TE TUPU NGĀTAHI
SUPPORTING GROWTH

Redhills Arterial Transport Network
Assessment of Ecological Effects

December 2022

Version 1

WAKA KOTAHI NZ TRANSPORT AGENCY
AT
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Document Status

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Abbreviations

Acronym / Term	Description
AEE	Assessment of Effects on the Environment
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
ED	Ecological District
NoR	Notice of Requirement (under the Resource Management Act 1991)
RMA	Resource Management Act 1991
SG	Te Tupu Ngātahi Supporting Growth
TAR	Threatened or At Risk
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency
ZOI	Zone of Influence

Glossary of Acronyms / Terms

Acronym / Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Ecological Baseline	Means the prevailing ecological state at the time of the assessment.
Likely Future Ecological Environment	The likely future environment informed by the Auckland Unitary Plan (AUP).
Ecological Feature	Specific aspects of an ecosystem that are described and evaluated; the term includes components such as species and habitats and related processes and functions, such as habitat buffers and roosting and feeding habitat.
Hydroperiod	Flow and or soil saturation period of streams or wetlands.
Project Area	Area of land that is within the proposed designation boundary.
Project Footprint	Area of land that is within the road design.
Significant Ecological Area	An overlay within the Auckland Unitary Plan Operational in Part, whereby areas of terrestrial, freshwater or marine habitat of significant indigenous vegetation or significant habitats of indigenous fauna are identified and protected from the adverse effects of subdivision, use or development.
Wetland	Defined in the Resource Management Act 1991 as “includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions”.
Zone of Influence	The Zone of Influence is defined in the EIANZ Guidelines as “the areas / resources that may be affected by the biophysical changes caused by the proposed Project and associated activities.”
Rapid Habitat Assessment	The RHA provides a standardised protocol for making a quick, qualitative, site-based assessment of physical stream habitat conditions (Clapcott, 2015).

1 Executive Summary

This Ecological Impact Assessment (EcIA) has been prepared to support AT's notices of requirement (NoRs) for the Redhills Arterial Transport Network (the Project) (Table 1-1).

Table 1-1: Redhills Arterial Transport Network – Notices of Requirement and Projects

Notice	Project
NoR 1	Redhills North-South Arterial Corridor
NoR 2a	Redhills East-West Arterial Corridor – Dunlop Road
NoR 2b	Redhills East-West Arterial Corridor – Baker Lane
NoR 2c	Redhills East-West Arterial Corridor – Nixon Road connection

As the Redhills Arterial Transport Network relates to proposed designations, this EcIA assesses district plan matters only. Regional matters (along with Wildlife Act (1953) compliance) will be subject to a future consenting phase along with a supporting EcIA. As such, regional matters have not been formally assessed in this report, however the relevant matters have been screened to inform the alternatives assessment, the designation boundary and future regional resource consents.

In order to inform the ecological baseline, ecological features within the Project Area were identified, mapped and their value assessed in terms of representativeness, rarity / distinctiveness, diversity / pattern and ecological context. A summary of the ecological values are provided for terrestrial vegetation (Table 1-2), district plan trees[1] (Table 1-3), terrestrial fauna (Table 1-4), streams (Table 1-5) and wetlands (Table 1-6).

Table 1-2: Ecological values of terrestrial vegetation within the Project Area

Vegetation Type	Classification (Singers et al. 2017)	Ecological Value
Brown Field	BF	Low
Exotic Forest	EF	Moderate
Exotic Grassland	EG	Low
Exotic Scrub	ES	Low
Planted Vegetation – Exotic (amenity)	PL.3	Low
Treeland – Exotic-Dominated	TL.3	Moderate
Mānuka, Kānuka Scrub	VS3	High

[1] Only district plan vegetation were included as it is an NoR application.

Table 1-3: Ecological values of District Plan trees within the Project Area

Vegetation Type	Classification (Singers et al. 2017)	Ecological Value
Treeland – Exotic-Dominated	TL.3	Low

Table 1-4: Ecological values of terrestrial fauna within the Project Area

Fauna Type	Ecological Value
Mammals	
Long-tailed bats	Very High
Birds	
Non-TAR birds	Low
Northern New Zealand dotterel	Very High
North Island kākā	High
North Island fernbird	High
Herpetofauna	
Copper skink	High
Ornate skink	High

Table 1-5: Ecological values of streams with the Project Area

Stream ID	Ecological Value
RH-S1a	Low
RH-S1b	Low
RH-S2a	Moderate
RH-S2b	Low
RH-S2c	Low
RH-S3	Moderate
RH-S4	Low
RH-S5a	Moderate
RH-S5b	Low
RH-S5c	Low
RH-S5d	Low
RH-S5e	Low
RH-S6	Moderate

Stream ID	Ecological Value
RH-S7a	Moderate
RH-S7b	Low
RH-S7c	Low
RH-S7d	Low
RH-S8	Low
RH-S9	Moderate
RH-S10	Low

Table 1-6: Ecological values of wetlands within the Project Area

Wetland ID	Ecological Value
RH-O1	Low
RH-W1a	Moderate
RH-W1b	Low
RH-W2	Moderate
RH-W3	Moderate
RH-W4	Moderate
RH-W5	Moderate
RH-W6	High
RH-W7	High
RH-W8	Low
RH-W9	Moderate
RH-W10	Moderate
RH-W11	High
RH-W12	Moderate
RH-W13	Moderate
RH-W14	Moderate

Construction Effects

Table 1-7 to Table 1-9 provides a summary of district plan matter ecological effects during construction prior to any mitigation[2]. The summary represents the level of effect for the baseline ecological environment.

Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Construction effect mitigation measures will include:

To address the effects of construction activities (noise, light and dust) on long-tailed bats, a Bat Management Plan (BMP) for the Project should be developed to include consideration for:

- Surveys prior to construction to confirm presence / likely absence. Surveys to confirm bat roost locations if activity is confirmed
- Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar)
- Siting of compounds and laydown areas to avoid EF, TL.3, and VS3 habitat
- Lighting design to reduce light levels and spill from construction areas
- Restriction of nightworks around EF, TL.3, and VS3 habitat

Bat management should be incorporated with any regional consent conditions that may be required for regional compliance.

All native fauna is protected by the Wildlife Act 1953 (WA 1953), therefore requirements of this legislation need to be adhered to during the removal of district plan vegetation. For long-tailed bats this should include the implementation of vegetation removal protocols (including pre-felling surveys). For native birds, any vegetation clearance within the bird nesting season (September to February) will need to be managed to avoid harm to native bird species and their nests e.g., programming vegetation clearance to avoid bird nesting season or else undertaking nesting bird checks.

Table 1-7: Summary of ecological effects during construction prior to mitigation for district plan terrestrial vegetation

Ecological Feature	Permanent loss of habitat / ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)
TL.3	Very Low

Table 1-8: Summary of ecological effects during construction prior to mitigation for bats

Ecological Feature	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Loss of foraging habitat due to removal of district plan vegetation	Mortality or injury to bats due to removal of district plan vegetation
Long-tailed bats[3]	**Moderate**	Low **WA 1953 requirements**	Low **WA 1953 requirements**

[2] Herpetofauna have been considered but excluded in the assessment of ecological effects as construction effects are considered Very Low.

[3] Roost loss has been considered but excluded as an effect as the consequence of roost loss (if it does occur at all) is considered Negligible in the context of this Project.

Table 1-9: Summary of ecological effects during construction prior to mitigation for birds

Ecological Feature[4]	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.)	Loss of foraging habitat due to removal of district plan vegetation	Mortality or injury to birds due to removal of district plan vegetation
Non-TAR birds	Low	Very Low **WA 1953 requirements**	Very Low **WA 1953 requirements**
Northern New Zealand dotterel	Low	-	-
North Island kākā	Very Low	Very Low **WA 1953 requirements**	Very Low **WA 1953 requirements**
North Island fernbird	Low	-	-

The residual (post-mitigation) level of effect for all construction effects is considered **Very Low**.

Operational Effects

Table 1-10 to Table 1-11 provides a summary of district plan matter ecological effects during operation[5]. The summary represents the level of effect for the baseline ecological environment.

Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Operational effect mitigation measures will include:

To address the operational effects (disturbance and loss in connectivity) on long-tailed bats, a Bat Management Plan (BMP) for the Project should be developed to include consideration for:

- Buffer planting (including hop-over / under late-stage / mature planting), retention of existing mature trees between the road alignment and features with potential for bat roost. Refer to Figure 8-1 for locations of bat mitigation
- Light and noise management through design.

Table 1-10: Summary of ecological effects during operation prior to mitigation for bats

Ecological Feature	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise / vibration	Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape
Long-tailed bats	**High**	**Very High**

[4] Construction effects on Northern New Zealand dotterel and North Island fernbird has been considered but excluded in the assessment of ecological effects as these species are not expected to utilise TL.3 (district plan vegetation only) habitat, therefore the effect is considered less than Negligible in the context of this Project.

[5] Herpetofauna have been considered but excluded in the assessment of ecological effects as operational effects are considered Very Low.

Table 1-11: Summary of ecological effects during operation prior to mitigation for birds

Ecological Feature	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure
Non-TAR birds	Low	Low
Northern New Zealand dotterel	Low	Low
North Island kākā	Low	Low
North Island fernbird	Low	Low

The residual (post-mitigation) level of effect for all operational effects are **Very Low** or **Low**.

2 Introduction

Auckland's population is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and other parts of New Zealand. The Auckland Plan 2050 anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities.

In response to this demand, the Auckland Unitary Plan Operative in Part (AUP:OP) identifies 15,000 hectares of predominantly rural land for future urbanisation. To enable the urban development of greenfield land, appropriate bulk infrastructure needs to be planned and delivered.

The Supporting Growth Programme is a collaboration between Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (Waka Kotahi), to investigate, plan and deliver the transport networks needed to support Auckland's future urban growth areas over the next 30 years.

2.1 Purpose and Scope of this Report

The Supporting Growth Programme has identified the need for a new arterial transport network in Redhills to support the urban development of the area. This report has been prepared to support AT's notices of requirement (NoRs) for the Redhills Arterial Transport Network (the Project). The NoRs under the Resource Management Act (RMA) are to designate land to enable the future construction, maintenance and operation of the Project.

This report provides an assessment of ecological effects associated with the construction, operation and maintenance of the Project. This assessment has been prepared to inform the Assessment of Environmental Effects (AEE) for the NoRs.

The key matters addressed in this report are as follows:

- Identify and describe the existing ecological environment
- Describe the actual and potential adverse ecological effects of construction of the Project enabled by the NoRs
- Describe the actual and potential adverse ecological effects of operation of the Project enabled by the NoRs
- Recommend measures as appropriate to avoid, remedy or mitigate potential adverse ecological effects enabled by the NoRs
- Present an overall conclusion of the level of potential adverse ecological effects of the Project enabled by the NoRs after recommended measures are implemented
- Comment on the future potential effects that will arise from future resource consent applications and offer guidance for the framework to be adopted at that time.

3 Project Description

The Project consists of two new arterial corridors through the Project Area, providing sufficient space for two-lanes for vehicles, new footpaths and dedicated cycleways on both sides of the road. The Project has been broken down into the following NoRs:

Table 3-1: Redhills Notices of Requirement

Notice	Project	Description
NoR 1	Redhills North-South Arterial Corridor	New urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.
NoR 2a	Redhills East-West Arterial Corridor – Dunlop Road	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the remaining East-West corridor (NoR 2c) at the intersection with the Redhills North-South arterial corridor.
NoR 2b	Redhills East-West Arterial Corridor – Baker Lane	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the intersection of the remaining East-West connection and Dunlop Road (NoR 2a).
NoR 2c	Redhills East-West Arterial Corridor – Nixon Road connection	New urban arterial transport corridor that intersects with the Redhills East West Arterial Corridor – Dunlop Road. This includes the upgrade of the existing Red Hills Road / Nelson Road / Nixon Road intersection, and the existing Nixon Road / Henwood Road intersection.

To safely tie into the existing road network, the Project includes the upgrade of existing intersections where the new corridors will connect, as follows:

- Signalisation of the intersection at Don Buck Road and Royal Road (NoR 1)
- Signalisation of the intersection at Fred Taylor Drive and Dunlop Road (NoR 2a)
- Signalisation of the intersection at Fred Taylor Drive and Baker Lane (NoR 2b)
- A new roundabout at the intersection of Red Hills Road, Nixon Road and Nelson Roads (NoR 2c).

The Project also provides for new stormwater wetlands for the treatment and attenuation of stormwater from the new corridors.

The Project has been split between four NoRs to reflect the likely implementation of the Project. It may also be possible for each designation to be delivered in stages as the Project Area develops.

An overview of the Project is provided in Figure 3-1. This design, along with the wider designation boundary, is referred to as the Project Area throughout this report.

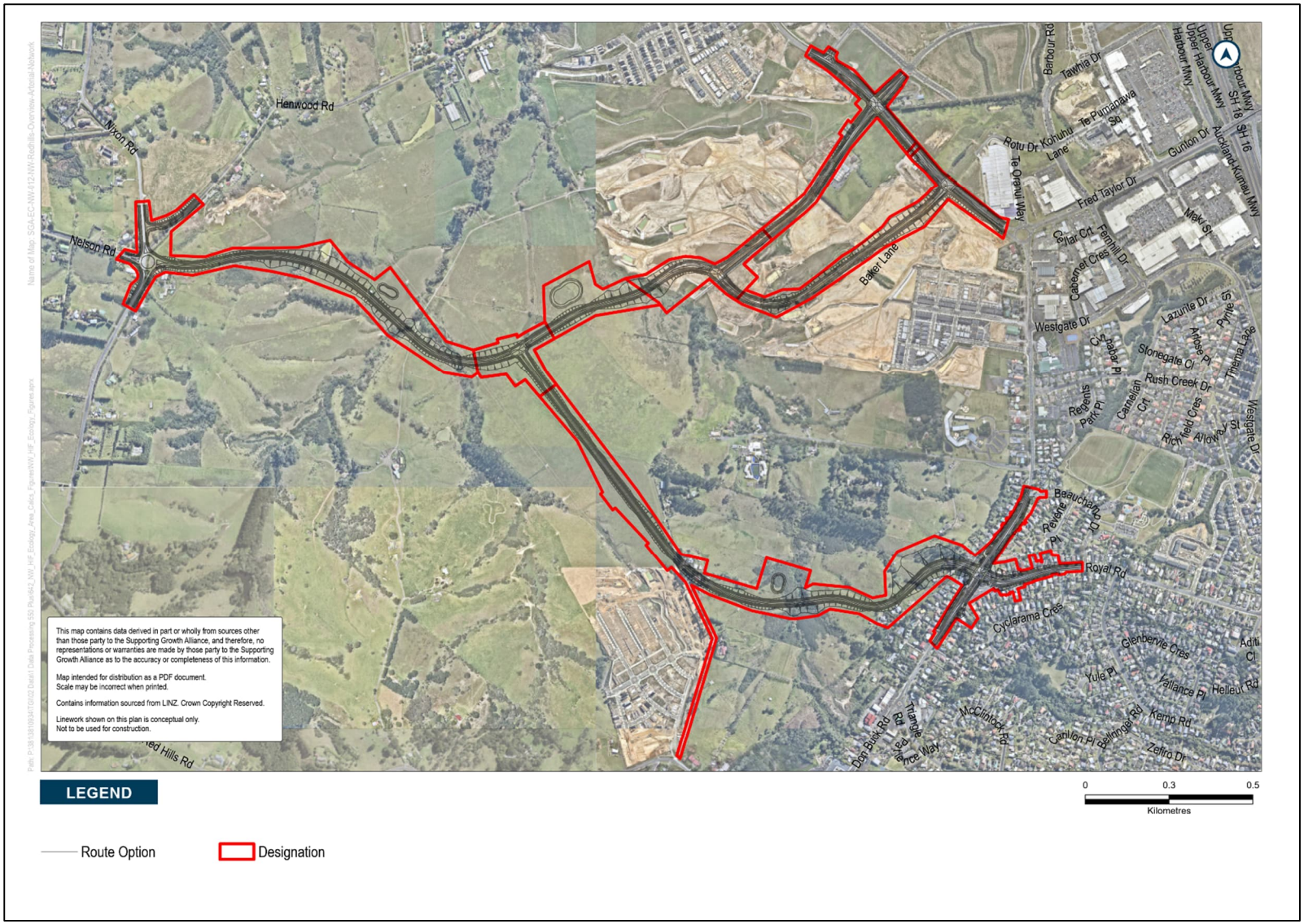

Figure 3-1: Redhills Arterial Transport Network Overview

4 Assessment Approach

4.1 EcIA Assessment

The approach followed in this study is consistent with the approach outlined in the Ecological Impact Assessment (EcIA) Guidelines (Roper Lindsay et al., 2018) (hereinafter referred to as the EIANZ Guidelines). The overarching goal of the ecological assessment is to determine the ecological effects of specific Project features or activities. The requirements for such an assessment are outlined with the EIANZ Guidelines and forms the basis of this report. This process is summarised in Figure 4-1 below. Note that for Stage 2 (Level of Effect) and Stage 3 (Impact Management) additional consideration was given to the permitted baseline and the likely future ecological environment under the AUP:OP.

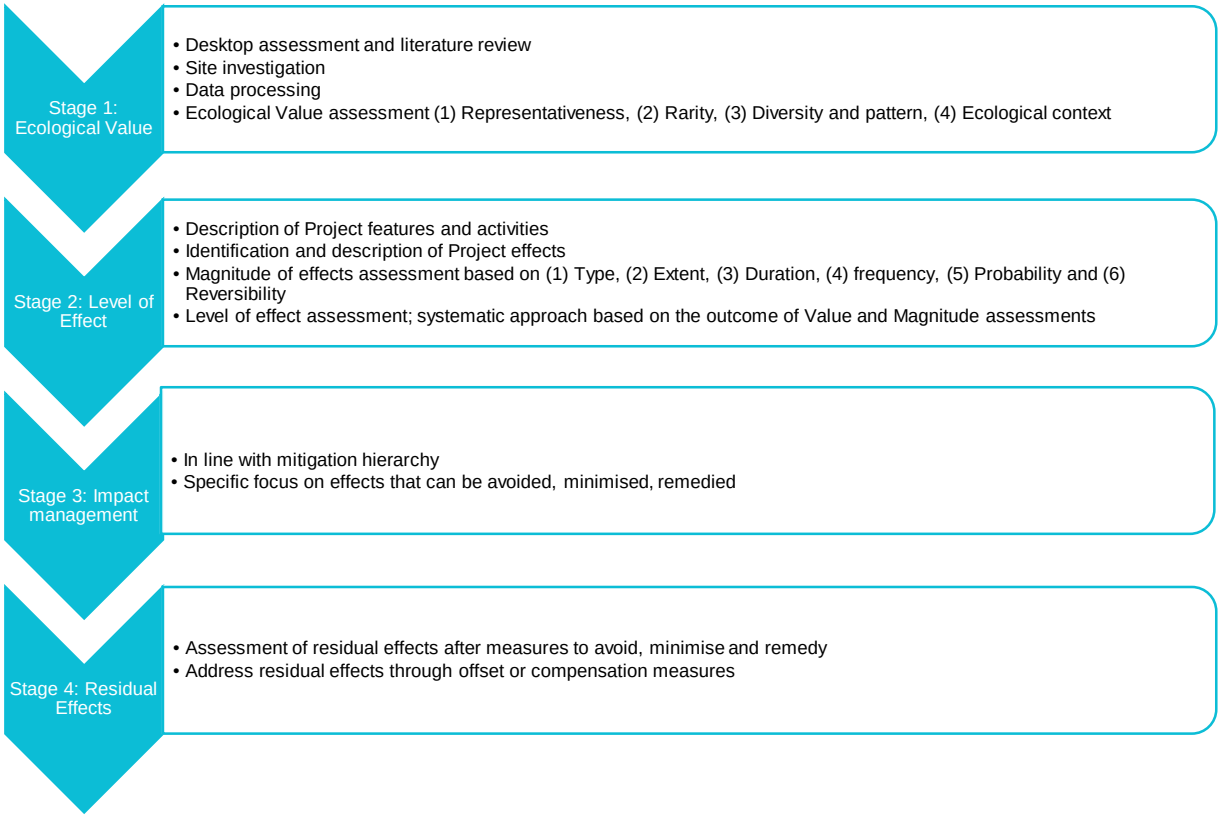

Figure 4-1: Approach process followed for this assessment

4.2 Assessment of District Plan Matters and Approach to Regional Matters

Designations are a form of 'spot zoning' over a route in a district plan. The designation authorises Waka Kotahi or AT, as the relevant requiring authority, to undertake work and activity without the need for land use consent. The designated area is still subject to restrictions on land use under regional matters in the AUP:OP.

As the Project relates to proposed designations this ecological effects assessment assesses District plan matters only. Regional matters will be subject to a future consenting phase along with a

supporting ecological impact assessment (EcIA). As such regional matters have not been formally assessed in this report, however the relevant matters have been screened to inform the alternatives assessment, the designation boundary and future regional resource consents. A discussion on regional matters is presented in Section 8.4.

Appendix C sets out the split between District and Regional matters in the AUP:OP

4.3 Wildlife Act Matters

The Wildlife Act (1953) includes specific provisions for activities that may disturb, injure or kill native animals. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix C. The scope of this report pertains to District matters and although not required for NoRs, further consideration has been given to ecological effects under the Wildlife Act in Section 8.4. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix C.

5 Assessment Methodology

Desktop and site investigations were undertaken for ecological features within all NoRs. Ecological features within the proposed designation boundary and a distance of approximately 100 m radius of the designation have been mapped and included in this assessment. Vegetation, stream and wetland features were investigated and mapped to provide context for potential adjustments to the proposed designation boundary. In addition to the area including into the ecological mapping, potential habitat for native fauna was considered within the Zone of Influence (ZOI) (see Section 5.1).

5.1 Zone of Influence

The ZOI of the Project relates to an area occupied by habitats and species that are adjacent to and may go beyond the boundary of the Project Area. It is defined in the EIANZ Guidelines as "the areas / resources that may be affected by the biophysical changes caused by the proposed Project and associated activities." The distance of the ZOI and type of effect from the Project can be different for different species and habitat types. The ZOI is used throughout this report to describe the impacts of the Project (construction and operation) on adjacent or connected terrestrial, freshwater and wetland habitats and associated native species. For example, all Significant Ecological Area's (SEA's) within 2 km of the Project Area has been included in the desktop review, along with their connectivity to the Project Area. This is to ensure that important habitat within the wider landscape has been taken into consideration and can be used to inform the potential for flora and fauna to be present within the Project Area and also whether the Project ZOI extends out to these SEA's.

The ZOI of the Project on different species differs depending on how individual species use their environment e.g., mobile species such as long-tailed bats have a larger home range and more diverse habitat requirements compared to herpetofauna and threatened plant species which may be restricted to a small area or specific habitat type. This affects how a species could be impacted by the Projects and this was taken into consideration during the desktop review and site investigations. To reflect the likelihood of a species occurring or dispersal ability within each the Project Area, varying search distances were used depending on the species context.

5.2 Desktop Review

A desktop review of existing ecological records was undertaken to gain an understanding of the species and habitats that could be present within the ZOI[6] of the Project Area.

The sources of information that were reviewed to determine the likelihood of a species or habitat occurring within or adjacent to each of the Project Areas include:

- Auckland Council GeoMaps7
- Department of Conservation (DOC) Bioweb records8
- Department of Conservation Threat Classification Series9

[6] Defined in the EIANZ Guidelines as "the areas / resources that may be affected by the biophysical changes caused by the proposed Project and associated activities".

[7] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

[8] https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/

[9] All Department of Conservation Threat Classification Documents are listed in the below webpage. When individual reports are referenced hereafter, they are referenced in-text and in Section 12. https://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system/

- Ecological Regions and Districts of New Zealand (McEwen, 1987)
- iNaturalist records10, records within approximately 2-5 km buffer of Project Areas
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al., 2017)
- National Institute of Water and Atmospheric Research (NIWA) New Zealand Freshwater Fish Database11
- New Zealand Bird Atlas eBird database12; recorded within 10 km2 grid squares
- NZ River Name Lines (LINZ Data Service13)
- Spatial data (wetland delineation) by RMA Ecology (provided by Hugh Green Group)
- Supporting Growth Alliance (SGA) – North West – Assessment of Ecological Effects (Supporting Growth, 2022).

5.3 Site Investigations

Site investigations were undertaken in order to:

- Prepare an ecological baseline of terrestrial, freshwater and wetland ecology
- Inform the assessment of each of the NoRs against the relevant district matters (terrestrial ecology)
- Set out terrestrial, freshwater and wetland matters which may be considered as part of a future regional resource consent, or under relevant wildlife legislation
- Inform the designation footprint.

5.3.1 Terrestrial Habitat

Site walkovers were undertaken in October 2019, November 2019, and September 2022 by experienced ecologists to map and describe the habitats present within and adjacent to the Project Area. Habitats were classified into ecosystem type based on those described in Singers et al. (2017). The habitats were also assessed as to their potential to support indigenous fauna, including bats, birds, and herpetofauna.

