Before the Taranaki Regional Council and New Plymouth District Council
Mt Messenger Bypass Project
Notices of Requirement and Consent Applications

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under: the Resource Management Act 1991

in the matter of: Applications for resource consents, and a notice of requirement by the NZ Transport Agency for an alteration to the State Highway 3 designation in the New Plymouth District Plan, to carry out the Mt Messenger Bypass Project

Joint Witness Statement – Ecology

Dated: 15 October 2018

JOINT WITNESS STATMENT - ECOLOGY

INTRODUCTION

1 This joint witness statement is written in response to the Hearing Commissioner's direction on 9 October 2018 (and confirmed in Commissioner's Minute 6 of 14 October 2018) that ecology witnesses should conference and produce a joint witness statement to document areas of agreement and areas of disagreement.

2 A conferencing meeting was held in New Plymouth from 8.30 am to 12.15 pm on 10 October 2018. Attendees at the meeting were:

- Mr Roger MacGibbon and Mr Simon Chapman, representing the Applicant
- Dr Colin O'Donnell and Dr Laurence Barea, representing the Director-General of Conservation
- Mr William Shaw and Dr Tim Martin, representing New Plymouth District Council
- Dr Brett Ogilvie, as Facilitator. For the record, Dr Ogilvie is Environmental Manager for the Applicant's Mt Messenger Alliance.

3 After the meeting, and until 15 October 2018, further communication was carried out between the experts, resulting in the production of this joint witness statement.

4 The following additional experts were consulted in relation to certain areas of disagreement:

- For Department of Conservation: Dr Drinan (Freshwater Ecology); Mr Burns (Avifauna)
- For Wildlands/NPDC: Mr Goldwater (Freshwater Ecology)
- For NZTA, in response to matters raised by the above experts: Mr Hamill (by telephone while on holiday in Australia, and not available to provide a statement in writing). Dr McLennan is travelling overseas and was not contactable.

5 All direct participants in this conferencing confirm that they have read, understood, and agree to abide by the Environment Court's Practice Note 2014, including Appendix 3 – Protocol for Expert Witness Conferences.

SCOPE OF CONFERENCING

6 The purpose of this conferencing was to discuss, clarify and reach agreement on issues raised in the expert evidence of ecology witnesses, and in questioning during the Hearing.

7 The scope of issues covered was the same scope as the Ecology and Landscape Management Plan.

AREAS THAT ARE IN AGREEMENT

8 The table in Attachment A documents the ecological issues that were traversed during caucusing, and presents the opinion of the experts appearing on behalf of the three parties with respect to each issue.

9 The table also presents, where possible, the agreed modification that is required to the project's Ecology and Landscape Management Plan (ELMP) in order to reflect any position that has been agreed between the experts, and signals any consequent action required by others, such as amendment to draft designation or resource consent conditions, to align with proposed amendments to the ELMP.

10 Areas that are in agreement are summarised as follows (see Attachment A for details).

- The Objectives of the ELMP, as set out in Schedule 1 of the Conditions, should be reflected in Section 1.1 of the ELMP.

- Where necessary, the Objectives of the ELMP in relation to specific habitats or taxa, should be reflected in the Introduction to the respective chapter of the ELMP.

- In addition to 'advising' NPDC, the work of the Ecological Review Panel (ERP) should include 'making recommendations to' NPDC, and that if the Waitaanga Pest Management Area (PMA) is selected, the scope of the ERP's purpose and scope of work will need to be widened, because coastal lowland forest is absent from that site and less is known about the ecological values, and therefore the potential for appropriate ecological enhancement, at this site compared to the Intended or Wider PMA areas at Mt Messenger/Parininihi.

- ELMP Table 1.1 needs to be updated to reflect final Conditions, once these have been agreed.

- Plant species to be monitored as indicators of mitigation success need to be standardised throughout the ELMP, and, as an indicator of pest management success, any increase in plant health needs to be statistically significant. Consequently, ELMP Section 9.5.3.2, pertaining to outcome monitoring for palatable and non-palatable

plant species has been amended, and a new version is included in Attachment B[1].

- Agree that some ecological values that are adversely affected at Mt Messenger/Parininihi cannot be addressed if the Waitaanga conservation area is used as the sole PMA. However, the parties are disagreed on how this might be addressed (see 'Areas that are in disagreement').

- ELMP needs to be clear that livestock removal and control of pigs and goats will be done permanently in the PMA.

- Agree that if nesting kokako are found in or near the project footprint, action should be taken to avoid disturbing them.

- Agree that nocturnal lizard searches need not be carried out, but that manual searches should include 'high risk habitat including scrub communities with manuka'.

- Agree that any financial compensation for effects on lizards (e.g. research) should benefit lizards in the Taranaki region.

- Agree that if the mapped boundaries of the Waitaanga PMA options do not currently encompass known short-tailed bat roost locations, the PMA boundary should be amended to be centred on these roost locations.

- Agree that if ten bat maternity roosts are found within the Intended PMA, more than 1 km from any edge, then this would be a decision trigger to indicate that the Intended PMA is a suitable PMA from the perspective of bats.

- Agree that if ten bat maternity roosts are found closer to the edge of the Intended PMA (within 1 km of the edge), the Intended PMA would be suitable if the management and monitoring is to a certain standard. Consequently, two sections of Chapter 9 of the ELMP have been re-drafted, to reflect the agreed position of the experts: Sections 9.3.2 and 9.4.2.1, pertaining to the need for 'buffer' areas for bats, and the monitoring and adaptive management that should take place if bat roosting sites are found near the edge of the PMA. Revised versions are included in Attachment B to this Joint Witness Statement.

- Agree that, because bat colonies change roosting sites frequently, the 'ring of steel' to protect individual roost sites within a certain distance of the PMA edge can be removed as a requirement, but retained as a management option.

[1] The version of Chapter 9 in Attachment B uses the version presented to the Hearing on 9 October as the base document, and the tracked changes show amendments made during witness conferencing.

- Agree that any relocation of peripatus can focus on movement and relocation of peripatus habitat (and therefore the animals with the habitat), because this species abandons its habitat if moved on its own. The ELMP should be amended to clarify that peripatus will be moved within their habitat.

- The experts also agreed on the need for a number of other minor edits to the ELMP, which are set out in the table included in Attachment A herewith.

AREAS THAT ARE IN DISGREEMENT

11 The areas of disagreement between experts are summarised as follows:

- NZTA experts do not agree with DOC or Wildlands experts' positions that, should the Waitaanga site be selected as the PMA and some taxa do not directly benefit from pest management at that site, additional PMA site(s) should be found and managed. The reason for disagreement is that NZTA experts consider that a single PMA would have surrogate benefits to all ecological values.

- DOC experts consider that kiwi fencing must be provided at all locations where kiwi may be able to access the road corridor. Dr McLennan was unavailable to discuss this matter, however his previously-stated position on kiwi fencing, which is in disagreement, is reflected in the ELMP.

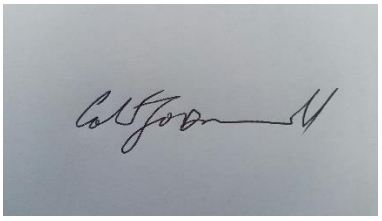
- NZTA's freshwater expert (Mr Hamill) disagrees with the opinion of DOC's freshwater expert (Dr Drinan), with regard to fish recovery, macroinvertebrate and fish monitoring, for the reasons stated in Mr Hamill's rebuttal evidence.

- NZTA experts disagree with the opinion of Wildlands' expert who seeks wasp control for extended periods and possibly in perpetuity. This is because the majority of effect will occur during the construction phase, which is when wasp management will be undertaken.

AREAS THAT HAVE NOT BEEN RESOLVED

12 With regard to the scope of the expert conferencing, no other matters are unresolved.

Date: 15 October 2018



Dr Colin O'Donnell

Dr Laurence Barea

Dr Tim Martin

Mr William Shaw

Mr Roger MacGibbon

Mr Simon Chapman

Dr Brett Ogilvie (Facilitator)

ATTACHMENT A – ISSUES DISCUSSED DURING CONFERENCING AND EXPERTS' POSITIONS ON EACH OF THESE

Attachment A. Issues Discussed in Expert Conferencing

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
1.1 Purpose and Objectives	Agree with including Schedule 1 objective and Section 1.1 of ELMP, and ongoing reflection of any changes in ELMP in Schedule 1. Need to be clear about net gain objective – depends on baseline.	For consistency, the Objectives in 1(a) of Schedule 1 should also be stated in Section 1.1 of the ELMP. Each objective in the Chapter 1 bullets should be expanded in the relevant chapter.	Agree with proposed changes. Need a mechanical, systematic process to reflect the final ELMP contents back into Schedule 1 of Conditions.	Include Objectives in 1(a) of Schedule 1, in Section 1.1 of the ELMP. Expand Objectives section of relevant ELMP chapters.	Authors of conditions need to ensure that Schedule 1 is updated to reflect revisions to ELMP.
1.1 Purpose and Objectives	Agree	Elevate No Net Loss objective, which is first mentioned in Section 3.3, to Section 1.1. (According to the 'technical' [BBOP] definition of no net loss, this is only achieved on this project for kahikatea swamp forest).	Agree	Edit 3.3 to include 'or equivalent' outcome, copy text to 1.1.	Authors of conditions to reflect this change in Schedule 1 as required.
1.6 Ecological Review Panel (ERP)	Agree	Purpose: add "and recommendations" i.e. purpose of ERP is to provide NPDC with "advice and recommendations" and "review and make recommendations" where ELMP refers to only, review. Agree clause required to change role of ERP to provide review and recommendations to Council if Scenario 4 selected.	Can understand the limitations in the list of the role and intent if Scenario 1, 2, or 3 selected. But if Scenario 4 eventuates, then significant changes to ELMP will be needed, which will need to change role of ERP. Add clause in 1.6 to state that if Scenario 4 is selected, ERP will have a wider scope of review and may need new expertise and members.	Amend ELMP where required.	Authors of conditions to reflect this change in Designation Condition 33 as required.

