TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Pukekohe Transport Network
# Assessment of Ecological Effects

September 2023

Version 1.0

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

# Document Status

| Responsibility | Name |
|---|---|
| Authors | Ian Bredin, Sahar Firoozkoohi |
| Reviewer | Fiona Davies |

# Revision Status

| Version | Date | Reason for Issue |
|---|---|---|
| 1.0 | 11/09/2023 | Final for lodgement |

# Table of Contents

# Appendices

# Table of Tables

# Table of Figures

# Glossary of Defined Terms and Acronyms

| Acronym/Term | Description |
|---|---|
| ABM | Acoustic Bat Monitoring |
| AC | Auckland Council |
| AEE | Assessment of Effects on the Environment |
| AT | Auckland Transport |
| AUP:OP | Auckland Unitary Plan Operative in Part |
| BMP | Bat Management Plan |
| CIA | Cultural Impact Assessment |
| DOC | Department of Conservation |
| ED | Ecological District |
| EcIA | The Ecological Impact Assessment |
| EIANZ | Environment Institute of Australia and New Zealand |
| FUZ | Future Urban Zone |
| GIS | Geographic Information System |
| LINZ | Land Information New Zealand |
| LMP | Lizard Management Plan |
| NIMT | North Island Main Trunk |
| NIWA | National Institute of Water and Atmospheric Research |
| NoR | Notice of Requirement (under the Resource Management Act 1991) |
| NPS-FM | National Policy Statement on Freshwater Management |
| NPS-IB | National Policy Statement for Indigenous Biodiversity |
| NZFFD | New Zealand Freshwater Fish Database |
| Project Area | Pukekohe Transport Network / Area that is located within the designation footprint (including all its associated NoRs) |
| RMA | Resource Management Act 1991 |
| RHA | Rapid Habitat Assessment |
| SEA | Significant Ecological Area |
| SEV | Stream Ecological Valuation |
| SH | State Highway |
| SNA | Significant Natural Area |
| TAR | Threatened and At Risk |

| Acronym/Term | Description |
|---|---|
| Te Tupu Ngātahi | Te Tupu Ngātahi Supporting Growth Alliance |
| Waka Kotahi | Waka Kotahi NZ Transport Agency |
| WDC | Waikato District Council |
| WDP | Waikato District Plan |
| ZOI | Zone of Influence |

# Executive Summary

This assessment of ecological effects has been prepared for the Te Tupu Ngātahi Supporting Growth Alliance (Te Tupu Ngātahi), Pukekohe Transport Network Project and nine Notices of Requirements (NoRs) for Auckland Transport (AT) and Waka Kotahi NZ Transport Agency as requiring authorities under the Resource Management Act 1991 (RMA). The notices (refer to the table below) are to designate land for future strategic transport corridors as part of Te Tupu Ngātahi Supporting Growth Alliance to enable the future construction, operation, and maintenance of transport infrastructure in the vicinity of Pukekohe, Paerata and Drury.

| Notice | Project |
|---|---|
| NoR 1 | Drury West Arterial |
| NoR 2 | Drury-Pukekohe Link |
| NoR 3 | Paerata Connections |
| NoR 4 | Pukekohe North-East Arterial |
| NoR 5 | Pukekohe South-East Arterial |
| NoR 6 | Pukekohe South-West Upgrade |
| NoR 7 | Pukekohe North-West Arterial |
| NoR 8 (AC) | Mill Road and Pukekohe East Road Upgrade (Auckland jurisdiction) |
| NoR 8 (WDC) | Mill Road and Pukekohe East Road Upgrade (Waikato jurisdiction) |

As the Pukekohe Transport Network Project relates to proposed designations, only Auckland and Waikato district plan matters have been assessed. Regional matters (along with Wildlife Act (1953) compliance) will be subject to a future consenting phase along with a supporting Ecological Impact Assessment. As such, regional matters have not been formally assessed in this report, however the relevant matters have been screened to inform the designation boundary and future regional resource consents.

To inform the ecological baseline, ecological features within each NoR boundary were identified, mapped and their value assessed in terms of representativeness, rarity/distinctiveness, diversity/pattern and ecological context. Ecological features included:

- A total of 15 vegetation types ranging in value from Negligible to High.
- Long-tailed bats were associated with all NoRs, however they were considered unlikely to occur within NoR 6. The bats were assessed to have a Very High value.
- A total of 48 avifauna species may be present, of which, 28 are native, 14 have a Threatened or At-Risk status, and the remainder are exotic. The Threatened or At-Risk species were considered unlikely to occur within NoR 6.
- Two native skink species with an At Risk- Declining status were identified to likely occur within all of the NoRs, except NoR 6. Three native gecko species with an At Risk- Declining status were identified to possibly occur within remaining adjacent indigenous forest patches, which marginally extend into NoR 4.

- A total 35 streams (intermittent and permanent) were assessed and range in value from Low to High. Streams are associated with the following main catchments: Ngakoroa Stream, Oira Creek, Whangapouri Creek, and Tutaenui Stream catchments.
- A total of seven native fish of which two have an At-Risk status have the potential to occur in the Pukekohe Transport Network area.
- Extensive natural inland wetland habitat was identified within the Pukekohe Transport Network project area. Wetlands range in value from Negligible to Moderate.

The district ecological matters relevant to construction and operation, prior to any mitigation, were assessed. All ecological effects assessed to be **Moderate** or higher required mitigation. These effects included:

- Effects on long-tailed bats and their roosts due the removal of district plan (Auckland and Waikato) trees within NoR 8.
- Effects on Threatened and At-Risk (TAR) herpetofauna species due to the removal of district plan (Auckland and Waikato) vegetation in NoR 8.
- Disturbance and displacement to TAR and native birds, and nest sites, resulting from construction activities (except NoR 3 and 6).
- Habitat fragmentation leading to loss in connectivity to long-tailed bats, due to light, noise, and vibration effects from the operation of the road.
- Disturbance and displacement of long-tailed bats and roost sites due to light, noise, and vibration effects from the operation of the road.
- Disturbance and displacement of TAR and native birds (including nest sites) due to light, noise, and vibration effects from the operation of the road.
- Habitat fragmentation leading to loss in connectivity to TAR and native birds, due to light, noise, and vibration effects from the operation of the road.

The recommended mitigation to reduce the **Moderate** or higher ecological effects relevant to construction and operation of the Pukekohe Transport Network included:

- A Bat Management Plan (BMP) for all NoRs except NoR 6, and specific recommendations for NoR 8 only. The BMP should include:

– Bat surveys prior to construction to confirm presence/likely absence.
– Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during December through to March).
– Positioning of compounds and laydown areas to avoid relevant habitats (refer to Table 8-1).
– Lighting design to reduce light levels and spill from construction areas.
– Restriction of nightworks around relevant habitats (refer to Table 8-1).
– Bat management should be integrated with any regional consent conditions that may be required for regional compliance.
– Lighting design to minimise light levels and light spill along the road corridor.
– Buffer planting should focus on the riparian corridors of the permanent streams crossed by the NoRs (refer to Table 6-8), and where possible retaining of existing mature tree features, as well as indicating riparian corridors where planting of mature trees could occur.
– Consideration to the provisions of the Wildlife Act including the implementation of a vegetation removal protocol (Bat Roost Protocol v2 DOC, 2021 or equivalent version at time of removal) (NoR 8).

- Where possible, retain existing mature trees (this is in accordance with the Urban and Landscape Design Management Plan (ULDMP) and Landscape Management Plan) (NoR 8).
- Artificial bat roosts (i.e., Bat boxes) should be erected within, or in close proximity to, where suitable roost habitat (i.e., large mature trees) is to be removed in NoR 8. A 1:1 ratio is recommended. The introduction of artificial bat roots will help to mitigate the short-medium term loss of suitable vegetation.
- An adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action.

- An Avifauna Management Plan for all Threatened and At Risk-Declining birds is recommended as a condition on the proposed designation for NoR 1, NoR 2, NoR 4, NoR 5, NoR 7, and NoR 8 (AC and WDC) – all NoRs except NoR 3 and NoR 6. This should consider the following:

- Pre-construction nesting bird surveys throughout wetlands, riparian habitat, and remaining native forest patches (refer to Table 8-5).
- Where practical, construction works near wetland habitat (Table 8-5) should commence prior to the bird breeding season (September to February) in order to discourage bird nesting.
- Bird management should be consistent with any regional consent conditions that may be required for regional compliance.
- Consideration of the provisions of the Wildlife Act including timing vegetation removal to avoid the key nesting period (September to February) or where this is not possible, pre-clearance inspections undertaken prior to vegetation removal (wetlands, riparian habitat listed in Table 8-5, and forest patches WF (warm forest) 9, WF 7 and MF (mild forest) 4 within NoR 4).
- Retention of vegetation near wetland habitat, riparian habitat, and forest habitat (refer to Table 8-6).
- Where practicable, the retention of remaining forest patches, particularly the portions marginally within NoR 4 (i.e., WF 9, WF 7, and MF 4).
- Buffer planting between the road alignment and suitable habitat adjacent to the relevant wetlands and riparian habitats (Table 8-6).

