Assessment of Ecological Effects - Avifauna

December 2017

Mt Messenger Alliance and Enviroservices Limited

Technical Report 7e

NZ TRANSPORT AGENCY WAKA KOTAHI

Mt Messenger Bypass

New Zealand Government

Quality Assurance Statement			
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Revision schedule		
Rev. Number	**Date**	**Description**
0	December 2017	Final for lodgement

ISBN: 978-1-98-851272-3

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Glossary

Term	Meaning
AEE	Assessment of Effects on the Environment Report
AWA	Additional works area, accounting for additional habitat loss for construction access, laydown areas and temporary stormwater drains.
DOC	Department of Conservation
Eastern Ngāti Tama forest block	The area of land east of existing SH3, which encompasses the Project footprint, and is approximately 3,098 ha in size
EcIA guidelines	Ecological Impact Assessment guidelines
EIANZ	Environment Institute of Australia and New Zealand
ELMP	Ecological and Landscape Management Plan
North Taranaki Ecological District	Part of the Taranaki Ecological Region, encompasses approximately 259,750ha, including the Project footprint
Parininihi	The area spanning the Waipingao Stream catchment located to the west of existing SH3, approximately 1,332 ha in size
Project	The Mt Messenger Bypass project
Project footprint	The Project footprint includes the road footprint (i.e. the road and its anticipated batters and cuts, spoil disposal sites, haul roads and stormwater ponds), and includes the Additional Works Area (AWA) and 5 m edge effects parcel.
RMA	Resource Management Act 1991 and amendments
RTC	Residual trap catch
SH3	State Highway 3
Transport Agency	New Zealand Transport Agency
TRC	Taranaki Regional Council
Wider Project area	An area approximately 4,430 ha in size which encompasses Parininihi and the Ngāti Tama Eastern forest block, and includes the Project footprint.

Executive Summary

This report forms part of a suite of technical reports prepared for the NZ Transport Agency's Mt Messenger Bypass project (the Project), which includes the development of a new 6km section of SH3, to bypass the existing highway at Mt Messenger, north of New Plymouth.

The overarching ecological aim for the Project is to ensure no net loss of biodiversity values, or to achieve a net benefit of biodiversity values, within the medium term.

To assess the ecological effects of the Project on avifauna, this report:

a Identifies and describes values of avifauna in the Project footprint and wider Project area;

b Describes the potential effects of the Project on avifauna rising from construction, operation and maintenance; and

c Recommends measures to avoid, remedy or mitigate potential adverse effects.

Including vegetation loss associated with construction, the Project footprint will result in the loss of a total of 44.4ha which is indigenous dominant or mixed exotic/ indigenous dominant. Within this area 19.466ha of primary vegetation communities are present, and 13.826 and 11.117ha of secondary scrub/forest and rushland, sedgeland mosaic respectively. The forest to the west of Mt Messenger (1,332ha), known as Parininihi and owned by Ngāti Tama, extends continuously from Mt Messenger to the west coast. The forest to the east of Mt Messenger and SH3 (2,828ha) is also owned partly by Ngāti Tama, with the remainder conservation estate, administered by the Department of Conservation.

Avifauna characteristics and values within the Project Area were assessed by reviewing existing information and data, and by undertaking field surveys in parts of it. The assessment of effects on avifauna values follows Ecological Impact Assessment (EcIA) guidelines developed by the Environment Institute of Australia and New Zealand. A 'Level of Effect' has been determined for each species, based on an assessment of their 'Ecological Value' and the extent to which they were likely to be affected ('Magnitude of Effect") by the proposed works. The input parameters for each species were derived from published information on threat rankings, from professional judgements on the role they play in native ecosystems, and from known information on breeding behaviour, social systems, survival rates, and susceptibility to predation from introduced mammals.

A total of 36 diurnal and two nocturnal bird species were recorded during the surveys in the Project Area. Twenty-three of these species are indigenous, nine of which are currently listed as 'At Risk' (Robertson et al. 2016), including fernbird (*Bowdleria punctata*), spotless crake (*Porzana tabuensis*, New Zealand falcon (*Falco novaeseelandiae)*, North Island brown kiwi (*Apteryx mantelli)*, North Island robin (*Petroica longipes*), long-tailed cuckoo (*Eudynamys taitensis*), whitehead (*Mohoua albicilla*), pipit (*Anthus novaeseelandiae*) and black shag (*Phalacrocorax carbo*). Additionally, three nationally 'Threatened' or 'At Risk' species (Australasian bittern (*Botaurus poiciloptilus*), kākā (*Nestor meridionalis*), and rifleman (*Acanthisitta chloris*) were not detected in surveys but are known to be present in the Taranaki region and possibly the wider Project area.

Our assessment shows the bird community in the wider Project area is comparable with those in large patches of forest elsewhere in the Taranaki region and in the lower North Island. The bird community is considered to be moderately rich by regional and national standards, in terms of the number of threatened and non-threatened species known to be present.

In the absence of efforts to address adverse effects, the project would affect avifauna adversely, both within and near the footprint. The three main potential effects identified in this report are loss and/or degradation of up to ca. 33ha of indigenous and mixed exotic/indigenous forest habitat, habitat severance, and the possibility of direct harm to individual birds associated with road construction and operation.

Potential effects were considered on North Island brown kiwi, North Island robin and whitehead were 'High' without mitigation. These three species have 'High' Ecological Value because they are threatened nationally (current status is 'At Risk'). The Magnitude of Effect on kiwi was considered 'High' due the loss of 44.4ha of habitat (approximately 1% of available indigenous habitat in the wider project area); potential effects associated with habitat severance, and potential effects associated with road construction and ongoing operation. In the absence of mitigation, the 'Magnitude of Effect' on North Island robin and whitehead was considered 'Moderate' due primarily to habitat loss but also because of the potential for harm to eggs and chicks during vegetation clearance.

Potential effects were considered on Tūī (*Prosthemadera novaeseelandiae*), kererū (*Hemiphaga novaeseelandiae*) and bellbird (*Anthornis melanura*) to be 'Moderate'. Although these species do not have a threat ranking, they range widely and provide critical ecosystem services (pollination and seed dispersal) over large areas. The local loss of these species from the footprint could therefore potentially have effects beyond the footprint boundaries. In the absence of mitigation, the 'Magnitude of Effect' on these species was considered 'Moderate' because of habitat loss and the potential harm resulting from vegetation clearance during the breeding season.

For all other bird species, except bittern, potential effects were considered to be 'Low' or 'Very Low', either because the they are numerous and widespread, or rare and unlikely to be present within the footprint area. Bittern was given a "Moderate Effect" because of its high threat status (Nationally Critical) but low probability of occurrence within the Project Area.

Measures to avoid, remedy, mitigate and offset potential effects on 'at risk' avifauna are detailed in the report. They include selection and optimisation of an alignment route that minimises adverse effects on avifauna; an intensive kiwi management and monitoring programme to protect individuals living near or alongside the footprint area; and long term pest management coupled with restoration planting and habitat enhancement in a 560ha forested offset area to the east of the Project footprint. The pest management programme will increase the populations of most native birds in the offset area, by increasing survival rates and/or breeding success. It will fully offset the residual effects on avifauna resulting from the permanent loss of 44.4ha of habitat. Similarly, the restoration plantings and habitat enhancement will, in time, create habitat, improve ecological connectivity and reduce edge effects, benefiting most forest and wetland bird species affected by the Project.

1 Introduction

1.1 Purpose and scope of this report

This report forms part of a suite of technical reports prepared for the NZ Transport Agency's Mt Messenger Bypass project (the Project). Its purpose is to inform the Assessment of Effects on the Environment Report (AEE) and to support the resource consent applications and Notice of Requirement to alter the existing State Highway designation, which are required to enable the Project to proceed.

This report assesses the ecological effects on avifauna of the Project as shown on the Project Drawings (AEE Volume 2: Drawing Set).

To assess the ecological effects of the Project on avifauna this report will:

1. Identify and describe avifauna activity and habitat values in the Project footprint (which is defined for the purposes of this assessment of effects on avifauna in Section 2.3.2 below) and the wider Project area (Section 3);
2. Describe the potential effects of the Project on avifauna arising from construction, operation and maintenance (Section 4); and
3. Recommend measures to avoid, remedy or mitigate potential adverse effects.

1.2 Project description

The Project involves the construction and ongoing operation of a new section of State Highway 3 (SH3), generally between Uruti and Ahititi to the north of New Plymouth (Figure 1.1). This new section of SH3 will bypass the existing steep, narrow and winding section of highway at Mt Messenger. The Project comprises a new section of two lane highway, approximately 6 km in length, located to the east of the existing SH3 alignment (Figure 1.1 and Figure 1.2).

The primary objectives of the Project are to enhance the safety, resilience and journey time reliability of travel on SH 3 and contribute to enhanced local and regional economic growth and productivity for people and freight.

A full description of the Project including its design, construction and operation is provided in the AEE (Volume 1) and accompanying Drawing Set (Volume 2).

Figure 1.1 – Location of the Project in the Taranaki Region

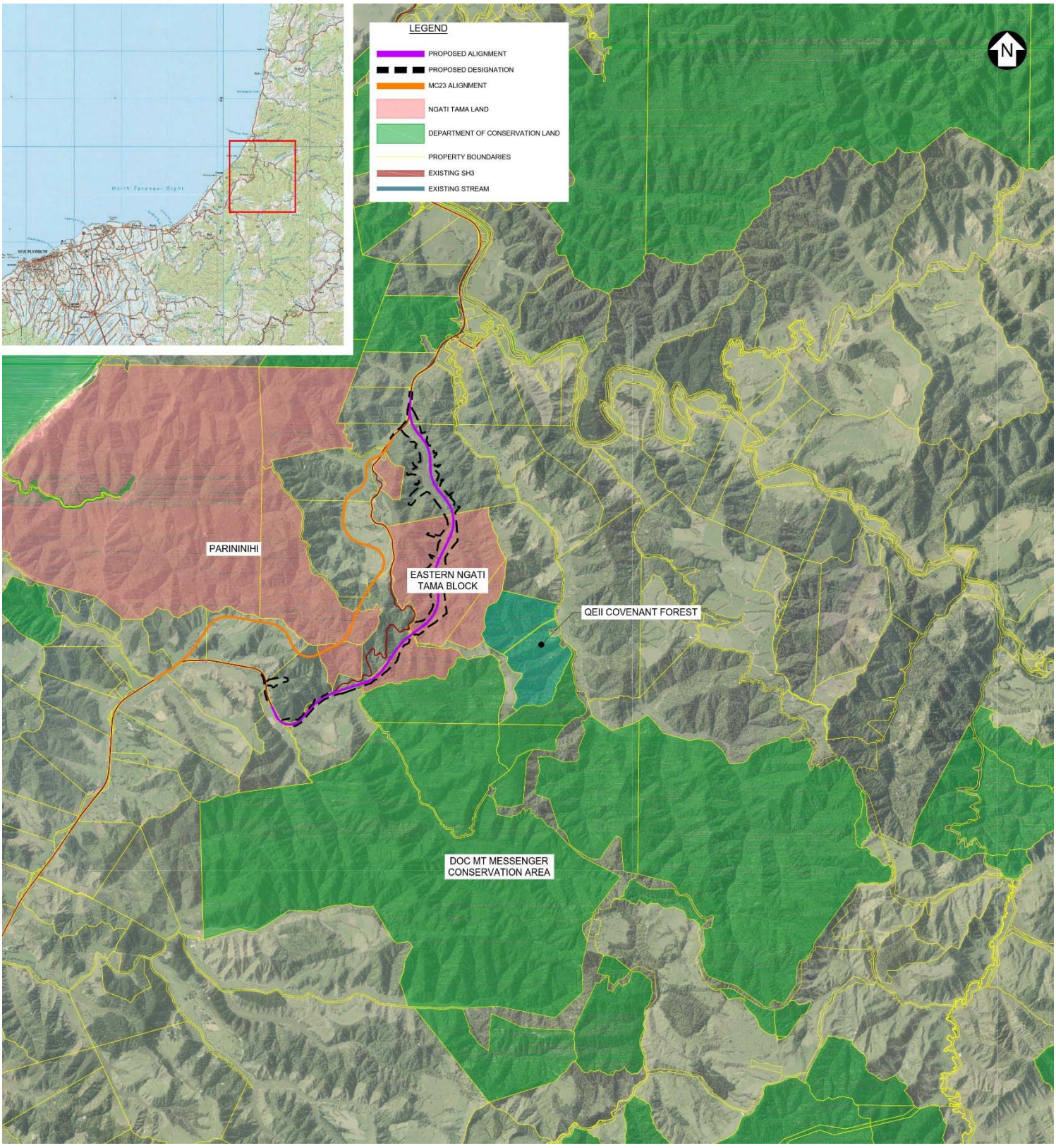

Figure 1.2 – The wider Project area, showing Parininihi and the previous proposed MC23 alignment to the west of the existing SH3, and the Project footprint, Eastern Ngati Tama Block to the east, with the Mimi River to the south and Mangapepeke Stream towards the n

1.3 Ecological aim for the Project

The overarching ecological aim for the Project is to ensure no net loss of biodiversity values (including avifauna), or to achieve a net benefit of biodiversity values, within the medium term.

