BEFORE THE TARANAKI REGIONAL COUNCIL AND NEW PLYMOUTH DISTRICT COUNCIL

MT MESSENGER BYPASS PROJECT

In the matter	of the Resource Management Act 1991
and	
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

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STATEMENT OF EVIDENCE OF ROGER JOHN MACGIBBON (ECOLOGY MITIGATION AND OFFSETS) ON BEHALF OF NZ TRANSPORT AGENCY

25 May 2018

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QUALIFICATIONS AND EXPERIENCE

1. My name is Roger John MacGibbon.

2. I am a Principal Ecologist at Tonkin & Taylor.

3. I hold a Bachelor of Science Degree with Honours in Zoology and Ecology from the University of Canterbury (1981).

4. I have 35 years' experience working as an ecologist and environmental consultant and have worked in all regions of New Zealand and in Hawaii, Vanuatu and Australia.

5. I am currently employed as Principal Ecologist with Tonkin and Taylor. Prior to that I worked for seven and a half years for worked for Opus, also as a Principal Ecologist. Between 1995 and 2010 I owned and managed my own environmental consultancy, Natural Logic Limited, which provided ecological, restoration and sustainable land and water management services to central and local government, and private landowner clients throughout New Zealand.

6. In the early years of my career I worked for the Department of Conservation ("**DOC**") in Taupo and the Environmental Division of the NZ Forest Service in Wellington before the creation of DOC.

7. I specialise in ecological restoration and have provided design, technical support and project management services for a wide range of restoration projects and across terrestrial, freshwater and coastal environments. This work has included the rehabilitation of damaged landscapes such as mines and quarries, the restoration of predominantly natural habitat, the enhancement of water quality in natural waterways (rivers, stream, wetlands and estuaries), the control and eradication of weeds and pests, and the management and reintroduction of animals (invertebrates and vertebrates) to restored environments.

8. I have provided specialist technical ecological, restoration and revegetation support on a wide range of New Zealand Transport Agency ("**Transport Agency**") (and Transit NZ) projects in many parts of New Zealand, including State Highway 1 Desert Road revegetation, Bombay Hills section of the Auckland Southern Motorway; State Highway 1 Orewa to Puhoi; Waikato Expressway (Hamilton, Huntly, Cambridge and Te Rapa Sections); AMETI (Stage 1 and 2) in Auckland, the Christchurch Northern Arterial, Caversham Highway Improvements in Dunedin and the Peka Peka to Otaki section of the Kāpiti Expressway.

9. I confirm that I have read the 'Code of Conduct' for expert witnesses contained in the Environment Court Practice Note 2014. My evidence has been prepared in compliance with that Code. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider

material facts known to me that might alter or detract from the opinions I express.

EXECUTIVE SUMMARY

10. The forest and natural habitat along and adjacent to the proposed Mt Messenger Bypass Project ("**Project**") footprint east of the existing State Highway 3 ("**SH3**") retains indigenous plant and animal communities that are considered to have high ecological value. However, the full ecological potential of the area has been significantly diminished over many decades by the largely uncontrolled impact of browsing, grazing and predatory animal pests and unfenced cattle.

11. The unmitigated ecological effects of the Project will be significant and are likely to include: removal of or damage to 31.676ha of predominantly indigenous vegetation; the removal of up to 17 significant trees from along the Project footprint; the loss or alteration of 3822 metres of stream; the loss or alteration of habitat occupied by indigenous bats, forest and wetland birds (including kiwi), lizards, aquatic fauna and invertebrates; increased fragmentation of habitat occupied by indigenous fauna; and the risk of indigenous fauna injury or mortality due to vehicle strikes.

12. Significant effort was directed during the route selection and design phases at avoiding and minimising the impact on ecological values. However, substantial residual ecological effects are expected and a comprehensive mitigation, offset and compensation package ("the **Restoration Package**") has been developed to address those effects.

13. The principal components of the Restoration Package are to:

    (a) undertake intensive pest management over an area of 1085 ha surrounding the Project area in perpetuity (or until such time as pest control techniques as we currently know them are no longer required);

    (b) remove all farm livestock from the Mangapepeke Valley and the adjacent forest areas;

    (c) establish 6 ha of ecologically significant kahikatea – swamp forest habitat in an area that would once have been swamp forest but has long since been cleared for farming;

    (d) fence 8.6km of stream from livestock and plant 17.25ha of riparian margin with indigenous species;

    (e) plant 200 seedlings of the same species for every significant tree removed. Currently, this is expected to amount to 3400 seedlings;

    (f) plant 8.38ha of mitigation planting on areas that are currently predominantly pasture; and

(g) salvage and relocate threatened plant species, lizards, peripatus and wood from the Project footprint.

14. In addition, vegetation removal protocols are proposed to ensure no trees are felled containing long tailed bats and no kiwi with territories over or adjacent to the Project footprint are harmed.

15. A further 120,000 native plants will be planted along the road margins and on the fill slopes.

16. The restoration and rehabilitation works are expected to result in a rapid and substantial recovery of palatable plant species and forest canopy condition, and provide improved habitat and reduced predation that will enable many wetland and forest birds (including kiwi), aquatic organisms and long tailed bats to increase in abundance.

17. A state of no net loss of biodiversity is likely to be achieved 10 years following construction and a net gain in biodiversity 15 years after construction.

BACKGROUND AND ROLE

18. The Transport Agency has engaged me to advise it on its proposed Mt Messenger Bypass Project to improve the section of SH3 between Ahititi and Uruti, to the north of New Plymouth.

19. I prepared the Ecological Mitigation and Offset Report included as Technical Report 7h, Volume 3 to the Assessment of Environmental Effects ("**AEE**") for the Project.

20. I am also the author of Chapters 3, 9 and the mitigation and offset sections of chapter 4 of the Ecology and Landscape Management Plan ("**ELMP**") prepared for the Project.

21. I am very familiar with the Project site having led several ecological survey teams into the Mangapepeke and upper Mimi catchments in 2017 and 2018 and assessed the ecology of the Parininihi, Mangaongaonga, Tongaporutu and lower Mimi valleys.

22. I participated in both of the Project Multicriteria Analysis ("**MCA**") workshops, and attended several Project meetings with Ngāti Tama representatives and DOC Conservation ecologists. I attended several technical meetings with DOC ecologists and with the Council's ecologists (Wildlands). These included separate vegetation, bird, bat, lizard and mitigation/offset sessions with DOC, and vegetation and mitigation/offset sessions with the Council ecologists I have also met with the Ngāti Tama consultant ecologists (Boffa Miskell) on two occasions.

23. I have met with several landowners who occupy land adjacent to the Project to discuss mitigation opportunities and have had several follow up meetings with

three landowners[1] in the upper reaches of the Mimi to discuss the riparian fencing and planting possibilities on their properties.

24. In preparing my report, this evidence, and the vegetation and pest management sections (Chapters 4 and 9 respectively) of the ELMP, I have relied on the expertise of, and worked alongside, the team of ecologists working on the Project for the Transport Agency.

SCOPE OF EVIDENCE

25. The purpose of my evidence is to outline the mitigation and offset measures proposed and captured in the ELMP, and to present information that demonstrates that the Project target of no net loss in biodiversity 10 years following construction, and a net gain in biodiversity by year 15, can be achieved.

26. My evidence addresses:

    (a) an overview of the existing ecological values of the Project area, and the effects the Project will have on those values;

    (b) the methodology for and approach to developing the package of measures to mitigate and offset the effects of the Project on ecological values;

    (c) the proposed mitigation, offset, compensation and monitoring package, by reference to the recommendations made by the ecology team, and to the ELMP and the more specific management plans that sit within the ELMP; and

    (d) responses to submissions and the Section 42A Report.

THE EXISTING ECOLOGICAL VALUES OF THE PROJECT AREA AND THE EFFECTS OF THE PROJECT

Summary of ecological values

27. The erodible nature of the Mt Messenger – Parininihi area geology and the high and intense rainfall experienced has created a mix of steep and eroded ridges and slopes and a mosaic of different vegetation age classes and composition. Warm, humid summers and mild, wet winters create conditions suitable for dense broadleaved dominant forest with an abundance of lianes and epiphytic plants over mostly hill country land, and kahikatea (*Dacrycarpus dacrydioides*), pukatea (*Laurelia novaezelandiae*) and swamp maire (*Syzygium maire*) forest and associated wetlands in valley floor areas.

28. The wider Project area, approximately 4430 ha in size, is situated in the North Taranaki Ecological District and straddles an ecological boundary between

[1] Messrs Thomson, Anglesey and Scott.

two broad forest classes with podocarp, broadleaved forest largely in the Mimi catchment and the upper Mangapepeke Valley, and podocarp, broadleaved, beech forest within the lower Mangapepeke Catchment and northwards.

29. The Parininihi land, previously known as “Whitecliffs Conservation Area” is located west of the existing SH3 corridor and is a tract of mainly primary forest approximately 1332 ha in size and centred on the Waipingao Stream.

30. Ecological management of the Parininihi land was started in the early 1990s by the DOC, and involved possum and goat pest control activities. Since being returned to Ngāti Tama in 2003, management of these pests has continued, and control of rodents, mustelids and feral cats has also occurred with the result that the area is now in considerably better ecological condition with vulnerable browse-sensitive plants regenerating.

31. The area through which the Project passes is dominated by two river catchments, the Mimi River and tributaries flowing to the south and the Mangapepeke Stream and tributaries flowing to the north. The upper sections of both rivers flow through moderately steep incised valleys but these open up into wider, more gently sloping, sediment-filled valleys through the middle and lower reaches of each river.

32. The dominant forest on the Ngāti Tama block to the east of the existing SH3 corridor (within the upper Mangapepeke Stream catchment), would have originally been very similar to the Parininihi land to the west, but it has not had consistent pest control. Consequently, the ecological condition of this area is poorer, with fewer palatable canopy trees remaining, such as thin-barked totara (*Podocarpus laetus*) and northern rata (*Metrosideros robusta*).

33. Within the Mangapepeke Stream catchment, vegetation communities are more modified and have been affected by long-term stock grazing, fire and logging with the result being a transition to large open and grazed rushlands and poor quality pastureland further down the valley towards SH3.

34. The forest understorey along the margins of the Mangapepeke valley bottom is devoid of any palatable plant regeneration and in some locations is devoid of any regeneration at all (**Figure 1**) due to the actions of farm livestock, feral goats and feral pigs. The impact of ungulates in the unfenced Mangapepeke valley is substantial and has been so for many decades.

35. The Mangapepeke valley bottom would originally have been dense swamp forest.

Figure 1: Forest understorey in the mid Mangapepeke Valley completely devoid of subcanopy and groundcover vegetation

36. Of greatest ecological significance in the wider Project area to the east of SH3 area is the hydrologically intact swamp forest and non-forest wetland areas in the valley floor of the northern Mimi River catchment. The valley floor sequence within the northern tributary of the Mimi River represents a full range of swamp forest, scrub and non-forest wetland communities that would once have been more common throughout this area.

37. There are a significant number of large, emergent trees in the wider Project area, with rimu (*Dacrydium cupressinum*) and miro (*Prumnopitys ferruginea*) being most common, as well as large northern rata and thin-barked totara which support a diverse range of epiphytes. These large, old trees play a significant ecological role in the forest ecosystem and provide important habitat for wildlife (for example roosting and nesting sites for bats and birds), and act as a source of pollinators for the rest of the ecosystem. They also provide food sources for a wide range of birds, lizards, geckos and invertebrates.

38. The North Island brown kiwi (*Apteryx mantelli*) is present in the wider Project area and is listed as Nationally Vulnerable. Three other bird species listed as At Risk or Naturally Uncommon which may be present in the area are black shag (*Phalacrocorax aristotelis*), long-tailed cuckoo (*Urodynamis taitensis*) and pipit (*Anthus novaeseelandiae*). The wetland area to the east of the existing SH3 corridor (adjacent to the southern portion of the Project

footprint[2]), is existing high quality habitat suitable for wetland birds including fernbird (*Megalurus punctatus*) and spotless crake (*Porzana tabuensis*).

39. Ngāti Tama recently reintroduced kōkako (*Callaeas wilsoni*) into the Parininihi Reserve. Five kōkako pairs and two individuals were translocated from Tiritiri Matangi Island and released to a central area of the Parininihi land, approximately 2.5km to the west of the Project footprint, on May 28th 2017. A further four pairs were released on 2nd July 2017.

40. The North Island long-tailed bat (*Chalinolobus tuberculatus*), a species with the recently revised classification of Threatened – Nationally Critical, is present in the wider Project area. The central lesser short-tailed bat (*Mystacina tuberculate rhyacobi*), listed as At Risk – Declining, may also be present in the wider Project area although this species has not been detected in recent surveys (they have been recorded in surveys undertaken since 2012 within 15km of the Project site).

41. Herpetofauna records show that the goldstripe gecko *(Woodworthia chrysosireticus)* (At Risk – Relict), striped skink (*Oligosoma striatum*) (At Risk – Declining), copper skink (*Cyclodina aenea*) (Not Threatened), forest gecko (*Mokopirirakau granulatus*) (At Risk – Declining), Hochstetter's frog (*Leiopelma hochstetteri*) (At Risk – Declining) and Duvaucel's gecko (*Hoplodactylus duvaucelii*) (At Risk – Relict) have all been found within a 50km radius of the wider Project area; all (with the exception of Duvaucels' gecko) within recent years. While surveys did not find any lizards within the Project footprint the mature forest habitat in the wider Project area and particularly the large number of epiphyte plants present provide ideal habitat for arboreal and semi-arboreal lizard species.