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
1.6. Ecological Review Panel	Agree	Agree	Change 'shall be limited to' to 'shall include'. Need a catch all-statement to say that significant review and updating of ELMP will be required if Mt Messenger/Parininihi PMA is not selected, including methods for achieving all of the objectives. This review would have oversight from the ERP who would advise and make recommendations to NPDC before certification. This is because if bat thresholds for Intended or Wider PMA are not met, considerable revision of the ELMP will be required for the Waitaanga scenario.	Edit accordingly.	Authors of conditions to reflect this change in Designation Condition 33 as required.
1.6 ERP	Make it clear what 'the condition' means in final line. (is it 33 (a) (ii) as per designation conditions)?	Agree	Agree	Edit to state Condition 33 (a) (ii) of Designation Conditions.	None
1.7 – Table 1.1	Agree	Needs to be updated as conditions are updated. [General comment]	Agree	Update as conditions are updated.	None

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
1.7 – Table 1.1	Agree	Agree	29 h) v) 1) and 2) – indicator species don't reflect species to be used. Chapter 4 only mentions one species.	Update Table 1.1, Chapter 4 and Conditions so that full suite of palatable species included objectives and monitoring methods	Authors of Conditions to update Conditions as advised by R MacGibbon
1.7 Table 1.1	Agree	Agree	29 h) vi) 1) needs to refer to a statistically significant 20% increase.	Amend in Chapter 9 and reflect this amendment in Conditions and Table 1.1	Authors of Conditions to update Conditions as advised by R MacGibbon
1.7 Table 1.1	Condition 29 (b) [Herpetofauna] needs to be completed.	Agree	Agree	Update Table 1.1 once Condition 29 (b) has been completed.	None
1.7 Table 1.1	29 c) i) 2 – list of trees and features should reflect what was in the chapter (needs updating)	Agreed	Agreed	Amend Condition and Table 1.1 as appropriate.	Authors of Conditions to update Conditions as advised by R MacGibbon
3.5	Agree	Agree	Move para at end of 3.5 (starting with 'In summary') to the top – i.e into 3.1 over-riding objective.	Move paragraph.	None

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
3.5	Agree with Wildlands' statement that ecological values other than bats need to be considered in selection of a PMA under Scenario 4. Disagree with DOC position that more than one PMA site is necessary, as a single PMA would have 'surrogate' benefits to all ecological values.	Agree with Wildlands that if Scenario 4 (Waitaanga PMA) is selected then some values lost to the project will not benefit at Waitaanga. In that case those values would need be compensated elsewhere if not accepted as permanent residual losses.	Wildlands in broad agreement with NZTA position as stated in ELMP if Scenarios 1, 2 or 3 are selected. If Scenario 4 selected then there are significant issues with addressing adverse effects for biodiversity other than bats (e.g. lowland forest).	Amend 3.5 to recognise that if Scenario 4 is selected, confirmation will be needed that the methods set out in 3.5 will meet the objectives as set out in 1.1 and 3.5.	Make sure the statement in Chapter 1 is adequately strong to make sure all of these types of issues are dealt with.
4.5.4	Agree. Accept the need to include reporting of riparian offset quantity in square metres of stream, based on the square metres calculated by Mr Hamill.	SEV-informed quantity of riparian offset restoration planting should be reported in square metres – 11,536 m^2 (as per para 7 of Mr Hamill's second set of speaking notes). This is required as formal landowner agreement for the compensation sites has not been finalised. If an alternative site is required then the linear quanta may not match the intended compensation.	Agree – this is the standard method for SEV.	No change because ELMP already uses square metres as the determinant of the amount of riparian restoration required.	None.

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
4.5.5	Disagree with Wildlands position: difference of professional opinion as to what constitutes a significant tree, noting that NZTA's offer to plant 200 seedlings for each significant tree lost is a voluntary additional part of our restoration package. The pest management area and swamp forest planting would be adequate compensation for all vegetation loss; the significant seedling plantings are additional to this.	No position stated.	Do not agree with significant tree criteria approach. Proposed additional species and criteria in S42A report.	No action agreed.	None proposed.
4.5.5.1	Agreed	Agreed	Change wording to final sentence to include 'height increase'.	Amend wording.	None.
4.5.6.8	Agree	Agree	Add statement that livestock removal and control of pigs and goats will be done permanently.	Amend wording.	None
5.1 - Bats - Introduction	Agree	Agree	Restore deleted paragraph 1 and make it more bat-focused.	Reinstate deletion and revise accordingly.	None
5.7.1.3	Agree	Agree	Purpose of tracking is to identify all roosts. Change bullet 4 to "To gather information about all roost locations discovered in the Study area, and including the Project Area"	Edit accordingly.	None

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
5.7.1.4	5.7.1.4 A – amend to remove reference to any kind of roost trees, add that trapping may cease when 30 transmitters have been deployed	Delete reference to "except if 10 or more roost trees are located in the Pest Management Area (PMA) in a shorter timeframe" and replace with "trapping may cease when 30 transmitters have been deployed".	Agree	Amend accordingly.	Authors of Conditions to update Conditions as advised by R MacGibbon
5.7.1.4	Agree	Agree	(From Kerry Borkin). End of para 3. Change final sentence to be consistent with the wording in Simon Chapman's evidence.	Amend accordingly.	None
5.7.2	Agree	Agree	5.7.2– delete 'maternity' and then it will reflect what is in Condition 29 c) i) 3) as shown in Table 1.1	Amend accordingly.	None
5.7.6 (b)	Agree	This version of the list needs to be reflected in Conditions and Schedule 1.	Agreed	None	Authors of Conditions to amend Condition and Schedule 1 to reflect final list in 5.7.6 (b)
6.3 Avifauna	Agree with both.	If nesting kokako or their nests are detected, disturbance will be avoided and the DOC Operations Manager at the New Plymouth District Office immediately notified regarding further action.	If nesting kokako are encountered, there should be some action – and the focus should be on avoiding rather than minimising disturbance	Add wording to Section 6.3 re: action to avoid disturbance.	None

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
6.3.1.1	Agree.	Kiwi survey and catching of kiwi should occur along entire length of road corridor, not just at designated 'high-risk habitat areas'. This is because kiwi can be found at nearly any site along the road corridor, not just in areas deemed to be 'high risk', as shown in Appendix A of ELMP.	Agree	Amend ELMP 6.3.1.1 by deleting reference to high risk areas.	None.
6.3.1.2	Agree. Already stated in 6.3.1.1 of ELMP.	Any juvenile or subadult kiwi found in the construction zone should have a transmitter attached. This will allow for more certain detection on subsequent days as construction proceeds.	Agree	None	None
6.3.1.2	Agree.	Add new text (underlined): 'In all cases, <u>each</u> egg will only be uplifted … 40 days'. This is because eggs can be laid up to 3 weeks apart, and so the age of each individual egg in a nest needs to be known before it can be moved.	Agree	Add the requested text to 6.3.1.2, at Footnote 9.	None.

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
6.3.1.3	Disagree for reasons stated in Dr McLennan's evidence and in questioning by the Commissioner. Focus should be on pairs whose territory straddles the new road.	Fencing should occur at all sites on the new road where kiwi may be able to access the road corridor. Restricting fences to just territorial areas of current pairs means sub-adult kiwi may not be protected (as they may cross road at any point), and future pairs may establish territories in different sites and with different shapes than current kiwi pairs.	Agree with DOC position.	No action agreed.	None
7.4.4. Lizards	Agreed – can draw into 7.4.4.1. Salvage will include translocation of striped skink to Rotokare and all other lizards to appropriate areas of forest in the PMA (as recommended by Ms Adams).	Focus can be restricted to high risk trees with epiphytes and scrub communities with mānuka	7.4.4 Reference to nocturnal searches has been deleted. It could be captured in next section re: destructive searches but trigger there is restricted to trees with epiphytes. 7.4.4.1 needs to be updated to target striped skink and arboreal geckos. P79 first line to include 'high risk habitat including manuka communities'.	Amend 7.4.4.1 to include destructive searches of other "High Risk habitat, including scrub communities with mānuka.	None
Not part of ELMP.	Agreed	Agreed include in statement that research will benefit lizards present in Taranaki, including those likely present in the Mt Messenger area such as, striped skink and arboreal geckos.	Would like conditions to state that focus of compensation should benefit lizards in Taranaki. Research could be outside Taranaki but focus on relevant taxa.	None	Authors of Conditions to reflect in Condition 29 (b) (ii)

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
8.3.1	Disagree for reasons stated in Mr Hamill's evidence i.e. Dr Drinan's proposal will result in more harm to fish.	Fish Recovery and Rescue Protocols (FRRP) are insufficient in methodology to minimise a largely avoidable effect. Edit FRRP to reflect TD's EIC (para 142).	FRRP proposed by NZTA acceptable.	No action agreed.	None
8.4.2 & 8.4.3	Disagree for reasons stated in Mr Hamill's rebuttal evidence – in his view the proposed monitoring is sufficient.	More intensive aquatic macroinvertebrate and fish sampling is required to detect potential project-related discharge effects.	Current proposed monitoring is sufficient.	No action agreed.	None
8.4.4	Disagree for reasons stated in Mr Hamill's rebuttal evidence.	Aquatic macroinvertebrate monitoring in response to turbidity exceedances (event-based) would provide a robust and reliable method to quantify potential project-related discharge effects on aquatic biota.	Agree with DOC position.	No action agreed.	None
8.4.4.2	Disagree for reasons stated in Mr Hamill's rebuttal evidence. Higher gradient culverts are located on intermittent streams where no fish have been detected in baseline monitoring.	Additional higher gradient culverts also need to be monitored, as these pose a higher risk of impeding fish passage.	Agree with DOC position.	No action agreed.	None

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
Chapter 9 – Pest Mgmt.	Agreed	Need Objective statement, including link to other chapters i.e. it meets the objectives of other Chapters. Including stating reason for perpetuity.	Agreed	Add Objective statement.	None
9.3	Agree, but the context is still relevant – when we have a PMA we still want to have these specific forest types included in the managed area.	Re-write bottom of page 101 to remove reference to offset calculations – no longer relevant. Remove reference to 230ha core area in PMP.	Agree	Amend	None
9.3.2. Scenarios	Accept the need for measures to respond to increased indices within the same year prior to breeding season. Disagree that a 1 km buffer is needed.	Continue to support DOC's proposed 3 Scenario PMA Scheme. But the critical things are the thresholds used to respond adaptively to higher than predicted predator numbers and how the PMA is designed with respect to the location of maternity roosts. Pest management to achieve performance measures in conditions applies to entire PMA (5% rat RTI) and measures to respond to increased indices within the same year prior to breeding season need to be included.	Not focused on buffer distances as a key issue. More interested in where the bats are and what to do about them. Reasonable limits can come from the ERP.	Mr MacGibbon has developed revised text which has been agreed by all witnesses (see Attachment B to this Joint Witness Statement).	Authors of Conditions to take revised agreed text into final Conditions.

