Project Number: 2-A0012.00

State Highway 1 and State Highway 29 Intersection Upgrade

Assessment of Effects on the Environment - Ecology

23 August 2021

wsp

150 YEARS IN AOTEAROA

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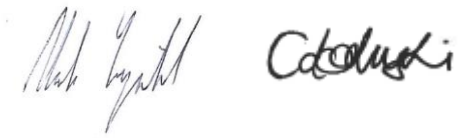

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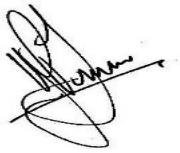

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Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for NZ Transport Agency Waka Kotahi ('**Client**') in relation to an application for a notice of requirements and regional resource consents ('**Purpose**') and in accordance with our contract with the Client dated May 2020. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

Glossary of Abbreviations

Abbreviation/acronym	Term
ABM	Automatic Bat Monitor
DOC	Department of Conservation
EIANZ	Environment Institute of Australia and New Zealand
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
km	Kilometres
m	Metres
MPDC	Matamata-Piako District Council
NES FW	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NoR	Notice of Requirement
NPS-FW	National Policy Statement for Freshwater Management 2020
RPS	Waikato Regional Policy Statement: Te Tauākī Kaupapahere Te-Rohe O Waikato 2016
SNA	Significant Natural Area
SWDC	South-Waikato District Council
VRP	Vegetation Removal Protocol
WRC	Waikato Regional Council
WRP	Waikato Regional Plan

1 Introduction

1.1 Purpose and Scope of this Report

This report forms part of a suite of technical reports prepared for Waka Kotahi New Zealand Transport Agency (Waka Kotahi) for the State Highway 1 (SH1) and State Highway 29 (SH29) Intersection Upgrade Project (the Project).

This ecological report informs the Assessment of Effects on the Environment Report (AEE) and supports two Notice of Requirements (NoR) for alterations to designations to Matamata-Piako District Council (MPDC) and South-Waikato District Council (SWDC) and applications for regional resource consent to Waikato Regional Council (WRC) for a new roundabout to be located on the western side of SH29 and to the north of the existing intersection (Figure 1-1).

A full description of the NoRs and regional resource consents required for the Project is provided in Section 4 of the AEE. A description of the background and strategic context for the Project is provided in Section 2 of the AEE.

1.2 Project Description

The Project is the construction and operation of a new two-lane roundabout connecting SH1 and SH29, north-west of the existing intersection of SH1 and SH29 at Piarere. The key components of the Project are:

a) A two-lane roundabout with a 60m diameter central island.

b) Realignment of parts of the SH1 and SH29 approaches to connect to the new roundabout.

c) The roundabout will be elevated approximately 3.5m above the existing ground level to provide for cycle and pedestrian underpasses.

d) A stormwater management system, including stormwater ponds, stormwater outlets, grassed swales, culverts and discharges.

e) Construction activities, including a construction compound, lay down area and establishment of construction access.

A full description of the Project including its current design, construction and operation is provided in Section 6 of the AEE and shown on the Project Drawings.

The final design of the Project (including the design and location of ancillary components such as stormwater treatment devices), will be refined and confirmed at the detailed design stage.

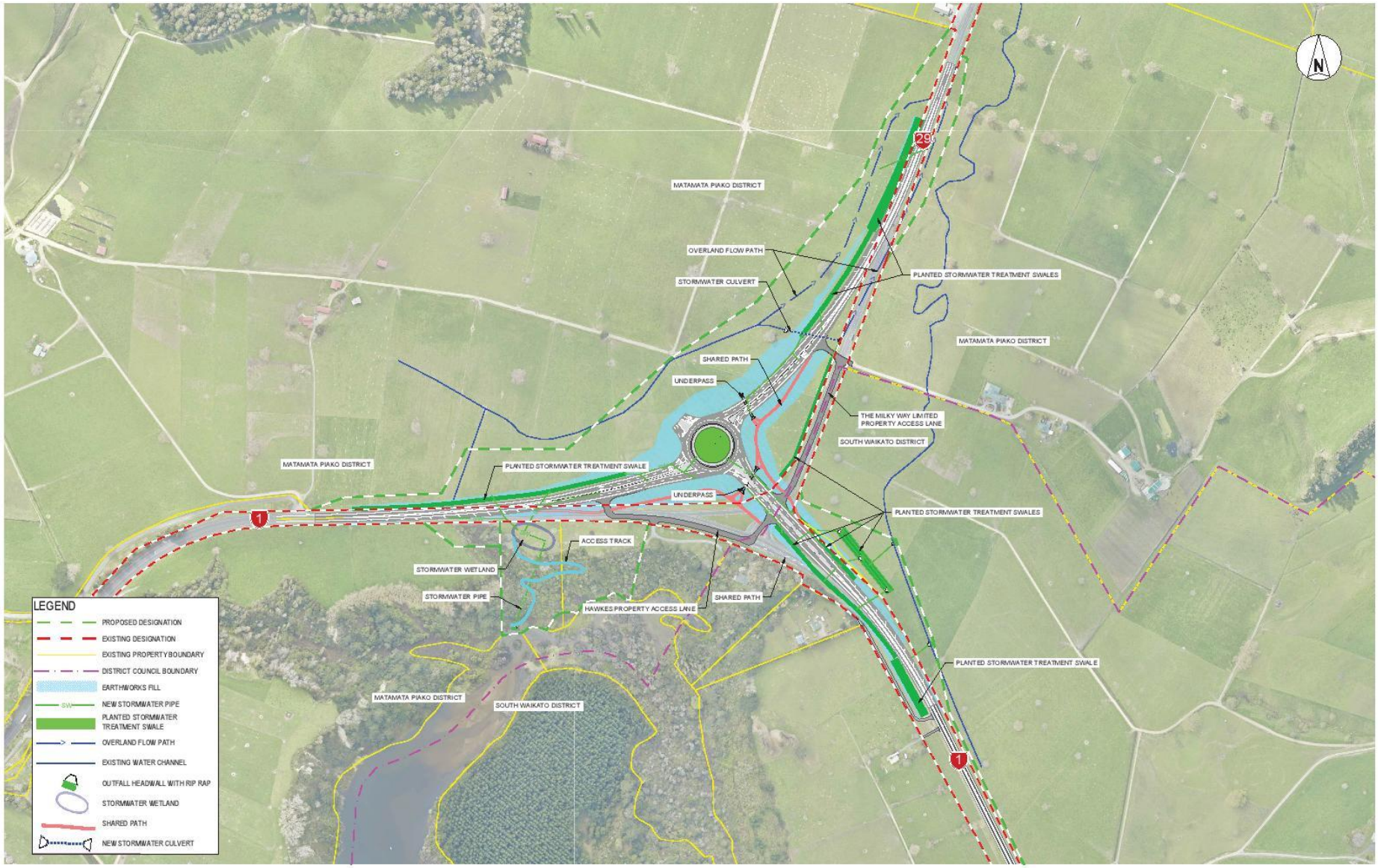

Figure 1-1: The Project design map showing proposed locations of stormwater culverts, wetland ponds and discharge points.

1.3 Scope of Assessment

This report provides an assessment of the ecological effects of the Project described in Section 1.2 above.

The scope of the ecological assessment is to provide:

- a description of ecological characteristics and values of the ecology that are potentially affected by the proposed intersection upgrade, including vegetation, aquatic ecology, birds, lizards, and bats;
- an assessment of the nature and significance of effects of the Project on the ecological values identified; and
- details of measures recommended to avoid, remedy or mitigate adverse effects, if required.

2 Methodology

2.1 Overview

The overall approach used to undertake the assessment of ecological effects involved applying the "Ecological Impact Assessments" guidelines published by the Environment Institute of Australia and New Zealand (EIANZ, 2018) using data and ecological information gathered by two primary methods:

- A desktop review of existing data and ecological information; and
- Field site visits conducted on 19 January 2021 (properties on the eastern side of SH29: SA1701/33 and SA646/95), 26 February 2021 (properties on the eastern side of SH29: SA1701/33, SA646/95, and southern side of SH1: SA15C/944, SA38B/65, SA66C/712), 26 March 2021 to retrieve bat monitors from properties: SA1701/33, SA646/95, SA15C/944, SA38B/65, and SA66C/712), and 21 April 2021 (properties within the western gully: SA32A/615).[1]

2.2 Desktop Assessment

The desktop assessment included the following information sources:

- Review of aerial imagery (from September 2019), google street view (from June & July 2020) and drone imagery (from June 2021);
- Search of Council databases and plans;
- Review of design drawings and Option Assessment Report (WSP, 2020);
- Search of the Department of Conservation (DOC) Herpetofauna BioWeb database records accessed December 2021;
- Search of the DOC Bat BioWeb database records accessed January 2021;
- Search for records in the New Zealand Freshwater Fish Database; and
- Search of the eBird database.

2.3 Field Assessment

Field assessments were limited to site walkovers of the properties on the eastern side of SH29 for all ecological matters, apart from bats. Automatic Bat Monitors (ABMs) were deployed on the eastern side of SH29 and some properties on the southern side of SH1. Property access was not available for the property on the western side of SH29 (SA69C/317) therefore field surveys have not taken place on this property. However, we undertook visual observations of that land from the eastern side of SH29.

The field assessments included the following:

- Description of the vegetation within and in close proximity to the Project footprint (i.e. within the designation boundaries for the Project), recording vegetation types and plant species.
- Field observations of birds, visually or by call, within or near to the Project Footprint during site walkovers.
- A lizard survey involving habitat assessments and manual searches of higher quality habitat directly impacted by the Project. The survey was completed by Mark Yungnickel who holds Wildlife Authorisation 69551-FAU[2].

[2] This wildlife authorization from the Department of Conservation allows survey and handling of native lizards in the Waikato Region.

- Aquatic ecology investigations including a walkover of the eastern watercourse and an unnamed river on the southern side of SH1 and visual inspection from across the road of the western watercourse (due to no property access), and visual inspection across the unnamed river of the natural wetland on the true left bank These were limited to a description of the existing habitat and plants.
- Acoustic monitoring of long-tailed bat activity within the proposed designation boundaries and wider area. The bat monitors were located on mature single trees within paddocks and woody vegetation on the fringes of the designation. Acoustic monitoring followed DOC's best practice guidelines (Sedgeley et al., 2017).
- Assessment of potentially affected trees for bat roost suitability. Trees were assessed from the ground by Caitlin Dodunski (Level C2, D Bat Ecologist, Appendix A (the draft Bat Management Plan (BMP)) provides a description of the DOC competency classes). Identification of roost features were undertaken using the roost identification criteria – habitat assessment as prescribed in the BMP adapted from Smith et al. (2017). Trees identified as potential bat roosts are those >15 cm diameter at breast height (DBH) and have one or more of the following attributes:
    - Cracks, crevices, cavities, fractured limbs, or other deformities, large enough to support roosting bat(s);
    - Sections of loose flaking bark large enough to support roosting bat(s);
    - A hollow trunk, stem or branches; and/or
    - Deadwood in canopy or stem of sufficient size to support roost cavities or hollows.

    Based on the presence (or absence) of the above, trees were then categorised as to their suitability as bat roosts (Table 2-1). This method was adapted from roost tree surveys conducted for the Southern Links Project (AECOM, 2019).

Table 2-1: Criteria for assessing trees for their suitability as bat roosts.

Suitability as a roost	Justification of assessment	Further survey required?
Low	A tree of at least 15cm DBH but no roost features visible or with only limited roosting potential i.e. loose bark present, but not sufficient to provide shelter for roosting bats.	No
Moderate	A tree of at least 15cm DBH with one or more roost features that could be used by individual bats or where it is not clear from the ground inspection whether roost features are present or not and therefore requires further inspection.	Yes
High	A tree of at least 15cm DBH with one or more roost features which could provide habitat for several bats due to their size and ability to provide sufficient shelter and protection.	Yes
Confirmed	A tree known to have been used by bats as a roost tree.	Yes

2.4 Methodology for Assessment of Effects

2.4.1 EIANZ Guidelines

Guidelines for undertaking environmental assessment were used to aid assessing ecological impacts of the Project (EIANZ, 2018). The guidelines assist in assessing values and effects in a consistent and transparent way. However, sound professional judgement is still required when applying the framework and matrix approach.

The approach involves assigning values for vegetation, habitats or species using the criteria in Table 2-2 below and then assigning a magnitude of effects rating using the criteria in Table 2-3

below. An overall level of effects is then determined by combining the value from Table 2-2 with the magnitude from Table 2-3 using the matrix in Table 2-4 below.

2.4.2 Assessment of Ecological Values

The first step of the EIANZ guidelines approach requires ecological values to be assigned on a scale of 'negligible', 'low', 'moderate', 'high', or 'very high' to each ecological feature (Table 2-1). Species were valued according to their conservation status; those 'At Risk' or 'Threatened' were valued at a higher level than those classified as 'Not Threatened'. Threat classifications have been sourced for plants (De Lange et al., 2018); birds (Robertson et al., 2016); reptiles (Hitchmough et al., 2016); fish (Dunn et al., 2018); and bats (O'Donnell et. al., 2018).

In determining whether or not a values criterion (as set out in Table 2-1 below) has been met or not, tools for determining the quality of habitat have also been applied where appropriate. The vegetation and habitats affected by the Project have been assessed with regard to values set out in the Waikato Regional Plan (WRP), South Waikato District Plan and Matamata Piako District Plan (e.g. significant natural areas) and whether it meets significance criteria of Section 11A of the Waikato Regional Policy Statement (RPS). Additional matters that have been considered when assigning ecological value to freshwater systems include classification, instream and riparian habitat, health and intactness, and stream order.

Table 2-2: Assignment of values to species and habitats (adapted from EIANZ, 2018)

Value	Species Value Requirements	Terrestrial and Freshwater Habitat Value Requirements
Very High	Nationally 'Threatened' species occur or expected to occur regularly within the Project Footprint on a permanent or seasonal basis.	Likely to be nationally important and recognised as such. Meets the majority or all of the ecological significance criteria outlined in Waikato Regional Policy Statement (section 11A) based vegetation and habitat.
High	Nationally 'At Risk' species occur or expected to occur on a permanent or seasonal basis.	Likely to be regionally important and recognised as such. Meets some of the ecological significance criteria outlined in the Waikato Regional Policy Statement (section 11A) based on vegetation and habitat.
Moderate	Locally uncommon or distinctive species.	Likely to be important at the level of the Ecological District. Habitat does not meet the ecological significance criteria outlined in the Waikato Regional Policy Statement (11A) but provides locally important ecosystem services (e.g. erosion and sediment control, and landscape connectivity).
Low	Nationally and locally common indigenous species.	Limited ecological value other than as local habitat for tolerant native species. Nationally or locally common habitat that does not provide locally important ecosystem services.
Negligible	Exotic species, including pests, species having recreational value.	Low or Very Low for remainder.

2.4.3 Magnitude of Effects

In determining a rating for the magnitude of effects on each ecological value, consideration was given to the scale of habitat loss relative to the size of the available resource, duration of the effect, likely effect at population level with respect to individual species and degree to which the Project was likely to impact on the sustainability of the ecosystem and associated species. The magnitude of the effects is described as 'Negligible', 'Low', 'Moderate', High', or 'Very High' (Table 2-3). In assessing the magnitude of effects, standard best practice in terms of minimising effects and post construction restoration have been included as part of the Project and the overall effect has been assessed with mitigation in place.

Table 2-3: Criteria for describing the magnitude of effects (EIANZ, 2018)

Magnitude	Description
Very high	Total loss of, or very major alteration to, key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature.
Moderate	Loss or alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature.
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population.

2.4.4 Overall level of Effects

The last step in the effects assessment process was to determine the overall level of effect using the EIANZ matrix shown in Table 2-4.

Table 2-4: Criteria for describing the level of effects (EIANZ, 2018)

Magnitude	Ecological Value				
	Very High	**High**	**Moderate**	**Low**	**Negligible**
Very High	Very High	Very High	High	Moderate	Low
High	Very High	Very High	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very Low	Very low
Negligible	Low	Very Low	Very Low	Very Low	Very low
Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

The level of effect or risk posed on ecological values ranges from Very High/High to Low/Very Low level, with the potential under some circumstances for a Net Gain. Moderate level effects, or greater, typically require measures to avoid, remedy or mitigate effects, while Low to Very low effects levels are not normally of concern, although care may be required to minimise effects through design, construction and operation of a project.

3 Assessment of Ecological Values

3.1 Vegetation

3.1.1 Roundabout footprint: Eastern and Western side of SH29

On the eastern side of SH29, vegetation is dominated by grazed exotic pasture, with areas of rank grass and weeds along the roadside fence. There are also several scattered exotic Pin Oak trees (*Quercus palustris*) and three of these trees will be removed within the Project footprint (Photo 1; and Figure 3-5).

Photo 1: Looking north-west on property SA646/95 showing vegetation on the eastern side of the existing intersection.

On the western side of SH29, similar to the eastern side, vegetation is dominated by grazed exotic pasture with areas of rank grass and weeds along the roadside fence. There are several scattered exotic plane trees (*Platanus* sp.) located within the designation boundaries. Three plane trees are proposed to be removed as part of the Project works in this area (Photo 2; and Figure 3-5).

Photo 2: Looking west on property SA646/95 showing vegetation on the western side of the existing intersection.

3.1.2 Southern side of SH1

The vegetation on the southern side of SH1 consists of mixed exotic and native trees and scrub, which includes mainly exotic species, such as pine (*Pinus radiata*), macrocarpa (*Cupressus macrocarpa*), privet (*Ligustrum* spp.), liquid amber (*Liquidambar styraciflua*), *Camellia* sp., wattle (*Acacia* sp.) and scattered native species such as cabbage tree (*Cordyline australis*), red mapou (*Myrsine australis*), lemonwood (*Pittosporum eugenioides*) and totara (*Podocarpus totara*) (Photo 3). The groundcover consists of areas of wandering jew (*Tradescantia fluminensis*) and ivy (*Hedera helix*). This vegetation will not be impacted by construction and operation of the roundabout.

Photo 3: Looking south from property SA646/95 showing the existing native and exotic vegetation on the southern side of the existing intersection.

3.1.3 Gully stormwater discharge footprint: Western gully

A stormwater discharge is proposed from a wetland pond on the southern side of SH1 (Crown land held in RT SA32A/615) to near the bottom of the western gully (within the Crown land). Construction of the discharge structure will require an approximately 4 m wide access track to be cut within the gully vegetation. Some vegetation will need to be removed to construct the discharge structure (referred to as the gully stormwater discharge footprint).