- A Lizard Management Plan (LMP) for the removal of vegetation within NoR 8 (WDC) and tree removal within NoR 8 (AC) (district plan trees identified in the Pukekohe Assessment of Arboricultural Effects Report). This should consider the following:

- Preconstruction surveys and/or habitat potential surveys to confirm (potential) presence and guide further management.
- Timing of the implementation of the LMP.
- A description of methodology for survey, trapping and relocation of lizards rescued including but not limited to: salvage protocols, relocation protocols (including method used to identify suitable relocation site(s)), nocturnal and diurnal capture protocols, supervised habitat clearance/transfer protocols, artificial cover object protocols, and opportunistic relocation protocols.
- A description of the relocation site(s); including discussion of:
    1. provision for additional refugia, if required e.g., depositing salvaged logs, wood or debris for newly released native skinks that have been rescued;
    2. any protection mechanisms (if required) to ensure the relocation site is maintained (e.g.) covenants, consent notices etc.; and
    3. any weed and pest management to ensure the relocation site is maintained as appropriate habitat.

- Monitoring methods, including but not limited to: baseline surveying within the site; baseline surveys outside the site to identify potential release sites for salvaged lizard populations and lizard monitoring sites; ongoing annual surveys to evaluate translocation success; pre and post – translocation surveys; and monitoring of effectiveness of pest control and/or any potential adverse effects on lizards associated with pest control;
- A post-vegetation clearance search for remaining lizards.
- A suitably qualified and experienced ecologist/herpetologist approved to oversee the implementation of the LMP shall certify that the lizard related works have been carried out according to the certified LMP within two weeks of completion of the vegetation clearance works.
- Lizard management should be consistent with any regional consent conditions (and the Wildlife Act 1953) that may be required for regional compliance.

The residual impacts from the **Moderate** or higher ecological effects were all assessed as **Low** post mitigation. As such, no further impact management is anticipated.

Consideration was also given to future regional resource consenting matters and the range of ecological assessments likely required to inform the regional consenting process. These may include:

- Detailed habitat and fauna surveys to inform the Ecological Impact Assessment which will be used to support future regional resource consent.
- Stream Ecological Valuation assessments will need to be undertaken to inform the re-evaluation of streams. Opportunities to restore riparian habitat along these features will also need to be taken into consideration. Fish salvage and relocation, sediment control and management of the riparian condition will also be required.
- A detailed wetland assessment, including delineation and functional assessments, will be required. Opportunities for wetland restoration and / or enhancement will also need to be assessed.
- An additional cumulative ecological effects assessment. The cumulative effect of all the NoRs proposed within the Pukekohe Transport Network Project requires consideration, along with other key drivers of change. A more comprehensive cumulative ecological effects assessment should be undertaken early in the resource consenting process.

# 1 Introduction

## 1.1 Purpose and scope of this Report

This ecology assessment forms part of the suite of technical reports prepared to support the Assessment of Effects on the Environment (AEE) for nine Notices of Requirements (NoRs) being sought by Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT) for the Pukekohe Transport Network under the Resource Management Act 1991 (RMA).

This report considers the actual and potential effects associated with the construction, operation, and maintenance of the Pukekohe Transport Network on the existing and likely future environment as it relates to ecological effects pertaining to district plan matters, and recommends measures that may be implemented to avoid, remedy, and/or mitigate these effects.

## 1.2 Report Structure

The report is structured as follows:

- The project overview with a summary of the Pukekohe Transport Network is in section 2.
- An overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines is in sections 3 and 4.
- The identification and description of the existing and likely future environment is in section 5.
- A description of the ecological baseline is in section 6.
- A description of the actual and potential positive ecological effects the Project will likely have, is provided in section 7.
- A description of the actual and potential adverse effects, including recommended measures to avoid or mitigate both potential construction and operational effects, the Project corridors will likely have on terrestrial, freshwater, and wetland ecology, is in section 8.
- Recommended design and future resource consent considerations is in section 9.
- An overall conclusion of the level of potential adverse ecological effects of the Pukekohe Transport Network after recommended measures are implemented is in section 10.

This report should be read alongside the AEE, which contains further details on the history and context of the Project. The AEE also contains a detailed description of works to be authorised for the Pukekohe Transport Network Project as a whole and each NoR, and likely staging and the typical construction methodologies that will be used to implement this work. These have been considered as part of this assessment of ecological effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

# 2 Pukekohe Transport Network Overview

The Pukekohe Project comprises nine NoRs through Pukekohe, Paerata and Drury (Figure 2-1). A concept design has been undertaken for the NoRs. The design will be further refined through future phases of the Project and will be undertaken within the scope of the designation conditions and future resource consent conditions. The detailed design of the Project will be undertaken prior to construction and reflected in the Outline Plan(s) which will be submitted to Council as set out in s176A of the RMA.

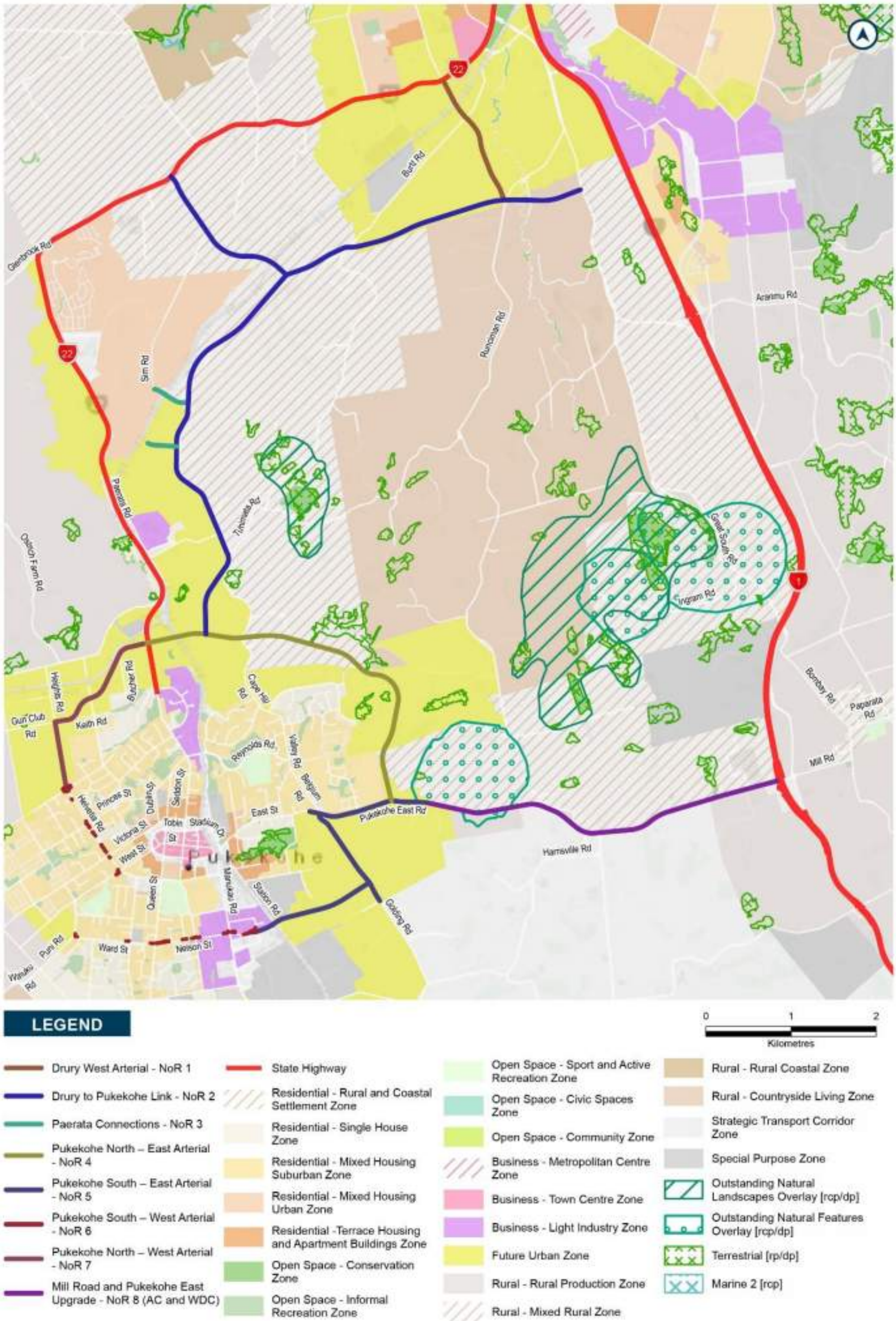



**Figure 2-1 Pukekohe Transport Network**

**Table 2-1 Pukekohe Package Project Summary**

| NoR | Project | Requiring Authority | Description |
|---|---|---|---|
| 1 | **Drury West Arterial** | • AT | • NoR 1 is a 1.6km new transport corridor extending south from the intersection of SH22 and Jesmond Road to the proposed Drury to Pukekohe Link (NoR 2).<br>• It connects Drury West Town Centre, Drury West Rail Station and provides access to the strategic transport network including SH1 and SH22. It connects with Burtt Road and to Runciman Road in the south.<br>• This new transport corridor improves local connectivity in Drury West and the wider area to centres, employment and rail stations.<br>• Between SH22 and Burtt Road, the proposed cross section is a four lane arterial 30m wide. This includes two lanes for PT and walking and cycling facilities on both sides of the corridor.<br>• South of Burtt Road a two lane arterial with a 24m wide cross section is proposed with two lanes for general traffic and walking and cycling facilities on both sides of the corridor.<br>• Three new bridges are proposed over existing North Island Main Trunk (NIMT) rail line, and two tributaries of the Ngakoroa Stream.<br>• Three new stormwater wetlands are proposed and new culverts and swales. |
| 2 | **Drury-Pukekohe Link** | • Waka Kotahi | • NoR 2 provides a north south strategic corridor with two general traffic lanes proposed and active transport facilities on one side of the corridor. The total length of the NoR is 10.6km.<br>• NoR 2 is split into the following four segments. |
| | South Drury Connection segment | | • South Drury Connection segment provides a new connection extending from Great South Road in the east at the proposed SH1 Drury South Interchange (a proposed Waka Kotahi SH1 project). The alignment is along the edge of the FUZ to Burtt Road in the west.<br>• It provides a strategic connection improving local access in Drury West, provides resilience in the transport network supporting SH22 and SH1, provides direct connectivity to the proposed Drury South Interchange and supports the proposed strategic active modes corridor.<br>• A 24m wide cross section is proposed with two lanes for general traffic, with walking and cycling on one side of the corridor.<br>• Three new bridges are proposed over tributaries of the Ngakoroa Stream.<br>• Three stormwater wetlands are proposed and new culverts and swales. |