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
9.3.2.3	Agree	Agree	Para 2, last sentence – replace "and has less coastal vegetation as a result" with "and has different landforms and vegetation elements". Reason – means that we don't forget that there is no swamp maire or coastal vegetation at Waitaanga, and also needs attention to being able to lift vegetation health to achieve compensation.	Amend accordingly.	None
Figure 9.3	Agree	Re-configure brown area on map to be centred on Short-Tailed Bat roosting sites.	Agree	Check and amend map if needed.	None (Conditions refer out to ELMP maps)
9.4.1.3	Agree	Remove 'trapinator' reference and replace with 'kill traps and other devices approved by DOC'.	Agree	Amend accordingly.	None

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
9.4.2.1	Generally in agreement – will re-draft this section and relevant sections of 9.3.	Include pest monitoring inside the edge zone (following DOC best practice) to give information as to whether it is going to go over 5% in future, then respond using adaptive management. Use DOC models to predict and adapt. (Reasons as per O'Donnell supplementary evidence) Moving to annual monitoring after 5 years, plus a 2-year lag until response, won't allow adaptability and may be too late to realise biodiversity gain.	Not hung up on the thresholds. Wants a good adaptable framework with monitoring and management, with reactive capability, up to forest edge.	Mr MacGibbon has developed revised text which has been agreed by all witnesses (see Attachment B to this Joint Witness Statement).	Authors of Conditions to update conditions as advised by R MacGibbon.
9.4.2.2	Agreed	Can remove ring of steel requirement, although the adaptive method set out in 9.4.2.1 does not preclude it as an option.	Agreed	Delete 9.4.2.2 and amend 9.4.2.1 to state ring of steel as a management option.	Authors of Conditions to update conditions as advised by R MacGibbon.
9.4.1.5	Disagree because the majority of any effect will occur during the construction phase, which is when wasp management will be undertaken.	No view at the moment.	Seeking wasp control in all new edge areas until forest canopy edges are sealed (could be 10-20 years). For some parts of route this will be in perpetuity.	No action agreed.	None proposed

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
9.5.3.2	Agree that this disconnect currently exists.	No position stated.	Disconnect between outcome monitoring and species in methods to be monitored e.g. species noted for recovery (northern rata, tōtara) are not in monitoring programme.	Mr MacGibbon has edited this section of the ELMP to add in northern rata and tōtara and remove inconsistencies (see Attachment B to this Joint Witness Statement).	Authors of Conditions to take revised agreed text into final Conditions.
9.5.3.2	Agree	Agree	Concerned about sample size. Should refer back to a statistically valid method.	Look at references already provided and find a best-practice reference method. If one can't be found, use 'statistically robust sample size'.	None
9.5.3.2	Agree	Agree	Para starting with 'Possum impact monitoring' has contradiction about canopy closure in 5-6 years – change 'any' to 'further'.	Amend	None
9.5.3.2	Agree	Agree	Para at end of p.113 – change veg monitoring to include whole PMA not just core.	Amend	None

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
9.5.3.2	Agree	Agree	Top of 114 – things being monitored need to reflect the objectives, or a broader definition e.g. 'a comprehensive suite of suitable indicator species'. Could add 'as recognised as being palatable and unpalatable to browsers known to be present'.	Amend	None
9.5.3.2	Agree	Agree	Last para on 114 – re-word to connect back to objectives.	Amend	None
9.5.3.2	Agree	Agree	Paragraph starting with 'Vegetation monitoring' – Move the sentence starting with 'Tagged seedlings' to the Vegetation chapter. (Chapter 4).	Amend	None
10 Peripatus.	Attempts to relocate Peripatus animals alone have been 100% failures. Destructive searches result in Peripatus abandoning site. There will be searches specifically for Peripatus habitat. Add explanation to ELMP that animals will be moved with habitat.	Agree with final NZTA position at left.	Recent amendments (a shift from peripatus relocation to habitat relocation) introduces contradictions within the ELMP and with the conditions. Stated objective of Chapter is defeated i.e. relocating peripatus. Discussed and NZTA position agreed.	Add explanation that animals will be moved with habitat.	Authors of Conditions to update conditions as advised by R MacGibbon.

Section of ELMP	NZTA position	DOC position	Wildlands position	Agreed action required by ELMP authors	Actions required of others
11. Biosecurity	Agree, although noted that objective (b) will stay as minimise as it is already at the site.	Add an objective statement to the effect that the intention is to avoid introducing new pests (not minimise). The process then sets out to achieve this. Changed minimise to avoid. Make sure inspections are by suitably qualified personnel and it is happening before plants leave the nursery.	Agree.	Change objective statements (a) and (c) in the Table in 11.1 from 'minimise [the likelihood of]' to 'avoid'.	None
11	Agree	Suitably qualified personnel to inspect nurseries for presence of pests and respond appropriately prior to plants leaving the nursery to prevent new incursion to project site.	Agree.	Amend accordingly.	
11	Agreed.	Plague skinks – include 'and plant material' into Table 11.2. (it is not just potting mix that is going to be inspected).	Agree.	Amend accordingly.	None
Outside of ELMP					Authors of Conditions to check that Schedule 1 reflects updated conditions (blanket comment – agreed by all six ecology experts).

ATTACHMENT B – PROPOSED REVISED WORDING FOR PEST MANAGEMENT PLAN

Base document is from the version of the ELMP presented to the Hearing on 9 October 2018, with all changes at that date accepted. Tracked changes are amendments agreed upon during witness conferencing since 9 October 2018.

9 Pest Management Plan

9.1 Introduction

The ecology technical reports prepared for the Project (Volume 3 of the AEE) have identified introduced animal pests as having significant impact on the indigenous plants and animals in the forest and wetland areas within and adjacent to the Project footprint. Intensive, enduring pest management is therefore the priority focus for compensation as it will result in the most immediate and largest net ecological gain.

The objective of the Pest Management Plan is to restore a range of ecosystem processes that have been degraded by the impact of animal pests and livestock by undertaking intensive multi-species pest management in perpetuity (or until such time as pest management is no longer necessary) over a 3650ha area of indigenous forest and wetland adjacent to the Project area.

The following table sets out the specific objectives, performance measures and monitoring relevant to this Pest Management Plan.

Specific Objectives	The Pest Management Plan addresses the following matters: a) The identification of the confirmed location for the 3,650ha Pest Management Area (PMA). b) Within the PMA, to: i) reduce and maintain rats, possums, feral cats and mustelids to low levels in perpetuity. ii) reduce and maintain feral goats and pigs to low densities in perpetuity. iii) exclude farm stock in perpetuity iv) monitor and control wasps along the road corridor during construction. c) To generate biodiversity benefits within the PMA across a wide range of plants and animals. d) An adaptive management approach to enable pest management techniques to be modified if the performance outcomes for avifauna identified below are not met.
Performance Outcomes	The Pest Management Plan includes the following performance measures: e) The following target pest densities in the PMA, measured immediately prior to the breeding season (for bats and birds) and then through the critical stages when young remain in the roost / nest: i) rat species – ≤5% tracking tunnel index; ~~, with 10% or more in two consecutive years triggering the need to review the method used~~; ii) mustelids – no detections; iii) cats – no detections; And throughout any year, the following target pest densities in the PMA: a. possums – ≤5% chew card index; b. goats and deer - <1 kill per hunter/day; c. feral pigs - <1 kill per hunter/day; d. farm livestock – zero presence. f) For palatable plant species: i) The recruitment of vegetation species which are currently suffering ungulate induced recruitment failure. Indicator species will include: mahoe, hangehange, large leaved coprosma spp., pate, wineberry, tawa, hinau, kamahi and pikopiko. ii) Recovery of condition of possum palatable trees. Indicator species will focus on measuring changes in foliage density of small trees such as; swamp maire, mahoe, kaikomako, and taller canopy species including northern rata and thin-barked totara. . g) A statistically significant 20% increase in relative abundance for kiwi, tui, bellbird, kereru, whitehead, long-tailed cuckoo, fernbird, and North Island Robin in the PMA within 12 years of the Completion of Construction Works.

Monitoring	The Pest Management Plan includes the following survey and monitoring requirements within the PMA. h) Provision for monitoring pest levels to assess performance targets and enable adaptive management processes in the event targets are not met. ~~for 2 consecutive years~~. i) Provision for a quantitative assessment of canopy condition and understorey condition to establish pre-pest management and post-pest management vegetation condition knowledge for the PMA, including the composition and abundance of palatable vegetation. j) Provision for monitoring avifauna prior to establishment of pest management in the PMA to establish a relevant baseline, including for kiwi, kōkako, forest birds and fernbird. k) Provision for outcome monitoring of kiwi, tui, bellbird, kereru, whitehead, long-tailed cuckoo, fernbird, North Island Robin conducted for 12 years, at 3-yearly intervals, following the onset of the pest management measures.

9.2 Pest management programme overview – expected results and outcomes

Target pest species will be intensively managed to low densities in perpetuity (or until such time as pest management is no longer necessary) over a 3650ha largely forested area (the Confirmed Pest Management Area – PMA).

The Pest Management Programme will target rats, possums, mustelids (stoats and ferrets), cats, goats and pigs. Hedgehogs are also likely to be effectively controlled as a result of the Pest Management Programme but they are not target pests for this programme because their impact is likely to be less significant. Farm livestock will also be excluded by the construction of permanent fencing where necessary.

Intensive, effective and enduring pest management, with a focus on controlling all target pest species, can be expected to generate biodiversity benefits across a wide range of plants and animals. Many forest bird species including kiwi, and most wetland bird species will increase in number as predatory pressures are greatly reduced and habitat recovery increases local carrying capacities. 3650ha is proposed to provide protection for bat breeding habitat.

Reptiles and invertebrates will benefit from the increased diversity and abundance of habitat but may not benefit from the management of possums, rats, mustelids and ungulates to the same extent as birds and bats.

Rapid recovery of palatable sub-canopy, canopy and emergent forest giants, such as kamahi, northern rata and totara, is expected to occur within 10 years, as a result of possums being controlled to very low levels. As grazing and browsing pressure is reduced on the forest floor, due to ungulate removal, the abundance of palatable shrub and fern species and tree seedlings is also expected to rapidly improve.

With habitat improvements in a low-pest environment, the carrying capacity within the PMA for many indigenous animal species will increase substantially. This will result in spill over benefits for surrounding areas as juvenile birds and bats disperse.

The pest management proposed is in perpetuity (or until such time as pest management in the form we know of it today is no longer necessary to sustain the levels of biodiversity created). This will result in permanent ecological benefits within the PMA. When combined with the pest management occurring at Parininihi, some wider benefits will also accrue such as increasing the area of suitable habitat for kōkako.

The western Ngāti Tama block (Parininihi) has been intensively managed for pests for 15 years now and the evidence of the value of an intensive pest management approach is visually very apparent, with the canopies of “old man” rata and totara in good condition and the diversity and volume of forest regeneration far greater than in the unmanaged Ngāti Tama Eastern Forest block.

9.3 Pest Management Area

The Biodiversity Offset Calculation supplementary report (February 2018) determined that an area of 230ha was required to be managed for pests to offset the vegetation loss that will occur as a result of the Project and achieve a high level of ecological integrity. A preferred PMA to meet the offset requirements for the Project was selected in the upper Mimi catchment to the east of SH3 (on a small area of Ngāti Tama land in the northwest corner and a larger block of DOC managed Mt Messenger Conservation Area to the south of the Ngāti Tama block). This area had been selected as the preferred area of pest management because it includes sufficient areas of all of the vegetation communities required for offset, including the required 22ha of swamp forest habitat in the Mimi Catchment, 190ha of tawa, kamahi, rewarewa forest and 18ha of hard beech dominant forest.