During a site visit on 21 April 2021, we observed that vegetation in the vicinity of the proposed access track is dominated by exotic trees, shrubs and weeds. The middle and upper reaches of the proposed access track are dominated by privet (*Ligustrum* spp.) with a variety of other exotic species such as poplar (*Populus* sp.), wattle (*Acacia* sp.), pine (*Pinus radiata*), bamboo, *Cotoneaster* sp. and *Camelia* sp., and interspersed with native vegetation including red mapou (*Myrsine australis*), cabbage tree (*Cordyline australis*), black mamaku (*Cyatheaceae medullaris*), wheki (*Dicksonia squarrosa*), flax (*Phormium tenax*), lemonwood (*Pittosporum eugenioides*), karamu (*Coprosma robusta*), makomako (*Aristotelia serrata*), hangehange (*Geniostoma ligustrifolium*), kawakawa (*Piper excelsum*), bracken (*Pteridium esculentum*), five finger (*Pseudopanax arboreus*) and a large kanuka (*Kunzea robusta*). Groundcover within this area includes areas of jasmine (*Jasmine polyanthum*), ivy (*Hedera helix*), wandering jew (*Tradescanthia fluminensis*) and bare ground. The gully floor vegetation was dominated by blackberry (*Rubus fruticosus*) and bindweed (*Convolvulaceae*). Photos from the site visit and vegetation encountered are shown in Photos 4 to 8 below.

Apart from the large kanuka tree which will be avoided by the access track, none of these species have a conservation rating. Privet and blackberry, which dominate the vast majority of this area, are invasive weeds.

Photo 4: Western gully showing a variety of vegetation present within property SA32A/615, view looking south down to the Unnamed River from the top of the gully where the access track is proposed to start.

Photo 5: Western gully showing a variety of mainly exotic vegetation present within property SA32A/615, looking north-east from the Unnamed River where the access track is proposed to start.

Photo 6: Western gully showing a variety of vegetation present within property SA32A/615, looking south-east at the location of the proposed wetland pond.

Photo 7: Western gully showing a variety of vegetation present within property SA32A/615, scattered tree ferns present in the middle reaches of the gully provide a small area of higher quality habitat.

Photo 8: Western gully showing a variety of vegetation present within property SA32A/615, privet dominates the gully vegetation, several of which are dead or falling over.

3.1.4 Significance of vegetation and habitat

Table 3-1 provides an assessment of the vegetation and habitats within the proposed roundabout footprint and gully stormwater discharge footprint, against the criteria for assessing the significance of indigenous biodiversity taken from the Waikato RPS (Section 11A).

No locally uncommon or rare plant species were recorded within the gully and therefore the value of the flora within the Project Footprint is Low in terms of plant species present. A single kanuka tree was observed, now classified as a 'Threatened' species due to the threat of possible decline posed by the spread of myrtle rust. This species is still common and widespread locally, regionally and nationally, and its threat classification is not considered to elevate the conservation status of the gully area. It is noted that the location of the gully stormwater discharge structure is within the MPDC District Plan's Conservation Zone. However, as noted above, the vegetation is dominated by exotic vegetation and weeds.

The presence of long-tailed bat, a 'Threatened' species, results in a Very High ecological value rating for the Project footprint in terms of terrestrial fauna species, however, the habitat is of lower quality for long-tailed bat compared to habitat in the wider landscape. However, as the habitats within the western gully meet four of the eleven RPS criteria and the habitats within the roundabout footprint meets one of the eleven RPS criteria, these habitats have High ecological value against the EIANZ criteria.

Table 3-1: RPS significance criteria met by the vegetation/habitat within the roundabout and gully stormwater discharge footprint.

	Criteria	Assessment
1	It is indigenous vegetation or habitat for indigenous fauna that is currently, or is recommended to be, set aside by statute or covenant or by the Nature Heritage Fund, or Ngā Whenua Rāhui committees, or the Queen Elizabeth the Second National Trust Board of Directors, specifically for the protection of biodiversity, and meets at least one of criteria 3-11.	Yes – within the western gully the stormwater discharge structure is just within the Matamata-Piako District Plan's Conservation Zone. No – not for the roundabout footprint.
2	In the Coastal Marine Area, it is indigenous vegetation or habitat for indigenous fauna that has reduced in extent or degraded due to historic or present anthropogenic activity to a level where the ecological sustainability of the ecosystem is threatened.	No – N/A.
3	It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are: • Classed as threatened or at risk, or • Endemic to the Waikato region, or • At the limit of their natural range.	Yes – the western gully and roundabout footprint provide habitat for long-tailed bats classified as Nationally Critical. The Waikato River supports fish species classified as 'At Risk'.
4	It is indigenous vegetation, habitat or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.	No – the vegetation and habitat is not under-represented
5	It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon such as geothermal, chenier plain, or karst ecosystems, hydrothermal vents or cold seeps.	No – not a nationally uncommon vegetation or habitat type.
6	It is wetland habitat for indigenous plant communities and/or indigenous fauna communities (excluding exotic rush/pasture communities) that has not been created and subsequently maintained for or in connection with: • Wastewater treatment; • Wastewater renovation; • Hydroelectric power lakes (excluding Lake Taupo); • Water storage for irrigation. Unless in those instances they meet the criteria in Whaley et al. (1995)	No – no wetland habitat directly impacted by the project. Potential indirect effects will be mitigated.
7	It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type.	No – the vast majority of vegetation potentially impacted by the proposed gully stormwater discharge footprint is invasive exotic privet. The trees within the roundabout footprint are exotic.
8	It is aquatic habitat (excluding artificial water bodies, except for those created for the maintenance and enhancement of biodiversity or as mitigation as part of a consented activity) that is within a stream, river, lake, groundwater system, wetland, intertidal mudflat or estuary, or any other part of the coastal marine area and their margins, that is critical to the self-sustainability of an indigenous species within a catchment of the Waikato region, or within the coastal marine area. In this context "critical" means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas and migratory and dispersal pathways of an indigenous species. This includes areas that maintain connectivity between habitats.	Yes – the Unnamed River at the bottom of the western gully provides feeding and migratory pathways for native fish. No – for the watercourse on the eastern and western side of SH29.
9	It is an area of indigenous vegetation or habitat that is a healthy and representative example of its type because: • its structure, composition, and ecological processes are largely intact; and • if protected from the adverse effects of plant and animal pests and of adjacent land and water use (e.g. stock,	No – the vast majority of vegetation potentially impacted by the proposed gully stormwater discharge footprint in the western gully is invasive exotic privet and

	discharges, erosion, sediment disturbance), can maintain its ecological sustainability over time.	blackberry. The trees within the roundabout footprint are exotic.
10	It is an area of indigenous vegetation or habitat that forms part of an ecological sequence, that is either not common in the Waikato region or an ecological district, or is an exceptional, representative example of its type.	No – the vast majority of vegetation potentially impacted by the proposed gully stormwater discharge footprint in the western gully is exotic invasive privet. The trees within the roundabout footprint are exotic. They are not an exceptional, representative example of their type.
11	It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, ecological buffer, linkage, or corridor and which is necessary to protect any site identified as significant under criteria 1-11 from external adverse effects.	Yes – while the western gully is dominated by mainly exotic vegetation it still provides important contiguous habitat for native flora and fauna in the Waikato Region. The gully vegetation is important habitat and commuting area for long-tailed bats. No – not for the roundabout footprint

3.2 Birds

3.2.1 Field Assessments

A total of fourteen species of birds were recorded in the vicinity of the Project area during the site visits in January, February and April 2021 as listed in Table 3-2. Seven of the observed species were native (including four New Zealand endemic species – grey warbler, fantail, New Zealand wood pigeon and tui) and seven were common introduced species (Photo 9). No species recorded are classified as 'At Risk' or 'Threatened' (Robertson et al., 2017). During the January site visit, a nest (species undetermined) was observed in one of the pin oak trees at property SA646/95 on the eastern side of SH29 (Photo 10).

The exotic and native vegetation within the southern part of the existing intersection provides habitat for a range of birds (Photo 3 and 4). The only vegetation within the southern part of SH1 that will be impacted will be in the western gully (Figure 1-1). This will require removal of predominantly exotic vegetation and may include some native shrubs which provide habitat for native birds. However, based on the small footprint, the Project area is not considered ecologically significant to these species.

3.2.2 Desktop Assessment

There were no records from the ebird database from similar habitat in the vicinity of the Project footprint. However, there was one record approximately 1.6km southwest of the Project site from the 'Karapiro-Horahora Domain bridge' where 42 species have been observed from observations between 2015 and 2020. This indicates there are a number of other bird species that may periodically visit or are present in the wider area. Of these several species have an 'At Risk' conservation ratings such as black shag (*Phalacrocorax carbo*), little black shag (*Phalacrocorax sulcirostris*), and New Zealand falcon (*Falco novaeseelandiae*). The riparian margins along the river have the potential to be utilised by shags. However, no shags or evidence of shags were observed roosting or nesting in the site specific river riparian zone within the western gully during the site visits.

Table 3-2 : Bird species observed during the January, February and April 2021 site visits of the eastern and southern sides of the existing intersection.

Species	Common name	Threat Status (Robertson et al. 2017)
Acridotheres tristis	Common myna	Introduced and Naturalised
Alauda arvensis	Eurasian skylark	Introduced and Naturalised
Callipepla californica	California quail	Introduced and Naturalised
Circus approximans	Australasian harrier	Native, Not Threatened
Columba livia	Rock pigeon	Introduced and Naturalised
Gerygone igata	Grey Warbler	Endemic, Not Threatened
Gymnorhina tibicen	Australian magpie	Introduced and Naturalised
Hemiphaga novaeseelandiae	New Zealand wood pigeon	Endemic, Not Threatened
Hirundo neoxena	Welcome swallow	Native, Not Threatened
Passer domesticus	House sparrow	Introduced and Naturalised
Rhipidura fuliginosa	New Zealand Fantail	Endemic, Not Threatened
Sturnus vulgaris	Common starling	Introduced and Naturalised
Prosthemadera novaeseelandiae	Tui	Endemic, Not Threatened
Vanellus miles	Spur-winged plover	Native, Not Threatened

Photo 9: A fantail observed within vegetation on property SA38B/65 on the southern side of SH1.

Photo 10: A bird's nest observed within one of the pin oak trees on property SA646/95 on the eastern side of the intersection.

3.3 Herpetofauna

3.3.1 Desktop Assessment

Based on a review of the DOC BioWeb herpetofauna database (accessed December 2020), there were two records of herpetofauna found within a 10 km radius of the Project footprint from the last 15 years. This included a copper skink (*Oligosoma aeneum*) located approximately 5.5 km northwest, and a rainbow/plague skink (*Lampropholis delicata*) located approximately 10 km northeast.

3.3.2 Field Assessments

Table 3-3 summarises the habitat throughout the Project site and a summary of the results from the lizard surveys carried out in January, February and April 2021 (Table 3-3; Photo 11 to 13).

Within the land on the western and eastern sides of SH29, areas of vegetation that would be impacted by the Project are generally limited to exotic grazed, mown and rank pasture, and six exotic trees. Areas of grazed and mown pasture are of very low or unsuitable quality for native lizards, and areas of rank grass are of low quality for native lizards. While the property on the western side of SH29 was not accessible, observations from the adjacent eastern properties show it is dominated by very low or unsuitable quality habitat (Photo 11).

Within the vicinity of the western gully, vegetation is dominated by mainly exotic privet (*Ligustrum* spp.), interspersed with native and exotic shrubs and trees, and areas of dense weed ground cover. The upper areas of gully are too steep for native skink but there are several flatter areas with rotting logs, rocks, wandering jew, leaf litter and various rubbish which provide potential habitat for native skinks. There is also a small potential for arboreal geckos to inhabit vegetation within the gully. While the vast majority of the vegetation within the gully is dominated by privet and is of low quality for arboreal species, there are several areas of higher quality habitat such as the large kanuka tree, native shrubs and tree ferns.

Table 3-3: Summary of habitat descriptions of areas impacted by the Project, and a summary of results from the lizard surveys undertaken in January, February and April 2021.

Site Location	Habitat description	Results of survey		
		January 2021	February 2021	April 2021
Eastern side of SH29	Dominated by mown and grazed grass. Strip of rank grass along the fenceline with scattered rocks, bricks, fenceposts and rubbish.	10 minutes active search effort.* No lizards observed	35 minutes active search effort.* No lizards observed	Not assessed
Western side of SH29	Dominated by mown and grazed grass. Strip of rank grass along the fenceline.	Not assessed. No land access	Not assessed. No land access	Not assessed. No land access
Western gully	Dominated by privet with some scattered native and exotic vegetation. Areas of dense groundcover including wandering jew, jasmine, ivy, leaf litter, rank grass and objects such as rotting logs, rank grass, corrugated iron, rocks, bricks, rubbish: fridges, ovens, microwaves.	Not assessed	Not assessed	60 minutes active search effort.* No lizards observed

* Note: In addition to active search efforts, ecologists spent many additional hours onsite, where there was potential to observe lizards within these areas.

Photo 11: Eastern side of SH29. No lizards were observed during manual searches of higher quality habitat which consisted of rank grass along the existing roadside, looking north-west on property SA646/95.

Photo 12: Eastern side of SH29. No lizards were observed during manual searches of higher quality habitat which consisted of rank grass along the existing roadside, looking northeast on property SA646/95 along SH29.

Photo 13: Western gully showing a variety of habitats present. No lizards were observed during manual searches of higher quality habitat (A-F) within property SA32A/615.

Manual searches focused on searching the highest value habitat in areas more likely to be directly impacted by the proposed works i.e. the rank grass on the eastern side of SH29; and areas with high ground cover such as rotting wood, rocks, wandering jew, thick leaf litter and grass within the western gully. Whitaker's (1994) 'searching by day' methodology was used which included pushing through rank grass, lifting cut grass, fenceposts, rocks, bricks, rotting logs, cut wood, and various types of rubbish such as microwaves, corrugated iron, ovens, and barbeques.

On the eastern side of SH29, this area was searched for approximately 10 minutes during the January site visit (limited effort due to marginal weather) and for 35 minutes during the February site survey (during warm, sunny weather with a 26°C high), and in the western gully 60 minutes search effort during the April site visit (during warm sunny weather with a 22°C high). Nocturnal spotlighting for arboreal species was not undertaken within the western gully due to little suitable vegetation and health and safety risks.

No lizards or evidence of lizards were observed during manual searching in the January, February or April site visits. While lizards are cryptic and can be difficult to detect when they are in low densities, based on the disturbed, isolated or steep nature of potential habitat, and no lizards being observed

during manual searches, it is reasonable to assume that native skinks (specifically copper skinks) may be absent from the site or are present in low densities. Based on the dominant exotic invasive vegetation within the gully, avoidance of small areas of native vegetation within the gully, it is unlikely that At Risk or Threatened arboreal geckos (e.g. forest gecko) are present.

3.4 Aquatic Ecology

3.4.1 Roundabout footprint: Unnamed watercourse on eastern side of SH29

An unnamed watercourse is noted as Surface Water Class on WRC's online Water Classification maps. The watercourse runs along the eastern side of SH29 and follows a north and north-east direction (outside of the designation boundary) before entering the Waitoa River approximately 7 km downstream of the site (Figure 3-1). At the time of survey (including after heavy rain during the January site visit), there was no flow or sitting water in the eastern watercourse in close proximity to the Project Footprint. There was no clearly defined channel or bed, nor riparian vegetation. The watercourse was unfenced from stock, exotic grass dominated the bed, and the macrophyte *Persicaria* sp. was observed. Areas downstream (north) include roadside drains, which were also found to be dry (Photo 8). As this area is a low quality habitat and will not be directly or indirectly affected by the Project, wetland delineation, under the NES-FW and NPS-FM did not take place as it does not apply.

It is expected that the sections of eastern watercourse in close proximity to the designation boundary would only flow for short periods after heavy rain during the wetter winter months. The landowner of the eastern watercourse advised that the watercourse had flowed for several weeks during the winter period (*pers comm,* Ross Watkins, Landowner, 26 February 2021). Based on the definition in the WRP, the watercourse falls within the WRP definition of an 'ephemeral stream' (WRP definition: *Ephemeral streams: Streams that flow continuously for at least three months between March and September but do not flow all year.*).

There was no water present in the eastern watercourse to enable sampling of water quality, macroinvertebrate communities, fish communities or detailed habitat assessments. However, when the watercourse does flow, the water quality is expected to be of low quality and degraded, based on the farming land use, the watercourse being unfenced from stock and lack of a riparian cover. It is expected that the watercourse will only periodically support macroinvertebrate taxa which are tolerant of degraded conditions and high disturbance.

Based on a review of the New Zealand Freshwater Fish Database (accessed January 2021), there are a number of records of native and exotic fish species present several kilometres away within the Waitoa River and tributaries (Table 3-4). Based on the absence of any water in the watercourse during the site visit, the degraded specific habitat with little or no fish cover, the farming dominated land use with little riparian cover within the wider catchment, and the ephemeral nature of the watercourse, it is considered that the watercourse does not provide high value habitat for native fish. During wetter winter months, fish may move into roadside drains and watercourses. However, it is expected this would be limited to species that are tolerant of degraded and disturbed sites, such as shortfin eels *(Anguilla australis*) and mosquito fish (*Gambusia affinis*).

Overall, based on the ephemeral nature of the watercourse, lack of any riparian cover, the watercourse being unfenced from stock and providing poor quality habitat for aquatic biota, the watercourse is considered to have low value.

Table 3-4: Fish species observed from the NZFFDB records several kilometres downstream from the site from Waitoa River and tributaries.

Scientific name	Common name	Threat status (Dunn et al, 2018; Grainger et al. 2014)
Anguilla australis	Shortfin eel*	Not threatened
Anguilla dieffenbachii	Longfin eel	'At Risk', Declining
Cheimarrichthys fosteri	Torrentfish	'At Risk', Declining
Galaxias maculatus	Inanga	'At Risk', Declining
Gambusia affinis	Mosquito fish*	Introduced and Naturalised
Gobiomorphus basalis	Crans bully	Not threatened
Gobiomorphus cotidianus	Common bully	Not threatened
Paranephrops planiforms	Koura	Not threatened
Retropinna retropinna	Common smelt	Not Threatened

*species most likely to be present in the watercourse (if any).

Photo 14: Eastern watercourse: ephemeral watercourse on the eastern side of SH29, looking north on property SA646/95.

Photo 15: Eastern watercourse: ephemeral stream on the eastern side of SH29, looking south-east from roadside drain on property SA1701/33.

Photo 16: Roadside drain: the eastern side of SH29, looking north-east along the roadside drain on property SA1701/33.