| NoR | Project | Requiring Authority | Description |
|---|---|---|---|
| | SH22 Connection segment | | • Connecting with the South Drury Connection and Drury-Paerata Link segments, this connection provides a strategic connection between State Highway 1 and State Highway 22.<br>• It improves access between Drury West and Paerata, provides resilience in the transport network supporting SH22 and SH1, provides direct connectivity to the proposed Drury South Interchange and supports the proposed strategic active modes corridor.<br>• It includes new transport corridor and a partial upgrade of Sim Road (north).<br>• A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on one side of the corridor.<br>• Two new bridges are proposed over the Oria Creek and NIMT.<br>• Two stormwater wetlands are proposed and new culverts and swales. |
| | Drury-Paerata Link segment | | • Drury-Paerata Link segment is a new corridor connecting the segments of South Drury Connection, SH22 Connection and Paerata Arterial. This segment extends from an intersection with Burtt Road in the north, to the Paerata Arterial segment in the south.<br>• It provides connectivity between Drury and Paerata providing a strategic connection between two areas of future urban development.<br>• A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on one side of the corridor.<br>• Two bridges are proposed over tributaries of the Oira Creek.<br>• Three stormwater wetlands are proposed and new culverts and swales. |
| | Paerata Arterial segment | | • Paerata Arterial segment is located along the eastern edge of Paerata FUZ. It connects with Paerata Connections NoR 3 at the northern extent and to the proposed Pukekohe North East Arterial NoR 4 at its southern extent.<br>• It includes an upgrade of part of Sim Road (south), Tuhimata Road and a new section of transport corridor.<br>• It increases connectivity to Paerata FUZ, Paerata Rail Station and Pukekohe Town Centre.<br>• A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on one or both sides of the corridor. No bridges are proposed.<br>• Six stormwater wetlands are proposed wetlands (one shared with NoR 4 and one shared with NoR 3) and new culverts. |
| 3 | **Paerata Connections** | AT | • The Paerata Connections provide two connections from the existing Sim Road (south) proposed to be upgraded by NoR 2 to the Paerata Rail Station and Paerata Rise development.<br>• The connections provide the primary east-west connections for all modes in Paerata. |

| NoR | Project | Requiring Authority | Description |
|---|---|---|---|
| | | | • NoR 3 has includes two segments:<br>• Sim to Sim Connection segment provides a new connection of approximately 400m between the two extents of Sim Road over the railway (NIMT).<br>• Paerata Rail Station Connection segment provides a new transport corridor approximately 330m in length between the Paerata Rail Station (KiwiRail designation 6311 currently under construction) and NoR 2.<br>• A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on both sides of the corridor.<br>• One bridge is proposed over the NIMT to connect the two extents of Sim Road for the Sim to Sim Connection segment.<br>• One new stormwater wetland is proposed that is shared with NoR 2 and a new culvert. |
| 4 | **Pukekohe North-East Arterial** | AT | • The Pukekohe North-East Arterial is an approximately 4km new transport corridor from SH22 in the northwest connecting to Pukekohe East Road in the south east.<br>• It connects the strategic corridors at SH22 (at the northern extent of the Pukekohe North West Arterial NoR 7), the Drury to Pukekohe Link NoR 2 and Pukekohe East Road proposed to be upgraded by NoR 5 and NoR 8.<br>• Its primary function is for general traffic, freight, an active mode links between future neighbourhoods and alleviating traffic on existing roads at Cape Hill Road and Valley Road.<br>• A 24m wide cross section is proposed with 2 lanes for general traffic and walking and cycling proposed on both or one side of the corridor.<br>• Seven bridges are proposed over the Whangapouri Creek, the NIMT, and other unnamed streams and tributaries.<br>• Six new stormwater wetlands are proposed and new culverts. |
| 5 | **Pukekohe South-East Arterial** | AT | • The Pukekohe South-East Arterial upgrades part of Pukekohe East Road, Golding Road and provides a new connection between Golding Road (from north of Royal Doulton Drive) and across Station Road and the NIMT to the existing industrial development on Crosbie Road to Svendsen Road.<br>• It is a primary east-west connection to assist in redirecting general traffic and freight away from the Pukekohe town centre to provide additional resilience to the wider network.<br>• A 24m wide cross section is proposed with two lanes for general traffic with walking and cycling on the southern side of the corridor on Pukekohe East Road and on both sides for the remainder of the corridor.<br>• One bridge is proposed crossing Station Road and the NIMT.<br>• Five new stormwater wetlands are proposed and new and upgraded culverts. |

| NoR | Project | Requiring Authority | Description |
| --- | --- | --- | --- |
| 6 | **Pukekohe South-West Upgrade** | AT | • Pukekohe South West Arterial involves the re-allocation of road space within the existing road corridor for a bi-directional cycle way and footpath upgrade. The proposed designation is limited to specific intersections and driveways to safely accommodate active mode facilities. The existing road reserve is to be utilised where possible retaining a 20m wide cross section with 2 lane general traffic, walking on both sides and a bi-directional cycleway on one side of the corridor.<br>• No bridges or stormwater wetlands are proposed. |
| 7 | **Pukekohe North-West Arterial** | AT | • Pukekohe North-West Arterial provides a connection between Helvetia Road in the southwest and SH22 in the northeast. It upgrades part of Helvetia Road, utilises part of Keith Road (a paper road), and forms a new connection between Beatty Road and Butcher Road to SH22 – connecting to the Pukekohe North East Arterial NoR 4.<br>• It provides an alternative connection for all modes travelling north to south in west Pukekohe assisting in redirection of general traffic away from the town centre and provides additional resilience to the wider network. A 24m wide cross section is proposed with two lanes for general traffic and walking and cycling on both sides of the corridor.<br>• No bridges are proposed.<br>• Two new stormwater wetlands are proposed and new and upgraded culverts. |
| 8 (AC)<br>And<br>8 (WD) | **Mill Road and Pukekohe East Road Upgrade** | Waka Kotahi | • NoR 8 upgrades Mill Road (Bombay) in the east and Pukekohe East Road in the west.<br>• It provides an important strategic connection between Auckland and Waikato and from SH1 to Pukekohe urban areas for traffic and freight, with a major rural active mode connection. Harrisville Road plays a significant role in distributing traffic from further south into Waikato.<br>• Mill Road is proposed to be upgraded to four lanes (2.1 kms) from SH1 in the east to Harrisville Road in the west. It has a 30m wide cross section with four lanes for general traffic, with walking and cycling on the southern side.<br>• Pukekohe East Road is proposed to be upgraded (3.4 kms) for walking and cycling facilities on the southern side from Harrisville Road in the east to NoR 5 in the west.<br>• One new stormwater wetland is proposed, swales and new and upgraded culverts. |

# 3 Assessment Approach

## 3.1 Preparation for this Report

Work undertaken for this report commenced in November 2022. In summary, the preparation for this work has included:

- Input to the options assessment process used to inform the preferred transport corridor alignment.
- Reviews of the project concept designs and Te Tupu Ngātahi GIS viewer and attendance at design review workshops.
- A review of the statutory setting of the Project and surrounding context.
- A review of background reports / other material.
- A review of the other GIS data such as contours and aerial photography [where relevant].
- Site visits, which were undertaken during December 2022 through to April 2023 to further understand the receiving environment.
- A site visit on 26 January 2023 with the project team.
- A specialists' workshop held on 22 March 2023 to discuss initial findings following the first project team site visit.

Alongside the preparation of this assessment, the authors have reviewed the following documents:

- Construction Method Statement
- Revisions of concept design drawings
- Other Technical Assessments:
    - Arborists Assessment
    - Urban Design Assessment
    - Flood Effects Assessment

Where other matters or expertise have been relied upon, these have been stated/referenced within the assessment.

## 3.2 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 in the EIANZ Guidelines and forms the basis of this report. This process is summarised in Figure 3-1 below and detailed in Appendix 1. Note that for the impact management (Stage 3) additional consideration was given to the permitted baseline and the future environment under the Auckland Unitary Plan: Operative in Part (AUP:OP).