Habitat assessment focused on areas of potentially significant value, such as habitat that was classified as forest habitat on Auckland Council's GeoMaps – Ecosystems Current Extent (Singers et al., 2017) or appears to be wetland or forest habitat based on aerial photos and during site investigation. Species records from relevant literature and biodiversity databases were used to focus search efforts on certain areas within the Project Area.

During the site walkovers the vegetation assessment included recording the dominant or characteristic species present and the general quality described, including structure, maturity, presence of weeds and evidence of grazing and foliar dieback. Vegetation surveys also included searches for any rare or threatened plant species previously recorded within the Project Area.

Common plant names are predominantly used within this report. Maps showing the vegetation cover are provided in Appendix E. Terrestrial ecological value assessment methodology is discussed in Section 5.4.

[10] https://www.inaturalist.org/
[11] https://nzffdms.niwa.co.nz/search
[12] https://ebird.org/atlasnz/home
[13] https://data.linz.govt.nz/layer/103632-nz-river-name-lines-pilot/

5.3.2 Bat Surveys

Bat activity surveys were undertaken using seven Automatic Bat Monitors (ABMs) (SM4BAT FS with SMM-U2 microphone) from 1 – 26 November 2019. The ABMs were placed along streams and vegetated linear features as these areas are more likely to be used by long-tailed bats for foraging and commuting (Borkin & Parsons, 2009; O'Donnell et al., 2006) (Figure 5-1).

When deployed, ABMs were pre-set to start recording 60 minutes before sunset, and cease recording 60 minutes after sunrise (a 'night'). The ABMs were left on site for a minimum of 14 nights, during weather conditions when bats would be active (Sedgeley, 2012).

Weather conditions while the ABMs were on site were also monitored through the NIWA Cliflo website; to ensure that conditions were suitable for bats to be active. This weather information is presented in Appendix K. Weather conditions are compared against guidelines provided in Smith et al., (2017). As these guidelines take a cautious approach to ensure monitoring occurs in optimal conditions; bats are often detected on nights when conditions are considered 'unsuitable' for monitoring. Therefore, whilst only nights with 'suitable' conditions are counted toward the total number of survey nights, bat passes recorded on 'unsuitable' nights are not discounted and are included in the final total. In total, 19 nights were considered suitable for bat activity[14].

[14] All ABMs were deployed on 1 November 2019. ABMs 1, 2, 5, 6, and 7 were retrieved on 18 November 2019 (17 nights of monitoring; eleven with suitable weather conditions). ABMs 3 and 4 were retrieved on 26 November 2019 (25 nights of monitoring, 19 with suitable weather conditions).

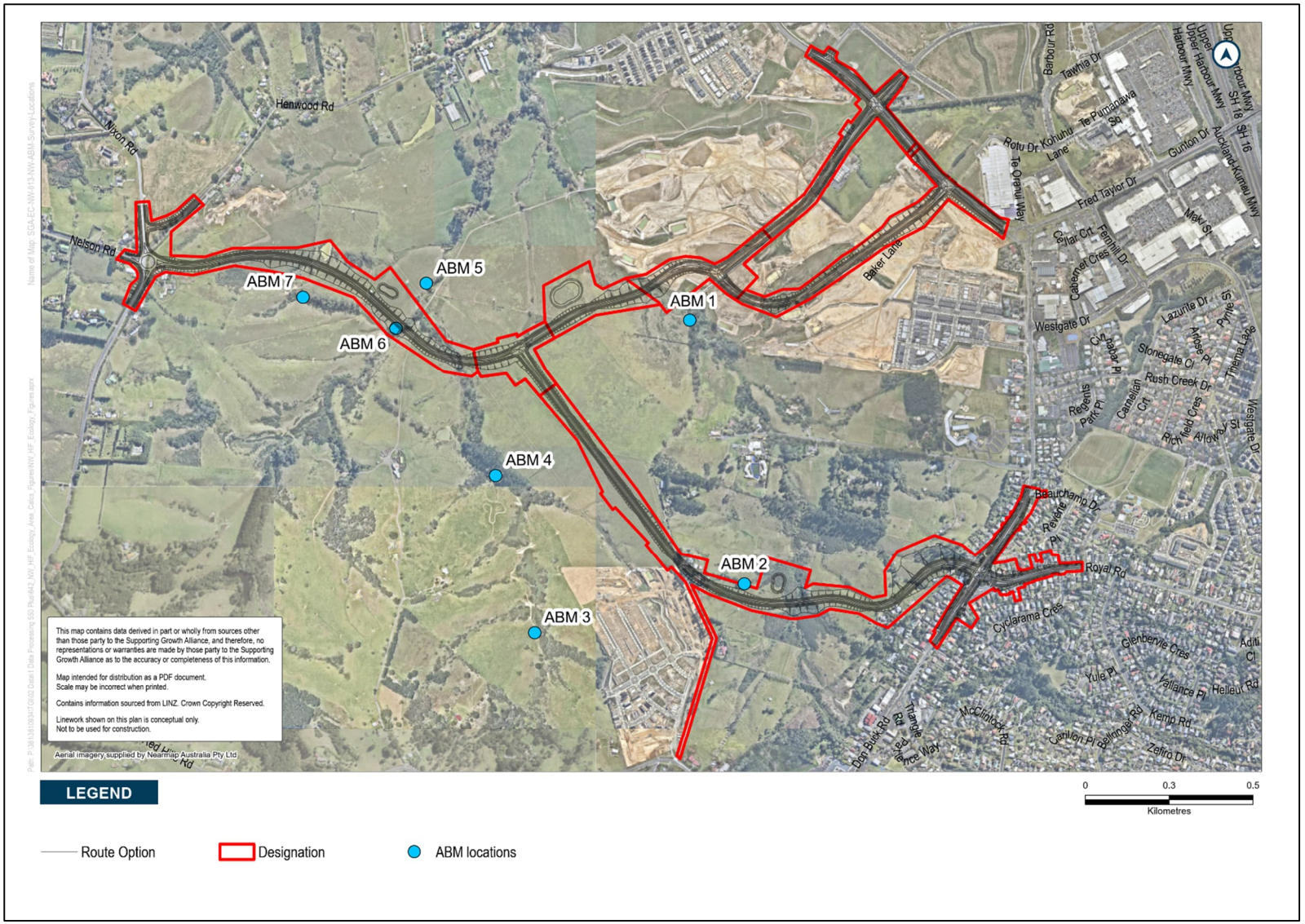

Figure 5-1: Automatic Bat Monitor (ABM) locations

5.3.3 Freshwater Habitat

Where access allowed, streams within the Project Area identified on Auckland Council GeoMaps ('Named Streams') were ground-truthed and classified as permanent, intermittent or ephemeral, according to the stream definitions described by Storey & Wadhwa (2009). Any additional streams observed during site walkovers were also classified. Streams are mapped in Appendix 5.3.

Freshwater assessments were undertaken on all streams identified on site and included stream classification and implementation of the Rapid Habitat Assessment (RHA) protocol and were undertaken by experienced ecologists. The RHA provides a standardised protocol for making a quick, qualitative, site-based assessment of physical stream habitat conditions (Clapcott, 2015). Stream Ecological Valuation (SEV) assessments were not undertaken but are expected to be included during the regional resource consenting phase. As such, macroinvertebrate and fish surveys were not undertaken as part of this assessment. However, NZ Freshwater Fish Database records (NIWA, 2022) were used to inform potential ecological value of streams. Access was restricted at several locations and as such stream assessments were based solely on desktop information. Freshwater ecological value assessment methodology is discussed in Section 5.4.

5.3.4 Wetland Habitat

Potential wetland habitat areas were identified by ecologists based on Auckland Council GeoMaps contours and the presence of wetland vegetation on aerial maps including a review of historical images). Potential wetlands were mapped and where access permitted, verified through the use of the rapid technique outlined in wetland delineation protocol (Ministry for the Environment, 2020). Because the wetland delineation predominantly relied on desktop assessment, a more conservative delineation was adopted. Ambiguous areas were assumed to be wetlands. Wetland areas are mapped in Appendix 5.3.

Note that the scope of the specialist study, for route protection, did not provide for a detailed wetland delineation. The key focus was to confirm wetland presence and approximate extent. This approach is considered practical for the purposes of route protection, while it is expected that a more detailed wetland assessment will be undertaken during the regional resource consenting phase.

Wetlands were assessed based on the RMA definition of a wetland[15] and classified into ecosystem type based on those described in Singers et al. (2017). If the habitat present met this definition, it was then further evaluated against the provisions of the NPS-FM for natural wetlands (assessed for potential exclusion on the basis of being artificial or pasture dominated, and temporary rain derived ponding). Details regarding the wetland value assessment is outlined in Section 5.4.

5.4 Ecological Value Assessment

The ecological value of each ecological feature (terrestrial, freshwater and wetland) was assessed using a spreadsheet template by assigning a score of 0 (None), 1 (Low), 2 (Moderate), 3 (High) or 4 (Very High) based on professional judgement (with justification) to attributes associated with each of the four ecological matters recommended within EIANZ (2018): (1) Representativeness 2) Rarity / distinctiveness 3) Diversity and pattern 4) Ecological context including. Considerations in relation to

[15] "wetland includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions"

the four matters and corresponding aspects for terrestrial, freshwater and wetland features are detailed below:

Terrestrial Ecology

- Representativeness: Typical structure, species composition and indigenous representation
- Rarity / distinctiveness: Species of conservation significance, distinctive ecological values
- Diversity and pattern: Habitat diversity, species diversity and patterns in habitat use
- Ecological context: Size, shape and buffering function, sensitivity to change, ecological networks (linkages, pathways, migration).

Freshwater Ecology

- Representativeness: RHA score for accessible sites and riparian habitat modification based on desktop stream and catchment assessments
- Rarity / distinctiveness: Species of conservation significance informed by the potential occurrence of Threatened and At-Risk (TAR) fish species
- Diversity and pattern: Level of natural diversity informed by the habitat diversity subsection of the RHA. Stream order, slope and hydroperiod were applied as desktop proxies to judge the likely habitat diversity for streams where access was constraint
- Ecological context: Stream order and hydroperiod.

Wetland Ecology

- Representativeness: Hydrological modification based on observations of drains, ponds and catchment land use. Native vegetation informed by site visit and review of landcover information
- Rarity / distinctiveness: Wetland type (rare or distinctive); distinctive ecological values (ecosystem services) in a larger catchment context
- Diversity and pattern: Representation of different hydroperiods (permanent, seasonal or temporary) and the structural complexity of vegetation cover
- Ecological context: flood attenuation, streamflow regulation, sediment trapping, water purification, connectivity and migration.

The score for each matter was constrained to the highest score for each aspect (for example a High score allocated to a wetland for flood attenuation will result in a High score for the Ecological context matter). The combined ecological value score (ranging from Very High to Negligible), for the four matters, was determined in accordance with the EIANZ Guidelines.

6 Positive Effects

The following section outlines the positive effects of the proposed alignment for the Project in relation to specific ecological features. The statement regarding positive effects assumes that native planting will occur on the roadsides as part of the landscape management. Potential positive effects include:

- Improved blue / green infrastructure (stormwater wetlands, swales, raingardens) and associated landscaping (which will be indigenous species)
- The Project landscape planting will tie into stream and riparian corridors. Riparian vegetation will be retained (where practicable) and enhanced (weeds control and indigenous vegetation planted)
- Existing infrastructure upgrades will include new bridge structures, culvert upgrades and additional / improvements to stormwater infrastructure. Upgrading undersized structures and improvements in culvert design such as embedding culverts with natural substrate / increased design capacity will improve habitat connectivity for freshwater and terrestrial species. This will include improved fish passage (where required) and improved riparian habitat connectivity
- Mass revegetation of sloping berms, batters, and embankments to connect with retained forest remnant / mature trees.

7 Ecological Baseline

This section presents the findings of the site and desktop investigations in relation to the terrestrial, freshwater, and wetland habitats and associated fauna species ('ecological features') present within the Project Area. All features within the study areas were investigated and mapped to provide context for the effects assessment and inform potential adjustments to the proposed designation boundary (Appendix E). Based on this information, and desktop assessments, an ecological value has been calculated for each ecological feature within the Project Area.

7.1 Historical Ecological Context

The Project Area lies within the Tamaki Ecological District, which has a warm humid climate and is characterised by volcanic cones, isthmus, harbours and volcanic terrain (McEwen, 1987). Originally forested, the landscape would have been dominated by northern North Island lowland broadleaved forest with abundant taraire (*Beilschmiedia tarairi*) and pūriri (*Vitex lucens*) (Singers et al., 2017).

Presently, only 7% of the native land cover; and 1% of freshwater wetlands and wetland forests remain in the Tamaki Ecological District (Auckland Regional Council, 2013), Reduction to around 20% of former extent is usually considered to be significant. Reduction to below 5% is considered to be severe (Walker et al., 2008). The reductions in the Tamaki Ecological District are well below these levels.

7.2 Terrestrial Ecology (Flora)

7.2.1 Desktop Review

Auckland GeoMaps aerial imagery shows that the original forest has been cleared and that the terrestrial habitats within the Project Area are dominated by agricultural land. Regenerating forest fragments in the wider Redhills area (outside of the Project Area) include tawa (*Beilschmiedia tawa*), kohekohe (*Dysoxylum spectabile*), rewarewa (*Knightia excelsa*), hīnau (*Elaeocarpus dentatus*) podocarp forest (WF13), kānuka (*Kunzea ericoides*) scrub / forest (VS2) and mānuka (*Leptospermum scoparium*), kānuka scrub (VS3).

The AUP:OP Natural Heritage data set was checked for notable trees. No notable trees occur within or adjacent to the Project Area.

There are no SEAs within the Project Area. The closest SEA which has been listed within the AUP:OP is SEA_T_2031 which is approximately 150 m south of the Project Area (Table 7-1). A further four SEAs are present within the Ngongetepara Stream catchment which is crossed by the Project. These include three terrestrial SEAs (SEA_T_2030, 6336 and 6337) and one marine SEA (SEA_M2_57b). These SEAs will not be directly affected by the Project, however, indirect impacts on habitats and the species they support could occur as the Ngongetepara Stream and its tributaries is a habitat linkage between the Project Area and the SEAs (e.g., sediment discharge, disturbance of species etc.). There are no other SEAs within 500 m of the Project Area. The SEAs along the Ngongetepara Stream catchment have been described in Table 7-1 and the location in relation to the Project Area is shown on Figure 7-1.

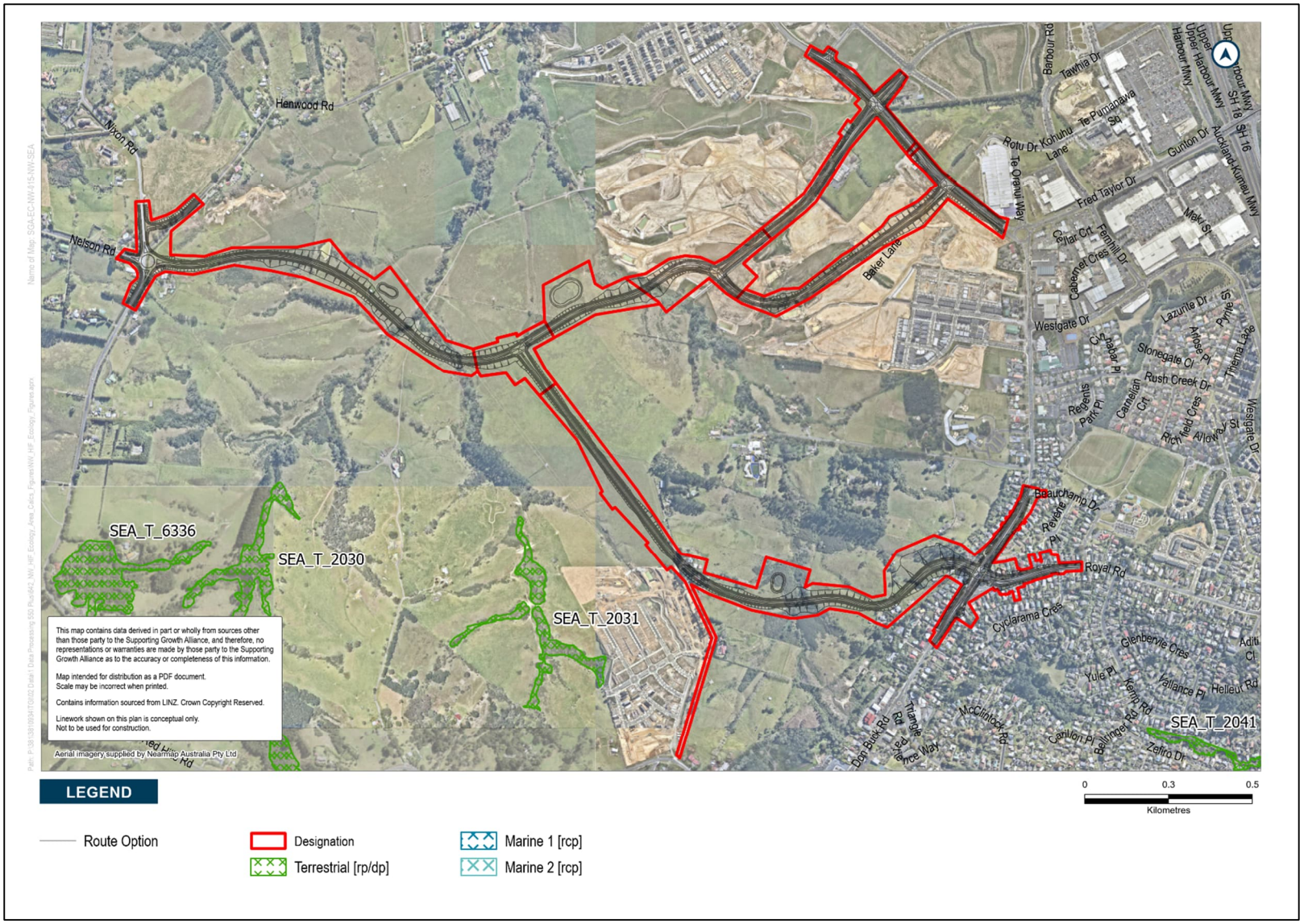

Figure 7-1: SEAs located near Project Area

Table 7-1: SEAs within the Ngongetepara Stream catchment

SEA	Approximate Distance from Project Area	SEA Type	Description
SEA_T_2031	150 m	Terrestrial	Oioi / restiad rushland reedland; and scrubland dominated by kānuka. Impacted by grazing.
SEA_T_2030	600 m	Terrestrial	Areas of wetland comprised of either reeds or sedges, with an area of open water. Fringed with shrubland which is kānuka-dominated.
SEA_T_6336	800 m	Terrestrial	An area of forest and open water. Forest is either pine or kānuka dominated. There is also some area of kānuka-dominated treeland.
SEA_T_6337	1.1 km	Terrestrial	An area of kānuka scrub / forest.
SEA-M2-57b	3 km	Marine	This area covers the inner Waitematā Harbour and it contains various mudflats and mangrove-lined inlets and creeks, with a natural succession between terrestrial, freshwater and marine habitats. These habitats are an important migration corridor for indigenous freshwater fish and for coastal fringe bird species.

7.2.2 Site Investigations

The Project Area is dominated by exotic grassland with small areas of exotic forest, exotic scrub, regenerating mānuka (*Leptospermum scoparium*), kānuka (*Kunzea robusta*) scrub and indigenous / exotic planted vegetation. These habitats were classified according to Singers et al. (2017) and mapped in Appendix E.

Table 7-2: Vegetation types present within Project Area

Habitat	Classification (Singers et al., 2017)	Description
Brown Fields (includes cropland)	BF	This definition includes industrial zones, metaled carparks, rail corridors, unmanaged or managed land within urban settings, road median strips, pavements, cracks in concrete. Substrate includes metal (stone chip) and concrete surfaces. Largely exotic herbfield (weeds) and occasional exotic or native woody species. For the purposes of mapping this has been extended to include bare ground associated with cropland, market gardens and construction sites.
Exotic Forest	EF	Forest vegetation with >50% cover of exotic species in the canopy. There are two types of exotic forest in the Project Area, eucalyptus and radiata pine. Understory vegetation was generally sparse due to deep shade, also these areas were largely unfenced and affected by grazing. Understorey vegetation was generally restricted to sparse woolly nightshade, cabbage tree, tree ferns and privet.

Habitat	Classification (Singers et al., 2017)	Description
Exotic Grassland	EG	Grassland dominated by exotic species. The exotic grass species included Yorkshire fog (*Holcus lanatus*), rye grass (*Lolium perenne*), cocksfoot (*Dactylis lomerate*) couch grass (*Cynodon dactylon*), sweet vernal grass (*Anthoxanthum odoratum*) and kikuyu grass (*Cenchrus clandestinus*).
Exotic Scrub	ES	Exotic secondary scrub or shrubland with >50% cover / biomass of exotic species. This includes gorse, woolly nightshade and privet. These plants generally dominated these areas with few other species present.
Planted Vegetation – Exotic (amenity)	PL.3	Planted amenity, including parks and gardens and areas of indigenous planting along existing roadsides.
Treeland – Exotic-Dominated	TL.3	The tree canopy cover in this habitat was discontinuous and between 20-80%. This habitat was exotic-dominated, with <25% indigenous species. For the purposes of this report this habitat also includes shelter belts of radiata pine (*Pinus radiata*). Other species present included ironwood (*Casuarina* sp.), crack willow (*Salix fragilis*) and eucalyptus species (*Eucalyptus* spp.). The understorey was generally dominated by exotics such as arum lily (*Zantedeschia aethiopica*) and woolly nightshade. Regenerating indigenous species included tree ferns and cabbage trees (*Cordyline australis*).
Mānuka, kānuka scrub	VS3	The majority of this habitat occurred outside the Project Area, however, a small amount (approx. 0.05 ha) was within the Project Area. This early successional habitat has regenerated after disturbance. Species present include mānuka, ponga (*Cyathea dealbata*), mamaku (*C. medullaris*) and wheki (*Dicksonia squarrosa*), karamu (*Coprosma lucida* and *C. robusta*), twiggy coprosma (*C. rhamnoides*) and mingimingi (*Leucopogon fasciculatus*). The understorey was dominated by exotic species including Chinese privet (*Ligustrum sinense*), woolly nightshade (*Solanum mauritianum*) and European gorse (*Ulex europeaus*). The patches of VS3 habitat within the Project Area were small and isolated, with more continuous stands occurred outside the Project Area.

7.2.3 Ecological Value

Appendix F details the ecological value for the terrestrial vegetation identified within the Project Area. Table 7-3 describes the habitats observed within the Project Area and their ecological value in accordance with the EIANZ Guidelines (Roper-Lindsay et al., 2018). As described in Section 7.2.2, the surveys identified the presence of kānuka and mānuka within areas of indigenous regeneration and planting. These species have been listed as 'Threatened – Nationally Vulnerable' (de Lange et al., 2017) because of the spread of myrtle rust within New Zealand and the risk that this poses to all Myrtaceae species. These species are currently common throughout the Tamaki Ecological District, in addition the individuals within the Project Area are predominantly immature or semi-mature. Therefore, the presence of these Threatened species has not altered the valuation of the habitats within which they occur.

Table 7-3: Ecological values of the vegetation types present within the Project Area

Habitat	Classification (Singers et al., 2017)	Ecological Value
Brown Fields (includes cropland)	BF	Low
Exotic Forest	EF	Moderate
Exotic Grassland	EG	Low
Exotic Scrub	ES	Low
Planted Vegetation – Exotic (amenity)	PL.3	Low
Treeland – Exotic-Dominated	TL.3	Moderate
Mānuka, Kānuka Scrub	VS3	High

7.3 Terrestrial Ecology (Fauna)

7.3.1 Bats

7.3.1.1 Desktop Review

Existing records (Department of Conservation, 2022[16]; Supporting Growth Alliance, 2022) confirm the presence of long-tailed bats (*Chalinolobus tuberculatus*) within 1 km of the Project Area (Figure 7-2). The conservation status of this species is 'Threatened – Nationally Critical' (O'Donnell et al., 2018). The nearest record is 50 metres north of the designation boundary within a stream / wetland complex with associated TL.3 vegetation (Figure 7-3).

[16] Bat surveys for this Project were completed in 2019 (detailed in Section 7.3.1.2), the results of these surveys have since been submitted to Department of Conservation. Therefore, the Department of Conservation bat records include the results of these surveys (as seen in Figure 7-2 Figure 7-3).

