Wyatt (2016) and endorsed by the AMVA Guidelines (Underwood & Antony, 2020) (Appendix 1, Figures 4 and 5). Wētā and other injured invertebrates shall be euthanised using blunt force trauma (Underwood & Antony, 2020). Euthanasia may only be carried out by the Project Ecologist following assessment[2].

[1] Kauri snail release recommendations have been edited in this updated IMP following discussions with DOC's Technical Specialist for large land snails *Paryphanta* and *Powelliphanta* species. Initial recommendations to move snails further away from capture sites into predator managed areas have been revised due to the potential for hyper-predation effects by rodents which may be unnaturally abundant due to mustelid suppression. Further, complex genetic considerations have been prioritised to retain resilience within highly localised sub-populations.

[2] It may be appropriate to supply a Euthanasia Kit (see Section 9) to each Senior Cultural Monitor. Full training on euthanasia protocols could be provided by the Project Ecologist to each Senior Cultural Monitor if this is deemed appropriate by DOC. This would only be undertaken if the Project Ecologist was not on-site and unable to quickly get to site. Verbal approval would need to be given by the Project Ecologist prior to euthanasia being undertaken.

A euthanasia kit will be assembled that contains the following:

1. Ethanol (lab-grade 5%)
2. Ethanol (70-95%) or neutral-buffered formalin (10%)
3. 2 x plastic jars with sealed lid
4. A small hammer with flat head (for other injured invertebrates such as tree wētā or stick insects that are frequently injured during tree-felling)

Snails with only minor shell damage shall be assessed by the Project Ecologist and DoC's Technical Specialist. Shells can regenerate quickly in these circumstances and therefore any individuals with only minor damage will be released in the same manner as uninjured snails. Any dead specimens shall be photographed and frozen. DoC and hapū shall be contacted and asked for direction on how they would like the specimen to be managed (i.e., submitted to DoC or taken to the release site).

11. Seasonality Requirements

As with mammals, invertebrates can be metabolically influenced by seasonal fluctuations between warm and cool, and wet and dry (Roberts, 1978). Activities including breeding, dispersal and dormancy are triggered by seasonal changes, and for this reason seasonal constraints associated with invertebrate management will be broadly similar to those applied to lizard and bat management. Salvage should therefore be prioritised (as much as possible) during spring, summer and autumn months (i.e., September – May) during suitable weather conditions (fine, warm with high humidity and light rain if possible).

12. Adaptive Management

The focus of this IMP is addressing project impacts on the dense populations of kauri snails residing in roadside vegetation throughout Mangamuka Gorge. The methods described to capture and relocate kauri snails will be applied to other indigenous invertebrates that are opportunistically detected during searches for kauri snails. However, the dynamic and challenging conditions associated with this slip repair project mean that it may not be possible to incorporate each search technique into the management methods at each site (e.g., if significant weather events cause further slip damage and vegetation requires immediate removal for human safety).

Any adaptations to these management protocols are at the discretion of the Project Ecologist(s). However, if these situations arise and the proposed management of kauri snail needs to be altered in any significant way, DoC and hapū will be consulted prior to implementation.

13. Information Gaps

Slip repair works across the *c.*30 SH1 slip sites throughout the MGSR are being undertaken as quickly as possible. Several slip remediations have already been completed, several are currently being worked on,

several are in the planning stages, and several have yet to be assessed or designed. Consequently, there is a lot of missing information regarding the overall level of effect of works to kauri snails, other invertebrates, and their habitats.

This IMP provides a strategy to mitigate direct impacts to kauri snails and other At-Risk invertebrates at each slip site yet to be remediated via a targeted salvage operation that seeks to rescue and relocate as many individuals from each slip footprint as possible.

14. Conclusions

Waka Kotahi is managing slip repair works on SH1 in the Mangamuka Gorge Scenic Reserve. The project is being undertaken under the Emergency provisions of the RMA, with a high priority placed on several critical slips that pose significant risk to road stability and threaten to keep communities in the Far North cut off from essential services, friends and whānau.

Biodiversity values throughout the MGSR and the wider Maungataniwha Ranges are significant, with several At Risk and Threatened flora and fauna species having already been identified, including kauri snails and rhytida snails. This IMP provides a proposed management strategy that focuses on the salvage of these invertebrates as the main activity to mitigate adverse impacts to them.

Provided that robust searches are undertaken, it is anticipated that this IMP will minimise the risk of injury or mortality that would otherwise occur during vegetation clearance and earthworks.

15. Acknowledgements

We acknowledge the Client Waka Kotahai, along with NZEM, Te Paatu (manawhenua on the northern side) and Ngā Hapū ō Mangamuka (manawhenua on the southern side of the gorge) and DOC for providing site access, field support and technical assistance, together with CLL, Stellar Projects and WSP.

16. REFERENCES

Biodiversity Recovery Unit. (1998). Threatened Weta Recovery Plan. Department of Conservation Threat Series. Wellington. Pp 51.

Conning, L., (2002). Natural areas of Maungataniwha Ecological District. *Reconnaissance Survey Report for the Protected Natural Areas Programme*. Department of Conservation, Whangarei. pp 25.

NZEM (2023). Mangamuka Slip Repairs, State Highway 1, Mangamuka – Biodiversity Report. *Technical report prepared for Waka Kotahi*. Northland. Pp 64.

Mahlfeld, K., Brook, F. J., Roscoe, D. J., Hitchmough, R. A., Stringer, I. 2012: The conservation status of New Zealand terrestrial Gastropoda excluding *Powelliphanta*. New Zealand Entomologist 35(2): 103–109

Gibbs, G. (1998). Raukumara tusked weta: discovery, ecology and management implications. *Conservation advisory science notes*, *218*, 18.

Gilbertson, C. R., & Wyatt, J. D. (2016). Evaluation of euthanasia techniques for an invertebrate species, land snails (*Succinea putris*). *Journal of the American Association for Laboratory Animal Science*, *55*(5), 577-581.

Honeymoon Valley Landcare Trust (2023). Accessed from: https://honeymoonvalleylandcare.org.nz/

Parrish, R., Sherley, G., Aviss, M. (1995). Giant land snail recovery plan *Placostylus spp., Paryphanta spp.,* (Department of Conservation Threatened Species Unit). Wellington. Pp 41.

Roberts, R. M. (1978). Seasonal strategies in insects. *New Zealand Entomologist*, *6*(4), 350-356.

Shelomi, M. (2021). Pain, Suffering, and Euthanasia in Insects. *International Journal of Applied Philosophy*, *35*(1), 31-43.

Spencer, H. G., Brook, F. J., & Kennedy, M. (2006). Phylogeography of kauri snails and their allies from northland, new zealand (mollusca: gastropoda: rhytididae: paryphantinae). *Molecular Phylogenetics and Evolution*, *38*(3), 835-842.

Stringer, I. A., & Montefiore, R. (2000). *Distribution and biology of the endangered kauri snail, Paryphanta busbyi watti*. Department of Conservation.

Stringer, I. A. N., Parrish, G. R., & Sherley, G. H. (2018). Homing, dispersal and mortality after translocation of long-lived land snails Placostylus ambagiosus and P. hongii (Gastropoda: Bothriembryontidae) in New Zealand. *Molluscan Research*, *38*(1), 56-76.

Trewick, S. A., & Morgan-Richards, M. (2004). Phylogenetics of New Zealand's tree, giant and tusked weta (Orthoptera: Anostostomatidae): evidence from mitochondrial DNA. *Journal of Orthoptera Research*, *13*(2), 185-196.

Trewick, S., Hegg, D., Morgan-Richards, M., Murray, T. J., Watts, C., Johns, P. M., & Michel, P. (2022). *Conservation status of Orthoptera (wētā, crickets and grasshoppers) in Aotearoa New Zealand, 2022*. Department of Conservation. Te Papa Atawhai.

Underwood, W., & Anthony, R. (2020). AVMA guidelines for the euthanasia of animals: 2020 edition. *Retrieved on March*, *2013*(30), 2020-1.