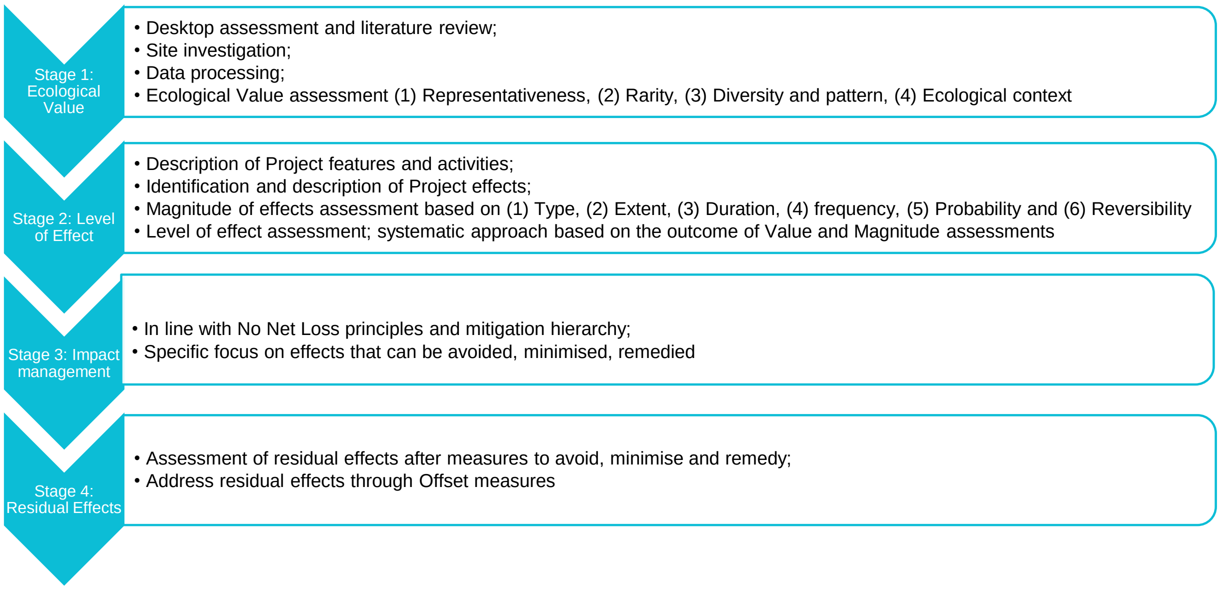



**Figure 3-1 Approach process followed for this assessment**

## 3.3 Mana Whenua Values

Māori value indigenous species for a variety of reasons with two key components being whakapapa (or genealogical and ancestral connection) and mahinga kai (food and resource gathering practices). According to the EIANZ Guidelines, mana whenua values may be considered when making ecological evaluations. Importantly, effects on these values should only be assessed by the appropriate iwi or hapū, or by working in collaboration with mana whenua.

At the impact management stage, management of impacts on cultural values and on ecological values may involve similar goals and there may be synergies around approaches to achieving those goals (EIANZ Guidelines). A Cultural Impact Assessment (CIA) was undertaken for the project and numerous huis held with mana whenua to discuss the ecological values and proposed mitigation for the project. Feedback was sought on numerous occasions, which in several cases resulted in design or designation adjustments where features of high ecological and cultural value were avoided. Overall, this process formed an integral part of the EcIA process.

## 3.4 EcIA and the Likely Future Ecological Environment

The EIANZ Guidelines provide guidance to assist with the assessment of the likely future ecological environment in this report. The EIANZ Guidelines state:

*"The ecologist needs to consider the permitted baseline to describe the potential future ecological environment and to assess effects at that time and should discuss this with the project planner or legal advisor if in any doubt".*

The Pukekohe Planning Team advised of the following to inform the assessment of the likely future environment:

- The purpose of the NoRs within the Pukekohe Transport Network Project is to protect the transport corridors that will support the future urbanisation of Pukekohe, Paerata, and Drury. Construction and operation of the new corridors will not occur until urbanisation has been confirmed or is under

development in the area. Guidance on the future urbanisation can be taken from Council's Pukekohe-Paerata and Drury-Ōpāheke Structure Plans.
- In addition, the AUP:OP and the Waikato District Plan (WDP) (Franklin Section) / Waikato Regional Plan permits activities for infrastructure, will also change the likely future environment. These activities include vegetation clearance and the removal of trees, excluding notable trees and street trees. The relevant permitted activities for ecology provisions are set out in Appendix 2.
- Given the planned urbanisation, particularly around Pukekohe, Paerata and Drury, assessing the effects on the environment solely as it exists today (i.e., at the time of ecological site investigations/the preparation of this ecology assessment report) does not provide an accurate reflection of the environment in which ecological effects, resulting from the construction and operation of each of the NoRs, will be experienced.
- The assessment of ecological effects also takes account of the likely future environment, which takes account of permitted activities for infrastructure and planned urbanisation within the Future Urban Zone (FUZ) and the operational effects of the transport corridors in an urban environment (where they are currently located in the FUZ).

## 3.5 Permitted Activities and the Future Ecological Environment

Vegetation clearance activities within the FUZ are identified as permitted activities within Chapters E26 and E15 of the AUP:OP. Habitat for Threatened and At Risk (TAR) species, vegetation within 10m of a riparian strip, and tree removal (regional plan vegetation only) are excluded from these permitted activities.

The assessment of ecological effects has taken this into account. The assessment was undertaken on the understanding that:

- Terrestrial ecological features (i.e., terrestrial habitat and the species supported by these habitats) which are currently present within and adjacent to the NoRs are likely to be present during the construction of the transport corridor.
- Terrestrial ecological features within the areas zoned as FUZ, adjacent to the NoR, will likely be removed by future development, and the majority of these features are unlikely to be present when the new or upgraded transport corridor is operational.
- Natural wetlands, streams, riparian edges, and the associated habitat for TAR species within and adjacent to the NoRs will be present during construction and operation of the transport corridor.

## 3.6 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. For NoR 8 (AC) and (WD), the Mill Road and Pukekohe East Road Upgrade, the designated area will not only be subject to restrictions on land use under the AUP:OP but also the Waikato Regional Plan (i.e., A portion of NoR 8 is located within the Waikato jurisdiction).

As the Pukekohe Transport Network Project relates to proposed designations this assessment of ecological effects 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 for both the Auckland and Waikato regions have not been formally assessed in this report. However, the relevant matters have been screened to inform the concept design, options assessment, the proposed designation boundary, and future regional resource consents. The findings of this screening are presented in Section 9.

Appendix 2 sets out the split between District and Regional matters in the AUP:OP and the WDP (Franklin Section) (Operative), WDP (Proposed), and the Waikato Regional Plan for the section of Mill Road – Pukekohe East Road Upgrade (NoR 8) within the Waikato jurisdiction. In particularly it is worth noting that according to the WDP (proposed) ruling only indigenous vegetation clearance outside a Significant Natural Area is a Restricted Discretionary activity.

## 3.7 Wildlife Act Matters

The Wildlife Act 1953 includes specific provisions for activities that may disturb, injure, or kill native animals[1]. Construction and operational activities that may require consideration under the Wildlife Act are outlined in Appendix 2. The scope of this report pertains to district plan matters and although not required for NoRs, further consideration has been given to ecological effects under the Wildlife Act.

## 3.8 National Policy Statements

### 3.8.1 National Policy Statement for Freshwater Management

The overarching concept of the National Policy Statement for Freshwater Management (NPS-FM) is Te Mana o te Wai, which refers to the fundamental importance of water, and recognises that protecting the health of freshwater protects the health and well-being of the environment. The NPS-FM seek to ensure that natural and physical resources are managed in a way that prioritises:

- Firstly, the health and well-being of water bodies and freshwater ecosystems;
- Followed by the health needs of people; and
- Then the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

In particular, the NPS-FM seeks to protect natural wetlands, rivers, outstanding waterbodies, and habitats of indigenous freshwater species.

Ecological effects associated with activities that require regional consents and consideration under the NPS-FM were considered to inform design and alignment options for the Pukekohe Transport Network.

### 3.8.2 National Policy Statement for Indigenous Biodiversity

The National Policy Statement for Indigenous Biodiversity (NPS-IB) seeks to maintain indigenous biodiversity across New Zealand so that there is at least no overall loss in indigenous biodiversity. The NPS-IB highlights the need for a cautionary approach to considering effects on indigenous biodiversity both within and beyond Significant Natural Areas (SNAs) and including areas supporting

[1] The Freshwater Fisheries Regulations 1983 should also be taken into consideration with regards to indigenous fish species.

highly mobile fauna. Increased indigenous vegetation cover in urban and non-urban environments is promoted, as is information gathering and monitoring of indigenous biodiversity.

At the same time, the NPS-IB sets out a need to recognise and allow for activities which contribute to New Zealand's social, economic, cultural, and environmental wellbeing. The NPS-IB provides a consenting pathway for specified infrastructure which provides significant national or regional public benefit, and which has a functional or operational need to locate in a particular location, when there are no practicable alternatives.

At the date of preparing the report, the NPS-IB had not been given effect to in the AUP. However, many of the policy directions in the NPS-IB are already contained within the AUP and in relation to large scale infrastructure projects there is not a notable change in policy direction. The assessment of the project against the NPS-IB is therefore substantively similar to the assessment against the corresponding AUP provisions along with EIANZ 2018.

Ecological effects associated with activities that require regional consents and consideration under the NPS-IB are discussed in the report (e.g., highly mobile fauna such as long-tailed bats) and were considered to inform design and alignment options for the Pukekohe Transport Network.

# 4 Assessment Methodology

Desktop and site investigations were undertaken to investigate the ecological features within all eight transport projects. The investigations focused on the proposed designated corridors for each of the NoRs and the areas adjacent to the designation boundaries. The desktop mapping of ecological features extended beyond the proposed designation boundary[2], which allowed for terrestrial, stream, and wetland features, and native fauna[3] to be investigated to inform the concept design. In addition to the area included in the ecological mapping, significant ecological features and potential habitat for native fauna was considered within the Project Zone of Influence (ZOI), refer to section 4.1.