The ecologists engaged to provide advice and assessments in respect of the Project have been closely involved in recommending measures, including design features, to achieve this aim.

The ecological aim for the Project will ultimately be achieved through a range of measures to avoid, remedy or mitigate effects on ecological values, including:

- A robust and transparent understanding of effects through detailed desktop and field assessments, as well as inputs from key stakeholders including Ngāti Tama, the Department of Conservation and New Plymouth District Council;
- Demonstrable efforts to avoid, remedy or mitigate potential adverse effects, through:
- The selection of a route option that avoids the generally higher ecological value land to the west of the existing SH3;
- The use of structures (i.e. a tunnel and bridge) to minimise habitat loss and severance;
- Within the proposed route, alignment optimisations through changes to design and construction methodologies that produce the best ecological outcomes (e.g. avoidance of wetlands);
- Monitoring programmes developed to minimise the potential for vulnerable species being harmed during road construction (e.g. kiwi);
- Salvaging and relocation of important biodiversity values (e.g. lizards, large felled trees); and
- The establishment and operation of a long-term pest management programme to mitigate for residual adverse effects on indigenous biodiversity values.

These measures are discussed in more detail, in the context of this avifauna assessment, in Section 4 of this report.

1.4 Background to the ecological assessment of the Project

In 2016, through the earlier stages of the Project, consideration of options for the Project focused on the land located to the west of SH3, known as Parininihi (Figure 1.2). As a consequence, much of the initial fieldwork (until mid-2017) was focused on assessing ecological values to the west of SH3, along the previously proposed 'MC23' alignment (Appendix A:, Figure 1). Nonetheless, much of the information gained from the initial surveys is relevant to this assessment because both routes pass through broadly similar forest types and the distance between the two routes is small (<5km) relative to the movements of most forest birds.

Where possible, within seasonal survey constraints, data have been gathered along the Project footprint during the 2017 autumn and winter periods to augment this earlier survey information obtained to the west, and to inform the assessment of the likely nature and

scale of effects of the Project. Importantly, the detailed vegetation mapping that has been undertaken for the Project footprint (as set out in the Assessment of Ecological Effects – Vegetation (Technical Report 7a, Volume 3 of the AEE)) provides a robust baseline habitat assessment for predicting the fauna species that are likely to be present.

It is noted that the land to the west of SH3 has had the benefit of some 20 years of intensive pest management. In addition, large parts of the Project footprint have been used for pastoral farming or have otherwise been subject to browsing by stock. Accordingly, the biodiversity values associated with Parininihi are recognised as being higher than those of the Project footprint.

In the absence of detailed baseline fauna surveys undertaken during the optimal season within the Project footprint, it has been conservatively assumed that species recorded west of SH3 are also present in similar habitats to the east of SH3. While some further survey work is to be undertaken to help refine mitigation options and provide baseline measurements for monitoring programmes, the data obtained to date are sufficient for assessing the likely effects of the Project on birds within and near the Project footprint.

1.5 The wider Project area

The Project is situated in the North Taranaki Ecological District[1] (Figure 1.3). The Ecological District includes a moderately diverse range of habitats, from stream flats and surrounding high productivity farmland to less developed steep hill country, through to high-diversity indigenous forest on hill country. The forest often occupies steep hillslopes with sparsely vegetated bluffs as well as a series densely vegetated interconnected ridge systems. 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 novae-zelandiae*) and swamp maire (*Syzigium maire*) forest and associated wetlands in valley floor areas.

[1] http://www.doc.govt.nz/Documents/science-and-technical/Ecoregions1.pdf

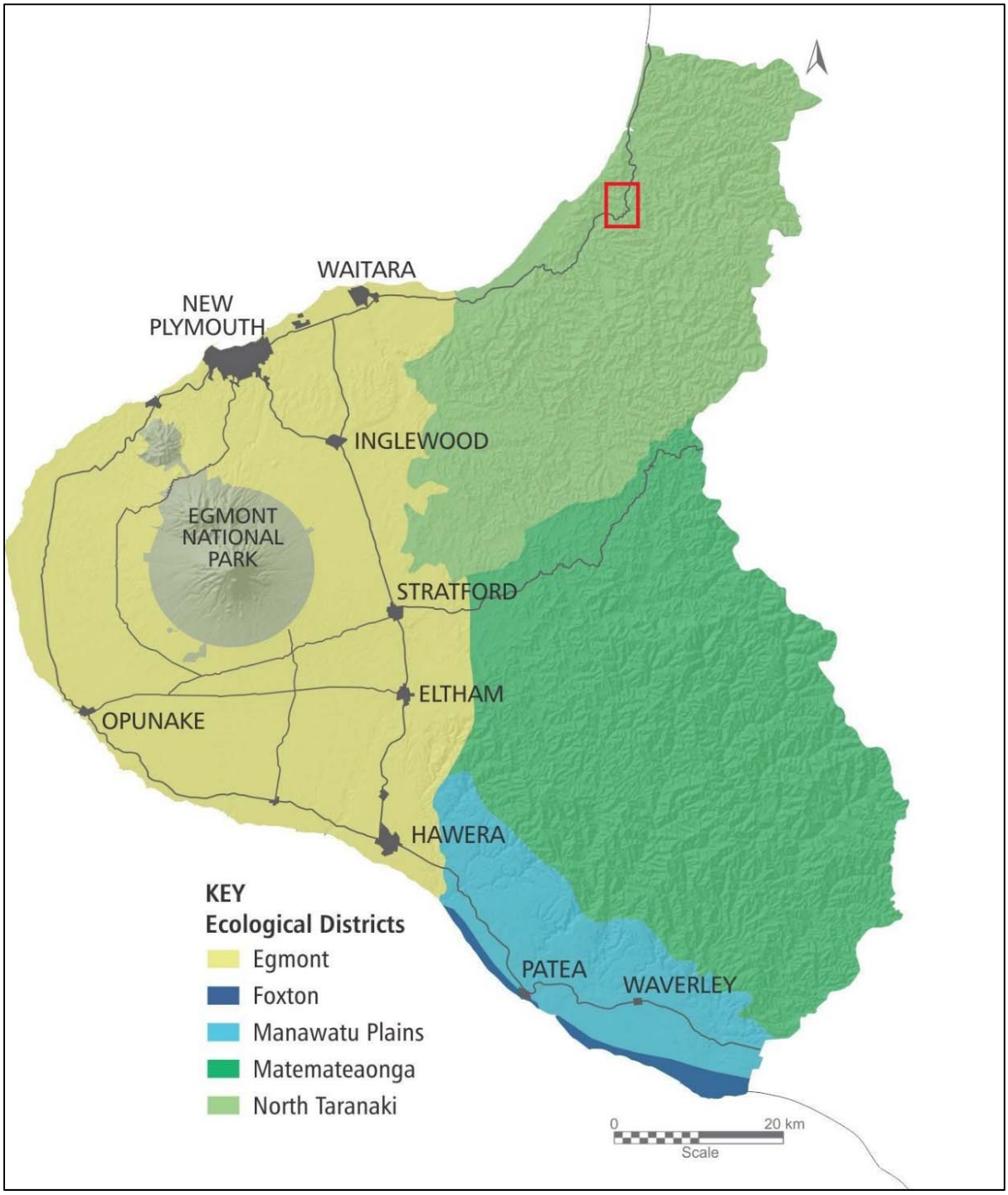

Figure 1.3 – Taranaki Ecological Districts (Taranaki Regional Council, 2017)

The wider Project Area (Figure 1.2), within which the Project footprint is located, includes farmland and approximately 4,430ha of predominately indigenous forest. The indigenous forest includes:

- a contiguous area of indigenous forest (1,332ha) owned by Ngāti Tama that is located to the immediate west of Mt Messenger known as Parininihi (see Section 1.5.1); and

- a contiguous forest (3,098ha) immediately adjacent to Mt Messenger and to the east of SH3 (see Section 1.5.2). This area is referred to as the Eastern Ngāti Tama forest block (but also includes land owned by the Department of Conservation and private landowners including a QEII covenant of 109ha).

1.5.1 Parininihi

Parininihi, previously known as "Whitecliffs Conservation Area" is a large tract (1,332 ha) of mainly primary forest centred on the Waipingao Stream catchment (Appendix A:, Figure 2). This area is classified as "Rimu tawa forest" within the New Zealand Forest Service class map (NZFSMS6). The area encompasses a rare continuous forest sequence through coastal, semi-coastal and lowland bioclimatic zones. As such, the area is regarded as being ecologically significant, and has been described as "the best example of primary coastal hardwood-podocarp forest on the west coast of the North Island" by eminent forest ecologist John Nicholls (Bayfield et al. 1991).

Ecological management of Parininihi was started in the early 1990s by the Department of Conservation, and involved possum and goat pest control activities. Since the return of this land to Ngāti Tama in 2003, management of these pests has continued, and control of rodents, mustelids and feral cats has also occurred. Consequently, the health and ecological integrity of the area is now improving, with browse-sensitive plants regenerating and various predation-sensitive birds increasing in abundance.

Parininihi (and all land to the west of the existing SH3) is being avoided by the Project footprint, following the route selection process carried out in 2017.

1.5.2 Eastern Ngāti Tama forest block

The Ngāti Tama land to the east of the existing SH3 (Figure 1.2) primarily comprises forest, with some pasture farmland. The dominant forest to the east of the existing SH3 corridor is approximately 3,098 ha (Figure 1.2) and would have originally been very similar forest type to the western part of Parininihi; however, it has not had consistent pest management. 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*).

Within the Mangapepeke Stream catchment to the east of existing SH3, vegetation communities are more modified and have been affected by stock grazing, fire and logging. Of greatest ecological significance in this area is the hydrologically intact swamp forest and non-forest wetland areas in the valley floor of the northern Mimi River catchment (Appendix A, Figure 2), which offers potential habitat for various threatened wetland birds. 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.

2 Assessment methods

Avifauna characteristics and values within the wider Project area were assessed by reviewing existing information and data, and by undertaking field surveys along and near the previously proposed MC23 alignment (Appendix A, Figure 1). This report broadly follows Ecological Impact Assessment (EcIA) guidelines developed by the Environment Institute of Australia and New Zealand (EIANZ 2015). As described in Section 2.3, ornithological professional judgement and expertise have also been applied in the assessment process to reflect good practice.

2.1 Desktop review

The desktop review focused on the following websites, publications and reports:

- New Zealand Birds Online (www.nzbirdsonline.org.nz);
- Opus (2017). Mount Messenger Bypass Investigation. Bird baseline Survey and Preliminary Assessment of Effects. New Zealand Transport Agency;
- Bayfield et al. (1991) North Taranaki Ecological District: Survey report for the Protected Natural Areas Programme;
- Robertson et al. (2016). Conservation status of New Zealand Birds (2016);
- Robertson, C.J.R. et al. (2007). Atlas of bird distribution in New Zealand;
- Tiaki Te Mauri O Parininihi Trust (2017). Application to the Department of Conservation for the kōkako translocation (May 2017 – October 2022) to Parininihi; and
- Flux, I.A. (2015). Parininihi: an assessment of habitat suitability for North Island Kokako, May 2015. Internal Report for Tiaki Te Mauri O Parininihi Trust.

Additional information was also obtained through discussions with:

- Ngāti Tama (Conrad O'Caroll, Ngāti Tama Trust); and
- Department of Conservation (Dr Laurence Barea, Avifauna/Biodiversity offsets specialist).