With the expansion of the PMA to 3650ha, the area of vegetation now proposed for pest management far exceeds that necessary for vegetation offset. ~~(but still includes all of the 230ha initial pest management area that was previously identified, unless the PMA is shifted to a different location, in accordance with the conditions). While the outer edges of the 3650ha PMA will serve as a pest management buffer where pest densities may exceed the performance targets, the area of the Intended PMA receiving all of the benefits of permanent intensive pest management (resulting in significantly improved ecological integrity) will be at least 2590ha in size (after deduction of a 200m deep buffer around the full PMA perimeter).~~

The ~~extra 3420ha of PMA, in excess of the 230ha required to meet offset requirements, and the~~ ecological benefits this ~~larger~~ area provides, ensures that the ecological effects of the Project are appropriately addressed.

9.3.1 The Intended PMA (Scenario 1 in the Designation Conditions)

The proposed 3650ha Intended PMA is shown in Figure 9.1. It includes all of the Parininihi (1335ha), Ngati Tama land east of SH3 (255ha), 56ha of road reserve, and 2004ha of DOC conservation area. Two areas are shown 'hatched' on Figure 9.1:

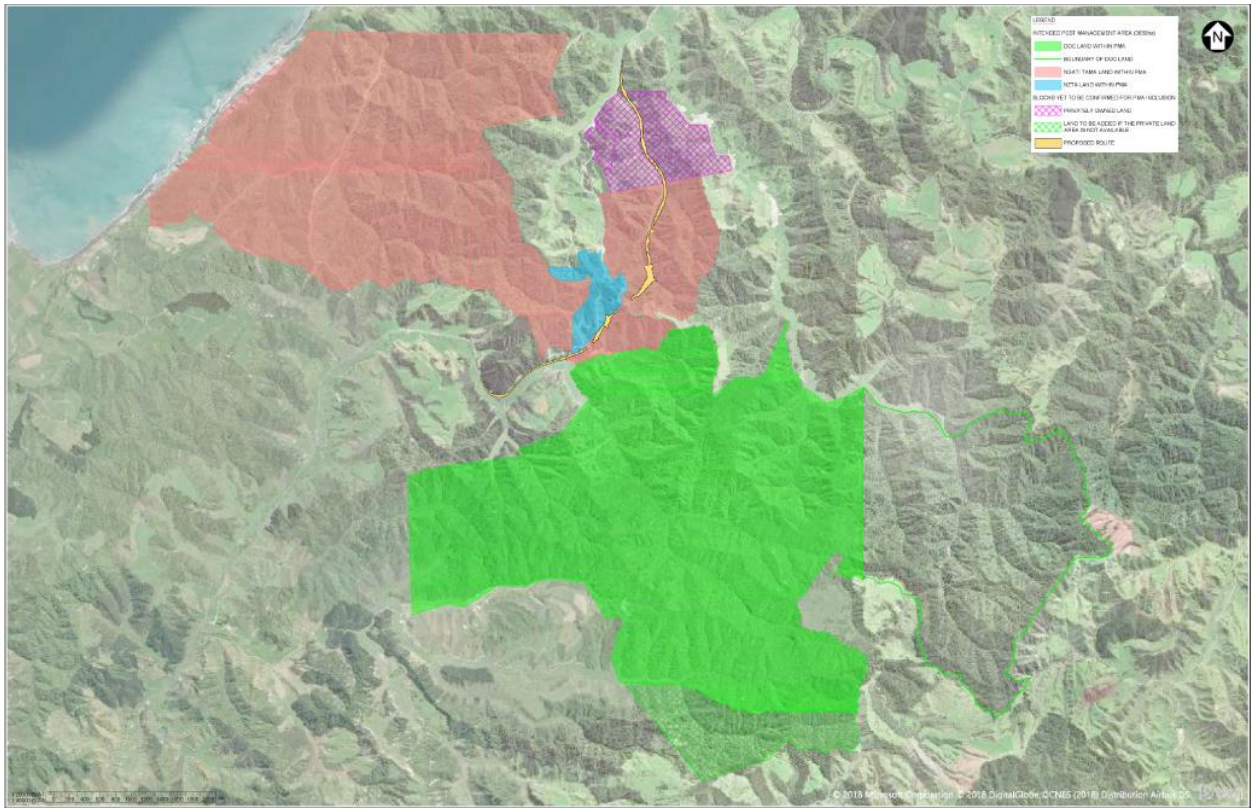


Figure 9.1: Intended Pest Management Area

1. The forest and valley land owned by the Pascoes (purple hatched); and
2. An equivalent area of DOC land (green hatched)

The intention is that the Pascoes' land will be included if land procurement negotiations are successful; otherwise the green hatched DOC land will be included in the final PMA.[1] The addition of either block will make the PMA area 3650ha.

The Intended PMA will be verified as the Confirmed PMA upon completion of the bat radio tracking programme and assuming the results of the programme confirm that the Intended PMA is suitable habitat for long tailed bats. If 10 or more maternity roosts are located within the Intended PMA or 10 or more are located within the Study Area (Figure 9.3) and 70% of these are in the Intended PMA then the Intended PMA will become the Confirmed PMA (refer to Scenario 1 in the Designation Conditions).

The Intended PMA, including the Parininihi, is considered to be the best PMA option in terms of overall ecological benefit and pest management because:

1. Pest management over a contiguous forest sequence extending from the coast to lowland hill country will improve the condition of a broader diversity of vegetation and a greater seasonal range of habitat for fauna, and as a result, will benefit a greater diversity of fauna than would occur with an inland site only;
2. The Parininihi contains the best remaining example of primary coastal broadleaved to podocarp broadleaved forest on the west coast of the North Island and includes the

[1] That is, only one of the two hatched areas shown on Figure 1 would be included in the final version of the PMA.

Waipingao Stream, which has a catchment that is entirely indigenous forest (from coast to headwaters).

3. There is evidence that current funding for pest management in the Parininihi is less than required to maintain pest densities at permanently low levels (Conrad O'Carroll pers com). There is also uncertainty as to the availability of ongoing funding to support pest management in the Parininihi, with no guarantee of funding beyond 2 years. The ecological gains resulting from pest management will be very quickly undone if a lack of funding prevents or reduces the current pest management effort. Inclusion of the Parininihi in the PMA provides certainty for the future of this ecologically important site.

~~3.~~4. The Intended PMA contains a significant stand of swamp maire, a vegetation type that is uncommon in North Taranaki.

9.3.2 Alternative PMA options

9.3.2.1 ~~Option 1~~Scenario 2: Reconfiguration within the Wider PMA

If the bat radio tracking programme results locate less than 10 maternity roosts in the Intended PMA, but suitable bat roosting habitat is located in adjacent forest the PMA will remain at 3650ha but will be reconfigured within the Wider PMA (Figure 9.2) to include as many maternity roost sites as possible. In reconfiguring the PMA, the Project bat ecologist and restoration ecologist will consult with the DOC bat ecologist and the Project avifauna and vegetation ecologists giving consideration ~~consideration will also be given to~~to:

1. the location of the identified maternity roosts;
2. retaining the Project Area and kahikatea-swamp forest plantings in the PMA;
3. minimising the overall length of the edge of the reconfigured PMA (which will become the Confirmed PMA);
4. minimising the length of the edge of the PMA that adjoins mature forest;
5. the practicality of implementing pest management, including access; and
6. the effectiveness of the PMA in offsetting or compensating for the effects of the Project on other ecological values, in particular vegetation and avifauna.

~~ensuring that pest management over the new area will benefit indigenous flora and other fauna to the same extent as the current Intended PMA~~.

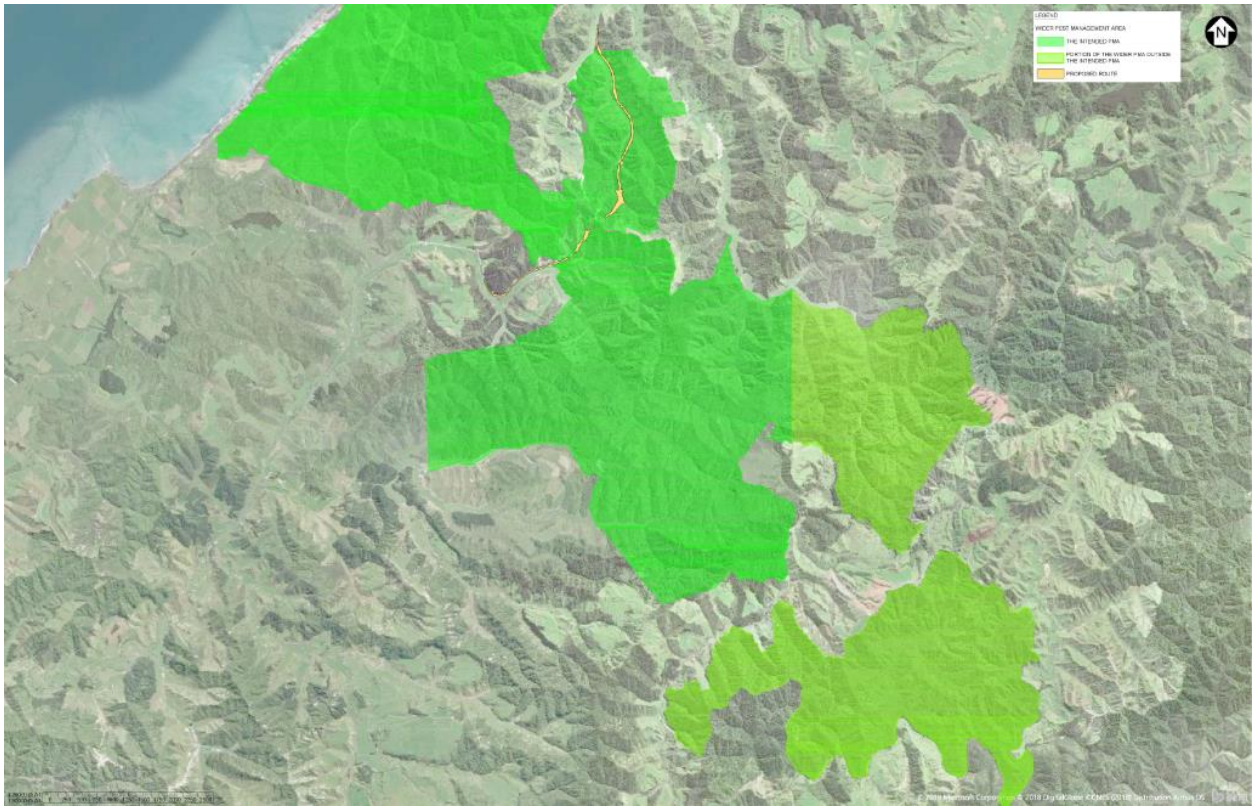


Figure 9.2: Wider Pest Management Area

9.3.2.2 Scenario 3~~Option 2~~: Reconfiguration within the Study Area

In the event that the majority of bat maternity roosts are found within the Study Area but outside both the Intended PMA and the Wider PMA, consideration will be given to reconfiguring the boundaries of the PMA within the Study Area (Figure 9.3) to include as many maternity roosts as reasonably possible. The PMA boundary reconfiguration will be undertaken by the Project's bat and restoration ecologists in consultation with the Project- avifauna and vegetation ecologists and DOC's bat expert. Consideration will be given to:

1. the location of the identified maternity roosts
1. ~~;~~
2. minimising the overall length of the edge of the reconfigured PMA (which will become the Confirmed PMA);
2. ~~—~~
3. ~~—~~minimising the length of the edge of the PMA that adjoins mature forest;
3. ~~—~~
4. ~~—~~the practicality of implementing pest management, including access;
4. ~~—~~
5. ~~—~~the effectiveness of the PMA in offsetting or compensating for the effects of the Project on other ecological values, in particular vegetation and avifauna; and
5. ~~—~~
6. the availability of the land for inclusion in the PMA.