Through the options assessment and design processes, recommendations were made by the ecology team that were incorporated into the concept design. Potential ecological effects have been either avoided or reduced where possible through these processes[4]. The remaining ecological effects pertaining to district plan matters are assessed in this report (refer to section 8).

## 4.1 Zone of Influence

Ecological mapping of significant ecological features and potential habitat for native fauna was undertaken within the ZOI.[5] The distance of the ZOI and type of effect from the project can be different for different species and habitat types. 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 Pukekohe Transport Network. The ZOI is used throughout this report to describe the impacts of the project (for both construction and operational phases) on adjacent or connected terrestrial, freshwater, and wetland habitats, and associated native species. For example, all Significant Ecological Areas (SEAs) and Significant Natural Areas (SNAs) within approximately 2 km of the Pukekohe Transport Network have been included in the desktop review, along with their connectivity to each NoR. This was to ensure that these important habitats within the wider landscape were taken into consideration when determining the ZOI for the project.

The ZOI of the project varies for different species. This is largely dependent on how individual species use their environment. For example, mobile species such as long-tailed bats have a larger home range and more diverse habitat requirements (i.e., a larger ZOI), compared to lizards and threatened plant species, which may be restricted to a small area or specific habitat type (i.e., a smaller ZOI). This affects how a species could be impacted by the project. To reflect the likelihood of a species being affected by the project, species specific search distances were used. These differences were taken into consideration during the desktop review and site investigations.

## 4.2 Desktop Assessment

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 of the project (i.e., across all of the NoRs).

[2] The mapping of ecological features within and adjacent to the designated area allowed for desktop assessments of relatively small adjustments during refinement and provided additional context regarding the nature and extent of ecological features.

[3] Native fauna investigations focused on bats, birds, and reptiles.

[4] If required, evidence of this process is available in a standalone register documenting avoidance and reduced impacts.

[5] The ZOI 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*." ZOI's are known for some features (e.g., SEAs/SNAs) and species (e.g., bats), but not all species and/or habitats. Research to identify appropriate ZOIs for all relevant habitats/species is still ongoing. All known ZOIs (defendable based on scientific research/justification) are referenced.

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

- Auckland Council Geomaps[6];
- Department of Conservation (DOC) Bioweb records[7];
- Department of Conservation Threat Classification Series[8];
- Ecological Regions and Districts of New Zealand (McEwen, 1987);
- iNaturalist records[9], records within approximately 2-5 km buffer of the NoRs;
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al., 2017);
- National Institute of Water and Atmospheric Research (NIWA) freshwater fish database[10;]
- New Zealand Bird Atlas eBird database[11]; recorded within 10km$^2$ grid squares. Results from grid square AF68, AF69, AE69 and AE68;
- NZ River Name Lines (LINZ Data Service[12]);
- South Wide Ecological Impact Assessment Report, 2020;
- Satellite and aerial imagery from Google maps and Google Street View;
- Historical Image Resource[13]; and
- Waikato District Council Data Service[14]

## 4.3 Site Investigations

Site investigations[15] were undertaken to:

- Prepare an ecological baseline of terrestrial, freshwater, and wetland habitats, and the flora and fauna associated with these habitats;
- Inform the assessment of each of the NoRs against the relevant district matters (i.e., terrestrial ecology);
- Identify freshwater and wetland ecological criteria which may be considered as part of a future regional resource consent, or under relevant wildlife legislation; and
- Inform the proposed designation footprint.

### 4.3.1 Terrestrial Habitat

Site walkovers were undertaken between December 2022 and April 2023 by experienced ecologists; to map and describe the habitats present within and adjacent to each of the eight transport projects. Habitats were classified into ecosystem types based on those described in Singers et al. (2017)[16].

6 https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

7 https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/

8 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/

9 https://www.inaturalist.org/

10 https://nzffdms.niwa.co.nz/search

11 https://ebird.org/atlasnz/home

12 https://data.linz.govt.nz/layer/103632-nz-river-name-lines-pilot/

13 https://retrolens.co.nz/

14 Significant natural area v1.0 | WDC Data Service (waikatodistrict.govt.nz)

15 Not all features were subject to a site investigation due to access constraints. Features assessed at desktop level are identified throughout the report.

16 The Singers et al. (2017) ecosystem types were also used to describe representative vegetation types.

The habitats were also assessed for their potential to support indigenous fauna including birds, bats, and lizards.

The habitat assessment focused on areas of potentially significant value identified through the desktop assessment, such as:

- Habitat that has been identified as a SEA / SNA;
- Habitat classified as forest habitat on Auckland Council's Geomaps – Ecosystems Current Extent (Singers et al., 2017); or
- Habitat that appeared to be either wetland, riparian or forest habitat based on the findings of interrogations of aerial imagery and/or previous site investigations. Species records from relevant literature and biodiversity databases were also used to focus search efforts on certain areas within the Pukekohe Transport Network.

During the site walkovers the vegetation assessment included recording the dominant or characteristic species present and a general quality description (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 Pukekohe Transport Network.

Common plant names are predominantly used within this report. Maps showing the vegetation cover along the NoRs are provided in Appendix 0. The terrestrial ecological value assessment methodology is discussed in section 4.4.

### 4.3.2 Freshwater Habitat

Where access allowed, streams within the Pukekohe Transport Network identified on the 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 0.

Freshwater assessments were undertaken by experienced ecologists on streams identified within the Pukekohe Transport Network. The assessments included classifying the streams and where possible the implementation of the Rapid Habitat Assessment (RHA) protocol. 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. Macroinvertebrate and fish surveys were not undertaken as part of this assessment. However, NZ Freshwater Fish Database records (NIWA, 2022) were used to inform the potential ecological value of streams. Where access was restricted, stream assessments were based solely on desktop information and prior Te Tupu Ngātahi related projects. Freshwater ecological value assessment methodology is discussed in section 4.4.

### 4.3.3 Wetland Habitat

Ecologists identified potential wetlands based predominantly on the interpretation of satellite and aerial imagery. Contours[17] and apparent changes in vegetation structure indicating the likely presence of wetland vegetation were used to guide the identification of potential wetlands within the landscape.

[17] Identified on Auckland Council Geomaps

Where required, historic aerial imagery was also reviewed to help detect the likely presence of wetland attributes within the landscape. Potential wetlands were mapped and where access permitted, verified using the rapid assessment technique outlined in the Wetland Delineation Protocol (Ministry for the Environment, 2022). However, the wetland delineation predominantly relied on findings from the desktop assessment. Approximate wetland areas are mapped in Appendix 0.

The key focus was to confirm wetland presence and approximate extent. This approach was considered practical for the purposes of route protection. However, a detailed wetland assessment, according to the wetland delineation protocol (Ministry for the Environment, 2022), will need to be undertaken during the regional resource consenting phase.

Wetlands were assessed based on the RMA definition of a wetland[18] and classified into ecosystem types 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 National Policy Statement for Freshwater Management 2020 (NPS-FM) for natural wetlands (assessed for potential exclusion based on being artificial or pasture dominated). Details regarding the wetland value assessment is outlined in Section 4.4 below.

## 4.4 Ecological Value Assessment

The 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. Considerations in relation to the four matters and corresponding aspects for terrestrial, freshwater, and wetland features are detailed below:

**Terrestrial Ecology**

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

**Freshwater Ecology**

1) **Representativeness**: RHA score for accessible sites and riparian habitat modification based on desktop stream and catchment assessments.
2) **Rarity/distinctiveness**: Species of conservation significance informed by the potential occurrence of TAR fish species.
3) **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.
4) **Ecological context**: Stream order and hydroperiod.

[18] "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"

**Wetland Ecology**

1) **Representativeness**: Hydrological modification based on observations of drains, ponds, and catchment land use. Native vegetation informed by site visits and the review of landcover information.
2) **Rarity/distinctiveness**: Wetland type (rare or distinctive) and distinctive ecological values (ecosystem services) in a larger catchment context.
3) **Diversity and pattern**: Representation of different hydroperiods (permanent, seasonal, or temporary) and the structural complexity of vegetation cover.
4) **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 (e.g., 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.

Notwithstanding the ecological value associated with terrestrial/freshwater/wetland habitat units, specific consideration still needs to be given to individual species and their conservation significance for the following reasons (in accordance with EIANZ Guidelines, Table 4-1 below):

- The habitat value may dilute the conservation value associated with specific species. For example, the combined value for exotic grassland is Low, while the value for copper skink (at risk - declining) is High. The combined value of Low therefore understates the conservation value of the species.
- Species may not be restricted to a single vegetation unit.
- Potential effects on species are unrelated to habitat units. For example, impact on highly mobile species (such as bats) by noise and light may be independent of the habitat loss associated with the Project footprint.
- Consideration and adjustment of ecological value may occur dependent on regional threat status and local knowledge (if available). The more conservative of the ecological values should be applied.