2.2 Avifauna field surveys

As described in Section 1.5, baseline bird surveys were undertaken by Opus (2017) in and near the MC23 alignment in the Parininihi area, west of SH3 (Appendix A, Figure 3). These surveys comprised:

- Spring survey of birds of pastoral farmland including river and stream environments;
- Summer survey of forest birds; and
- Kiwi survey, including surveys undertaken in spring and summer.

2.2.1 Spring survey of birds of farmland and stream environments

Eighteen bird count stations were established along the northern sections of the MC23 alignment on 17th and 18th October 2016 (Appendix A: Figure 3; Appendix B: Photograph

A). Stations were a minimum of 200 m apart and were monitored once each using standard bird five-minute bird count methods (after Dawson and Bull, 1975). The northern area, hereafter referred to as 'Mt Messenger North', comprised farmland occupying a tributary catchment of the Tongaporutu River. This area included 10 stations on flat ground near a small stream flowing south to north through fertile alluvial flats. The remaining eight stations in this catchment were located adjacent to the intact forest of Parininihi. These stations occupied moderate to steep farmland hill-slopes further up the catchment. Intact indigenous forest occupies the hill-country on both sides of this survey area.

Eighteen bird count stations were also established in the southern section of the MC23 alignment, and referred to as 'Mt Messenger South' (Appendix A: Figure 3 and Appendix B: Photograph B). These stations occupied river-flat or moderately sloping hill country in the upper reaches of the Mimi catchment. Parininihi forms the northern backdrop to this survey area, while farmland extends to the east and south.

Environmental parameters measured at each site included surrounding vegetation, weather and listening conditions (sunshine, temperature, rainfall, wind and any other noise interference). Data gathered in the field were entered into an Excel spreadsheet for analysis.

2.2.2 Summer survey of forest birds along and around MC23

Seventeen bird monitoring stations were established within the Parininihi area along the MC23 alignment, and five-minute bird counts were undertaken over three days by two experienced observers on 8-10 February 2017 (Appendix A: Figure 3). Distance sampling was incorporated into the design, with birds assigned to one of three classes (0-20m, 20-50m and 50-200m) according to the radial distance from the listening station at which they were first heard or seen. This sampling method will allow more quantitative information to be derived from the data in the future if necessary.

Stations were placed at a minimum of 200m apart (with one exception where stations were on either side of a high point). Environmental information was noted as for the farmland counts.

2.2.3 North Island brown kiwi survey

Kiwi monitoring was undertaken at seven sites, all but one of these falling within Parininihi. Listening sites were selected to optimise listener coverage over the MC23 alignment area, so were generally on ridge crests, overlooking broad catchments (Appendix A: Figure 4). Three-hour call-count surveys were undertaken at two different sites on 18-19 October 2016 by one observer, while two-hour surveys were undertaken at five sites by two observers between 6-9 February 2017. Listening commenced 45 minutes after sunset.

Call rates of kiwi vary seasonally, at different times of night, and between individuals (Colbourne and Digby, 2016) and therefore do not provide accurate measures of kiwi abundance. Call counts do, however, provide a quick and easy way of establishing whether kiwi are present in an area. They also provide useful information on the location of adults and their reproductive status (alone or paired). Over time, they also indicate the general whereabouts of nests, since incubating males generally call when they emerge from nests.

Environmental variables measured included degree of darkness, wind, noise and precipitation (after Robertson and Colbourne, 2003).

2.3 Assessment of effects methodology

Our assessment of ecological effects broadly follows the EcIA guidelines (EIANZ, 2015), with some adaptation, including to allow for the expert opinion of avifauna specialists to be applied within the context of the EIANZ framework.[2] This approach is consistent with the purpose of the EcIA guidelines, which are intended to provide guidance on good practice without being prescriptive or binding.

Perhaps most importantly in terms of the substantive assessment, Assignment of Ecological Value (Step 1) categories in the EcIA guidelines are almost exclusively driven by 'Threat status' or rarity, which is only one of a number of measures used to assess ecological significance or value. Examples of other ecological significance criterion commonly included in Regional and District Policy Statements and Plans around New Zealand are 'Representativeness', 'Diversity and Pattern', and 'Buffering/surrounding landscape boundaries' (Davis et al. 2016).

Nevertheless, the guidelines are useful in that they enable effects to be assessed in a systematic and transparent way, potentially enabling the ecological consequences of various development options to be compared meaningfully, both within and between projects.

2.3.1 Assessment of Ecological Values (Step 1)

Ecological values were assigned a level on a scale of 'Low', 'Moderate', 'High' or 'Very High' based on assessing the values of species, communities, and habitats identified against criteria set out in the EcIA guidelines (Table 2.1). For our avifauna assessment, each individual species is assigned an 'Ecological Value' based exclusively on criteria set out in Table 2.1 in the column entitled 'Species Value Requirements'.

Table 2.1 - Assignment of values within the Project footprint to species, vegetation and habitats (adapted from EIANZ, 2015). Note that the ecological value assigned to each species was based on criteria set out in the column 'Species Value requirements' only.

Value	Species value requirements	Vegetation/habitat value requirements
Very High	Nationally 'Threatened' species occur or expected to occur within the Project footprint	Meets most of all of the ecological significance criterion as set out in relevant statutory policies and plans.
High	Nationally 'At Risk' species occur or expected to occur	Meets one of some of the ecological significance criterion as set out in relevant statutory policies and plans

[2] In terms of the EIANZ process steps, Step 4, which provides for the overall level of effects to be translated to an "RMA effect" has been omitted. The rationale for this is that it is considered more appropriate / straightforward for ecological effects to be expressed in the high / moderate / low terms used in the other EIANZ steps, in the context of this assessment.

Value	Species value requirements	Vegetation/habitat value requirements
Moderate	No Nationally Threatened or At Risk species occur, but locally uncommon or rare species, or keystone species (that are considered important for ecological integrity and function) present	Habitat type does not meet ecological significance criteria as set out in the relevant statutory policies and plans but does provide locally important ecosystem services (e.g. erosion and sediment control, and landscape connectivity)
Low	No species present that are Nationally Threatened, At Risk, locally uncommon or rare, or considered keystone species	Nationally or locally common habitat and that does not provide locally important ecosystem services

2.3.2 Magnitude of Unmitigated Effect assessment (Step 2)

Step 2 of the EcIA guidelines requires an evaluation of the magnitude of effects on local ecological values based on footprint size, intensity and duration. The unmitigated 'Magnitude of the Effect' that the Project is expected to have on species found in the Project area is evaluated as being either 'No effect', 'Negligible', 'Low', 'Moderate', 'High' or 'Very High' (see Table 2.2);

The unmitigated 'Magnitude of Effect' is a function of:

- The scale of unmitigated effect per se (i.e. the areal extent of the Project footprint);
- The proportion of habitat loss versus local availability (e.g. the proportion of habitat loss relative to the contiguous habitat that remains);
- The duration of effect (e.g. permanent versus temporary); and
- The intensity of the effect (i.e. the extent to which habitat loss within the Project footprint was complete or partial).

The 'Project footprint' is the principal spatial zone, where the direct effects of the Project on ecology were considered to occur (see detailed plans in Volume 3: Drawing Set). The Project footprint includes:

- The road footprint (i.e. the road and its anticipated batters and cuts, spoil disposal sites, haul roads and stormwater ponds);
- An Additional Works Area (AWA), accounting for additional habitat loss for construction access, laydown areas and temporary stormwater drains (Figure 3, Appendix A); and
- 5m edge effects parcel.

Note that the AWA is smaller in habitats with 'High' 'Ecological Values' because temporary work activities will be focused on the road footprint and immediately adjacent areas, and more precautions will be taken in managing construction effects, in order to mitigate potential adverse effects on the surrounding habitat. These measures will be set out in the Construction and Environmental Management Plan (Volume 5 of the AEE), which will include the Ecological and Landscape Management Plan.

The inclusion of the 5m edge effects parcel in the Project footprint accounts for the degradation of habitat suitability in close proximity to the direct effects footprint through edge effects. The creation of new edges where existing vegetation is removed is known to alter micro-climatic conditions (e.g. through increased exposure to temperature extremes, desiccation, and wind) with potential adverse effects on both habitat suitability and availability for a number of species (Young & Mitchell 1994; Davis-Colley et al. 2000). Moreover, a variety of other factors, including invasion of weeds and occupancy of mammalian predators and browsers are generally considered to be higher in edge habitats (Murcia 1995; Lahti 2009) though evidence for higher predation rates is mixed (Ruffell et al. 2014). The inclusion of a 5m zone as a habitat loss equivalent (that will be factored into the ecological mitigation package) is considered to be appropriate for addressing such effects in respect of avifauna.

Table 2.2 - Summary of the criteria for describing the magnitude of unmitigated effect as adapted from EcIA guidelines, 2015.

Magnitude of effect	Description
Very High	Total loss or major alteration of the existing baseline conditions; Total loss or loss of a very high proportion of the known population or range
High	Major loss or alteration of existing baseline conditions; Loss of high proportion of the known population or range
Moderate	Loss or alteration to existing baseline conditions; Loss of a moderate proportion of the known population or range
Low	Minor shift away from existing baseline conditions; Minor effect on the known population or range
Negligible	Very slight change from the existing baseline conditions; Negligible effect on the known population or range

2.3.3 2.3.3 Level of effects assessment in the absence of mitigation (Step 3)

Step 3 of the EcIA guidelines requires the overall level of effect to be determined using a matrix that is based on the ecological values and the magnitude of effects on these values **in the absence of any efforts to avoid, remedy or mitigate for potential effects**. Level of effect categories include 'No Ecological Effect', 'Very Low', 'Low', 'Moderate', 'High' and 'Very High'. Table 2.3 shows the matrix of criteria used to describe the overall level of ecological effects in this assessment.

Table 2.3 departs from the EcIA guideline where a more conservative assignment of value is considered to be appropriate. For example, EcIA guidelines assign a 'Low' level of effect to a biodiversity value with a 'Moderate' Ecological Value and a 'Moderate' Magnitude of Effect.

Table 2.3 – Criteria for describing overall levels of ecological effects as adapted from EcIA guidelines, 2015.

Magnitude of effect	Ecological Value			
	Very High	High	Moderate	Low
Very High	Very High	Very High	High	Moderate
High	Very High	High	Moderate	Low
Moderate	High	High	Moderate	Low
Low	Moderate	Low	Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low
No effect	No ecological effect	No ecological effect	No ecological effect	No ecological effect

3 Avifauna survey results and discussion

The probable bird community in the wider Project area is comparable with communities in the North Island and is typical of those in large patches of forest in the Taranaki region. The bird community is moderately rich in terms of the number of patchily distributed endemic species known to be present in the Taranaki region, and in terms of the number of threatened species known to be present. Four endemic species (kākā, red crowned kakariki (*Cyanoramphus novaezelandiae*), yellow crowned kakariki (*Cyanoramphus auriceps*) and whio (*Hymenolaimus malacorhynchos*) present in the Taranaki region appear to be extremely rare and possibly absent altogether in the wider Project area. Table 3.1contains a list of the bird species known to be present or likely to be present in the Project footprint.

A total of 36 diurnal and two nocturnal bird species were recorded during the surveys in farmland and forest. Twenty-three of these species are indigenous, eight of which are currently listed as 'At Risk' (Robertson et al. 2016).

Conditions were warm during surveys, fine and sunny on the first day while drizzle and light rain fell on the second day of survey, before becoming fine in the afternoon. Despite the variable weather, background noise was minimal during all counts, providing favourable conditions for listening. Ground conditions were very wet in the Messenger North area while the soil at the Messenger South area, with better drainage generally, was less saturated.

3.1 Spring farmland bird survey

Twenty-eight species were recorded during the diurnal survey of the farmland area. Of these, 14 were native/endemic species while 14 were introduced. The assemblage included the 'At Risk' black shag and pipit. All remaining 26 species were listed as 'Not Threatened' (Robertson et al, 2016). All species were recorded during five-minute bird counts, i.e., none were noted only as incidental sightings. The most commonly encountered birds were chaffinch (*Fringilla coelebs*), followed by grey warbler (*Gerygone igata)*, paradise duck (*Tadorna variegate)*, silvereye (*Zosterops lateralis*), bellbird, and yellowhammer (*Emberiza citronella*).