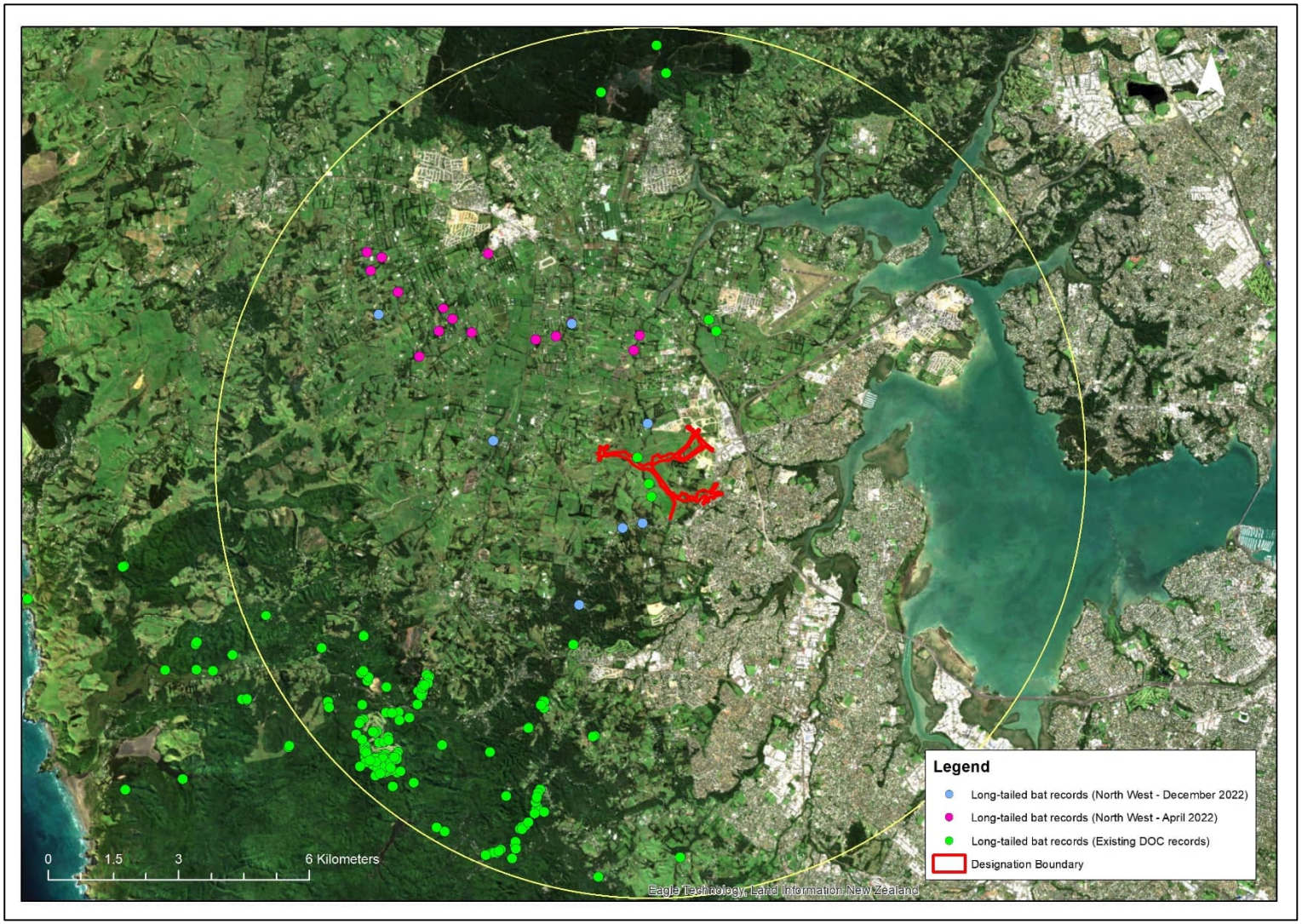

Figure 7-2: Existing long-tailed bat records within a 10 km radius of the Project Area (Department of Conservation, 2022; Supporting Growth Alliance 2022)

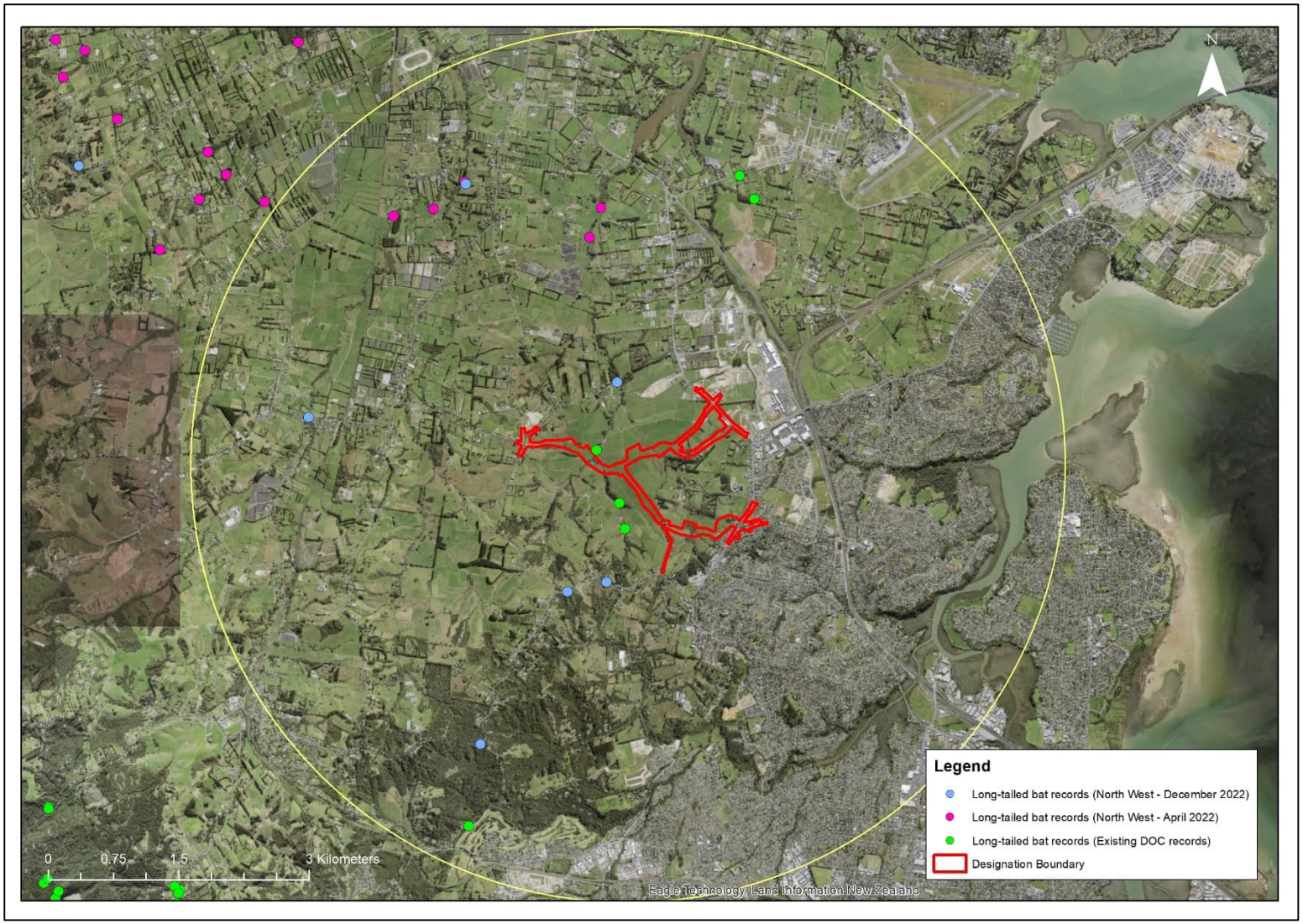

Figure 7-3: Existing long-tailed bat records within a 5 km radius of the Project Area (Department of Conservation, 2022; Supporting Growth Alliance 2022)

7.3.1.2 Site Investigations

Analysis of the ABM data identified a low number[17] of bat passes at three of the seven ABM sites. These three ABMs were located along Red Hill Stream which extends into the vegetated foothills of the Waitakere Ranges. Table 7-4 presents the number of bat passes recorded at each ABM throughout the monitoring period.

The results indicate that the corridors of low value riparian vegetation and indigenous and exotic forest habitat within the Project Area provide suitable foraging and commuting habitat for indigenous bats. Mature trees (*Eucalyptus* sp. and *Pinus* sp.) with suitable roosting features (branch and trunk cavities) were identified within and adjacent to the Project Area (including district plan vegetation located along the northern side of Henwood Road).

[17] Low number = < 10 bat passes at each ABM during 19 nights of monitoring.

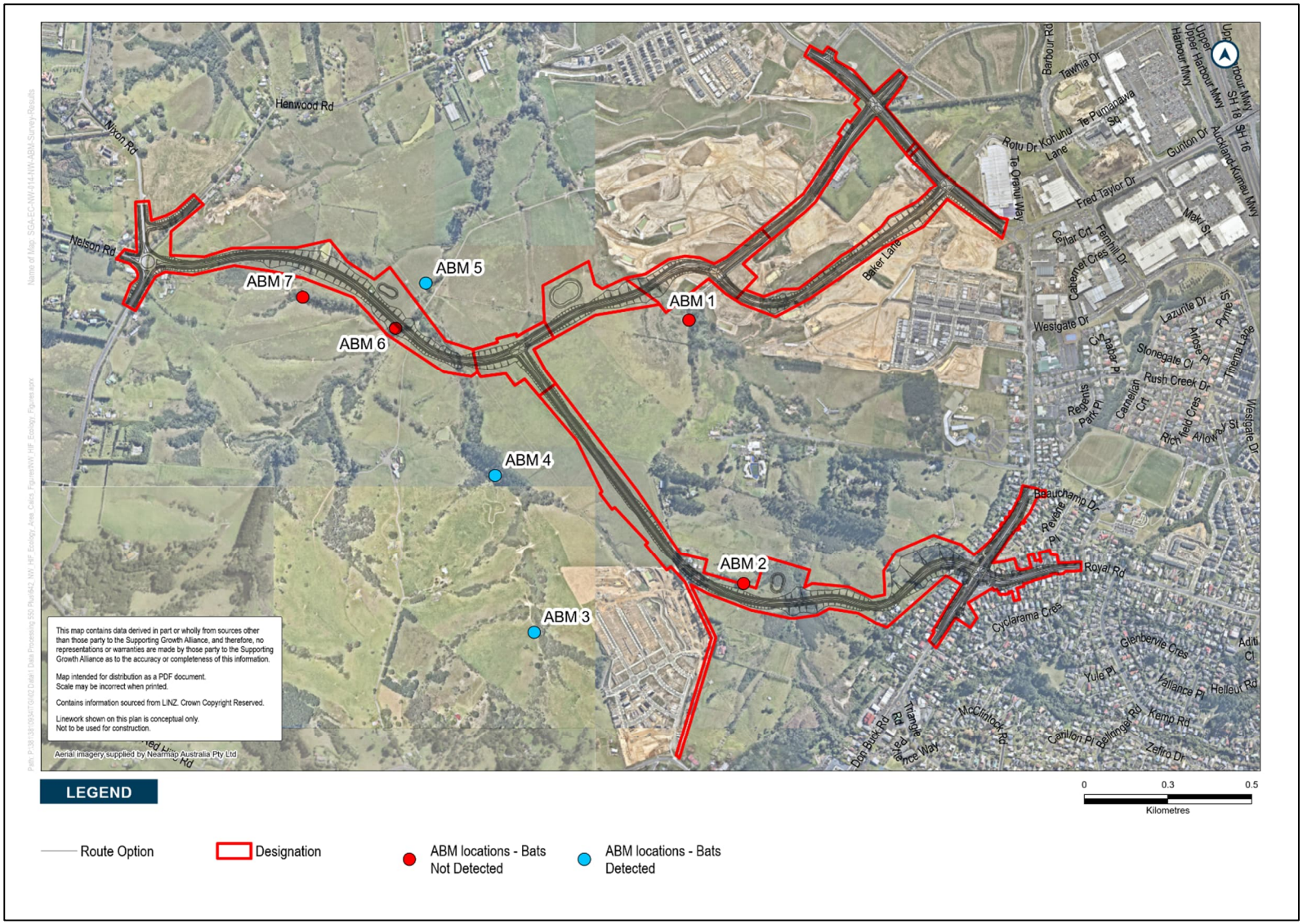

Figure 7-4: ABM locations. Blue circles denote bat passes and red circles denote no bat passes.

Table 7-4: Number of long-tailed bat passes during ABM survey

Date (start of monitoring)*	ABM ID	Number of bat passes
02-Nov-2019	ABM 3	1
02-Nov-2019	ABM 4	6
03-Nov-2019	ABM 4	4
04-Nov-2019	ABM 4	5
07-Nov-2019	ABM 3	5
11-Nov-2019	ABM 5	2
12-Nov-2019	ABM 3	1
15-Nov-2019	ABM 5	2
21-Nov-2019	ABM 3	2

Notes: * = Monitoring was continuous between 1 – 26 November 2019, however, bats were not recorded every night. Therefore, not every night of monitoring is listed in the table.

7.3.1.3 Ecological Value

The conservation status of long-tailed bats is 'Threatened – Nationally Critical' (O'Donnell et al., 2018), therefore the ecological value of long-tailed bats is **Very High**.

7.3.2 Birds

7.3.2.1 Desktop Review

New Zealand Bird Atlas database[18] identified 52 forest, freshwater and coastal bird species (30 of which are indigenous) within a 2 km radius of the Project Area (Appendix D). This included 12 indigenous bird species which are listed as 'At Risk' or 'Threatened' (Robertson et al., 2021) (Table 7-5). These indigenous bird species are associated with coastal and marine habitats located > 1.5 km from the Project Area.

North Island fernbird (*Bowdleria punctata vealeae*) (At Risk – Declining) is associated with freshwater wetlands. The wetland habitat within SEA_T_2030, located approximately 600 m from the Project Area has the potential to support this species. Therefore, North Island fernbird may commute through the Project Area, between coastal wetlands located to the north and east, through to those within the SEA.

Additionally, North Island kākā (*Nestor meridionalis septentrionalis*) (At Risk – Recovering) are recorded to be present in the wider landscape. As they are a highly mobile it is anticipated that this species may utilise the Project Area.

Table 7-5: TAR bird species recorded within a 2 km of the Project Area

Common Name	Scientific Name	Conservation Status (Robertson et al., 2021)
Banded dotterel	*Charadrius bicinctus*	At Risk – Declining
Banded rail	*Gallirallus philippensis assimilis*	At Risk – Declining
Caspian tern	*Hydroprogne caspia*	Threatened – Nationally Vulnerable
Eastern bar-tailed godwit	*Limosa lapponica baueri*	At Risk – Declining
Lesser knot	*Calidris canutus rogersi*	At Risk – Declining
New Zealand dabchick	*Poliocephalus rufopectus*	Threatened – Nationally Increasing
North Island fernbird	*Bowdleria punctata vealeae*	At Risk – Declining
Northern New Zealand dotterel	*Charadrius obscurus aquilonius*	Threatened – Nationally Increasing
Pied shag	*Phalacrocorax varius*	At Risk – Recovering
Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk – Declining
Royal spoonbill	*Platalea regia*	At Risk – Naturally Uncommon

[18] https://birdatlas.co.nz/

Common Name	Scientific Name	Conservation Status (Robertson et al., 2021)
South Island pied oystercatcher	*Haematopus finschi*	At Risk – Declining
Variable oystercatcher	*Haematopus unicolor*	At Risk – Recovering
White-fronted tern	*Sterna striata*	At Risk – Declining

7.3.2.2 Site Investigations

During the site investigation, incidental bird observations were recorded. A total of 22 bird species were recorded, including 12 indigenous species (Appendix D). The indigenous bird species that were observed are presented in Table 7-6. These species could nest in scrub and trees within the Project Area, while the exotic wetland and areas of open water could provide nesting habitat for pūkeko, paradise shelduck, pied stilt, spur-winged plover, and white-faced heron. Northern New Zealand dotterel (Threatened – Nationally Increasing) was observed in Brown Field (BF) habitat associated with residential development construction at Baker Lane, Westgate (which is located within the Project Area).

Table 7-6: Incidental indigenous bird species identified in the Project Area during the site investigation

Common Name	Scientific Name	Conservation Status (Robertson et al., 2021)
Australasian harrier	*Circus approximans*	Not Threatened
Grey warbler	*Gerygone igata*	Not Threatened
North Island fantail	*Rhipidura fuliginosaplacabilis*	Not Threatened
Northern New Zealand dotterel	*Charadrius obscurus aquilonius*	Threatened – Nationally Increasing
Paradise shelduck	*Tadorna variegata*	Not Threatened
Pied stilt	*Himantopus himantopus leucocephalus*	Not Threatened
Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened
Shining cuckoo	*Chrysococcyx lucidus lucidus*	Not Threatened
Silvereye	*Zosterops lateralis lateralis*	Not Threatened
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened
Tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened
White-faced heron	*Ergretta novaehollandiae*	Not Threatened

7.3.2.3 Ecological Value

The habitats in the Project Area are suitable for non-TAR forest and wetland indigenous bird species that have adapted to agricultural and urban environments, these would be considered **Low** ecological value. However, connective linkages through the Project Area could be of value to some TAR bird

species as they migrate through the Project Area. Table 7-7 presents the ecological value for TAR bird species identified within the Project Area.

Table 7-7: Ecological value for TAR bird species

Species	Habitat	Conservation Status (Robertson et al., 2021)	Ecological Value
North Island fernbird*	EW, OW	At Risk – Declining	**High**
North Island kākā*	TL.3, VS3	At Risk – Recovering	**High**
Northern New Zealand dotterel**	BF	Threatened – Nationally Increasing	**Very High**

Notes: * = Inferred from desktop records and habitat. ** = Observed during site visit in Project Area.

7.3.3 Herpetofauna

7.3.3.1 Desktop Review

A review of the DOC Bioweb database found five indigenous lizard records within a 6 km radius of the Project Area (Table 7-8). No records were found within the Project Area; however, this is likely to indicate that herpetofauna surveys have not been completed in the local area, rather than herpetofauna are not present. Four of the five indigenous lizard species identified in the DOC Bioweb search have a conservation status of 'At Risk' (Hitchmough et al., 2021).

Table 7-8: Indigenous lizard species observations recorded within 6 km of the Project Area

Common Name	Scientific Name	Conservation Status (Hitchmough et al., 2021)
Elegant gecko	*Naultinus elegans*	At Risk – Declining
Copper Skink	*Oligosoma aeneum*	At Risk – Declining
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining
Ornate skink	*Oligosoma ornatum*	At Risk – Declining
Pacific gecko	*Dactylocnemis pacificus*	Not Threatened

7.3.3.2 Site Investigations

Indigenous herpetofauna were not identified during opportunistic searches completed during the site walkover. However, the introduced plague skink (*Lampropholis delicata*) was identified within the Project Area. Copper skink and ornate skink have been recorded within 500 m of the Project Area. Copper skink and ornate skink habitat includes fragmented modified forest edge, scrub and rank grassland habitats ('surrogate habitats') in Auckland (van Winkel, Baling & Hitchmough, 2018). This habitat type is present within the Project Area and is connected to high quality SEA habitat to the south-west.

Forest geckos, elegant geckos, and pacific geckos (identified in the desktop review) require intact or regenerating forest habitat for survival. The forest habitat within the Project Area is small

(approximately 0.28 ha), early successional and highly fragmented. It is therefore unlikely that these species would occur within the Project Area and they have not been considered further in this report.

7.3.3.3 Ecological Value

Table 7-9 presents the ecological value of herpetofauna identified within the Project Area.

Table 7-9: Ecological value for TAR herpetofauna species

Species	Habitat	Conservation Status (Hitchmough et al., 2021)	Ecological Value
Ornate skink	• EF (with appropriate understorey) • EG • ES • PL.3 • TL.3 (with appropriate understorey) • VS3 (with appropriate understorey)	At Risk – Declining	High
Copper skink	• EF (with appropriate understorey) • EG • ES • PL.3 • TL.3 (with appropriate understorey) • VS3 (with appropriate understorey)	At Risk – Declining	High

7.4 Aquatic Ecology

7.4.1 Desktop Review

7.4.1.1 Streams

Auckland GeoMaps layers indicate that the Project could cross three named streams; Red Hill Stream, Waiteputa Stream and Ngongetepara Stream (Figure 7-5).

In 2015, Golder Associates classified streams within the Redhills catchment (Figure 7-6). The classification indicates five permanent stream branches, four intermittent, two ephemeral, one unclassified and seven described as wetlands within the Project Area (Golder Associates, 2015). The classification of streams 2, 3, 6, 7, 11, 15, and 19 in Golder Associates mapping could not be determined because they were masked by the wetland layer.

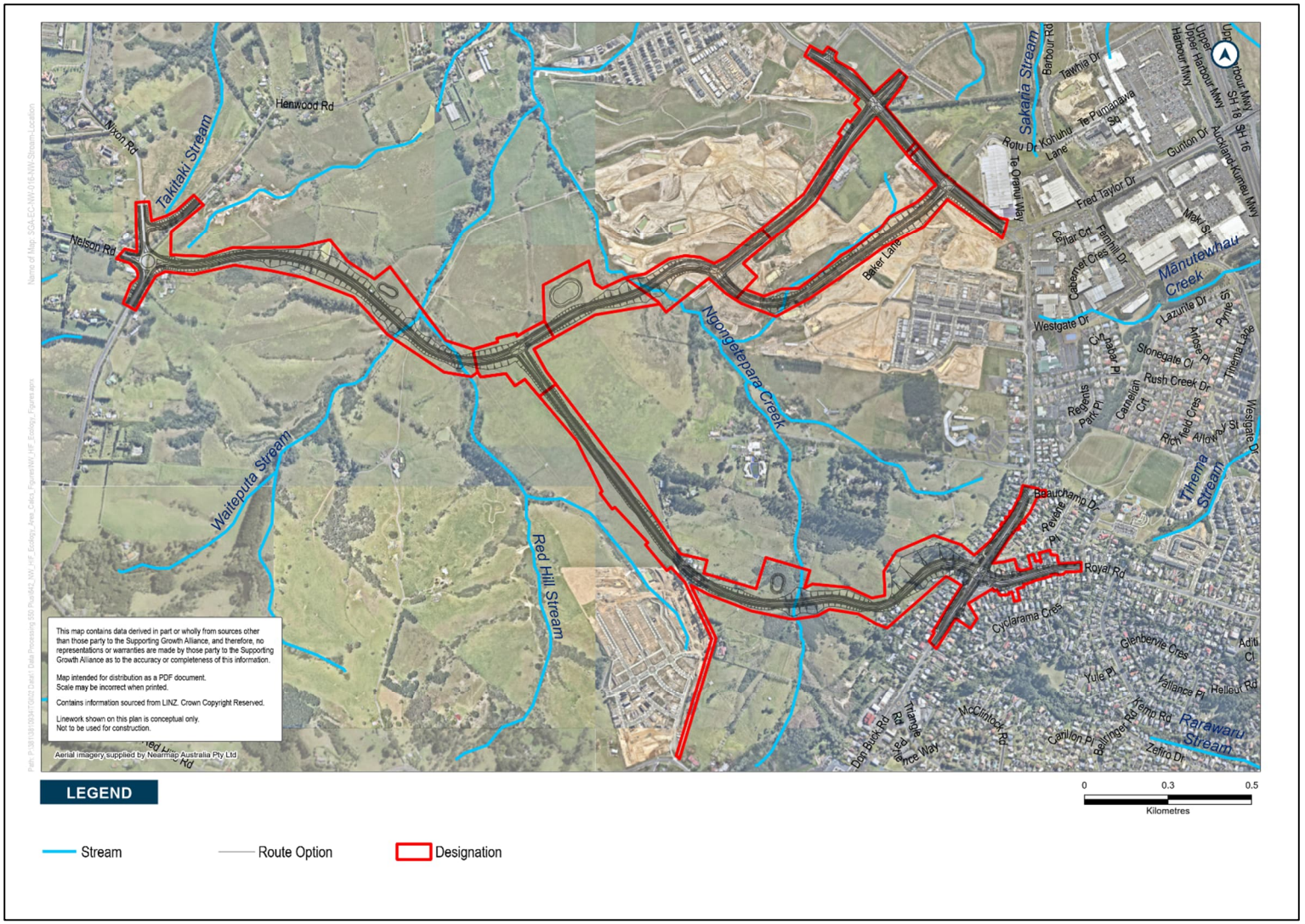

Figure 7-5: Named streams within the Project Area

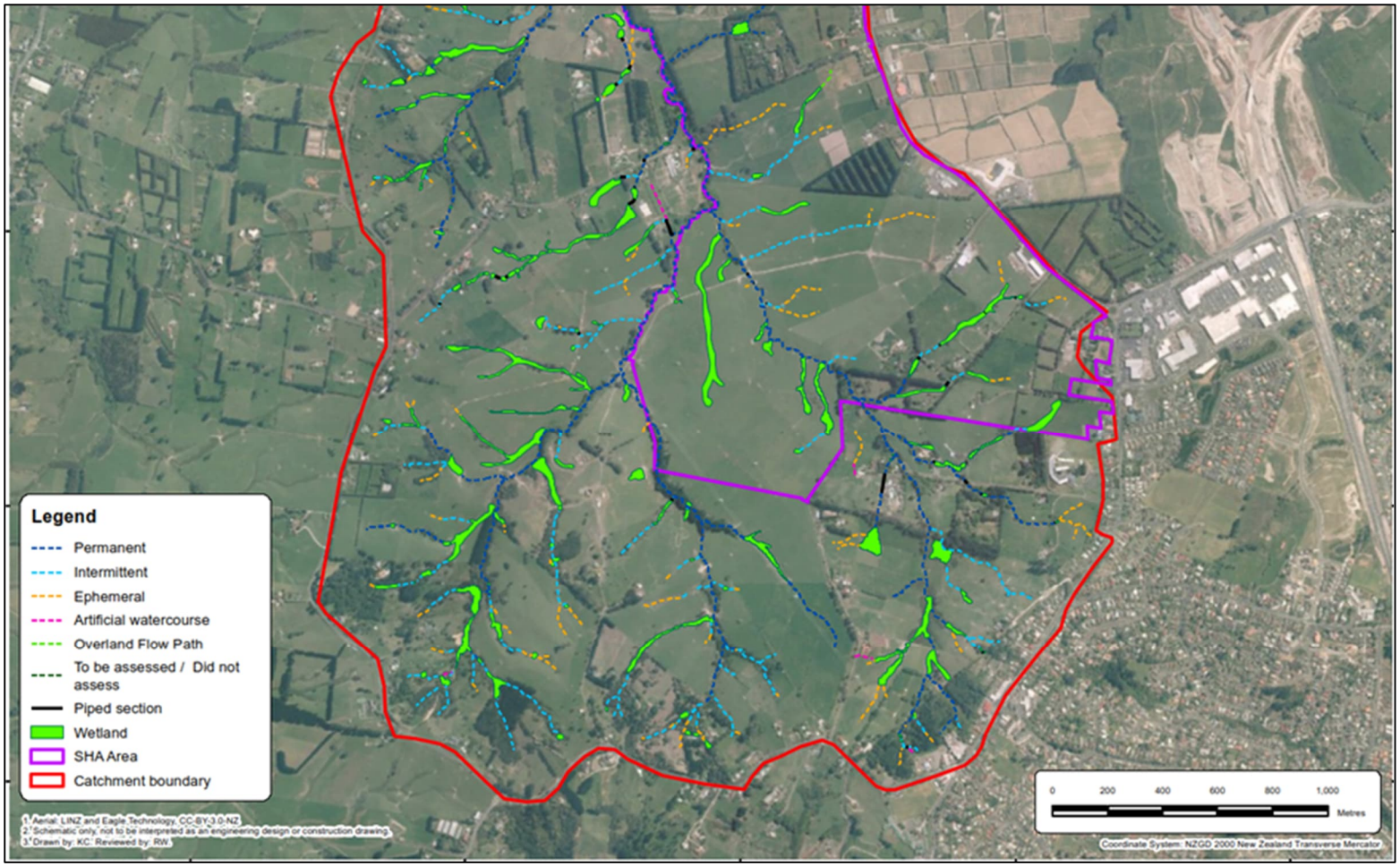

Figure 7-6: Classification of streams by Golder Associates in the Redhills Catchment (Golder Associates, 2015)

7.4.1.2 Fish

The New Zealand Freshwater Fish Database (NZFFD) (Stoffels, 2022) did not hold fish records for Red Hill Stream and Waiteputa Stream, which are tributaries of Ngongetepara Stream. However, the database indicates that three fish species, and two freshwater invertebrate species have been recorded in the Ngongetepara Stream. This includes longfin eel (*Anguilla dieffenbachia*) which is classified as 'At Risk – Declining' (Dunn et al., 2018). The desktop review results are presented in Table 7-10 and Table 7-11.