**Table 4-1 Factors to consider in assigning value to terrestrial species for EcIA (Roper-Lindsay, et al., 2018)**

| Determining factors | Score |
|---|---|
| Nationally Threatened species, found in the ZOI either permanently or seasonally | Very high |
| Species listed as At Risk – Declining, found in the ZOI, either permanently or seasonally | High |
| Species listed as any other category of At Risk, found in the ZOI either permanently or seasonally | Moderate |
| Locally (ED) uncommon or distinctive species Moderate Nationally and locally common indigenous species | Low |
| Exotic species, including pests, species having recreational value | Negligible |

## 4.5 Limitations of the Assessment

Assessments of this nature can typically be constrained by a range of both known and unknown actions or events. Identifying these limitations helps provide context for the assessment. While a range of limitation occurred, they did not prevent the assessing of ecological effects and the identifying of suitable recommendations to avoid, remedy, and/or mitigate these effects. Limitations included:

- Site investigations on private property required obtaining permission from the landowners beforehand, as a result access was not available for all locations. This was a limitation for the infield assessment component of this study. As a result, not all features were assessed infield. Features assessed at a desktop level, or from the roadside, and/or taken from previous Te Tupu Ngātahi reports are identified throughout the report.
- Uncharacteristic weather conditions and storm events throughout December 2022 through to February 2023 resulted in several delays to infield assessments. Conditions after the storm events were also not optimal for ecological assessments, particularly stream and wetland assessments.
- No dedicated herpetofauna, avifauna, and invertebrate field investigations were conducted. These investigations relied on desktop records and inferences from habitat types identified. In addition, during the site walkover the incidental presence of birds, herpetofauna, and invertebrates were recorded. Dedicated herpetofauna, avifauna, and invertebrate investigations should be included during the regional consenting phase.
- Stream Ecological Valuation (SEV) assessments were not undertaken but are expected to be included during the regional resource consenting phase. Macroinvertebrate and fish surveys will also need to be included during the regional consenting phase.
- Detailed wetland delineations according to the wetland delineation protocols (Ministry for the Environment, 2022) were not undertaken. The assessment focused on identifying the presence of wetlands within and adjacent to the transport corridor. This was undertaken primarily at a desktop level (note - access restrictions prevent infield investigations of most of the wetlands likely to occur within the Pukekohe Transport Network), and through the use of the rapid assessment technique. A detailed wetland assessment will need to be undertaken during the regional resource consenting phase.
- The desktop and infield mapped features compiled during the project were digitized as an individual polygon, point, or line feature. These features were used to guide the identification of likely ecological effects. Most of these mapped features were identified at a desktop level and therefore still need to be ground-truthed to confirm both the feature and the extent. Detailed mapping of ecological features will need to be undertaken during the regional resource consenting phase.
- Contributing to the development of a detailed design for each NoR, which included updating the required designation and the realignment or redesign of associated features, was a fluid process. Changes and improvements to accommodate findings from not only an ecological perspective, but a range of specialist assessments, were undertaken in collaboration with the project team. As such, changes to limit impacts on ecological features in the landscape were made prior to this report being finalised. These measures to avoid or reduce ecological effects were documented. However, some of the more subtle changes may have been omitted.

# 5 Existing and Likely Future Ecological Environment

The projects encompassing the Pukekohe Transport Network, are likely to be constructed 15-20 years from now. The implementation timeframe for the projects may vary and correspond with future land release within the area. Assessing the effects on the environment solely as it exists today (i.e., at the time of assessment) will not provide an accurate reflection of the environment in which some of the effects will be experienced. Accordingly, the assessment of effects considers both the existing environment and the likely receiving environment in which the effects will likely occur.

Within the Pukekohe Transport Network there are a range of existing and future urban zoning patterns, which influence the likely future environment for assessment purposes. These are summarised in Table 5-1 and are as follows:

- Areas with existing urban or open space zoning are not likely to materially change in the future (i.e., all ecological features are likely to remain similar or the same. Regional vegetation cover (e.g., SEAs/SNAs), streams, and wetland features are likely to be relatively unchanged). For the Pukekohe Transport Network this includes:
    - The Mill Road esplanade reserve (NoR 8);
    - The Pukekohe industrial and business area at the southern extent of Pukekohe South East Arterial (NoR 5) at Svendsen Road and Wrightson Way;
    - The areas being designated for Pukekohe South West Upgrade (NoR 6); and
    - The BP and commercial centre near the SH1 Bombay interchange at the very eastern extent of the Mill Road- Pukekohe East Road Upgrade (NoR 8).
- Areas zoned as Rural Zone are also unlikely to change in the future. This relates to parts of the alignment of Drury to Pukekohe Link (NoR 2), Pukekohe North East Arterial (NoR 4) and Mill Road-Pukekohe East Road Upgrade (NoR 8).
- The starting assumption is that the transport corridors in existing urban, open space or rural zones will be constructed in the existing environment and will operate in the same environment.
- Areas within the FUZ are likely to experience material change (i.e., most of the terrestrial vegetation such as planted vegetation, forestry, and shelterbelts adjacent to the relevant NoRs, excluding riparian and wetland features, will be cleared, and replaced.). It is likely the construction of the transport corridors will occur ahead of, or in parallel to, the urbanisation of these areas. Therefore, the starting assumption is that corridors in the FUZ will be constructed in a rural greenfield (or transitioning) environment and operate in an urban environment. The construction and operation of the transport network will therefore likely contribute to the loss of habitats and habitat fragmentation.
- For the transport corridors in the FUZ, Auckland Council's Pukekohe-Paerata and Drury-Ōpāheke Structure Plans can be used to reasonably inform the future urban receiving environment in which the corridors will operate. The structure plans signal the intended land use pattern within the FUZ areas (although this pattern has yet to be confirmed).

**Table 5-1 Existing and Likely Future Environment**

| Environment today | Zoning | Likelihood of Change of the environment (based on zoning/policy direction) | Likely Future Environment (based on zoning/policy direction) |
|---|---|---|---|
| Business | Business (Industrial) | Low | Business (Industrial) |
| Open Space | Open Space | Low | Open Space |
| Rural | Future Urban | High | Urban |
| Rural | Rural | Low | Rural |
| Residential | Residential | Medium | Some intensification with PC 78 and MDRS |

*Note = Refer to the AEE for a detailed description of the existing and likely receiving environment for the overall Pukekohe Transport Network package.*

# 6 Ecological Baseline

## 6.1 Mana Whenua Ecological Values

Important ecological values identified by Mana whenua throughout the CIA included:

- Several catchments, which the Pukekohe Transport Network is likely to cross were identified as having significance to Ngaati Te Ata Waiohua. This included the Whangapouri stream, Oira stream, Ngaakooroa stream, and the Tuutaenui stream catchments.
- Streams and wetlands mauri, including lower quality ecological areas and vegetation.
- Native bats, lizards, birds, and fish.
- Maintaining fish passage throughout the streams which the Pukekohe Transport Network is likely to cross.

## 6.2 Historical Ecological Context

All the NoRs are within the Manukau Ecological District (ED). According to McEwen (1987), the Manukau ED has warm humid summers and mild winters. The ED is characterised by a range of soil types including well-drained loam soils on hilly land through to poorly drained and gleyed alluvial soils and peats on river flats and swamps. The district is largely modified, due to urban settlement and agriculture.

Originally forested, the Manukau ED is the most southerly extent of the northern North Island lowland forest type, with abundant taraire (*Beilschmiedia tarairi*) and pūriri (*Vitex lucens*) (McEwen, 1987). Now only 1.6% of the land area remains in native vegetation cover in the Manukau ED (Auckland Regional Council, 2013). For context, a reduction to around 20% of former extent is usually considered to be significant. A removal to below 5% is considered to be severe (Walker et al., 2008).

The extent of remaining indigenous vegetation cover in the Pukekohe Transport Network is mainly restricted to SEAs / SNAs or reduced to small fragments of regenerating vegetation following historical clearance.

## 6.3 Terrestrial Habitat and Fauna

### 6.3.1 Terrestrial Vegetation

The AUP:OP and WDP (proposed) have mapped and classified natural remaining terrestrial habitats as SEAs and Significant Natural Areas (SNAs), respectively. There is only one terrestrial SEA that occurs within the Pukekohe Transport Network. The proposed designation boundary of the Pukekohe Northeast Arterial (NoR 4) includes a small portion of an SEA, and the proposed designation boundary of the Drury to Pukekohe Link (Paerata Arterial segment of NoR 2) is immediately adjacent to an SEA. These are presented in Table 6-1 below. SEAs and SNAs that occur within 2 km of the Pukekohe Transport Network are illustrated in Figure 6-1, and presented in Appendix 0. A distance of 2 km was selected as a potential ZOI for adverse effects of the Pukekohe Transport Network depending on the potential receiving environment and the habitats and species present within the SEA/SNA.