During the farmland survey, some birds calling in forests near the survey sites were included in counts, even though they were clearly not 'farmland' inhabitants. These forest birds qualified for inclusion because they were within 200m, the sampling distance specified for the five-minute count technique (Dawson and Bull, 1975). In reality, the 'farmland' counts sampled both farmland and forest habitats, and the list of the most commonly encountered species reflects this.

3.2 Forest bird survey

Sixty-three five-minute bird counts were undertaken in forested areas, with all but three stations monitored twice by each observer. Twenty bird species were recorded during the counts, sixteen indigenous and four introduced.

Three of the species recorded were 'At Risk': the North Island robin, whitehead and long-tailed cuckoo[3]. For long-tailed cuckoo, the presence of moderate numbers of whitehead around Mt Messenger is significant, as it selects only this species as its host within the North Island. Long-tailed cuckoo were recorded in both the October and February counts, and were noted during audio recordings made from February to March. Long-tailed cuckoo migrate through an arc of Pacific Islands extending from Palau in the west to Pitcairn Island in the east. They breed only in New Zealand, and their 'At Risk' threatened species status is determined by their declining numbers here rather than their fortunes in their overwintering sites. Their breeding season in New Zealand is therefore a critical part of their life-cycle before they disperse throughout the Pacific.

The most commonly encountered species was bellbird, followed by silvereye, grey warbler, fantail (*Rhipidura fuliginosa*) and whitehead (Table 3.1) Kererū, North Island robin and New Zealand fantail were occasionally encountered. No shining cuckoo (*Chrysococcyx lucidus*) were noted during the forest survey, but these were occasionally heard earlier in the season during the farmland survey. Call rates were relatively low overall with only four species recorded more than once per five-minute count period. Only four introduced species, blackbird (*Turdus merula*), thrush (*Turdus philomelos*), magpie (*Gymnorhina tibicen*) and chaffinch, were noted and many of these observations were from a single station that bordered on pine forest and farmland in the furthest western part of the survey area.

3.3 Western Brown Kiwi Survey

Western brown kiwi currently inhabit the Wanganui and Taranaki districts and formerly extended northwards into the Waikato. They are one of four races of North Island brown kiwi, genetically distinct from those in other regions, but not so distinct that they justify separate species status. Current estimates put the taxon population at between 8,000 – 10,000 birds, with about 2000 pairs present within areas that are actively managed (Scrimgeour and Pickett, 2011). The criteria attached to this ranking for the species is B (1/1), which indicates a predicted decline of 30-70% over the next three generations (some 15 years).

Western brown kiwi are widespread throughout the wider Project area in forested habitats, both within Parininihi and the Eastern Ngāti Tama block. In total, 25 western brown kiwi call sequences were heard during a total of 16 nocturnal listening hours, yielding a call rate of 1.56 calls/hour. Twelve of these calls were duets i.e. a bird answered to an individual with which it was likely paired. Sixteen of the 24 calls were male birds and nine were calls from a female, a ratio of 1.77:1 (Appendix A: Figure 4). Birds were heard up to 1 km away from the observer. One pair of birds was heard calling in the steep gully immediately above one of the hair-pin bends of SH3 during the October survey (Appendix A: Figure 5; Appendix B: Photograph C).

The mean call rate of 1.56 per hour indicates a moderate to high abundance by regional standards, especially because the measurements were taken during the breeding season

[3] North Island brown kiwi, with a status of Nationally 'At Risk', were heard and seen during nocturnal survey, as were long-tailed cuckoo.

when some males would be on nests and not active during the first 2-3 hours of darkness (the listening periods). A recent study on the ratio of male: female call rates for brown kiwi has shown that males tend to have a significantly higher call rate than females, rather than females being necessarily being at a lower abundance (Colbourne and Digby, 2016). The results of the Mt Messenger survey are consistent with their findings.

Although about 40% of Western brown kiwi is currently benefitting from some form of pest management, the losses in the unmanaged areas still exceed the gains in the managed sites, and the race as a whole is declining overall. The kiwi population in the Project footprint appears to have received little or no management at any time, apart from intermittent possum control and irregular applications of 1080 since the early 1990s. Typically, 1080 applications generate a 2%-3% per annum increase in kiwi populations for the three years following an application, but no benefits thereafter. The current status of the population in the Project footprint is therefore best described as 'unmanaged'. Kiwi are perhaps the most significant and important of Mt Messenger's avian inhabitants.

In addition to brown kiwi, ruru (*Ninox novaeseelandiae*) were frequently heard throughout the survey area. No efforts were made to quantify the number of ruru heard but they were considered relatively common. As noted earlier, long-tailed cuckoos were also heard calling during the nocturnal surveys.

3.4 Species likely to be present but not detected in surveys

While not encountered in field surveys around the MC23 alignment, Australasian bittern (Threat Status: 'Nationally Critical'), North Island rifleman (Threat status: 'At risk-declining'), kākā ('At Risk – recovering'), New Zealand falcon ('At Risk – recovering'), fernbird ('At Risk – Declining) and spotless crake ('At Risk' - Declining) are included in the assessment of effects on native birds (Table 3.1). These species are known to be present in the Mt Messenger area[4] and may be present in the Project footprint.

New Zealand falcon and rifleman are likely to be present in low numbers year-round, while kākā may visit the wider Project area occasionally. The Australasian bittern may be present in some of the raupo-dominated wetlands in the Mimi River catchment.

3.5 North Island kōkako

North Island kōkako (*Callaeas wilsoni* ; Threat Status: 'At Risk – Recovering') have also been included in this assessment as the Tiaki Te Mauri O Parininihi Trust (the Parininihi Trust) has commenced its translocation of the species to Parininihi. The Parininihi Trust's March 2017 translocation application to the Department of Conservation (Translocation Application) noted the initial goal of establishing 36 kōkako in 1300ha of protected habitat in Parininihi by 2022. This area is considered suitable for supporting up to 250 kōkako (Flux, 2015). The Trust aims to subsequently increase the population to 500 birds within 2000 ha of protected habitat, and then to over 1000 birds in Parininihi and its surrounds.

[4] Atlas of Bird Distribution in New Zealand, www.birdsonline.org.nz

The first kōkako release (12 birds) occurred on 29 May 2017, and a further eight birds were released in July 2017. The Translocation Application noted that the release site was chosen to be as central as possible within Parininihi, to reduce the potential for kōkako to disperse outside this area. Based on conversations with Ngati Tama during the first Multi-Criteria Analysis workshop, the release sites were in the western part of Parininihi, to provide a large pest managed area surrounding the release site. This is approximately 2km north of the nearest part of SH3, and approximately 3.5km from the summit of Mt Messenger and the nearest parts of the Project footprint.

The Translocation Application notes at Section 4.3.4 that the biggest uncertainty in the translocation is the extent to which kōkako will disperse out of the intensively protected area. The Trust proposes to conduct annual population surveys to measure settlement rates within Parininihi, and to attach transmitters to some birds to determine dispersal distances Section 8.7 of the Application states that potential dispersal pathways for kōkako include towards the north and east.

Where kōkako are found to disperse beyond Parininihi, the Translocation Application notes that they could be caught and moved back to Parininihi, or to extend habitat protection to encompass the areas they have dispersed to. Thus far, no kokako have settled near the proposed alignment, and the chances of it happening in the near future are small, given the extent of available habitat both in and near Parininihi. Kokako typically live as bonded pairs in territories ranging in size from 4-25ha; the 20 birds released thus far are therefore unlikely to currently occupy more than 250ha of forest (20% of Parininihi) even if they have all taken up very large territories.

3.6 Wetland species

No habitat along the MC23 alignment was considered suitable for wetland species.

Table 3.1 – Avian species known to be present or likely to be present in the Project footprint (noting threat status)* The field surveys (column 5) were undertaken before North Island kokako were released in Parininihi.

Broad habitat association	Common name	Scientific name	Threat Status	Detected in field surveys	Mean No. detected during five minute bird counts in forest sites	Mean No. detected during five minute bird counts in farmland sites
Wetland bird species	Australasian bittern	*Botaurus poiciloptilus*	Threatened – Nationally critical	No	–	–
	Fernbird	*Bowdleria punctata*	At Risk – declining	No	–	–
	Spotless crake	*Porzana tabuensis*	At Risk – declining	No	–	–
Forest bird species	New Zealand falcon	*Falco novaeseelandiae*	At Risk – recovering	No	–	–
	North Island brown kiwi	*Apteryx mantelli*	At Risk – declining	Yes (via calls)	–	–
	Long-tailed cuckoo	*Eudynamys taitensis*	At Risk – Naturally uncommon	Yes	0.03	–
	Rifleman	*Acanthisitta chloris*	At Risk – declining	No	–	–
	North Island kōkako	*Callaeas wilsoni*	At Risk – recovering	No*	–	–
	North Island Kākā	*Nestor meridionalis*	At Risk – recovering	No	–	–
	North Island robin	*Petroica longipes*	At Risk – declining	Yes	0.24	–
	Whitehead	*Mohoua albicilla*	At Risk – declining	Yes	0.95	–

Broad habitat association	Common name	Scientific name	Threat Status	Detected in field surveys	Mean No. detected during five minute bird counts in forest sites	Mean No. detected during five minute bird counts in farmland sites
	New Zealand fantail	*Rhipidura fuliginosa*	Not Threatened	Yes	1.43	0.13
	Grey warbler	*Gerygone igata*	Not Threatened	Yes	1.49	1.13
	Tomtit	*Petroica macrocephala*	Not Threatened	Yes	0.44	–
	Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	Yes	0.56	–
	Kererū	*Hemiphaga novaeseelandiae*	Not Threatened	Yes	0.37	–
	Bellbird	*Anthornis melanura*	Not Threatened	Yes	1.62	0.25
	Shining cuckoo	*Chrysococcyx lucidus*	Not Threatened	Yes	–	0.22
	Silvereye	*Zosterops lateralis*	Not Threatened	Yes	1.6	0.44
	Ruru	*Ninox novaeseelandiae*	Not threatened	Yes	Incidental sighting	–
	Sacred kingfisher	*Todiraphus sanctus*	Not Threatened	Yes	0.08	0.25
Farmland species	New Zealand pipit	*Anthus novaeseelandiae*	At Risk – declining	Yes	–	0.06
	Welcome swallow	*Hirundo neoxena*	Not Threatened	Yes	0.02	0.19
	Paradise shelduck	*Tadorna variegata*	Not Threatened	Yes	0.03	1.06

Broad habitat association	Common name	Scientific name	Threat Status	Detected in field surveys	Mean No. detected during five minute bird counts in forest sites	Mean No. detected during five minute bird counts in farmland sites
	Spur-winged plover	*Vanellus miles*	Not Threatened	Yes	0.17	0.69
	Swamp harrier	*Circus approximans*	Not Threatened	Yes	0.03	0.06
	Pukeko	*Porphyrio melanotus*	Not Threatened	Yes	-	0.19
	White-faced heron	*Egretta novaehollandiae*	Not Threatened	Yes	-	0.03
	Southern black-backed gull	*Larus dominicanus*	Not Threatened	Yes	0.05	-
	Black shag	*Phalacrocorax carbo*	At Risk - Naturally uncommon	Yes	-	0.03

4 Assessment of effects on bird values

This assessment is broadly based on the EcIA guidelines produced by EIANZ (2015), adapted based on expert opinion as described in Section 2.3 to determine the overall 'level of effect' of the Project on each species of avifauna.

4.1 Avifauna values

The ecological value of native birds affected by the Project was determined using Step 1, Table 2.1 (Section 2.3). The Australasian bittern was assigned a 'Very High' ecological value because it is a nationally 'Threatened' species (Table 3.1). Likewise, fernbird, spotless crake, New Zealand falcon, Western brown kiwi, long-tailed cuckoo, rifleman, North Island kākā, North Island kōkako, North Island robin, whitehead, pipit and black shag were all assigned a 'High' ecological value because they are all Nationally 'At Risk' species (Table 4.1).

Tūī, kererū and bellbird were given a 'Moderate' ranking because they are 'keystone species' that contribute significantly to pollination and seed dispersal in indigenous forest ecosystems and therefore play a critical role in maintaining ecological function and integrity (Kelly et al. 2010; Anderson et al. 2011). Moreover, bellbirds retain patchy populations throughout most of the North and South Islands, and are uncommon north of Waikato and all species, particularly bellbird and kererū, are vulnerable to predation by introduced predatory mammals.