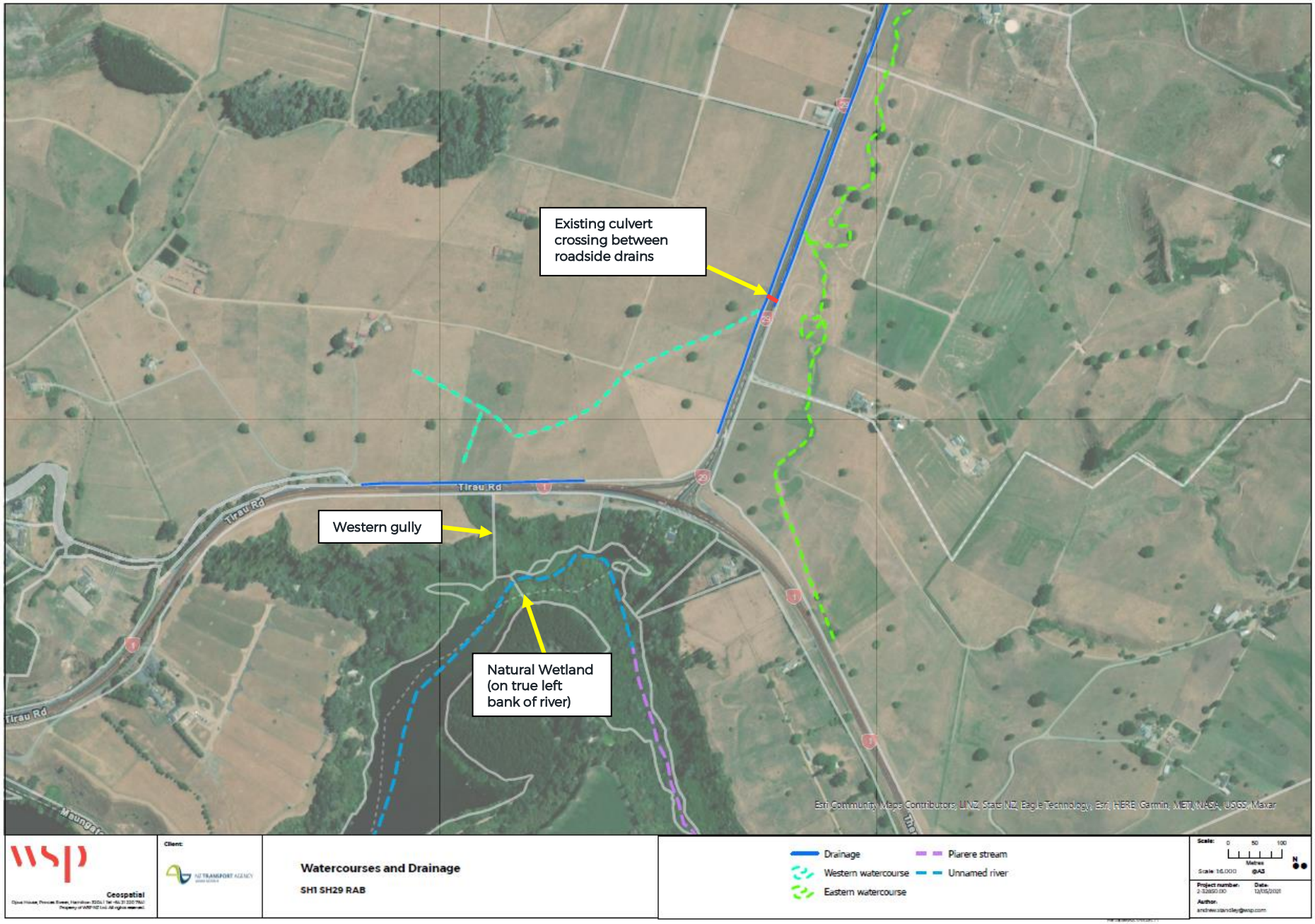

Figure 3-1: Design map showing approximate locations of watercourses, roadside drains and natural wetland within the site.

3.4.2 Roundabout footprint: Overland flowpath on western side of SH29

WRC's online Water Classification maps indicate an unnamed watercourse (Surface Water Class) on the western side of SH29. This watercourse on the western side of SH29 is shown as starting in the north-west of SH1 and heading to the northeast direction before intersecting with SH29 (Figure 3-1). While access to this land was not available, based on observations from the roadside and neighbouring properties, driving by in a car (on 11 August 2021), and review of drone imagery and 'google earth streetview', the watercourse is considered to be an ephemeral overland flowpath and does not meet the definition of an ephemeral stream in the WRP.

As the overland flow path is only expected to flow for short periods after heavy rain in winter months, it is expected that the watercourse will only periodically support macroinvertebrate taxa that are tolerant of degraded conditions and high disturbance. Due to the ephemeral modified nature, it is unlikely that this watercourse will support native fish.

Overall, based on the ephemeral nature of the watercourse, lack of any riparian cover, poor quality habitat for aquatic biota, and the watercourse being unfenced from stock, the watercourse is considered to have low value.

Photo 17: Drone imagery of the overland flow path in June 2021 on the western side of SH29. Looking north east from SH1.

3.4.3 Proposed gully stormwater discharge footprint: Western Gully

The proposed stormwater discharge location at the bottom of the western gully is proposed to flow into a perennial Unnamed River, downstream of the Piarere Stream and upstream of the Waikato River. The location of discharge is shown in Figure 1-1. It was not possible to walk across the gully floor due to the dense blackberry; however, access was gained to the Unnamed River downstream of the discharge point. The river flowed in a south-west direction and was characterised by a slow flowing run with a depth of <0.2m. Based on aerial imagery, the wetted width of the river is approximately 17 m. The stream substrate is dominated by sand, with some silt and gravels. The macrophytes starwort (*Callitriche stagnalis*), and water purslane (*Ludwigia palustris*) are abundant within the river bed, and, *Persicaria* sp. is abundant on the true right bank (ca. 1 m setback). Riparian vegetation on the true left bank of the river at the discharge point (within 20m) is fully vegetated and dominated by dense blackberry (*Rubus fruticosus*), and several grey willow (*Salix cinerea*) observed directly upstream.

Based on a review of drone aerial footage and observations of the true left bank from the true right bank of the Unnamed River, this area is completely dominated by species tolerant of wetted conditions including mainly floating sweetgrass (*Glyceria* sp.), several grey willow, and cabbage trees. Based on the vegetation present, and naturally wet conditions on the edge of the river it is therefore considered to be a natural wetland as defined by the National Environmental Standards for Freshwater (NES-FW) and National Policy Statement for Freshwater Management (NPS-FM). Also, within the Unnamed River there is the significant natural area (SNA) '*Upper Lake Karapiro BE35UP068*' located within the SWDP which includes aquatic habitat but not the terrestrial habitats directly impacted by the proposed works.

Surface water quality was not measured, but water within the river was cool, clear and uncoloured at the time of survey in April. Macroinvertebrate communities were not sampled but are expected to include a range of taxa including both taxa tolerant of modified conditions and some Ephemeroptera (mayflies); Plecoptera (stoneflies) and Trichoptera (caddisflies) (EPT) taxa which comprise three orders of insects that are generally considered to be sensitive to organic or nutrient enrichment. Based on a search of the New Zealand freshwater fish database, unidentified bullies *(Gobiomorphus* sp.) have been observed within Piarere Stream (based on one record). A diverse range of fish species have also been recorded within the Waikato River. Within 5 km of the discharge point, four records were found which included longfin eel, shortfin eel, brown bullhead catfish (*Ameiurus nebulosus*), rudd (*Scardinius erythrophthalmus*) and goldfish (*Carassius auratus*). Other fish species, and koura (*Paranephrops planifrons*) may utilise habitat or pass through this site. The WRP also classifies this area as 'trout habitat class' and 'indigenous fish class'.

Overall, based on the perennial nature of the Unnamed River, fully vegetated riparian zone (although dominated by exotic invasive species), At Risk fish species found in the wider area, and sensitive receiving environment, the discharge area has moderate to high aquatic value.

Photo 18: Unnamed River in the vicinity of the proposed discharge point, looking north-east showing the true right bank where the proposed access track will be located.

Photo 19: Unnamed River in the vicinity of the proposed discharge point, looking west where the proposed discharge point is located.

Photo 20: Unnamed River in the vicinity of the proposed discharge point, looking north-east showing both the true left and true right banks. The wetland area is on the right of this picture.

3.5 Bats

3.5.1 Desktop Assessment

A review of the DOC Bat BioWeb Database provides records of bat activity in close proximity to the Project area.

An acoustic bat survey was undertaken by DOC in 2018 in a stand of trees approximately 0.7 km to the north (Figure 3-2) of the existing intersection within the property that could not be accessed (SA69C/317). Long-tailed bats were detected on three ABMs closest to the proposed location of the roundabout during the DOC survey at activity levels between 19.57 and 48.00 average passes per night (7-night survey).

A single record of bat activity (BioWeb Database) was also detected, in 2011, approximately 1 km to the south of the proposed location of the roundabout.

3.5.2 Acoustic Bat Survey

A total of ten ABMs were deployed along properties to the north-east and south of the existing intersection on 26 February 2021. ABMs were deployed continuously for 21 nights where weather conditions remained favourable for bat activity. Once collected, the data were then processed using BatSearch software (DOC). Figure 3-2 provides a map of bat monitoring locations.

Figure 3-2: Acoustic monitoring locations surveyed between February and March 2021. The blue points show historical records of bat activity taken from the DOC Bat BioWeb Database.

A total of 6,705 long-tailed bat passes were recorded across all ten monitors over the 21 nights the ABMS were deployed. See Table 3-5 for a summary of activity recorded at each monitoring site. It is important to note that the number of passes cannot be considered indicative of population size, as the movement of an individual bat can generate multiple passes.

Mean activity levels at each site were calculated by averaging the number of bat passes (individual files assigned as long-tail bats per night of deployment) (total passes/valid nights). One monitor (R15) failed completely, and two monitors failed after one (R4) and fifteen (R3) nights. Mean activity

levels for these sites were calculated using only the nights of data collected and not the full 21 nights.

ABMs confirmed the presence of bats within the Project Footprint and adjacent habitats. Sites to the south-west of the intersection recorded moderate to high levels of bat activity, with Site R2 recording significantly higher levels of bat activity than all other sites surveyed (over 270 bat passes per night). Low to moderate levels of bat activity were recorded at all sites to the east of SH29 (<5 mean passes per night). Higher activity levels recorded at Site R2 are likely due to the presence of the highest quality habitat for bats as opposed to other sites surveyed. Site R2 was located along a shelter belt of poplar *(Populus spp.)* and blackwood *(Acacia spp.)* trees with optimal accessibility to riparian habitat.

Table 3-5 : Summary of long-tailed bat activity across all monitoring locations.

Site # (refer to Fig 3-2 for location)	Total passes (21 valid nights)	Mean activity levels ± SD
R1	101	4.8 ± 4.3
R2	5710	271.9 ± 88.1
R3	518 (failure after 15 nights)	34.5 ± 23.5
R4	92 (failure after 1 night)	92.0 ± 0.0
R11	66	3.14 ± 2.9
R12	43	2.04 ± 1.8
R13	98	4.7 ± 2.6
R14	49	2.3 ± 1.9
R15	Failure	-
R16	28	1.3 ± 1.5

The timing of activity recorded at Site R2 (closest site to proposed gully stormwater footprint) shows that bats were recorded at higher levels within the first one to two hours after sunset (Figure 3-3.) All other sites showed reasonably consistent low activity at each hour after sunset (Figure 3-4).

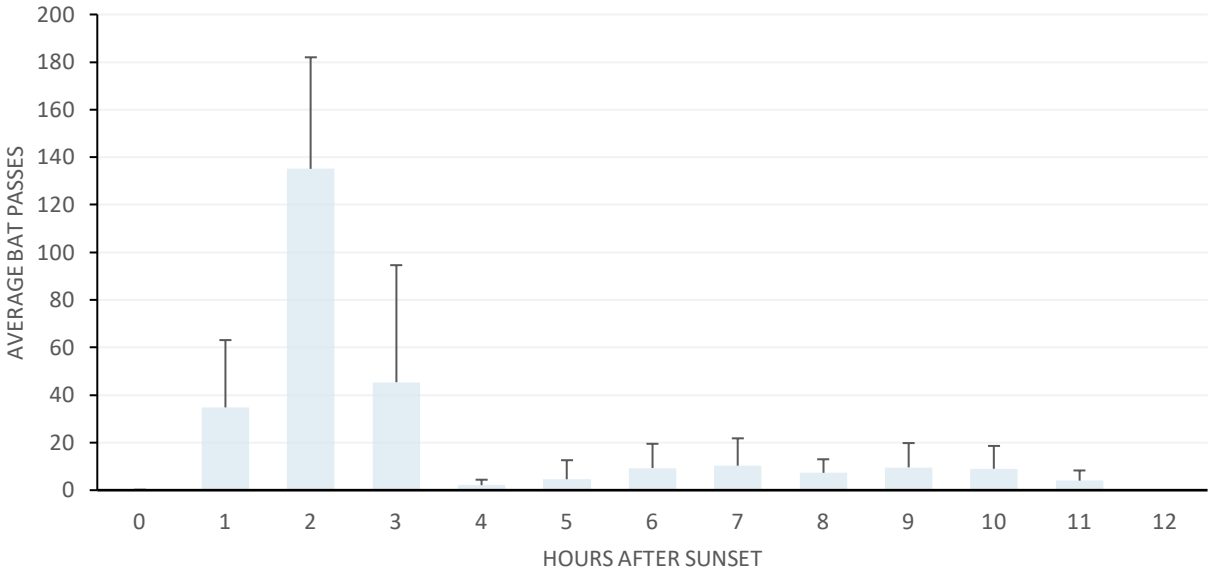

Figure 3-3: Average bat activity (+ std dev) recorded at site R2 at each hour after sunset.

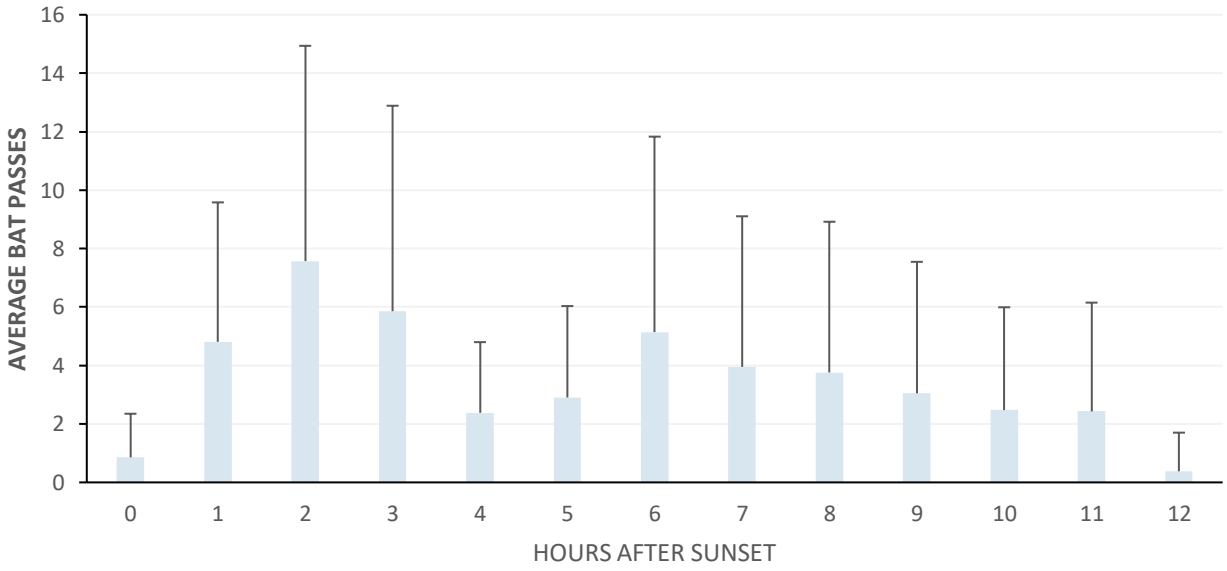

Figure 3-4. Average bat activity (+ std dev) recorded across all sites (excl. R2) at each hour after sunset.

3.5.3 Roost tree assessment

3.5.3.1 Proposed roundabout footprint

A total of 16 trees were assessed in the roundabout footprint (Figure 3-5) (using the criteria outlined in section 2.3 of this report) to determine the suitability of these trees as potential bat roosts. Thirteen of these trees were all located on the eastern side of SH29 side and were identified as pin oak (*Quercus palustris)* of approximately 60-70 cm DBH. While no roost features were obvious from the ground, the amount of leaf cover made it impossible to determine if roost features were present further up the tree. They are all therefore assessed as having moderate suitability for a bat roost. Three of these trees will be removed for construction (Figure 3-5).

Three plane *(Platanus sp.)* trees that are located on the property on the western side of SH29 (SA69C/317) were viewed from across the road (Figure 3-5). Based on the report and the author's knowledge of exotic trees of that size, it is possible that they have at least some features for bats to

roost. Therefore, they are considered to have moderate suitability for a bat roost which excludes potential maternity or communal roosts. All three trees will be removed for construction of the roundabout.

Figure 3-5: Trees assessed as potential bat roosts within the roundabout footprint and adjacent. Those trees circled in red are proposed for removal.

3.5.3.2 Proposed gully stormwater discharge footprint

A number of trees within the footprint of the proposed gully discharge were assessed for bat roost potential on 14 April 2021. There are three large pine trees which will have moderate-high roosting suitability (Figure 3.6) identified at the top of the gully, as well as a number of poplar trees and while they are not yet mature enough to be of significant roosting value to bats, they will likely be in the future. Other potential roost trees identified included several tree ferns with dense skirtings, cabbage trees and a mature kanuka. Privet is common throughout this gully, and while they technically have roost features, they are of very low quality.

As the location and path of the access track has not yet been finalised it is difficult to confirm at this stage how many potential roost trees may be impacted. Once the path of the track has been decided, a thorough assessment of vegetation will then be undertaken. However, we expect the vegetation composition in this western gully to be consistent throughout, and therefore the proposed management measures will mitigate any effects of habitat loss, regardless of path of the access track.

Figure 3.6: Drone image of western gully showing trees already identified as having moderate-high suitability for roosting bats (the trees circled on this map will be avoided). There are also a number of scattered tree ferns, cabbage trees, and privet that were identified as having some suitability as roosts, but a detailed assessment will be undertaken once the location of the access track has been refined.

As the potential roost trees are reasonably scattered throughout the proposed gully stormwater footprint, it may be possible to avoid all higher quality roost trees with minor alterations to the access track and only remove the lower-quality bat roost trees such as privet and tree ferns.

3.5.4 Ecological Value

The results of the acoustic survey are consistent with patterns of activity observed elsewhere in similar habitats (Le Roux, 2010; Smith et al. 2017; WSP, 2019) of isolated vegetation (e.g. Sites R11-R14), compared to activity closer to higher value habitats such as edges of woody vegetation and riparian margins (Sites R1-R4).

Based on desktop and acoustic survey data, it is evident that long-tailed bats are active at low to moderate levels within the Project footprint, but present at much higher levels to the south of the existing intersection. Therefore, due to bats having a status of 'Threatened - Nationally Critical' (O'Donnell et al., 2017) and a confirmed presence within the immediate vicinity of the existing intersection and wider area, ecological value for long-tailed bats is assessed as Very High.