Table 7-10: Freshwater fish species recorded in Ngongetepara Stream

Common Name	Scientific Name	Conservation Status (Dunn et al., 2018)
Shortfin eel	Anguilla australis	Not Threatened
Longfin eel	Anguilla dieffenbachii	At Risk – Declining
Banded kōkopu	Galaxias fasciatus	Not Threatened

Table 7-11: Freshwater invertebrate species recorded in Ngongetepara Stream

Common Name	Scientific Name	Conservation Status (Grainger et al., 2018)
Kōura	Paranephrops planifrons	Not Threatened
Freshwater shrimp	Paratya curvirostis	Not Threatened

7.4.2 Site Investigations

7.4.2.1 Streams

All streams within the Project Area were numbered, classified (permanent, intermittent, or ephemeral) and mapped.

Twenty stream branches associated with wetland complexes were identified during the site investigations within the Project Area. These were assessed against the stream classification criteria developed by Storey and Wadhwa, 2009. The streams are mapped in Appendix E and are listed in Table 7-12.

All permanent and intermittent streams accessed during the site investigations were surveyed using the Rapid Habitat Assessment (RHA). The streams measured overall habitat quality scores that ranged from 'Poor' to 'Moderate' (Table 7-12). Detailed RHA results are presented in Appendix J. The RHA category was included within the ecological value assessment.

Table 7-12: Summary of streams identified in the Project Area

Stream ID	Classification	RHA Category
RH-S1a	Intermittent	Poor

Stream ID	Classification	RHA Category
RH-S1b	Intermittent	Poor
RH-S2a	Permanent	Moderate
RH-S2b	Intermittent	Poor
RH-S2c	Intermittent	Poor
RH-S3	Permanent	Moderate
RH-S4	Intermittent	Poor
RH-S5a	Permanent	Moderate
RH-S5b	Intermittent	Poor
RH-S5c	Intermittent	Poor
RH-S5d	Intermittent	Poor
RH-S5e	Intermittent	Poor
RH-S6	Permanent	Moderate
RH-S7a	Permanent	Moderate
RH-S7b	Intermittent	Poor
RH-S7c	Intermittent	Poor
RH-S7d	Intermittent	Poor
RH-S8	Intermittent	Poor
RH-S9	Intermittent	Poor
RH-S10	Intermittent	Poor

7.4.2.2 Fish

Fish surveys were not carried out during site investigations, however longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with the Project Area (Table 7-10). The freshwater habitats within the Project Area were assessed for their potential to support native fish during the RHA. No freshwater fish were observed during site investigations.

7.4.3 Ecological Value

Appendix G details the ecological value for the aquatic habitats identified within the Project Area. Information obtained for the ecological baseline (Section 7.4) was used to score the matters that inform the ecological value. The ecological values of freshwater habitats are presented in Table 7-13.

Table 7-13: Summary of aquatic ecological value identified in the Project Area

Stream ID	Ecological Value
RH-S1a	Low

Stream ID	Ecological Value
RH-S1b	Low
RH-S2a	Moderate
RH-S2b	Low
RH-S2c	Low
RH-S3	Moderate
RH-S4	Low
RH-S5a	Moderate
RH-S5b	Low
RH-S5c	Low
RH-S5d	Low
RH-S5e	Low
RH-S6	Moderate
RH-S7a	Moderate
RH-S7b	Low
RH-S7c	Low
RH-S7d	Low
RH-S8	Low
RH-S9	Moderate
RH-S10	Low

7.5 Wetland Ecology

7.5.1 Desktop Review

The Golder Associates (2015) report identifies seven wetlands within the Project Area; identified as green polygons in Figure 7-6. Whilst not individually described, these wetlands were identified as ‘natural wetlands, farm ponds and boggy wetland-like areas’.

7.5.2 Site Investigations

A total of 16 wetlands within the Project Area were identified and assessed. Details regarding the vegetation cover and NPS-FM classification for each wetland is presented in Table 7-14. Refer to Appendix E for a map showing the spatial distribution of wetlands.

Table 7-14: Summary of wetlands identified in the Project Area

Wetland ID	Vegetation / Wetland Type[19]	NPS-FM Classification	Potential for TAR Species
RH-O1	Open Water	Artificial (stock water dam)	-
RH-W1a	Exotic Wetland	Natural	North Island fernbird
RH-W1b	Exotic Wetland	Natural	-
RH-W2	Exotic Wetland	Natural	North Island fernbird
RH-W3	Exotic Wetland	Natural	-
RH-W4	Exotic Wetland	Natural	-
RH-W5	Exotic Wetland	Natural	North Island fernbird
RH-W6	Exotic Wetland	Natural	North Island fernbird
RH-W7	Exotic Wetland	Natural	North Island fernbird
RH-W8	Exotic Wetland	Natural	-
RH-W9	Exotic Wetland	Natural	North Island fernbird
RH-W10	Exotic Wetland	Natural	North Island fernbird
RH-W11	Exotic Wetland	Natural	North Island fernbird
RH-W12	Exotic Wetland	Natural	North Island fernbird
RH-W13	Exotic Wetland	Natural	North Island fernbird
RH-W14	Exotic Wetland	Natural	-

7.5.3 Ecological Value

Appendix H details the ecological value for the wetland habitats identified within the Project Area. Information obtained for the ecological baseline (Section 7.5) was used to score the matters that inform the ecological value. The ecological values of wetland habitats are presented in Table 7-15.

Table 7-15 Summary of wetland ecological value identified in the Project Area

Wetland ID	Ecological Value
RH-O1	Low
RH-W1a	Moderate
RH-W1b	Low
RH-W2	Moderate
RH-W3	Moderate

[19] Open water, as an ecological feature, has been included under the wetland section.

Wetland ID	Ecological Value
RH-W4	Moderate
RH-W5	Moderate
RH-W6	High
RH-W7	High
RH-W8	Low
RH-W9	Moderate
RH-W10	Moderate
RH-W11	High
RH-W12	Moderate
RH-W13	Moderate
RH-W14	Moderate

8 Assessment of Ecological Effects and Measures to Avoid, Remedy or Mitigate Actual or Potential Adverse Effects

Section 4 assesses the ecological effects of activities which relate to district plan matters under the AUP:OP.

8.1 Construction Effects – Terrestrial Ecology

The potential construction effects (direct and indirect) to the terrestrial habitat and species within and adjacent to the Project Area (as they relate to district matters) have been identified:

- Vegetation removal subject to district controls (refer to Appendix E).
- Disturbance and displacement to roosts / nests and individual (existing) bats, birds and lizards due to construction activities (noise, light, dust etc.). It is assumed that this effect will occur after vegetation clearance (subject to regional consent controls) has been implemented and is therefore likely to happen in habitats adjacent to the project footprint / designation or underneath structures such as bridges20.

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix A). The effects assessment has considered the current ecological baseline only, under the assumption that the likely future ecological environment (considering permitted activities) will not change substantially.

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

8.1.1 Terrestrial Vegetation

Vegetation to be removed that is subject to district controls is presented in Appendix E and also detailed in the table below. The effects of district plan vegetation removal on fauna i.e., bats and birds (as it relates to loss in foraging habitat, and mortality and injury) is assessed in Sections 8.1.2 and 8.1.3.

Table 8-1: Assessment of ecological effects for terrestrial vegetation (district plan vegetation only) and impact management during construction

Effect Description	Permanent loss of habitat / ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)
	Baseline
Level of effect prior to impact management	**TL.3 (total area of 2246 m^2)** The magnitude of effect is assessed as **Low** due to the direct, local, permanent, but unlikely probability that fragmentation and edge effect will occur.

[20] Herpetofauna have been considered but excluded in the assessment of ecological effects as construction effects are considered **Very Low**.

	The ecological value of TL.3 is assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required.
Impact management and residual level of effect	N/A
Management of residual effect	N/A

8.1.2 Bats

Bats may utilise the habitats associated with the Project Area for roosting or foraging. Specifically, areas of Exotic Forest (EF), Exotic-Dominated Treeland (TL.3), and Mānuka, Kānuka Scrub (VS3). During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within this area or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction can be an issue if bats are roosting in the immediate vicinity of the construction works. The ABM survey indicated that vegetation within the Project Area provides suitable foraging and commuting habitat for bats. Additionally, it can be assumed that bats will utilise roost sites within the Project Area as mature trees (*Eucalyptus* sp. and *Pinus* sp.) with suitable roosting features (branch and trunk cavities) were identified within and adjacent to the Project Area.

Additionally, bats may be impacted by removal of district plan vegetation through the following effects:

- Loss of foraging habitat
- Roost loss[21]
- Mortality or injury to bats.

Table 8-2 outlines the effect assessment for bats due to construction activities related to noise and light, and removal of district plan vegetation.

[21] Roost loss has been considered but excluded as an effect as the consequence of roost loss (if it does occur at all) is considered Negligible in the context of this Project.

Table 8-2: Assessment of ecological effects for bats and impact management during construction

Effect Description	Disturbance and displacement to roosts and individual bats (existing) adjacent to construction activities (noise, light, dust etc.) Baseline	Effects due to removal of district plan vegetation: - Loss of foraging habitat - Mortality or injury to bats Baseline
Level of effect prior to impact management	The magnitude of effect is assessed as **Low** due to the relatively short duration of construction related effects. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. As such impact management is required.	**Loss of foraging habitat** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Mortality or injury to bats** The magnitude of effect is assessed as **Negligible** due to an unlikely probability, and local extent if impact occurs. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. ***Wildlife Act 1953*** Long-tailed bats are protected under the Wildlife Act 1953 and some of the district plan trees may have bat roost potential. Therefore the requirements of the Wildlife Act 1953 will need to be adhered to during vegetation removal.
Impact management and residual level of effect	A Bat Management Plan (BMP) should be developed to include consideration for: Surveys prior to construction to confirm presence / likely absence. Surveys to confirm bat roost locations if activity is confirmed Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar) Siting of compounds and laydown areas to avoid EF, TL.3, and VS3 habitat	A BMP should be developed to include consideration for: The provisions of the Wildlife Act 1953 Design and implementation of a vegetation removal protocol, including pre-felling surveys.

	Lighting design to reduce light levels and spill from construction areas Restriction of nightworks around EF, TL.3, and VS3 habitat Bat management should be incorporated with any regional consent conditions that may be required for regional compliance. The residual impact is assessed as **Very Low** post mitigation.	
Management of residual effect	N/A	N/A

8.1.3 Birds

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to the Project Area. Additionally, birds may be impacted by removal of district plan vegetation through the following effects:

- Loss of foraging habitat
- Mortality or injury to birds.

Table 8-3 outlines the effect assessment for birds due to construction activities related to noise and light, and removal of district plan vegetation.

Table 8-3: Assessment of ecological effects for birds and impact management during construction

Effect Description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.)	Effects due to removal of district plan vegetation[22]: - Loss of foraging habitat - Mortality or injury to birds
	Baseline	**Baseline**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **Moderate** due to definite presence of native birds associated with several habitat features of the Project Area. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect due to construction disturbance is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR bird (Northern New Zealand dotterel)** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and short duration of effect if disturbance occurs. The ecological value of this species is **Very High**. The Northern New Zealand dotterel was observed at the Universal Homes residential development construction site. It is expected that the road will be constructed once the residential development is already constructed, therefore Northern New Zealand dotterel are unlikely to be present, and therefore would not be impacted by disturbance effects during construction. Additionally Northern New Zealand dotterel are increasingly breeding in modified habitats including construction sites (Waka Kotahi, 2012), suggesting that they can become acclimatised to construction disturbance. As such the overall level of effect would be considered **Low** prior to mitigation and no impact management is required. **Terrestrial TAR bird (North Island kākā)**	**Non-TAR birds** The magnitude of effect is assessed as **Negligible** due to the direct and local extent of effect, and unlikely probability and permanent duration for loss of foraging habitat, and likely probability and short-term (<5 years) duration for mortality of injury to birds. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent if impact occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Wildlife Act 1953** All native birds are protected under the Wildlife Act 1953, therefore requirements of the Wildlife Act 1953 will need to be adhered to during vegetation removal.

[22] Construction effects on Northern New Zealand dotterel and North Island fernbird has been considered but excluded in the assessment of ecological effects as these species are not expected to utilise TL.3 (district plan vegetation only) habitat, therefore the effect is considered less than Negligible in the context of this Project.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) adjacent to construction activities (noise, light, dust etc.) Baseline	Effects due to removal of district plan vegetation[22]: - Loss of foraging habitat - Mortality or injury to birds Baseline
	The magnitude of effect is assessed as **Negligible** due to an unlikely probability and short duration of effect if disturbance occurs. The ecological value of this species is **High**, and the overall level of effect is assessed as **Very Low** prior to mitigation. As such no impact management is required. **Wetland TAR bird (North Island fernbird)** The magnitude of effect is assessed as **Low** due to a likely probability of disturbance and frequent occurrence. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	
Impact management and residual level of effect	N/A	Impact management will be required under the Wildlife Act to prevent killing or injuring of native birds. As part of this management, timing of vegetation removal should be constrained to avoid the key nesting period (September to February) or pre-clearance inspections should be undertaken prior to vegetation removal.
Management of residual effect	N/A	N/A

8.2 Operational Effects – Terrestrial Ecology

The Project involves upgrading existing roads, and the construction of new roads largely within a rural landscape that is located in future residential zoned areas; therefore, it is likely that operational effects such as fragmentation and noise and lighting may increase from the current baseline. In general, potential operational effects from the Project that relate to District plan matters are summarised below.

- Loss in connectivity to indigenous fauna (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road, leading to fragmentation of habitat; and
- Disturbance and displacement of indigenous fauna and their nests / roosts (e.g., bats, birds, herpetofauna) due to light, noise and vibration effects from the operation of the road[23].

The following sections detail the magnitude of effect and subsequent level of effect on ecological features (further detail regarding how these were determined are provided in Appendix A). The effects assessment has considered one scenario – the current ecological baseline.

Impact management and residual effects are also presented where the level of effect is assessed to be **Moderate** or higher.

8.2.1 Bats

The loss of connectivity through the presence of the road and associated disturbance such as operational noise / vibration and light can lead to an overall reduction in size and quality of bat foraging habitat, it can impact on bat movement in the broader landscape and can potentially disturb nearby bat roosts (including maternity roost). Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 8-4 outlines the effect assessment for:

- Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to additional fragmentation of terrestrial habitat due to the presence of the infrastructure
- Disturbance and displacement of bats due to light, noise, and vibration from the road.

[23] Herpetofauna have been considered but excluded in the assessment of ecological effects as operational effects are considered **Very Low**.

Table 8-4: Assessment of ecological effects for bats and impact management during operation

	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise / vibration	Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape
Effect Description	**Baseline**	**Baseline**
Level of effect prior to impact management	The magnitude of effect is assessed as **Moderate** due to the relatively local extent of disturbance and high likelihood of disturbance occurring. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **High** for the disturbance of individual bats and roosts. As such impact management is required.	The magnitude of effect is assessed as **High** due to the high probability of loss in connectivity due to the proposed road located in areas with confirmed bat movement. The ecological value of bats is assessed to be **Very High**, and the overall level of effect is assessed as **Very High** for loss in connectivity. As such impact management is required.
Impact management and residual level of effect	A BMP should be developed to include consideration for: • Buffer planting (including hop-over / under late-stage / mature planting), retention of existing mature trees between the road alignment and features with potential for bat roost. Refer to Figure 8-1 for locations of bat mitigation • Light and noise management through design. The residual impact is assessed as **Very Low** post mitigation.	A BMP should be developed to include consideration for: • Buffer planting (including hop-over / under late-stage / mature planting), retention of existing mature trees between the road alignment and features with potential for bat roost. Refer to Figure 8-1 for locations of bat mitigation • Light and noise management through design. The residual impact is assessed as **Low** post mitigation.
Management of residual effect	N/A	N/A

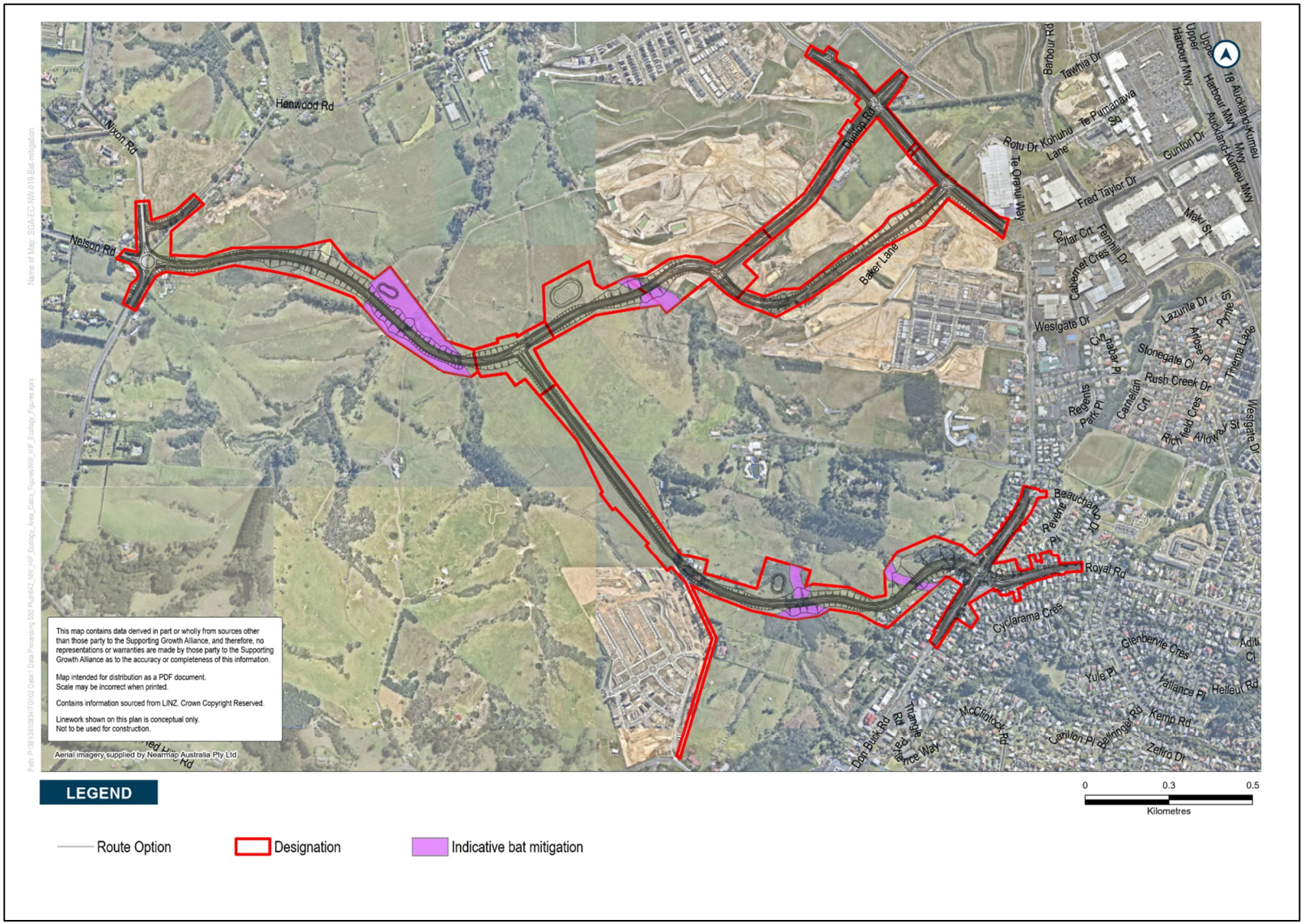

Figure 8-1: Indicative long-tailed bat mitigation locations for Redhills Arterial Transport Network

8.2.2 Birds

Noise, vibration, and lighting disturbance caused by the presence of the road could potentially displace native birds from suitable nesting and foraging habitat within and adjacent to the Project Area, while noise, light and vibration may also affect connectivity in the broader landscape.

Table 8-5 outlines the operational effect assessment and impact management for birds.

Table 8-5: Assessment of ecological effects for birds and impact management during operation

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure
	Baseline	**Baseline**
Level of effect prior to impact management	**Non-TAR birds** The magnitude of effect is assessed as **High**, due to the definite likelihood of disturbance due to noise, light and vibration from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (Northern New Zealand dotterel)** The magnitude of effect is assessed as **Negligible** due to an unlikely probability and local extent of effect if disturbance occurs. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Low** due to an unlikely probability and local extent of effect if disturbance occurs. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (North Island fernbird)** The magnitude of effect is assessed as **Low** due to an unlikely probability and local extent of disturbance.	**Non-TAR birds** The magnitude of effect is assessed as **High** due to the definite likelihood of loss in connectivity from the areas of new road. The ecological value of birds in the context of habitat features are assessed to be **Low**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Terrestrial TAR birds (Northern New Zealand dotterel)** The magnitude of effect is assessed as **Low** due to unlikely probability, and local extent of the effect. The ecological value of these species is **Very High**, and the overall level of effect is assessed as **Moderate** prior to mitigation. The Northern New Zealand dotterel was observed at the Universal Homes residential development construction site. It is expected that the road will be constructed once the residential development is already constructed, therefore Northern New Zealand dotterel are unlikely to be present, and therefore would not be impacted by loss in connectivity and the level of effect would be considered **Low**. As such no impact management is required. **Terrestrial TAR birds (North Island kākā)** The magnitude of effect is assessed as **Low** as North Island kākā are a highly mobile species and there is an unlikely probability of loss in connectivity.

Effect Description	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure
	Baseline	**Baseline**
	The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.	The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required. **Wetland TAR birds (North Island fernbird)** The magnitude of effect is assessed as **Low** due to a likely probability and local extent of loss in connectivity. The ecological value of these species is **High**, and the overall level of effect is assessed as **Low** prior to mitigation. As such no impact management is required.
Impact management and residual level of effect	N/A	N/A
Management of residual effect	N/A	N/A

8.3 Effects Conclusions

The ecological level of effects assessed as **Moderate**, **High** or **Very High** for the Project are described in Section 8.3.1.