All other native avifauna known to be present were considered to be of 'Low' ecological value on the basis that these are common throughout New Zealand and while they have a role in maintaining ecological integrity, are not keystone species. Species assigned a low ecological value included tomtit, fantail, grey warbler, spur-winged plover, sacred kingfisher, silvereye, shining cuckoo, ruru, welcome swallow, Australasian harrier, pukeko, paradise shelduck, white-faced heron and southern black-backed gull. All exotic avifauna were assigned a 'Low' value.

4.2 Potential adverse effects

In general terms, new roads have the potential to create a range of ecological effects on avifauna, both during construction (resulting from direct physical disturbance) and on an ongoing basis from road operation and maintenance. Potential adverse effects on avifauna generated during and after road construction include:

- Direct removal of habitat for nesting or foraging;
- The creation of habitat edge effects, altering the composition and habitat value of adjacent vegetation;
- Direct mortality of nests and their contents, and for flightless species, possible mortality of incubating adults;
- Habitat fragmentation and isolation, reducing the ability for avifauna to move about the landscape for food, shelter, and breeding purposes;
- Construction noise disturbance, particularly during breeding and dispersal; and

- Sediment runoff to wetlands and watercourses that may affect the quality of wetland bird habitat.

Potential ongoing adverse effects of roads (in general) on avifauna include:

- Effect of vehicle noise on birds (e.g. resulting in reduced breeding success and dispersal);
- Decreased landscape and habitat connectivity through fragmentation, permanently affecting movement of some birds, with possible effects on meta-population dynamics and increased vulnerability to local extinction;
- Mortality or injury on roads through bird strike or road kill;
- The increased presence of people and introduced species in previously less accessible areas;
- Lost opportunities for creating wildlife corridors; and
- Degradation of wetland and riparian habitat quality through:
- altered hydrology of streams/wetlands;
- contaminated stormwater runoff (sediment, heavy metals and elevated temperature) from road surface to wetlands and watercourses; and
- risk of spills of potential toxins (oil, milk, chemicals) from cartage vehicles.

It is noted that the existing SH3 corridor, located to the west of the Project footprint, establishes some of these effects locally. In some respects, therefore, the Project would shift a number of these effects to the east (noting that at worst the existing SH3 will become an infrequently used local access road).

4.3 Magnitude of effects on avifauna

The magnitude of unmitigated effects of the Project on native birds was determined using the methodology set out in Section 2.3.2. While the range of potential effects described in Section 4.2 above have been considered where relevant, the three main effects on avifauna associated with Project construction and operation that have informed the effects rating are:

- Habitat loss and habitat degradation through edge effects that reduce the suitability or availability of nesting and/or foraging habitat;
- Habitat severance, i.e. loss of ecological connectivity; and
- The possibility of direct harm to individual birds (disturbance, injury or possible mortality).

4.3.1 Habitat loss and degradation

It is expected that up to approximately 44.41ha of indigenous dominant or mixed exotic/indigenous habitat will be affected by the Project. Within this area, 19.466 ha of primary vegetation communities are present, and 13.826ha and 11.117ha of secondary scrub/forest and rushland/sedgeland mosaic respectively (as set out in Table 3.1 in the Assessment of Ecological Effects – Vegetation (Technical Report 7a, Volume 3 of the AEE). This includes 15.46ha of direct loss associated with the Project footprint and 28.95ha

associated with Additional Working Area (AWA) requirements. These effects will result in the loss of feeding opportunities available to birdlife, as well as bird-nesting and roosting opportunities afforded by an intact forest ecosystem. Residual effects on birds will be mitigated primarily through restoration planting and habitat enhancement and through the proposed pest management as set out in Section 5.5.2.1.

4.3.2 Avifauna subject to a 'High' 'Magnitude of Unmitigated Effect'

For kiwi, the Project would, without any mitigation, have a 'High' magnitude of effect due to the extent of habitat loss and degradation (44.41ha) and the potential for habitat severance and mortality. These effects will be avoided or mitigated through salvage and relocation of birds immediately prior to vegetation clearance activities, establishment of kiwi exclusion fencing, restoration planting and habitat enhancement and a pest management programme as set out in Section 5.5.2. Opportunity also exists to reinstate some of the habitat connectivity lost with the establishment of the existing SH3 corridor.

The discussion below focusses on the effects the Project could have on kiwi, if no mitigation was proposed. Mitigation to address these potential effects on North Island brown kiwi is discussed in Section 5.5.2 (but not taken into account in the initial effects assessment).

Brown kiwi territories range from 30 to 91ha in size. Several kiwi territories may therefore be held over the Project footprint and this is consistent with the finding of several birds in the vicinity of the MC23 alignment during this survey. Loss of territories or partial territories may result in territorial disputes and possible eviction of some of the current residents. The Project footprint is 6km long, and thus, could potentially bisect or encroach on the territories of up to 15 pairs of kiwi.

North Island brown kiwi dispersal is limited by their flightlessness but juveniles sometimes move many kilometres from their natal areas. The road is likely to sever, fragment and isolate an area of North Island brown kiwi habitat, thus the impacts on North Island brown kiwi are predicted to be higher than those for other forest birds. The road is expected to partially inhibit kiwi dispersal on cut and fill sections and may reduce the extent to which some favourable habitats are utilised.

In the absence of mitigation, mortality and injury is expected to be higher for kiwi than for other forest birds. Some individuals are likely to frequent sites close to the existing highway and are therefore already vulnerable to being struck by traffic. Without mitigation, the risk of being struck may be greater with increased traffic speed on an improved alignment. Furthermore, kiwi may have burrows or other roosting sites within or close to the Project footprint and incubating kiwi may be affected by the road construction. Although North Island brown kiwi have a long breeding season, most eggs are laid between June and December (Scrimgeour and Pickett, 2011; Heather and Robertson, 1996). Nesting kiwi and their young are particularly vulnerable to disturbance at this time.

4.3.3 Avifauna subject to a 'Moderate' 'Magnitude of Unmitigated Effect'

In the absence of mitigation, the Project could have a 'Moderate' magnitude of effect on all flighted forest birds that regularly or commonly inhabit the Project footprint, largely due to habitat loss and degradation, but also due to mortality of eggs and chicks given vegetation

clearance will be undertaken during breeding season (i.e. September to March inclusive). Species subject to a 'Moderate' magnitude of unmitigated effect include, bellbird, tūi, kererū, whitehead, North Island robin, fantail, and grey warbler. These effects will be mitigated through restoration planting and habitat enhancement, and a pest control programme, as set out in Section 4.5.2.

The amount of habitat loss (44.41ha) constitutes only a little more than 1% of the available habitat within the wider Project area (ca 4,430ha), whilst the amount of direct primary and secondary forest loss (33.29ha) constitutes less than 1% of the available habitat in the wider Project area (ca 4,430ha; Figure 1.2). On a strict application of the EcIA guidelines, this might lead to a 'Low' magnitude of effect being assigned. However, the loss of 44.41ha of potential habitat is not insignificant, and taking a conservative view should not result in a 'Low' magnitude of effects classification in respect of the relevant species. Applying professional judgment, the effect on the relevant flighted bird species is considered to be more appropriately classified as 'Moderate' for the purposes of this assessment.

Most flighted bird species are expected to successfully disperse across the road, not only under the bridge and over the tunnels but also across cut and fill sections. As such, effects of severance (or effects on dispersal) are considered to be low. In the absence of mitigation, it is expected that some birds would be killed or harmed due to the activities associated with the Project.

To a large extent, the Project will simply shift existing issues associated with severance, and potential mortality caused by the existing SH3 corridor to the new proposed corridor further to the east.[5] The key differences in terms of effects on birds from the operation of the Project route in comparison to the existing SH3 are:

- Overall speeds on the proposed new road are expected to be considerably higher. It is inevitable that a small proportion of the population will be lost to traffic-strike (Jacobson, 2005) over time, potentially more so than on the existing road due to the higher traffic velocities.
- There may be some net decrease in traffic noise emitted by heavy vehicles as a result of this Project. Rapid acceleration (especially by cars) or deceleration from trucks with air brakes on the existing SH3 can be audible from hundreds of metres away and may be disruptive to calling birds. The re-aligned highway, being straighter and with considerably lower grades than the existing road, will likely require less acceleration and deceleration. The overall effect of this is an anticipated reduction in traffic noise caused by rapid changes in speed.

Although there may be an overall decrease in noise along the realigned highway, the rerouted highway may expose some individual birds to noise levels that they are not currently exposed to. However, the Project will also reduce noise levels to birds along the existing highway, especially in the Parininihi area.

[5] Noting that even if the existing SH3 remains open as a local or private access road, it would be used only infrequently.

In terms of potential effects during the construction period, for all flighted species within the footprint, some egg and chick mortality would be expected on the assumption that vegetation clearance would be undertaken during breeding season (i.e. September – March inclusive).

4.3.4 Avifauna subject to a 'Low' or 'Negligible' magnitude of effect

The Project is expected to have a 'Low' magnitude of unmitigated effect on forest birds that have large and extensive populations, or are uncommon in the wider Project area. This includes kākā, tomtit, rifleman and long-tailed cuckoo. The magnitude of effects on these species are considered low because the proportion of the population affected is low or the proportion of habitat loss versus what is available is low. However, residual effects are mitigated through restoration planting, habitat enhancement and a pest management programme as set out in Section 4.5.2.

The Project is expected to have a 'Low' magnitude of unmitigated effect on wetland bird species. Wetland species affected include the critically endangered Australasian bittern (which is assumed to be present), spotless crake and fernbird (noting that fernbird also inhabit forest margins and shrublands). The Project is expected to result in the loss or degradation of 1.372 of sedgeland habitat. However, a 'Low' magnitude of effect is expected as most of the sedgeland/wetland habitat is degraded swamp forest and of poor quality for wetland birds. Conversely, high value wetland bird habitat is located in low stature wetland that is at least 300m away from the Project footprint. Direct mortality or injury to wetland birds is expected to be low because adults can readily disperse and if any eggs or young are present during habitat loss activities, only a few birds (if any) are likely to be present. In a worst case scenario, this area could potentially be affected through sedimentation (discussed in Section 4.3.5 in the Assessment of Ecological Effects – Vegetation (Technical Report 7a, Volume 3 of the AEE)). Sedimentation controls have specifically been developed to avoid this occurring and so loss of this wetland habitat has not been assessed.

The unmitigated effect on kokako is also currently considered to be low for the reasons given earlier. Furthermore, it will continue to remain low for some years, given that kokako have relatively low reproductive rates, and relatively long population doubling times (about eight years for the national population). The Project is expected to have a 'Negligible' magnitude of effect on species that use farmland habitat types. This includes two 'At Risk' species (pipit and black shag), welcome swallow, Australasian harrier, pukeko, paradise duck, white-faced heron and southern black-backed gull. A 'Negligible' magnitude of effects is expected for these birds because only 4.7ha of farmland is expected to be lost and this constitutes such a small fraction of available habitat with the wider landscape (<0.01%), which is dominated by farmland habitat.

Moreover, these species are adapted to highly disturbed environments and tend to be less susceptible to edge effects and severance. For example, pipits may frequently be seen on disturbed ground, including road verges. White faced heron and southern black-backed gull are native birds ubiquitous throughout New Zealand and capable of utilising various habitat

types as feeding and breeding grounds. These species are unlikely to be affected greatly by the Project due to their life-history traits and resilience to habitat modification.

4.4 Level of effects on birds without mitigation

The 'without mitigation' assessment of environmental effects of the Project for all native bird species likely (or assumed) to be in the Project footprint is shown in Table 4.1. Without mitigation, effects could be 'High' for three species (kiwi, robin and whitehead), 'Moderate' for four species, and 'Low' or 'Very low' for 22 species. The without mitigation effects are, on average, higher for endemic species than for indigenous species, though many endemic species have 'Low' or 'Very low' rankings.

In summary, the Project without mitigation could have adverse effects on the indigenous bird assemblage of the wider Project area. For all species with 'level of effects' that are considered to be 'Moderate' or greater, mitigation is considered to be required. As set out in Section 5, effects on avifauna will be appropriately mitigated for through control of introduced mammalian pests (as detailed in Section 4.5.2.1), restoration planting and habitat enhancement; and in respect of kiwi only, capture and relocation and exclusion fencing.

These efforts may also benefit some forest species for which the level of effects are considered to be 'Low' or 'Very Low' (e.g. rifleman).