4 Assessment of Ecological Effects

4.1 Effects on Vegetation

Vegetation removal within the intersection upgrade footprint will impact predominately exotic pasture, weeds, and six exotic trees on the eastern and western sides of SH29. The gully stormwater discharge outlet to the Unnamed River will result in approximately 30 m² to 60 m² of vegetation removal for the outlet structure, which is within a Conservation Zone, and approximately 1,000m² for the approximately 4 m wide and 200 m to 250 m long access track. The structure and access track will result in removal of predominantly exotic privet, but will also include a small amount of native vegetation. It is recommended that any native trees or concentrated areas of native vegetation are retained as the access track location is refined.

This vegetation and habitat within the western gully only meets four of eleven criteria in Section 11A of the Waikato RPS for determining significant indigenous vegetation or significant habitat of indigenous fauna as the site supports only a small amount of indigenous vegetation, and no species with a conservation rating apart from bats. The relative value of the vegetation for bats in the context of the local landscape is low due to the open nature of the landscape and poor quality of vegetation within the western gully compared to vegetation present in the wider landscape. Effects on habitat loss for fauna have been addressed in the relevant sections below.

The loss of **Negligible** value vegetation within the roundabout footprint and **Low** value vegetation within the gully stormwater discharge footprint has been assessed as having a **Low** magnitude of effect resulting in a **Very Low** overall effect.

The loss of **High** value habitat for fauna within the roundabout and gully stormwater discharge footprint has been assessed as having a **Low** magnitude of effect resulting in a **Low** overall effect.

A **Very Low** and **Low** level of effect for vegetation and habitats would not normally be of concern requiring mitigation. However, given effects on fauna and to enable betterment under the 'Vision and Strategy for the Waikato River' (Waikato River Authority, 2018), as discussed in more detail in Section 4.4 and 4.5, it is recommended that restoration planting and weed control take place at a 1:1 ratio to replace the vegetation lost at the disturbed sites and provide higher quality habitat than is currently found at the site. A 1:1 ratio is considered appropriate as the existing habitat is dominated by exotic weeds. Removal of this vegetation will result in the removal of pest species and result in betterment than what currently exists. Assuming removal of pest species and such restoration planting takes place, the overall level of effects of the Project on vegetation and habitats may result in a net gain, once the proposed restoration planting is established.

4.2 Effects on Birds

Only common introduced and native bird species were observed within the vicinity of the site. Some At Risk species have been recorded in the wider area (e.g. shags and falcon) which may periodically visit the site, however, these species were not found to be roosting or nesting within the site specific vegetation potentially impacted by the Project. Although, the majority of the affected habitats are considered to have Low value for 'At Risk' or 'Threatened' bird species, all native birds are also protected under the Wildlife Act 1953. Compared to the existing intersection, the roundabout will be located a greater distance away from the exotic and native vegetation south of the site and traffic speeds will be reduced. There will therefore be less disturbance to birds than the current situation. The removal of six exotic trees and approximately 1,060 m² vegetation (predominantly exotic) for the gully stormwater footprint would reduce the quantity of available habitat for native birds, but such effects are likely to be **Low** in the context of the wider landscape.

Removal of vegetation during bird nesting season could also result in injury or mortality of birds during construction. However, the number of affected birds that could be nesting is expected to

be small. The magnitude of effect without mitigation has been assessed as **Low**. This combined with **Moderate** to **High** value results in a **Low** level of effect.

Assuming vegetation is removed outside of bird nesting season and restoration planting and/or weed control takes place, which would provide better quality habitat for local bird communities, the overall level of effect on birds will be **Negligible** and may even result in a positive effect once the vegetation is established.

4.3 Effects on Herpetofauna

The habitat in the designation boundaries is dominated by either low or not suitable habitat for native lizards. Within the proposed stormwater discharge footprint there are some areas of dense vegetation and low to moderate value habitat for native lizards. However, no lizards were observed during the site visit surveys in January, February and April 2021. Based on manual search survey effort, it is reasonable to assume that native skinks (copper skink) are either absent from the site or are present in low densities, but for the purposes of this assessment, we have taken a very conservative approach and assumed them to be present. Nocturnal spotlighting did not take place to detect the potential presence of arboreal species within the western gully but it is highly unlikely any 'At Risk' or 'Threatened' species are present.

The proposal could still have potential impacts on copper skinks including habitat loss with vegetation removal, and injury or mortality during construction. Therefore, the magnitude of effect without mitigation has been assessed as **Low**. This magnitude of effect combined with a **Low** value results in **Very Low** overall ecological effect on any lizard populations. This would not normally require mitigation but all native lizards are protected under the Wildlife Act 1953 from killing and injury. Based on the small amount of native vegetation, low risk of arboreal species being present, and health and safety risk associated with any potential lizard salvage or relocation (e.g. nocturnal spotlighting prior to works in steep terrain was not possible) a precautionary approach is recommended. Therefore, a lizard management plan should be prepared to outline passive lizard management (namely Vegetation Removal Protocol (VRP)) that could take place to mitigate and minimise any potential effects on native lizards. Also, as the gully stormwater access track location is further refined, this will largely include avoidance of the small areas of native vegetation, and it is assumed the large kanuka tree will remain. Furthermore, provided mitigation for the Project includes restoration planting and/or weed control, this would provide better quality habitat and enhanced protection for potential herpetofauna communities resulting in an overall positive effect.

4.4 Effects on Aquatic Ecology

The ephemeral stream on the eastern side of SH29 and overland flow path on the western side of SH29 are highly modified and degraded, had no flow during the site visits and are of low ecological value. The Unnamed River at the bottom of the western gully near the proposed discharge point has a highly modified riparian zone but has moderate to high ecological value.

Construction works have the potential to discharge sediment and contaminants into the aquatic habitats (ephemeral stream, unnamed river and natural wetland). Sedimentation in waterways can have numerous negative impacts on aquatic environments such as the clogging of refuges and interstitial spaces for fish and macroinvertebrates, reducing the amount of oxygen, absorption and refraction of sunlight which raises the water temperature, inundating aquatic plants, reducing light penetration, and altering the behaviour of aquatic biota. Hydrocarbons include a range of adverse effects on the fish and macroinvertebrates, which can affect the development and functioning, and in some situations can lead to death. However, best practice erosion and sediment control (ESC) measures are proposed to be implemented to reduce any sediment inputs to aquatic habitats. Based on the ephemeral degraded nature of the eastern ephemeral stream within the roundabout footprint and lack of suitable habitat for native fish, there are unlikely to be any potential adverse effects.

However, the Unnamed River as a receiving environment retains higher ecological values than the ephemeral stream and the banks of the Unnamed River are relatively steep and more prone to erosion and contaminant runoff. Therefore, construction works should also occur during drier months in this area as the risk of sediment discharge to the river increases during wetter months and storm events. Also, suitable controls for contaminants around water ways should be in place such as procedures to prevent and respond to potential spills and contamination such as refuelling away from the stream and having a spill kit available.

The only area of watercourse which results in direct disturbance associated with a culvert installation, swales, and diversions has been confirmed as an overland flowpath on the western side of SH29. For example, 'diversion 1' diverts the current alignment of the overland flowpath to the roadside drain (Figure 1-1). Disturbance of the overland flowpath would result in minimal loss of aquatic habitat function and bed disturbance associated with culvert installation and diversions. The overall unmitigated effects of these activities on this western overland flowpath are considered Low which would not normally be of concern.

Stormwater will be treated through the use of a wetland pond, wetland swales and planted wetlands. The wetland pond is located offline on the southern side of SH1 with treated stormwater proposed to be discharged into the Unnamed River and a large wetland swale is proposed offline of the eastern watercourse. Therefore, road runoff will be treated before it enters watercourses and rivers, which will improve the water quality when discharged compared to the current situation. 'The Project team selected a constructed wetland pond as a treatment device based on it being the best practicable option for the sub catchment. The constructed wetland pond (WP 01) will be designed in accordance with the Waikato stormwater management guideline, TR2020/07 (WRC, 2020). The primary contaminants expected are traffic-generated contaminants, including heavy metals and hydrocarbons. Constructed wetlands are highly effective at protecting against these contaminants provided they are designed correctly. Where practicable, planted swales are proposed to convey runoff to the constructed wetland WP 01, thus providing pre-treatment, and soakage opportunities. As such, the treatment train of the planted swales and constructed wetland pond provides additional resilience to the system and is expected to perform at a high treatment standard' (WSP, 2021).

The receiving environment of the gully stormwater discharge (from the western gully into the Unnamed River) includes an SNA within the aquatic habitat at the discharge point of the Unnamed River, and the true left bank of the Unnamed River is a natural wetland. The natural wetland and SNA will not be directly impacted by any vegetation removal within the gully stormwater discharge footprint which is occurring within terrestrial habitat on the true right bank. This discharge will have no base flow, will be treated and will improve the water quality entering the gully from what currently exists (untreated road runoff) and is therefore considered to have no adverse effects on these areas and values. The management of the stormwater in the western gully will result in the loss of some water inputs from the western overland flow path. Based on the small catchment area, surface runoff from the road being minimal, the highly modified, degraded ephemeral nature of this watercourse, any potential effects from this water loss are considered negligible.

The outlet to the Unnamed River will comprise of a DN450 pipe directionally drilled to the base of the Crown Land. The proposed outlet structure is an 'impact basin' or 'stilling well' arrangement for energy dissipation of flows and to ensure controlled discharge to the Unnamed River then to Waikato River. Rip rap is to extend to the base of the Crown land approximately 10 m in length by 5 m wide to reduce the risk of scour. The stormwater discharge and access track within the western gully includes the removal of up to 1,060 m² predominantly invasive exotic vegetation on the riparian margin of the true right bank of the Unnamed River. All areas of riparian vegetation are valuable for the river based on their function for buffering, sediment control, and shading effects to maintain cool water temperatures, provision of food sources and cover for native fish. However, the removal of any vegetation within the river riparian zone will be a small strip

compared to the existing vegetation within the gully and the proposal includes replacement with natives which will likely have an overall positive effect on the river. The improvement of water quality, of the existing watercourses onsite align with the goals set out in the 'Vision and Strategy for the Waikato River' (Waikato River Authority, 2018).

There are a number of potential effects on the aquatic ecology from this Project outlined above resulting in the magnitude of effect without mitigation that could be assessed conservatively as **Moderate**. For the ephemeral stream, this magnitude of effect, combined with a **Low** value results in a **Low** overall ecological effect on aquatic habitats. However, assuming appropriate mitigation is put in place (e.g. implementing best practice erosion and sediment control, having controls around refuelling of machinery, construction works taking place during a period of stable weather outside of storm events, and treatment of road runoff through the swales and stormwater wetland), the magnitude of effect will be Negligible resulting in a Very Low overall effect, and the treatment of water will likely have a **Net Gain**.

For the Unnamed River, this magnitude of effect, combined with a **High** value results in a **High** overall ecological effect on aquatic habitats. However, assuming appropriate mitigation is put in place (e.g. implementing best practice erosion and sediment control, having controls around refuelling of machinery, construction works taking place during a period of stable weather outside of storm events, replacement planting within the gully, and treatment of road runoff through the swales and stormwater wetland), the magnitude of effect will be **Low** resulting in a **Low** overall effect and the replacement planting, once established and through the treatment of road runoff will likely have a **Net Gain**.

4.5 Effects on Bats

4.5.1 Habitat loss

A total of six trees assessed as having moderate roosting suitability within the roundabout designation footprint will be removed. While minimal roost features were observed within these trees, they have been assumed as having moderate roosting suitability as the author could not see all extents of each tree. They are therefore not likely to be significant roosting trees for bats and the magnitude of the loss of these trees is likely to be **Low**.

The construction of the access track in the gully for the stormwater discharge may result in the loss of more potential roost trees. A number of potential roost trees within the gully have been identified and as they are reasonably scattered throughout the gully, it is likely that many of these will be able to be avoided. It should be noted that the quality of the common roost features within this habitat were observed as low quality roosts compared to other trees within the wider landscape, i.e. common features were small cracks/crevices <4m off the ground, compared to large splits and cavities observed in larger, more mature trees not located within the designation. However, due to the path of the access track being unknown at this stage, it is not known which trees will be removed and if they can or cannot be avoided. Therefore, we have conservatively assessed the magnitude of the loss of these trees to be **Moderate**.

The overall level of effects from the removal of potential roosting habitat within the Project footprint are likely to be **Moderate** to **High.**

4.5.2 Fragmentation

There is existing fragmentation between bat habitats as a result of the existing intersection. The Project will result in a slight shift of the existing infrastructure away from the gully habitat, and any change or increase in fragmentation from the existing situation is expected to be minor. The loss of the six trees are not expected to cause further fragmentation effects as there are trees of the same species and size within 20 m-40m of the trees on the eastern side, and within 130 m-200 m on the western side of SH29, that will be retained.

While it is not known at what heights or areas bats are currently commuting through the intersection, raising the road surface approximately 3.5 m will result in a physical change to the landscape therefore could potentially alter the flight behaviour of bats. Many observations of bats using the State Highway 1 corridor South of Hamilton, have been made by the WSP Ecology Team whilst undertaking roost watches, thermal imaging surveys and hand-held acoustic surveys. Bats have been observed flying directly over, and alongside well illuminated sections of SH1 with high volumes of traffic. Based on these observations, it is expected that while there may be minor changes in bat behaviour as a result of the new roundabout, connectivity between the two sides of the road will remain. The bats may just slightly divert flightpaths or fly overtop to avoid the lit roundabout. The magnitude of this change in effect has therefore been assessed as **Low**.

The construction of an access track within the gully will result in approximately a 4 m gap in the vegetation for 200 m to 250 m resulting in the creation of edges and a flyway that will be minimally disturbed, once constructed. As bats are known to favour such habitat (Rockell et. al, 2017), the magnitude of fragmentation is therefore assessed as **Positive.**

The overall level of effect of fragmentation caused by construction of the roundabout and access track has been assessed as **Net gain** to **Moderate.**

4.5.3 Injury/death during vegetation removal

As there will be removal of potential roost trees, there is a risk of felling of a tree while there are bats actively roosting within, which would likely result in injury or death to a bat. The magnitude for removal of potential roost trees is assessed as **High** resulting in an overall level of effect of **Very High** prior to the implementation of the VRP.

4.5.4 Mortality by vehicle collision

The roundabout will be elevated approximately 3.5m above ground to allow an underpass for cyclists and pedestrians. This elevation could result in an increased risk of bats colliding with vehicles as they commute through the landscape. As it is not known at what heights bats are currently commuting through the intersection or exactly which areas they use to commute from the gully habitat to the rural landscape to the north, it must be assumed that bats will utilise the landscape through which the roundabout is to be located, at least on occasion. As the new roundabout will slow down approaching traffic, this change in speed is expected to give bats extra reaction time to avoid oncoming traffic, if they do in fact pass through the landscape at vehicle height. This view is supported by research by Forman et al. (2003), which concludes that wildlife collisions increase as vehicle speed and traffic volume increase, and with proximity to wildlife habitat and wildlife movement corridors. Furthermore, Altringham & Kerth (2016) state that "there are no data on bats relating mortality to speed and traffic volume, but there is no reason to believe they will be different from that of other taxa". Also, as the roundabout will have lighting (discussed below), it is likely that bats will avoid these areas altogether. The magnitude of this change in effect from the existing situation is therefore assessed as **Negligible**, resulting in an overall level of effect of **Low.**

4.5.5 Lighting effects

Long-tailed bats tend to avoid lit zones along road corridors and have been observed flying alongside or over the top of lit zones when commuting (pers. obs. Caitlin Dodunski, Simon Chapman).

The monitoring data collected for the Project indicates that bats are already active across the existing intersection, even with the current road lighting, which is not what would now be described as best practice for bats (i.e. minimal baffle[3]). These lights will be removed once the roundabout becomes operational and the current SH1 is decommissioned.

[3] Mechanism to prevent unnecessarily or unwanted light spill

Lighting effects from headlight glare are expected to be minimal. Bats are currently subjected to effects from headlight glare from the same directions as they will be once the roundabout is constructed. However, raising the roundabout will slightly increase the height of headlight glare. Landscape planting around all sides of the roundabout will mitigate any net change in effects by blocking the majority of headlight glare.

The Project will incorporate best practice lighting standards for bats (i.e. warm-colour LEDs, baffled to direct light downwards) and the existing lighting along the intersection will be removed. Also, landscape planting and moving the designation further away from high value habitat will reduce the current effects of headlight glare. The magnitude of lighting effects has therefore been assessed as **Positive** resulting in an overall **Net gain** effect.

4.5.6 Noise and vibration disturbance

As there are potential roost trees within and adjacent to the designation boundaries of both the roundabout and stormwater discharge works, construction activities, such as those that generate vibration and noise, could potentially disrupt bats' normal behaviour, causing them to abandon roosts or emerge later than is optimal for foraging. However, bats have been confirmed to utilise habitats within 100 metres of the SH1/SH29 intersection, which are already subject to significant noise, light and vibration from high-volume traffic including many heavy vehicles. It is not expected that construction will add to these levels, particularly when bats are active at night, therefore the magnitude of possible disturbance is therefore assessed as **Low** resulting in an overall **Moderate** level of effect.

Table 4-1: Potential effects on long-tailed bats.

Expected impacts	Ecological value	Magnitude of effect	Level of un-mitigated effect
Loss of habitat	Very High	Roundabout: Low Access track: Moderate	Moderate High
Fragmentation of habitat	Very High	Roundabout: Low Access track: Positive	Moderate Net gain
Mortality/harm during vegetation clearance	Very High	High	Very High
Mortality through vehicle collision	Very High	Negligible	Low
Disturbance to active roosts during construction	Very High	Low	Moderate
Lighting (operational)	Very High	Positive	Net gain

As a result of the varied **Moderate** to **Very High** levels of effects, including habitat loss, fragmentation and potential direct harm through tree removal and vehicle collision, there are requirements for management measures such as supplementary planting, lighting design, vegetation removal protocol and minimising disturbance during construction. These are described in detail in a draft BMP presented in **Appendix A** and summarised in the following section.

4.6 Recommendations to avoid, remedy and/or mitigate ecological effects

There are potential very high overall effects (or risk of effects) on bats, and high overall effects (or risk of effects) on aquatic ecology. However, provided the following recommended measures to

mitigate the potential adverse ecological effects are implemented, the overall level of effects is expected to be low, very low or positive.