42. While there is a paucity of entomological knowledge of the Mt Messenger and wider Project area the invertebrate fauna that has been found in the area is 'typical' of communities inhabiting primary forests of the southern portion of the North Island. The forest habitat available to invertebrates is considered to be of high quality, with deep leaf litter layers, an abundance of dead wood and numerous potential plant hosts.

43. Two species of velvet worm or peripatus have been found in the Project area. Peripatus are classified in a Phylum of their own – Onychophora. They are considered to be a possible ancient link between worms (Annelida) and insects, spiders and centipedes (Arthropoda). One of the two species found, *Peripatoides suteri,* is listed as 'Vulnerable' in the IUCN Red List of Threatened Species. The other, *Peripatoides novaezealandiae* (likely to be a species complex rather than a single species), is more widespread and not considered to be threatened.

[2] 'Project footprint' includes the road footprint (that is, the road and its anticipated batters and cuts, spoil disposal sites, haul roads and stormwater ponds), the Additional Works Area (("**AWA**"); temporary works areas outside the direct road footprint) and a 5 m margin along the forested sections of the road footprint.

44. The waterways in the wider Project area provide high quality habitat for freshwater fish and invertebrates. Waterways draining north to the Mangapepeke Stream and headwater tributaries draining to the Mimi River on the south side of Mt Messenger all present high ecological values. The lower section of the Mangapepeke Stream has an aquatic macroinvertebrate community that indicates good water quality and there is a good diversity of fish present including adult inanga (*Galaxias maculatus*), longfin eel (*Anguilla dieffenbachia*), koura/crayfish (*Paranephrops planifrons*) and redfin bully (*Gobiomorphus huttoni*) (all classified as At Risk – Declining), whilst common bully (*Gobiomorphus cotidianus*) and paratya shrimp (Not Threatened) are also present. The headwaters of the Mimi River are very small and have seasonally intermittent flow. The forested sections have moderate to high habitat values and good to excellent water quality.

45. In summary, the forest and natural habitat along and adjacent to the Project footprint east of the existing SH3 retains indigenous plant and animal communities that are considered to have high ecological value. However, the full ecological potential of the area has been significantly diminished over many decades by the largely uncontrolled impact of browsing, grazing and predatory animal pests and unfenced cattle.

Summary of potential ecological effects of the Project

46. Details of the potential ecological effects of the Project can be read in the evidence of the ecological specialists.

47. In summary, the ecological effects are likely to be:

    (a) removal of or damage to 31.676ha of predominantly indigenous vegetation;

    (b) the removal of up to 17 significant trees from along the Project footprint;

    (c) the loss or alteration of 3822 metres of stream;

    (d) the loss or alteration of habitat occupied by indigenous bats, forest and wetland birds (including kiwi), lizards, aquatic fauna and invertebrates;

    (e) increased fragmentation of habitat occupied by indigenous fauna; and

    (f) the risk of indigenous fauna injury or mortality due to vehicle strikes.

METHODOLOGY FOR DEVELOPING MITIGATION AND OFFSET MEASURES

Background

48. The purpose of the Resource Management Act 1991 ("**RMA**") is to promote the sustainable management of natural and physical resources, while avoiding, remedying, or mitigating adverse effects on the environment. International guidelines on the management of ecological effects, particularly

those espoused by the Business and Biodiversity Offsets Programme ("**BBOP**"), promote a “mitigation hierarchy” or an “effects management hierarchy” that prioritises the sequence with which management of the effects should be approached.

49. The term *mitigate* in the RMA does not include “*biodiversity offsetting*” as mitigation relates to the reduction of effects at or on the site where the effects were created, whereas offsetting provides new positive effects of a similar nature to those being lost at a nearby site with similar ecological conditions. While recognising that the RMA is not a "no effects" statute, development of the concept of offsetting has led to an extended effects management hierarchy or order of priority:

    AVOID ⇨ REMEDY ⇨ MITIGATE ⇨ OFFSET ⇨ COMPENSATE

50. The publication “Guidance on Good Practice Biodiversity Offsetting in New Zealand” ("**Biodiversity Offsetting Guidance**"), produced for the New Zealand Government in August 2014, draws on the BBOP definition to define a biodiversity offset as:

    ‘Measureable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground’.[3]

51. The Biodiversity Offsetting Guidance notes that "*significant residual adverse impacts*" is not analogous to significant effects under the RMA but rather "*can be thought of as referring to effects that are ecologically meaningful or of non-minor ecological importance*."[4]

52. Compensate, as the last listed term in the effects management hierarchy, is sometimes used to describe less conventional approaches, such as cash payments, where mitigation and offsetting may not be possible. More recently, ecologists have used *compensation* to also define ecological restoration investment that is not “like-for-like”, that is, the ecological values being restored are not ecologically equivalent to those being lost, and in situations where the achievement of “no-net-loss” cannot be specifically measured.

53. In summary and for clarity, in my evidence I use the terms mitigation, offset and compensation to mean the following:

    (a) Mitigation: all restorative efforts (predominantly replacement planting) that can re-recreate what was lost in relatively short time.

[3] At page 3.
[4] At page 18.

(b) Offset: aspects of restoration and management for which the effects and outcomes can be measured and compared. All offset in this Project has been generated using the SEV Model and Offset Model.

(c) Compensation: all remaining restoration and management actions recommended that have been determined by the Project ecology specialists to be sufficient to achieve no net loss of biodiversity.

54. However, whatever the label applied to offsets/compensation, they both relate to providing offsite ecological benefits to deliver an overall beneficial ecological outcome for the Project.

55. A very conservative and precautionary approach has been applied to all aspects of determination of effects for the Project in order to determine the offset/compensation requirements. For example:

(a) A 5 metre margin of total loss has been added to the edge of the Project footprint presented to us by the Project design engineers, even though little if any of it is likely to be cleared or damaged. This margin is to make some allowance for effects that may result from the 3845m of additional forest edge that will be created as a result of construction of the road.

(b) Experts have assumed several lizard species are present, based on the suitability of habitat, even though surveys have yet to detect any.

(c) The 1.325 ha of affected forest that contains kahikatea trees has received both pest management offset and restoration planting offset (that is, it has been double counted) because species other than kahikatea in those areas will benefit from pest management whereas the kahikatea in those areas will be more effectively offset by restoration planting.

(d) While peripatus have been found only in a few sites on or near the Project footprint, all likely suitable woody habitat (rotting stumps and logs) found along the footprint will be assumed to have peripatus present and will be lifted and relocated to forested areas beyond the footprint margin.

(e) The substantial landscape and revegetation planting that will occur along the Project footprint once the road is built has not been included so it is additional to the proposed mitigation, offset and compensation package proposed below (this amounts to a minimum of 120,000 additional native plants). These plants will eventually create valuable habitat for indigenous biodiversity.

Application of biodiversity offsetting to the Project

Overview

56. The discussion above is relevant to the management of ecological effects on this Project because, as is highlighted in sections below, it is not possible to avoid, remedy or mitigate the significant net residual ecological effects of the Project within the Project footprint.

57. Biodiversity offsetting is therefore proposed to provide a long-term net gain in biodiversity values to address the potential effects of the project that have not been avoided or mitigated.

58. BBOP developed ten principles of biodiversity offsetting (BBOP 2009) and a Biodiversity Offsetting Standard (BBOP 2012) which sets out how each of the standards should be met. DOC and the Ministry for the Environment, through the Biodiversity Offsetting Guidance document, have essentially adopted these principles for New Zealand:

- Adherence to the **mitigation hierarchy**. This is now referred to more commonly as the "effects management hierarchy".
- **Limits to what can be offset.** There are situations where residual adverse effects cannot be fully compensated for because of the irreplaceability or vulnerability of the biodiversity affected.
- **Landscape context.** A biodiversity offset should be designed and implemented in a way that is appropriate across the wider landscape.
- **No net loss.** A biodiversity offset should be designed and implemented to achieve *in situ* conservation outcomes where the result is no net loss and preferably a net gain of biodiversity.
- **Additional conservation outcomes** (sometimes referred to as "**additionality**"). A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place.
- **Stakeholder participation.** In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision making about biodiversity offsets.
- **Equity.** A biodiversity offset should be designed and implemented so that the rights and responsibilities, and risks and rewards associated with the offset are shared equitably amongst stakeholders including indigenous peoples and local communities.
- **Long-term outcomes.** The design and implementation of a biodiversity offset should have the objective of securing outcomes that last at least as long as the project's impacts and, preferably, in perpetuity.
- **Transparency.** The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.
- **Science and traditional knowledge.** The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

59. The Restoration Package outlined in subsequent sections of this report has been designed to achieve these principles, as appropriate. In addition, the following ecology principles of best practice have also been applied in the development of the Restoration Package:

- **Ecological equivalence.** The design and implementation of mitigation and offsetting should endeavour, wherever possible, to replace the affected form of biodiversity with the same or similar form or taxa (that is, preference for replacement of 'like for like').
- **Ecological proximity.** Ecological equivalence and the achievement of no net loss of biodiversity will normally be achieved most effectively when the offset is undertaken at or close to where the effects occur.
- **Connectedness.** The value of ecological mitigation and offsetting will be greater where the result is improved connection with similar adjacent habitat which, in turn, creates improved opportunity for the dispersal and movement of indigenous biota.
- **High likelihood of success.** Any offsetting activity should have a high likelihood of success and perseverance. In other words, it should be based on sound science and proven practice.

60. The Stream Ecological Evaluation Model ("**SEV**") and the Biodiversity Offset Accounting Model have been used to determine biodiversity offsets for the Project that can be expected to generate measureable like-for-like benefits. Measureable offset outcomes have been generated by using the Offset Model for indigenous vegetation, using ecological integrity as the 'currency'.

The SEV model

61. The SEV model is widely applied in New Zealand and enables the amount of stream and riparian restoration required to compensate for that loss to be calculated for any stream selected for offsetting. The SEV calculator has been used by Mr Keith Hamill to determine the freshwater habitat values and offset compensation for the Project (refer to: The Assessment of Ecological Effects – Freshwater Ecology (Technical Report 7b, Volume 3 of the AEE) (Freshwater Ecology Technical Report) and Mr Hamill's evidence.

The Offset Model

62. Until recently no such standardised method or calculator existed for the quantification of terrestrial ecological values and the determination of mitigation or biodiversity offset required to compensate for terrestrial values lost. However, in 2015 DOC developed the Offset Model that quantifies biodiversity losses and gains, and expresses the results in a common currency (Catalyst Group 2015). This Model calculates net present biodiversity value (NPBV; Overton et al 2013) for individual biodiversity attributes and average NPBV across a range of attributes, and uses NPBV to estimate whether no net loss is achieved (for 'like for like' biodiversity trades only).

63. While the Offset Model has been well-tested in a variety of scenarios it has not been used previously for the determination of biodiversity offsets for national

roading projects. However, Mr Nicholas Singers, the author of the report applying the Offset Model to the Project, has previously used it on other projects. Having had the use of the model peer reviewed by Fleur Maseyk[5], and its use discussed during expert meetings with DOC and Wildlands, I consider the Offset Model to be the most appropriate method to determine the offsetting requirements for the vegetation and habitat that will be lost or modified within the Project footprint.

64. The Offset Model is explained in more detail in the evidence of Mr Singers and in the Biodiversity Offset Calculation Report.

Ecological compensation

65. Because of insufficient abundance data for other aspects of biodiversity, and pre- and post-construction and post mitigation/offset monitoring is unlikely to generate statistically meaningful data, the Offset Model has not been used to generate appropriate offsets for bats, birds, herpetofauna and, invertebrates. Instead the expert opinions of the Project's specialist bat, bird, herpetofauna and invertebrate ecologists have been applied to recommend the nature and extent of ecological restoration and management necessary to result in a likely no net loss of biodiversity outcome.

66. The principles of offsetting (as stated in sections above) have been applied to the compensation part of the Restoration Package as much as possible. The restoration area selected to compensate for effects on bats, birds, and invertebrates adjoins the offset and mitigation areas and is immediately adjacent to the Project footprint; it is physically linked to the actively managed Parininihi; the restoration effort proposed is ecologically equivalent to that being affected; and, based on past experience and research, the restoration has a high likelihood of success.

67. Restoration efforts for lizards are less likely to be successful at the main offsetting and compensation site (for reasons explained in sections below) so an alternative compensation programme is proposed that has a higher likelihood of success.

AVOIDANCE AND MINIMISATION OF ECOLOGICAL EFFECTS

Avoidance of effects

68. The first steps for the Project were, to the degree possible recognising the area within which the Project lies, to avoid or minimise ecological effects. As set out in Mr Kenneth Boam's and Mr Peter Roan's evidence, and the Assessment of Alternatives section of the AEE (Section 6), considerable effort was put into the option selection process. In advance of the MCA workshops the members of the Project ecology team were asked to separately score

[5] Fleur Maseyk is co-author of the "Biodiversity Offset Accounting Model for New Zealand" user manual (Maseyk et al 2014).

each route option using a 9 point scale applied to pre-determined assessment criteria. The ecology team then met to determine a prioritised list of route options from least to most preferred. The ecology team met separately for the first MCA workshop (where the long list of options was considered) but the second workshop (short list of options) was also attended by DOC representatives to fully debate the alternative options being considered. The chosen option ranked second for ecology behind the option of upgrading the existing SH3 route and critically avoided the Parininihi area which has significantly higher ecological values than the chosen route, having been managed intensively for pests for 15 years.