The report containing the proposed reconfigured PMA and the justification for the selection of the chosen PMA area will be submitted to the Ecological Review Panel, including the Independent Bat Reviewer, for review and recommendation to NPDC for certification.

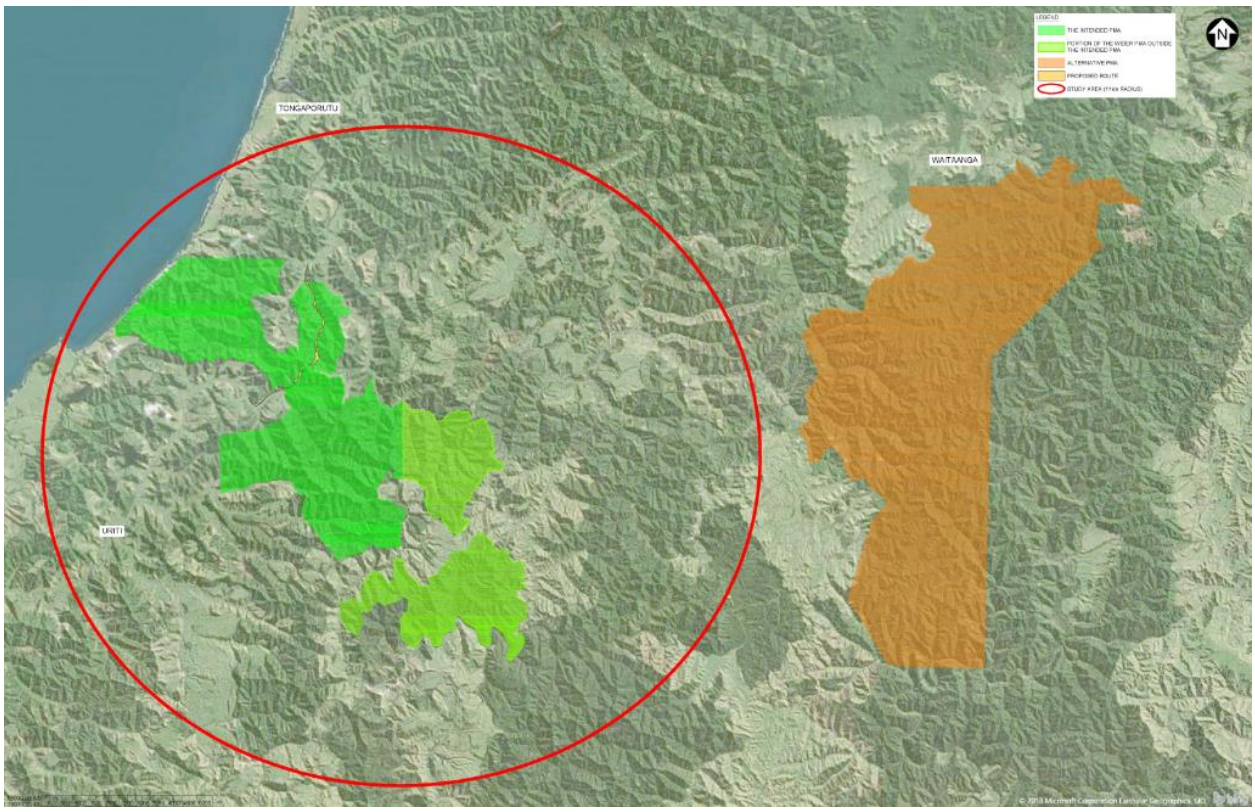


Figure 9.3: The study area and the alternative pest management area

9.3.2.3 ~~Option 3~~Scenario 4: The Alternative PMA

In the event that the bat radio tracking results indicate that the Intended PMA, the Wider PMA and the Study Area are not suitable as bat roosting habitat an Alternative PMA site has been identified in the Waitaanga Conservation Area to the northeast (Figure 9.4).

This area was previously identified as a potential alternative pest management site by DOC. It is an area of known long-tailed bat activity and contains known short-tailed bat roost trees. While no recent biodiversity surveys have been undertaken in the Waitaanga Conservation Area it is known by DOC field staff to be an area occupied by kiwi and likely to be inhabited by all or most of the forest bird species present in areas adjacent to the Project Area. The forest is at a higher altitude than the Intended PMA or Wider PMA and has different landforms and vegetation elements.~~ and has less no coastal vegetation and no known swamp mairas a result.~~

A zone of approximately 10,~~8~~000ha has been identified (Figure 9.4) from which a 3650ha PMA will be determined taking into account all available information about the presence and location of long and short-tailed bats, kiwi, forest birds and ~~forest~~ vegetation composition. Determination of where the PMA boundaries will occur at this Alternative PMA site will give due consideration to ~~the~~ all ecological effects of the Project that need to be offset or compensated for. A preferred Alternative PMA location and boundary will be determined by the Project's bat and restoration ecologists in consultation with Ngati Tama, the Project avifauna and vegetation ecologists and DOC's bat, avifauna and vegetation ecologists. Consideration will be given to:

1. the location of the known short-tailed bat maternity roosts

2. minimising the overall length of the edge of the Alternative PMA;
3. minimising the length of the edge of the PMA that adjoins mature forest;
4. the practicality of implementing pest management, including access;
5. the effectiveness of the PMA in offsetting or compensating for the effects of the Project on other ecological values, in particular vegetation and avifauna; and
6. the availability of the land for inclusion in the PMA.
7. Other pest control undertaken by DOC that may act as a buffer to the PMA

The Project bat and restoration ecologists will produce a report recommending a preferred location for the 3650ha Alternative PMA and provide that to the Ecological Review Panel for review, and to NPDC for certification. ~~aspects outlined in 9.3.2.2 above.~~ If the Alternative PMA cannot be centred on known short-tailed bat maternity roosts, then a radio tracking study to determine the location of long-tailed bat maternity roosts will be needed to define the location of the PMA.

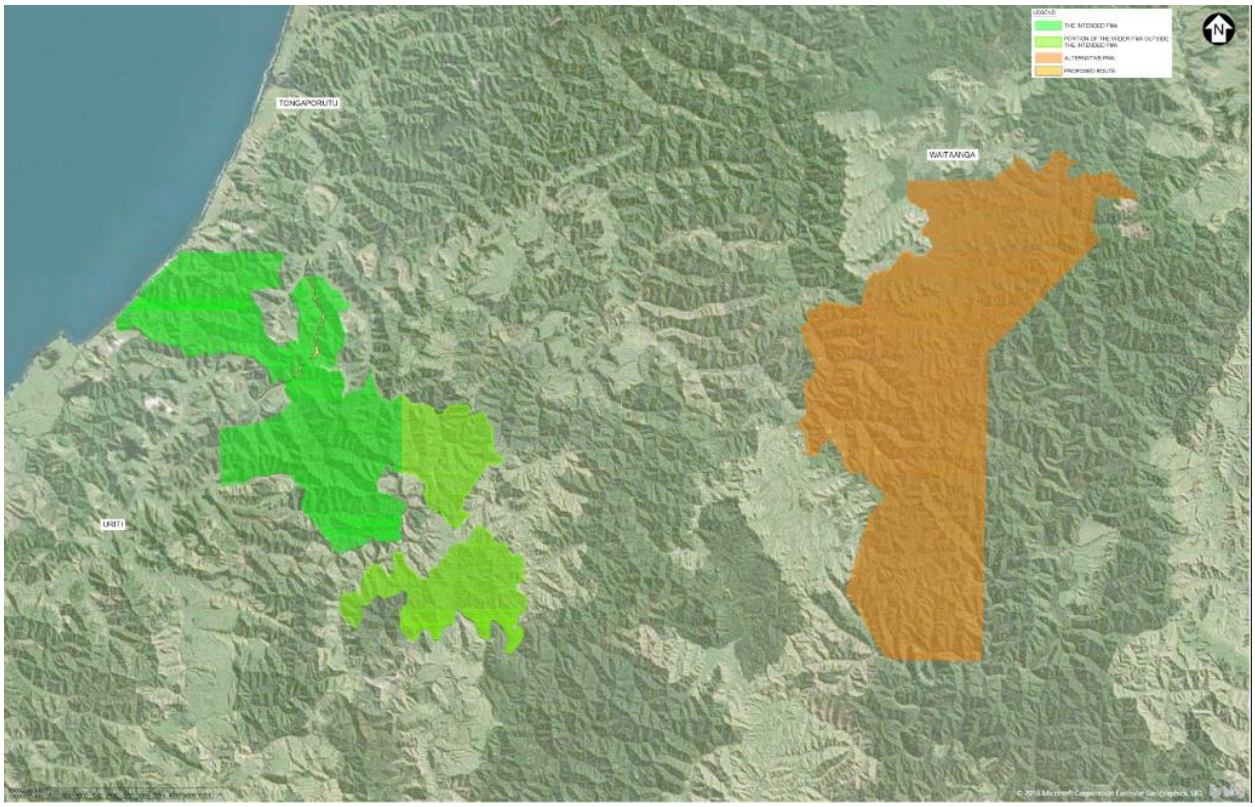


Figure 9.4: Alternative Pest Management Area

9.4 Proposed pest management strategy

The pest management will include:

- A combined aerial and ground-based approach over the full PMA to reduce and maintain rats, possums, mustelids and cats to low levels in perpetuity; and
- A hunting programme to reduce and maintain feral goats and pigs to low densities in perpetuity.
- A responsive and adaptive management approach to the achievement of target pest densities.

~~9.4.1 Pest management methodology~~

~~9.4.2~~9.4.1 Adaptive management approach

The long term strategy for possum, rat and mustelid control will be based on achieving very low pest densities from three-yearly aerial 1080 applications, and maintenance of the low densities in the years between 1080 applications by a ground based bait station and trap network across the entire PMA. An adaptive management approach will be adopted for each animal pest in the choice of pest management methods used and trap and/or bait station intensity.

Methods that have been successful at other New Zealand sites may not be as successful at Mt Messenger due to factors such as the nature of the terrain and weather conditions. An adaptive management approach will result in the determination of the best combination of methods for the PMA to achieve target pest densities and will also allow for continuous improvement as new pest management technology becomes available.