Table 4.1 - Assessment of environmental effects on native birds in the Project footprint likely impacted by the Project. * = nationally 'At Risk', ** = nationally 'Threatened', ^ = keystone species.

Common name	Ecological value	Magnitude of effect	Level of effect (w/o mitigation)	Measures to adequately avoid, remedy or mitigate effects where required
North Island brown kiwi*	High	High	High	Salvage and relocation to avoid/minimise the risk of harm to eggs, birds, and chicks, exclusion fencing to minimise harm attributed to road kill or construction hazards, restoration planting and habitat enhancement and pest management
North Island robin*	High	Moderate	High	Restoration planting and habitat enhancement and pest management
Whitehead*	High	Moderate	High	Restoration planting and habitat enhancement and pest management

Common name	Ecological value	Magnitude of effect	Level of effect (w/o mitigation)	Measures to adequately avoid, remedy or mitigate effects where required
Australasian bittern**	Very high	Low	Moderate	Wetland restoration and habitat enhancement and pest management
Tūī^	Moderate	Moderate	Moderate	Restoration planting and habitat enhancement and pest management
Kererū^	Moderate	Moderate	Moderate	Restoration planting and habitat enhancement and pest management
Bellbird^	Moderate	Moderate	Moderate	Native revegetation and habitat enhancement and pest management
Fernbird*	High	Low	Low	Wetland restoration and habitat enhancement and pest management
Spotless crake*	High	Low	Low	Wetland restoration and habitat enhancement and pest management
Tomtit	Low	Moderate	Low	These species will benefit from proposed mitigation measures for other species. No specific targeted mitigation is required in light of that benefit; and the 'low' or 'very low' without mitigation level of effect.
Long-tailed cuckoo*	High	Low	Low	
Rifleman*	High	Low	Low	
North Island kōkako*	High	Low	Low	
North Island kākā*	High	Low	Low	
New Zealand fantail	Low	Moderate	Low	
Grey warbler	Low	Moderate	Low	
Shining cuckoo	Low	Moderate	Low	
Silvereye	Low	Moderate	Low	
Sacred kingfisher	Low	Moderate	Low	

Common name	Ecological value	Magnitude of effect	Level of effect (w/o mitigation)	Measures to adequately avoid, remedy or mitigate effects where required
Ruru	Low	Moderate	Low	These species will benefit from proposed mitigation measures for other species. No specific targeted mitigation is required in light of that benefit; and the 'low' or 'very low' without mitigation level of effect.
Black shag*	High	Negligible	Low	
New Zealand falcon	High	Negligible	Very Low	
New Zealand pipit*	High	Negligible	Very Low	
Pukeko	Low	Negligible	Very low	
Welcome swallow	Low	Negligible	Very low	
Paradise shelduck	Low	Negligible	Very low	
Black shag*	High	Negligible	Low	
New Zealand falcon	High	Negligible	Very Low	
New Zealand pipit*	High	Negligible	Very Low	
Pukeko	Low	Negligible	Very low	
Welcome swallow	Low	Negligible	Very low	
Paradise shelduck	Low	Negligible	Very low	
Australasian harrier	Low	Negligible	Very low	
White-faced heron	Low	Negligible	Very low	
Black-backed gull	Low	Negligible	Very low	

4.5 Proposed measures for addressing potential adverse effects

Considerable efforts have been made to avoid, remedy or mitigate potential ecological effects of the Project on avifauna. The 'mitigation' package presented here was discussed and 'ground tested' with a number of ecologists and ornithologists as it was being developed, and is designed to produce a net overall benefit for avifauna in the Project Area in the medium term.

Through the process of selecting the alignment, the inclusion of structures (a tunnel and bridge), and design and construction methods for the Mt Messenger Bypass, ecological effects on avifauna have been either avoided altogether or reduced in magnitude. To mitigate for residual effects that cannot be avoided, the Project will include restoration planting and habitat enhancement, and most importantly, a large scale pest management programme. Through these efforts, and in line with the overarching ecological aim for the Project, it is expected that there will be no net loss (and most likely a net benefit) for avifauna affected by the Project in the medium term.

Measures that will avoid, remedy or mitigate potential adverse effects on avifauna are set out below. These measures will be detailed and actioned through the development and implementation of an Ecological and Landscape Management Plan (ELMP) that will include a section that sets out avifauna management and monitoring requirements and provides further detail on all measures discussed below.

4.5.1 Measures to avoid effects

A number of adverse ecological effects on avifauna (and other ecological values) have been avoided through the selection of the proposed Project alignment, which (unlike many other options considered) completely avoids the higher value land to the west of the existing SH3.

4.5.1.1 Avoidance through the options assessment process

The options considered included alignments to the west of SH3 which traversed areas with significant biodiversity values, including the Waipingao catchment and adjacent Parininihi land. Potential adverse effects identified for options to west of SH3 are described in the options assessment reports (Volume 4 of the AEE). These effects include loss of significant habitats, severance of a nationally important vegetation sequence and effects on associated regionally and nationally significant flora, and on kōkako. Moreover, half of these options excluded the use of structures (bridges and tunnels) and had large cuts and fills, which would have resulted in much more significant ecological effects through both habitat loss and potential effects on kiwi and kōkako.

The selection of the preferred route, which has evolved into the Project footprint, has led to the avoidance of a range of adverse effects which would have resulted if Parininihi was bisected by the road. The higher quality of habitat and release of kōkako in Parininihi meant that the effects on avifauna, including direct mortality and severance, would have been considerably higher than along the Project footprint.

4.5.1.2 Avoidance of effects through optimisation of the Project footprint

The Project footprint traverses areas of significant habitat and vegetation types to the east of Mt Messenger, as described in various specialist reports (Volume 3 of the AEE). All vegetation types and significant trees have been mapped and delineated, in the Assessment of Ecological Effects – Vegetation (Technical Report 7a, Volume 3 of the AEE) to identify the most ecologically significant areas and relict trees in the wider Project area. Project ecologists have worked closely with design and construction engineers to avoid or minimise ecological effects on these significant habitat types. Such efforts include:

- Inclusion of a 235m long tunnel through the ridge dividing the Mangapepeke and Mimi catchments. The tunnel has greatly reduced the size of the cut and fill area that would otherwise have been required and has preserved the important east-west connectivity of habitat (ridge to coast) and mobile animal movement (especially bats and forest birds).
- Incorporation of a 120m bridge across a tributary valley to the Mimi River on the south side of the route. This bridge sits very close to the ecologically significant wetland area and has substantially avoided the impact that a cut and fill approach would have had on the wetland and will preserve east-west ecological connectivity.
- Introduction of construction techniques to reduce ecological impact. The bridge mentioned above has been designed in a way that will allow it to be constructed from each side rather than 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 down into the wetland.
- Minor adjustments to the route to avoid the need to remove significant trees. The number of trees potentially needing to be removed has been reduced from more than 20 to 15 by this means.
- Avoidance of effects on significant ecological values (i.e. significant vegetation/habitat types and trees) through:
    - Realignment of the corridor, including shifting part of the corridor further from the ecologically significant wetland area.
    - 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.
    - Use of retaining walls to avoid loss of significant trees where possible.
    - Undertaking vegetation/habitat clearance in accordance with the Construction Environmental Management Plan (CEMP) and the ELMP to further reduce effects on significant habitat. The CEMP is to be supported by a suite of sub-plans, which outline the management of specific construction effects such as construction-related ecological effects in more detail.
    - 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.

- Vegetation clearance will be staged so that vegetation is only cleared immediately prior to construction works at a given site in order to reduce habitat effects and reduce the potential for erosion and sediment generation.
- Installing an effective waste management system to minimise the chances of attracting pest mammals.
- Having an ecologist on site to advise the construction teams when vegetation is being cleared near wetlands.
- Management of light spill associated with construction lighting through careful consideration of the layout and arrangement of temporary lighting (including shrouding and spectrum limits to minimise impacts on adjacent ecological habitats).

4.5.1.3 Species-specific avoidance of effects - North Island brown kiwi

To avoid potentially more than minor effects on 'At Risk' North Island brown kiwi, a radio-tracking programme will be conducted by suitably qualified ecologists, which aims to ensure that all kiwi potentially at risk of harm during construction (i.e. those with territories that border or straddle the Project footprint) are not harmed when the road is built. The programme involves the identification of potential individuals at risk, finding and capturing them, tagging them with an individually identifiable radio-transmitter, then monitoring them on a daily basis when the road is being built in or near their territory. Any kiwi found roosting in the Project footprint would be uplifted and moved to another part of their territory. Similarly, eggs would be uplifted and taken to an incubation facility if any kiwi was found nesting in the danger zone. With this level of monitoring system in place, there would be no need to stop construction during the kiwi breeding season.

Temporary fences in selected places along the Project footprint to prevent kiwi entering the construction zone have also been recommended, and will be provided when the Project is constructed. Target locations would include sections of the Project footprint that kiwi can easily access, and places bordered by forest, which kiwi might use for feeding and roosting. The fences would be particularly valuable for protecting dispersing juveniles, which would not be radio-tagged, and could be located within or near to the construction zone at any time. Once vegetation is cleared, permanent kiwi exclusion fences will be constructed in selected locations along the new road in areas where kiwi could enter the road corridor and find it difficult to escape (e.g. in large sections of cut). Appropriate signage will be erected alerting motorists to the possible presence of kiwi along the road.

4.5.2 Off-setting proposed for the Project

While the measures proposed above will go some way to avoiding and minimising the adverse effects of the Project on birds, there will still be residual adverse effects. Effects may also result from partial habitat severance (particularly for kiwi and possibly kōkako), or from harm to eggs, chicks or adult birds due to vegetation clearance activities during construction or possible traffic-strike during operation.

Details of the Transport Agency's measures to mitigate for residual effects on ecological values are set in detail in the Assessment of Ecological Effects - Mitigation and Offset

(Technical Report 7h, Volume 3 of the AEE). The amount / area of restoration planting and pest management to be undertaken has been determined through utilisation of the Biodiversity Offsets Accounting Model (Singers 2017b). The extent of stream and riparian restoration to be undertaken has been determined by using the Stream Ecological Valuation method and the details about how this method was used for this Project are set out in the Assessment of Ecological Effects – Freshwater Ecology (Technical Report 7b, Volume 3 of the AEE).

The key measures that are expected to contribute to mitigating for potential adverse effects on avifauna are summarised below. The measures include a comprehensive pest management programme to control introduced animals as the major focus of mitigation, coupled with restoration planting and habitat enhancement. This mitigation package will ensure that residual effects on avifauna are appropriately addressed.

4.5.2.1 Pest Management

A key threat to indigenous biodiversity in New Zealand is the adverse impact of introduced mammals (Clout 2001). Most unmanaged, or minimally managed, natural forested sites exhibit reduced and altered plant and animal diversity, elevated indigenous plant and animal mortality and decreased plant and animal recruitment as a result of the impact of pest animals (Byrom et al 2016; Leathwick et al 1983; O'Donnell 1996; Timmins 2002; Wilson et al 2003; Gillies et al 2010). The initiation of effective, targeted and enduring animal pest control has repeatedly shown substantial improvements in the survival and recruitment of multiple forest bird species (Gillies et al 2003), long tailed bats (O'Donnell et al 2017) and lizards (Towns 1994; Reardon et al 2012), and reduced mortality, increased seedling regeneration and increased foliage growth in forest vegetation (Meads 1976; Timmins 2002; Gillies et al 2003; Wilson et al 2003).

The proposed long-term pest management programme will include a ground-based poison and trapping regime over a minimum area of 560ha, with a core of 222ha where animal pest numbers will be sustained at permanently low levels. The buffer area of 330ha is necessary to maintain a permanently low pest core. Residual trap catch (RTC) targets will be set for each pest species that New Zealand research has shown will generate intended or targeted biodiversity outcomes. In addition to the ground-based network, periodic (annual, once numbers have been reduced) hunting of feral goats, pigs and deer is recommended to keep numbers low although the omnivorous pig may reduce in numbers by secondary poisoning (consumption of the carcasses of poisoned possums or rats). Depending on the location of land used for pest management (likely to be within the wider Project area, or nearby to the wider Project area), farm livestock will need to be excluded completely by the construction of permanent eight wire post and batten fences wherever effective fences do not currently exist.