69. During Project design ecological effects were avoided by:

(a) a 235m long tunnel through the ridge dividing the Mangapepeke and Mimi catchments which has preserved the important east – west connectivity of habitat (ridge to coast) and mobile animal movement (especially bats);

(b) realignment of the road corridor, including:

(i) shifting the southern end of the route further east (uphill) away from the ecologically significant Mimi Wetland; and

(ii) positioning the route down the Mangapepeke valley to largely avoid the stream and the valley bottom (which is a restoration target); and

(c) a 120m long bridge across a tributary valley to the ecologically significant Mimi Wetland area which has avoided direct effects on the Mimi Wetland that a fill would have caused.

70. Before and after the selection of the preferred route, alterations to the road design have occurred to minimise the likely ecological effects. These include the following:

(a) Adjustments to the road corridor to reduce the number of significant trees affected (from 22 down to a maximum of 17). Refinement of the detailed design will continue to see if there are methods, such as the use of retaining walls, to reduce the number of significant trees that require felling;

(b) Introduction of construction techniques to reduce ecological effects. For example, the bridge across a tributary to the Mimi Wetland has been designed in a way that will allow it to be constructed from each side rather than from the valley bottom. This will reduce the amount of ground and vegetation disturbance compared to a more conventional approach of building the bridge from the valley bottom, and it will also reduce the risk of sediment erosion into the wetland.

(c) Location of construction yards, laydown areas, construction access tracks and haul roads away from ecologically sensitive/significant areas to minimise the extent of disturbance and vegetation clearance.

(d) Location of spoil fill sites in areas likely to cause the least ecological effects.

71. Additional measures will be undertaken before and during construction to minimise adverse ecological effects, reduce the likelihood of additional effects, and detect, relocate or recycle as much living flora and fauna and organic material as is practicable. These measure will include:

(a) Implementation of vegetation removal, construction and sediment management best practices to minimise effects on adjoining vegetation, habitat and fauna (ELMP chapters 4-10).

(b) Physical delineation (such as fencing or flagging tape) will be used to clearly mark the extent of vegetation clearance to be undertaken, along with vegetation to be protected (ELMP Chapter 4).

(c) Having an ecologist on site to advise the construction teams when vegetation is being cleared near wetlands (ELMP Chapter 4).

(d) Construction lighting will be managed (selection and design/layout of lighting) to minimise effects on ecological values including bats. (ELMP Chapter 5, and section 5.20 of the Construction Environmental Management Plan (CEMP)).

(e) Implementation of the bat tree removal protocol (also referred to as the vegetation removal protocol) or other process agreed with DOC, prior to and during tree removal to reduce the likelihood of any bat mortality as a result of tree felling to the minimal possible levels. The bat tree removal protocol has been applied to several large roading projects in New Zealand in recent years where long tailed bats have occupied habitat in the vicinity of stands of trees that had to be felled and there have been no reported cases of trees being felled with bats in them where the protocol has been enacted (ELMP Chapter 5).

(f) The footprint and surrounding landscape will continue to be monitored for kiwi and all kiwi found to have territories that intercept or are adjacent to the footprint will be radio tracked so that their location is known when trees are felled. A Kiwi dog will also be used to search for any dispersing juveniles in areas to be disturbed. Kiwi found to be in a zone requiring trees to be felled will be captured and moved to safe alternative roost sites within their existing territories (ELMP Chapter 6).

(g) Throughout the kiwi breeding season (July to February) the contents of nests that are at risk of disturbance (within 40m of construction activity)

will be removed and all eggs and young chicks taken to a permitted incubation and chick-rearing facility. The resulting offspring will be released back into the pest management area ("**PMA**"). The resulting offspring will be returned back into the PMA or nearby area once they are old enough for relocation.

(h) If a recently established nest is found in a disturbance zone, construction activities within 40 m of the nest will cease and not recommence till the eggs can be safely uplifted at over 40 days of age.

(i) Post-construction, 1.2 m high fences made of kiwi-proof mesh netting may be erected along the road edge if the monitoring identifies risk of kiwi moving on to the road.

(j) Fish will be captured and relocated from sections of stream that will be affected by construction (ELMP Chapter 8).

(k) Vegetation along the footprint that has high habitat value for lizards is proposed to be identified by experienced lizard ecologists prior to vegetation clearance. This vegetation will be monitored as trees are felled and any lizards detected will be salvaged and relocated to suitable habitat(s) outside the Project footprint (ELMP Chapter 7). The primary focus of salvage efforts will be searches for striped skink (this is the most significant species likely to occur within the Project footprint) and other arboreal lizards during vegetation removal.

(l) Woody habitat (especially rotting stumps and logs) recognised as likely to be favoured by the two species of peripatus known to be present in the area, *Peripatoides suteri* and *Peripatoides novaezealandiae*, will be lifted from the footprint and placed in suitable adjacent forest. This technique was successfully used to relocate *P. novaezelandiae* as part of the Caversham Valley Highway Improvements in Dunedin in 2013 (ELMP Chapter 10).

(m) The Project footprint contains a small number of the At Risk plant kohurangi (*Brachyglottis kirkii var.kirki*i) and two regional distinctive plants, *Pittosporum cornifolium* and swamp maire (*Syzygium maire*). Both kohurangi and *P. cornifoliu*m are small epiphytic shrubs that grow in the tops of large trees such as rimu and matai. Propagation material (cuttings, seed if it is present, or the whole plant) will be collected from freshly fallen large trees and supplied fresh to a native plant propagator who will attempt to produce plants suitable for restoration planting in the mitigation and offset sites (ELMP Chapter 4).

(n) *Gahnia pauciflora* and *G. setifolia* plants, host species for the 'At Risk: Relict' forest ringlet butterfly (*Dodonidia helmsii*), will be harvested (seed and/or whole plants) when detected along the footprint, cultivated and returned to suitable restoration sites (ELMP Chapter 4).

(o) Live recovery of small nikau (*Rhopalostylis sapida*) and tree ferns for replanting in adjacent sites. Nikau and tree ferns are two of the few native plants that tolerate and survive live extraction and translocation beyond the first year of life. Both species may be “lined-out” and kept alive in trenches under shade near the Project site until new planting areas are created along the footprint (ELMP Chapter 4).

(p) During the process of vegetation removal large wood will be stockpiled for use in stream restoration (habitat for fish and koura) and for providing habitat and food for insects and birds (ELMP chapters 6, 8 and 10).

(q) Within the Additional Working Areas ("**AWA"**), vegetation clearance will be minimised to ensure a vegetation buffer remains as large as practical and clearance does not trespass into high value ecological areas, which have a smaller (5m) AWA (ELMP Chapter 4).

(r) Where suitable sites exist, large fallen and decaying logs and a proportion of cleared vegetation will be left in-situ adjoining the road footprint to provide habitat for fauna (ELMP Chapter 4). Priority plant material for leaving in-situ includes:

(i) Large (>50cm diameter) fallen (rotting) logs — these are habitat for invertebrates such as the threatened velvet worm and lizards.

(ii) The heads of large trees (>50cm diameter) typically covered in epiphytes — these tree heads will be habitat for invertebrates and potentially lizards.

(iii) Large tree trunks (>50cm diameter), especially any which are partially rotten and contain cavities.

(s) Vegetation which is not left in-situ will be mulched on-site and stockpiled for later placement over new fill areas to enhance plant growth and natural seed germination (ELMP Chapter 4).

(t) As much topsoil and organic matter as practicable will be collected from along the footprint as it is cleared, stockpiled and later applied to new fill areas to facilitate plant establishment (ELMP Chapter 4).

THE PROPOSED MITIGATION, OFFSET, COMPENSATION AND MONITORING PACKAGE (THE RESTORATION PACKAGE)

Primary mitigation, offset and compensation measures proposed

72. Restoration mitigation, offset and compensation of natural or semi-natural sites that have been altered by infrastructure works can be achieved by a range and combination of methods, including:

(a) Planting of trees, shrubs and grasses;

(b) Application of seed;

(c) Promotion of natural regeneration by creating conditions suitable for that to occur;

(d) Weed management or removal;

(e) Construction of new natural habitat (for example new stream sections);

(f) Construction of passageways for fauna over or under the structure;

(g) Translocation/relocation of fauna to alternative existing habitat or newly created habitat;

(h) Relocation of fauna and their habitat together;

(i) Management / control of one or several pest animal species; and

(j) Pest animal eradication or exclusion.

73. Mitigation of the ecological effects of road construction in New Zealand typically has a significant replanting component, especially where native vegetation has been removed in the process of road construction. However, in circumstances where mature forest has been removed, the time span between planting and the achievement of conditions that resemble what has been lost can take decades or centuries. When planting is the only mitigation strategy used, the time lag to achieve no net loss is of the same magnitude – decades or centuries.

74. The forest on the Mangapepeke valley edge, and within the Project footprint, has trees between 50 and 80 years of age and some of the emergent rimu, rata and totara in the wider Project area are likely to be several hundred years old. Replacement of the forest area lost, by planting alone, will eventually recreate habitat equivalent to that lost, but not for many decades.

75. The forested areas beneath and within the proposed Project footprint exhibit evidence of long term and substantial adverse impacts of introduced animal pests and farm livestock. While a largely intact forest canopy exists over much of the area the forest is in a poor state of health with heavily browsed canopy trees and an understorey largely lacking palatable species regeneration. In some locations closer to farmed areas the forest has no regeneration at all because of the long term actions of cattle, feral pigs and feral goats. The poor state of the forest inevitably means that the quality and volume of habitat for most indigenous animals is also reduced.

76. Based on the experiences of many New Zealand studies that have shown significant and rapid recovery of many plant and animal taxa in response to intensive pest management (as set out in Technical Report TR07h – Ecological Mitigation and Offset), and reinforced by the success of the pest management campaign over the past 15 years in the adjacent Parininihi land,

the introduction of intensive pest management over the forest areas adjacent to the Project footprint (and within the wider Project area) is proposed as the primary restorative measure to offset the residual ecological effects that will arise from the Project.

77. While mitigation planting, offset planting, and other measures are proposed (see details in sections below), intensive and enduring pest management can be expected to result in considerably more rapid and more ecologically diverse recovery of forest biodiversity than could be achieved by planting alone.

78. Details of the pest management programme, as well as the other aspects of the proposed mitigation / offset / compensation strategy, follow in sections below. In summary, the proposed Restoration Package that will address the residual ecological effects of the Project is:

    (a) Mitigation:

        (i) Restoration/replacement planting of all secondary scrub areas along the footprint, plus temporary access tracks and storage areas where these retain soil, hydrology and growing conditions suitable for reinstatement.

        (ii) Installation of fish passage devices to facilitate fish movement past the road footprint.

    (b) Offset:

        (i) Pest management in perpetuity (or until such time as pest control techniques as we currently know them are no longer required) to reduce all major introduced mammalian predators and herbivores (including livestock) from a defined pest management area to levels sufficiently low to induce the recovery of most species of indigenous flora.

        (ii) Planting of high value forest types, especially kahikatea, that are unlikely to benefit from intensive pest management to the extent that other forest types will. Kahikatea are less affected by browsing and grazing animals than other more palatable forest species.

        (iii) Restoration planting and fencing along stream margins, the quantity of has been determined using SEV.

    (c) Compensation:

        (i) An additional area of intensive pest management in perpetuity (linked to the offset area) to provide improved quality habitat for indigenous fauna that are unlikely to benefit from the smaller offset pest management area.

(ii) Planting of multiple seedlings of the same species for every significant tree that has to be removed.

(iii) Collection (where possible) of propagation material of threatened plants species that may have to be removed from the Project footprint, to grow new plants for replanting at appropriate sites adjacent to the Project area.

(iv) Salvage and relocation of striped skinks and possibly arboreal geckos to alternative sites.

79. The mitigation, offsetting and compensatory actions proposed (collectively the Restoration Package) are expected to generate a net gain in biodiversity 15 years following construction. In addition to the Restoration Package, additional landscape and rehabilitation works will be undertaken to generate vegetative cover over as much as possible of the exposed cut and fill areas of the Project footprint that will not be sealed. While the rehabilitation works will look dissimilar to the vegetation that was removed for many decades it is expected that these areas will ultimately mature into habitat of relatively high ecological value.

80. Proposed rehabilitation works include:

(a) Rehabilitation planting of fill areas along the new road footprint (minimum of 120,000 plants) to fast-track reversion to indigenous forest and to create habitat for a range of fauna. All plants will be indigenous species naturally occurring in the wider Project area.

(b) Enhancement of steep cut faces (with ecosourced native species) to promote natural regeneration.

(c) Creation of new stream channels to receive flow from diverted streams. Newly formed channels will be made as naturally as possible to mimic local stream form with banks planted in native species and woody debris placed in the channels.

Mitigation

81. The Project footprint and areas of the designation that do not have indigenous plant cover that retain similar growing conditions after the completion of construction will be replanted with the same or similar native plant species to those lost. This is considered to be *mitigation* because similar vegetation communities will be established in relatively quick time (5 to 10 years).

82. Vegetation types that fall into this category are modified secondary forest/bush areas including manuka-tree fern scrub, manuka succession, tree fern scrub and manuka scrub (see **Table 1**). Replacement planting of these areas will occur on a one-for-one basis, that is, one hectare will be fully restored for every hectare affected.