The specialist pest management members of the Ecological Review Panel will provide methodological and adaptive management recommendations to the Transport Agency's Pest Management Lead/expert on a regular basis, but especially immediately preceding and during the bat and bird breeding seasons and when monitoring data shows pest densities to be above target thresholds or trending upwards so as to be likely to exceed target thresholds. ~~-~~If target, or near target, pest density performance standards are not being achieved during the bat and bird breeding seasons, for reasons other than because ~~with one method for two consecutive years (after excluding years when targets are not met due to~~ of severe natural events or circumstances beyond the ~~Alliance's~~ Transport Agency's control~~)~~, the Ecological Review Panel can recommend changes to the methods or approach to increase the likelihood of achieving pest density targets. Recommendations made by the Ecological Review Panel will align with recognised best practice and will give consideration to optimising the cost effectiveness of the pest management programme. Recommendations for changes to pest management methods or approach may be for specific localised parts of the PMA (eg. along sections of PMA boundary where there is a high risk of pest reinvasion) or across all or a larger part of the PMA, depending on where target densities are exceeded.

The Ecological Review Panel will be provided with pest monitoring data on a regular basis (refer to Section 9.5.3.1 below) from the pest management contractors and independent auditors and will use this information to determine the areas of the PMA that require extra attention to reduce pest densities to target levels. ~~.will be varied, based on experience and research, until target levels are consistently achieved.~~

~~Methods that have been successful at other New Zealand sites may not be as successful at Mt Messenger due to factors such as the nature of the terrain and weather conditions. An adaptive management approach will result in the determination of the best combination of methods for the PMA and will also allow for continuous improvement as new pest management technology becomes available.~~

9.4.2 Management of high predation risk areas

9.4.2.1 Increased pest management where edge reinvasion risk is high

Additional pest management effort (e.g. increased trap/bait station intensity using similar methods to those stated in section 9.4.1.3 above) will be undertaken around the PMA perimeter to reduce the risk of pest intrusion in areas of high risk edge reinvasion. Increased effort will ~~primarily be directed at rats, mustelids, feral cats and goats~~include all pest species around the PMA boundaries, including areas where monitoring results determine sizable pest populations exist on adjacent

~~unmanaged~~ land unmanaged by this ELMP. The additional pest management effort will be pulsed to coincide with the period leading up to and during bat and bird breeding season (August to February inclusive).

9.4.2.2 Responsiveness to elevated pest densities

Pest density monitoring data (sourced from the pest management contractors and independent auditors – see section 9.6.3.1 below) will be analysed by the Requiring Authority and a report made available to the Ecological Review Panel ~~on a regular basis~~within 1 month of data being collected in any monitoring event. The monitoring information will be utilised by the Requiring Authority to determine locations within the PMA where pest densities are higher than target thresholds or trending upwards in a way that is likely to result in target thresholds being exceeded without additional intervention.

Where pest densities are found to be above or trending to be above target densities leading up to and during the bat and bird breeding seasons, the Ecological Review Panel will provide recommendations to the Pest Management Programme Manager to change methods and/or increase control intensity at those sites. Adaptive pest management will continue until monitoring shows target pest thresholds have been achieved.

9.5 Pest management methodology

~~9.4.3~~9.5.1 Aerial toxin programme

Pest management will begin with an aerial 1080 toxic bait application to quickly reduce possums, rats and predators to low levels over the full 3650ha PMA. This operation will involve a minimum of one pre-feed with non-toxic bait followed by toxic bait application ideally 10 days after. Aerial 1080 operations will be timed to coincide with the start of the bird breeding season (July to September) to ensure pest densities are as low as possible early in the season. Aerial application will ensure even coverage of toxin across the entire treatment area including areas where extremely steep terrain prevents the safe establishment of control devices. This is expected to result in a uniform reduction of pests which is critical for the ongoing success of ground-based control methods, to maintain possums, rats and predators to below target densities between aerial applications.

Aerial 1080 operations will be repeated on a three-yearly time frame. .

~~9.4.4~~9.5.2 Ground-based bait station and trap grid for rats, possums and mustelids

An intensive ground-based bait station and trap grid network will be established and used to hold pest densities down to target levels between the three yearly aerial 1080 drops. The grid will consist of cut and marked trap-lines which have been specifically located to ensure adequate coverage of pest control devices.

The initial pest management strategy to be adopted is outlined below, however a detailed Pest Management Operational Plan will be developed by the appointed pest management contractor(s) and the Pest Management Programme Manager in consultation with ~~a pest control expert who has been appointed to~~ the Ecological Review Panel and as approved by the Requiring Authority prior to the commencement of the pest management programme. This Plan will apply recognised best practice approaches to all aspects of the programme and may be altered or refined adaptively by the Ecological Review Panel ~~(through the pest control expert) in the early stages of~~throughout the pest management programme in response to performance monitoring results and contractor feedback.

The initial approach to pest management in the PMA is likely to be:

- Rats to be managed using a mix of bait stations (with first generation anticoagulants) and A24 Goodnature traps. A24s to be used where access may be limited and as an alternate treatment every few years to prevent build-up of generally bait shy rats. Aim is for devices to be at 1 per ha (and as close as physically possible to 100 x 100 m spacings where the terrain allows). The traps will be serviced and replaced as per the manufacturer's recommendations.
- Possums: Feratox complemented by kill traps and other devices (that are DOC approved) ~~(Trapinator traps or equivalent)~~ where needed and especially around the bush perimeter.
- Stoats: double set DOC 200's with traps at 100m spacings along lines that are between ~~-~~1km and 500m apart. A24 Goodnature traps will be used where access may be limited or challenging in poor weather.
- Ferrets: single set DOC 250's set around the bush – pasture margins.
- Feral cats: Kill traps set around the bush perimeter, possibly supplemented with PAPP if considered necessary.

The Goodnature A24 traps are self-resetting (up to 24 resets per CO_2 canister) multi-species kill *traps that have proven very effective as rat and stoat traps.* The traps will be visited every 4 months (at least initially while pest densities are high) to refresh the lure and 6-monthy to replace the CO_2 canisters that drive the trap mechanism.

The Goodnature A24 kill traps have proven to be effective tools for the control of rats and stoats, and DOC 150, 200 and 250 traps are recognised effective and humane mustelid kill traps when set in prescribed trap-set tunnels. Fresh or salted rabbit meat, Erayz® dried rabbit lures or fresh hen eggs will be used to bait the DOC traps.

Rats will get caught in stoat traps, so trap sets for stoats (using different lures) will follow the initial rat knock down effort so that there is less rat interference with the traps.

Between periods of 1080 use (by air or in bait stations) first generation anti-coagulants particularly diphacinone and pindone will be applied in bait stations for rat control. Because these toxins are cumulative and the animals do not feel ill-effects for some time after consumption they do not associate the bait with the effects and so are less likely to build up an aversion. For this reason pre-feeding is not required. Rats need to feed on this bait type for between 3 and 7 days before a fatal dose is consumed so bait stations need to be filled on a daily basis especially if rat numbers are high. First generation anticoagulants begin to lose their potency after about 3 days, another reason why a daily bait replenishment programme is required. If bait stations are used repeatedly, annual rotation of toxin types used will be necessary to reduce the likelihood of aversion to a particular toxin/bait type developing. Animals, especially rats, that survive poisoning from one bait type can develop a strong aversion to that bait type, hence the need to rotate bait types from season to season.

First generation anticoagulants are considerably less effective against possums. Consequently, an alternative cyanide based toxin will be used for possum control when 1080 is not being used. Feratox Strikers (a biodegradeable bait station containing encapsulated potassium cyanide) can be used in conjunction with the permanent bait station regime to control possums and minimise the amount of anti-coagulant bait that possums eat before rats can get to it. Feratox Strikers are highly effective on possums, with possums needing to consume only one pill for a fatal dose.

PAPP (para-aminopropriophenone) is a toxin that has shown potential in the control of stoats and feral cats and may offer an alternative to trapping if additional tools are needed to lower stoat numbers to the performance targets set. A Controlled Substances Licence is required to use PAPP, and will be obtained if necessary.

~~9.4.5~~9.5.3 Hunting and the use of Judas animals

Goats and pigs will need to be controlled by hunting.

Goats

Initially, an experienced goat culler should be able to reduce goat numbers to moderately low levels with concerted effort. Further reduction of goats to target levels below 1 goat kill per hunter day is likely to be more challenging and require the use of additional tools to locate and kill those remaining. These will include (as required):

- Judas goats -Judas goats are animals that have been caught and fitted with a radio collar before being released back into the target area. These goats usually link up with other goats and can be tracked to find their location.
- Dogs can be used in more open areas and pasture margins to flush out goats but this method tends to be less effective in thick bush on steep terrain.
- Aerial thermal imaging -Thermal imaging and drone technologies have advanced considerably over the past decade to the point where it is now possible to detect warm-blooded animals the size of a possum and larger through a forest canopy. Drone mounted thermal imaging will be used periodically to detect residual feral goats, pigs and deer (if any) across the Pest Management Area.
- Fencing -Reinvasion by goats from unmanaged neighbouring scrubland may be an occasional problem around the perimeter of the Pest Management Area. The addition of goat proof appendages to boundary fences will be undertaken if the risk of goat reinvasion from unmanaged neighbouring properties is considered by the Requiring Authority (in discussion with the goat control contractor) to be high. Determination of where goat-proof fencing is required will be confirmed when the land areas that will be used for all of the offset and mitigation works are confirmed.

To be effective against goats:

- the fence needs to be an 8 or 9 wire post and batten fence with posts at 4 or 5m spacings and battens at 1m spacings;
- box stays rather than angle stays are needed to prevent goats climbing the fence and an electric hot wire may be needed near the top of the fence;
- tie-downs need to be installed at every depression to prevent goats pushing under the fence; and
- well-tensioned wire netting can also be used instead of 8 or 9 single wire strands but this must be well pinned to the ground.

Pigs

Pigs will be managed by hunting using experienced pig hunters and with the assistance of good pig dogs. Because pigs often occupy thick bush pig dogs are needed to find and flush out pigs. The appointed contract pig culler will need to be experienced at operating in steep, mudstone country such as that found in the Mt Messenger area.

As for goats, there are additional tools that can be used to find and cull pigs that remain hard to find. The decision as to which of these tools are used and where and when they are used will occur after the effectiveness of initial hunting efforts are evaluated, and will be made by the Alliance manager in charge of pest management following discussions with the pig control contractor and DOC. Additional expertise may be consulted as necessary.