8.3.1 Long-Tailed Bats

- **Moderate** level of effect for disturbance and displacement to roosts and individuals (existing) during construction
- **High** level of effect for the disturbance and displacement of (new and existing) roosts and individuals due to the presence of the road during operation
- **Very High** level of effect for loss in connectivity due to the presence of the road during operation.

The post mitigation level of effect is considered to be **Very Low** to **Low** for construction and operational related effects.

8.3.2 Wildlife Act 1953

All native fauna is protected by the Wildlife Act 1953, therefore requirements of this legislation need to be adhered to during the removal of district plan vegetation. For long-tailed bats this should include the implementation of vegetation removal protocols (including pre-felling surveys). For native birds, any vegetation clearance within the bird nesting season (September to February) will need to be managed to avoid harm to native bird species and their nests e.g., programming vegetation clearance to avoid bird nesting season or else undertaking nesting bird checks.

8.4 Design and Future Resource Consent Considerations

Ecological effects associated with activities that require regional consents and consideration under the NPS-FM are briefly discussed in the following sections to inform design and alignment options for the Project. Wildlife Act Authority permits are also discussed in relation to the potential killing or injuring of native fauna associated with the Project activities.

8.4.1 Terrestrial Ecology

Construction of the Project will result in temporary and permanent loss of vegetation within the Project Area, including suitable habitat that is potentially being used by native fauna (bats, birds, and herpetofauna). Loss of vegetation that is subject to district plan controls is discussed in Section 8.1.

The amounts and types of all[24] terrestrial habitat and vegetation (including habitat used by native fauna) that could be lost as a result of the Project is presented in Table 8-6 under the Footprint column.

[24] Includes vegetation that is subject to district and regional plan controls as well as vegetation that can be removed as a permitted activity.

The terrestrial vegetation to be lost (temporary and permanent) is comprised of both native and exotic vegetation which ranges from **Low** to **High** ecological value (Section 7.2.3). Some of these areas are likely to provide habitat to native fauna, as discussed in Sections 8.4.2 to 8.4.4 below.

Table 8-6: Potential area of permanent terrestrial vegetation loss within the road footprint

Feature	Classification*	Footprint (m²)
Brown Field (includes cropland)	BF	64,374 m^2
Exotic Grassland	EG	15,7444 m^2
Exotic Scrub	ES	5,943 m^2
Planted Vegetation – Exotic	PL.3	10,615 m^2
Exotic-Dominated Treeland^	TL.3	7,612 m^2
Mānuka, Kānuka Scrub	VS3	823 m^2

Notes: * = Classification from Singers et al. (2017). ^ = Includes district plan vegetation.

As the design develops and resource consent applications are prepared, more detailed habitat and fauna surveys may be required to inform an EcIA (in line with the EIANZ Guidelines) which will be used to support future regional resource consent (for example, removal of vegetation in the riparian setback) and Wildlife Act Authority permit applications (if required).

8.4.2 Bats

Mature trees in suitable habitat areas (EF, TL.3, and VS3) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape. The presence of bats and roosts will be re-assessed prior to obtaining any regional resource consents for vegetation removal (relevant under regional matters)and managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed because they are district plan trees.

If the presence of bat habitat and bat roosts are confirmed at regional consenting stage then a BMP will likely be required which should address the following:

- Identify bat priority areas that may be affected by the Project
- Avoid bat priority areas through alignment and design
- Avoid effects of lighting and noise on bats within bat priority areas
- Avoid injury and / or death of roosting bats during vegetation removal
- Avoid disturbance through construction management (seasonal restriction on vegetation removal December to April)
- Outline additional mitigation where avoidance is not feasible including any offset / compensation that may be required.

8.4.3 Birds

TAR birds associated with terrestrial habitats are likely to include Northern New Zealand dotterel, and migratory North Island kākā. The Northern New Zealand dotterel was observed at the Universal Homes residential development construction site in Brown Fields (BF) habitat which is of **Low** value. Habitats available for North Island kākā (EF, TL.3, and VS3) provide low quality, nonbreeding habitat

and may be used seasonally and infrequently for roosting and foraging. The value of these habitats ranges from **Moderate** to **High**. TAR birds associated with wetland habitats are likely to include North Island fernbird, and the value of these habitats range from **Moderate** to **High**. Non-TAR native birds are highly likely to be present within the NoR and utilise all identified habitats.

Vegetation clearance required for construction could result in the loss of these habitats of local value to native birds. The value of these habitat ranges from **Low** to **High** and any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953. The loss of some of this habitat is already assessed as it is considered district plan vegetation.

8.4.4 Lizards

Native copper skink and ornate skink are likely to be present within vegetation impacted by the Project. Therefore, there is potential that site clearance required for construction could kill or injure native lizard species and result in the removal of their habitat. A Lizard Management Plan (LMP) would be required to ensure the management of effects and ensure compliance with the Wildlife Act 1953 (including a Wildlife Act Authority permit for the implementation of the LMP).

8.4.5 Freshwater Ecology

The construction of the Project will directly impact 11 streams, ranging from **Low** to **Moderate** ecological value. Approximately 846 m (510 m of permanent stream, 336 m of intermittent stream) of stream reclamation will be required to accommodate the Project works. The predicted permanent and intermittent stream loss for the Project is presented in Table 8-7. These calculations will require re-evaluation as part of the future regional consent process. All assessed streams have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features.

Table 8-7: Potential stream loss (permanent and intermittent) within the Project Area

Stream ID	Hydroperiod	Ecological Value	Length to be lost (m)*
RH-S2a	Permanent	Moderate	88.5
RH-S3	Permanent	Moderate	97.6
RH-S5a	Permanent	Moderate	139.5
RH-S5c	Intermittent	Low	43.4
RH-S6	Permanent	Moderate	79.5
RH-S7a	Permanent	Moderate	104.7
RH-S7c	Intermittent	Low	21.8
RH-S7d	Intermittent	Low	108.3
RH-S8	Intermittent	Low	14.5
RH-S9	Intermittent	Moderate	123.4
RH-S10	Intermittent	Low	24.8

Notes: * = Lengths are approximate and include an additional 12 metres (as the construction footprint for a culvert is approximately 6 metres).

During the detailed design phase, stream crossing plans (i.e., bridge or culvert) will be confirmed as well as details regarding fish passage requirements. Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

8.4.6 Wetland Ecology

Wetland extent and approximate value was considered during the Multi Criteria Assessment (MCA) to inform the Alternatives Assessment for all of the proposed alignment options. This was achieved through a desktop wetland delineation for all of the NoR options along with a proxy based assessment of ecological value (catchment condition, vegetation cover, relationship with other ecological features).

The construction of the Project will impact 13 natural wetlands (RH-O1 is considered an artificial wetland) ranging from **Low** to **High** ecological value. Approximately 7,568 m^2 of direct wetland loss will occur (Table 8-8).

Table 8-8: Potential wetland loss within the Project Area

Wetland ID	Vegetation Type	Ecological Value	Loss (m^2)*
RH-O1	Open Water	Low	321
RH-W1a	Exotic Wetland	Moderate	122
RH-W1b	Exotic Wetland	Low	91
RH-W2	Exotic Wetland	Moderate	63
RH-W3	Exotic Wetland	Moderate	568
RH-W4	Exotic Wetland	Moderate	884
RH-W6	Exotic Wetland	High	519
RH-W7	Exotic Wetland	High	2255
RH-W8	Exotic Wetland	Low	1513
RH-W10	Exotic Wetland	Moderate	367
RH-W11	Exotic Wetland	High	168
RH-W12	Exotic Wetland	Moderate	536
RH-W13	Exotic Wetland	Moderate	70
RH-W14	Exotic Wetland	Moderate	93

Notes: * = Areas are indicative.

9 Conclusion

Construction Effects

To address the effects of construction activities (noise, light and dust) on long-tailed bats, a Bat Management Plan (BMP) for the Project should be developed to include consideration for:

- Surveys prior to construction to confirm presence / likely absence. Surveys to confirm bat roost locations if activity is confirmed
- Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar)
- Siting of compounds and laydown areas to avoid EF, TL.3, and VS3 habitat
- Lighting design to reduce light levels and spill from construction areas
- Restriction of nightworks around EF, TL.3, and VS3 habitat
- Bat management should be incorporated with any regional consent conditions that may be required for regional compliance.

All native fauna is protected by the Wildlife Act 1953 (WA 1953), therefore requirements of this legislation need to be adhered to during the removal of district plan vegetation. For long-tailed bats this should include the implementation of vegetation removal protocols (including pre-felling surveys). For native birds, any vegetation clearance within the bird nesting season (September to February) will need to be managed to avoid harm to native bird species and their nests e.g., programming vegetation clearance to avoid bird nesting season or else undertaking nesting bird checks.

Table 9-1 to Table 9-3 provides a summary of district plan matter ecological effects during construction prior to any mitigation[25]. The summary represents the level of effect for the baseline ecological environment.

Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Construction effect mitigation measures will include:

To address the effects of construction activities (noise, light and dust) on long-tailed bats, a Bat Management Plan (BMP) for the Project should be developed to include consideration for:

- Surveys prior to construction to confirm presence / likely absence. Surveys to confirm bat roost locations if activity is confirmed
- Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during Dec-Mar)
- Siting of compounds and laydown areas to avoid EF, TL.3, and VS3 habitat
- Lighting design to reduce light levels and spill from construction areas
- Restriction of nightworks around EF, TL.3, and VS3 habitat
- Bat management should be incorporated with any regional consent conditions that may be required for regional compliance.

All native fauna is protected by the Wildlife Act 1953 (WA 1953), therefore requirements of this legislation need to be adhered to during the removal of district plan vegetation. For long-tailed bats this should include the implementation of vegetation removal protocols (including pre-felling surveys). For native birds, any vegetation clearance within the bird nesting season (September to February) will

[25] Herpetofauna have been considered but excluded in the assessment of ecological effects as construction effects are considered Very Low.

need to be managed to avoid harm to native bird species and their nests e.g., programming vegetation clearance to avoid bird nesting season or else undertaking nesting bird checks.

Table 9-1: Summary of ecological effects during construction prior to mitigation for district plan terrestrial vegetation

Ecological Feature	Permanent loss of habitat / ecosystem, fragmentation, and edge effects due to vegetation removal (district plan vegetation only)
TL.3	Very Low

Table 9-2: Summary of ecological effects during construction prior to mitigation for bats

Ecological Feature	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Loss of foraging habitat due to removal of district plan vegetation	Mortality or injury to bats due to removal of district plan vegetation
Long-tailed bats[26]	**Moderate**	Low **WA 1953 requirements**	Low **WA 1953 requirements**

Table 9-3: Summary of ecological effects during construction prior to mitigation for birds

Ecological Feature[27]	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.)	Loss of foraging habitat due to removal of district plan vegetation	Mortality or injury to birds due to removal of district plan vegetation
Non-TAR birds	Low	Very Low **WA 1953 requirements**	Very Low **WA 1953 requirements**
Northern New Zealand dotterel	Low	-	-
North Island kākā	Very Low	Very Low **WA 1953 requirements**	Very Low **WA 1953 requirements**
North Island fernbird	Low	-	-

The residual (post-mitigation) level of effect for all construction effects is considered **Very Low**.

[26] Roost loss has been considered but excluded as an effect as the consequence of roost loss (if it does occur at all) is considered Negligible in the context of this Project.

[27] Construction effects on Northern New Zealand dotterel and North Island fernbird has been considered but excluded in the assessment of ecological effects as these species are not expected to utilise TL.3 (district plan vegetation only) habitat, therefore the effect is considered less than Negligible in the context of this Project.

Operational Effects

Table 9-4 to Table 9-5 provide a summary of district plan matter ecological effects during operation[28]. The summary represents the level of effect for the baseline ecological environment.

Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Operational effect mitigation measures will include:

To address the operational effects (disturbance and loss in connectivity) on long-tailed bats, a Bat Management Plan (BMP) for the Project should be developed to include consideration for:

- Buffer planting (including hop-over / under late-stage / mature planting), retention of existing mature trees between the road alignment and features with potential for bat roost. Refer to Figure 8-1 for locations of bat mitigation
- Light and noise management through design.

Table 9-4: Summary of ecological effects during operation prior to mitigation for bats

Ecological Feature	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise / vibration	Loss in connectivity due to permanent habitat loss, light, and noise effects from the road, leading to fragmentation of terrestrial habitat and influencing bat movement in the broader landscape
Long-tailed bats	**High**	**Very High**

Table 9-5: Summary of ecological effects during operation prior to mitigation for birds

Ecological Feature	Disturbance and displacement to roosts and individual birds (existing) due to the presence of the road (noise, light, dust etc.)	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure
Non-TAR birds	Low	Low
Northern New Zealand dotterel	Low	Low
North Island kākā	Low	Low
North Island fernbird	Low	Low

The residual (post-mitigation) level of effect for all operational effects are **Very Low** or **Low**.

[28] Herpetofauna have been considered but excluded in the assessment of ecological effects as operational effects are considered Very Low.

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1 Appendix A – Ecological Impact Assessment Methodology

The standard by which this EcIA was undertaken follows the guidelines published by the Environment Institute of Australia and New Zealand (EIANZ Guidelines) (Roper-Lindsay et al., 2018).

1.1 Assessment of Ecological Value

The first step in the EcIA approach is to assess the value of ecological features in terms of Representativeness, Rarity, Diversity and Pattern, and Ecological context. Details on each matter and its associated considerations are provided in Table 10-1 for terrestrial ecological value and Table 10-2 aquatic ecological value

Table 10-1: Matters and considerations for the assessment of terrestrial ecological value

Representativeness
Typical structure and composition
Indigenous representation
Rarity / distinctiveness
Species of conservation significance
Range restricted or endemic species
Distinctive ecological values
Diversity and pattern
Habitat diversity
Species diversity
Patterns in habitat use
Ecological context
Size, shape and buffering
Sensitivity to change
Ecological networks (linkages, pathways, migration)

Table 10-2: Matters and considerations for the assessment of aquatic ecological value

Representativeness (including SEV, RHA and ecological integrity)
Extent to which site / catchment is typical of characteristic
Instream habitat modification
Riparian habitat modification

Representativeness (including SEV, RHA and ecological integrity)
Hydrological modification
Catchment conditions
Geomorphological modification
Water quality modification
Presence of alien and invasive species
Invertebrate assemblage representation
Fish assemblage representation
Rarity / descriptiveness
Pool characterisation
Species of conservation significance
Range restricted or endemic species
Stream type (rare or distinctive)
Diversity and pattern
Distinctive ecological values
Level of natural diversity
Diversity metrics
Complexity of community
Ecological context (Ecosystem services, importance sensitivity)
Stream order
Catchment size
Hydroperiod
Sensitivity to flow modification
Sensitivity water quality modification
Sensitivity to sedimentation / erosion
Connectivity and migration

1.2 Assessment of Ecological Effects

The ecological effects assessment includes several steps that collectively assess the way the Project will interact with elements of the physical and biological, environment to produce effects to habitat and receptors. The method for determining the level of effect are outlined in the following sections.

Basic impact characteristic terminology and respective descriptors are incline with the EIANZ Guidelines and are provided in Table 10-3.

Table 10-3: Magnitude of effect assessment terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	Direct
		Indirect
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.)	Local
		Regional
		National
Duration	The time period over which a resource / receptor is affected.	Temporary (days or months)
		Short-term (<5 years)
		Long-term (15-25 years)
		Permanent (>25 years)
Frequency	A measure of the constancy or periodicity the receptor will be affected.	Infrequently
		Periodically
		Frequently
		Continuously
Likelihood	The probability of an effect occurring if it is unplanned.	Highly Unlikely
		Unlikely
		Likely
		Highly Likely
		Definite
Reversibility	The degree to which the ecological effect can be reversed in a reasonable time scale through natural processes or mitigation.	Totally
		Partially
		Irreversible
		Not applicable

Based on the above-mentioned descriptors, the characteristics of each effect are used to assign a magnitude to the specific effect. Magnitude designations are provided in Table 10-4.

Table 10-4: Magnitude of effect descriptions

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

Magnitude	Description
	be fundamentally changes and may be lost from the site altogether; and / or loss of very high proportion of the known population or range of the elements / features.
High	Major loss or major alteration to key elements / features of the existing baseline 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 one or more key elements / features of the existing baseline 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 the existing baseline conditions. Change arising from the loss / alteration will be discernible, but underlying character, composition and / or attributes of the existing baseline conditions will be similar or 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 or range of the element / feature.

The magnitude of an effect is considered in relation to the ecological value of the habitat or receptor to be impacted on. The ecological value of habitat or receptors are the primary focus of the ecological assessment. The ecological value of habitat or receptors are typically expressed on a local, district, regional or national scale. The ecological value designations are provided in Table 10-5.

Table 10-5: Ecological value descriptions

Value	Description
Very High	Area rates High for three or all the four assessment matters. Likely to be of National importance and recognised as such.
High	Area rates High for two of the assessment matters, Moderate and Low for the remainder or Area rates High for 1 so the assessment matters, moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low Dortha remainder, or Area rates Moderate for 2 or more assessment matters Low or Very low for the remainder. Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for most assessment matters and Moderate for one. Limited ecological value other as local habitat for tolerant species.
Negligible	Area rates Very low for three matters and Moderate, Low or Very low for the remainder.

Once magnitude of effect and the ecological value of the habitat or receptor have been determined, the level of effect can be assigned for each effect using the matrix shown in Table 10-6.

Table 10-6: Ecological effect matrix

		Ecological Values				
		Very High	High	Moderate	Low	Negligible
Magnitude	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	Negligible	Negligible	Negligible	Negligible	Negligible

From Table 10-6, the level of effect designations are defined below:

- **Negligible**: An effect of negligible consequence is one where habitat or receptors will not be affected in any meaningful way by a Project activity or the predicted effect is indistinguishable from natural background variations
- **Low**: An effect of minor consequence is one where habitat or receptors will experience a noticeable effect, but the effect magnitude is sufficiently small (with or without mitigation) and / or the resource / receptor is of low ecological value. In either case, the magnitude should be well within applicable standards
- **Moderate**: An effect of moderate consequence has an effect magnitude that is within applicable standards but higher than that of a minor effect. The emphasis for moderate effects is to show that the effect has been reduced or minimised in line with the mitigation hierarchy
- **High**: A high level of effect of is one where an accepted limit or standard may be exceeded, or moderate magnitude of effect will occur to moderate or high value habitat or receptors
- **Very High**: A very high level of effect will occur when the magnitude and value of effects are assessed as high or very high. Typically, very high level of effects notably exceeds standard limits.

1.3 Impact Management

Informed by the level of effects suitable impact management measures are provided consistent with the mitigation hierarchy. The priority in mitigation is to first apply mitigation measures to the source of the impact (avoid) and then to address the resultant effects (reduce or minimise) of the impact.

1.4 Residual Impacts

Once mitigation measures are declared, the next step in the effect assessment process was to assign residual impact significance. This is a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional recommended mitigation measures.

1.5 Managing Uncertainty

Biophysical impacts are difficult to predict with certainty, but uncertainty stemming from on-going development of the Project design and implementation is inevitable, and the environment is variable over time. If uncertainties are relevant to the effect assessment, they were stated and approached conservatively, to identify a range of likely residual effects and relevant mitigation measures.

1.6 Cumulative Effects

Cumulative impacts and effects are those that arise because of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect. These are termed cumulative impacts and effects. No structured methods were employed to assess cumulative impacts, but where relevant descriptions of potential cumulative effects have been provided.

2 Appendix B – Auckland Unitary Plan Activities

Auckland Unitary Plan – E26 Infrastructure

Table E26.4.3.1 is relevant for considering effects and recommending mitigation in relation to tree removal. Note that, except for Trees in Roads, in Open Space Zones and Notable Trees, trees are not protected under the AUP.

Table E26.4.3.1: Activity table – Network utilities and electricity generation – Trees in roads and open space zones and the Notable Trees Overlay

Activity	Activity Status			Permitted Standards or Matters of Discretion / Control
	Trees in roads [dp]	Open space zones [dp]	Notable trees [dp]	
(A89) Tree removal of Notable Trees	N/A	N/A	Discretionary	N/A
(A90) Tree trimming, alteration or removal on roads adjoining rural zones and on roads adjoining the Future Urban Zone	Permitted	N/A	N/A	N/A
(A91) Tree alteration or removal of any tree less than 4m in height and / or less than 400mm in girth	Permitted	Permitted	Restricted Discretionary	N/A
(A92) Tree alteration or removal of any tree greater than 4m in height and / or greater than 400mm in girth	Restricted Discretionary	Restricted Discretionary	N/A	N/A
(A93) Tree trimming, alteration and removal not otherwise provided for	D	D	D	N/A

Auckland Unitary Plan – E26 Infrastructure

Table E26.3.3.1 below is relevant for considering effects and recommending mitigation in relation to vegetation clearance. Also refer to Table E15.4.1.

Table E26.3.3.1: Activity table – Network utilities and electricity generation and vegetation management

Activity	Activity Status						Permitted Standards
	Rural zones, coastal areas and riparian areas [rp]	SEA [rp]	ONF [dp]	HNC [dp]	ONL [dp]	ONC [dp]	
(A76) Vegetation	P	P	P	P	P	P	Refer to E26.3.5.4. Vegetation

Activity	Activity Status						Permitted Standards
	Rural zones, coastal areas and riparian areas [rp]	SEA [rp]	ONF [dp]	HNC [dp]	ONL [dp]	ONC [dp]	
alteration or removal							alteration or removal for Permitted Activity Standards
(A77) Vegetation alteration or removal that does not comply with Standards E26.3.5.1 to E26.3.5.4	RD	RD	RD	RD	RD	RD	
(A78) Vegetation alteration or removal not otherwise provided for	D	D	D	D	D	D	

Note: Greyed-out boxes relate to Regional Activities which are not considered as part of the NoR and will be relevant for future Regional Resource Consents.

Auckland Unitary Plan – E15 Vegetation management and biodiversity

Table E15.4.1 below is relevant for considering effects of activities over and above those that are permitted and recommending mitigation in relation to vegetation clearance in urban and FUZ zones, and adjacent to riparian areas.

Table E15.4.1: Activity table – Auckland-wide vegetation and biodiversity management rules

Activity	Activity Status	Permitted Standards
Riparian areas (as described below)		
(A16) Vegetation alteration or removal within 20m of rural streams, other than those in Rural – Rural Production Zone and Rural – Mixed Rural Zone	RD	N/A
(A17) Vegetation alteration or removal within 10m of rural streams in the Rural – Rural Production Zone and Rural – Mixed Rural Zone	RD	N/A
(A18) Vegetation alteration or removal within 20m of a natural wetland, in the bed of a river or stream (permanent or intermittent), or lake	RD	N/A
(A19) Vegetation alteration or removal within 10m of urban streams	RD	N/A
All other zones and areas not covered above (i.e. Urban Zones and FUZ)		

Activity	Activity Status	Permitted Standards
(A22A) Vegetation alteration or removal	P	Refer to E15.6. Vegetation alteration or removal for Permitted Activity Standards
All areas		
(A23) Permitted activities in Table E15.4.1 that do not comply with one or more of the standards in E15.6	RD	N/A

Auckland Unitary Plan – E26 Infrastructure – Earthworks

The table below is relevant for considering effects of activities over and above those that are permitted and recommending mitigation in relation to earthworks.