APPENDIX 1 – EUTHANASIA PROTOCOL FOR INJURED KAURI SNAILS

In the event that a kauri snail is injured and requires immediate euthanasia, the techniques recommended by Gilbertson and Wyatt (Figure 4) as per the AMVA Guidelines (Figure 5) will be used.

Journal of the American Association for Laboratory Animal Science
Copyright 2016
by the American Association for Laboratory Animal Science

Vol 55, No 5
September 2016
Pages 577–581

Evaluation of Euthanasia Techniques for an Invertebrate Species, Land Snails (*Succinea putris*)

Cody R Gilbertson[1] and Jeffrey D Wyatt[2,*]

The euthanasia of invertebrates used in scientific investigations poses unanswered questions regarding the rapid induction of unconsciousness with minimal distress and pain. Relative to vertebrates, invertebrates' sensory experience of pain, nociception, and physiologic response to aversive stimuli are poorly characterized. The scientific communities in the European Union, Canada, United States, Australia, and New Zealand join in consensus regarding the need to address alleviation of pain and distress in cephalopods (octopus, squid, and so forth), which have the best-characterized nervous system among invertebrates. In the current study, we evaluated various euthanasia techniques in a terrestrial gastropod species, with priority on animal wellbeing, scientific variability, feasibility in both field and laboratory settings, and acceptability by personnel. In addition, we demonstrated that the 2-step method of euthanasia described in the *AVMA Guidelines* as acceptable for aquatic invertebrates is effective for terrestrial snails and meets all welfare and scientific requirements. This 2-step method first induces anesthesia by immersion in 5% ethanol (laboratory-grade ethanol or beer) followed by immersion in a euthanizing and tissue-preserving solution of 70% to 95% ethanol or 10% neutral buffered formalin. Furthermore, alternative methods of euthanasia for terrestrial snails commonly used in field research, such as live immersion in concentrated ethanol or formalin, were shown to be unacceptable.

Abbreviation: RO, reverse-osmosis–purified

Figure 4: Research abstract highlighting the literature endorsing the proposed method of euthanasia for kauri snails if they are badly injured on site.

formulation, and route of administration, as well as the distress associated with physical restraint. The advantages and disadvantages of administering anxiolytics, anesthetics, or other drugs and applying physical restraint should be balanced against the benefit of providing a swift death to end suffering. Research is needed to improve the euthanasia options available for some taxonomic groups and circumstances.

S7.2 CAPTIVE INVERTEBRATES

Invertebrates comprise more than 95% of the animal kingdom's species and include unrelated taxonomic groups: spiders (Araneae),[343] centipedes and millipedes (Myriapoda), insects (Hexapoda),[344] and many others. Terrestrial invertebrates play important roles in laboratory research, as display animals, and as companions in the home. Despite their varied roles, limited guidance is available on appropriate methods by which invertebrates may be euthanized.[251,336,345–347] This is due, in part, to a lack of coverage under animal welfare regulations applicable to animals used for research and other purposes in the United States and other countries.[333,348] Diversity in anatomic, physiologic, and other characteristics limits generalizations across taxa.[349] Of particular relevance are differences in innervation and circulatory systems, some of which do not have close corollaries in familiar vertebrate systems. This creates challenges for developing humane means of terminating invertebrates' lives.

While there is ongoing debate about invertebrates' abilities to perceive pain or otherwise experience compromised welfare, the Guidelines assume that a conservative and humane approach to the care of any creature is warranted and expected by society. Consequently, euthanasia methods should be used that minimize the potential for pain or distress. Most commonly used methods involve terminal anesthesia, followed by physical destruction of the nervous system, to assure lack of sensory perception and death of the animal. The diversity of invertebrate taxa may require equally diverse approaches to euthanasia.

S7.2.1 Acceptable Methods

S7.2.1.1 Noninhaled agents

Injectable agents—While there is little dosing or outcome data in the peer-reviewed literature, an overdose of pentobarbital or similar agent, at a dose equivalent to that used for other poikilotherm verte-

S7.2.2 Acceptable With Conditions Methods

S7.2.2.1 Inhaled agents

Inhaled anesthetics—Overdose of an inhaled anesthetic is acceptable with conditions for terrestrial invertebrates where injectable agents are not available. Because confirming death of many species of invertebrates can be difficult, subsequent use of an adjunctive method of euthanasia is recommended.

Carbon dioxide—Carbon dioxide may be useful for euthanasia of some terrestrial invertebrates, but additional information is needed to confirm its efficacy.

S7.2.2.2 Acceptable first steps of 2-step methods

Two-step euthanasia procedures, as described for aquatic invertebrates, are acceptable for some or many species of invertebrates. Recent research documented the efficacy of immersion in 5% laboratory-grade ethanol or an undiluted, uncarbonated beer (5% ethanol content) served to anesthetize land snails (*Succinea putris*) without signs of distress as a first-step procedure.[335] This was followed by immersion in solutions of 70% to 95% ethanol or neutral-buffered 10% formalin that served to euthanize snails and preserve tissue. Further research is needed to establish the general validity of applying this 2-step method and other methods to terrestrial invertebrate species.

S7.2.2.3 Physical and chemical methods

Physical (eg, boiling, freezing, pithing) and chemical (eg, alcohol, formalin) methods act by destroying the brain or major ganglia. Physical and chemical methods should be applied adjunctively, following pharmaceutical or other chemical induction of anesthesia, nonresponsiveness, or presumptive death. These methods are not considered to be humane as sole methods of euthanasia.[345,346,350,351]

Pithing—This method requires detailed anatomic knowledge of the species in question.

S7.2.3 Unacceptable Methods

Because information on the physiologic responses of invertebrates to many methods of euthanasia is not available at this time, comments regarding unacceptable methods of euthanasia are limited to those that should not be applied as sole methods of euthanasia (see comments under Acceptable With Conditions Methods).

Figure 5: Excerpt from the AVMA Guidelines (2020) highlighting the literature endorsing the proposed method of euthanasia for kauri snails if they are badly injured on site.

Lizard Management Plan
Mangamuka Slip Repairs

Prepared for:
NZ Environmental Management Limited
on behalf of the client Waka Kotahi
September 2023 (Revised February 2024)

Document Quality Assurance

Document Version	Action	Name	Signed	Date
1.0	Prepared by	Sec 9(2)(a) Kūkūwai Consulting Ltd	Sec 9(2)(a)	08.09.2023 (updated 22.09.2023)
	Peer review	Sec 9(2)(a)	Sec 9(2)(a)	12.09.2023
2.0	Updated by	Sec 9(2)(a)	Sec 9(2)(a)	21.02.2024

Cover image: Example of potential lizard habitat that has been lost in landslips at Mangamuka Gorge Scenic Reserve.

TABLE OF CONTENTS

1. INTRODUCTION

In July 2020, heavy rainfall caused more than 20 slips and significant damage to State Highway 1 (SH1) where it crosses the Maungataniwha Range and Mangamuka Gorge Scenic Reserve (MGSR). The damage caused the closure of SH1, cutting off local communities from access to Kaitaia and other parts of Te Tai Tokerau via SH1 (Figure 1). Since then, significant and ongoing storm events have caused additional slips and erosion, adding further complexity to the repair operation and reopening of the road.

In December 2022, Waka Kotahi secured funding for road repair works as part of the Far North State Highway Resilience Program. Site investigations, planning and design work commenced early 2023, and subsequently NZ Environmental Management Ltd (NZEM) was engaged to undertake ecological assessment surveys and prepare a Biodiversity Assessment report for the project. It was quickly determined that indigenous fauna of conservation concern was present within the vegetation and habitats of MGSR, including an abundant population of endemic and protected kauri snail (*Paryphanta busbyi busbyi;* At Risk-Declining), long-tailed bat (*Chalinolobus tuberculatus;* Threatened-Nationally Critical) and copper skink (*Oligosoma aeneum;* At Risk-Declining*)*. It is likely that other indigenous lizard species are also present throughout the MGSR as the Department of Conservation ('DoC') Herpetofauna Database holds records of four other At Risk species within 20kms of MGSR.