The additional tools that could be implemented for pig management include:

- Trapping - Specialised pig traps can be used particularly if pigs come out on open pasture at predictable locations. Captured pigs need to be head shot by an experienced and licensed shooter. This method will be used if there are locations where it can be used cost-effectively.
- Aerial thermal imaging - As for goats, thermal imaging and drone technology is likely to be very useful in detecting remaining pigs in steep and bush covered terrain and will be adopted on the PMA.
- Toxins - Sodium nitrite is the only toxin currently registered for pig control in New Zealand and it may be useful if other techniques fail to eliminate some individuals. Secondary poisoning of pigs can occur following possum poisoning using 1080 but the general consensus is that secondary poisoning has relatively little effect on pig populations.
- Judas pigs - The use of Judas pigs is generally only an effective technique when densities are very low and dogs have been unable to find the last animals present. It is not effective against older boars who tend to be less sociable than other pigs.
- Fencing - Effective pig barrier fences can be built along boundaries by appending materials to existing boundary fences. This may be necessary where unmanaged pig populations occur on neighbouring land. Chainlink mesh is the most effective material to use on a pig barrier fence. Steel standards (Waratahs) need to be rammed into the ground at 1 metre spacings; the chainlink needs to be well pinned to the ground and a tensioned barbed wire is required along the base of the fence at ground level. The fence also needs to be held down into all depressions by tie-downs.

~~9.4.6~~9.5.4 Wasp management

To address the adverse effects of the creation of new forest edge and general forest disturbance as a result of the road construction *Vespula* and *Polistes* wasp nests will be monitored for along the new road margins throughout the construction and plant maintenance periods and nests will be destroyed when found using appropriate measures.

~~9.4.7 Pest management around the PMA perimeter~~

~~9.4.7.1 Increased pest management where edge reinvasion risk is high~~

~~Additional pest management effort (increased trap/bait station intensity using similar methodologies in section 9.4.1.3 above) will be undertaken around the PMA perimeter to reduce the risk of pest intrusion in areas of high risk edge reinvasion. Increased effort will primarily be directed at rats, mustelids and goats around the PMA boundaries in areas where sizable pest populations are suspected to exist on adjacent unmanaged land. The additional pest management effort will be pulsed to coincide with the period leading up to and during bat and bird breeding season (August to January inclusive).~~

~~Extra protection for edge bat maternity roosts~~

~~If 10 maternity roost are located within the PMA, but beyond 500m of the edge of the PMA, no increased predator control is required. Otherwise, acknowledging the increased risk of predation along the PMA edge, intensified pest management will occur around up to five known and utilised maternity roosts (ie, those identified through the radio-tracking programme) that are located inside the PMA, and within 500 metres of the PMA edge. If more than five of the identified maternity roost trees are within 500 metres of the PMA edge, up to five roosts located in areas of greatest predation risk – close to unmanaged mature forest or other areas of known high pest densities – will be selected for intensive management.~~

~~The intensified pest management will consist of traps and bait stations installed at 20 metre spacings extending 50 metres out from the roost tree. This equates to a trapping density that is between 12 and 25 times that used over the rest of the PMA.~~

~~The additional traps and bait stations will be activated prior to the bat breeding season every year, and will be maintained until the young of the year have left the maternity roosts (ie. late September to March). An adaptive management approach will be applied as to trap and toxin types and configuration within the 50m radius to achieve the best results.~~

~~9.4.8~~9.5.5 Timing of pest management

Aerial and/or ground based toxin pest management programmes are most effective in very late winter or early spring when possums and rats are most hungry and natural food supplies are at their lowest. Pests are more inclined to eat baits when hungry and in quantities that will lead to their death. Autumn and early winter should be avoided because forest foods are abundant at this time.

Trapping effort can occur all year round and this should be the case initially until pest numbers are reduced to target levels. When pest densities are low focused pest management in spring immediately preceding bird and bat breeding season will help to improve breeding success and recruitment. Continued pest management effort through the summer, especially targeting rats, will reduce predatory pressure on lizards and insects especially and aid increased breeding success.

Goat and pig control effort can occur throughout the year but control will be easier to undertake in the Pest Management Area when ground conditions are drier. Goat control will commence in areas adjacent to the offset and mitigation areas before planting. This is because goats have a preference for several of the plant species likely to be included in the planting mixes and will cause considerable damage to new plantings if they are present when planting begins.

~~9.5~~9.6 Performance standards and monitoring

~~9.5.1~~9.6.1 Existing pest densities

Monitoring data from pest animal surveys undertaken within the Intended Pest Management Area from November 2017 to February 2018 suggest moderately high to high densities of both rats and possums.[2] Possum chew card activity (CCI) has ranged from 25% to 67% for each of the three survey periods, possum tracking tunnel activity (RTI) has ranged from 4 to 36%, and rat tracking tunnel activity (RTI) has ranged between 53% and 71%. The highest rat activity occurred in January and February surveys (both 71%).

Chew card indices from monitoring undertaken by the Department of Conservation at Mt Messenger for the 2013-2016 period[3] yielded an index of 39.2% for possum presence, apparently amongst the highest CCI measures recorded nationally.

Mustelid tracking peaked at 50% in early January 2018 (range: 10 to 50%). Tracking indices of 50% are considered to be typical for unmanaged pest populations in forest types similar to those at Mt Messenger.

Mouse tracking of 5% was recorded in the February tracking tunnel survey, the only time mice were detected.

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[2] WSP-Opus. 2018. Mt Messenger Baseline Monitoring for Vertebrate Pests. Survey design and baseline monitoring (2017/2018)

[3] http://www.doc.govt.nz/2017-annual-report-factsheets/?report=NationalPossumFactsheetWeb

Local goat hunting specialists have suggested that current goat densities could be equivalent to around 20 kills/man day.[4]

~~9.5.2~~9.6.2 Pest management targets

The performance targets for effective pest management within the Pest Management Area are as listed below. The targets set are performance indices of relative pest density for each species adopted by DOC and other agencies when undertaking pest control activities. Achievement and maintenance of pest densities below or near to these target indices is expected to result in substantial ecological recovery across the Pest Management Area and achieve the biodiversity outcomes outlined in the Ecological Mitigation and Offset Reports. The targets will also serve as performance targets for the pest management contractors employed to deliver the pest management programme.

The pest management performance targets for the PMA are:

- Possums –5% or lower RTC (Residual Trap Catch Index) or 5% or lower CCI (Chew Card Index).
- Rats – 5% or lower RTI (Residual Trapping Tunnel Index).
- Goats – less than 1 kill/man day.
- Mustelids– no detections.
- Cats – no detections.
- Pigs – less than 1 kill / man day then no fresh pig sign or pig detections.
- Farm livestock – zero presence

The objective is to achieve the target pest densities throughout the PMA immediately prior to the commencement of the breeding season (for bats and birds) and to hold densities at low levels through the critical stages when young remain in the nest.

Achieving and holding rat densities to the target 5% residual rat tracking index (RTI) threshold will be the most challenging target and it is likely, based on the experiences of other large-scale NZ rat control programmes undertaken in challenging terrain, that rat densities will not be lowered to 5% in some seasons due to weather or indeterminate reasons. Achievement of 10% rat RTI or lower is generally accepted as a successful outcome. However, while all pests will be adaptively managed, specific adaptive management will be applied to pest control methods used where monitoring results show rat densities are above 5%, or trending to be above 5%, immediately prior to and during the bat and bird breeding season. ~~While 5% RTI will remain the target for rats in the PMA and every endeavour will be directed at achieving that target, tracking indices above 10% in two consecutive years will trigger the need to review the method used.~~

~~9.5.3~~9.6.3 Performance and compliance monitoring

~~9.5.3.1~~9.6.3.1 Pest density performance monitoring

Pest density performance monitoring will align with recognised best practice and be undertaken ~~in~~ throughout the PMA ~~annually~~ at a minimum of three times per year ~~for 5 years~~ following the commencement of the pest management programme. ~~Annual monitoring in the first 5 years will include 3 sample points – the~~ The first monitoring session will occur ~~first~~ immediately prior to the commencement of the bird/bat breeding season ~~and~~and the remaining ~~two~~ two ~~more through~~will occur at intervals through the summer period.

[4] Paul Prip, Taranaki Regional Council pers comm via Richard Nichol

~~A~~All monitoring will be undertaken- ~~only~~ by personnel certified by the National Pest Control Agencies (NPCA) as trained monitoring personnel, and monitoring will be undertaken in accordance with the NPCA Standard National Protocol. Once a year, pest density monitoring will be undertaken by personnel who are independent of the pest management contractors and this shall serve as an audit of the contractor's performance.

All monitoring data, including trap catch and bait consumption information, will be made available to the Pest Management Programme Manager and the Ecological Review Panel and will be used to guide the location and intensity of pest management effort within the PMA.

After 5 years from the commencement of the programme and when target pest densities have been achieved over at least 3 consecutive years for a pest species, monitoring requirements for that pest species may be reduced to once per year. The timing of the once yearly monitoring will align with recognised best practice. However, if at any time the once yearly monitoring shows pest densities in excess of the target thresholds, the monitoring regime for that species will return immediately to 3 times per year and will remain at 3 times per year until target thresholds have been achieved for 3 consecutive years again. ~~monitoring will occur once annually immediately prior to breeding season. Annual monitoring is necessary to assist in the determination of the level of additional effort needed to achieve the performance targets.~~

~~In situations where the performance target indices for a target species are exceeded in two consecutive years, triggering the need for a review and possible change to the pest management methodology, the monitoring regime will revert back to that required for the first 5 year period (ie. 3 monitoring points per year) until performance targets are achieved (for rats this is less than 10%).~~

~~Performance monitoring indices will be generated from the area of the PMA excluding a 200 metre deep buffer around the full perimeter of the PMA. Pest densities can be expected to be higher in the buffer as a result of incursions from the surrounding unmanaged landscape.~~

Compliance monitoring of contractors will be undertaken by requiring GPS logs of daily activity. This information must be provided to the Pest Management Programme Manager ~~Project manager~~ and will be a contractual requirement of payment. This also will ensure that all lines are being visited.

Pigs will be excluded from pest density performance monitoring once they have been reduced to low densities. This is because there are no reliable methods for determining relative pig density when numbers are low. Instead pig hunters will be called in when fresh pig sign is detected by those undertaking independent monitoring or any management of the other pest species.

~~All monitoring will be undertaken only by personnel certified by the National Pest Control Agencies (NPCA) as trained monitoring personnel, and monitoring will be undertaken in accordance with the NPCA Standard National Protocol.~~

~~9.5.3.2~~9.6.3.2 Outcome monitoring within the PMA

Outcome monitoring will be undertaken for vegetation and selected forest bird species. The primary objectives of outcome monitoring are to measure the (expected) positive trends in ecological integrity indices resulting from pest management.

Outcome monitoring for bird species

The purpose of outcome monitoring for bird species is to provide sufficient evidence that the stated benefits of the pest control programme on those species affected by the Project will be achieved.