Table E26.5.3.1: Activity table – Earthworks all zones and roads [dp]

Activity	Activity Status	Permitted Standards
(A95) Earthworks up to 2500m2 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)
(A96) Earthworks up to 2500m3 other than for maintenance, repair, renewal, minor infrastructure upgrading	P	Refer to E26.5.5.2. General standards (District)
(A97) Earthworks greater than 2500m2 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	N/A
(A97A) Earthworks greater than 2500m3 other than for maintenance, repair, renewal, minor infrastructure upgrading	RD	N/A

3 Appendix C – Regional Plan, District Plan, and Wildlife Act Matters

Table 10-7: Ecological effects of road infrastructure construction broken down into AUP:OP Regional and District Plan matters, and Wildlife Act (1953)

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
Construction					
Terrestrial habitat	Vegetation removal (including trees) outside of roads and public spaces in: • a rural zone • riparian margins • coastal areas • SEAs This also includes other terrestrial habitat of value identified in the EcIA.	Permanent loss of habitat / ecosystem, fragmentation and edge effects.		✓	
	Vegetation removal (including trees) in: • Roads • Public spaces • ONFs • ONLs • HNCs • ONCs	Permanent loss of habitat / ecosystem, fragmentation and edge effects.	✓		
	Earthworks – leading to invasion of bare earth surfaces with weeds and transfer of weeds (seeds and fragments) between earthworks areas.	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity.		✓	
Bats	Vegetation removal.	Roost loss.		✓	✓
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	
	Construction activities (Noise, light, dust etc.).	Disturbance and displacement to roosts and to individuals (existing).	✓		✓

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
Birds (native)	Vegetation removal.	Nest loss.		✓	✓
	Vegetation removal.	Kill or injure individual.			✓
	Vegetation removal.	Loss of foraging habitat.		✓	
	Construction activities (noise, light, dust etc).	Disturbance and displacement of roosts and individuals (existing).	✓		✓
Herpetofauna (native)	Vegetation removal.	Lizard habitat loss		✓	
	Vegetation removal.	Kill or injure individual			✓
	Construction activities (noise, light, dust etc).	Disturbance and displacement of individuals (existing).	✓		✓
	Reclamation / culverting / other structures e.g., bank armouring.	Permanent loss / modification of habitat / ecosystem.		✓	
Freshwater habitat – wetland or stream (including riparian margins)	Vegetation removal.	Permanent loss of habitat / ecosystem, fragmentation and edge effects.		✓	
	Construction activities – earthworks (leading to sediment discharge), machinery use and chemical storage (leading to leaks / spills).	Uncontrolled discharge leading to habitat and water quality degradation.		✓	
	Diversion, abstraction or bunding Wof watercourses and water level / flow / periodicity changes.	Detrimental effects on habitats including plant composition and fauna.		✓	
Fish (native)	Reclamation / diversion / other structures e.g., bank armouring.	Loss of aquatic habitat.		✓	
	Reclamation / diversion / culverting / other structures e.g., bank armouring.	Kill or injure individual.			✓
Operation					

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
Terrestrial habitat	Presence of the road – use of road edges as dispersal corridors by invasive plant species.	Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity.		✓	
	Road maintenance – increased use of herbicides.	Increased weed incursion, unintentional spray of indigenous vegetation.		✓	
Bats	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting and noise / vibration.	Disturbance and displacement of (new and existing) roosts and individuals.	✓		✓
Birds (native)	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓
	Lighting and noise / vibration.	Disturbance and displacement of (new and existing) nests and individuals.	✓		✓
Herpetofauna (native)	Vehicle movement.	Kill or injure individual.			✓
	Presence of the road.	Loss in connectivity due to permanent habitat loss, light and noise / vibration effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat.	✓		✓

Ecological feature	Activity	Ecological Effect	AUP:OP District Plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
	Lighting.	Disturbance of nocturnal lizard behaviour.	✓		✓
Freshwater habitat – wetland or stream (including riparian margins)	Vehicle (cartage) movement – risk of spills of potential toxins (oil, milk, chemicals).	Temporary degradation of instream / wetland habitat and water quality.		✓	
	Presence of bridge.	Shading leading to change in ecosystem structure.		✓	
	Gradual change in hydrology from presence of the road / stormwater, including reclamations.	Effect on downstream habitat (including erosion / sediment discharge) due to change in hydrology (increase or decrease).		✓	
	Stormwater discharges – pollutants (such as heavy metals and herbicides).	Permanent degradation of wetland or instream habitat and water quality.		✓	
Fish (native)	Presence of culvert.	Loss of connectivity due to culvert preventing fish passage up and downstream.		✓	

4 Appendix D – Desktop and Incidental Bird Records

Table 10-8: Desktop bird records within 2 km of the Project Area

Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)	Record Source
Banded dotterel	Pohowera	*Charadrius bicinctus*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Banded rail	Mioweka	*Gallirallus philippensis assimilis*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Barbary dove	-	*Streptopelia risoria*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Blackbird	Manu pango	*Turdus merula*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Canada goose	-	*Branta canadensis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Caspian tern	Taranui	*Hydroprogne caspia*	Threatened – Nationally Vulnerable	Desktop record – iNaturalist / eBird (Bird Atlas)
Chaffinch	Pahirini	*Fringilla coelebs*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Common pheasant	Peihana	*Phasianus colchicus*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Dunnock	-	*Prunella modularis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Bar-tailed godwit	Kuaka	*Limosa lapponica bauer*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Dabchick	Weweia	*Poliocephalus rufopectus*	Threatened – Nationally Increasing	Desktop record – iNaturalist / eBird (Bird Atlas)
Eastern rosella	-	*Platycercus eximius*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)

Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)	Record Source
Fantail	Pīwakawaka	*Rhipidura fuliginosa placabilis*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Goldfinch	-	*Carduelis carduelis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Greenfinch	-	*Carduelis chloris*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Grey duck x mallard hybrid	-	*Anas platyrhynchos x superciliosa*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Greylag goose	Kuihi	Anser anser	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
House sparrow	Tiu	*Fringilla coelebs*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Kingfisher	Kōtare	*Todiramphus sanctus vagans*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Little shag	Kawau paka	*Phalacrocorax melanoleucos*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Magpie	Makipae	*Gymnorhina tibicen*	Introduced and Naturalised	Desktop record - iNaturalist / eBird (Bird Atlas)
Mallard	-	*Anas platyrhynchos*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Muscovy duck	-	*Cairina moschata*	Introduced, not established	Desktop record – iNaturalist / eBird (Bird Atlas)
Myna	-	*Acridotheres tristis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
New Zealand pigeon	Kereru	*Hemiphaga novaeseelandiae*	Not Threatened	eBird (Bird Atlas), iNaturalist
North Island fernbird	Mātātā	*Poodytes punctatus*	At Risk – Declining	Assumed present based on suitable habitat present in the Project Area.

Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)	Record Source
North Island kākā	Kākā	*Nestor meridionalis septentrionalis*	At Risk – Recovering	Known to be present in wider landscape and assumed present based on suitable habitat present in the Project Area.
Northern New Zealand dotterel	Tūturiwhatu	*Charadrius obscurus aquilonius*	At Risk – Recovering	Desktop record – iNaturalist / eBird (Bird Atlas)
Paradise shelduck	Pūtangitangi	*Tadorna variegata*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Pied shag	Kāruhiruhi	*Phalacrocorax varius*	At Risk – Recovering	Desktop record – iNaturalist / eBird (Bird Atlas)
Pied stilt	Poaka	*Himantopus himantopus leucocephalus*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Pūkeko	Pūkeko	*Porphyrio melanotus*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Red-billed gull	Tarāpunga	*Larus novaehollandiae scopulinus*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Red knot	Huahou	Calidris canutus	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Rock pigeon	-	*Columba livia*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Royal spoonbill	Kōtuku ngutupapa	*Platalea regia*	At Risk – Naturally Uncommon	Desktop record – iNaturalist / eBird (Bird Atlas)
Shining cuckoo	Pīpīwharauroa	*Chrysococcyx lucidus*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Silvereye	Tauhou	*Zosterops lateralis*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Skylark	Kaireka	*Alauda arvensis*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)

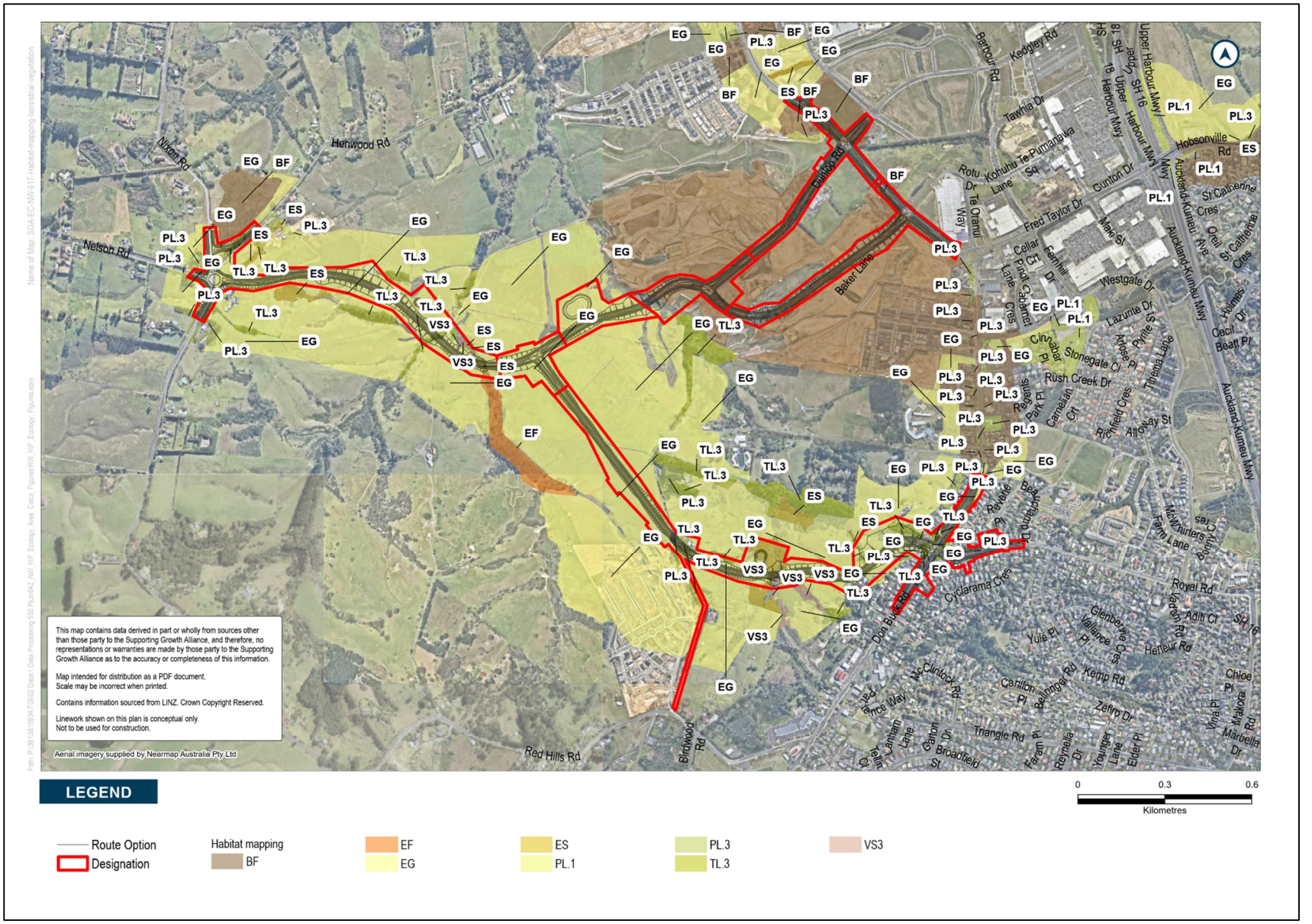
Common Name	Māori Name	Scientific Name	Conservation Status (Robertson et al., 2021)	Record Source
Song thrush	-	*Turdus philomelos*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
South Island pied oystercatcher	Tōrea	*Haematopus finschi*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Southern black-backed gull	Karoro	*Larus dominicanus*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Spotted dove	-	*Streptopelia chinensis tigrina*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Spur winged plover	-	*Vanellus miles novaehollandiae*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Starling	-	*Sturnus vulgaris*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)
Swamp Harrier	Kāhu	*Circus approximans*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Tūī	Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
Variable oystercatcher	Tōrea pango	*Haematopus unicolor*	At Risk – Recovering	Desktop record – iNaturalist / eBird (Bird Atlas)
Welcome swallow	Warou	*Hirundo neoxena*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
White-faced heron	Matuku moana	*Egretta novaehollandiae*	Not Threatened	Desktop record – iNaturalist / eBird (Bird Atlas)
White-fronted tern	Tara	*Sterna striata*	At Risk – Declining	Desktop record – iNaturalist / eBird (Bird Atlas)
Yellowhammer	-	*Emberiza citrinella*	Introduced and Naturalised	Desktop record – iNaturalist / eBird (Bird Atlas)

Table 10-9: Incidental bird species identified in the Project Area during the site investigation

Common Name	Scientific Name	Conservation Status (Robertson et al., 2021)
Australasian harrier	*Circus approximans*	Indigenous – Not Threatened
Blackbird	*Turdus merula*	Introduced and Naturalised
Canada goose	*Branta canadensis*	Introduced and Naturalised
Common pheasant	*Phasianus colchicus*	Introduced and Naturalised
Eastern rosella	*Platycercus eximius*	Introduced and Naturalised
Goldfinch	*Carduelis carduelis*	Introduced and Naturalised
Grey warbler	*Gerygone igata*	Indigenous – Not Threatened
Indian peafowl	*Pavo cristatus*	Introduced and Naturalised
Mallard	*Anas platyrhynchos*	Introduced and Naturalised
Myna	*Acridotheres tristis*	Introduced and Naturalised
North Island fantail	*Rhipidura fuliginosaplacabilis*	Indigenous – Not Threatened
Norhern New Zealand dotterel	*Charadrius obscurus aquilonius*	Threatened – Nationally Increasing
Paradise shelduck	*Tadorna variegata*	Indigenous – Not Threatened
Pied stilt	*Himantopus himantopus leucocephalus*	Indigenous – Not Threatened
Pūkeko	*Porphyrio melanotus melanotus*	Indigenous – Not Threatened
Shining cuckoo	*Chrysococcyx lucidus lucidus*	Indigenous – Not Threatened
Silvereye	*Zosterops lateralis lateralis*	Indigenous – Not Threatened
Skylark	*Alauda arvensis*	Introduced and Naturalised
Song thrush	*Turdus philomelos*	Introduced and Naturalised
Spur-winged plover	*Vanellus miles novaehollandiae*	Indigenous – Not Threatened
Tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Indigenous – Not Threatened
White-faced heron	*Ergretta novaehollandiae*	Indigenous – Not Threatened

5 Appendix E – Ecological Habitat Maps

5.1 Terrestrial Vegetation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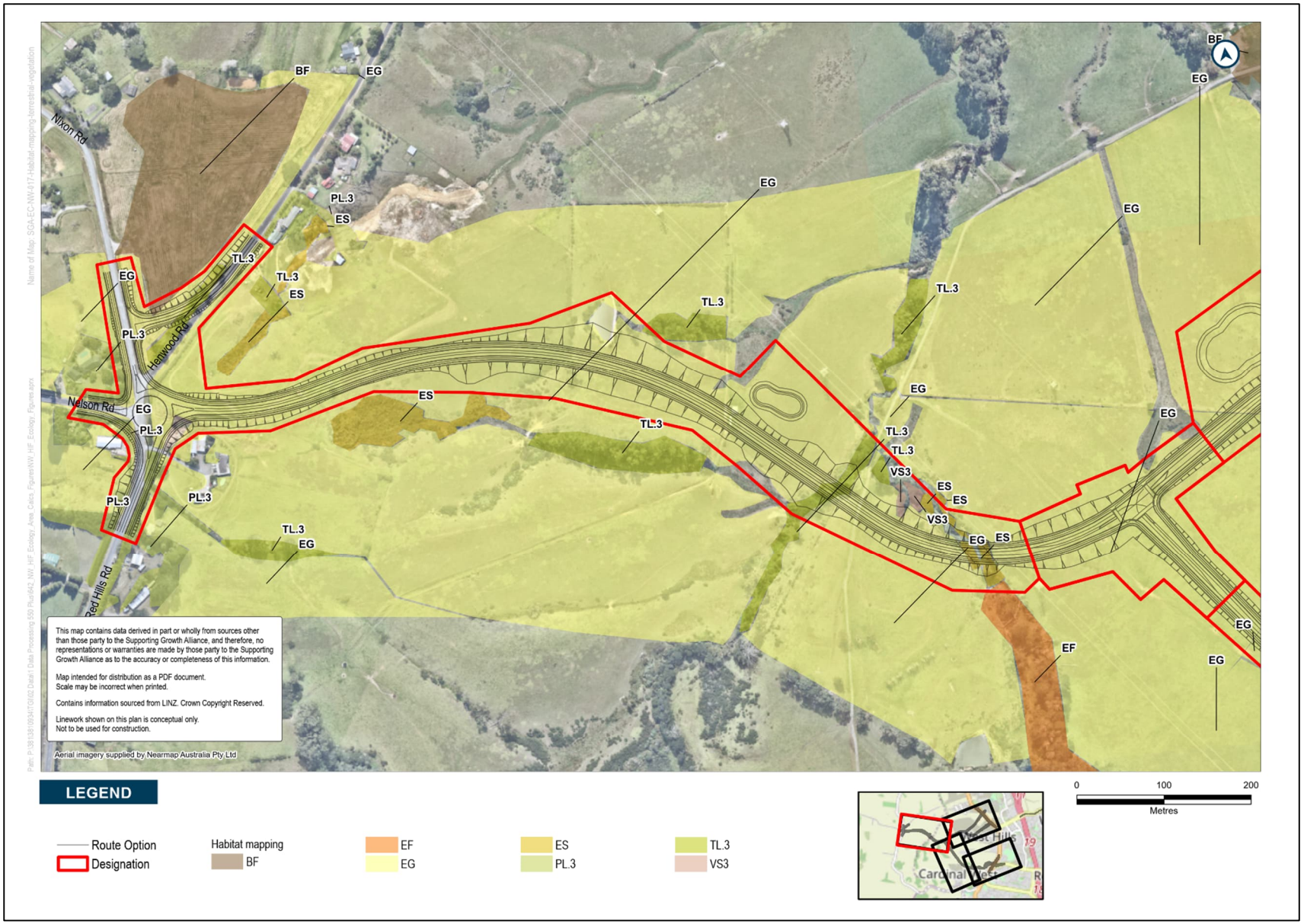
LEGEND
Route Option
Designation
Habitat mapping
BF
EF
EG
ES
PL.1
PL.3
TL.3
VS3
0
0.3
0.6
Kilometres


BF
EG
Nixon Rd
PL.3
ES
TL.3
EG
Henwood Rd
Nelson Rd
Red Hills Rd
VS3
EF
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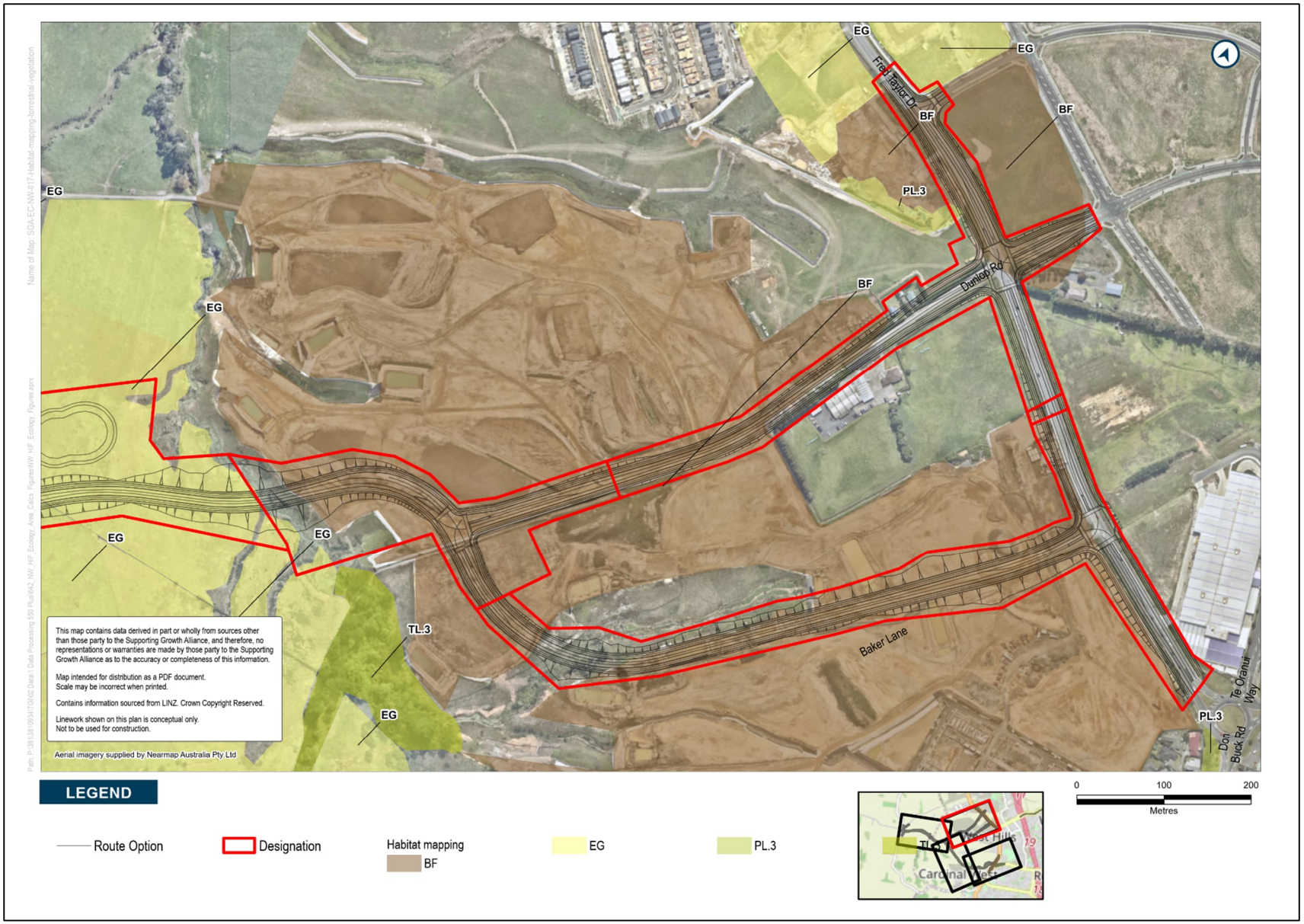
LEGEND
Route Option
Designation
Habitat mapping
BF
EF
EG
ES
PL.3
TL.3
VS3
0
100
200
Metres


EG
EG
Fred Taylor Dr
BF
BF
PL.3
EG
BF
Dunlop Rd
EG
EG
EG
TL.3
EG
Baker Lane
PL.3
Te Oranui Way
Buck Rd
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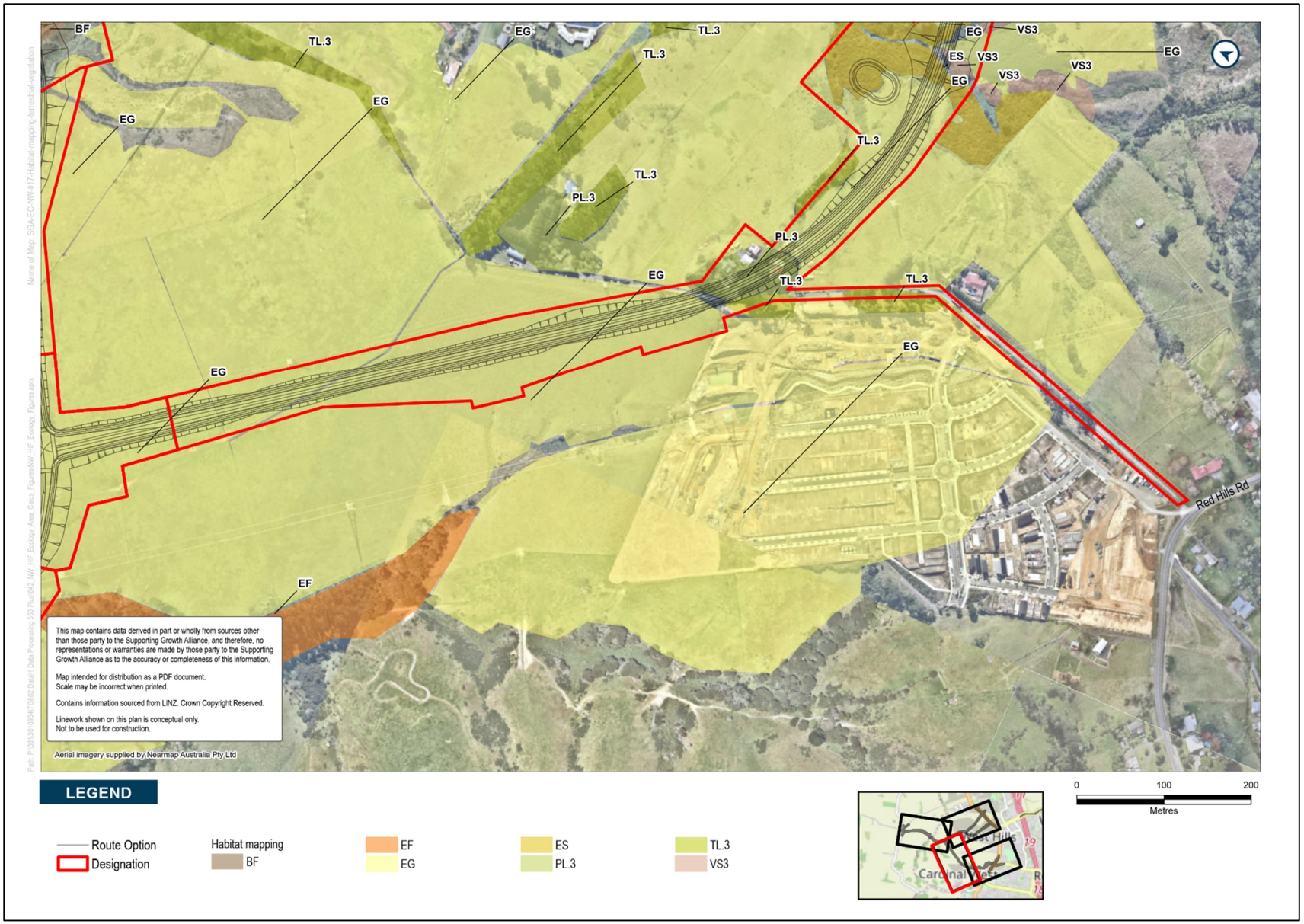
LEGEND
Route Option
Designation
Habitat mapping
BF
EG
PL.3
0
100
200
Metres