**Table 6-1 Description of SEAs that occur within or directly adjacent to the Pukekohe Transport Network**

| NoR | SEA | SEA Classification | SEA Description |
|---|---|---|---|
| NoR 2 – SEA adjacent to the proposed designation boundary (SEA avoided through options assessment and concept design) | SEA_T_4380 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem Pūriri forest (WF7). |
| NoR 4 – A small portion of SEA (810m$^2$) occurs within the proposed designation boundary at a bridge construction area (Majority of SEA avoided through options assessment and concept design). | SEA_T_4375 | 1,2,3 | Representative of <10% natural extent within Eco District and threatened ecosystems: Kahikatea-pukatea Forest (WF8), Flaxland (WL18), and Raupõ reedland (WL19). |

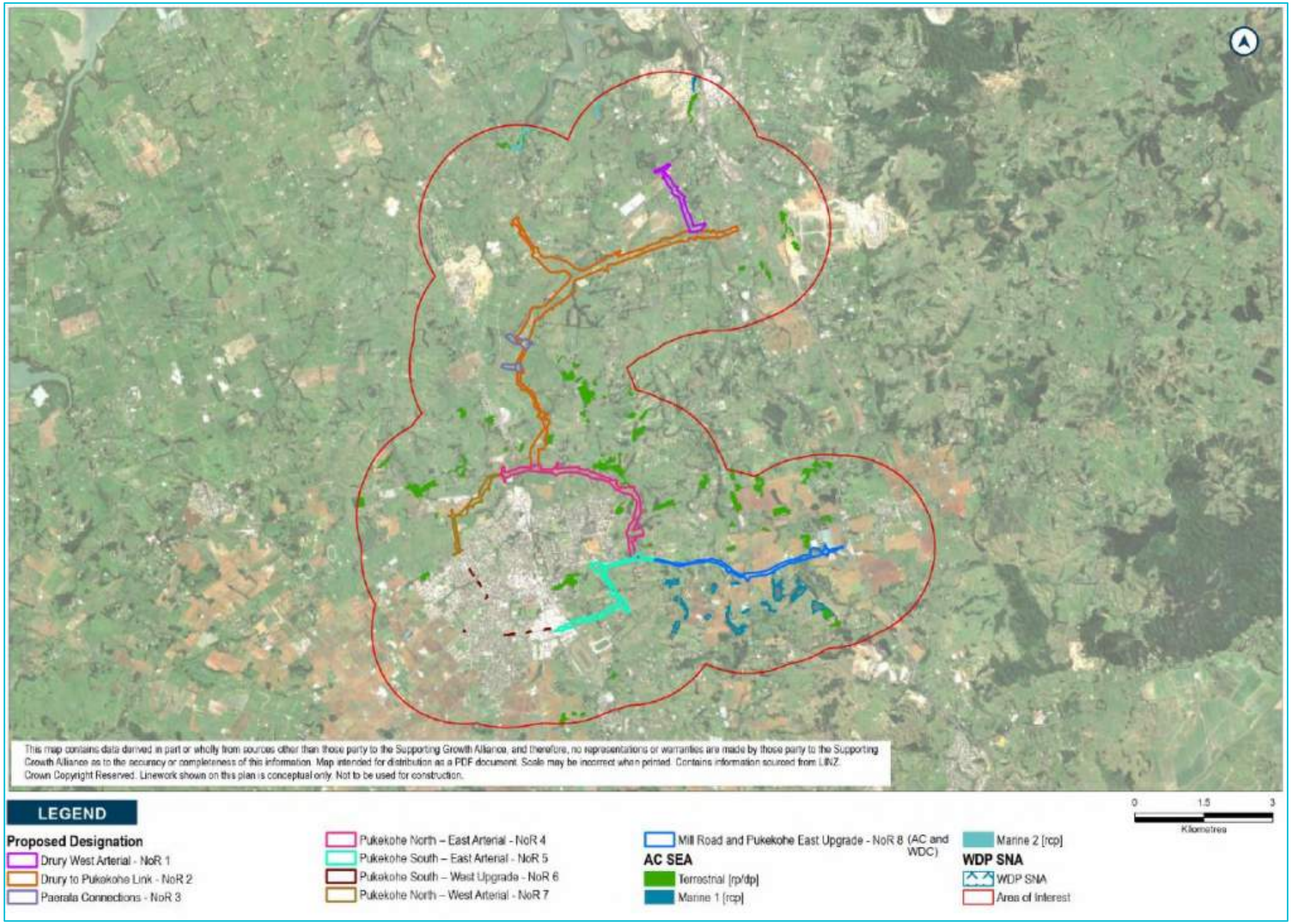



**Figure 6-1 SEAs and SNAs present within the 2km ZOI**

Site investigations and desktop surveys were undertaken and Table 6-2 summarises the vegetation types, classification (abbreviations according to Singers et al., 2017) and ecological value associated with each NoR. Mapping of terrestrial vegetation is presented in Appendix 0, and Appendix 0 provides a description of the terrestrial vegetation types identified for all the NoRs. Appendix 6 presents the detailed ecological value for terrestrial vegetation identified for all the NoRs.

**Table 6-2 Terrestrial vegetation types present within the Pukekohe Transport Network**

| Vegetation Type | Abbrev. | NoR 1 | NoR 2 | NoR 3 | NoR 4 | NoR 5 | NoR 6 | NoR 7 | NoR 8 AC & WD |
|---|---|---|---|---|---|---|---|---|---|
| Brown Field | BF | Negligible | N/A | Negligible | N/A | Negligible | N/A | Negligible | Negligible |
| Exotic Forest – Native Understory Dominated | EF.1 | N/A | Moderate | Moderate | Moderate | N/A | N/A | N/A | N/A |
| Exotic Forest – Exotic Understory Dominated | EF.2 | N/A | N/A | N/A | Moderate | N/A | N/A | N/A | N/A |
| Exotic Grassland | EG | Negligible | Negligible | Negligible | Negligible | Negligible | N/A | Negligible | Negligible |
| Exotic Scrub | ES | Low | Low | Low | Low | Low | N/A | Low | Low |
| Kahikatea forest | MF4 | N/A | N/A | N/A | High | N/A | N/A | N/A | N/A |
| Planted Vegetation – Native (recent) | PL.1 | N/A | Moderate | N/A | Moderate | Moderate | N/A | N/A | Moderate |
| Planted Vegetation - Native (mature) | PL.2 | Moderate | N/A | N/A | N/A | N/A | N/A | N/A | Moderate |
| Planted Vegetation – Amenity | PL.3 | Low | Low | Low | Low | Low | Low | Low | Low |
| Treeland – Native-Dominated | TL.1 | N/A | Moderate | N/A | Moderate | Moderate | N/A | Moderate | Moderate |

| Vegetation Type | Abbrev. | NoR 1 | NoR 2 | NoR 3 | NoR 4 | NoR 5 | NoR 6 | NoR 7 | NoR 8 AC & WD |
|---|---|---|---|---|---|---|---|---|---|
| Treeland – Mixed Native/Exotic | TL.2 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Moderate |
| Treeland – Exotic-Dominated | TL.3 | Moderate | Moderate | Moderate | Moderate | Moderate | Low | Moderate | Moderate |
| Broadleaved species scrub/forest | VS5 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Moderate |
| Pūriri Forest | WF7 | N/A | High | N/A | High | N/A | N/A | N/A | N/A |
| Taraire, tawa, podocarp forest | WF9 | N/A | N/A | N/A | High | N/A | N/A | N/A | N/A |

*Note = Classification from Singers et al. (2017)*

Table 6-3 summarises the AUP:OP district plan vegetation which is only associated with NoR 8 (e.g., road trees, open space trees, notable trees), and also vegetation types within the Waikato portion of NoR 8. Table 6 4 lists the tree species protected by the district plan provisions within NoR 8. Mapping of district plan vegetation is presented in Appendix 0 (refer to the Arboricultural Effects Report for the Pukekohe Transport Network for detailed maps of individual trees or groups or trees). Appendix 6 presents the detailed ecological value for district plan vegetation identified within the Waikato portion of NoR 8.

**Table 6-3 District Plan and Waikato District vegetation types present within the Pukekohe Transport Network (NoR 8)**

| Vegetation Type | Abbrev. | AUP OP District Plan Trees - NoR 8 only | NoR 8 - Waikato District only |
|---|---|---|---|
| Exotic Scrub | ES | n/a | Low |
| Planted Vegetation – Amenity | PL.3 | Low | Low |
| Treeland – Native-Dominated | TL.1 | Low | Low |
| Treeland – Exotic-Dominated | TL.3 | Low | Low |

**Table 6-4 List of trees protected by the district plan provisions within the native and exotic dominated treelands, NoR 8 only (according to the Arboricultural Effects Report for the Pukekohe Transport Network)**

| Common Name | Scientific name |
|---|---|
| Pōhutukawa* | *Metrosideros excelsa* |
| Totara* | *Podocarpus totara* |
| Broad-leaf privet | *Ligustrum lucidum* |
| Monterey pine | *Pinus radiata* |
| Coast redwood | *Sequoia sempervirens* |
| Coast banksia | *Banksia integrifolia* |
| Southern silky oak | *Grevillea robusta* |
| American sweetgum | *Liquidambar styraciflua* |
| Tulip tree | *Liriodendron tulipifera* |
| Lilly pilly | *Syzygium smithii* |
| Japanese cedar | *Cryptomeria japonica* |
| Kapuka* | *Griselinia littoralis,* |
| Pin oak | *Quercus palustris* |
| Lawson cypress | *Chamaecyparis lawsoniana* |
| Oak | *Quercus robur* |
| Karo* | *Pittosporum crassifolium* |
| Tarata* | *Pittosporum eugenioides* |
| Norfolk Island pine | *Araucaria heterophylla* |
| Puka* | *Meryta sinclairii* |
| Kohuhu* | *Pittosporum tenuifolium* |
| Pūriri* | *Vitex lucens* |

* = native tree species

### 6.3.2 Long-tailed bats

Extensive surveys in the wider landscape have been undertaken as part of the Te rapu ngā pekapeka o Franklin surveys undertaken in 2022/23 (Clarke, 2022; Clarke, 2023). Their findings suggest a resident population of long-tailed bats that are roosting in forest remnants across the Franklin District. High levels of activity were detected between Waiuku and Pukekohe, and in particular the regions of Glenbrook, Patumahoe and Whakaupoko.