83. In addition, some mitigation replacement planting will be undertaken for the 5.826ha of exotic rushland that will be lost. While the introduced rush species that dominate these areas have little botanical value, they do offer moderate value habitat to wetland birds and invertebrates and for this reason mitigation replacement planting at a ratio of 0.5 ha for every hectare altered is proposed.

84. In total, 8.38ha of replacement planting will be undertaken to mitigate the above effects.

85. Where growing conditions are suitable mitigation replacement planting area plant mixes will be supplemented with hardy mid-and later successional species. The intention with this approach is to promote successional processes and speed up the development of these scrub areas back to forest. Species such as totara, rewarewa, kamahi, pigeonwood and kaikomako will be interplanted in locations where they are likely to survive. A greater proportion of these species will be used for blanking (planting through the 6 year maintenance period to replace dead plants) because the additional shelter created by the first plantings will be of benefit to these species.

Table 1: Summary of the area of vegetation communities that will be lost or altered and how they will be offset and mitigated

Potential Ecosystem Type	Vegetation community	Project footprint total (ha)	Offset required: Pest management (ha)	Offset required: Restoration planting (ha)	Mitigation required: Replacement planting (ha)	Mitigation/offset treatment
WF8: Kahikatea pukatea forest	Kahikatea swamp maire forest & kahikatea forest	0.684	15			Offset: Intensive pest management
	Kahikatea treeland	0.641	3			Offset: Intensive pest management
	Kahikatea trees	(1.325)*		6		Offset: Swamp forest/kahikatea restoration planting
	Pukatea treefern treeland	0.722	3			Offset: Intensive pest management
	Manuka scrub	0.582	1			Offset: Intensive pest management
	Exotic rushland**	5.826			2.913**	Mitigation: replacement planting
WF13: Tawa kohekohe, rewarewa, hinau,	Tawa rewarewa kamahi forest	6.457	95			Offset: Intensive pest management
	Tawa nikau treefern forest	8.507	61			Offset: Intensive pest management
	Miro rewarewa kamahi forest	0.536	8			Offset: Intensive pest management

Potential Ecosystem Type	Vegetation community	Project footprint total (ha)	Offset required: Pest management (ha)	Offset required: Restoration planting (ha)	Mitigation required: Replacement planting (ha)	Mitigation/offset treatment
podocarp forest	Pukatea nikau forest	1.347	11			Offset: Intensive pest management
	Secondary mixed broadleaved forest	2.231	15			Offset: Intensive pest management
	Manuka treefern scrub	0.146			0.146	Mitigation: replacement planting
	Manuka succession	0.514			0.514	Mitigation: replacement planting
WF14: Kamahi, tawa, podocarp, hard beech forest	Hard beech forest and tawa, kamahi, rewarewa forest	0.814	7			Offset: Intensive pest management
	Manuka treefern rewarewa forest	3.291	11			Offset: Intensive pest management
	Manuka treefern scrub	3.164			3.164	Mitigation: replacement planting
	Treefern scrub	0.080			0.080	Mitigation: replacement planting
	Manuka scrub	1.560			1.560	Mitigation: replacement planting

Potential Ecosystem Type	Vegetation community	Project footprint total (ha)	Offset required: Pest management (ha)	Offset required: Restoration planting (ha)	Mitigation required: Replacement planting (ha)	Mitigation/offset treatment
CL6: *Hebe*, flax rockland	Dry cliff	0.399				Treat to enhance natural regeneration
Total hectares		37.50	230	6	8.38	

Notes: * The 1.325ha community 'Kahikatea trees' is derived from the area of the 2 communities above it. ** Replacement planting of 50% of the area lost

86. Fish passage will be provided through all new culverts where fish movement is likely to be impeded. Details about the nature and location of fish passage devices are set out in the evidence of Mr Hamill and Mr Boam. While the provision of fish passage through culverts and the re-creation of stream habitat along diverted stream channels are both forms of mitigation, it is acknowledged that there will be residual effects of the Project on aquatic and riparian biodiversity. Consequently, all affected stream areas are considered to require offset and the SEV model has been used to determine the offset required (see offset section below).

Biodiversity offset

General

87. All of the forest types affected by the Project that are not able to be replaced by mitigation planting require offsetting to reduce the residual effects of the Project on them to the point of no-net-loss, and then to achieve the Project aim of net biodiversity gain. The Project team have set the target of achieving no net loss of biodiversity by year 10 (following construction) and net gain in biodiversity from year 15.

Enhancement offset

88. Intensive pest management in perpetuity (or until such time as pest control techniques as we currently know them are no longer required) has been selected as the primary method to be used to implement the offset. As stated above, this is because the expected recovery in biodiversity once an intensive pest management programme is implemented in the forested areas surrounding the Project area is likely to be rapid and diverse.

89. The amount of offset required has been determined using the Offset Model (refer to the evidence of Mr Singers). Ecological integrity has been used as the currency by which the ecological effects of the Project on each vegetation type have been measured and it is also the currency used to determine the extent of offset required.

90. The results generated from the Offset Model are that intensive pest management over 230ha is required to offset the ecological effects of the Project on those forest types susceptible to pest damage (25.8ha of affected forest, see **Table 1**) and achieve no net loss of biodiversity by year 10.

91. Intensive pest management as proposed consists of the permanent control of all major mammalian pest predators (excluding mice) and herbivores, notably feral pigs, feral goats, possums, feral cats, mustelids, and rats, plus farm livestock and deer (if any are detected), to residual levels that research has shown will result in the recovery of most indigenous plants and animals present. The residual target densities for each pest animal are referred to in the monitoring section of my evidence below.

92. Mice are not included as a target in the proposed pest management programme. This is because the technology does not exist to effectively manage mice to low densities over large forested areas where few or no rats are present. Furthermore, the steep nature of the Project area terrain would make it impossible to safely establish and maintain a bait station and trap network grid that is sufficiently intense to have any likelihood of controlling mouse densities. Research in areas where rats and other predators have been effectively controlled to low numbers has shown that a grid of bait stations no further apart than 50m is necessary (and potentially as close as 25m spacing) to have any likelihood of successfully controlling mice and even in those situations effective control is very unlikely in areas larger than 100ha and very expensive (4 times the cost of rat control or greater).

93. Based on the experiences of other intensive pest management programmes in New Zealand, mouse densities are expected to spike periodically in the Pest Management Area once rat densities in particular are reduced to below 5% RTI (residual tracking index). Increased mouse densities can be expected to have an adverse effect on some lizard and invertebrate species (further discussion on this topic in sections below). Despite this, I consider that an intensive and perpetual pest management programme that excludes mice will still achieve substantial and diverse ecological benefits (to flora and fauna) that cannot be matched by any other restorative technique in this landscape. Dr Corinne Watts and Mr Simon Chapman support this viewpoint in their evidence.

94. The pest management programme is proposed to continue in perpetuity. In my experience, this is the first time such a commitment has been offered as ecological offset on an infrastructure project of this nature. Perpetual pest management offers substantially greater ecological benefits than any pest management programme of fixed duration. This is because many of the introduced animal pests present in New Zealand, especially rats but also possums and stoats, reinvade forest rapidly when pest control ceases and can eliminate many of the biodiversity gains generated by pest control very quickly. A successful perpetual pest management programme will enable many indigenous plant and animal species to regain and sustain levels of abundance and diversity close to levels that occurred before mammalian pests were introduced to New Zealand. The young of mobile species are also likely to disperse to and successfully establish in surrounding forest areas.

Habitat creation

95. Restoration planting of kahikatea / swamp forest species has been selected as a secondary method of offset. This is because kahikatea, in particular, is not as greatly affected by animal pests as most other forest canopy species and so will not benefit as greatly from pest management. Intact and healthy lowland kahikatea - swamp forests are a rare ecosystem type in New Zealand largely because of the impacts of agriculture and associated drainage. A

sizeable area exists in the Mangapepeke Valley, alongside the Project area, that was once kahikatea swamp forest and still retains much of its original hydrological characteristics (that is, it is poorly drained). This area is very suitable for the re-establishment of a kahikatea dominant swamp forest.

96. The Offset Model has determined that 6ha of kahikatea swamp forest planting is needed to offset the impact of the Project on this forest type (1.325ha) by year 10. Details of the proposed pest management programme and its location and the restoration planting are presented in a section below.

SEV

97. The other area of ecological offset calculated has been for the stream areas lost or disturbed as a result of the Project. The SEV has been used as the offset model and its use is described in more detail in the evidence of Mr Hamill.

98. Mr Hamill has determined that 3,822m of stream length (3361m2 of stream surface) will be affected by the Project (**Table 2**), and that 8627m of stream length (or 8175m2 of stream surface) will need to be restored (fenced and planted) to offset the ecological effects.

Table 2: Stream lengths and areas affected by the Project and proposed offsets derived from the SEV model.

	Impact		Offset	
Catchment	Length (m)	area (m^2)	Length (m)	area (m^2)
Mangapepeke	2799	2678	6110	6234
Mimi	1023	683	2517	1923
Total	3822	3361	8627	8157

99. Details of the nature and extent of the proposed riparian restoration are presented in sections below.

Compensation

General

100. As set out above, the other ecological values likely to be affected by the Project, notably bats, birds, herpetofauna, and invertebrates, have not been assessed in the offset models because insufficient data exists to quantify the abundance and distribution of these animals in the Project area. The lack of data is not because of a lack of effort, rather it is because available survey

methods are not available to define (except over long periods of many years) the extent of populations (especially bats and forest birds), locate small and cryptic species (especially lizards), and make allowances for seasonal and yearly natural perturbations (insects). Without reliable data to feed into the Offset Model meaningful offset requirements cannot be generated.

101. Instead the Project team of ecology experts have applied their knowledge, expertise, and the principles of offsetting discussed in sections above, and drawn on peer reviewed literature to determine the nature and extent of intensive pest management, restoration planting and/or other restorative techniques required to result in a no net loss of biodiversity outcome for those values not assessed in the models. For the sake of clarity, as mentioned above, I refer to this as ecological compensation (effects and offset that cannot be accurately measured).

Habitat enhancement

102. A PMA of 1085ha (see **Figure 2**) is proposed to meet biodiversity offset and compensation requirements for the Project. The extra 835ha of PMA, in excess of the 250ha offered as offset, and the ecological benefits this larger area will provide, ensures that the ecological effects of the Project are appropriately addressed and the desired outcome of a net gain in biodiversity 15 years after road construction has a high likelihood of being achieved. The enlarged PMA has largely been derived by extending the perimeter to natural barriers to pest movement and defendable buffers.

103. The PMA has been increased to 1085ha to achieve the following ecological benefits:

    (a) The Core ‘ Offset Pest Management Area has been increased to 250ha, instead of 230ha, to create a practical management area on the ground that includes all of the vegetation types required to provide the necessary offset.

    (b) To provide an effective pest management buffer around the Core / Offset PMA of 250ha so that the core has constantly low pest densities. Mobile pest species, especially stoats, have large home ranges (up to 200ha for stoats) and will travel substantial distances looking for prey. The buffer will greatly reduce the likelihood of mobile species reaching the Core Offset Pest Management Area ("**COPMA**").

    (c) Extension of the PMA to natural barriers to pest movement to the north and northwest (existing SH3), to the east (farmland), to the southwest (SH3 and farmland) and to the west (the pest managed Parininihi) will provide even greater protection to pest reinvasion.

    (d) Physical linkage of the PMA to the Parininihi thereby greatly increasing the available contiguous low-pest habitat available.

(e) The larger 1085ha PMA is very likely to result in an increase in kiwi presence in the managed area. Dr John McLennan supports this view in his evidence and refers to documented increase in average kiwi chick survival from 14% to 56% and a doubling of the kiwi population in 7 years at a 750ha Lake Waikaremoana site subject to a sustained predator control programme. Dr McLennan in his evidence considers that there is a "reasonably high" likelihood of effective control of kiwi predators (stoats and ferrets) being achieved within the proposed PMA.

(f) Arboreal mammalian pests, especially ship rats and stoats, are known to be major predators of long tailed bats and effective predator control is considered to be essential for recovering long-tailed bat populations (O'Donnell et al 2017). However, very little data exists that shows positive responses of long tailed bats to intensive pest control. A 22 year-long study in Fiordland, documented by O'Donnell et al., suggests that rat management needs to be undertaken over an area of 3000ha or more before population level recovery can be measured. This paper notes (referring to Pryde at al 2006) that long tailed bat populations are declining at a rate of up to 9% per annum in areas of high predator numbers. When combined with the pest managed 1332ha Parininihi forest area, the total conjoined area under pest management will be approximately 2400ha. On the basis of the Fiordland study I consider that there is a high likelihood that a slow-down in the rate of bat population decline can be achieved in both the PMA and the Parininihi in response to the proposed pest management programme.

(g) This view is supported by Project bat specialist, Mr Chapman as stated in his evidence. Mr Chapman considers that the combined 2400ha under intensive pest management will "be of a scale sufficient to significantly slow the current likely long-tailed bat population decline in the wider Project area. The combined pest control area may in fact be sufficient to halt the decline or possibly even reverse it". He adds that he does not think reversal of the long tailed bat decline is necessary in order to address the effects of the Project.

(h) The anticipated improvement in vegetation quality and quantity as a result of intensive pest management over 250ha core and the 835ha buffer, is expected to compensate for the residual effects of the Project for many indigenous forest bird species. As vegetation improves so will the value of habitat for forest bird species. Dr McLennan has identified kiwi, fernbird, NI robin, whitehead, long-tailed cuckoo, kereru, tui, and bellbird as species likely to benefit from the perpetual intensive pest management.