BF
TL.3
EG
TL.3
EG
VS3
ES
VS3
EG
VS3
VS3
EG
EG
TL.3
TL.3
PL.3
PL.3
EG
TL.3
TL.3
EG
EG
Red Hills Rd
EF
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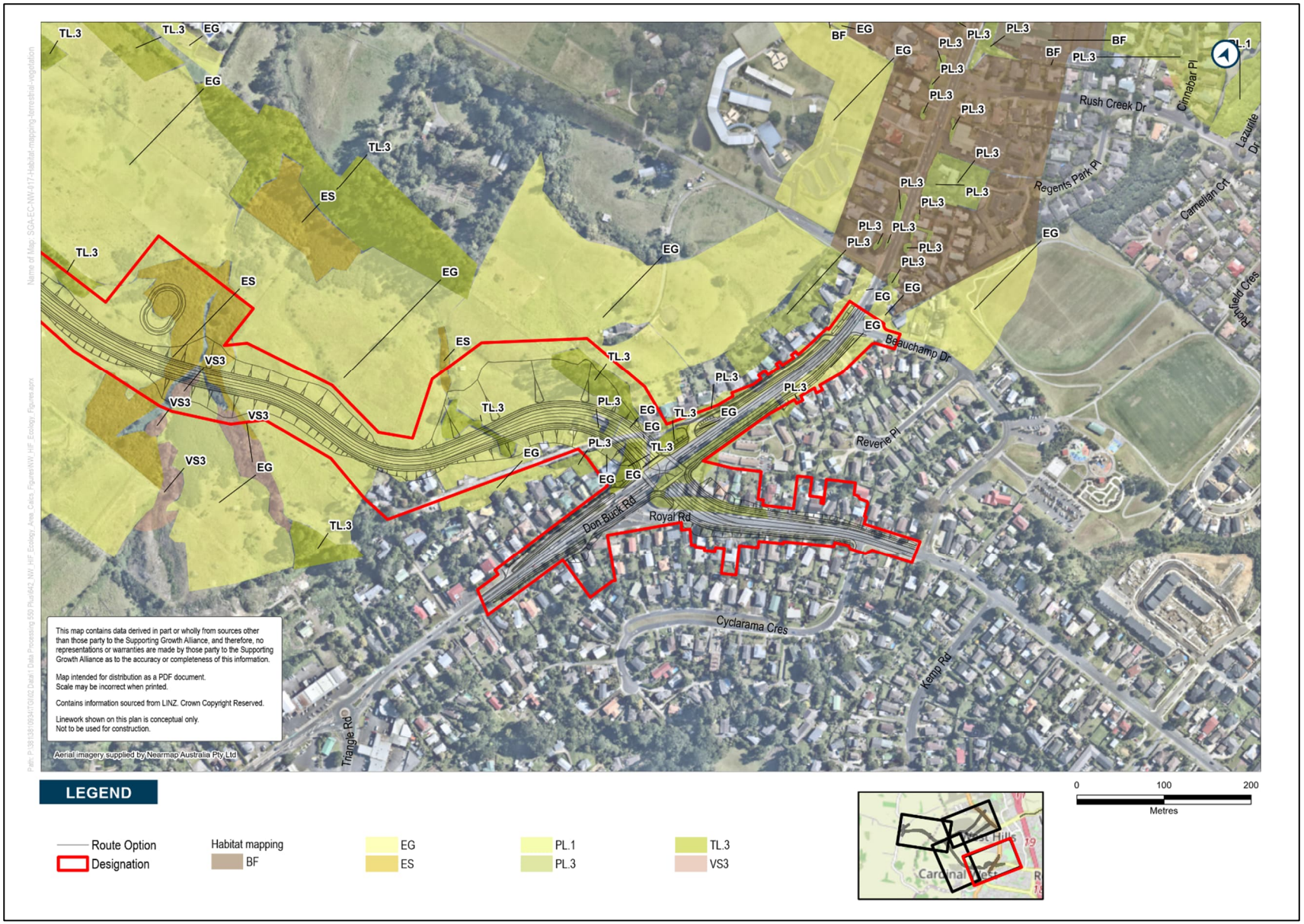
LEGEND
Route Option
Designation
Habitat mapping
BF
EF
EG
ES
PL.3
TL.3
VS3
0
100
200
Metres


TL.3
EG
ES
VS3
PL.3
BF
Rush Creek Dr
Cinnabar Pl
Lazurite Dr
Regents Park Pl
Camellian Crt
Beauchamp Dr
Reverie Pl
Don Buck Rd
Royal Rd
Cyclarama Cres
Kemp Rd
Triangle Rd
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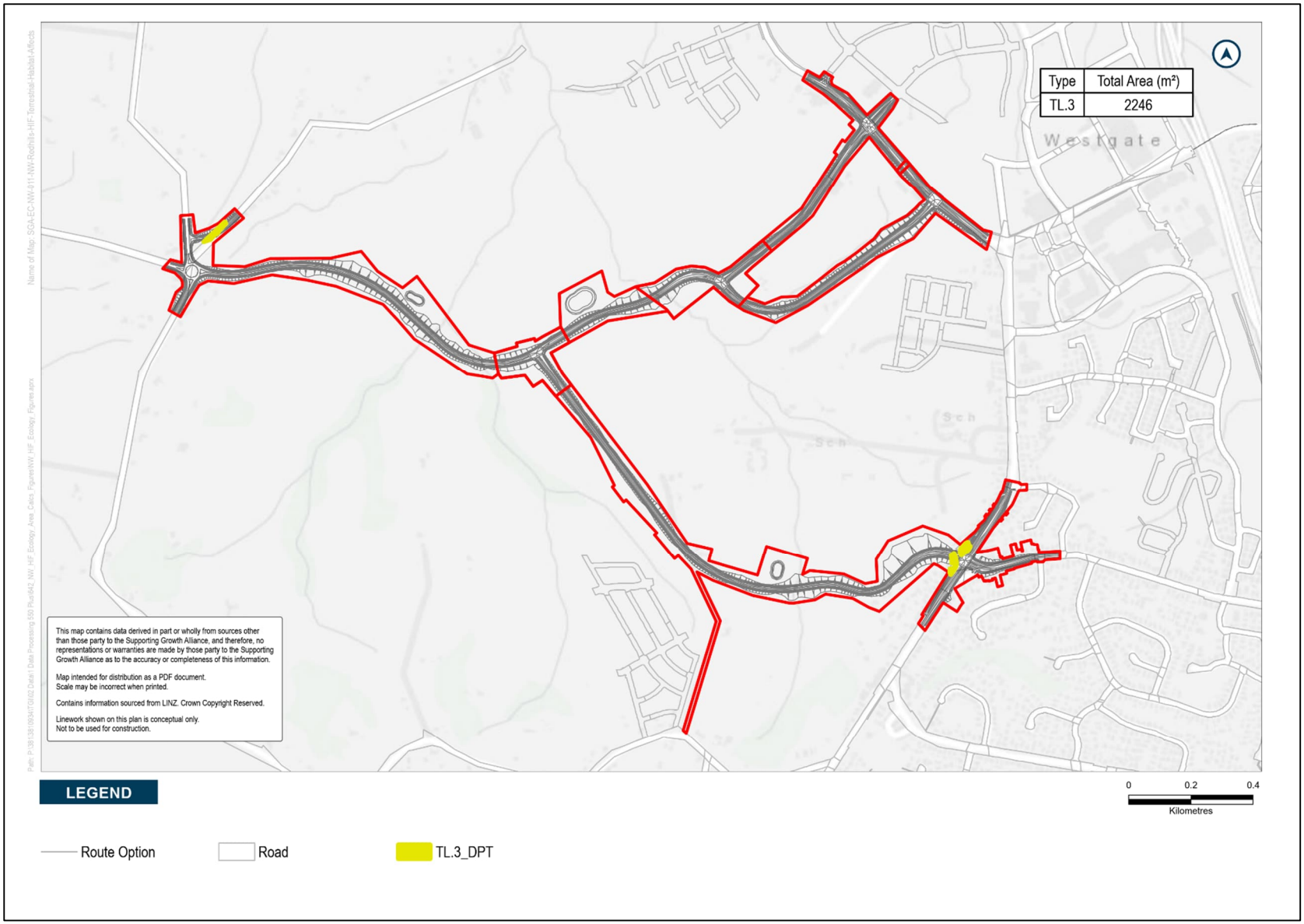
LEGEND
Route Option
Designation
Habitat mapping
BF
EG
ES
PL.1
PL.3
TL.3
VS3
0
100
200
Metres

5.2 District Plan Vegetation


Type
Total Area (m²)
TL.3
2246
Westgate
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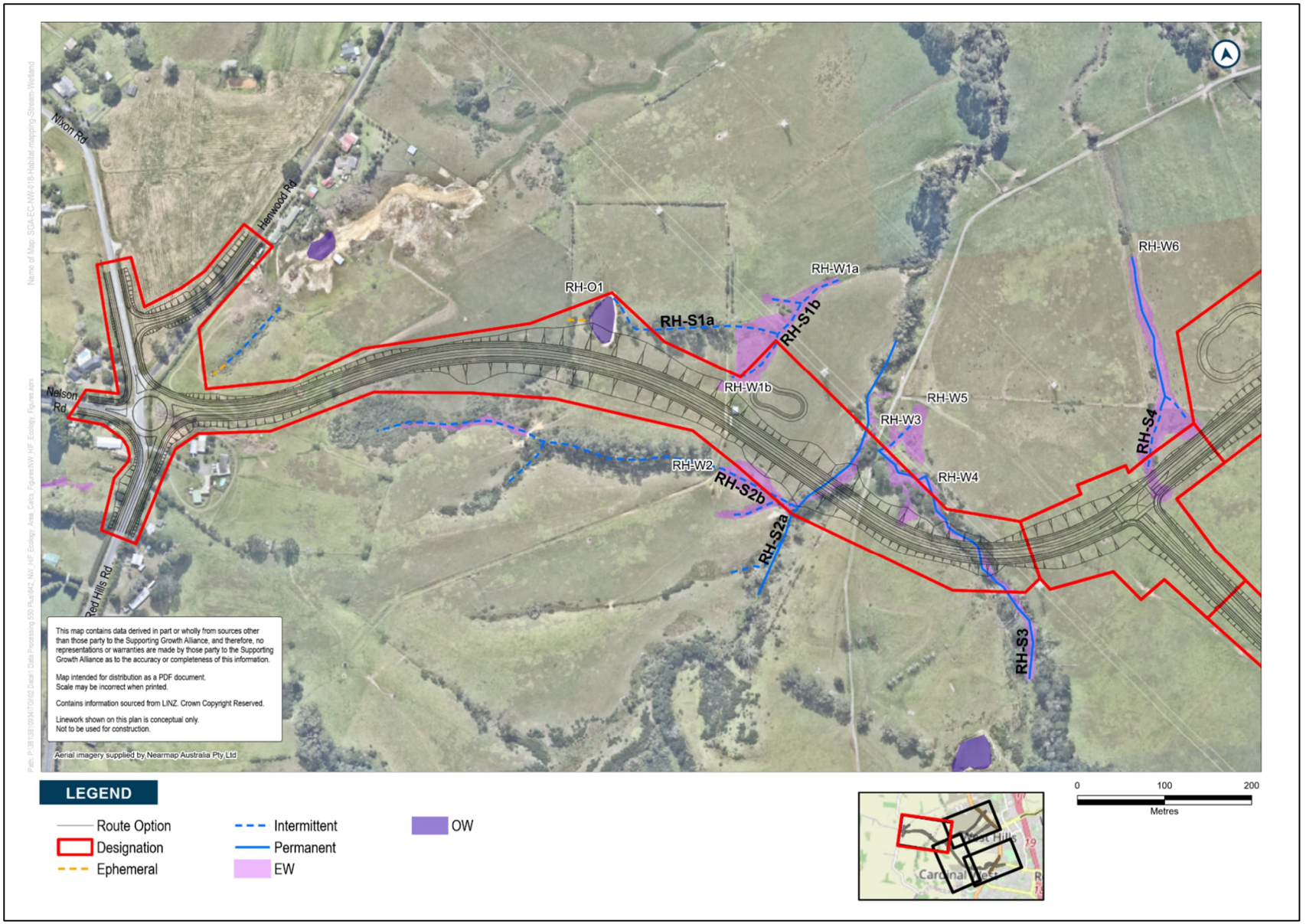
LEGEND
Route Option
Road
TL.3_DPT
0
0.2
0.4
Kilometres

5.3 Freshwater Streams and Wetland Habitat


Nixon Rd
Hanwood Rd
Nelson Rd
Red Hills Rd
RH-O1
RH-S1a
RH-S1b
RH-W1a
RH-W1b
RH-W2
RH-S2b
RH-S2a
RH-W3
RH-W4
RH-W5
RH-W6
RH-S4
RH-S3
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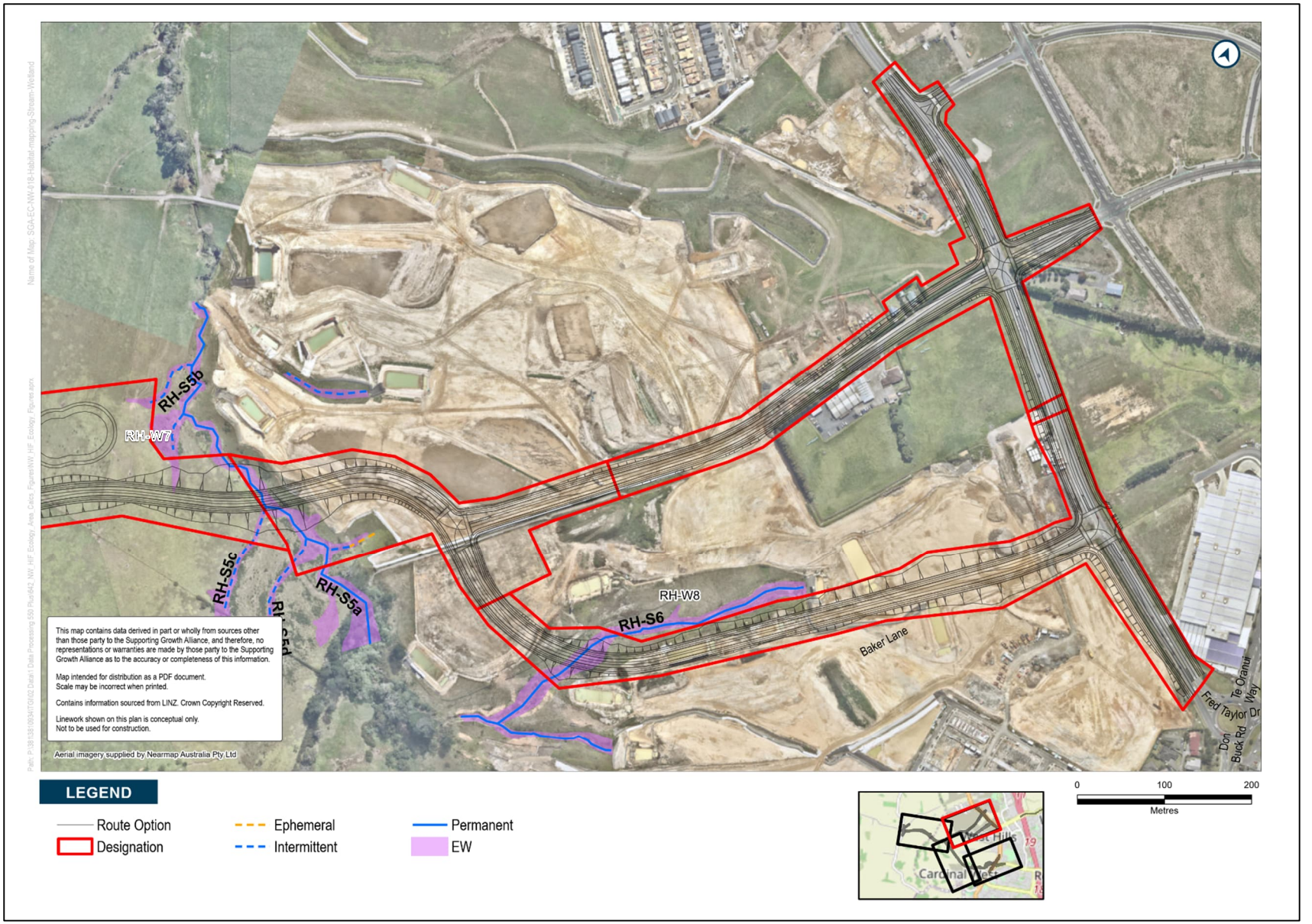
LEGEND
Route Option
Designation
Ephemeral
Intermittent
Permanent
EW
OW
0
100
200
Metres


RH-S5b
RH-W7
RH-S5c
RH-S5a
RH-W8
RH-S6
Baker Lane
Fred Taylor Dr
Te Oranui Way
Don Buck Rd
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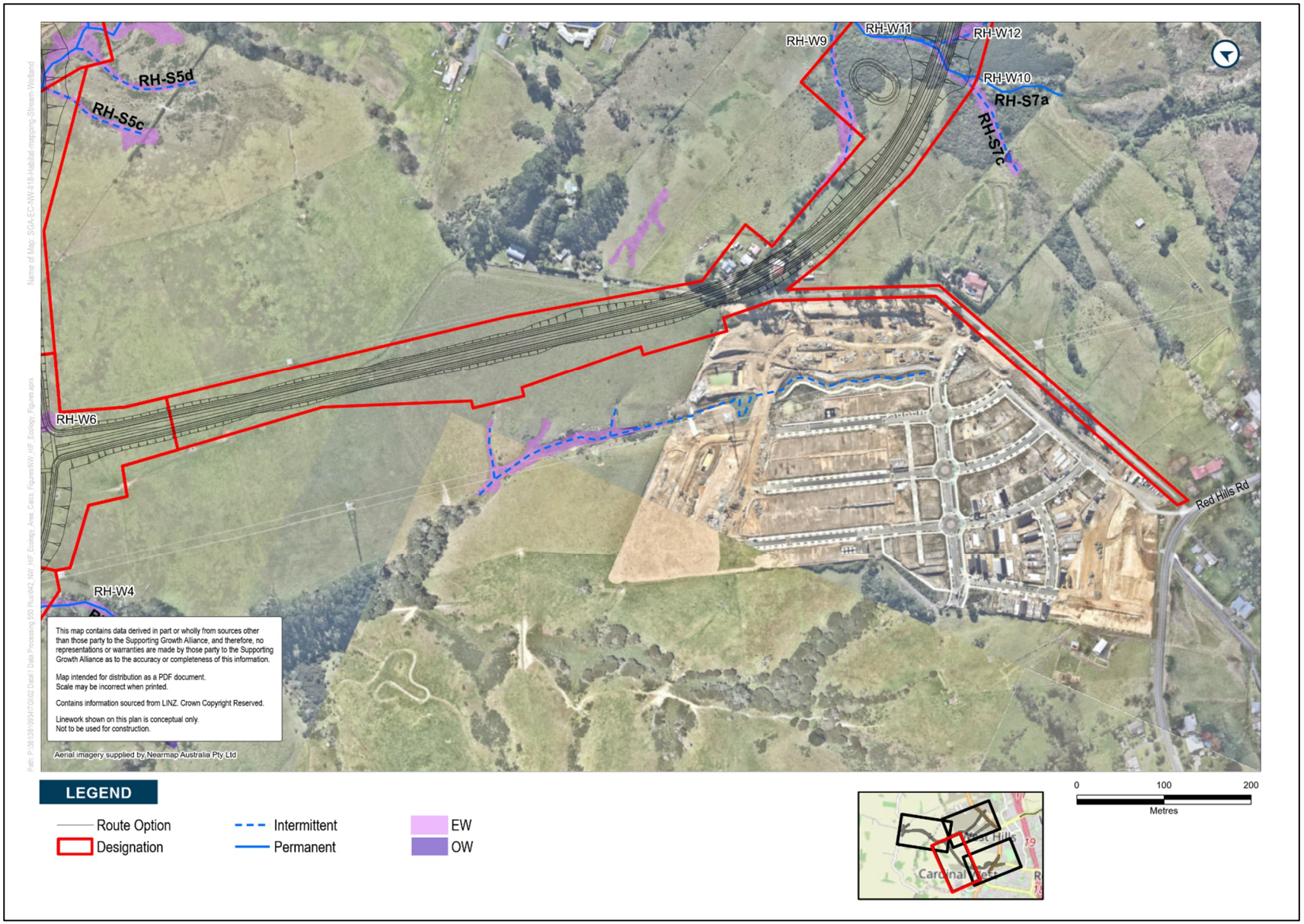
LEGEND
Route Option
Designation
Ephemeral
Intermittent
Permanent
EW
0
100
200
Metres


RH-S5d
RH-S5c
RH-W9
RH-W11
RH-W12
RH-W10
RH-S7a
RH-S7c
RH-W6
RH-W4
Red Hills Rd
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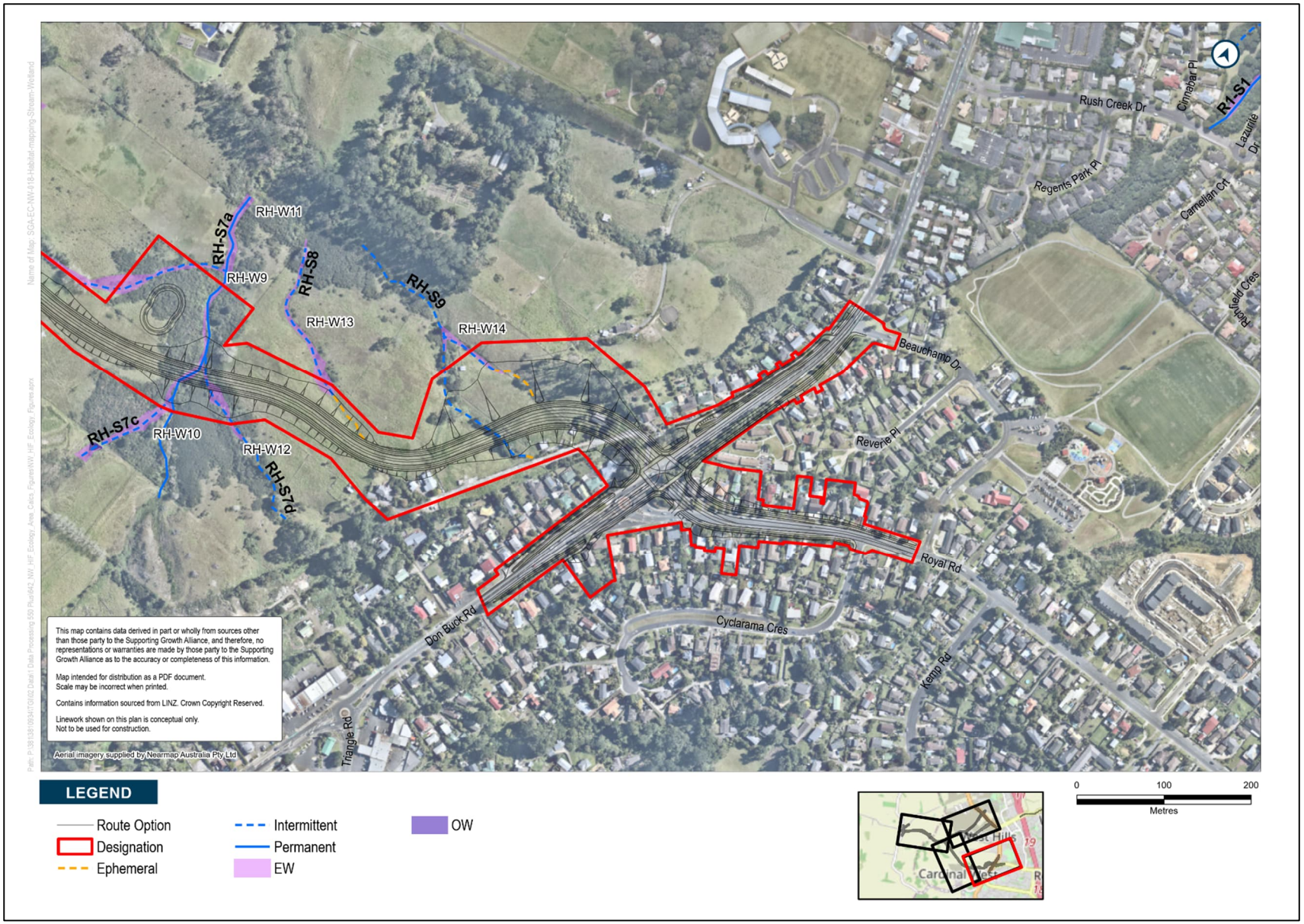
LEGEND
Route Option
Designation
Intermittent
Permanent
EW
OW
0
100
200
Metres


RH-W11
RH-S7a
RH-W9
RH-S8
RH-S9
RH-W13
RH-W14
RH-S7c
RH-W10
RH-W12
RH-S7d
R1-S1
Rush Creek Dr
Cinnabar Pl
Lazurite Dr
Regents Park Pl
Camellian Crt
Rodney Cres
Beauchamp Dr
Reverie Pl
Royal Rd
Cyclarama Cres
Don Buck Rd
Kemp Rd
Triangle Rd
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LEGEND
Route Option
Designation
Ephemeral
Intermittent
Permanent
EW
OW
0
100
200
Metres

6 Appendix F – Terrestrial Value Assessment

Table 10-10: Assessment of ecological value for terrestrial ecology features in the Project Area

Attributes to be considered	BF	EF	EG	ES	PL.3	TL.3	VS3	Justification
Representativeness	**1**	**2**	**1**	**2**	**2**	**2**	**4**	
Typical structure and composition	1	1	1	1	1	1	3	BF, EF, EG, ES, PL.3, TL.3: Habitats have been significantly altered by human activities (exotic dominated). VS3: Habitat has been insignificantly affected by human activities.
Indigenous representation	1	2	1	2	2	2	4	BF, EG: <10% of the species are indigenous. EF, ES, PL.3, TL.3: 10-50% of the species are indigenous. VS3: >90% of the species are indigenous.
Rarity / distinctiveness	**4**	**4**	**3**	**3**	**3**	**4**	**3**	
Species of conservation significance	4	4	3	3	3	4	3	Long-tailed bat (Threatened – Nationally Critical, value score of 4) present and potentially using ecological features associated with the Project Area (EF, TL.3). No TAR bird species expected to be reliant on terrestrial ecological features associated with the Project Area. Northern New Zealand Dotterel is present and likely breeding in current construction area associated with a residential development would score 4 (BF), and seasonal use by kākā, would score 3 (EF, TL.3). Copper skink and ornate skink (At Risk – Declining, value score 3) likely to utilise ecological features within the Project Area (EF, EG, ES, PL.3, and TL.3 and VS3 (with appropriate understorey)).
Distinctive ecological values	-	2	1	1	1	1	2	BF: Habitat not playing an important role in provisional or regulatory ecosystem services at any scale.