- Any earthworks in close proximity to the ephemeral watercourses or Unnamed River should take place where possible when there is little or no flow, during a period of stable weather outside of storm events.
- An Erosion and Sediment Control Plan (ESCP) should be prepared and implemented following best practice guidelines (e.g. WRC, 2009) to prevent sediment runoff into watercourses.
- The Construction Management Plan should include designated refuelling locations and control mitigation measures to minimise effects of potential hydrocarbon spillage.
- Revegetation of exposed earth after the completion of the construction works.
- Any removal or disturbance of vegetation from the gully stormwater discharge footprint should include restoration planting and weed control at a ratio of 1:1 in close proximity to the site where this will add noticeable ecological value. For example, areas of blackberry and privet within the gully could be removed and replaced with natives at the base of the Crown land.
- The vegetation management plan should include detail of areas where this will take place, species, size of plants, bank stabilisation methods, methods of plant control, and maintenance programme.
- The removal of shrubs and trees should occur outside of the main bird breeding season (September to December, inclusive). If this is not possible, then the tree should be inspected prior to felling for active native bird nests. If active nests are present, there would need to be an appropriate exclusion zone for any works until the chicks have fledged.
- As a precautionary approach, a basic lizard management plan should be prepared to outline passive management (e.g. VRP) that can occur.
- Wherever possible, all potential bat roost trees will be retained, particularly within the stormwater access track area. The removal of all vegetation will require implementation of VRP by a suitably qualified Bat Ecologist. These protocol have been incorporated into the draft BMP (Appendix A).
- Best practice lighting design is recommended to improve lighting effects on bats from what is currently in place.
- Supplementary planting of both exotic and native trees species known to provide roosting habitat should be provided as mitigation for the loss of roosting habitat. Tall growth tree species should also be incorporated into embankment planting plans and designed in a way to encourage bats to commute through the landscape as usual (i.e. hop-overs, buffer zones) and to reduce the already minor effects of habitat loss and fragmentation.

4.7 Summary of the overall level of effect

4.7.1 Ecological Values

Step 1 of the EIANZ guidelines requires ecological values to be assessed and ranked using the criteria in Table 2-2 which is summarised in Table 4-2.

It is considered that the value of the vegetation is 'Negligible to High', the value of the aquatic habitats is 'Low to High', the value of bird fauna is 'Low to High', the value of lizard fauna is 'Low' and the presence of bats triggers a 'Very High' rating. However, it is noted that the relative value of the area for bats in the context of the local landscape is low to moderate due to the open nature of the landscape and poor quality of vegetation within the western gully compared to the wider landscape.

Table 4-2 : Assignment of values to vegetation, habitats, flora and fauna within the Project Footprint (adapted from EIANZ, 2018).

Vegetation/Habitat/Species	Value	Comments
Vegetation/habitats	Negligible to High Low to High	Roundabout footprint: Negligible for intrinsic botanical value (plant species present) as it includes six exotic trees (three plane trees and three pin oak tree), exotic weeds and pasture. High as the habitat meets one of eleven ecological significance criteria. Gully stormwater discharge footprint: Low for intrinsic botanical value (plant species present). High as the habitat meets four of eleven ecological significance criteria.
Bats	Very High	Roundabout footprint: Removal of six exotic trees assessed as having Moderate suitability for Nationally Critical long-tailed bats. Gully stormwater discharge footprint: Some moderate-high value potential roost trees scattered throughout the gully. Cabbage trees and tree ferns also present as potential roosting habitat.
Lizards	Low	Roundabout footprint: Assumed the copper skink could be present, although no lizards were observed and includes only some rank grass of low quality for native lizards. Gully stormwater discharge footprint: Assumed the copper skink could be present. No lizards were observed and habitat is not ecologically significant and dominated by low value habitat for native lizards.
Birds	Low Moderate to High	Roundabout footprint: Low as it includes only common introduced and native bird species, and only six exotic trees will be removed. Gully stormwater discharge footprint: Moderate as it includes a number of common introduced and native bird species some of which are endemic. At Risk species are found in the wider landscape and may periodically visit the site, and vegetated habitat is dominated by exotic privet and blackberry.
Freshwater Ecology	Low Moderate to High	Roundabout footprint: Low, as the eastern stream is ephemeral and the western watercourse has been confirmed as a flowpath, largely grassed over with very low-quality habitat for aquatic biota. Gully stormwater discharge footprint: Moderate to High as the Unnamed River supports habitat for Nationally 'At Risk' fish species; the aquatic habitat is an SNA, vegetation is dominated by exotic weeds but retains ecological function to the river; it is permanent.

4.7.1 Magnitude of Effect

Step 2 of the EIANZ guidelines requires an evaluation of the magnitude of effects on ecological values based on footprint size, intensity and duration. As per Table 2-3, it is considered that the magnitude of the effect on vegetation, aquatic ecology, birds, lizards and bats is 'Negligible to Low', assuming appropriate mitigation, as there will only be a very slight change from the existing baseline condition or a noticeable shift away from baseline conditions. The change will be barely distinguishable from the 'no change' situation or loss/alteration will be discernible; and/or will have negligible or minor effect on the populations of affected species.

4.7.2 Overall Levels of Effect

As per EIANZ Step 3, Table 2-4 shows the EIANZ matrix outlining criteria to describe the overall level of ecological effects. This is summarised in Table 4-3.

Based on the EIANZ methodology and assuming appropriate mitigation detailed in Section 4.6 of this report is implemented, it is considered that there will be an overall 'Low' level of effect on the vegetation, bats, and aquatic ecology and 'Very Low' level of effect on birds and lizards resulting from the removal of vegetation and associated earthworks for the intersection upgrade and enabling works, which may have positive effects in the longer term.

Table 4-3: Overall level of effects rating (EIANZ, 2018).

Vegetation/Habitat/Species	Ecological Value	Magnitude of Effect	Overall Level of effects (mitigated)
Vegetation/habitat	Negligible to High	Low	Low
Bats	Very High	Negligible	Low
Lizards	Low	Negligible	Very Low
Birds	Low to High	Negligible	Very Low
Aquatic ecology	Low to High	Low	Low

5 Conclusions

Provided the mitigation measures recommended in this assessment are implemented, it is considered the overall effects of the Project and enabling works on birds, and lizards will be **Very Low**; for vegetation, aquatic ecology, and bats effects will be **Low**, and in some cases, there may even be a **Net Gain**.

6 References

AECOM (2019). Environmental Management and Monitoring Plan (EMMP), Southern Links Project - Hamilton City Council Section. Unpublished report (Job No.: 60526419) prepared for Hamilton City Council and NZ Transport Agency. 212 p., 9th April 2019.

Altringham, J., & Kerth, G. (2016). Bats and roads. In Bats in the Anthropocene: conservation of bats in a changing world (pp. 35-62). Springer, Cham.

Australian Government, Department of the Environment and Energy. 2019. National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia.

Burns, R. J., Bell, B. D., Haigh, A., Bishop, P. J., Easton, L., Wren, S., Germano, J., Hitchmough, R., Rolfe, R., & Makan, T (2018). 'Conservation status of New Zealand amphibians, 2017', New Zealand Threat Classification Series 24, Department of Conservation, Wellington.

Dunn, N. R., Allibone, R. M., Closs, G. P., Crow, S. K., David, B. O., Goodman, J. M., Griffiths, M., Jack, D. C., Ling, N., Waters, J. M., & Rolfe, J. M (2018). 'Conservation status of New Zealand freshwater fish, 2017', New Zealand Threat Classification Series 24, Department of Conservation, Wellington.

Environmental Institute of Australia and New Zealand Inc. (EIANZ) 2018. Environmental Impact Assessment (EcIA): EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems, 2nd Edition. EIANZ, Melbourne, Australia, May 2018.

Forman, R. T., Sperling, D., Bissonette, J. A., Clevenger, A. P., Cutshall, C. D., Dale, V. H., France, F., Goldman, c. R., Heanue, K., Jones, J. A., Swanson, F. J., Winter, T. C., & Winter, T. C. (2003). Road ecology: science and solutions. Island press, pp 120–122.

Franklin, P., Gee, E., Baker, C., & Bowie, S. (2018). New Zealand fish passage guidelines: for structures up to 4 metre. NIWA Client Report No. 018019HN

Grainger, N., Collier, K., Hitchmough, R., Harding, J., Smith, B., & Sutherland D. (2014). 'Conservation status of New Zealand freshwater invertebrates, 2013', New Zealand Threat Classification Series 8, Department of Conservation, Wellington.

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

Le Roux, D (2010). Monitoring long-tailed bat *(Chalinolobus tuberculatus)* activity and investigating the effect of aircraft noise on bat behaviour in a modified ecosystem. Unpublished MSc thesis. University of Waikato, Hamilton, New Zealand.

Ministry for the Environment (2020a). National Policy Statement for Freshwater Management. Published August 2020, ME 1518.

Ministry for the Environment (2020b). National Environmental Standards for Freshwater. Retrieved January 2020 from from https://www.legislation.govt.nz/regulation/public/2020/0174/latest/LMS364099.html

O'Donnell, C.F.J.; Borkin, K.M.; Christie, J.E.; Lloyd, B.; Parsons, S.; Hitchmough, R.A. (2018). Conservation status of New Zealand bats, 2017. New Zealand Threat Classification Series 21, Department of Conservation, Wellington, New Zealand.

Robertson., H, Baird., K, Dowding., J, Elliot., G, Hitchmough, R., Miskelly., C, McArthur., N, O'Donnell., C, Sager., P, Scofield., P, Taylor., G. (2017). Conservation status of New Zealand birds, 2016. New Zealand Threat Classification Series 19, Department of Conservation, Wellington, New Zealand.

Rockell, G.; Littlemore, J.; Scrimgeour, J. 2017: Habitat preferences of Chalinolobus tuberculatus along riparian corridors of the forested Pikiariki Ecological Area, Pureora Forest Park. DOC Research and Development Series 349. Department of Conservation, Wellington. 11 p.

Sedgeley, J.; O'Donnell, C.; Lyall, J.; Edmonds, H.; Simpson, W.; Carpenter, J.; Hoare, J.; & McInnes, K. 2012. DOC best practice manual of conservation techniques for bats, Version 1.0. Inventory and Monitoring Toolbox: Bats, Department of Conservation.

Smith, D., Borkin, K., Jones, C., Lindberg, A., Davies, F., & Eccles, G. (2017). Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature. Prepared by Wildlands Consultants Ltd for New Zealand Transport Agency October 2017. NZ Transport Agency research report 623.

Waikato River Authority (2008). Vision and strategy for the Waikato River: restoring and protecting the health and wellbeing of the Waikato River.

Waikato Regional Council (2009). Erosion and sediment control: guidelines for soil disturbing activities. Prepared January 2009. Environment Waikato Technical Report No. 2009/02

Waikato Regional Council (2020a). Waikato Regional Plan. Updated 11 December 2020. Retrieved February 2021 from https://www.waikatoregion.govt.nz/council/policy-and-plans/rules-and-regulation/regional-plan/

Waikato Regional Council (2020b). Waikato Stormwater Management Guideline. Updated Version May 2020, Environment Waikato Technical Report No. 2020/07

WSP (2019). Long-tailed bat Monitoring Report 2018-2019, Waikato Expressway: Hamilton Section. Prepared for Waka Kotahi.

WSP (2020). SH1/SH29 Roundabout Option Assessment Report V2. Prepared 19th February 2021 by WSP for Waka Kotahi NZ Transport Agency.

WSP (2021). State Highway 1 and State Highway 29 Intersection Upgrade. Stormwater Assessment. Prepared August 2021 by WSP for Waka Kotahi NZ Transport Agency.

Appendix A
Bat Management Plan

Project Number: 2-A0011.04

State Highway 1 and State Highway 29 Intersection Upgrade

Draft Bat Management Plan

19 August 2021

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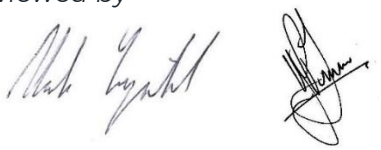

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Approved for release by

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Contents

1 Introduction

1.1 Purpose

This document presents a draft adaptive Bat Management Plan (BMP), prepared by WSP, for Waka Kotahi New Zealand Transport Agency (Waka Kotahi), for the proposed intersection upgrade of State Highway 1 (SH1) and State Highway 29 (SH29) (the Project). This BMP outlines and guides implementation of the required management of effects on long-tailed bats. This document accompanies the Assessment of Effects on the Environment (AEE) in relation to ecology, which forms part of the resource consent lodgement package submitted to Waikato Regional Council (WRC).

The scope of this BMP includes:

- Summary of potential effects on long-tailed bats resulting from the Project;
- Details of measures to avoid, remedy and/or mitigate adverse effects; and,
- Vegetation Removal Protocol to be implemented.

1.2 Long-tailed bats

The long-tailed bat *(Chalinolobus tuberculatus),* a species classified as 'Threatened -Nationally Critical'[1] is found widely throughout the North Island and is common within the Waikato Region. The species roosts in cavities and damaged trunks/branches of mature native and exotic trees and often utilise sheltered areas of woody vegetation for foraging and commuting. If bats are confirmed present within an area, it is necessary for potential effects on bats to be identified and appropriate mitigation measures implemented to avoid any harm or disturbance to the species. As a native species they are protected under the Wildlife Act 1953. Therefore, any harm (direct or indirect) caused to bats during construction activities can result in prosecution, if all practical steps to avoid this are not demonstrated.

1.3 Project Bat Ecologist

A nominated Project Bat Ecologist (PBE), who has been approved by the Department of Conservation (DOC) as competent with bat competency Class D or Class E (or redefined categories), will be responsible for the implementation of this BMP and the associated Vegetation Removal Protocol (VRP) presented in Appendix A[2].

[1] O'Donnell, C.F.J.; Borkin, K.M.; Christie, J.E.; Lloyd, B.; Parsons, S.; Hitchmough, R.A. (2018). Conservation status of New Zealand bats, 2017. *New Zealand Threat Classification Series 21, Department of Conservation, Wellington, New Zealand.*

[2] Vegetation Removal Protocol presented in Appendix A are industry standard (Smith et al., 2017). These protocol are currently under review by industry professionals and are subject to changes in the near future (pers. comm, Moira Pryde, Department of Conservation Technical Advisor, April 2021).

2 Potential effects on long-tailed bats

There are potential direct and indirect effects on long-tailed bats that have been identified, both during- and post-construction. These effects are:

- Construction phase
  - mortality/injury during vegetation removal;
  - habitat loss; and
  - noise, vibration and light disturbance during construction.
- Operation phase
  - fragmentation; and
  - artificial light pollution.

The management of these effects are addressed in sections 3 to 6 below.

3 Construction phase

3.1 Avoiding mortality/injury during vegetation removal

3.1.1 Assessment of vegetation for roosting potential

Potential roosting habitat has been identified within the designation boundaries of the roundabout and the stormwater discharge works (as detailed in the AEE) and will be impacted by construction. Prior to the earthworks and vegetation clearance required for the construction of the access track, discharge and associated erosion protection structures, the PBE will undertake a roost tree suitability assessment of the vegetation proposed to be removed.

All potential roost trees will be marked, given an ID number and their location recorded on a GPS device. This information will be used as a reference to improve efficiency during tree clearance, and to ensure no potential roost trees are accidentally felled.

3.1.2 Avoiding direct harm to bats

There is a possibility that vegetation to be felled could be an active bat roost and, as mentioned in section 1.2, it is important that measures are taken to avoid direct harm to bats. Strict protocol (VRP, Appendix A) therefore must be implemented for **all** vegetation to be removed or pruned for construction purposes. The protocol outline monitoring and inspection methods to be used to ensure bats are not occupying vegetation immediately prior to removal, such as:

a) Visual inspections

This method requires arborists to climb all vegetation (where safe to do so), under the supervision of the PBE, and inspect all identified roost features or areas of the tree the PBE cannot see from the ground. Arborists will relay any potential evidence of bats (e.g. urine staining, cavities, droppings) by way of live audio-visual equipment and/or photographs for review by the PBE. This inspection must be undertaken immediately prior to (same day) removal. At the time of visual inspections, the PBE may also use a thermal camera to inspect roost features from the ground.

b) Dawn/dusk roost watches

This method will be used when vegetation is not safe or not practical (i.e. dense ivy covering tree) for arborists to climb. Vegetation will be subject to two consecutive nights of watches at both dusk and dawn, carried out by PBE and at least one other experienced ecologist where health and safety considerations allow. A thermal camera and handheld acoustic detectors will be used to assist with observations. If the PBE is confident after the second dawn watch that bats are not occupying the subject vegetation, then it can be removed on that same day.

c) Active bat roosts

If bats are confirmed, via the methods above, to be roosting within the subject vegetation, it must not be felled. The roost will be isolated and marked, and all relevant staff will be notified to ensure the roost is not removed or disturbed by nearby construction activities. Monitoring will be continued until the PBE can confirm that no bats are roosting within the vegetation in question. If bats are found to be consistently using the roost (i.e. after seven nights of monitoring), then a meeting with be held with council and DOC representatives to decide an appropriate way forward.

3.2 Habitat Loss

3.2.1 Avoidance

To minimise the effects of roost habitat loss, tree clearance will be kept to a minimum, and only removed when absolutely necessary. A total of six exotic trees of moderate roosting suitability have been proposed for removal within the roundabout footprint, which will be unavoidable.

However, for the stormwater discharge and associated access track works, there will be opportunities for avoidance. Several mature trees with varied moderate to high roosting suitability have already been identified by ecologists, and as a result these trees will not be removed. The approximate location and path of the access track has now been decided but there are further opportunities for avoidance of roost trees achieved through minor adjustments to the track design.

To guide these alterations and finalisation of the track design, a walkover meeting between the PBE, contractors and engineer representatives will be held. The PBE will then identify any high value roost trees that will be affected by construction and will discuss options for avoidance by moving the access track away from the potential roost tree and its dripline.

The finalised access track will be clearly delineated using tape and/or marker pegs to ensure that no trees are unnecessarily removed.

3.2.2 Mitigation

Mitigation for the loss of potential roost trees will be offered in the form of planting of both native and exotic tree species. Exotic tree species tend to mature and produce roosting features much faster than native species. Table 1 provides a list of both exotic and native species, known to provide such habitat for bats, and will be considered for mitigation planting.

For the loss of **each** tree assessed as having "high" roosting suitability the following mitigation will be provided:

- Planting of four trees (1:4 ratio); two of which will be exotic species and two will be native species.

If roosting bats are confirmed within any of the vegetation to be removed (while enacting the VRP), the following mitigation will be provided:

- Planting of eight trees (1:8 ratio); four of which will be exotic species, and four will be native species.

The PBE shall also determine whether any natural roosts found during tree clearance. (i.e. cavities and their extents) can be relocated and attached to another tree that will be unaffected by construction, therefore preventing the loss of the roost.

If planting of trees is required (due to loss of high suitability and/or confirmed roost trees). The formation and location of the plantings will be considered in a way that will naturally encourage foraging and commuting behaviours. Trees can be planted to provide further edge habitat; whether this is a single external edge, or in a tunnelling formation to provide both internal and external flyways. Trees will also be planted in areas that are able to grow and eventually decay naturally without encroaching into road corridors or areas that will pose future threats to safety and therefore as a result, have to be felled.

Table 1. List of exotic and native tree species that will be considered for mitigation planting, if required.