(i) The extended 1085ha PMA encompasses the 6ha of swamp forest restoration planting, 6.2ha of riparian planting, 8.38ha of mitigation replacement planting, and landscape rehabilitation planting of a

minimum of 120,000 plants that will occur in the Mangapepeke Valley. Low pest densities in perpetuity will support the successful establishment of the new plantings and enhance natural succession.

(j) Dr Watts acknowledges in her evidence that invertebrate response to pest management can often be hidden by food web complexities (eg. insectivorous native birds consume invertebrates previously eaten by predators). She also mentions that there has been very little study of invertebrate responses in areas subject to pest management. Nevertheless, she agrees that the proposed pest management programme will lead to significant enhancement of the health of the vegetation communities in the area subject to management, which, in turn, will lead to benefits for invertebrate communities.

Lizard compensation

104. While the amount and quality of habitat is likely to improve for lizards as a result of intensive pest management in perpetuity, studies suggest that this does not often result in measureable lizard population recovery. This may be the result of increased predation by mice when rats and other predators are removed or reduced, but it may also be, in part, because of the difficulties associated with effectively surveying lizards in mature forest.

105. Mr Chapman has stated in his evidence that some lizard species (especially arboreal geckos) are likely to benefit from the pest management programme. However, because it is doubtful that intensive pest management over 1085ha will result in measurable recovery of all lizard species, compensation in a different form is proposed that has a greater chance of resulting in a measureable positive conservation outcomes.

106. Small scale fenced enclosure(s) can be built and maintained to effectively exclude mice and other predators however to be effective such enclosures need to be built around optimum habitat and cannot be built to effectively exclude mice where trees within the enclosure link physically with trees on the outside. Consequently, it would be challenging to find habitat suitable for all the lizard species likely to be salvaged along the Project footprint around which an effective mouse-proof enclosure can be built. Furthermore, the survival rate of animals eventually released from pest free enclosures into areas with high mouse densities and no well-established lizard population is likely to be low.

107. Rather than attempt to cater for all lizard species likely to be present it is proposed that effort is focused on one or two species only with an approach that has a higher chance of generating positive conservation outcomes.

108. Of the threatened lizards likely to be present in and adjacent to the Project footprint, striped skink is the only species that doesn’t have a secure population nationally on an island or sanctuary free of predators. Salvaged

animals of this species would have the greatest chance of survival if they could be released into a mouse proof enclosure that surrounds a known existing population of striped skink. Populations of striped skink are known to exist in the Taranaki area.

109. A prioritised hierarchy of compensation options is proposed for striped skink with the option chosen dependent on the availability of suitable sites and input from Ngāti Tama. The hierarchy is:

(a) mouse proof predator fence to be constructed around a known local population of striped skink and all striped skink salvaged from the footprint to be relocated to this enclosure; or

(b) mouse proof predator fence to be constructed around a known distant population of striped skink and all striped skink salvaged from the footprint to be relocated to it; or

(c) translocation of all captured lizards into a mouse proof predator fenced enclosure located within the PMA.

110. The decision as to which of these options is adopted will depend on whether suitable local or regional populations of striped skink can be found around which a mouse-proof fence can be constructed, and consultation with iwi.

111. Additional ecological compensation offered includes:

(a) Planting of seedlings. 200 seedlings of the same species as each significant tree felled from along the Project footprint will be planted in appropriate locations within the designation or immediately adjacent to it. Up to 17 significant trees will be felled (efforts will be made to further reduce this number), so up to 3400 seedlings will be planted.

(b) Propagation and planting of threatened plant species. Propagation material (seed and cuttings) or whole plants will be retrieved from threatened plant species growing on the area of vegetation clearance before or during clearance. This material will be used to propagate replacement plants which will be planted in appropriate locations within the restoration planting areas, PMA and Project footprint.

THE PEST MANAGEMENT PROGRAMME

112. The pest management programme will include[6] :

(a) a combined aerial and ground-based approach over the full PMA (1085ha) to reduce and maintain rats, possums, and mustelids to low levels in perpetuity; and

[6] Pest management programme details can be found in Chapter 9 of the ELMP

(b) a hunting programme over the full PMA to reduce and maintain feral goats and pigs to low densities in perpetuity.

113. The long term strategy for possum, rat and mustelid control will be based on achieving very low pest densities from three-yearly aerial applications of 1080, supported by the maintenance of a ground based trapping and poisoning network across the entire PMA.

114. A responsive management approach will be adopted for each animal pest as to the choice of pest management methods used and trap and/or bait station intensity. If target pest density performance standards are not achieved with one method, the method or approach 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. A responsive 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.

115. Pest management will begin with an aerial 1080 toxic bait application to quickly reduce possums, rats and predators to low levels over the full 1085ha PMA. Aerial 1080 operations will be repeated on a three-yearly time frame and ideally will be synchronised with the current cycle applied to the adjoining Parininihi PMA.

116. The use of 1080, and its application from the air on a three year cycle, is considered to be essential for the successful reduction of possums, rats and predators to low levels. 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, and into the forest canopy where ground-based methods don't reach. 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.

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

118. The 1085ha PMA will have two zones (see **Figure 2**), each managed slightly differently. Each of the two zones will receive three yearly 1080 drops and the same intensity of goat and feral pig control (see performance targets for these in sections below).

(a) The southern PMA area (approximately 525ha). This zone lies entirely in the Mimi catchment and includes the 250ha Core Pest Management

Area and a 275ha buffer around the core area. Trap and bait station densities will be sufficient to hold rat and possum to 5% residual levels (residual tracking index [RTI] for rats, and residual trap catch [RTC] for possums), and zero detection levels for stoats, ferrets, and feral cats permanently.

(b) The northern PMA area (560ha). This zone lies in the Mangapepeke catchment and will be managed for possums, stoats, ferrets and feral cats with the same intensity and performance targets as for the southern PMA. Rats, however, will be managed less intensively with traps at 1 per 3.5ha instead of 1 per ha (as in the southern PMA. The result will be some increase in rat densities above 5% RTI between the 3 yearly 1080 operations.

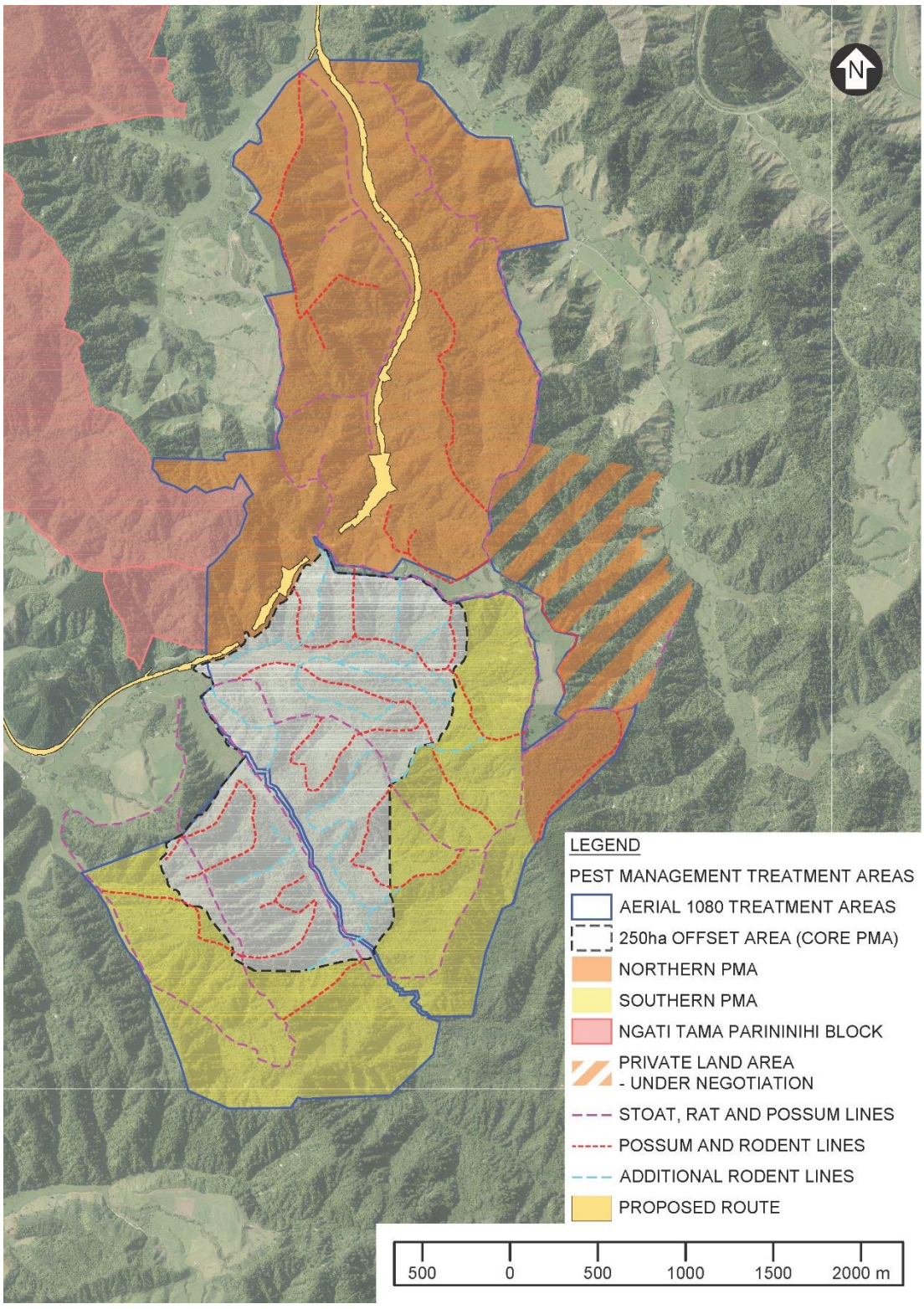


Figure 2: Map of the proposed Pest Management Area

PROPOSED OFFSET RIPARIAN RESTORATION WORKS[7]

119. 8627 lineal metres of stream or 8175m^2 of stream surface area require restoration to offset the effects of the Project on streams.

[7] Refer to Chapter 4, Section 4.6.4 of the ELMP for details of the proposed riparian restoration.

120. The restoration effort proposed for the streams chosen for offset will be to permanently fence the stream to exclude livestock and to plant the riparian margins with native sedges, shrubs and, where sufficient margin exists, trees.

121. The most desirable location for the riparian offset is as close to the area of effects as possible, and preferably in the same catchments as those affected. Contiguous lengths of stream are also preferred especially those linked directly to existing forested catchments. Consequently, 3117m of the Mangapepeke Stream within the proposed designation has been the first selected area for restoration. The remaining 5510m of stream will be located on private land.

122. Informal agreement has been obtained from landowners in the Upper Mimi catchment to secure the remaining stream length required. The preferred stream length will provide 5510m of contiguous fully fenced and planted stream margin linking to the forested area at the southern edge of the Project area.

123. The priority for riparian restoration planting is to provide shade to the stream channel to benefit aquatic life, and margins of vegetation that will provide habitat for riparian species and food sources for aquatic organisms.

124. The riparian planting will also serve to anchor the banks of the meandering Mangapepeke and Mimi streams against erosion.

125. The rush and sedge vegetation that will be planted in flood prone areas will filter out sediment (and attached phosphorus) from drainage water derived from the surrounding farmland although most of the sediment load is derived from mass slips in the steeper forested areas and stream banks rather than from farming practices.

126. Riparian fences will be positioned to allow sufficient room for plants to be established to provide shade across the stream channel when the plants are well grown and also to ensure that the fences and any woody vegetation sit above the regular flood line.

127. On average the fenced and planted margin will be 10 metres wide on each side of the stream, however the margin will vary between two or three metres where stock and vehicle access requires it to 40 or 50 metres where stream meanders or inaccessible areas are not required for other uses. In total 17.25ha of riparian area will be fenced from livestock and planted in native plants.

KAHIKATEA – SWAMP FOREST RESTORATION PLANTING[8]

128. The intention of the 6ha of kahikatea – swamp forest restoration planting is to transform grass, rush and sedgeland dominated areas to kahikatea, pukatea

[8] Refer to Chapter 4, Section 4.6.2 of the ELMP for details of the proposed kahikatea-swamp forest restoration.

and swamp maire forest, with small areas of rimu and matai where ground conditions are not as saturated.

129. The kahikatea - swamp forest restoration area will be in the wetter parts of the Mangapepeke valley and will integrate seamlessly with the riparian planting along the Mangapepeke Stream. This planting, along with the mitigation replacement planting further downstream and the riparian planting along the full length of the valley, will result in the entire Mangapepeke valley being fully planted (except for the new road) in native vegetation (see **Figure 3** for a representative cross section and **Figures 4-7** in **Appendix 1** for a plan view of the likely planting mosaic in the Mangapepeke Valley).

130. The biodiversity offset targets for all valley floor planting are to obtain a near complete cover of indigenous species across the valley (including riparian areas) by year 6 (target 80% canopy cover) and to have kahikatea contribute 65% of the forest canopy by year 35.

131. Initial planting in the more exposed zones will need to consist of hardy, early successional species including manuka, hukihuki, houhere, putaputaweta, kaikomako, wineberry, koromiko, karamu, toetoe and whaririki. The tree species can be inter-planted once the initial shrub and small tree layer is established.