Slip repair works are in progress, with Waka Kotahi working with Councils, the DoC, hapū and other stakeholders to apply for retrospective Resource Consent (in areas outside of the existing roading designation) and other required permissions including a Wildlife Act Authority (WAA) permit for the capture and relocation of indigenous lizards that are specifically protected under the Wildlife Act (1953).

A Lizard Management Plan ('LMP') is required to provide a strategy for the rescue and relocation requirements of skink and gecko populations that are present within slip remediation footprints. This LMP describes the values of habitats at the slip sites with respect to lizards (both terrestrial and arboreal). It presents a salvage strategy to minimise the effects of the project on those values and describes mitigation measures to manage potential impacts on lizards.

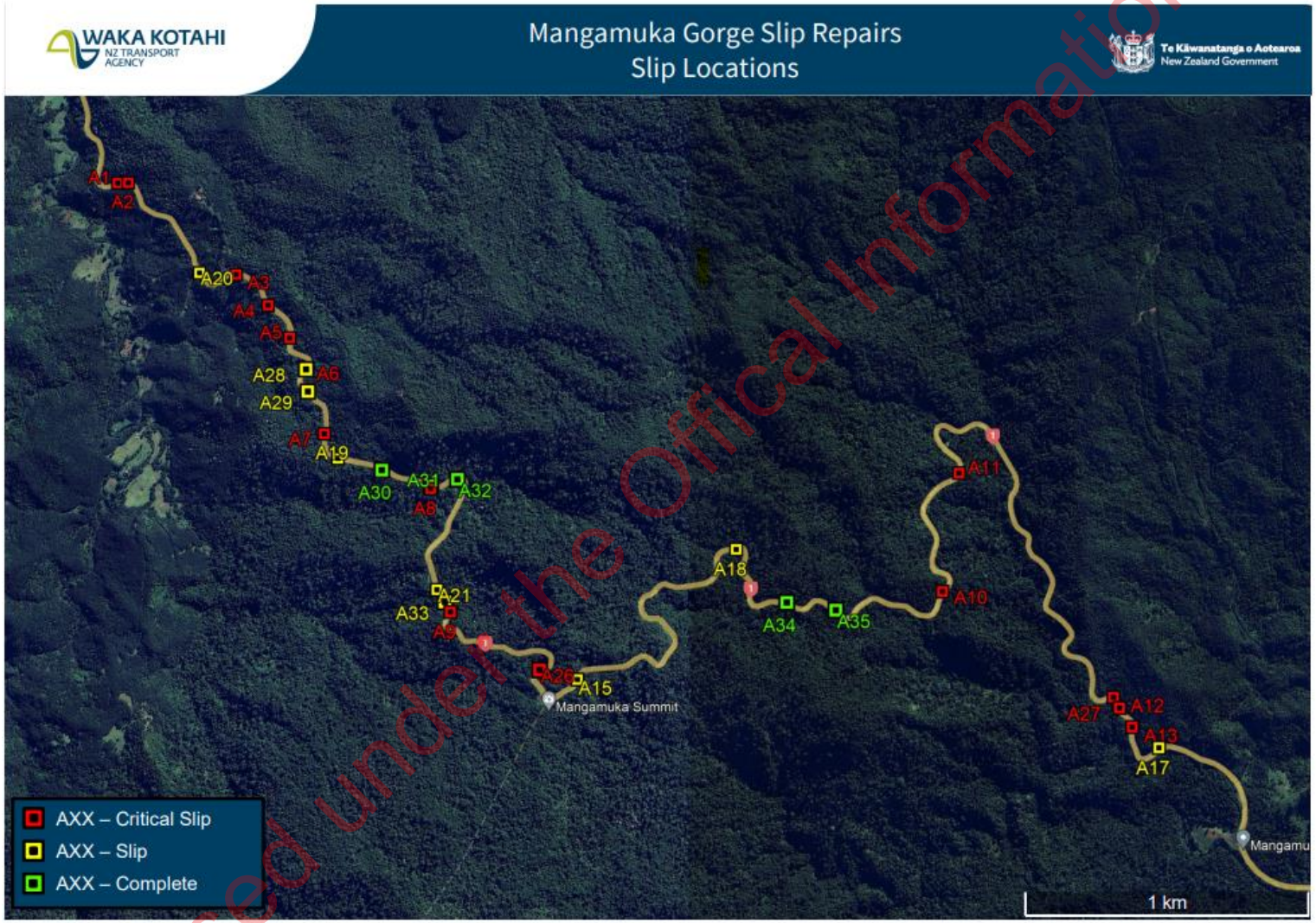


Figure 1: Map of 'critical', 'non-critical' or completed slip sites at SH1 locations in the Mangamuka Gorge Scenic Reserve.
Figure Source: Waka Kotahi

2. LEGISLATIVE REQUIREMENTS

All indigenous lizards are protected under the Wildlife Act regardless of their threat status. Capturing and relocating lizards should not be undertaken prior to gaining a Wildlife Act Authority ('WAA') permit from DoC, or without gaining written permission from DOC. This LMP is being prepared alongside an application to gain a WAA under Section 71 of the Wildlife Act. It is noted that new legislation requires roading project WAA applications to be processed under Section 71 due to the intersection with the Government Roading Powers Act (1989). Under this section, WAA applications may only be approved by the Minister of Conservation and the Minister of Transport.

Once approved, this WAA will enable protected lizards to be safely removed from impact areas and relocated into areas of forest that are subject to predator management in the wider, contiguous landscape.

2.1 DoC's Key Principles for Lizard Salvage and Transfer in New Zealand

This LMP has been prepared in accordance with DOCs best practice guidelines for salvaging indigenous lizards. These guidelines include the following nine key principles that have been prepared specifically for New Zealand practitioners to ensure that mitigation-driven translocations of lizards have the greatest chance of success at achieving the goal of 'no net loss of lizards'.

1. Lizard values and site significance must be assessed at both the impact (development) and receiving sites.
2. Actual and potential development-related effects and their significance must be assessed.
3. Alternatives to moving lizards must be considered.
4. Threatened lizard species require more careful consideration than less-threatened species.
5. Lizard salvage, transfer and release must use the best available methodology.
6. Receiving sites and their carrying capacities must be suitable in the long term.
7. Monitoring is required to evaluate the salvage operation.
8. Reporting is required to communicate outcomes of salvage operations and facilitate process improvements.
9. Contingency actions are required when lizard salvage and transfer activities fail.

3. Purpose and Scope

This LMP describes measures to salvage and relocate indigenous protected lizards within areas of vegetation and habitat clearance. This LMP includes the following:

a) Desktop and field assessments of habitat value to indigenous lizards
b) Summary of the potential effects to lizards that arise from habitat clearance
c) Responsibilities and competencies of the staff involved in lizard salvage and relocation
d) Salvage protocols
e) Relocation site description
f) Additional considerations (seasonality and adaptive management)
g) Information gaps

4. Lizard Values

4.1 Desktop Assessment

A desktop assessment of vegetation, habitats, and iNaturalist records of lizards was undertaken to better understand the historical and ecological context of the site with respect to species included in this plan. Only a few records of lizards are held on iNaturalist within or near the MGSR and the surrounding contiguous forest tracts of Raetea Forest, Ōmahuta Forest and Puketī Forests. This is generally because of the sensitivities around lizard locations and the risk of illegal poaching. DOC's database also holds a few records and these are listed below in Table 1.

Table 1: Lizard species known to be present within a 20km radius of State Highway 1 within the MGSR.