Common name	Latin name
Exotic species	
Giant gum	*Eucalyptus regnans*
Brown Barrel	*Eucalyptus fastigata*
Messmate	*Eucalyptus obliqua*
Tasmanian Blackwood	*Acacia melanoxylon*
Radiata pine	*Pinus radiata*
London plane	*Platanus x acerifolia*
Sessile oak	*Quercus petraea*
Native species	
Ti kouka	*Cordyline australis*
Kahikatea	*Dacrycarpus dacrydioides*
Rimu	*Dacrydium cupressinum*
Kanuka	*Kunzea var.*
Manuka	*Leptospermum var.*
Mahoe	*Melicytus ramiflorus*
Totara	*Podocarpus totara*
Matai	*Prumnopitys taxifolia*
Tawa	*Beilschmiedia tawa*

3.3 Minimising fragmentation

Embankment planting (from a landscape architecture aspect) is currently planned on all sides of the roundabout, as well as specimen trees along the cycleway for shading. The PBE will work with landscape architects to incorporate tall growth tree species into the vegetation management plan to encourage commuting bats through the landscape. These trees will also help to guide bats safely over the roundabout, reducing the already minor risk of collision with vehicles. Minimising fragmentation will also be achieved by the installation of best practice lighting as outlined in Section 4.1, whereby bats will tend to avoid the lit zones (pers. obs. Caitlin Dodunski, Simon Chapman) and oncoming traffic by flying over the top or around. In addition, the general improvement of road lighting from the current situation should encourage bats to commute within the adjacent landscapes more often.

3.4 Minimising noise and vibration disturbance to active roosts

While long-tailed bats can roost and remain very active close to lit sections of road and appear tolerant in many situations of the associated traffic noise and vibration, the variability and less predictable nature of construction related disturbance potentially risks affecting the bats normal behaviour. Noise and vibration, or even light from vehicles and plant could cause disturbance, including causing them to abandon roosts or emerge later than is optimal for foraging. Considering these risks, measures need to be implemented to minimise the potential for disturbance associated with active roost trees.

In the event that a roost is located by the PBE during vegetation clearance (while enacting the requirements of the VRP) the following actions will be taken:

a) The immediate area of the roost will be cordoned off with safety fencing and signage erected, alerting any person approaching the area that a bat roost is present and to stay clear;

b) The existence of the roost will be widely publicised to all construction staff and work instructions for the immediate area will be updated to reflect the presence of the roost and the measures to minimise disturbance; and

c) No construction activities will take place within 50m of the roost from 2 hours before official dusk to 1 hour after official dawn unless approval is given by the PBE.

4 Operational Phase

4.1 Minimise artificial light pollution

To minimise light spill into the surrounding environment, low intensity, longer-wavelength and warm colour LED lighting will be installed. All lighting will be designed with baffles to ensure the light is directed downwards to ensure minimal light spill into the environment. Artificial lighting currently present along the SH1/SH29 intersection will also be decommissioned.

Landscape planting on all sides of the roundabout will block the majority of headlight glare from vehicles therefore reducing effects of headlight glare from what is currently present.

5 Reporting

The following report will be submitted to Waikato Regional Council:

- Tree Clearance Report submitted within four weeks after all trees have been removed. Details of all potential bat roost trees (GPS location, species, DBH, photos and roost suitability rating), and actions taken to ensure no bats were harmed during clearance, will be included.

Appendix A
Vegetation Removal Protocol

Appendix A
Vegetation Removal Protocol

Adapted from:
Smith, D.; Borkin, K.; Jones, C.; Lindberg, S.; Davies, F.; Eccles, G. 2017. Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature. NZ Transport Agency research report 623. Annex DH*.

*The protocol outlined in this document are currently under review by industry professionals are subject to change in the near future.

1 Introduction

This document presents Vegetation Removal Protocol (VRP) to be implemented prior to removal of all vegetation for construction of the SH1/29 Intersection upgrade (the Project). These protocol follow industry best practice adhering to both the Bat Management Framework set out by Waka Kotahi New Zealand Transport Agency (Smith et al., 2017) and the Department of Conservation's (DOC's) best practice manual of conservation techniques (Sedgeley et al., 2012).

These protocol are specific to this Project and they aim to provide clear, concise procedures that are to be followed prior to the removal of all vegetation for the Project, with the goal of avoiding mortality or injury to long-tailed bats during clearance activities.

There are four protocol that must be adhered to:

Protocol A: Identification of potential bat roost habitat;

Protocol B: Pre-felling procedures;

Protocol C: Felling procedures; and

Protocol D: Bat Injury or Mortality.

1.1 Project Bat Ecologist

The implementation of these protocol must be undertaken by a nominated Project Bat Ecologist (PBE). The nominated PBE must be approved by the Department of Conservation (DOC) as competent with Bat competency Class D or E (or redefined categories) (Appendix A). Class A and B bat ecologists may form part of their team and undertake tasks outlined within this VRP under supervision from the PBE. The PBE is not required to be present at the site all the time but must retain sufficient oversight of their team to be confident good decisions are being made regarding presence/absence of bats and potential roost sites. However, the PBE is expected to be available to oversee vegetation removal.

2 Vegetation Removal Protocol

2.1 Protocol A: Identification of potential bat roost habitat

Prior to undertaking this protocol, ensure the designation boundaries have been visually delineated using flagging tape or boundary pegs, to ensure all trees that are required for removal are assessed appropriately. This also ensures that no more vegetation than necessary is removed.

1 All vegetation that might be disturbed and/or removed for construction must first be assessed by the PBE for presence of roost features. Vegetation identified as potential bat roosts1 are those >15 cm Diameter at Breast Height (DBH) and have one or more of the following attributes:

- Cracks, crevices, cavities, fractured limbs, or other deformities, large enough to support roosting bat(s);
- Sections of loose flaking bark large enough to support roosting bat(s);
- A hollow trunk, stem or branches; and/or
- Deadwood in canopy or stem of sufficient size to support roost cavities or hollows.

Based on the presence (or absence) of the above, vegetation must then be categorised[2] as to their suitability as bat roosts (Table 1). This method was adapted from roost tree assessments conducted for the Southern Links Project (AECOM, 2019).

Table 1: Criteria for assessing vegetation for their suitability as bat roosts.

Suitability as a roost	Justification of assessment	Further survey required?
Low	A tree of at least 15cm DBH but no roost features visible or with only limited roosting potential i.e. loose bark present, but not sufficient to provide shelter for roosting bats.	No
Moderate	A tree of at least 15cm DBH with one or more roost features that could be used by individual bats or where it is not clear from the ground inspection whether roost features are present or not and therefore requires further inspection.	Yes
High	A tree of at least 15cm DBH with one or more roost features which could provide habitat for several bats due to their size and ability to provide sufficient shelter and protection.	Yes
Confirmed	A tree known to have been used by bats as a roost tree.	Yes

[1] Roosts tend to be observed in mature trees that are >15cm DBH; however, native bats have also been observed in tree ferns, cabbage trees and epiphytes, therefore this vegetation should also be considered as High-Risk.

[2] This method was adapted from roost tree assessments conducted for the Southern Links Project (AECOM, 2019).

2 All trees of at least moderate suitability shall be subjected to pre-felling monitoring as per Protocol B. Pre-felling vegetation assessments using visual methods (see Protocol B for details) shall be undertaken under the supervision of the PBE.

3 No trees or vegetation identified as potential roosts can be felled or cleared without the approval of the PBE.

2.2 Protocol B: Pre-felling procedures

Once all vegetation has been assessed as having moderate or high suitability as bat roosts using Protocol A, occupancy will be confirmed using one or a combination of methods outlined below, immediately prior to vegetation clearance. The most effective method will be determined by the PBE on a case-by-case basis.

2.2.1 Visual inspections

This method will be used in the first instance, where the extents of all potential roost features will be inspected for presence of bats. If roost features are low enough, the PBE will undertake the inspection, however if they cannot be reached, or the full extent of the vegetation cannot be seen by the PBE from the ground, arborists will be required to climb and inspect the tree, under supervision of the PBE. The following guidelines are to be used:

1 All vegetation identified as having moderate-high suitability as a roost may be inspected to confirm occupancy by roosting bats.

2 An arborist may undertake a visual inspection of vegetation by climbing (under guidance and supervision of the PBE) and relaying any potential evidence of bats (e.g. urine staining, cavities, droppings) by way of live audio-visual equipment and/or photographs for review of the PBE. This must be undertaken immediately prior to (same day) removal. The arborist will also check for signs of roosting bats using a handheld bat detector (to detect social and echolocation calls from roosting bats).

3 Arborists may carefully inspect and check the extents of split branches, and if necessary, use an endoscopic camera to inspect cavities for presence of roosting bats.

4 If potential roosts are located within tree ferns or other 'delicate' vegetation, climbing will only be undertaken if it is safe to do so for the climber and if this will not damage the roost or disturb potentially roosting bats at the time of inspection. All climbing must take place under the careful supervision of the PBE to prevent roost damage or disturbance/injury to roosting bats. Photographs will be taken of any roosts or roost evidence found.

5 A thermal camera may also be used from the ground to inspect any roost features at the time of tree inspections. This technique is useful when a particular branch or tree cannot be climbed to provide certainty that a tree is unoccupied.

6 If no bat activity or evidence of roosting bats at the potential roost trees is identified and the PBE determines the vegetation can be removed, this information should be relayed to the contractors in sufficient time to allow clearance of vegetation to be completed prior to dusk the same day.

2.2.2 *Dusk/Dawn Roost Watches*

This method will be used if potential roosts cannot be ruled out using visual inspection techniques and/or a tree cannot be climbed (e.g. vegetation that is unsuitable for climbing, dense ivy covering. In this instance, the following methodology should be implemented.

1 Observations should begin before sunset. Bats begin to leave their roosts while there is still light outside, therefore, there is potential to observe bats without the aid of cameras or video equipment.

2 Ambient temperature should be >10˚C and there should be no precipitation (otherwise bats may not emerge).

3 Observations shall be carried out close to potential roost sites where flying bats are back-lit against the sky (where possible). It may be useful to have more than one person observing potential roost sites from different angles to determine precise trees or vegetation and exit holes.

4 A thermal imaging camera should be used wherever possible to assist in the detection of bats and provides the opportunity to review footage should there be any bat passes observed and/or heard.

5 Hand-held bat detectors should be used to alert the ecologist(s) to the presence of bats nearby, narrowing down the potential roost site locations and allowing roosts to be confirmed.

6 This method should be repeated at dusk and dawn (return observations) for two consecutive nights prior to felling.

7 If no bat activity at the potential roost trees is identified after the second dawn watch and the PBE is confident the vegetation can be removed, this information should be relayed to the contractors in sufficient time to allow contractors to clear vegetation prior to dusk the same day.

2.2.3 *Acoustic monitoring via Automated Bat Detectors*

1 Relying on acoustic data is difficult in areas where bat activity is common, such as in this Project area. Therefore, for this Project, visual inspections and roost watches will be the primary pre-felling methods used. However, to supplement tree inspections, the use of acoustic monitors may be used as a back up to further understand bat activity prior to felling.

2 If acoustic monitors are used, the identified potential roost trees will be acoustically monitored for two consecutive nights immediately prior to felling. Monitors will be programmed to detect activity from one hour before dusk until one hour after dawn.

3 The Automatic Bat Monitors (ABMs) should be placed so that detection of bats is likely if they are using the potential roosts.

2.3 Protocol C: Felling Protocol

1 If bats are confirmed via either of the methods detailed above, to be roosting within the tree, it must not be felled. The following actions will be taken:

(a) Roost trees should be clearly marked, and the immediate area will be cordoned off with safety fencing and signage erected in a 10 m radius around the roost, alerting any person approaching the area that a bat roost is present and to stay clear.

(b) The PBE will notify the Waikato Regional Council (WRC) and DOC within 12 hours of when the occupied bat roost was discovered and provide relevant information such as photos, GPS co-ordinates.

(c) All relevant Project staff will be briefed to ensure the tree is not removed.

(d) The PBE will determine whether all tree clearance works should be suspended or whether inspections and clearance can continue away from the roost.

(e) Further monitoring must continue until the PBE can confirm that no bats are roosting within the vegetation in question.

(f) If bats are confirmed to still be roosting within the vegetation after fourteen nights of monitoring, then a meeting will be set up by the PBE between suitable Waikato Regional Council and DOC staff to decide on an appropriate way forward. This will be a risk assessment-based approach dependent on the type of roost identified.

2 The PBE should be onsite to supervise all potential vegetation clearance operations and to advise staff should bats be detected (either leaving trees or injured) and to inspect each felled tree or vegetation for signs of bats. Removal must occur on the same day as per the pre-felling procedures listed in Protocol B. If this is not possible then monitoring and/or repeat inspection of roost features must be continued until the tree can be removed in its entirety.

3 Potential or vacant bat roost trees will only be removed between 1st October and 30th April. However, trees that are identified as “potential roost trees” from the ground based on limited visibility but are later climbed by an arborist to find that no roost features are present, are exempt from this period, and can be felled at any time.

4 If bats are detected while felling is in progress, felling must stop long enough to allow any uninjured bats to escape (if it is safe to do so). Every effort should be made to relocate the section of the trunk/branch where the bats were roosting before felling may recommence.

5 Attempts should be made to capture any observed bats by the PBE for injury assessment.

6 Uninjured bats will be released immediately and if any injured or deceased bats are salvaged, Protocol D shall be implemented.

7 All potential bat roost vegetation shall be thoroughly inspected immediately after felling with the aid of a handheld detector by the PBE, to check for any roosting bats remaining within the tree.

8 If any injured bats are observed during/after vegetation clearance, then Protocol D must be implemented.

2.4 Protocol D: Bat Injury or Mortality

In the event of finding a dead or injured bat(s) the following procedures will be implemented:

1 Injured bats will be placed in a dark material-lined bag by the PBE to ensure the bat is handled appropriately.

2 Injured bats will be taken immediately to the nearest available veterinarian for assessment/treatment. The vet will make a decision as to whether to euthanise the bat or not (this does not require DOC approval). If the vet decides that the bat can be rehabilitated, the vet will contact DOC on the emergency hotline (0800 362 468).

3 If the bat is dead or has been euthanised by the vet, it will be taken to the local DOC office as soon as practicable (required under the Wildlife Act 1953). The bat(s) must be stored in a fridge at less than 4˚C.

References

Sedgeley, J.; O'Donnell, C.; Lyall, J.; Edmonds, H.; Simpson, W.; Carpenter, J.; Hoare, J.; & McInnes, K. 2012. DOC best practice manual of conservation techniques for bats, Version 1.0. Inventory and Monitoring Toolbox: Bats, Department of Conservation.

Appendix A
Bat Ecologist Competency Levels*

*These are currently under review by industry professionals and are subject to change.

Class	Key Field Activity	Competency	Individual Experience/Knowledge
A	*ABMs*	*Setting up automatic bat detectors monitoring systems (ABMs)*	*Recent previous experience in installing ABMS in at least 2 comprehensive surveys.*
B	*Analysing ABMs*	*Setting up ABMS, and analysing and interpreting results.*	*Recent previous experience at analysing and interpreting ABM results in at least 2 comprehensive surveys.*
C1	*Identifying bat roosts (short tailed bats)*	*Finding and identifying short-tailed bat roosts that are either occupied or unoccupied. This competency may also include arborists.*	*Recent extensive experience in searching for and finding active and inactive roosts (by radio tracking, exit observations, and/or visual inspections).*
C2	*Identifying bat roosts (long tailed bats)*	*Finding and identifying long-tailed bat roosts that are either occupied or unoccupied. This competency may also include arborists.*	*Recent extensive experience in searching for and finding active and inactive roosts (by radio tracking, exit observations, and/or visual inspections).*
D	*Handling bats*	*Handling bats (in one or more field methods), as outlined in DOC's best practice manual (Sedgeley et. al. 2012).*	*Has undertaken field training from a competent trainer demonstrating the required technique to the trainer's satisfaction and meets DOC's best practice manual standards (Sedgeley et. al. 2012) to carry out one or more of the following specialised field methods:* • *extracting bats from mist net using harp traps at roost sites* • *handling bats* • *marking bats (e.g. forearm band, temporary marks)* • *using wing biopsies for genetic sampling attaching transmitters* • *inserting transponder tags* • *applying release technique*

E	*Trainer for class X*	*Competent at the relevant class plus capable of training staff.*	*Has a high level of knowledge and experience regarding the competency they are training people in.*
F	*Bat Management*	• *Survey/monitoring programme design*[2] • *Survey data analysis and interpretation*[1] • *Preparation of bat impact assessment reports*[1] • *Can recommend impact management strategies (e.g. mitigation) for projects*[1] • *Prepare, co-author, or certify the appropriateness of BMMPs*[1] *Presentation of expert evidence for projects impacting bats*	• *Competency in 3 or more of A/B/C/D activities (field experience relating to competency classes A/B/C/D activities)* • *Experience writing ecological assessments and/or species restoration or recovery plans. Thorough knowledge of available bat survey techniques and methodology, and their limitations. Thorough knowledge of the threat's bats face and national recovery actions.* • *Thorough knowledge of measures to avoid, mitigate or compensate for impacts of infrastructure projects on bat populations* • *Understands seasonality and conditions of bat activity, and how these might affect surveys* • *Can recognise and articulate how the practical constraints of a survey affect the conclusions in an impact assessment* • *Understand the importance of sampling design and sample size (effort) in determining whether monitoring results will have sufficient statistical power to detect changes in the variable of interest*

1 http://www.DOC.govt.nz/our-work/biodiversity-inventory-and-monitoring/bats/
2 May be undertaken by individuals or a team which collectively has these competencies.

wsp.com/nz

wsp.com/nz

Running, Tanya

From: Running, Tanya
Sent: Tuesday, November 9, 2021 4:27 PM
To: Michael Parsonson
Cc: 'Mike Wood'
Subject: SH1/SH29 | Updated Bat Management Plan
Attachments: SH1-SH29__BMP_Final_ Updated 091121.pdf; FW: WRC Section 92 request

Kia ora Michael

Please find **attached** an updated Bat Management Plan dated todays date which includes the Vegetation Removal Protocol.

Changes have been made to the Bat Management Plan as a result of comments and proposed changes from Gerry Kessels following his review of the Waka Kotahi section 92 response dated 15 October 2021, as detailed in the **attached** email from Gerry Kessels dated 1 November 2021.

Kind regards Tanya

Tanya Running
Principal Environmental Consultant

M: +64 27 298 4502
tanya.running@wsp.com

wsp.com/nz

Running, Tanya

From: Michael Parsonson <michael@southernskies.co.nz>
Sent: Monday, November 1, 2021 2:58 PM
To: Mike Wood; Running, Tanya
Subject: FW: WRC Section 92 request

Comments from Gerry. Can discuss tomorrow.