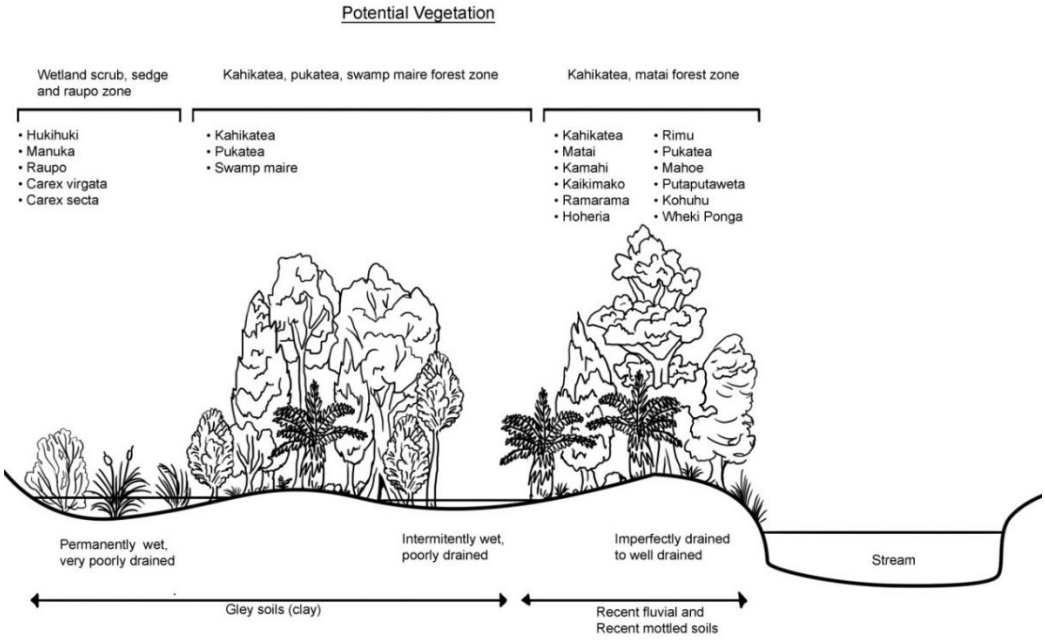


Figure 3: Cross sectional representation of how the Mangapepeke Valley might look once the restoration plantings have matured.

132. While transition to a diverse mature swamp forest will take many decades, the ecological value will begin to improve immediately because of the removal of livestock and the management of pests and weeds.

133. Ultimately the valley will transform into a diverse, high value valley floor kahikatea, pukatea, swamp maire forest, with small areas of hukihuki/ carex sedge-shrublands in the small permanently saturated areas.

134. The design and management of the swamp forest restoration will be supervised by an appropriately qualified restoration ecologist or landscape architect to ensure plant species are matched to the environmental conditions and survival is maximised.

PERFORMANCE STANDARDS AND OUTCOME MONITORING

135. Interim pest monitoring data from rat and possum surveys undertaken within the PMA from November 2017 to January 2018 suggest that there are currently moderately high densities of both. Possum chew card activity ("**CC**I") has ranged from 25% to 30% and rat tracking tunnel activity ("**RTI**") has ranged between 53% and 60% (Baseline Monitoring for Vertebrate Pests – Interim Report (February 2018); Richard Nichol pers comm).

136. Local goat hunting specialists have suggested that current goat densities could be equivalent to around 20 kills/man day[9].

137. The performance targets for effective pest management within the Southern PMA (COPMA Area plus buffer) it 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 these target indices is expected to result in substantial ecological recovery across the PMA and achieve the intended net biodiversity beneficial outcomes. The targets will also serve as performance targets for the pest management contractors employed to deliver the pest management programme.

138. The pest management performance targets within the Southern PMA are:

    (a) Possums – 5% or lower RTC (Residual Trap Catch Index) or 5% or lower CCI (Chew Card Index)

    (b) Rats – 5% or lower RTI (Residual Tracking Tunnel Index).

    (c) Feral goats – less than 1 kill/man day.

    (d) Stoats – no detections.

    (e) Feral pigs – less than 1 kill / man day then no fresh pig sign or pig detections.

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

(f) Farm livestock – zero presence.

139. Pest management performance targets in the Northern PMA are the same as for the Southern PMA except for rats. The target for rats will be 5% RTI immediately following each 1080m operation (ie. 3 yearly).

Pest density performance monitoring

140. Pest density performance monitoring will be undertaken in the COPMA on an annual basis for five years following the commencement of the pest management programme. Thereafter, monitoring will occur every two years until year 10, and then at three year intervals ongoing. However, should the performance target indices for a target species be exceeded in any one year monitoring will be undertaken in the subsequent year for that species and will continue annually until the target indices are met. Where targets are exceeded, annual monitoring for that species will continue for one year following the achievement of performance targets after which monitoring will revert back to every two years if within the first 10 years post construction, or every three years if more than 10 years has passed. Pest management effort within the Core Pest Management Area will increase until the target thresholds are met.

141. Performance monitoring will occur annually in the rest of the PMA until target densities are achieved after which performance monitoring will only occur every three years immediately following a 1080 drop. However, if target densities are not met for any pest species following a 1080 drop ground based pest management effort will be increased until target densities for that species are achieved. Performance monitoring will also continue on an annual basis until the target thresholds are met.

142. Feral pigs will be excluded from pest density performance monitoring once pigs 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 of the other pest species.

Outcome monitoring within the PMA

143. 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.

Birds

144. 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.

145. Bird monitoring will focus on kiwi, robin, fernbird, whitehead, long-tailed cuckoo, kereru, tui, and bellbird. These species are commonly used as biodiversity outcome indicators for pest management programmes.

146. The performance target for birds is set at a 20% increase in relative abundance within 12 years of road construction for all seven forest bird indicator species plus kiwi within the PMA.

147. 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).

148. Outcome monitoring of selected forest birds will occur within the PMA and will be conducted for up to 12 years, at three-yearly intervals, following the onset of integrated pest control. Daytime bird counts will occur at the same bird count stations using the standard five-minute bird count methodology), 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 if and when they disperse from the adjacent Parininihi Reserve.

Vegetation

149. Outcome monitoring for vegetation will focus on measuring the recovery of palatable species within the ungulate browse tier and improvements in canopy condition from a reduction in possum abundance.

150. Vegetation monitoring will be established prior to any control of ungulates and will measure the survival and growth of tagged indicator species (>35cm) within the understorey tier in permanent Recce plots. Indicator species will likely include; tawa, kamahi, mahoe, hangehange, large-leafed coprosma shrubs, pate and pikopiko — species which represent most tiers of the forest structure. The target performance outcome will be 75% of tagged palatable individual plants in the browse tier of the Recce plots showing no sign of animal pest browsing five years after the completion of road construction.

151. In the event that pest density targets are not achieved and/or more than one of the biodiversity outcome monitoring targets (for birds and vegetation) are not met, for reasons associated with the impact of pests or the effects of the road, the pest management programme will be reappraised 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.

152. Variables not associated with the relative effectiveness of the pest management programme or the effects of the road (for example plant or animal disease, or extreme weather events) may contribute to poorer than anticipated recovery of one or more of the monitored biodiversity indicators. Such improvement of the pest management programme will only occur where less than expected monitoring outcomes are likely to be the result of continued animal pest impacts or the direct effects of the Project.

RESTORATION PACKAGE SUMMARY

153. The Restoration Package is comprehensive. It includes intensive pest management in perpetuity over 1085ha, 6ha of kahikatea-swamp forest restoration planting, fencing and planting of 17.25ha of stream margin, 8.38 of mitigation replacement planting, a selection of targeted compensation recommendations, and a range of effects avoidance, minimisation and monitoring actions.

154. The Restoration Package as a whole meets the key principles of offset, with particular mention of the following:

    (a) No net loss of biodiversity. The Project ecology team have set the target of achieving not net loss of biodiversity 10 years following construction and a net gain by 15 years, and documented studies and experience from around New Zealand would suggest that these targets are achievable.

    (b) Long-term outcomes. The Restoration Package provides intensive pest management in perpetuity (or until such time as better pest management techniques are available or unnecessary) provides an enduring assurance that the good work commenced will not be compromised at a later date.

    (c) Ecological equivalence and proximity. The Restoration Package has been tailored to optimise benefits for each of the major aspects of ecology affected by the Project and the close proximity of the proposed restoration to that of the impacts means that there is a reasonable likelihood that the adjacent ecology will benefit from the Restoration Package.

    (d) Connectedness. There will be mutual ecological benefit from linking the proposed restoration area with the Parininihi. Enhanced habitat quality in the PMA will increase the chances of kokako successfully inhabiting this area, and the collective pest management in both areas could benefit the long tailed bat population over both areas.

(e) High likelihood of success. Practices and techniques that have been shown to produce successful ecological outcomes elsewhere in New Zealand have been adopted for this Project, but the most telling evidence that a successful outcome can be expected is apparent in the adjacent Parininihi where 15 years of intensive pest management have produced improvements that are visually obvious and created sufficient to enable kokako to be released and to thrive.

RESPONSE TO SUBMISSIONS AND SECTION 42A REPORT ON MITIGATION, OFFSET AND MONITORING ISSUES

Director-General of Conservation's submission

155. I respond below to ecology mitigation, offset and monitoring issues raised in submissions on the Project by the Director General of the Department of Conservation. Five matters were raised in the submission.

156. DOC's submission, Paragraph 12 (a) states: *Due to the incomplete information provided on the state of biodiversity present within the project site, the information required to develop a biodiversity offset approach is not currently available and it cannot be determined whether no-net loss of biodiversity will be achieved.*

157. As identified in this submission, further baseline monitoring is required to be undertaken in some areas. While substantial further information was provided in the supplementary ecology reports please refer to the specialist ecology evidence of Dr McLennan (birds), Mr Chapman (bats and lizards), Dr Watts (invertebrates) in response to requests for additional baseline monitoring to be undertaken.

158. It is accepted, as stated in my evidence above, that not all aspects of biodiversity can be offset (when using the term in its most strict sense) because it has not been possible to collect sufficient baseline data (due to the limitations of existing survey techniques) to use the Offset Model to determine appropriate levels of offset and subsequently measure outcomes. In recognition of this, the Restoration Package has been enlarged to provide compensation for the aspects of biodiversity that could not be used in the Offset Model.

159. Paragraph 12 (b) states: *The proposed offset lacks transparency allowing for its assessment.* This issue has been discussed at two technical meetings with DOC ecologists and one with New Plymouth District Council ecologists. While earlier versions of the ELMP and initial reports lacked some detail (as that was still in development), comprehensive detail is now provided.

160. Paragraph 12 (c) states: *I endorse the NZ Government Guidance on Good Practice Biodiversity Offsetting as providing appropriate guidance on robust process to follow and request that the guideline be adopted for this project.*

The Guidance on Good Practice Biodiversity Offsetting publication has been used as the cornerstone for our approach to developing a mitigation, offset and compensation package for this Project.

161. Paragraph 12 (d) states: *Incongruences in the location of the offset site between the Ecological Effects – Ecological Mitigation and Offset Report (Volume 3, Technical Report 7h) and its Appendix A: Biodiversity Offset Calculation Report are confusing and render the offset calculations invalid if the offset site differs from that used in the calculations. I consider that this should be clarified and confirmed by the Applicant. The location of the offset site must be reflected in the offset calculations so that quantified loss at the impact site can be compared with anticipated gains at a specific offset site.* There were inconsistencies in both the size and location of the offset areas reported in the technical reports. This occurred for two reasons. Firstly, we deliberately identified a potential offset area that was larger than likely to be needed because there was uncertainty about whether all preferred land would be made available by the landowners. Secondly, it was apparent that an area larger than generated by the Offset Model would likely be required to reverse all residual effects.

162. The offset sites – 250ha of pest management and 6ha of kahikatea/swamp forest planting – are now clearly shown in **Figure 2** above and in the ELMP.

163. Paragraph 12 (e): *To ensure that intended Ecology and Landscape Management Plan (ELMP) outcomes occur, a more robust process be followed than that proposed by the Applicant. This must include independent peer review and comment upon a clearly delineated plan specifically addressing biodiversity offsets, offset design, implementation and monitoring, and provision for adaptive management following certification*. The final ELMP contains a clear plan for mitigation, offset and compensation accompanied by achievable outcome targets that are based on sound science and documented practical experience. The outcome targets are measurable and monitoring methodologies for each are clearly stated. The pest management component of the Restoration Package has a significant responsive management component built into it to enable pest control methods to be varied and new technologies to be incorporated, if any one or more performance targets are not being achieved.

PUBLIC SUBMISSIONS

Forest and Bird.

164. Forest and Bird acknowledge the significant ‘ecological mitigation and offset package’ that has been developed to address the adverse effects of the Project, and agree that enhancement of biodiversity values may be achieved through several of the proposed restoration efforts, such as pest control in perpetuity and exclusion of stock from areas of indigenous vegetation.

However, they conclude that *"residual effects will result in loss of significant indigenous biodiversity if the proposal goes ahead*". They also express their concern about the potential impact of the Project on the habitat of indigenous bats.

165. Since the production of the ecology Technical Reports 7a – 7h, the Restoration Package has been increased substantially with specific consideration of the habitat requirements of long tailed bats, kiwi and forest bird species. With an enlarged PMA of 1085ha I consider Forest and Bird's concerns about effects on bats have been addressed by providing perpetual and intensive pest management over an area that has an improved likelihood of providing population scale benefits to bats (assuming such an outcome is necessary to respond to the effects of the Project), especially when linked to the 1332ha Parininihi where intensive pest management is already undertaken.