Most forest birds are known to respond positively to pest control as indicated by increases in relative abundance/conspicuousness and/or increase in breeding success. Table 4.2 summarises results found in other studies conducted elsewhere in New Zealand that have quantified effects of pest control on bird species that are also found within the wider Mt Messenger area.

Table 4.2 – Evidence of general positive effects of pest control (from other studies) on species in the wider Project area subject to 'Moderate' or higher level of unmitigated effects.

Species subject to 'Moderate' or higher level of effects due to the Project	Effect of pest control
North Island brown kiwi	3.3% increase in NI brown kiwi population per annum with pest control (Robertson et al. 2011)
North Island robin	Modelling shows it is most likely robin populations will increase under a bait station regime (Armstrong et al. 2006). NI robin nest success higher after predator control (Armstrong et al. 2002)
Whitehead	Eradication of possums on Kapiti Island lead to an increase in whitehead abundance (Miskelly et al., 2005). Re-establishment of whiteheads in Wellington attributed to the control of possums and rats (Genovesi 2008). Whiteheads present after re-introduction in 'Ark in the Park' an area of possum and rat control in the Waitakere Ranges (Lovegrove, T. 1988; Veltman, C.J. 2000.
Australasian bittern	At high risk of predation and likely to benefit from pest control (O'Donnell et al., 2015)
Tūī	Increase from 0.89 to 1.54 birds per count in 5 yrs (1.7 multiplier) (Innes et a. 2004); Relative abundance increase of approx 0.1 – 1 over 10 years (10.0 multiplier) (O'Donnell & Hoare 2012)
Kererū	Increase in no. of successful nests over time (0 – 100% when possums and rats at low levels) Innes et al., (2004) and positive response to pest control (Clout et al., 1995; Smith & Westbrook 2004 and Ruffell & Didham 2012)
Bellbird	Relative abundance increase ~0.75 to 1.1 over 10 years (1.5 multiplier) (O'Donnell & Hoarse 2012) and significant increase in abundance when mammals eradicated (Graham et al., 2013)

Following implementation of the proposed mitigation programme, it is considered that all potential adverse effects of the Project on native bird species will be appropriately mitigated. Based on the beneficial effects observed from studies in other pest management areas, it is expected that all avifauna species associated with the wider Project area will benefit significantly from the proposed pest management programme. These beneficial effects will include increased breeding success, increased recruitment of individuals, reduced mortality of adults and overall, an increase in abundance. These beneficial effects will mitigate all potential adverse effects of the Project described in Section 4 above in the 'without mitigation' scenario, and will in fact result in enhanced conditions for avifauna generally across the pest management area and adjacent habitats.

4.5.2.2 Restoration plantings and habitat enhancement

In time, restoration planting and habitat enhancement can create habitat, improve ecological connectivity and reduce edge effects on existing vegetation, all of which are likely to benefit all forest and wetland bird species affected by the Project. Restoration planting and habitat enhancement will likely occur within the wider Project area, or nearby to the wider Project area and will consist of:

- Restoration planting of up to 8ha swamp forest and wetland;
- Planting of 200 seedlings of the same species for every significant tree that has to be felled;
- Protection (fencing) and riparian planting of approximately 8.9km of existing stream. Planted riparian margins of 10m each side of the channel will be created;
- Restoration planting of all secondary scrub areas along the footprint plus temporary access tracks and storage areas that retain soil, hydrology and growing conditions suitable for reinstatement (up to 9ha); and
- Deployment of felled logs within mitigation sites to improve biodiversity values for a number of plants and animals (including forest and wetland birds).

4.5.2.3 Monitoring and reporting requirements

There will likely be some minor refinements to the amount/area of restoration planting and pest management proposed, based on both the optimisation of design and the results of further ecological fieldwork. This fieldwork is proposed between October 2017 and March 2018. Monitoring of the kōkako dispersal by the Parininihi Trust will also provide valuable information on managing effects.

The purpose of this pre-construction monitoring is to provide more detailed baseline information on the composition and relative abundance/conspicuousness of birds in the Project footprint and immediate surrounds (potentially affected areas) and the proposed / potential pest control mitigation site(s).

Pre-construction monitoring of pest densities and biodiversity monitoring indicators in the proposed pest management area will be necessary to help develop the details of pest management measures to be included in the ELMP. This will serve as a baseline against which the results of the campaign can be measured.

Monitoring will also be undertaken in the pest control mitigation site in the first 20 years following establishment of the pest management programme. The purpose of this monitoring is to confirm the Avifauna outcome objectives have been achieved. To this end, monitoring and associated reporting will be undertaken in Years, 1, 2, 5, 10 and 20.

4.6 Overall conclusion on effects of Project

Based on the beneficial effects that will occur following implementation of the proposed mitigation programme it is expected that enhanced conditions for avifauna will result from this Project across the pest management and wider mitigation area.

It is expected that all avifauna species associated with the wider Project area will benefit significantly from the proposed long-term pest management programme. These beneficial effects will mitigate all of the potential adverse effects of the Project described in Section 4 above in the 'without mitigation' scenario, and will result in significantly better outcomes for avifauna than currently exist in the wider Project area. The overall mitigation proposed will achieve no net loss or a net biodiversity gain for avifauna in the medium term.

Overall, taking into account the proposed mitigation, it is considered that the overall effects of the Project on avifauna will be beneficial and positive.

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Appendices

Appendix A: Maps and Figures

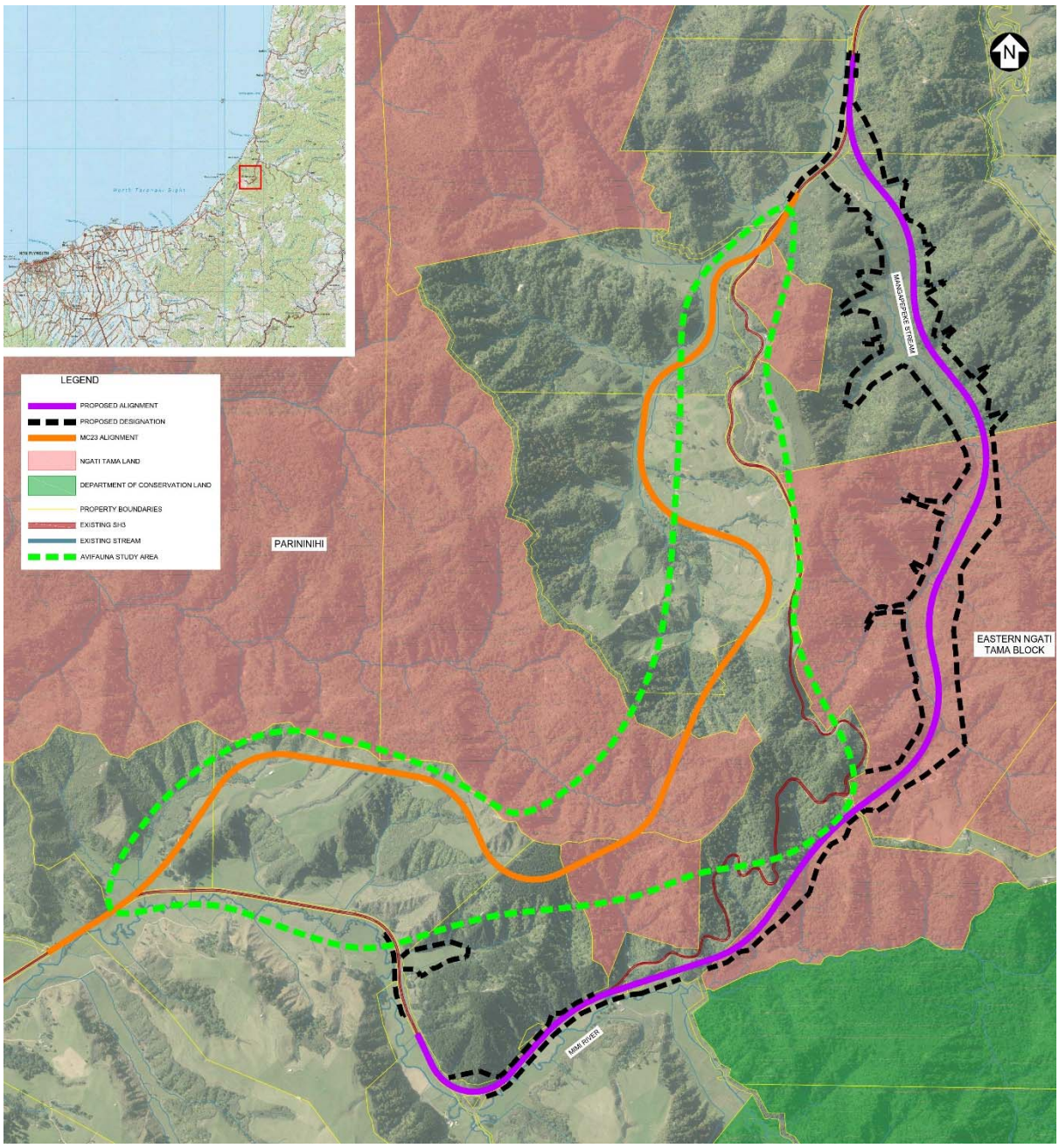

Figure A 1 – Mount Messenger Bypass Wider Project Area, Project footprint, MC23 alignment and Avifauna study area

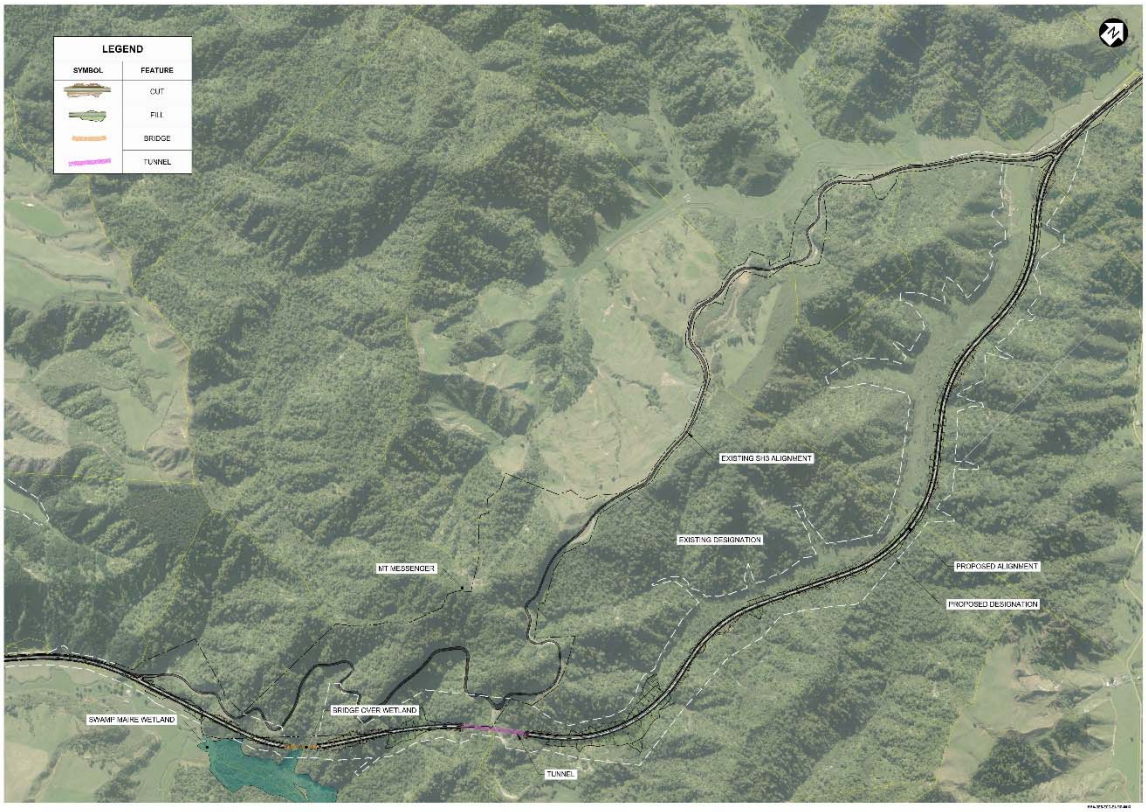

Figure A 2 – Mount Messenger Bypass Wider Project Area, Project footprint and designation area