From: gkessels@bluewattle.co.nz <gkessels@bluewattle.co.nz>
Sent: Monday, 1 November 2021 11:52 am
To: Michael Parsonson <michael@southernskies.co.nz>
Cc: 'Jorge Rodriguez' <Jorge.Rodriguez@waikatoregion.govt.nz>; connie.daws@waikatoregion.govt.nz
Subject: RE: WRC Section 92 request

Hi Michael,

As well as my comments of the bat related managed plans which I have just emailed you, here are a few ecology related points I have in relation to the s92 response from Waka Kotahi:

1. I still have concerns about the 1:1 ratio proposed for replacement vegetation being sufficient. The vegetation, while exotic and weedy, does provide foraging and commuting habitat for bats (and possibly roosting habitat). While the BMP address loss of potential and occupied roost trees (and noting I don't agree with quantum for occupied roost trees as proposed), it does not replace functional commuting and foraging habitat for bats – this habitat is clearly significant in terms of Table 11-1 of the Waikato regional Policy Statement and hence s6c of the RMA, hence a high bar is required for mitigating loss of habitat. Condition 43 of the proposed conditions points to prep of a Vegetation Management Plan (which I don't have in front of me at this point in time). I would like to know where the location of this planting is proposed and what the performance standards are.

2. I don't agree that the 1:8 ratio of planted trees and bat boxes for replacement of lost occupied roost trees as being sufficient. I have stated this on several occasions now. I presume Waka Kotahi wish to address this matter in evidence during the hearing process now as an unresolved point of difference in opinion between the ecologists?

3. I am unclear what the consultation with WRC and DOC entails in terms of addressing the loss of occupied roost trees. There is no specified outcome required as a consequence of this consultation as far as I can tell.

4. The response mis-interprets my advice to undertake ABM surveys in the tree felling protocols. I never stated that ABM surveys should be the only method for determining bat roost occupancy. Each of the methods proposed are not perfect, but using a combination of all of the methods reduces the risk of non-detection (and hence harming bats) when felling potential bat roost trees. The baseline ABM surveys can also provide useful baseline data when developing monitoring conditions to ensure the efficacy of the proposed mitigation measures.

Finally I am unclear of any monitoring requirements and performance standards pertaining to ecology and will be recommending measures to ensure the consent conditions incorporate a suitable monitoring and performance standard compliance regime as it relates to bats, lighting, and the protection and maintenance of the revegetated areas.

Ngaa mihi | Kind Regards
Gerry Kessels

Principal Ecologist/Managing Director

Bluewattle Ecology

M: 027 286 8449

Kessels & Associates Ltd trading as Bluewattle Ecology

From: Michael Parsonson <michael@southernskies.co.nz>
Sent: Friday, 15 October 2021 2:30 pm
To: gkessels@bluewattle.co.nz; James Oakley <james@wainuienvironmental.co.nz>; Peter Stacey <Peter.Stacey@ghd.com>
Cc: Jorge Rodriguez <Jorge.Rodriguez@waikatoregion.govt.nz>; connie.daws@waikatoregion.govt.nz
Subject: FW: WRC Section 92 request

Hi all

s92 response attached. Would you be able to review this by the end of next week?

Regards
Michael

From: Mike Wood <Mike.Wood@nzta.govt.nz>
Sent: Friday, 15 October 2021 2:13 pm
To: Michael Parsonson <michael@southernskies.co.nz>
Cc: Running, Tanya <tanya.running@wsp.com>
Subject: WRC Section 92 request

Hi Michael, see attached s92 request for WRC. This includes a number of attachments. Please note that our stormwater specialist has been attempting to contact James regarding some further clarification around request 3.

Regards
Mike

Mike Wood (he/him) MRP, MNZPI

Principal Planner

Environmental Planning – Transport Services

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Waka Kotahi NZ Transport Agency

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PO Box 973, Waikato Mail Centre, Hamilton 3240, New Zealand

Project Number: 2-A0011.04

State Highway 1 and State Highway 29 Intersection Upgrade

Draft Bat Management Plan

9 November 2021

wsp

150 YEARS IN AOTEAROA

Contact Details

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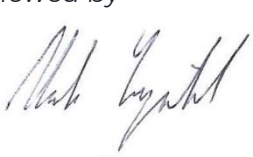
Document Details:

Date: Updated 9 November 2021
Reference: 2-A0011.04
Status: Final

Prepared by

Caitlin Dodunski I Ecologist

Reviewed by



Mark Yungnickel I Senior Ecologist

John Turner I Technical Principal

Approved for release by

Zaid Essa I Project Manager

Contents

1 Introduction

1.1 Purpose

This document presents a draft adaptive Bat Management Plan (BMP), prepared by WSP, for Waka Kotahi New Zealand Transport Agency (Waka Kotahi), for the proposed intersection upgrade of State Highway 1 (SH1) and State Highway 29 (SH29) (the Project). This BMP outlines and guides implementation of the required management of effects on long-tailed bats. This document accompanies the Assessment of Effects on the Environment (AEE) in relation to ecology, which forms part of the resource consent lodgement package submitted to Waikato Regional Council (WRC).

The scope of this BMP includes:

- Summary of potential effects on long-tailed bats resulting from the Project;
- Details of measures to avoid, remedy and/or mitigate adverse effects; and,
- Vegetation Removal Protocols to be implemented.

1.2 Long-tailed bats

The long-tailed bat *(Chalinolobus tuberculatus),* a species classified as 'Threatened -Nationally Critical'[1] is found widely throughout the North Island and is common within the Waikato Region. The species roosts in cavities and damaged trunks/branches of mature native and exotic trees and often utilise sheltered areas of woody vegetation for foraging and commuting. If bats are confirmed present within an area, it is necessary for potential effects on bats to be identified and appropriate mitigation measures implemented to avoid any harm or disturbance to the species. As a native species they are protected under the Wildlife Act 1953. Therefore, any harm (direct or indirect) caused to bats during construction activities can result in prosecution, if all practical steps to avoid this are not demonstrated.

1.3 Project Bat Ecologist

A nominated Project Bat Ecologist (PBE) will be responsible for the implementation of this BMP and the associated Vegetation Removal Protocol (VRP) presented in Appendix A. As described in the Department of Conservation's (DOC) Bat Recovery Group, Bat handling competencies authorisation (Version 1.2, September 2021)[2], the PBE must be certified as "Competent" to the following levels:

- Competency 2.1.1: Bagging, storage, handling, measuring, weighing, sexing, aging, temporary marking and releasing appropriately.
- Competencies 3.1, 3.2, 3.3: High risk activities – Roost felling

[1] O'Donnell, C.F.J.; Borkin, K.M.; Christie, J.E.; Lloyd, B.; Parsons, S.; Hitchmough, R.A. (2018). Conservation status of New Zealand bats, 2017. *New Zealand Threat Classification Series 21, Department of Conservation, Wellington, New Zealand.*

[2] Bat Handling competencies authorisation provided in Appendix A.

2 Potential effects on long-tailed bats

There are potential direct and indirect effects on long-tailed bats that have been identified, both during- and post-construction. These effects are:

- Construction phase
  - mortality/injury during vegetation removal;
  - habitat loss; and
  - noise, vibration and light disturbance during construction.
- Operation phase
  - fragmentation; and
  - artificial light pollution.

The management of these effects are addressed in sections 3 to 6 below.

3 Construction phase

3.1 Avoiding mortality/injury during vegetation removal

3.1.1 Assessment of vegetation for roosting potential

Potential roosting habitat has been identified within the designation boundaries of the roundabout and the stormwater discharge works (as detailed in the AEE) and will be impacted by construction. Prior to the earthworks and vegetation clearance required for the construction of the access track, discharge and associated erosion protection structures, the PBE will undertake a roost tree suitability assessment of the vegetation proposed to be removed.

All potential roost trees will be marked, given an ID number and their location recorded on a GPS device. This information will be used as a reference to improve efficiency during tree clearance, and to ensure no potential roost trees are accidentally felled.

3.1.2 Avoiding direct harm to bats

There is a possibility that vegetation to be felled could be an active bat roost and, as mentioned in section 1.2, it is important that measures are taken to avoid direct harm to bats. Strict protocols (VRP, Appendix A) therefore must be implemented for **all** vegetation to be removed or pruned for construction purposes. The protocols outline monitoring and inspection methods to be used to ensure bats are not occupying vegetation immediately prior to removal, such as:

a) Acoustic monitoring

This involves the Installation of automated bat monitors (ABMs) in the tree(s) that are to be removed, for at least two consecutive nights preceding tree clearance and with weather conditions favourable for bats (see Appendix A). If ABMs detect bat activity in the vicinity of the subject tree(s) further investigation through visual inspections and/or roost watches are required. If no activity is detected on the two nights immediately prior to clearance, then the tree can be removed on that same day.

b) Visual inspections

This method requires arborists to climb all vegetation (where safe to do so), under the supervision of the PBE, and inspect all identified roost features or areas of the tree the PBE cannot see from the ground. Arborists will relay any potential evidence of bats (e.g. urine staining, cavities, droppings) by way of live audio-visual equipment and/or photographs for review by the PBE. This inspection must be undertaken immediately prior to (same day) removal. At the time of visual inspections, the PBE may also use a thermal camera to inspect roost features from the ground.

c) Dawn/dusk roost watches

This method will be used when vegetation is not safe or not practical (i.e. dense ivy covering tree) for arborists to climb. Vegetation will be subject to two consecutive nights of watches at both dusk and dawn, carried out by PBE and at least one other experienced ecologist where health and safety considerations allow. A thermal camera and handheld acoustic detectors will be used to assist with observations. If the PBE is confident after the second dawn watch that bats are not occupying the subject vegetation, then it can be removed on that same day.

d) Active bat roosts

If bats are confirmed, via the methods above, to be roosting within the subject vegetation, it must not be felled. The roost will be isolated and marked, and all relevant staff will be notified to ensure the roost is not removed or disturbed by nearby construction activities. The PBE will consult with suitable WRC and DOC staff to decide an appropriate way forward before any further monitoring

and subsequent clearance can occur. This will be a risk assessment-based approach, dependent on the type of roost identified

3.2 Habitat Loss

3.2.1 Avoidance

To minimise the effects of roost habitat loss, tree clearance will be kept to a minimum, and only removed when absolutely necessary. A total of six exotic trees of moderate roosting suitability have been proposed for removal within the roundabout footprint, which will be unavoidable.

However, for the stormwater discharge and associated access track works, there will be opportunities for avoidance. Several mature trees with varied moderate to high roosting suitability have already been identified by ecologists, and as a result these trees will not be removed. The approximate location and path of the access track has now been decided but there are further opportunities for avoidance of roost trees achieved through minor adjustments to the track design.

To guide these alterations and finalisation of the track design, a walkover meeting between the PBE, contractors and engineer representatives will be held. The PBE will then identify any high value roost trees that will be affected by construction and will discuss options for avoidance by moving the track away from the potential roost tree and its dripline.

The finalised track will be clearly delineated using tape and/or marker pegs to ensure that no trees are unnecessarily removed.

3.2.2 Mitigation

Mitigation for the loss of potential roost trees will be offered in the form of planting of both native and exotic tree species. Exotic tree species tend to mature and produce roosting features much faster than native species. Table 1 provides a list of both exotic and native species, known to provide such habitat for bats, and will be considered for mitigation planting.

For the loss of **each** tree assessed as having “high” roosting suitability the following mitigation will be provided:

- Planting of eight trees (1:8 ratio); four of which will be exotic species and four will be native species.

If roosting bats are confirmed within any of the vegetation to be removed (while implementing the Vegetation Removal Protocol), and the tree cannot be retained by any means, then the PBE will consult with suitable WRC and DOC staff to decide an appropriate way forward. This will be a risk assessment-based approach, dependent on the type of roost identified. The following mitigation will also be provided:

- Planting of eight trees (1:8 ratio); four of which will be exotic species, and four will be native species; and
- Installation of four artificial bat boxes of the “kent” design on a suitable tree(s) adjacent to the designation, and with aluminium predator exclusion banding situated both above and below the boxes. Locations and installation will be under the guidance and supervision of the PBE.

The PBE shall also determine whether any natural roosts found during tree clearance. (i.e. cavities and their extents) can be relocated and attached to another tree that will be unaffected by construction, therefore preventing the loss of the roost.

If planting of trees is required (due to loss of high suitability and/or confirmed roost trees). The formation and location of the plantings will be considered in a way that will naturally encourage foraging and commuting behaviours. Trees can be planted to provide further edge habitat; whether this is a single external edge, or in a tunnelling formation to provide both internal and external flyways. Trees will also be planted in areas that are able to grow and eventually decay naturally without encroaching into road corridors or areas that will pose future threats to safety and therefore as a result, have to be felled.

Table 1. List of exotic and native tree species that will be considered for mitigation planting, if required.

Common name	Latin name
Exotic species	
Giant gum	*Eucalyptus regnans*
Brown Barrel	*Eucalyptus fastigata*
Messmate	*Eucalyptus obliqua*
Tasmanian Blackwood	*Acacia melanoxylon*
Radiata pine	*Pinus radiata*
London plane	*Platanus x acerifolia*
Sessile oak	*Quercus petraea*
Native species	
Ti kouka	*Cordyline australis*
Kahikatea	*Dacrycarpus dacrydioides*
Rimu	*Dacrydium cupressinum*
Kanuka	*Kunzea var.*
Manuka	*Leptospermum var.*
Mahoe	*Melicytus ramiflorus*
Totara	*Podocarpus totara*
Matai	*Prumnopitys taxifolia*
Tawa	*Beilschmiedia tawa*

3.3 Minimising fragmentation

Embankment planting (from a landscape architecture aspect) is currently planned on all sides of the roundabout, as well as specimen trees along the cycleway for shading. The PBE will work with landscape architects to incorporate tall growth tree species into the vegetation management plan to encourage commuting bats through the landscape. These trees will also help to guide bats safely over the roundabout, reducing the already minor risk of collision with vehicles. Minimising fragmentation will also be achieved by the installation of best practice lighting as outlined in Section 4.1, whereby bats will tend to avoid the lit zones (pers. obs. Caitlin Dodunski, Simon Chapman) and oncoming traffic by flying over the top or around. In addition, the general improvement of road lighting from the current situation should encourage bats to commute within the adjacent landscapes more often.

3.4 Minimising noise and vibration disturbance to active roosts

While long-tailed bats can roost and remain very active close to lit sections of road and appear tolerant in many situations of the associated traffic noise and vibration, the variability and less predictable nature of construction related disturbance potentially risks affecting the bats normal behaviour.

Noise and vibration, or even light from vehicles and plant could cause disturbance, including causing them to abandon roosts or emerge later than is optimal for foraging. Considering these risks, measures need to be implemented to minimise the potential for disturbance associated with active roost trees.

In the event that a roost is located by the PBE during vegetation clearance (while enacting the requirements of the VRP) the following actions will be taken:

a) The immediate area of the roost will be cordoned off with safety fencing and signage erected, alerting any person approaching the area that a bat roost is present and to stay clear;

b) The existence of the roost will be widely publicised to all construction staff and work instructions for the immediate area will be updated to reflect the presence of the roost and the measures to minimise disturbance; and

c) No construction activities will take place within 50m of the roost from 2 hours before official dusk to 1 hour after official dawn unless approval is given by the PBE.

4 Operational Phase

4.1 Minimise artificial light pollution

To minimise light spill into the surrounding environment, low intensity, longer-wavelength and warm colour LED lighting will be installed. The following specifications will be followed for installation of all lighting:

- Luminaires shall produce no direct upwards light;
- Luminaires shall have a maximum colour temperature of 2700K (white); and
- Light levels on the boundary of key bat habitats (as presented in Figure 1) will not exceed 0.3 Lux.

Figure 1. Key bat habitats where light levels will not exceed 0.3 Lux.

Artificial lighting currently present along the SH1/SH29 intersection will also be decommissioned.

Landscape planting on all sides of the roundabout will block the majority of headlight glare from vehicles therefore reducing effects of headlight glare from what is currently present.

5 Reporting

A Tree Clearance and Mitigation Report will be submitted to Waikato Regional Council within 2 months following completion of all tree felling associated with this Project and will include:

- Details of all trees felled (GPS location, species, DBH, photos and roost suitability rating), and actions taken to ensure no bats were harmed during clearance;
- Details of measures taken to avoid wherever possible, felling of trees assessed as having high roosting suitability, or of confirmed bats roost trees; and
- Details and quantities of required mitigation based on number and quality of roost trees removed (as outlined in Section 3.2.2). This will include proposed planting sites and their protection and management, locations of artificial roost boxes and proposed management.
- Confirmation that mitigation for habitat loss (if required) has been implemented.

Appendix A
Vegetation Removal Protocol

Appendix A
Vegetation Removal Protocol

Adapted from:

Smith, D.; Borkin, K.; Jones, C.; Lindberg, S.; Davies, F.; Eccles, G. 2017. Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature. NZ Transport Agency research report 623. Annex DH.

and,

Bat handling competencies authorisation. Version 1.2. 7/09/21. Department of Conservation, Bat Recovery Group.

1 Introduction

This document presents Vegetation Removal Protocols (VRP) to be implemented prior to removal of all vegetation for construction of the SH1/29 Intersection upgrade (the Project). These protocol follow industry best practice adhering to both the Bat Management Framework set out by Waka Kotahi New Zealand Transport Agency[1] and the Department of Conservation's Bat Roost Protocols (2021)[2]

These protocol are specific to this Project and they aim to provide clear, concise procedures that are to be followed prior to the removal of all vegetation for the Project, with the goal of avoiding mortality or injury to long-tailed bats during clearance activities.

There are four protocol that must be adhered to:

Protocol A: Identification of potential bat roost habitat;

Protocol B: Pre-felling procedures;

Protocol C: Felling procedures; and

Protocol D: Bat Injury or Mortality.

1.1 Project Bat Ecologist

A nominated Project Bat Ecologist (PBE) will be responsible for the implementation of these protocol. The PBE, or any ecologist overseeing clearance activities on behalf of the PBE must be certified as "Competent" to the following levels as described in the Bat handling competencies authorisation (DOC, 2021)[3], and are required to be present on site **at all times** during vegetation removal:

- Competency 2.1.1: Bagging, storage, handling, measuring, weighing, sexing, aging, temporary marking and releasing appropriately.
- Competencies 3.1, 3.2, 3.3: High risk activities – Roost felling

[1] Sedgeley, J.; O'Donnell, C.; Lyall, J.; Edmonds, H.; Simpson, W.; Carpenter, J.; Hoare, J.; & McInnes, K. 2012. DOC best practice manual of conservation techniques for bats, Version 1.0. Inventory and Monitoring Toolbox: Bats, Department of Conservation.

[2] Bat Roost Protocols. Protocols for minimising the risk of felling bat roosts. Department of Conservation, Bat Recovery Group. Version 2 October 2021

[3] Bat Handling competencies authorisation provided in Appendix A.