166. The creation of 6ha of new kahikatea – swamp forest habitat plus the enlargement of the PMA, including the removal of all ungulates (including livestock) from the entire Mangapepeke Valley, and a commitment to undertake intensive pest control in perpetuity (or until such control efforts are no longer required) should alleviate any concerns Forest and Bird have about there being residual ecological effects.

Ms Lacy

167. Ms Lacy expresses her concern about what will happen to the birds, bats, lizards and freshwater fauna that occupy the Project site, and asks whether the rare birds present in the area will be relocated or destroyed.

168. Tree removal protocols will be implemented to minimise the risk of any bats, birds or lizards being killed when the vegetation along the footprint is cleared. Kiwi with territories that cross the footprint or are close to it may be relocated to adjacent forest areas if they are at risk of harm due to forest clearance, and any lizards observed when trees are felled will be captured and relocated to safe habitat.

RESPONSES TO THE SECTION 42A REPORTS

New Plymouth District Council

169. I respond below to ecology mitigation, offset and monitoring issues raised in submissions on the New Plymouth District Council ("**NPDC"**).

170. In paragraph 302 of the NPDC Section 42A Report ("**Section 42A Report**") concern is expressed that the ELMP implies that substitution of the species of seedlings planted to replace significant trees may occur if suitable planting sites for one or more species cannot be found. This implication is an error and the final ELMP has been changed accordingly. 200 seedlings of the same

species of each of the significant trees that have to be removed will be planted. There are suitable planting sites available within the designation for seedlings of all of the identified significant tree species.

171. Paragraph 302 of the Section 42A Report. An alternative condition relating to the performance measures for the planting of significant seedlings is proposed. I respond to that in paragraphs below.

172. Mr Singers addresses in his evidence the matters raised in paragraph 302 that relate to the definition of significant trees.

173. In paragraph 303 (f) of the Section 42A Report, several matters are raised regarding the proposed mitigation plantings.

    (a) It is suggested that the vegetation proposed for 1:1 mitigation replacement planting includes "*pole-sized rewarewa, kahikatea, and rimu"* and therefore the planting ratio should be 1:2 to account for the time lag required to get the tree species to the size of those that will be removed. In reality, the areas proposed for 1:1 mitigation replacement planting are manuka scrub, manuka succession and treefern scrub which do not contain any more than a very small number (less than 15) of pole sized tree species. The tree fern and manuka vegetation can be re-established to a size and ecological equivalency comparable to the areas being removed in relatively short time (less than 10 years). For this reason, a 1:1 replacement ratio is appropriate.

    (b) The question is also asked how "no net loss" can be achieved with a 1:1 ratio when there is risk of planting failure. The performance measures for all plantings on the Project, proposed in conditions, is that an 80% canopy cover must be achieved by year 6. Achievement of 80% cover across the full mitigation replacement planting area would represent effective replacement of the loss of this vegetation and a suitable measure of achievement of "no net loss".

174. Paragraph 303 (h). Reference is made to Section 3.4 of the ELMP and a statement there that says *"planting will resemble what is removed in the matter of a few years"*. NPDC (Wildlands) consider this to be "*a gross understatement of the time required to replace the lost vegetation. A more likely timeframe is considered to be 100-200 years."* This section of the ELMP states: "*Replanting within the Project footprint, wherever soil conditions and hydrology remain essentially the same as prior to construction, with early successional plant species similar to or the same as those removed. It is expected that these areas of mitigation planting will resemble what is removed in a matter of a few years",* and refers only to the mitigation replacement planting areas referred to above. None of the vegetation types to be replaced by mitigation replacement planting are anywhere near 100 to 200 years old.

175. Paragraph 303 (j). Two separate matters are raised in this paragraph:

(a) NPDC ask for assurance that the riparian planting areas are additional to the mitigation and kahikatea/swamp forest plantings. I can confirm that allocation of area for each type of planting has been determined so that there are no overlaps or double ups (ie. all planting areas are additional). Please refer to Figures 4-7 in **Appendix 1** below. The proposed riparian planting alongside the Mangapepeke Stream has been delineated first and then the remaining area between the riparian planting and the existing bush edge has been allocated to swamp forest or mitigation planting depending on the ground conditions.

(b) Confirmation is requested that "*existing areas of pest control adjacent to the site are not relied upon because the proposal needs to result in ecological gains that are additional and solely attributable to the mitigation package for the project*." The PMA proposed does not require any adjacent areas of pest management to be effective. The PMA has been selected so it is defendable against pest reinvasion and I am confident that the pest density performance targets are achievable through management of the PMA alone. The benefits of pest management to the bat population that inhabits an area substantially greater than the PMA are addressed in more detail in the evidence of Mr Chapman, however, recent published data would suggest that the combined pest management programmes of the Project and the Parininihi may well generate population level recovery that is more beneficial to both land areas than if either programme operated in isolation. The benefits of pest management to the bird population that inhabits an area substantially greater than the PMA are addressed in more detail in the evidence of Dr McLennan.

176. Paragraph 303 (k). Edge effects. As agreed in the technical meetings between the Project Ecologists and the Wildlands ecologists (representing NPDC) the net change in forest edge once the road is constructed has been calculated. There will be a net increase of 3845m of forest edge once the road is constructed and the restoration planting is completed. In my opinion the extent of the ecological effects resulting from this additional new edge will be less than in many forest ecosystems and will be suitably offset by the addition of a 5m margin over and above the AWA area plus the conservative calculation of the AWA. My reasons for stating that the impact of the new edge created will reduced are:

(a) The edge created by the road as it passes down the lower Mangapepeke Valley is an existing area of edge between the forest and grazed valley bottom and the flora and fauna living in this zone are adapted to edge conditions.

(b) The swamp forest and mitigation replacement planting proposed for the Mangapepeke Valley will eliminate a substantial existing edge (the true left of the stream).

(c) The steeper areas of the Mt Messenger forest experience frequent mass slippage which creates new forest edge on a regular basis – it is a natural process to which local flora and fauna have adapted.

177. Paragraph 303 (s). Four separate issues are raised by NPDC about the proposed riparian and stream restoration works:

(a) Concern has been expressed about the lack of alternatives for stream restoration works if landowner negotiations are unsuccessful. At the time of writing this evidence informal agreement has been obtained from landowners to fence and plant all of the 5.5km of stream length required outside of the designation. This required stream margin is on the Mimi River and will run as a contiguous zone from the bush edge on the south western edge of the PMA (adjacent to the new road alignment) south along the river. The rest of the riparian restoration will be undertaken within the designated area on the Mangapepeke.

(b) As raised in the Section 42A Report, the final length of stream required will not be determined until the final detailed design for the road has been completed. Additional riparian margins, linked to those proposed above, are available to accommodate any extra stream length required.

(c) The Section 42A Report requests that any tributaries proposed for restoration do not already have indigenous woody vegetation along their banks. I can confirm that all of the proposed riparian restoration areas are devoid of indigenous woody vegetation.

(d) I agree with the Wildlands submission that pukeko control may be required to protect new riparian plantings. This would be undertaken, if required, as a normal part of post planting maintenance.

178. Paragraph 303 (v). Dr McLennan will respond to the first part of this paragraph that refers to the number of forest bird species to be monitored. In the second part, reference is made to a statement from the Wildlands report: "*the approach to managing outcomes needs to not only be adaptive but also needs to be flexible if it is shown that achieving a particular outcome is not possible. Decisions regarding the adequacy of the adaptive management approach, and any alterations to proposed management tools, approaches or outcomes, should be made by independent experts, based on annual reports on pest control operations and outcome monitoring results."* The need to be able to call on the best expertise is acknowledged and to enable the best options to be considered for the management of the PMA an Ecological Peer Review Panel will be established and will serve to provide guidance to the Transport Agency if performance targets are not met.

179. Paragraph 306. Wildlands consider that the mitigation and offset package may place an "*over-reliance on the pest management plan to address adverse effects that could have been addressed through the restoration of habitats to*

replace areas of vegetation loss, on a like-for-like basis." For reasons that are clearly expressed in my evidence above, intensive pest management in perpetuity will provide significant, diverse and enduring ecological benefits that planting alone could not achieve for many decades. Evidence that pests can be managed to low levels and visible positive ecological recovery will be evident in 10 years or less can be seen in the Parininhi where 15 years of pest management and habitat recovery has been sufficient to enable kōkako to be successfully reintroduced.

180. Paragraph 313. NPDC's Section 42A Report refers to several additional mitigation and offset measures proposed by Wildlands which the Wildlands ecology team believe will address the ecological effects of the Project. I discuss these below:

(a) *Increase the extent of pest management to a minimum of 3000 hectares, additional to areas of existing pest animal control.* I assume this proposed increased in the size of the PMA is to accommodate the findings of O'Donnell et al in their Fiordland study where modelling determined that population level recovery would require a pest management area of 3000ha or greater. This is addressed in Mr Chapman's evidence.

(b) *Plantings to ensure no net loss in area of indigenous vegetation, with a minimum of 1:2 loss to replacement ratio for all scrub/shrubland/forest habitats*. As discussed above, I do not consider this to be necessary.

(c) *Restoration of hillslope forest to offset the loss of 19.85 hectares of hillslope podocarp broadleaved forest (possibly by fencing and retirement from grazing of a much larger area).* Selection of a large pest management area and intensive enduring pest management programme are the primary components of the Restoration Package and pest management has been selected to offset the loss of all of the hillslope podocarp broadleaved forest that will be lost because of the Project.

(d) *Define significant trees as per the Applicant's three point definition, with 200 seedlings of each of these species planted.* Please refer to the evidence and reports of Mr Singers for the criteria used to determine significant trees and a response to this matter.

(e) *Retro-fitting any existing perched or broken culverts along the route to facilitate upstream fish passage.* Mr Hamill has addressed this matter in his evidence.

(f) *Adequate measures to reduce the mortality of kiwi due to vehicle collisions*. Dr McLennan has addressed this issue in his evidence.

181. NPDC (with reference to Wildlands) consider that consent conditions should include a variety of extra requirements (Paragraph 315). I respond below to

those associated with the restoration package, although several have been addressed in my Section 42A Report responses above.

(a) *No net loss of indigenous vegetation on an area basis.* The early successional manuka and tree fern scrub areas are proposed for replanting on an area basis (1 for 1) but all other vegetation loss is offset by pest management because I consider more immediate and comprehensive biodiversity responses will be achieved through pest management.

(b) *Plantings to replace vegetation loss should be 'like for like'.* All proposed plantings (riparian, mitigation replacement and kahikatea-swamp forest plantings) are like-for-like.

(c) *Mitigation planting should only occur where it would result in an increase in the extent of indigenous vegetation; not in areas with existing or regenerating vegetation.* All mitigation planting will be into areas where no existing or regenerating vegetation occurs. To fully plant the Mangapepeke Valley small unvegetated areas amongst remnant pole kahikatea stands will need to be planted but no areas retaining a cover of native vegetation after construction will be planted as mitigation. There is sufficient area in the Mangapepeke Valley (with some reserve area in the upper Mimi) to accommodate the required riparian, swamp and mitigation plantings.

(d) *A pest management plan shall achieve measurable biodiversity gains, with the area to be determined by the area requirements of the indigenous fauna that is adversely affected by the route.* This approach has been how the proposed 1085ha PMA and its location has been determined.

(e) *The core area of intensive pest control should include all introduced mammals (including mice), pest plants and wasps.* Pest plant control is proposed in the ELMP. Please refer to the evidence of Dr Watts for discussion on the management of wasps proposed for the Project. Technology does not currently exist to successfully control mice to low densities in the absence of rats on steep forested terrain of the nature found at Mt Messenger. Attempts made to eradicate or control mice to low levels at pest proof fenced reserves such as Maungatautari have not been successful, and the terrain at the proposed PMA is even more challenging than Maungatautari.

(f) *All pre-construction, during-construction and post-construction monitoring (should be conditioned). This is particularly important for:*

(i) *Bats, avifauna and lizards.* Please refer to the evidence of Mr Chapman and Dr McLennan.

(ii) *Pre-construction survey and post-construction monitoring of translocated gahnia species (habitat for forest ringlet butterfly) and epiphytes.* Please refer to the evidence of Dr Watts. Note that it is considered by the experts that forest ringlet butterfly is unlikely to be present in the Project area and so the need to salvage Gahnia is diminished.

(iii) *Pre-construction baseline survey and post-construction monitoring of forest condition (to ensure vegetation condition improvements occur as the mitigation package intends, and if not, requiring that an alternative approach to mitigating effects is implemented).* Performance monitoring of palatable species regeneration and forest canopy recovery is proposed.

(iv) *Measurable performance targets should apply to every component of the mitigation package. i.e., "80% canopy cover 10 years following planting in the zones where trees and shrubs are planted; Kahikatea forming 65% of the tree canopy (ie. 65% of the area where trees are planted, excluding those areas where trees are not planted) by year 35"; "20% increase in relative abundance for tui, bellbird, kereru, and kiwi within 12 years"; "For each significant tree felled, 200 saplings of the same species are present within areas of indigenous plantings 10 years following planting and 90% of these saplings are in good health, and either two metres tall, or emergent above the height of surrounding competing vegetation."* Performance monitoring, with measureable targets, is proposed for all plantings, forest birds, and vegetation (as described in my evidence and the evidence of Mr Singers, Dr McLellan, Mr Chapman, Mr Hamill and Dr Watts).