Species	Common name	National Threat Status	Nearest record	Habitat preferences	Likelihood of presence
Oligosoma aeneum	Copper skink	At Risk-Declining	0km	Habitat preferences: Grassland, scrubland, shrubland and forested areas, residing within leaf litter and beneath woody debris and rocks. Widely distributed within rural, coastal and urban areas throughout Northland.	Confirmed present
Oligosoma ornatum	Ornate skink	At Risk-Declining	7.9km (bone record only)	Grassland, scrubland, shrubland and forested areas, residing within leaf litter and beneath woody debris and rocks. Widely distributed within rural, coastal	High

			No recent records within 20km	and urban areas throughout Northland.	
Naultinus grayii	Northland green gecko	At Risk-Declining	12.8km	Inland and lowland forest and scrub, particularly within manuka and kānuka.	High
Mokopirirakau granulatus	Forest gecko	At Risk-Declining	14.9km	Coastal, lowland and alpine species that may inhabit forest, scrub, rocky bluffs and outcrops.	High
*Dactylocnemis Pacificus**	Pacific gecko	Not Threatened	18km	In habits a wide range of habitats between the coast and lowland forest.	High
D. "North Cape"*	Te Paki gecko)	At Risk-Taxonomically Unresolved	No records within 20km	In a wide range of habitats between the coast and lowland forest.	High

** There is taxonomic uncertainty between Pacific gecko and Te Paki gecko around which Dactylocnemis species is present in this area. For this reason, both species have been included as having high potential as being present.*

***Note:** The sparsity of records should not be considered as representative of these species distributions, but rather likely reflect the lack of official surveys, and limited access to records held by Councils and DOC.*

4.1.1 Vegetation and habitats: Maungataniwha Ecological District

Maungataniwha Ecological District ('ED') encompasses approximately 101,900ha extending east from Kaitaia and the Herekino Forest, to the southern boundary of Raetea Forest and the head of Mangamuka River (Conning, 2002), and eastwards almost to Kaeo Valley. The southern boundary lays approximately 5km south of Mangamuka township and just to the north of Ōmahuta and Puketī forests. The northern boundary is formed by eastern coast, from the southern point of Tokerau Beach in the west to Hihi in the east.

Historically, much of the ED was characterised by broadleaf-podocarp-kauri forest which was subject to extensive logging. Potential bat habitat within the Maungataniwha ED and Range is now characterised by mature forest (mainly secondary forest) comprising species such as northern rata (*Metrosideros robusta),* rimu (*Dacrydium cupressinum*), tōtara (*Podocarpus tōtara* var. *tōtara*), kahikatea (*Dacrycarpus dacrydioides*), kauri (*Agathis australis*), tōwai (*Pterophylla sylvicola*) and taraire (*Beilschmiedia tarairi*). Additional species including tawa (*B. tawa*), rewarewa (*Knightia excelsa*) and pūriri (*Vitex lucens*) are also frequent within this ED. Roadside vegetation along SH1 mostly comprises regenerating shrubland that includes the above listed species, with patches of mānuka (*Leptospermum scoparium*) and kānuka (*Kunzea robusta*) (Conning, 2002).

The Maungataniwha Forest is an area of ecological significance, as demonstrated by the number of Regionally Significant, Threatened and At-Risk species present. A description of vegetation types, and rare and threatened flora are provided in the Draft Biodiversity Report (NZEM, 2023).

4.2 Field surveys

Field surveys to assess broad biodiversity values were undertaken by a generalist ecologist in the Autumn of the 2022-2023 to guide the Biodiversity Assessment report (NZEM, 2023). Dedicated lizard habitat assessments were then undertaken in May by a specialist herpetologist (the author) who identified potential lizard habitat within each of the slip remediation areas (Table 2). A variety of vegetation types are present along SH1 slip sites within the MGSR and these are likely to provide habitat to a range of lizard species with different habitat preferences (Photos 1-4).

Table 2: List of slip sites and assessment of potential lizard habitat in edge vegetation to be cleared.

Slip Site	Potential habitat for skinks	Potential habitat for geckos
A1 & A2	✓	✓
A3	✓	✓
A4	✓	✓
A5	✓	✓
A6	✓	X
A7	✓	X
A8	✓	✓
A9	✓	✓
A10	Not assessed	Not assessed
A11	✓	✓
A12 & A13	✓	✓
A26	Not assessed	Not assessed
A27	✓	✓

Photo 1: Example of good quality skink habitat above the slip line with dense leaf litter and sunlight.

Photo 2: Example of good quality skink habitat with dense terrestrial vegetation providing moisture and complexity for skinks.

Photo 3: Example of potential habitat for arboreal geckos in roadside vegetation.

Photo 4: Example of potential habitat for arboreal geckos in roadside vegetation.

5. SUMMARY OF POTENTIAL EFFECTS

There are a range of potential and actual adverse effects to lizards that are commonly associated with vegetation clearance and construction activities. Some of the activities that can adversely impact lizards, and the potential effects associated with these activities, are outlined in Table 3 below.

This LMP specifically addresses the risk of injury or mortality to lizards through vegetation clearance, with Section 7 providing a strategy to minimise and mitigate the risk (Table 4). Activities to address the remaining potential impacts are not addressed within this plan.

Table 3: Construction-related activities and their potential adverse effects to lizards

Activity	Potential Direct & Indirect Effects
Clearance of vegetation and habitat	▪ Injury and/or mortality to lizards ▪ Reduced habitat availability ▪ Deterioration of forest interior habitats associated with newly created edges and edge effects
Relocation into habitats outside of the impact areas	▪ Displacement ▪ Increased competition for resources ▪ Increased vulnerability to predation ▪ Stress related reproductive failure

Table 4: Level of effects for lizards in the MGSR based on EIANZ assessment criteria (2018).

Species	Ecological value of species	Effect	Timescale of effect	Magnitude of effect	Level of ecological effect (no mitigation)	Main mitigating activity	Level of ecological effect following mitigation
At Risk lizards	High	Injury & mortality	Temporary (Medium term: 5-15 years)	Moderate	High	Salvage	Low
Not Threatened lizards*	Low	Injury & mortality	Temporary (Medium term: 5-15 years)	Moderate	Low	Salvage	Very Low

* Pacific gecko only, noting there is taxonomic uncertainty and Te Paki gecko is listed as At Risk.

6. Responsibilities and Competencies

Implementation of this LMP will be supervised by the Project's herpetologist and undertaken by the herpetologist and appointed Project Ecologist(s). It is the responsibility of the appointed Project/Site Manager to ensure clear and consistent information is relayed to the herpetologist and ecology team regarding proposed vegetation and habitat clearance activities. All ecologists undertaking lizard salvage must be under the supervision/guidance of the suitably qualified and experienced herpetologist and have been trained in the basic techniques required to search for and safely handle indigenous lizards. A good understanding of the habitat requirements of each species of lizard being relocated should be gained prior to commencing salvage activities. It is important that all key project team members are familiar with the requirements and protocols of this LMP to ensure that appropriate mitigation (i.e., salvage) is able to be implemented both prior to, and where appropriate during, habitat clearance.

The responsibilities of the Project / Site Manager include but are not limited to:

- Review of this LMP, with a clear understanding of what comprises potential habitat for both terrestrial and arboreal lizards.
- Liaising with the herpetologist / project ecologist on a weekly basis with clear communication of any/all proposed works that require vegetation clearance the following week (to the greatest extent possible).
- Ensure that hapū representatives are also contacted and given advance notice regarding participation and supervision of lizard salvage activities.
- Maintaining clear lines of communication with the herpetologist regarding changes to the works schedule.

7. Management of Effects

In many cases, slip remediation activities have been able to avoid the removal of lizard habitats. In other cases, the removal of habitats has been minimised through careful engineering redesign to reduce the quantum of vegetation clearance required. Where avoidance cannot be achieved, salvage and relocation are the main activities being undertaken to mitigate the adverse effects of vegetation and habitat clearance on indigenous lizards. The following methods describe how lizards are to be detected, handled and released.

7.1 Systematic and destructive hand-searching for skinks

At least two days prior to planned vegetation clearance at any given area, destructive hand-searching will be undertaken throughout the clearance footprint. This method will be used to specifically target ground-dwelling skinks. This will involve using hand-forks and leaf rakes to gently rake through leaf litter and loose debris to search for skinks. Fronds of tree ferns that collect around the bottom of the trunk forming 'fern skirts' will also be searched thoroughly, together with cavities that form at the base of trees where skinks can frequently be found taking refuge (particularly for species like kānuka). This will generally be undertaken concurrently with searches for kauri snails where habitats are suitable for both taxa. Terrestrial vegetation including grasses and mosses will be pulled away from the soil surface to search beneath vegetation layers, and all objects providing potential refuge such as rotting logs and liftable rocks will be inspected. Wherever possible, leaf litter and vegetation will be raked back to the edges of the footprint to remove skink habitat and minimise the risk of recolonisation.