2 Vegetation Removal Protocols

2.1 Protocol A: Identification of potential bat roost habitat

Prior to undertaking this protocol, ensure the designation boundaries have been visually delineated using flagging tape or boundary pegs, to ensure all trees that are required for removal are assessed appropriately. This also ensures that no more vegetation than necessary is removed.

1 All vegetation that might be disturbed and/or removed for construction must first be assessed by the PBE for presence of roost features. Vegetation identified as potential bat roosts[4] are those >15 cm Diameter at Breast Height (DBH) and have one or more of the following attributes:

- Cracks, crevices, cavities, fractured limbs, or other deformities, large enough to support roosting bat(s);
- Sections of loose flaking bark large enough to support roosting bat(s);
- A hollow trunk, stem or branches; and/or
- Deadwood in canopy or stem of sufficient size to support roost cavities or hollows.

Based on the presence (or absence) of the above, vegetation must then be categorised[5] as to their suitability as bat roosts (Table 1). This method was adapted from roost tree assessments conducted for the Southern Links Project (AECOM, 2019).

Table 1: Criteria for assessing vegetation for their suitability as bat roosts.

Suitability as a roost	Justification of assessment	Further survey required?
Low	A tree of at least 15cm DBH but no roost features visible or with only limited roosting potential i.e. loose bark present, but not sufficient to provide shelter for roosting bats.	No
Moderate	A tree of at least 15cm DBH with one or more roost features that could be used by individual bats or where it is not clear from the ground inspection whether roost features are present or not and therefore requires further inspection.	Yes
High	A tree of at least 15cm DBH with one or more roost features which could provide habitat for several bats due to their size and ability to provide sufficient shelter and protection.	Yes
Confirmed	A tree known to have been used by bats as a roost tree.	Yes

[4] Roosts tend to be observed in mature trees that are >15cm DBH; however, native bats have also been observed in tree ferns, cabbage trees and epiphytes, therefore this vegetation should also be considered as potential roost habitat.
[5] This method was adapted from roost tree assessments conducted for the Southern Links Project (AECOM, 2019).

2 Potential (those assessed as moderate suitability or higher) or vacant bat roost trees must only be removed between 1st October and 31st April. Weather parameters provided in Section 2.2.1 must also be met before any potential bat roost trees can be removed.

3 All trees of at least moderate suitability shall be subjected to pre-felling monitoring as per Protocol B.

4 No trees or vegetation identified as potential roosts can be felled or cleared without the approval of the PBE.

2.2 Protocol B: Pre-felling procedures

For all vegetation assessed as having moderate or high suitability as bat roosts using Protocol A, occupancy will be confirmed using a combination of methods outlined below, immediately prior to vegetation clearance. The most effective method(s) will be determined by the PBE on a case-by-case basis.

2.2.1 Acoustic monitoring via Automated Bat Monitors

Due to current knowledge of bat activity being common within the Project area, this method will likely be used as supplementary information to visual inspections, and/or roost watches, as detailed in the following sections. If acoustic data is to be solely relied upon for confirming presence or absence of roosting bats, monitoring must be undertaken using the following methods and parameters:

1 The identified potential roost tree(s) will be acoustically monitored for two consecutive "valid" survey nights immediately prior to felling.

2 The Automatic Bat Monitors (ABMs) should be placed so that detection of bats is likely if they are using the potential roosts.

3 Monitors will be programmed to detect activity from one hour before official sunset dusk until one hour after official sunrise.

4 A "valid" survey night requires the following overnight weather conditions:

(a) Air temperature remains above 10˚C until four hours after official sunset;
(b) Rainfall of < 2.5mm in the first two hours after official sunset, and <5 mm in the first four hours after official sunset.
(c) Where a night of monitoring is lost to adverse weather, or equipment failure, further monitoring will take place until two consecutive nights of monitoring is achieved.

5 If no bat activity is detected at any time during the two consecutive valid survey nights, then the tree(s) can be removed the same day without any further monitoring.

2.2.2 *Visual inspections*

This will be the predominant method used on the Project due to the likelihood of consistent bat activity being detected on ABMs on nights preceding vegetation removal, and particularly within the more densely vegetated habitats. The extents of all potential roost features will be inspected for presence of bats. If roost features are low enough, the PBE will undertake the inspection, however if they cannot be reached, or the full extent of the vegetation cannot be seen by the PBE from the ground, arborists will be required to climb and inspect the tree, under supervision of the PBE. The following guidelines are to be used:

1 All vegetation identified as having moderate-high suitability as a roost may be inspected to confirm occupancy by roosting bats.

2 An arborist may undertake a visual inspection of vegetation by climbing (under guidance and supervision of the PBE) and relaying any potential evidence of bats (e.g. urine staining, cavities, droppings) by way of live audio-visual equipment and/or photographs for review of the PBE. This must be undertaken immediately prior to (same day) removal. The arborist will also check for signs of roosting bats using a handheld bat detector (to detect social and echolocation calls from roosting bats).

3 Arborists may carefully inspect and check the extents of split branches, and if necessary, use an endoscopic camera to inspect cavities for presence of roosting bats.

4 If potential roosts are located within tree ferns or other 'delicate' vegetation, climbing will only be undertaken if it is safe to do so for the climber and if this will not damage the roost or disturb potentially roosting bats at the time of inspection. All climbing must take place under the careful supervision of the PBE to prevent roost damage or disturbance/injury to roosting bats. Photographs will be taken of any roosts or roost evidence found.

5 A thermal camera may also be used from the ground to inspect any roost features at the time of tree inspections. This technique is useful when a particular branch or tree cannot be climbed to provide certainty that a tree is unoccupied.

6 If no bat activity or evidence of roosting bats at the potential roost trees is identified and the PBE determines the vegetation can be removed, this information should be relayed to the contractors in sufficient time to allow clearance of vegetation to be completed prior to dusk the same day.

2.2.3 *Dusk/Dawn Roost Watches*

This method will be used if potential roosts cannot be ruled out using visual inspection techniques and/or a tree cannot be climbed (e.g., vegetation that is unsuitable for climbing, dense ivy covering). In this instance, the following methodology should be implemented.

1 Roost emergence and re-entry watches[6] will be undertaken for two consecutive valid survey nights prior to removal, and require the same weather conditions as described in Section 2.2.1 (4a-c).

2 Each tree shall be watched from just prior to official sunset and continue until it becomes too dark to see by people observing all potential exit points. Bats begin to leave their roosts while there is still light outside therefore there is potential to observe bats without the aid of cameras or video equipment.

3 The tree shall then be watched the following morning to determine if bats return to the tree(s), at a minimum two hours prior to official sunrise, or two hours prior to when the last passes were recorded on ABMs on previous nights.

4 Hand-held bat detectors will be used to alert the ecologist(s) to the presence of bats nearby, narrowing down the potential roost site locations and allowing roosts to be confirmed. ABMs should also be deployed simultaneously.

5 A thermal imaging camera should be used wherever possible to assist in the detection of bats and provides the opportunity to review footage should there be any bat passes observed and/or heard.

6 If no bat activity at the potential roost tree(s) is identified after the second re-entry watch and the PBE is confident that no bats are roosting within the subject tree(s), then it can be removed. Removal must occur on the same day following roost watches (i.e., if the survey ends in the morning, the tree can be felled the same day only. If the tree is not able to entirely felled and there is residual risk (roost features still present), then roost watches must continue.

2.3 Protocol C: Felling Protocol

1 If bats are confirmed via either of the methods detailed above, to be roosting within the tree, it must not be felled. The following actions will be taken:

(a) Roost trees should be clearly marked, and the immediate area will be cordoned off with safety fencing and signage erected in a 10 m radius around the roost, alerting any person approaching the area that a bat roost is present and to stay clear.

(b) The PBE will notify the Waikato Regional Council (WRC) and DOC within 12 hours of when the occupied bat roost was discovered and provide relevant information such as photos, location, date(s), tree species, roost type and methods used to confirm bat presence.

(c) All relevant Project staff will be briefed to ensure the tree is not removed. The PBE will determine whether all tree clearance works should be suspended or whether inspections and clearance can continue away from the roost.

[6] Two sessions required per "valid survey night" i.e. one emergence watch and one re-entry watch per night until two consecutive nights with no roosting bat activity is observed.

(d) Further monitoring must continue until the PBE can confirm that no bats are roosting within the vegetation in question.

(e) If the tree is a maternity roost tree removal works shall be scheduled to only occur within the period 1 March to 31 April inclusive.

(f) The PBE will review whether it is possible to relocate the roost into an area that would remain of value to bats, for example. could the hollow be kept and attached to another tree as a bat box? Could the tree be relocated as standing dead timber? Therefore, preventing the loss of the roost through careful repositioning.

(g) If bats are confirmed to still be roosting within the vegetation after fourteen nights of monitoring, then a meeting will be set up by the PBE between suitable Waikato Regional Council and DOC staff to decide on an appropriate way forward. This will be a risk assessment-based approach dependent on the type of roost identified.

2 The PBE should be onsite to supervise all potential vegetation clearance operations and to advise staff should bats be detected (either leaving trees or injured) and to inspect each felled tree or vegetation for signs of bats. Removal must occur on the same day as per the pre-felling procedures listed in Protocol B. If this is not possible then monitoring and/or repeat inspection of roost features must be continued until the tree can be removed in its entirety.

3 Potential or vacant bat roost trees will only be removed between 1st October and 30th April. However, trees that are identified as "potential roost trees" from the ground based on limited visibility but are later climbed by an arborist to find that no roost features are present, are exempt from this period, and can be felled at any time.

4 If bats are detected while felling is in progress, felling must stop long enough to allow any uninjured bats to escape (if it is safe to do so). Felling should only resume after consultation with DOC and the PBE. Every effort should be made to relocate the section of the trunk/branch where the bats were roosting before felling may recommence.

5 Attempts should be made to capture any observed bats (those that don't fly away) by the PBE for assessment. Any bats found should be placed in a cloth bag in a dark, quiet place at ambient (or slightly warmer temperatures and Protocol D shall be implemented.

6 All potential bat roost vegetation shall be thoroughly inspected immediately after felling with the aid of a handheld detector by the PBE, to check for any roosting bats remaining within the tree.

2.4 Protocol D: Bat Injury or Mortality

In the event of finding a bat during tree removal, the following procedures will be implemented:

1 Bats will be placed in a dark material-lined bag by the PBE to ensure the bat is handled appropriately, and put in a dark, quiet place at ambient (or slightly warmer temperatures A maximum of two bats should be kept in one bag.

2 Bats will be taken immediately to the nearest available veterinarian for assessment/treatment. The veterinarian will make a decision as to whether to euthanise the bat, or if its injuries/or lack thereof will allow rehabilitation and return to the wild

3 DOC must be notified and consultation between the vet, the PBE and DOC will be undertaken to decide an appropriate rehabilitation programme for the bat(s).

4 If the bat is dead or has been euthanised by the veterinarian, it will be taken to the local DOC office as soon as practicable (required under the Wildlife Act 1953). The bat(s) must be stored in a fridge at less than 4˚C.

Appendix A

Bat Ecologist Competencies

Bat handling competencies authorisation

Version and Date: V 1.2, 7/9/2021
Revision date: 7/9/2021
Approved by: Bat Recovery Group

1. Context:
   - Certification by the NZ Bat Recovery Group is required for any permits that require handling bats (for NZ Wildlife Act 1953 Authorisations).
   - New Zealand bats, which are threatened species, are small, delicate and thus vulnerable to injury if handled incorrectly. Therefore, anyone that handles them must have levels of competency that ensure they are handled ethically. A competent handler will know how to catch, hold and release appropriately, understand if a bat is in torpor or not and adjust their handling appropriately, and when and how to attach monitoring devices.
   - Bat workers can reach a level of competency in up to 27 skills described below.
   - Each skill is represented by a separate competency.
   - Details of skill requirements are outlined in the NZ Bats Best Practice Manual:

     http://www.doc.govt.nz/Documents/science-and-technical/inventory-monitoring/im-toolbox-bats/im-toolbox-bats-doc-best-practice-manual-of-conservation-techniques-for-bats.pdf).

2. Purpose:
   To outline the ethical standards required to be registered as competent, authorised bat workers by the NZ Bat Recovery group.

3. Definitions and registration processes:
   - **Registered Bat Trainee:** A person who has registered with the Bat Recovery Group as a Trainee.
   - **Bat Banding Trainee:** A person who has registered with the NZ Banding Office as a Level 1 bat bander.
   - **Trainee Log:** A logbook of all training sessions undertaken, with each session signed by an Authorised Trainer. Logbooks are available from bathandler@doc.govt.nz or from DOC—6228629).
   - **Competent bat worker:** A person who has been certified as 'Competent" in a particular skill by the NZ Bat Recovery Group.
   - **Authorised Trainer:** A person who is registered as competent in a particular skill AND has been authorised by the Bat Recovery Group to teach and supervise Registered Trainees in that skill (but only if they are working under an existing Research or Collection Permit and Wildlife Act Authority or if they are a Department of Conservation Trainer). The Trainer **must** be present for all training and inspect all competency activities.

4. Training:
   - While people are designated as Trainees, training must occur under the direct supervision of an Authorised Trainer (see above).

- Once a competency or competencies has/have been signed off by the Bat Recovery Group, the bat worker can work independently with respect to that skill(s) (if they have the appropriate permits).
- The Trainee will keep a logbook that describes experience in each competency (DOC-6228629). This needs to be signed by an Authorised Trainer(s).
- The Trainee must have read and understood the NZ Bats Best Practice Manual (see link above).
- Trainees can be certified either in individual competencies or multiple competencies. Like bird banding in New Zealand, it is envisioned that for most trainees it may take several years to achieve all competencies because opportunities for hands-on bat work are limited.

5. Application for competency:
   - When trainees reach target handling levels described under each competency, they may apply to the Bat Recovery Group, via bathandler@doc.govt.nz, for certification in that competency. However, reaching the target level does not automatically give the applicant certification and an application for competency must be accompanied by a letter of endorsement in writing from at least one Authorised Trainer.
   - Applicants can apply for certification for single or multiple competencies.
   - Applications must include a short summary of bat handling experience, copies of signed training logs, and the names of two bat trainers that can attest to the applicant's competency.
   - Applications will be reviewed by the Recovery Group at its monthly meeting.
   - Applicants will receive confirmation of competency from the Recovery group within 2 months of applying.
   - If competency for banding long-tailed bats is sought then the Trainee must apply to the Department of Conservation Banding Office for Level 1 Bander registration (bandingoffice@doc.govt.nz) after filling in the appropriate form (Level 1 banders; https://www.doc.govt.nz/our-work/bird-banding/how-to-become-a-certified-bander/).

6. Rescinding competency:
   - The Bat Recovery Group may rescind certification if practitioners are no longer considered competent or do not follow Best Practice.

7. Authorised trainers:
   - Competent bat workers may apply in writing to the Bat Recovery Group, via bathandler@doc.govt.nz, to be Authorised Trainers.
   - Authorisation is at the discretion of the Recovery Group and discussion with the Recovery Group is recommended before applying.
   - Applicants can apply for authorisation for training against single or multiple competencies.
   - Authorised Trainers must be able to demonstrate:
     a. A deep understanding and experience of the ecology of New Zealand bats.
     b. Considerable experience well beyond competency levels in catching, handling and manipulating bats.
     c. A strong aptitude for, and experience of, teaching others about bats.

d. A clear understanding of teaching standards.
e. Knowledge of the Wildlife Act and Wildlife Regulations as they apply to working with bats.
f. Effective communication skills, understanding of Health & Safety requirements, and administration of records.

8. List of competencies:

Catching bats

1.1 Use of mist nets

1.1.1 Extract, bag and store correctly a total of 30 individuals of either species

1.1.2 Demonstrate correct mist net placement, set up, smooth operation, appropriate mist net attendance, assessment of risks and safe extraction and handling on 10+ different nights

1.2 Use of harp traps (free standing)

1.2.1 Lead identification of appropriate harp trapping sites and set up and monitor trap(s) on 10+ different nights

1.2.2 Extract 10+ bats appropriately from free standing traps

1.2.3 Demonstrate harp trapping protocols (animal welfare considerations, trapping in the breeding season, rain, repair and maintenance etc)

1.3 Use of harp traps (at roost entrances)

1.2.4 Lead set up and monitoring of trap(s) on 10+ different nights

1.2.5 Extract 10+ bats appropriately from traps hoisted up trees

1.2.6 Demonstrate harp trapping protocols at roost entrances (safe trapping at tree roosts (risk management), predation risks, disturbance risks, animal welfare considerations, trapping in the breeding season, rain, repair and maintenance etc)

2. Handling bats

2.1 Bagging, storage, handling, measuring, weighing, sexing, aging, temporary marking and releasing appropriately:

2.1.1 For long-tailed bats: 50 individuals

2.1.2 For short-tailed bats: 50 individuals

2.2 Banding long-tailed bats:

2.2.1 50 individuals

2.2.2 Demonstrate knowledge of how to remove bands safely (2 methods; demonstrate on model bat)

2.3 Pit-tagging insertion in short-tailed bats:

2.3.1 Pit-tag insertion to short-tailed bats

2.3.2 Bat handling for pit tagging

Note that that transponder skills require exacting standards and specialised training from a select few people, and if people need this skill, they should contact the Bat Recovery Group to apply to get trained.

2.4 Attaching radio transmitters (should first be competent in 2.1 and/or 2.2):

- 2.4.1 For long-tailed bats: watch 5 individuals having radio transmitters attached by a Competent Bat Worker or Authorised Trainer
- 2.4.2 For long-tailed bats: attach radio transmitters to 5 individuals correctly under supervision
- 2.4.3 For short-tailed bats: watch 5 individuals having radio transmitters attached
- 2.4.4 For short-tailed bats: attach radio transmitters to 5 individuals correctly under supervision
- 2.4.5 Demonstrate understanding of reasons for attaching transmitters, Animal Ethics issues, (risk management and animal welfare considerations, trapping

2.5 Taking wing biopsies

- 2.5.1 Watch 5 individuals having biopsies taken by a Competent Bat Worker or Authorised Trainer
- 2.5.2 Take biopsies from 10 individuals under supervision
- 2.5.3 Understand and follow the Standard Operating Procedure (available on request from Bat Recovery Group Leader)

3. High risk activities – Roost felling (all of these competencies include the understanding of what to do when bats are found during tree felling as per Appendix 6 of 'Initial veterinary care for New Zealand Bats' https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Initial_Vet_Care_NZ_Bats.pdf)

3.1 Assessing roost tree use using Automatic Bat Monitors - Demonstrate correct timing, placement, and interpretation of data for 10+ times according to DOC's Bat Roost Protocols.

3.2 Undertake roost watches/emergence counts at 10+ occupied roosts where the entrance is visible.

3.3 In at least two different forest/habitat types, including the forest/habitat type where trees are going to be assessed: evaluate 10+ potential roost features in trees (e.g., cavities, peeling bark, epiphytes).

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