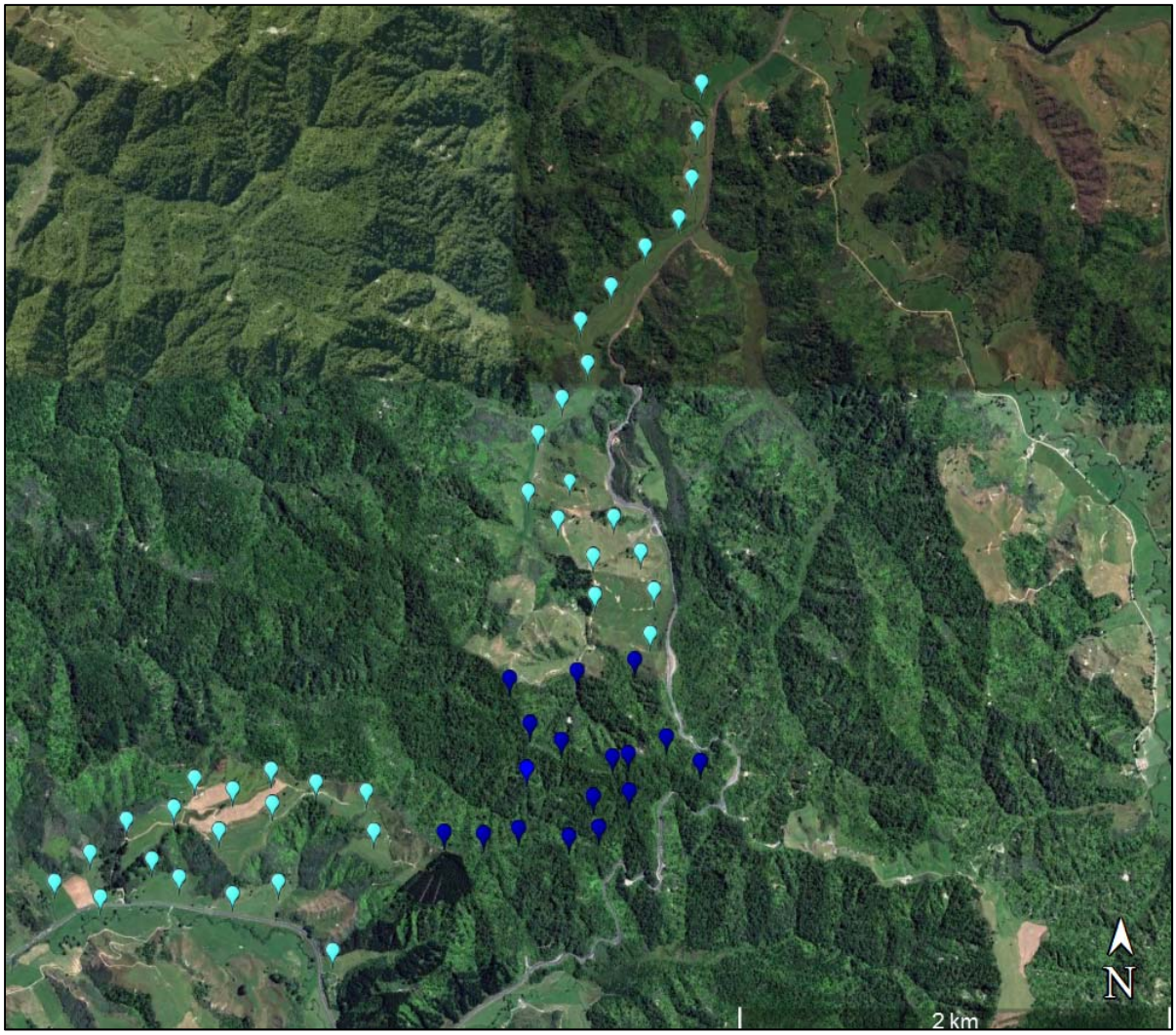

Figure A 3 – Five minute bird count station locations along the MC23 alignment. Blue points = indigenous forest bird surveys; turquoise points = open farmland and streamside bird surveys.

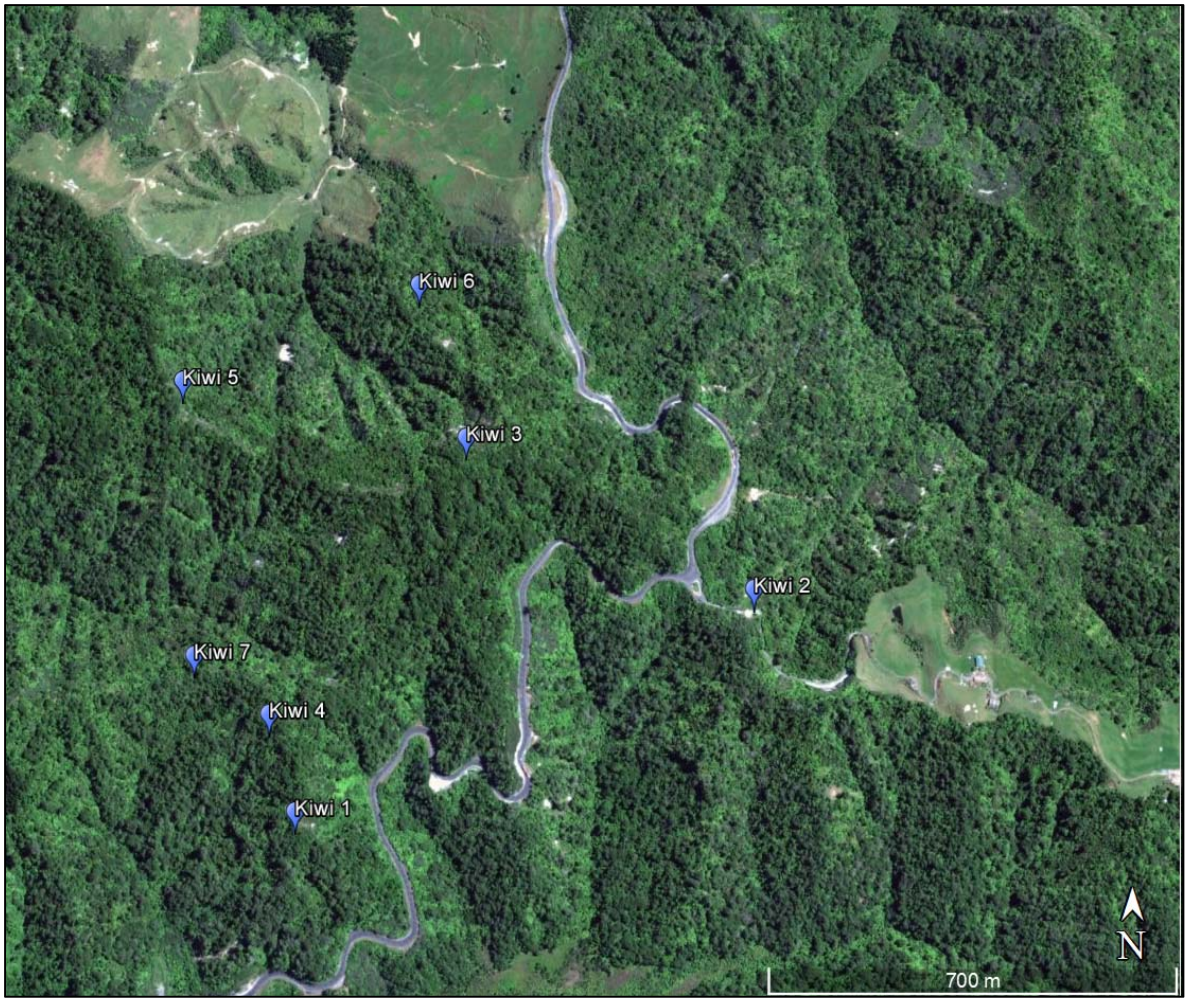

Figure A 4 – Kiwi listening survey sites at Mt Messenger. Kiwi 1 and Kiwi 2 were surveyed in October 2016, while the remainder were surveyed in February 2017.

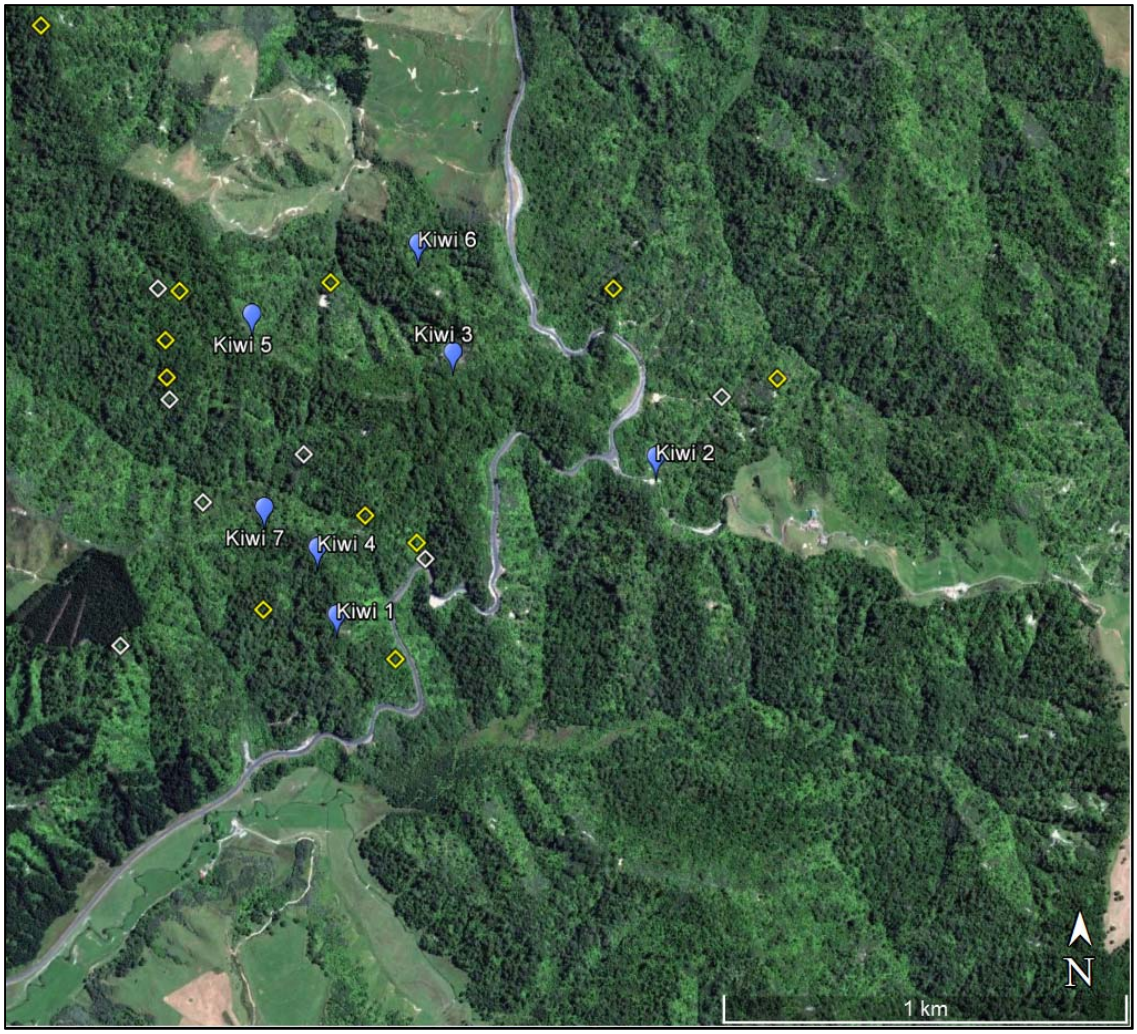

Figure A 5 – Kiwi listening survey sites during October 2016 and February 2017 around the MC23 alignment (Kiwi 1 – 7, purple pins) and estimated kiwi locations (diamonds). Yellow diamonds = male kiwi, white diamonds = female kiwi.

Appendix B: Photographs

Photograph A. *Typical farmland within the Mt Messenger North bird survey area. A small volume tributary flows north and indigenous forest occupies the hill-slopes to the west.*

Photograph B. *Typical farmland monitoring site in the Messenger South area. Developed grassed terraces give way to shrubland gullies while pine forest in the distance abuts the indigenous forest of Parininihi beyond.*

Photograph C. *Steep gully in which a pair of kiwi (Figure 6) were heard in close proximity to the highway in October 2016*