Bird monitoring will focus on kiwi, whitehead, long-tail cuckoo, kereru, bellbird, tui, fernbird and NI robin. These species are commonly used as biodiversity outcome indicators for pest management programmes on the basis that:

- They are of high ecological importance: kiwi are nationally 'Threatened' and while not 'Threatened' bellbird, tui and kereru provide critical pollination and seed dispersal services. In doing so these species are essential to the ecological health of forest ecosystems and serve as surrogates for the overall integrity of forest ecosystems
- Evidence suggests that these species respond positively to pest control through reduced predation pressure and/or increased food or habitat availability
- These species can be readily monitored through standardised and commonly used techniques to detect statistically measurable trends in relative abundance
- These species that can be monitored in a cost-effective and efficient manner, i.e. forest bird monitoring that can be covered in the same technique (five-minute bird counts).

The performance target for birds is set at a statistically significant 20% increase in relative abundance within 12 years of road construction for all eight indicator species within the PMA. In the event that performance targets are not met for any of the bird species listed above by year 12, for reasons associated with the impact of pests or the effects of the road (as determined by the Project avian ecologist and reviewed by the Ecological Review Panel), a review of the monitoring data and recommendations for any management changes will be undertaken by an avifauna expert who has been appointed to the Ecological Review Panel. This review will trigger the adaptive management actions as set out in section 9.6~~5~~.3.3 below.

Kiwi monitoring

A kiwi survey will be conducted every three years for 12 years following completion of road construction. Nocturnal kiwi surveys will be undertaken following the same method used in the baseline survey (see Baber and McLennan 2017 for detailed methods) and the locations of calling kiwi at different stations around the completed road will be mapped. These data will then be compared against the baseline survey results documented in Baber and McLennan (2017).

Forest bird monitoring

Outcome monitoring of selected forest birds will occur within the full 3650ha PMA and will be conducted for 12 years, at 3-yearly intervals, following the onset of integrated pest control. The main focus will be on measuring changes in abundance of functionally important pollinator and seed dispersal species including tui, bellbird and kererū. Daytime bird counts will occur at the 355 bird count stations using the standard 5-minute bird count methodology (Dawson and Bull, 1975), which will also be used for the baseline pre-construction surveys. These data will then be compared against baseline survey results documented in Baber and McLennan (2017). It is expected that forest bird monitoring will also provide the opportunity to pick up the presence and increase of kōkako when they disperse from the adjacent Parininihi Reserve.

Vegetation monitoring

Outcome monitoring for vegetation will focus on measuring the recovery of palatable species within the ungulate browse tier and vegetation improvements from a reduction in possum abundance. The monitoring focus will be on highly palatable indicator species for monitoring trends in condition (Monks et al. 2010). Monitoring will occur in plots located throughout the PMA. ~~core areas that are at least 500 metres away from the PMA edge where ungulates are expected to be at very low levels within 3 years of commencement of control~~.

Specific outcome objectives of pest control include:

- Recruitment of species which are currently suffering ungulate induced recruitment failure. Indicator species will include; mahoe, hangehange, large leaved coprosma spp., pate, wineberry, tawa, hinau, kamahi and pikopiko — species which represent most tiers of the forest structure.
- Recovery of condition of possum palatable trees which are currently impacted by browse. Indicator species will focus on measuring changes in foliage density of small trees including~~;~~ swamp maire, mahoe, kaikomako as these are easier and more accurate to monitor possum browse on, plus northern rata and thin barked totara in the taller canopy.~~.~~

Vegetation monitoring will be established prior to any control of ungulates and possums. Recovery of the ungulate browsed understorey tier will measure the survival and growth of indicator species in seedling ratio plots (Sweetapple & Nugent 2004) in association with Recce plots (to describe forest composition). A sample of seedlings will be tagged and half will be fenced (ungulate excluded) as a control group.
~~Tagged seedlings will include; tawa, the canopy dominant which is suffering recruitment failure as also described in Whanganui National Park (Hawcroft & Husheer 2009).~~

The target performance outcome will be >75% of tagged palatable individual plants showing no sign of animal pest browsing 5 years after the commencement of intensive pest management in the PMA. Seedlings will also show positive growth (changes in average height) over sampling periods in trait groups (e.g. highly palatable understorey species).

Possum impact monitoring will use a combination of methods including FBI (foliar browse index; Payton et al. 1999) and potentially general measurements of canopy density (by measuring chlorophyll) are intended to be trialled using drone imagery. The outcome performance target is to achieve a statistically significant improvement in canopy density by year 5. It is expected that recovery of browsed tree canopies will not show ~~any~~ further improvement in canopy density after 5-6 years, because ~~-~~possum diet changes with control, with remaining individuals in a very low population consuming more very highly preferred species and resources (Sweetapple et al. 2014). For this reason the feasibility of monitoring very highly preferred resources, such as flowers and fruit of hinau (Cowan & Waddington 1990) or potentially kohekohe (Nugent et al. 2002) if sufficient individuals can be found, will be investigated during initial monitoring establishment.

Within the valley floor areas, additional monitoring plots will be placed as the recovery of these (kahikatea, pukatea and riparian forest) communities from pest management has not been commonly monitored. In these communities additional indicator species will likely be measured, such as pukatea seedling regeneration is currently being suppressed by cattle browse, though this species is known to recruit in the presence of goats.

The outcome objectives and performance targets (described above) are required to achieve the biodiversity offset calculated for vegetation The forecast measures of ecological integrity used within the offset calculator were +5% and +5.25% by year 10 (no net loss) and +8% and 9% by year 15 (net gain) (Singers 2018). It is considered that if the performance targets described above are met or exceeded, then no net loss and net gain will have occurred.

~~9.5.3.3~~9.6.3.3 Adaptive pest management response to monitoring targets

In the event that pest density targets are not achieved and/or more than one of the biodiversity outcome monitoring targets are not met, for reasons associated with the impact of pests or the effects of the road, the pest management programme will be reappraised by the pest management specialists on the Ecological Review Panel and the intensity or methods used changed to be more effective at addressing the pests or aspects of biodiversity that have not reached the outcome targets. The pest management methods and intensity will continue to be adapted until all pest density targets and biodiversity indicator targets have been met.

It is conceivable that variables not associated with the relative effectiveness of the pest management programme or the effects of the road (eg plant or animal disease, or extreme weather events) may be contributing to poorer than anticipated recovery of one or more of the monitored biodiversity indicators. These situations are considered to be beyond the control of the Transport Agency and will not trigger any adaptive management response. ~~Adaptive improvement of the pest management programme will only occur where less than expected monitoring outcomes are considered to be the result of continued animal pest impacts or the direct effects of the road.~~

~~9.6~~9.7 Appointment of pest management contractors and development of a Pest Management Operational Plan

Experienced, appropriately qualified pest control contractors will be appointed at the commencement of the Project to undertake the Pest Management Programme. One or several separate contractors may be appointed to undertake individual components or all components of the Pest Management Programme. The components will include:

- Ground-based management of rats, possums and mustelids using traps (and possibly toxins);
- Aerial application(s) of 1080;
- Ground-based hunting of goats and pigs;
- Possible aerial hunting of goats and pigs; and
- Fencing to exclude farm livestock and possibly goats and pigs, where that is necessary to meet pest management targets.

The Pest Management Contractor will produce a Pest Management Operational Plan in accordance with the conditions of the designation and the provisions of this ELMP (note that all pest control operations on DOC land require an operational plan). This plan will detail all aspects of the intended pest management programme including:

- the location of the planned pest management;
- control methods to be used;
- timing of the programme elements;
- legislation and regulations that need to be complied with, consents, approvals and permits that need to be obtained;
- evidence of adherence to industry best practice;
- resources to be used;
- health and safety provisions;
- details of a public consultation and communications plan; and
- performance and outcome monitoring and independent auditing and reporting.

Each pest management contractor will be required to achieve the pest density performance standards and adhere to all consent and permit conditions, access agreements, and rules and regulations.

As the Pest Management Programme will continue in perpetuity (or until such a time that pest management is no longer required to sustain biodiversity values), it is envisaged that new / replacement contractors will be employed from time to time. A review of the Operational Plan will occur each time the principal contractor is replaced or every 5 years, whichever occurs sooner.

~~9.7~~9.8 Legal mechanisms and governance

Pest management activities are governed by several Acts and legal requirements including Hazardous Substances and New Organisms Act 1996 (HSNOA), the Agricultural Compounds and Veterinary Medicines Act 1997, the RMA, the Trespass Act 1980, and the Wild Animal Control Act 1977. Adherence to all relevant clauses in these Acts will be required, and addressed in the Pest Management Operational Plan.

All approvals, particularly those relating to toxin use, will be obtained prior to the commencement of control work. The following approvals are likely to be needed to implement the Pest Management Plan at the Project site:

- Ministry of Health / Public Health Unit approval/consent to use a vertebrate toxin (with associated requirements for public notification and communication);
- DOC approval for application of a vertebrate toxic agent (VTA) on DOC estate (under Section 95A of the HSNOA), assuming some of the Pest Management Area will be on DOC estate;
- Access permission from all landowners to undertake pest management activities on their land; and
- Consents from the Taranaki Regional Council and/or New Plymouth District Council.

~~9.8~~9.9 Management of farm livestock

While the focus of the Pest Management Plan is to reduce the densities of mammalian pests, the removal and exclusion of farm livestock (cattle and horses) is also critical if the proposed ecological recovery is to be achieved.

Cattle have grazed the unfenced upper Mangapepeke Valley for decades and have contributed to the current denuded state of the forest understorey on and adjacent to the valley floor in a major way. Cattle also have access to the parts of the Mimi catchment and will need to be adequately excluded through fencing. All stock will need to be removed from the Pest Management Area before toxin application commences.

~~9.9~~9.10 Programme

The timing of the Pest Management Programme cannot be confirmed until the required land access is obtained and a construction start date is determined. However, the broad sequence of pest management related events will be as follows:

i) First summer
   - Establishment of baseline vegetation and bird monitoring prior to commencement of pest control.
   - Appointment of goat and pig cullers and commencement of goat and pig control in and adjacent to the swamp, mitigation and riparian (where possible) planting areas, with the initial effort to serve as the baseline population density estimate.
   - Appointment of the Principal Pest Management Contractor and development and submission of the Pest Management Operational Plan.
   - Commencement of cutting and marking of the ground-based bait station and trap lines (this is likely to take 2 (and possibly 3) years to complete over the full 3650ha PMA.
   - Pre-control tracking tunnel and chew card monitoring of rats, possums and mustelids to serve as the baseline for pest management performance.

ii) Late winter – early spring, start of year 2:
   - Pre-control (and pre-breeding season) tracking tunnel and chew card monitoring of rats, possums and mustelids to serve as the baseline for pest management performance.

iii) Second summer
- Completion of cutting and marking of the bait station and trap grid network.
- Possible commencement of planning for the first 1080 drop if that is to occur in August/September at the end of the second construction year.
- Continuation of ground- hunting effort for pigs and goats.

iv) Late winter – early spring, start of year 2:
- Aerial 1080 drop (if one is scheduled) followed by commencement of ground-based trapping effort.

v) September, start of year 3
- First pest management independent performance monitoring survey.

~~9.10~~9.11 References

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