Where possible, at least two ecologists will undertake this searching process, using a type of 'double observer' technique that ensures each clearance area has been thoroughly searched twice.

7.1 Nocturnal spotlighting searches for geckos

The evening prior to vegetation clearance in any given area, the site will be subject to no less than four-person search hours (e.g., two hours of searching by two people) for every 200m of road edge habitat. Spotlighting surveys will only be undertaken during suitable weather conditions (>15°C, warm, calm with little to no wind or rain). Surveys will be conducted using powerful headlamps (at least 1000 lumens or higher) and supported with binoculars. Road edge vegetation will be systematically scanned to ensure all visible trunk wood, limb wood and foliage is searched for the presence of nocturnal, arboreal geckos.

If a gecko is detected and accessible it will be carefully caught, handled and released in accordance with best practice as described in Section 7.5. If a gecko is high in the canopy a telescopic pruner may be used to assist with its capture. Alternatively, the tree will be clearly marked with flagging tape or dazzle paint and prioritised for supervised felling the following day.

7.4 Supervision of tree-felling

Forest, scrub and shrubland habitats in roadside margins that require removal shall be assessed by the herpetologist for their potential value to geckos. Geckos are frequently found to favour species like manuka, kānuka and tōtara that have dense, spikey leaves with complex cover and flaking bark. Where these species

are present in roadside vegetation to be removed they will be classified as 'high risk' habitat and consequently prioritised for supervised felling, inspection and relocation into adjacent habitats to be left in-situ. Broadleaved species are less likely to contain resident geckos but cannot be excluded from searching, particularly if close to high-risk species. The herpetologist shall apply expert judgement on all sections of roadside vegetation to be felled and determine whether supervised removal is required.

It is noted that in many instances vegetation removal may be avoided by pushing it backwards using an excavator into the adjacent forest to provide room for equipment. The project herpetologist should assess these areas on a case-by-case basis to determine if supervising this activity is also required.

7.5 Supervision of earthworks (machine assisted clearance and topsoil scrapeback)

Following tree-felling activities, most roadside banks will also require earthworks to prepare for enabling works. Where skinks or snails have been detected through pre-clearance salvage then it may also be necessary to supervise the initial scrapeback of any remaining vegetation and topsoil. This will be required where ground cover is too thick to completely remove or search through effectively by hand. In some cases, the ecology team may have already completely cleared an area of leaf litter and vegetation and the project herpetologist will clear the area to proceed without any further lizard management activities.

If supervised scrapeback is required, this will involve the herpetologist / on-site ecologist working alongside an excavator with a toothed bucket attachment to scrape back vegetation and expose/disturb skinks residing within deeper layers and the vegetation root matrix. Clear communication and hand-signals shall be established between the ecologist and the contractor to ensure only ecologists approach to capture a fleeing lizard, once the machine has stopped and it is safe to proceed.

This is an extremely effective technique for revealing and catching a good proportion of resident lizards if undertaken by an experienced team.

7.6 Data collection

Each captured lizard will have the following information recorded:

- Date and slip site
- GPS location (capture and release)
- Species
- Habitat type (i.e., leaf litter, rotting log, foliage)
- Snout-vent-length
- Vent-tail-length
- Age class
- Sex (except for juvenile skinks)
- Photograph and assignment of ID number to link data to photo
- Any other relevant information (e.g., tail loss, distinctive pattern or scar, if found with any other individuals).

7.5 Capture, handling and transport

All captured lizards will be handled gently in accordance with best practice techniques described in the New Zealand Lizard Conservation Toolkit. All captured lizards will be placed immediately into either an individual cloth bag or directly into a well-ventilated container with damp leaf litter. Containers will be secured with a lid and stored in the shade for no more than four hours before being released. Morphometric data will be collected immediately prior to release. Containers will be washed and sterilized between each slip site. All handling and transport will be in accordance with requirements of the Animal Welfare Act (1999).

7.6 Vegetation management

Where possible, felled vegetation will be relocated into the understorey of adjacent vegetation that sits outside of the clearance footprint. Mānuka, kānuka, ponga, mamaku and other cut material with obvious cavities capable of providing refuge to arboreal geckos that can't be searched properly will be prioritised.

Felled trees of the above species must not be chipped, but rather stacked into the understorey of adjacent vegetation outside the zone of impact for each slip site.

The logistical challenges associated with this project mean that most other vegetation will be chipped immediately on site as there are no on-site storage areas that felled vegetation can be transported to and left in-situ. The Project Ecologist and Site Manager shall liaise on a site-by-site basis to determine how vegetation may be managed in a practical manner that is able to preserve critical habitat for lizards.

8. LIZARD RELEASE LOCATIONS

The Mangamuka works site is divided into two areas: north of the summit and south of the summit. All salvaged lizards will be released on the same side of the summit as they were caught. As the Mangamuka Gorge sits within a scenic reserve and a much larger landscape of contiguous forest, the habitat in general is suitable anywhere for release if it fulfils the following criteria as detailed in the Key Principles for Lizard Salvage and Transfer in New Zealand guidelines:

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
    a. The site should have the same or superior habitat quality that is relevant to each species being moved
3. The site must have protection from predators
4. The site must be protected from future human disturbance
    a. Ideally, the site should be protected in perpetuity

For small salvage areas where <100m² of vegetation clearance is required, lizards will be relocated into suitable adjacent habitat between 100-200m from the capture location. For clearance areas >100m² the following locations have been selected for lizard release.

8.1 Northern Release Site: Raetea Reserve (Raetea North Side Camping Area)

For lizard salvages that are undertaken throughout clearance areas exceeding 100m², the proposed lizard release site in the northern section of the MGSR is within Raetea Reserve (Photos 5 & 6). A DoC camping area borders the reserve that is adjacent to Victoria River. Community predator management is actively undertaken via a trapping programme for possums, stoat and rats throughout the upper hillslopes and river valleys (Figure 2). Vegetation and habitats within reserve edges are contiguous with Raetea Forest, enabling lizards to freely disperse into the wider landscape. Lizards will be relocated into enhanced habitats (See Section 9.3) on the other side of the river to ensure they are unable to return to, or access the State Highway. Lizards will be released into forest edge habitats that are within the predator management area. This area fulfils all the required criteria for a suitable lizard release area. Approval of this location as a release site is supported by Te Paatu (Appendix 1).

Photos 5 & 6: Proposed northern relocation area for lizards at Raetea Reserve.

8.2 Southern Release Site

A suitable southern release area for salvages that exceed 100m² has been identified as a Protected Natural Area that is situated approximately 300m north of the southern entry gate to Mangamuka (Figure 3) . This area has been used as a kauri snail relocation area for work undertaken previously on site. Vegetation and habitats are suitable for all lizard species likely to be found throughout the MGSR with abundant space and scrubby edge vegetation for skinks to freely disperse throughout. The area is an accessway labelled as 'Maungatureia' on Google Earth (Figure 4) and comprises a vehicle track that leads to a wider network of tracks throughout MGSR. This site fulfils three of the four criteria requirements with the exception of being subject to predator control.

It is recommended that the implementation of an intensive one-hectare predator management area be implemented around this release site if triggered by the capture and release of more than twenty lizards (of any species or combination of species) into the area. This is subject to consultation and approved by DOC and Ngā Hapū ō Mangamuka. If approved, it is recommended that a network of traps be deployed across a grid of 25x25m spacings that will result in the suppression of most known lizard predators including mice. Trapping could be sustained for a period of 12 months beyond the life of the repair work being completed. This will give relocated lizards adequate time to adjust to their new home range without the level of predation pressure they had adapted to at their capture sites.