Attributes to be considered	BF	EF	EG	ES	PL.3	TL.3	VS3	Justification
								EG, ES, PL.3, TL.3: Habitat playing an important role in provisional or regulatory ecosystem services typically on Local scale. EF: Habitat playing an important role in provisional or regulatory ecosystem services typically on Catchment scale. VS3: Habitat playing an important role in provisional or regulatory ecosystem services typically on Regional scale.
Diversity and pattern	**1**	**3**	**1**	**1**	**1**	**3**	**3**	
Habitat diversity	-	1	-	-	-	1	2	Increased habitat diversity in areas with indigenous species present: VS3. Increased habitat diversity in areas with late succession: EF, TL.3, VS3.
Species diversity	-	1	-	-	-	1	2	Increased species diversity in areas with indigenous species present: VS3. Increased species diversity in areas with late succession: EF, TL.3, VS3.
Patterns in habitat use	1	3	1	1	1	3	3	EF, TL.3, VS3 rated high due to potential seasonal utilisation by long-tailed bat and kākā. All other habitats are not important for lifecycle completion or periodic habitat utilisation on any scale.
Ecological context	**0**	**1**	**0**	**0**	**0**	**3**	**3**	
Size, shape and buffering	-	1	-	-	-	1	1	EF, TL.3, VS3 are represented by small (or isolated), patches of habitat surrounded by pasture but provide buffering to stream / wetland areas.
Sensitivity to change	-	-	-	-	-	-	1	VS3: Intact habitat. All other habitats are generally modified with no residual sensitive receptors.
Ecological networks (linkages, pathways, migration)	-	-	-	-	-	3	3	Aged woody structure (TL.3 and VS3) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and kākā.

Attributes to be considered	BF	EF	EG	ES	PL.3	TL.3	VS3	Justification
Ecological Value	**L**	**M**	**L**	**L**	**L**	**M**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 10-11: Assessment of ecological value for terrestrial ecology features in the Project Area (fauna)

Attributes to be considered	Long-tailed bat	Non-TAR bird	Northern New Zealand dotterel	North Island fernbird	North Island kākā	Copper skink / ornate skink	Justification
Representativeness	**0**	**2***	**0**	**0**	**0**	**0**	
Typical structure and composition	-	2*	-	-	-	-	
Indigenous representation	-	-	-	-	-	-	
Rarity / distinctiveness	**4**	**2**	**4**	**3**	**3**	**3**	
Species of conservation significance (fauna only)	4	2	4	3	3	3	Long-tailed bat: Threatened – Nationally Critical Northern New Zealand dotterel: Threatened – Nationally Increasing North Island fernbird: At Risk – Declining North Island kākā: At Risk – Recovering Copper skink, ornate skink: At Risk – Declining

Attributes to be considered	Long-tailed bat	Non-TAR bird	Northern New Zealand dotterel	North Island fernbird	North Island kākā	Copper skink / ornate skink	Justification
Species of conservation significance	-	-	-	-	-	-	
Distinctive ecological values	-	-	-	-	-	-	
Diversity and pattern	**0**	**2***	**0**	**0**	**0**	**0**	
Habitat diversity	-	2*	-	-	-	-	
Species diversity	-	-	-	-	-	-	
Patterns in habitat use	-	-	-	-	-	-	
Ecological context	**0**	**2***	**0**	**0**	**0**	**0**	
Size, shape and buffering	-	2*	-	-	-	-	
Sensitivity to change	-	-	-	-	-	-	-
Ecological networks (linkages, pathways, migration)	-	-	-	-	-	-	-
Ecological Value	**VH**	**L**	**VH**	**H**	**H**	**H**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High. * = Scores not representative of corresponding row, scores required to produce 'Low' combined value.

Table 10-12: Assessment of ecological value for terrestrial ecology features in the Project Area (district plan vegetation)

Attributes to be considered	TL.3	Justification
Representativeness	**2**	
Typical structure and composition	1	TL.3: Habitat has been significantly altered by human activities (exotic dominated).
Indigenous representation	2	TL.3: 10-50% of the species are indigenous.
Rarity / distinctiveness		
Species of conservation significance	1	Areas of TL.3 are small, isolated and adjacent to roads, therefore unlikely to be utilised by bats. Non-TAR bird species expected to utilise TL.3.
Distinctive ecological values	1	
Diversity and pattern	**1**	
Habitat diversity	1	
Species diversity	1	
Patterns in habitat use	1	
Ecological context	**1**	
Size, shape and buffering		
Sensitivity to change		
Ecological networks (linkages, pathways, migration)	1	
Ecological Value	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

7 Appendix G – Aquatic Value Assessment

Table 10-13: Assessment of ecological value for aquatic ecology features (RH-S1a to RH-S5c)

Attributes to be considered	RH-S1a	RH-S1b	RH-S2a	RH-S2b	RH-S2c	RH-S3	RH-S4	RH-S5a	RH-S5b	RH-S5c	Justification
Representativeness	**1**	**1**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	
Riparian habitat modification	1	1	2	1	1	2	1	2	1	1	RH-S2a, S3, S5a = RHA total score is 40-70% relative to reference. All other RHA total scores are <40%.
Rarity / distinctiveness	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	
Species of conservation significance	3	3	3	3	3	3	3	3	3	3	Longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with the Project Area.
Diversity and pattern	**1**	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	
Level of natural diversity	1	1	3	1	1	2	1	2	1	1	Instream RHA scores: S1a = 8 (1) S1b = 6 (1) S2a = 30 (3) S2b = 6 (1) S2c = 6 (1) S3 = 22 (2) S4 = 6 (1) S5a = 19 (2) S5b = 6 (1) S5c = 6 (1)

Attributes to be considered	RH-S1a	RH-S1b	RH-S2a	RH-S2b	RH-S2c	RH-S3	RH-S4	RH-S5a	RH-S5b	RH-S5c	Justification
Ecological context	**3**	**3**	**4**	**3**	**3**	**4**	**3**	**4**	**3**	**3**	
Stream order	1	1	3	1	1	3	1	3	1	1	Order 2 streams = RH-S2a, S3, S5a All other streams are zero order streams.
Hydroperiod	3	3	4	3	3	4	3	4	3	3	Intermittent streams = RH-S1a, S1b, S2b, S2c, S4, S5b, S5c, S5 Permanent streams = RH-S2a, S3, S5a
Ecological Value	**L**	**L**	**M**	**L**	**L**	**M**	**L**	**M**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High.

Table 10-14: Assessment of ecological value for aquatic ecology features (RH-S5d to RH-S10)

Attributes to be considered	RH-S5d	RH-S5e	RH-S6	RH-S7a	RH-S7b	RH-S7c	RH-S7d	RH-S8	RH-S9	RH-S10	Justification
Representativeness	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	
Riparian habitat modification	1	1	2	2	1	1	1	1	1	1	RH-S6, S7a = RHA total score is 40-70% relative to reference. All other RHA total scores are <40%.
Rarity / distinctiveness	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	
Species of conservation significance	3	3	3	3	3	3	3	3	3	3	Longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with the Project Area.
Diversity and pattern	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	
Level of natural diversity	1	1	2	2	1	1	1	1	2	1	Instream RHA scores: S5d = 6 (1)

Attributes to be considered	RH-S5d	RH-S5e	RH-S6	RH-S7a	RH-S7b	RH-S7c	RH-S7d	RH-S8	RH-S9	RH-S10	Justification
											S5e = 6 (1) S6 = 19 (2) S7a = 24 (2) S7b = 8 (1) S7c = 8 (1) S7d = 9 (1) S8 = 6 (1) S9 = 17 (2) S10 = 6 (1)
Ecological context	**3**	**3**	**4**	**4**	**3**	**3**	**3**	**3**	**3**	**3**	
Stream order	1	1	2	2	1	1	1	1	1	1	Order 1 streams = RH-S6, S7a All other streams are zero order.
Hydroperiod	3	3	4	4	3	3	3	3	3	3	Intermittent streams = RH-S5d, S5e, S7b, S7c, S7d, S8, S9, S10 Permanent streams = RH-S6, S7a
Ecological Value	**L**	**L**	**M**	**M**	**L**	**L**	**L**	**L**	**M**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High.

8 Appendix H – Wetland Value Assessment

Table 10-15: Assessment of ecological value for wetland ecology features (RH-W1a to RH-W10)

Attributes to be considered	RH-W1a	RH-W2	RH-W3	RH-W4	RH-W5	RH-W6	RH-W7	RH-W8	RH-W9	RH-W10	Justification
Representativeness	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**3**	
Hydrological modification	2	3	3	3	3	3	3	1	3	3	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity / distinctiveness	**3**	**3**	**1**	**1**	**3**	**3**	**3**	**1**	**3**	**3**	
Species of conservation significance	3	3	1	1	3	3	3	1	3	3	North Island fernbird (At Risk – Declining, value score of 3) likely utilising large, palustrine wetlands that are present in the Project Area.
Vegetation type of conservation significance	1	1	1	1	1	1	1	1	1	1	Exotic-dominated vegetation.
Diversity and pattern	**3**	**2**	**4**	**4**	**2**	**4**	**4**	**3**	**3**	**3**	
Diversity of habitat types	3	2	4	4	2	4	4	3	3	3	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, small wetlands (< 100 m2) that provide only temporary (<3 months / year) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal, and temporary habitat were scored higher.

Attributes to be considered	RH-W1a	RH-W2	RH-W3	RH-W4	RH-W5	RH-W6	RH-W7	RH-W8	RH-W9	RH-W10	Justification
Ecological context	**3**	**3**	**4**	**4**	**3**	**4**	**4**	**2**	**3**	**3**	
Flood attenuation	2	2	3	3	2	2	4	2	2	2	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered include surface roughness, slope, size of flood benches, and sinuosity.
Streamflow augmentation	2	2	3	3	2	3	4	2	3	3	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation / inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	3	3	3	3	3	4	3	2	3	3	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	3	3	3	3	3	4	3	2	3	3	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher,

Attributes to be considered	RH-W1a	RH-W2	RH-W3	RH-W4	RH-W5	RH-W6	RH-W7	RH-W8	RH-W9	RH-W10	Justification
											while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	2	2	4	4	2	4	4	1	3	3	Scores reflect differences in the position of wetlands within the larger stream networks.
Ecological Value	**M**	**M**	**M**	**M**	**M**	**H**	**H**	**L**	**M**	**M**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

Table 10-16: Assessment of ecological value for wetland ecology features (RH-W11 to RH-W14, RH-W1b, RH-01)

Attributes to be considered	RH-W11	RH-W12	RH-W13	RH-W14	RH-W1b	RH-O1	Justification
Representativeness	**3**	**3**	**3**	**3**	**1**	**1**	
Hydrological modification	3	3	3	3	1	1	Scoring considered abstraction (including the presence and extent of exotic trees with high evapotranspiration rates), regulation by impoundments, drains or increased runoff from agricultural land or urban development.
Rarity / distinctiveness	**3**	**3**	**3**	**1**	**1**	**1**	
Species of conservation significance	3	3	3	1	1	1	North Island fernbird (At Risk – Declining, value score of 3) likely utilising large, palustrine wetlands that are present in the Project Area.
Vegetation type of conservation significance	1	1	1	1	1	1	Exotic-dominated vegetation.
Diversity and pattern	**4**	**3**	**3**	**3**	**1**	**2**	

Attributes to be considered	RH-W11	RH-W12	RH-W13	RH-W14	RH-W1b	RH-O1	Justification
Diversity of habitat types	4	3	3	3	1	2	Scores reflect differences in the representation of different habitats associated with the period of inundation and or saturation. For example, small wetlands (< 100 m2) that provide only temporary (<3 months / year) saturation was scored lower while larger wetlands (> 500 m2) with permanent, seasonal, and temporary habitat were scored higher.
Ecological context	**3**	**3**	**3**	**3**	**2**	**4**	
Flood attenuation	3	2	2	2	1	1	Scores reflect differences in wetland size in relation to its catchment (a wetland size that is >10% of its catchment was scored higher). Additional consideration was given to the way in which stormflows are spread across the wetland. Other factors considered include surface roughness, slope, size of flood benches, and sinuosity.
Streamflow augmentation	3	3	3	3	1	1	Scores reflect differences in the size and representation of different hydroperiods for each wetland. Wetlands with > 50% permanent saturation / inundation and that are directly connected to a downslope stream were scored higher. A temporary isolated wetland (such as a small seep) scored lower.
Sediment trapping	3	3	3	3	1	4	Scores reflect differences in estimated likely sediment yields from the catchments of each wetland (highest for steep catchments with no vegetation cover) against the ability of each wetland to trap sediment. Wetlands with diffuse flow patterns have high capacity to trap sediment while wetlands with strongly channelled flows and drains scored lower. Scoring also considered how frequently stormflows move through the wetland (>1 in 5 years likely to score lower, while >1 per year score higher).
Water purification	3	3	3	3	2	2	Scores consider sources of contamination in the wetland's catchment (agrichemicals, urban runoff etc) and the wetland's capacity to treat (size relative to catchment and hydrological modification). As an example, a pasture wetland that is >10% of catchment and which retains hydrological integrity scored higher, while a very small wetland that was <1% of its catchment and modified scored lower.
Connectivity and migration	3	3	3	3	1	1	Scores reflect differences in the position of wetlands within the larger stream networks.
Ecological Value	**H**	**M**	**M**	**M**	**L**	**L**	

Notes: N = Negligible, L = Low, M = Moderate, H = High, VH = Very High

9 Appendix I – Impact Assessment

Phase	Project Activity	Resource	Ecological Value	Main Effect Description	Detailed Effect Description	Type	Extent (ZOI)	Duration	Frequency	Likelihood	Reversibility	Magnitude (pre-mitigation)	Level of Effect (pre-mitigation)
Construction	Noise/vibration/lighting	Long-tailed bat	Very High	Construction- Bats	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Highly Likely	Totally	Low	Moderate
Operation	Presence of the road	Long-tailed bat	Very High	Operation- Bats	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure.	Indirect	Regional	Permanent (>25 years)	-	Highly Likely	Irreversible	High	Very High
Operation	Presence of the road	Long-tailed bat	Very High	Operation- Bats	Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Highly Likely	Irreversible	Moderate	High
Construction	Noise/vibration/lighting	Non-TAR Bird	Low	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Definite	Totally	Moderate	Low
Construction	Noise/vibration/lighting	Northern New Zealand Dotterel	Very High	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Low
Construction	Noise/vibration/lighting	North Island Fernbird	High	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Likely	Totally	Low	Low
Operation	Presence of the road	Non-TAR Bird	Low	Operation- Birds	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure.	Indirect	Local	Permanent (>25 years)	-	Definite	Irreversible	High	Low
Operation	Presence of the road	Northern New Zealand Dotterel	Very High	Operation- Birds	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure.	Indirect	Local	Permanent (>25 years)	-	Unlikely	Irreversible	Negligible	Low
Operation	Presence of the road	North Island Fernbird	High	Operation- Birds	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure.	Indirect	Local	Permanent (>25 years)	-	Likely	Irreversible	Low	Low
Operation	Presence of the road	Non-TAR Bird	Low	Operation- Birds	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Definite	Irreversible	High	Low
Operation	Presence of the road	Northern New Zealand Dotterel	Very High	Operation- Birds	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Moderate
Operation	Presence of the road	North Island Fernbird	High	Operation- Birds	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Low
Construction	Noise/vibration/lighting	North Island kākā	High	Construction- Birds	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.).	Indirect	Local	Short-term (<5 years)	Frequently	Unlikely	Totally	Negligible	Very Low
Operation	Presence of the road	North Island kākā	High	Operation- Birds	Loss in connectivity due to permanent habitat loss, light and noise effects from the road, leading to fragmentation of terrestrial, wetland and riparian habitat due to the presence of the infrastructure.	Indirect	Regional	Permanent (>25 years)	-	Unlikely	Irreversible	Low	Low
Operation	Presence of the road	North Island kākā	High	Operation- Birds	Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration.	Indirect	Local	Permanent (>25 years)	Continuously	Unlikely	Irreversible	Low	Low
Construction	Vegetation removal	TL.3 (District Plan)	Low	Construction- Terrestrial habitat	District plan vegetation only. Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal.	Direct	Local	Permanent (>25 years)	-	Unlikely	-	Negligible	Very Low
Construction	Vegetation removal	Long-tailed bat	Very High	Construction- Bats	District plan vegetation only. Loss of foraging habitat due to vegetation removal.	Direct	Local	Permanent (>25 years)	-	Unlikely	-	Negligible	Low
Construction	Vegetation removal	Long-tailed bat	Very High	Construction- Bats	District plan vegetation only. Kill or injure individual bats due to vegetation removal.	Direct	Local	Short-term (<5 years)	-	Unlikely	-	Negligible	Low
Construction	Vegetation removal	Non-TAR Bird	Low	Construction- Birds	District plan vegetation only. Loss of foraging habitat due to vegetation removal.	Direct	Local	Permanent (>25 years)	-	Unlikely	-	Negligible	Very Low
Construction	Vegetation removal	Non-TAR Bird	Low	Construction- Birds	District plan vegetation only. Kill or injure individual due to vegetation removal.	Direct	Local	Short-term (<5 years)	-	Likely	-	Negligible	Very Low
Construction	Vegetation removal	North Island kākā	High	Construction- Birds	District plan vegetation only. Loss of foraging habitat due to vegetation removal.	Direct	Local	Permanent (>25 years)	-	Unlikely	-	Negligible	Very Low
Construction	Vegetation removal	North Island kākā	High	Construction- Birds	District plan vegetation only. Kill or injure individual due to vegetation removal.	Direct	Local	Short-term (<5 years)	-	Unlikely	-	Negligible	Very Low

10 Appendix J – Rapid Habitat Assessment Results

Table 10-17: Summary of RHA values

Stream ID	Deposited Sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width	Riparian shade	RHA Habitat Quality Score	Corresponding Habitat Value*
RH-S1a	1	2	1	1	2	2	1	3	8	8	**29**	**P**
RH-S1b	1	1	1	1	2	1	1	2	8	4	**22**	**P**
RH-S2a	1	6	6	8	7	3	7	4	5	7	**54**	**M**
RH-S2b	1	1	1	1	2	1	1	2	9	4	**23**	**P**
RH-S2c	1	1	1	1	2	1	1	2	8	6	**24**	**P**
RH-S3	1	4	4	4	5	5	5	4	9	7	**48**	**M**
RH-S4	1	1	1	1	2	1	4	3	9	5	**28**	**P**
RH-S5a	1	2	4	2	6	5	6	3	9	5	**43**	**M**
RH-S5b	1	1	1	1	2	1	3	2	8	4	**24**	**P**
RH-S5c	1	1	1	1	2	1	3	2	7	4	**23**	**P**
RH-S5d	1	1	1	1	2	1	3	2	7	4	**23**	**P**
RH-S5e	1	1	1	1	2	1	3	2	9	4	**25**	**P**
RH-S6	1	2	3	3	6	5	8	4	9	5	**46**	**M**
RH-S7a	1	4	1	4	8	7	9	5	9	7	**55**	**M**
RH-S7b	1	1	2	1	3	1	8	2	7	4	**30**	**P**
RH-S7c	1	2	1	1	3	1	8	2	9	5	**33**	**P**
RH-S7d	1	1	1	2	3	2	9	4	9	7	**39**	**P**
RH-S8	1	1	1	1	2	1	1	2	4	4	**18**	**P**
RH-S9	1	3	1	2	6	5	3	3	5	6	**35**	**P**
RH-S10	1	1	1	1	2	1	1	2	4	4	**18**	**P**

Notes:

* = Corresponding habitat values for each habitat quality score

P = Poor (Score 10-40)

M = Moderate (Score 41-60)

G = Good (Score 61-80)

E = Excellent (Score 81+)

Light blue shading = Permanent stream

No shading = Intermittent stream

11 Appendix K – Bat Survey Weather Conditions

Date	ABMs deployed	Maximum overnight wind gust (km/h)	Average Nightly Windspeed (km/h)	Minimum temperature in first four hours after sunset (°C)	Total rainfall in first two hours after sunset (mm)	Suitable for ABM data to be used
1-Nov	All	36.0	13.7	**9.2**	0.0	**No**
2-Nov	All	23.8	9.2	11.0	0.0	✓
3-Nov	All	22.3	7.8	**8.7**	0.0	**No**
4-Nov	All	18.0	5.8	11.0	0.0	✓
5-Nov	All	17.3	5.1	**7.7**	0.0	**No**
6-Nov	All	15.5	2.6	14.8	0.0	✓
7-Nov	All	23.8	5.7	14.6	0.0	✓
8-Nov	All	23.8	7.6	18.1	0.0	✓
9-Nov	All	41.8	14.7	17.0	0.0	✓
10-Nov	All	45.7	16.7	13.1	**4.2**	**No**
11-Nov	All	33.8	12.5	11.3	0.0	✓
12-Nov	All	29.2	7.0	**5.4**	0.0	**No**
13-Nov	All	18.4	4.1	11.4	0.0	✓
14-Nov	All	46.8	13.6	13.2	0.0	✓
15-Nov	All	39.6	9.4	**7.1**	0.0	**No**
16-Nov	All	19.8	6.3	13.0	0.0	✓
17-Nov	All	19.4	6.7	16.5	0.0	✓
18-Nov	3 & 4	26.6	7.3	10.0	0.2	✓
19-Nov	3 & 4	12.2	3.1	**4.8**	0.0	**No**
20-Nov	3 & 4	27.0	5.8	11.9	0.0	✓
21-Nov	3 & 4	34.6	14.3	11.4	0.0	✓
22-Nov	3 & 4	32.8	7.6	13.2	0.0	✓
23-Nov	3 & 4	34.2	12.5	15.1	0.0	✓
24-Nov	3 & 4	31.7	10.9	17.2	0.0	✓
25-Nov	3 & 4	36.4	12.4	13.4	0.0	✓

Date	ABMs deployed	Maximum overnight wind gust (km/h)	Average Nightly Windspeed (km/h)	Minimum temperature in first four hours after sunset (°C)	Total rainfall in first two hours after sunset (mm)	Suitable for ABM data to be used
26-Nov	3 & 4	12.2	4.3	-	0.0	✓

12 Appendix L – Site Photographs (2019)

Plate 1 – Exotic scrub (ES) present in the Project Area.

Plate 2 – ABM in situ in the Project Area, adjacent to stream and treeland habitat.

Plate 3 – Exotic wetland (EW) present in the Project Area. Small stand of exotic eucalyptus forest in background.

Plate 4 – Exotic wetland (EW) present in the Project Area.

Plate 5 – Example of a typical stream channel on site in 'Poor' condition, with damage from stock pugging and removal of natural riparian vegetation.

Plate 6 – Example of habitat where opportunistic searches for lizards were undertaken.

Plate 7 – Exotic-dominated treeland (TL.3) present in the Project Area.

Plate 8 – Open water area present in the Project Area (stock water dam).

Figure 10-1: Site photographs (2019)