(v) *Timing for planting and establishment of planting, specifying duration of maintenance required. For example, restoration planting for significant trees felled could be deemed complete when these plantings reach an average height of 2m, or when 'canopy closure' has been completed. (Canopy closure could be defined in the designation condition as 85% cover by indigenous species.)* Details about the timing of planting and the duration and nature of maintenance can be found in the ELMP along with planting performance measures.

(vi) *Requirement for the regular compilation of pest management and outcome monitoring reports (e.g. annual), which document the results of outcome monitoring, and proposes alterations as required to achieve performance measures.* All performance parameters that will be monitored will be reported on.

Taranaki Regional Council ("TRC")

182. Paragraph 163 in the TRC Section 42A report. TRC express their concerns that the offset and mitigation package will occur on land not owned or controlled by The Transport Agency and are reliant on landowner approval for its completion. Mr Roan has addressed this issue in his evidence. Informal agreement has been obtained with landowners for the 5.5km of stream length required for riparian fencing and planting outside the designation (as set out in my evidence above). Draft legal agreements are currently being developed with these landowners to ensure the fenced and planted riparian margins remain in that state in perpetuity. A significant part of the proposed PMA is on public conservation land and land owned by Ngāti Tama. Discussions with DOC and Ngāti Tama about the management of pests on their land are ongoing.

183. Paragraph 183. TRC agree with the Wildlands comments that *"it is important that any tributaries earmarked for restoration purposes do not already have indigenous woody vegetation along their riparian margins, ie. there needs to be a clear benefit as a result of restoration works."* As stated above, none of the riparian areas selected for fencing and planting have established areas of indigenous vegetation along the margins.

184. Paragraph 188 and 215. TRC restate their concerns expressed in paragraph 163 that offsetting, including planting, will occur on land not under the control of the Transport Agency. Please refer to my responses above.

References

Baber, M.; McLennan, J. A. 2017: Mt Messenger Bypass: Assessment of Ecological Effects - Avifauna. Technical Report 7e, October 2017. Tonkin and Taylor, Hamilton. 46 pp.

Maseyk, F., Maron, M., Seaton, R. and Dutson, G. 2015. A biodiversity offsets accounting model for New Zealand. March 2015. The Catalyst Group 1-67.

O'Donnell, C., Pryde, M., Dam-Bates, P. and Elliot, G. 2017. Controlling invasive predators enhances the long-term survival of endangered New Zealand long-tailed bats (*Chalinolobus tuberculatus*): Implications for conservation of bats on oceanic islands. Department of Conservation 156-167.

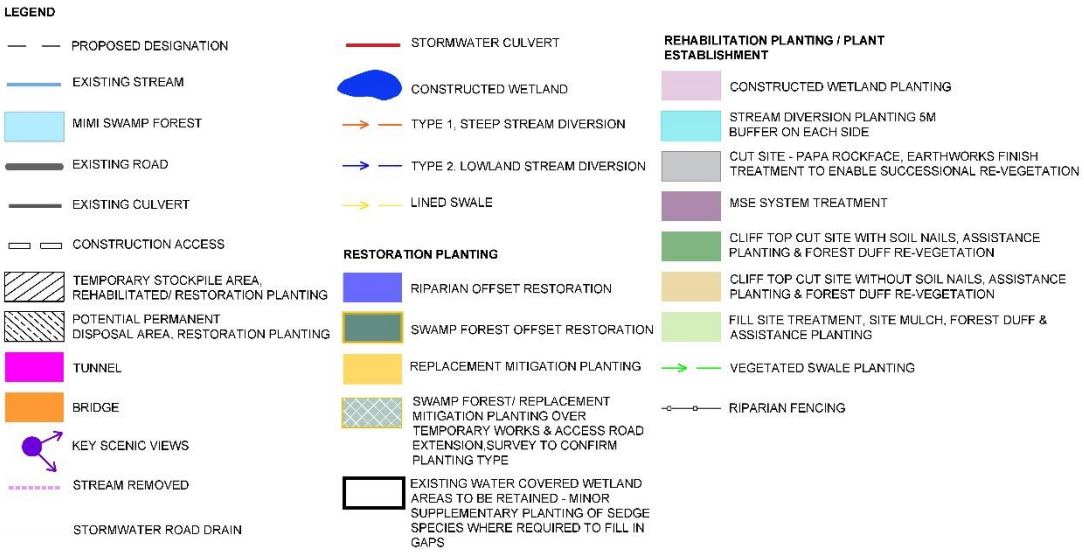
Pryde, M.A., Lettink, M., O'Donnell, C.F.J. 2006. Survivorship in two populations of long-tailed bats (*Chalinolobus tuberculatus*) in New Zealand. NZ Journal of Zoology, 33, 85-95.

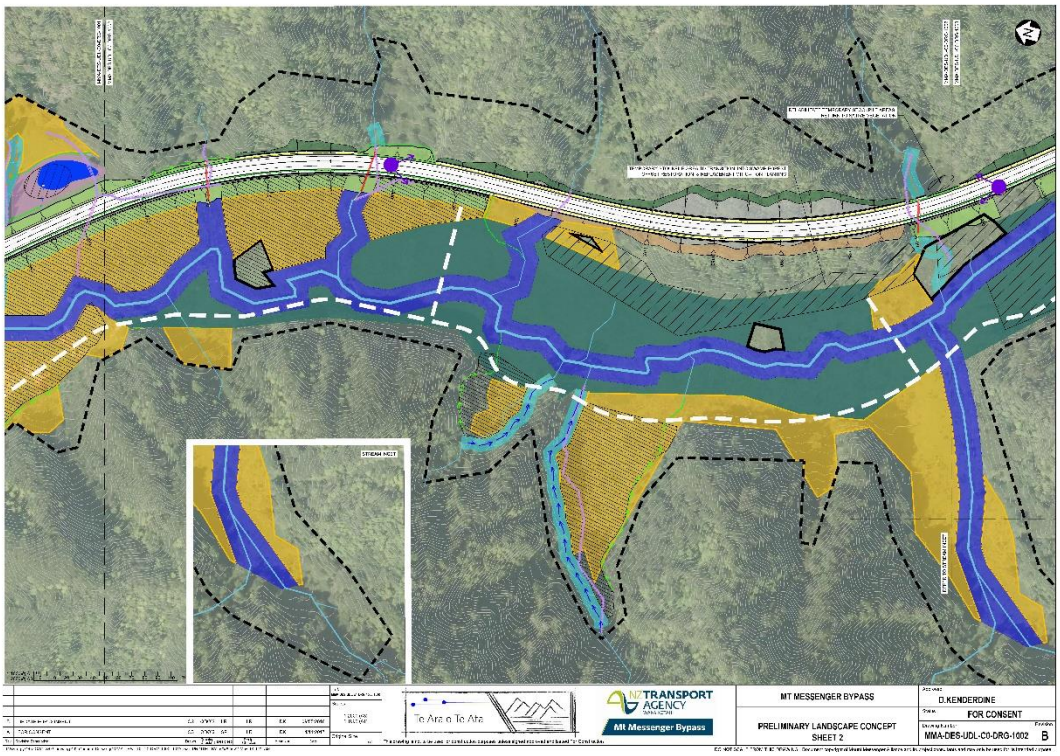
Roger MacGibbon

25 May 2018

APPENDIX 1: PLANS SHOWING THE MOSAIC OF PROPOSED PLANTING AREAS ALONG THE MANGAPEPEKE VALLEY

Figures 4 -7 (plus legend)




STREAM MOUTH
Te Ara o Te Ata
NZ TRANSPORT AGENCY
Mt Messenger Bypass
MT MESSENGER BYPASS
PRELIMINARY LANDSCAPE CONCEPT SHEET 2
D.KENDERDINE
FOR CONSENT
MMA-DES-JDL-C0-DRG-1002
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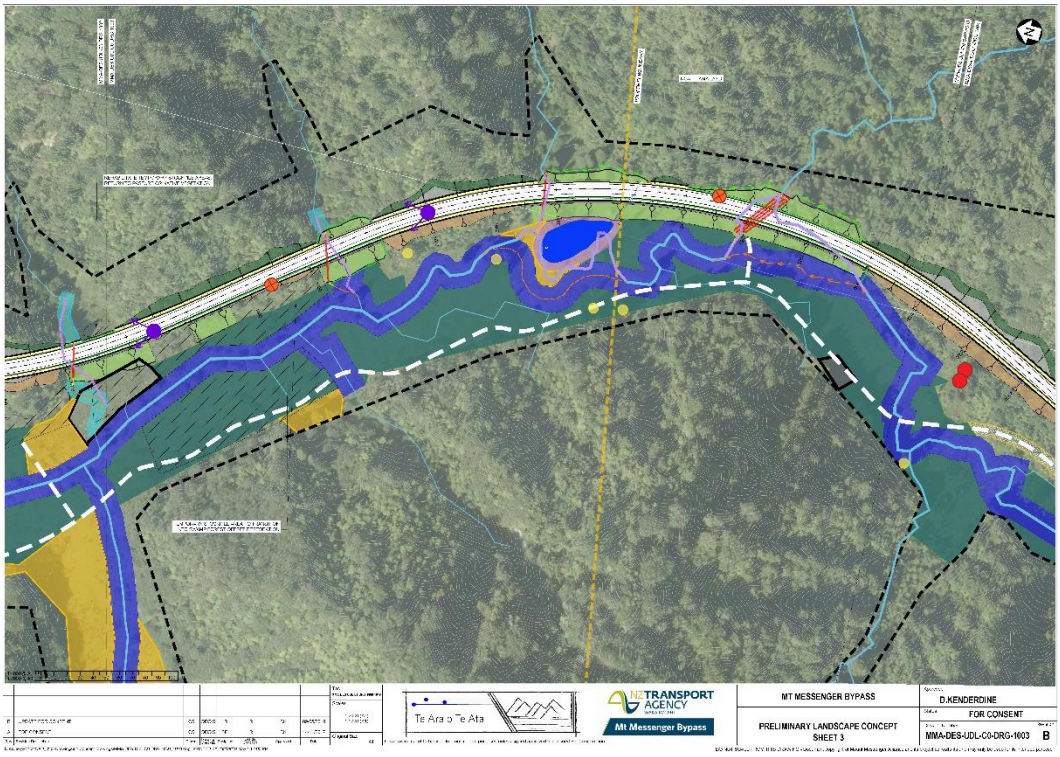
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NZ TRANSPORT AGENCY
Mt Messenger Bypass
MT MESSENGER BYPASS
PRELIMINARY LANDSCAPE CONCEPT SHEET 3
D.KENDERDINE
FOR CONSENT
MMA-DES-JDL-C0-DRG-1003
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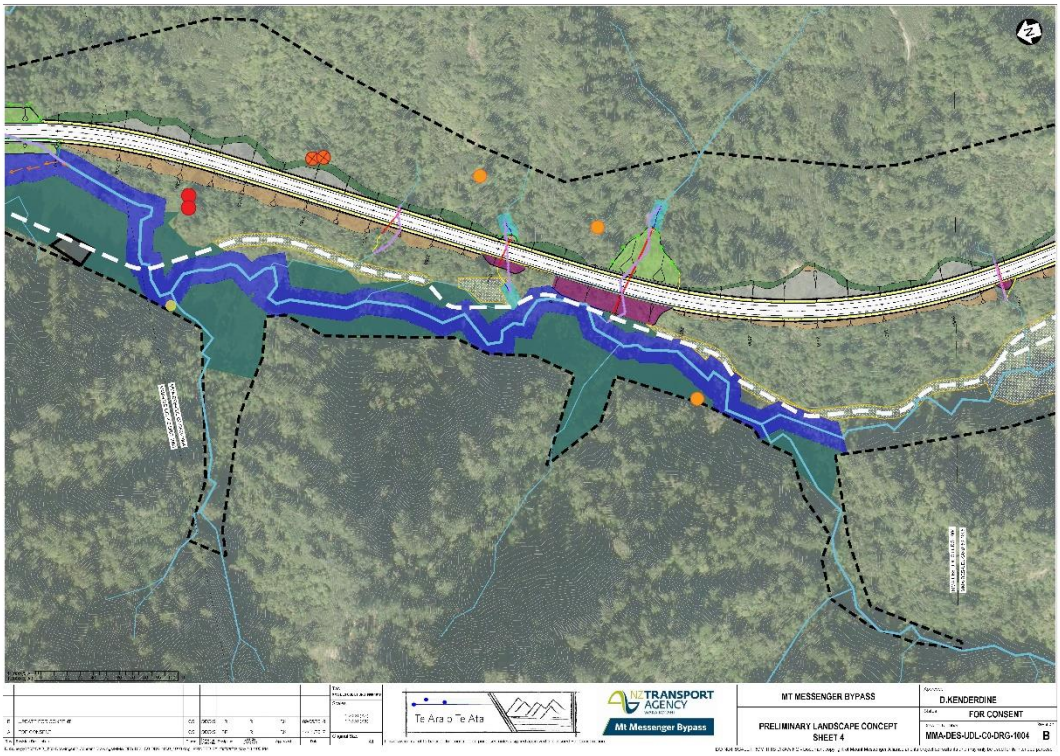
Te Ara o Te Ata
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PRELIMINARY LANDSCAPE CONCEPT
SHEET 4
FOR CONSENT
MMA-DES-JDL-CO-DRG-1004
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