8.3 Habitat enhancement

To ensure that they are released into microhabitats that are free of competition, all skinks will be released into specially constructed lizard refuges that comprise stacks of woody debris with dense layers of damp leaf litter and ponga fronds built up around them. Materials will be gathered from the understorey of the release area on a daily basis and constructed to suit numbers caught each day. Each refuge will be approximately 1-2m² and no more than five skinks will be relocated into a single refuge.

Refuges will also be constructed at the base of mature kānuka and tōtara trees for any geckos to be released into. This will allow geckos to have somewhere covered and free of competition to rest in during the day so they can freely relocate themselves into suitable arboreal habitats that night.

8.4 Predator management

Mammalian predators pose a significant threat to indigenous lizards. While the very small-scale salvages associated with most of the slip sites will simply move lizards into adjacent habitats without predator control, it is proposed that larger salvage areas will result in lizards being moved into areas with some predator management.

8.5 Monitoring

Due to the proposed strategy of moving small numbers of lizards into habitats adjacent to slip sites, monitoring is not considered as feasible, particularly as copper skinks are the only species detected on site to-date. For larger slip sites, it's also unlikely that that capture numbers will be sufficient for effective post-salvage monitoring.

Figure 2: Map of the proposed lizard release location for salvage areas >100m² for slip sites to the north of Mangamuka Summit. Cream coloured cells represent the predator management grids for possums, mustelids, rodents and hedgehogs. Brown polygons represent feral pig management areas. *Source: Trap.NZ*

Figure 3: Map of the proposed lizard release location for salvage areas >100m² for slip sites south of Mangamuka Summit. Sec 6(c)

Figure 4: Google imagery location of the proposed lizard release site for salvage areas >100m² for slip sites south of Mangamuka Summit. *Source: Google Earth Pro*

9. INCIDENTAL INJURY OR MORTALITY

If an injured lizard is found during any of the above-described activities then the herpetologist shall be contacted immediately if not already on site. The lizard shall be assessed by the on-site ecologist to determine the severity of the injury and whether immediate euthanasia may be required to prevent unnecessary suffering.

If the injury is assessed as minor or survivable then the lizard shall be immediately transported to Auckland Zoo for assessment and treatment. It is recommended that the Zoo Veterinarian is contacted prior to commencing salvage activities as a courtesy and to confirm they would be willing to receive and treat indigenous lizards that may be injured during salvage or construction works.

If immediate euthanasia is deemed as the most appropriate course of action then this shall be undertaken only by the herpetologist or by the on-site ecologist under the supervision and direction of the herpetologist. The preferred technique for New Zealand skink and gecko euthanasia shall be using blunt force trauma as per Gatrell and Kirk (2005). This is a mechanical method for small reptiles that are less than 1kg body weight and is the only practical method to achieve quick, humane euthanasia in the field. A description of this method is provided as Appendix 2 of this LMP.

10. SEASONALITY REQUIREMENTS

Lizards shall only be salvaged during the official season (October – April) when weather conditions are warmer and conducive to higher levels of activity. During the cool months lizards enter a slower metabolic state known as 'torpor' which makes them much harder to find and less resilient to the stress associated with salvage (i.e., more vulnerable to stress-induced mortality). It may be appropriate to continue salvaging into May if warm weather conditions continue into this month. This should only be undertaken at the discretion of the project herpetologist.

11. ADAPTIVE MANAGEMENT

The focus of this LMP is addressing project impacts on resident lizard populations in roadside vegetation throughout Mangamuka Gorge. The proposed methods described throughout Section 7 of this LMP will be selected according to targeted species (i.e., skinks or geckos) and based on other variables such as lead-in times, topography, and health and safety considerations. However, the dynamic and challenging conditions associated with this slip repair project mean that it may not be possible to incorporate each search technique into the management methods at each site (e.g., if significant weather events cause further slip damage and vegetation requires immediate removal for human safety).

Any adaptations to these management protocols are at the discretion of the Project Herpetologist. However, if these situations arise and the proposed management of lizards needs to be altered in any significant way, DoC and hapū will be consulted prior to implementation.

12. REPORTING

A detailed report will be prepared following the completion of all lizard salvage work at site. The report will contain capture records and data for each slip where lizards were detected, together with a map showing GPS locations of capture and relocation sites. Amphibian and Reptile Distribution Scheme Cards (ARDS) will be completed and submitted to DoC.

13. CONTINGENCIES

In the event that a species classified as 'Threatened' is detected then works shall be temporarily paused while DOC's local office and Technical Specialists are contacted.

14. INFORMATION GAPS

Slip repair works across the *c.*30 SH1 slip sites throughout the MGSR are being undertaken as quickly as possible. Several slip remediations have already been completed, several are currently being worked on, several are in the planning stages, and several are yet to be assessed or designed. Consequently, there is a lot of missing information regarding the overall level of effect of works to lizards and their habitats.

This LMP provides a strategy to mitigate direct impacts to lizards at each slip site yet to be remediated via a targeted salvage operation that seeks to rescue and relocate as many lizards from each slip footprint as possible.

15. CONCLUSIONS

Waka Kotahi is managing slip repair works on SH1 in the Mangamuka Gorge Scenic Reserve. The project is being undertaken with urgency, with a high priority placed on several critical slips that pose significant risk to road stability and threaten to keep communities in the Far North cut off from essential services, friends and whānau.

Biodiversity values throughout the MGSR and the wider Maungataniwha Ranges are significant, with several At Risk and Threatened flora and fauna species having already been identified, including indigenous copper skinks. This LMP provides a proposed management strategy that focuses on the salvage of lizards as the main activity to mitigate adverse impacts to them.

Provided that robust searches for lizards are undertaken, it is anticipated that this LMP will minimise the risk of injury or mortality that would otherwise occur during vegetation clearance and earthworks.

16. ACKNOWLEDGEMENTS

We acknowledge the Client Waka Kotahai, along with NZEM, Te Paatu (hapū on the northern side) and Ngā Hapū ō Mangamuka (hapū on the southern side of the gorge), DOC's Technical Specialist for providing site access and field support, together with CLL, Stella Projects and WSP.

17. REFERENCES

Anderson, P.; Bell, T.; Chapman, S. and Corbett, K. (2012). New Zealand Lizard Conservation Toolkit. Society for Research on Amphibians and Reptiles of New Zealand.

Conning, L., (2002). Natural areas of Maungataniwha Ecological District. *Reconnaissance Survey Report for the Protected Natural Areas Programme*. Department of Conservation, Whangarei. pp 25.

Department of Conservation Lizard Technical Advisory Group 2018: Guidelines for conservation-related translocations of New Zealand lizards. Department of Conservation, Wellington.

Department of Conservation (2019). Key principles for lizard salvage and transfer in New Zealand. Technical Report prepared by the Department of Conservation's Technical Advisory Group.

Gartrell, B. D., & Kirk, E. J. (2005). Euthanasia of reptiles in New Zealand: current issues and methods. Kokako, 12(1), 12-15.

Hare, M. (2012) Inventory and monitoring toolbox. Herpetofauna: systematic searches Version 1.0. DOCDM-725787. Department of Conservation.

Hitchmough, R., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson, G., Reardon, J.T., van Winkel, D., Rolfe, J. and Michel, P. (2021). Conservation status of New Zealand reptiles, (New Zealand Threat Classification Series 35). Department of Conservation, Wellington. 23 pp.

Hitchmough, R., Baling, M., & van Winkel, D. (2018). Reptiles and Amphibians of New Zealand: A Field Guide. Auckland University Press.

NZEM (2023). Mangamuka Slip Repairs, State Highway 1, Mangamuka – Biodiversity Report. *Technical report prepared for Waka Kotahi*. Northland. Pp 64.

Honeymoon Valley Landcare Trust (2023). Accessed from: https://honeymoonvalleylandcare.org.nz/

Underwood, W., & Anthony, R. (2020). AVMA guidelines for the euthanasia of animals: 2020 edition. *Retrieved on March*, *2013*(30), 2020-1.

APPENDIX 1: RELEASE SITE APPROVAL INTO RAETEA RESERVE (NORTH OF MANGAMUKA SUMMIT)

The below emails provide confirmation of consultation and approval by Te Paatu hapū representative for lizard release into Raetea Reserve.

Re: Kauri snail and lizard relocation areas & next site visit date (28th August)

Reply | Reply All | Forward | ...

Tue 22/08/2023 3:00 pm

TL Sec 9(2)(a) @kauhanga.nz>
To Sec 9(2)(a) Tomo Otene (Contract Worker)'; Sec 9(2)(a)
Cc Sec 9(2)(a)

You replied to this message on 22/08/2023 3:02 pm.
If there are problems with how this message is displayed, click here to view it in a web browser.

From: Sec 9(2)(a) @kukuwai.nz>
Sent: Tuesday, 22 August 2023 2:46 pm
To: Sec 9(2) @kauhanga.nz>; 'Tomo Otene (Contract Worker)' <Tomo.Otene@nzta.govt.nz>; Sec 9(2)(a) @gmail.com>; Sec 9(2)(a) @gmail.com>
Cc: Sec 9(2)(a) @nzrem.co.nz>; Sec 9(2)(a) @cll.net.nz>
Subject: Kauri snail and lizard relocation areas & next site visit date (28th August)

Kia ora koutou,

Thank you so much Sec 9(2)(a) for taking the time to undertake the visual assessments with me at each of the slip sites on Friday. I wanted to follow up on the conversations that I had with you regarding the proposed new areas to release kauri snails and lizards into. I'd like to propose these locations within the snail and lizard management plans that I have started preparing but am keen to gain provisional support for these locations from yourselves before I put them forward in the reports.

The purpose of identifying specific areas to move captured snails and lizards into is to give them the best chance of survival that we can. This means moving them into areas where there is some existing pest animal control and where they can't 'home' themselves back to the sites they were rescued from and risk getting caught up in construction activities (believe it or not, lizards and kauri snails are a bit like homing pigeons!).

I'd like to propose that wildlife salvaged from southern slip sites get relocated into the southern section of the Honeymoon Valley pest management area on the other side of the river, as per the map below. Wildlife rescued from north of the summit could go into Raetea Reserve, also behind the river. By putting animals on the other side of the rivers this will prevent them from being able to get back into those roadside areas where they're in danger of being squashed or getting caught up in further slips. The benefit of putting them into areas with pest control means that they are less vulnerable to being eaten by predators while they are orientating themselves in their new homes.

Sec 9(2) and Tomo, if you are both supportive of this location would it be possible to please be connected an appropriate person at Honeymoon Valley L/C Trust? I'd be keen to better understand where I can cross the river and access the area, and to undertake a visual inspection of the area next time I am on site.

Sec 9(2)(a) if you are supportive of Raetea Reserve is there anybody else that you recommend I contact to consult with them about this?

On a different note, I am planning on spending a full day on site next Monday (28th) undertaking a site orientation day with a new Ecologist that is joining our team. We will be starting around 8am with Sec 9(2) at the summit getting induction stuff sorted, then hoping to start site visits with a quick look at the Peria Valley wetland site. From there we will start at A1 and work our way through the sites for the rest of the day. Will it be possible to have kaitiaki assistance for the day please?
At a guess I'd say we'll be looking at Peria Valley wetland and the northern slips from around 9am – midday, and southern slips from around 1-4 ish.

Please don't hesitate to get in touch if you have any questions about the wildlife relocation areas or the site visit next week, and I'll look forward to hearing back from you once you've had the chance to discuss.

Ngā mihi,
Sec 9(2)(a

Re: Kauri snail and lizard relocation areas & next site visit date (28th August)

Reply | Reply All | Forward | ...

Tue 22/08/2023 3:00 pm

TL Sec 9(2)(a) @kauhanga.nz>
To Sec 9(2)(a) Tomo Otene (Contract Worker)'; Sec 9(2)(a)
Cc Sec 9(2)(a)

You replied to this message on 22/08/2023 3:02 pm.
If there are problems with how this message is displayed, click here to view it in a web browser.

Kia ora Sec 9(2)(a)

Support relocation of Kauri and lizards to Raetea Forest. There should be no issue with relocation here with the exception that the reserve gate is locked over the winter period. The gate is locked by DOC and Te Rarawa.

I will let you know if I am available on Monday 28th by Friday as I am away in Auckland at the moment, if not I will defer to Kevin.

Nga mihi, na

Sec 9(2)(a)
Trust Secretary - Treasurer
Te Paatu ki Kauhanga Trust

Sec 9(2)(a)
www.kauhanga.nz
PO Box 297 Kaitaia 0441

APPENDIX 2: EUTHANASIA PROTOCOL FOR INJURED LIZARDS

In the event that an indigenous lizard is injured and requires immediate euthanasia, the technique recommended by Gatrell and Kirk (2005) (Figure 4) will be used.

Kokako 12 (1) 12-15, 2005 *Discussion Paper*

Euthanasia of Reptiles in New Zealand: Current Issues and Methods

B.D. (Brett) Gartrell[1]§ and E.J. (Ted) Kirk[2]

[1] *Senior Lecturer in Avian and Wildlife Health, New Zealand Wildlife Health Centre,Massey University, Private Bag 11-222, Palmerston North*
[2] *Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11-222, Palmerston North*
§ *Author for correspondence. Email: B.Gartrell@massey.ac.nz*

Abstract

Current best practice for euthanasia of reptiles in New Zealand involves overdosage with either an inhalation anaesthetic agent (e.g., halothane) or appropriately diluted sodium pentobarbitone solution. Particular care is needed to ensure that a "euthanised" reptile actually is dead.

Key Words: euthanasia, gecko, halothane, humane, pentobarbitone, skink, tuatara, turtle.

up to an hour after decapitation (Cooper and others, 1984; Cooper, 2003). [In mammals, electrical waves have been recorded from the brain for short periods after decapitation and there has been debate as to whether these waves were indicative of sensibility (Reilly, 1993).]

Recommended Procedures

The techniques recommended are grouped below; first according to types of agents, and then according to sizes

Figure 4: Research abstract highlighting the literature used for reference regarding field euthanasia: https://www.researchgate.net/profile/Brett-Gartrell/publication/228493980_Euthanasia_of_Reptiles_in_New_Zealand_Current_Issues_and_Methods/links/00b49528bafc0d1514000000/Euthanasia-of-Reptiles-in-New-Zealand-Current-Issues-and-Methods.pdf

5. Massive head trauma

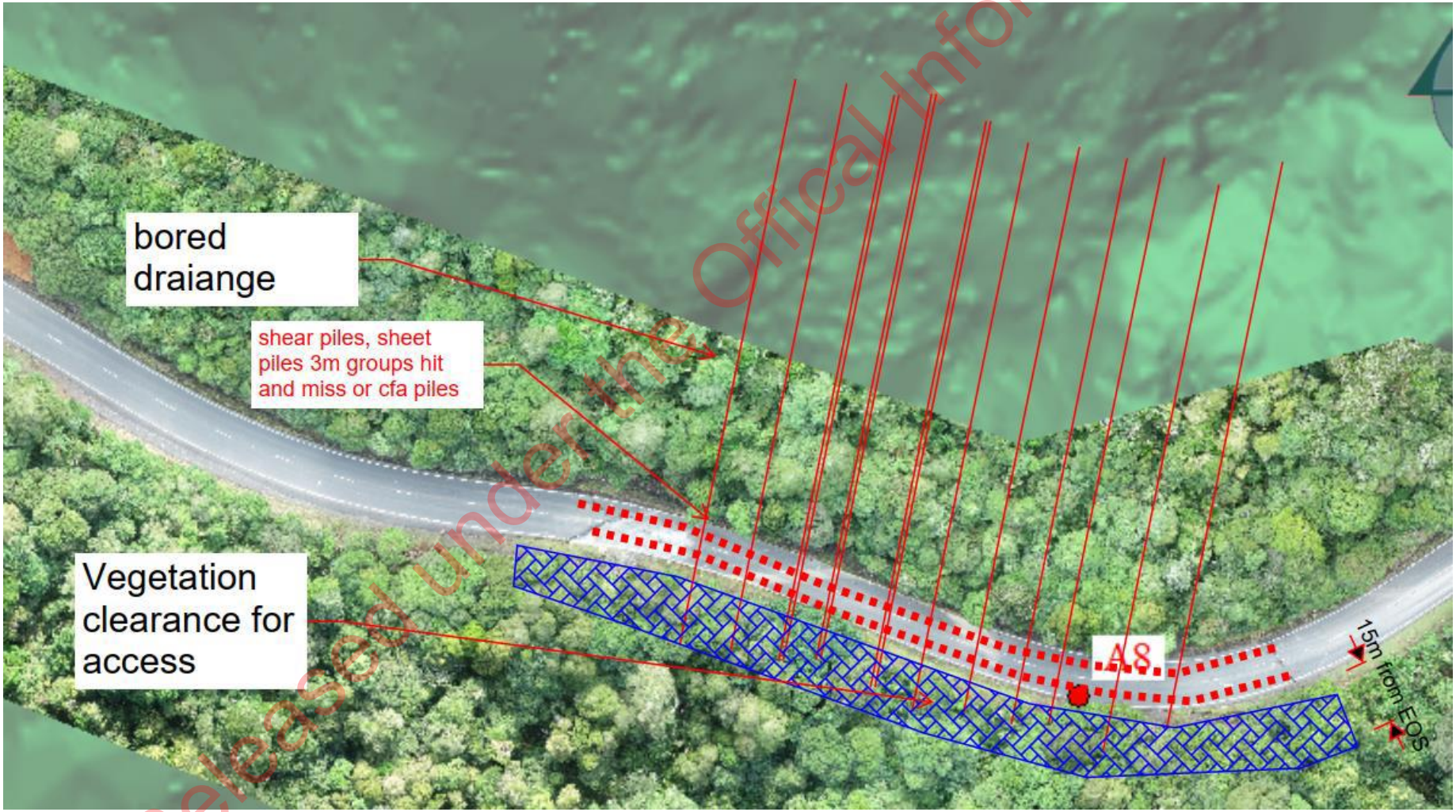
The use of concussive head trauma is another mechanical means of euthanasia reported as being feasible for reptiles of less than one kilogram body weight (Anonymous, 2003). For this technique to be effective, the reptile's head must impact against an unyielding surface with sufficient force to produce immediate unconsciousness. The brain of the reptile should then be destroyed immediately by pithing or by crushing the skull. This method should only be used when the use of other methods is not possible. Decapitation following concussion is not considered suitable as reptiles may recover consciousness, but can be used in combination with immediate extensive pithing of the brain.

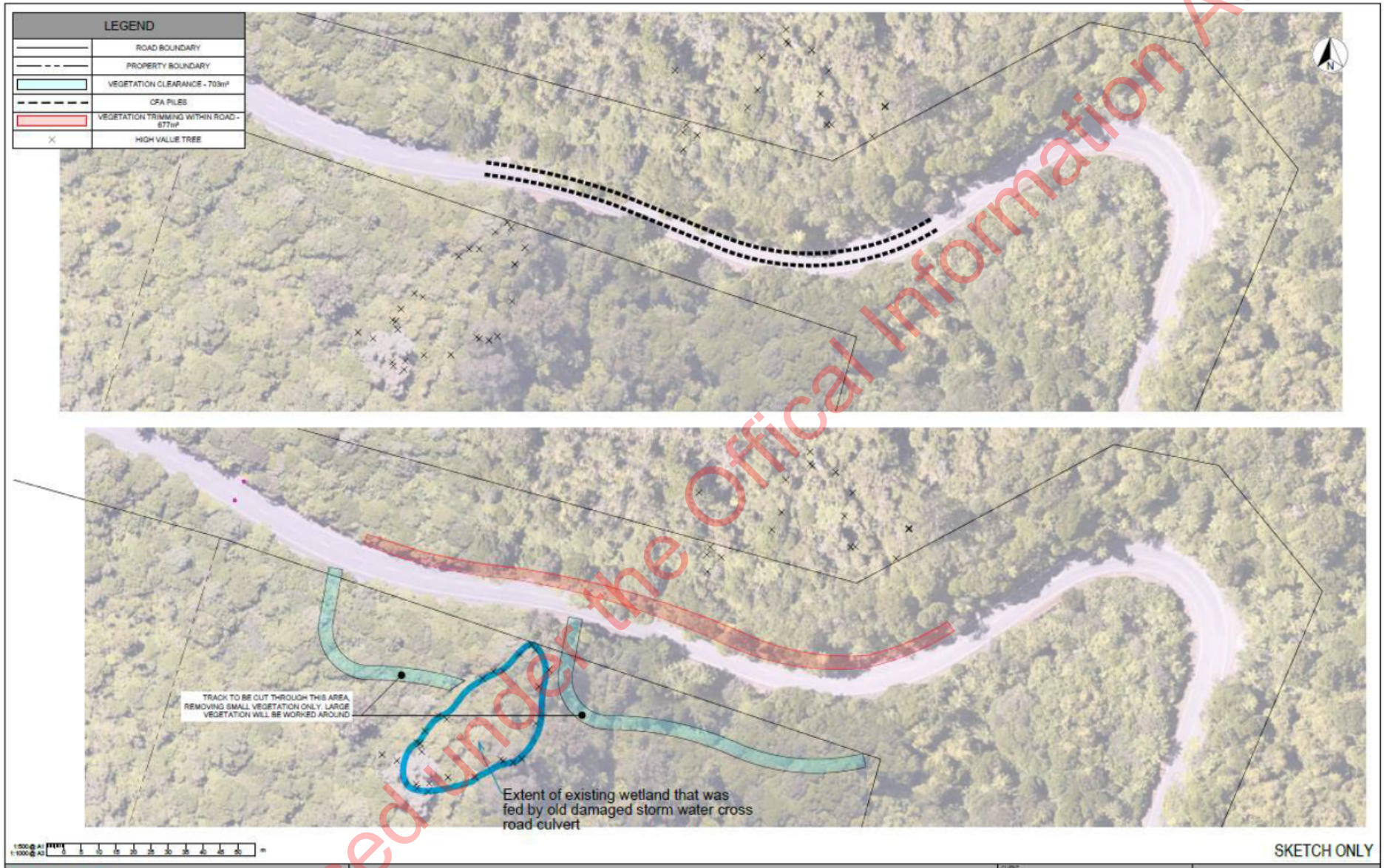
Shooting, by captive bolt or bullet, can also be used to produce sudden, massive destruction of brain tissue. However, in most instances the small size of the reptile's brain makes accurate aiming difficult. In addition, free bullets are likely to be hazardous to humans and any other nearby animals and to cause damage within the surroundings.

Figure 4: Excerpt from Gatrell & Kirk (2005) describing the preferred method for field euthanasia of skinks and geckos if deemed necessary by the project herpetologist.

Attachment E – Maps of slips A8 and A11

Slip A8:
The remediation works will involve the installation of two rows of 12m-15m deep shear pile walls (hit and miss layout) beneath the road carriageway. In addition, bored drainage will be installed beneath the road, starting downslope of the road and extending into the hillside above the road. This will require approximately 1,500m2 - 2,000m2 of vegetation clearance (15m wide x 135m long) on the downslope side of the road to install the bored drainage. The extent of vegetation clearance is being reviewed by the project ecologist for feedback.
Due to the presence of numerous overslips above A8, a rock wall comprising large spalls with granular backfill and geotextile liner has been constructed to stabilise this slope.





SKETCH ONLY

Whangarei Office
+64 9 430 1700
125A Bank Street
PO Box 553
Whangarei 0110

SITE OVERVIEW
A8 CONCEPT

CLIENT: -
PROJECT: -
PROJECT NO.: -
DESIGN: Sec 9(2)(a)
DATE: -

Slip A11:

Slip A11 is a long-term subsidence site and has been identified as requiring remedial works to ensure the long-term safety of the road in this location.