In parallel to the Te rapu ngā pekapeka o Franklin surveys area wide Acoustic Bat Monitoring (ABM) surveys were undertaken for the Pukekohe Transport Network. The ABM surveys were undertaken during January - February 2023, and again in April – May 2023.The results of the bat surveys are detailed in Appendix 7. The ABM surveys confirmed bat activity at survey locations along NoRs 2, 3, 4, 7, and 8. Bat activity was also detected in close proximity to NoR 1, 5, and 6.

Figure 6-2 presents the survey results along with existing Department of Conservation records (obtained in 2022), and the recent Te rapu ngā pekapeka o Franklin surveys (Clarke, 2022; Clarke, 2023) within the 10km ZOI for the Pukekohe Transport Network. Combined results suggest the presence of a resident population of long-tailed bats in the Franklin District that is roosting in forest fragments.

The conservation status of this species is 'Threatened - Nationally Critical' (O'Donnell et al., 2017) and regionally critical, therefore the ecological value of long-tailed bats is **Very High** where they are likely to be present. Table 6-5 presents the ecological value for each NoR based upon the results of the existing records, ABM surveys, and habitat potential surveys for long-tailed bats.

**Table 6-5 Results based on existing survey records, two ABM surveys, and habitat potential surveys for long-tailed bats within the ZOI for the Pukekohe Transport Network**

| NoR | Existing records confirming the presence of bats within the 10km ZOI (Yes/No) | Potential bat habitat present – bat roost potential, and foraging | Closest ABM survey site to NoR | Bats detected within NoR (Yes/No), if No, distance from nearest confirmed bat detection site | Ecological Value |
|---|---|---|---|---|---|
| NoR 1 | Yes | Ngakaora Stream and tributaries, and tall stands of exotic trees | Directly within the NoR | No – The closest record was approximately 2km from the NoR (May 2023 survey site located along Burtt Road). | Very High |
| NoR 2 | Yes | Oira Creek, Whangapouri Creek, and Ngakoroa Stream tributaries, and tall stands of native and exotic trees | Directly within the NoR | Yes - Bat passes were recorded within the NoR during the Jan/Feb and April/May 2023 surveys. | Very High |
| NoR 3 | Yes | Oira Creek unnamed tributary. Large stands of mature exotic trees and bushes | Directly within the NoR | Yes - Bat passes were recorded within the NoR during the Jan/Feb and April/May 2023 surveys. | Very High |

| NoR | Existing records confirming the presence of bats within the 10km ZOI (Yes/No) | Potential bat habitat present – bat roost potential, and foraging | Closest ABM survey site to NoR | Bats detected within NoR (Yes/No), if No, distance from nearest confirmed bat detection site | Ecological Value |
|---|---|---|---|---|---|
| NoR 4 | Yes | Tall stands of indigenous and exotic trees, and large stands of bushes. Adjacent SEA. Oira Creek and Whangapouri Creek unnamed tributaries | Directly within the NoR | Yes - Bat passes were recorded within the NoR during the April/May 2023 survey. | Very High |
| NoR 5 | Yes | Tall stands of indigenous and exotic trees, and farmlands with scattered treelands. Tutaenui Stream and Whangapouri Creek unnamed tributaries | Directly within the NoR | No – The closest record was within 800m from the NoR (Feb 2023 survey site located off Kitchener Road). | Very High |
| NoR 6 | Yes | Potential bat habitat highly unlikely | The closest ABM survey site was within 400m | No – The closest record was within 800m from the NoR (Feb 2023 survey site located off Kitchener Road). | N/A |
| NoR 7 | Yes | Tall stands of indigenous and exotic trees and large stands of bushes, along with Whangapouri Creek unnamed tributaries | Directly within the NoR | Yes - Bat passes were recorded within the NoR during the April/May 2023 survey. | Very High |
| NoR 8 (AC & WDC) | Yes | Tall stands of indigenous and exotic trees, large stand of bushes, along with Tutaenui Stream and Ngakoroa Stream unnamed tributaries | Directly within the NoR | Yes - Bat passes were recorded within the NoR during the April/May 2023 survey. | Very High |

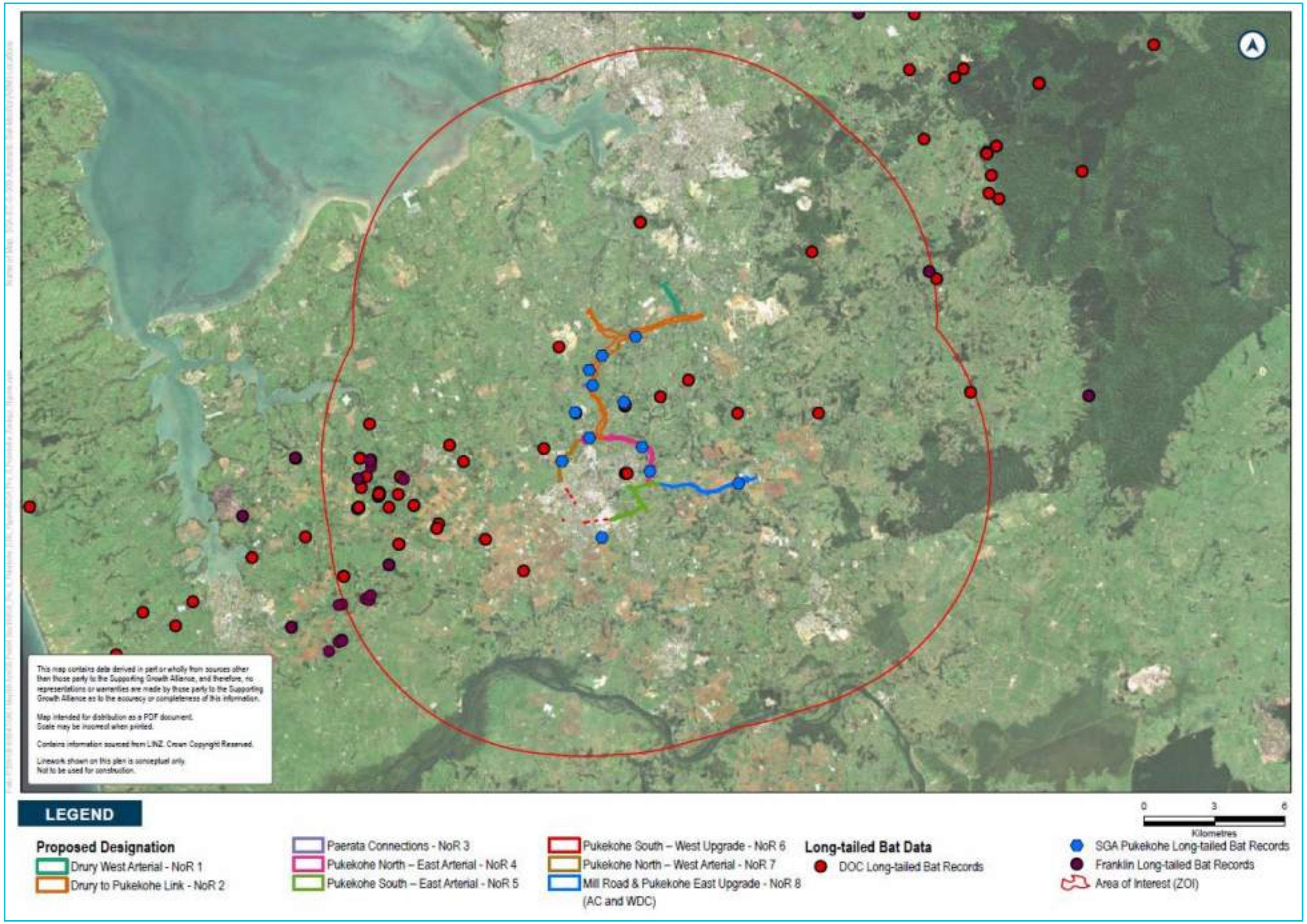



**Figure 6-2 Long-tailed bat records (DOC, Franklin, and AECOM data) within 10 kms of the Pukekohe Transport Network**

### 6.3.3 Avifauna

An area wide desktop review identified 48 forest, freshwater and coastal bird species (28 of which are native) within a 2 km buffer of the Pukekohe Transport Network. A full list of species identified in the desktop review is included in Appendix 8 (including incidental observations during site investigations). Additionally, a desktop assessment identified potential habitat for a number a TAR specie details all the observed and potential TAR bird species for each NoR, including the ecological value for each species.

**Table 6-6 TAR bird species observed or likely to occur within suitable habitat in the Pukekohe Transport Network**

| Species | Conservation Status (Robertson et al., 2021) | Record Source | Distribution and Habitat | Habitat within the Pukekohe Transport Network | Ecological Value | Relevant NoR |
|---|---|---|---|---|---|---|
| Banded rail<br>(*Gallirallus philippensis assimilis*) | At Risk – Declining | • iNaturalist (area wide)<br>• Incidental observation at NoR 1 and 2<br>• Auckland Council SEA information | Breeding and foraging within coastal wetland habitat (saltmarsh and mangroves).<br>Roosting and breeding within wetlands above the high tide.<br>Uncommon but widespread in the Auckland region (Bellingham, 2013). | Reported within Drury Creek and mangroves in Whangapouri Stream (SA1.2 and SA1.3)<br>No suitable roosting or breeding habitat within the NoR but may utilise wetlands within and adjacent to the NoRs for foraging. | High | NoR 1, 2, 4, and 8 |
| Red-billed gull/Tarāpunga<br>(*Chroicocephalus novaehollandiae scopulinus*) | At Risk – Recovering | • iNaturalist (area wide)<br>• eBird (area wide)<br>• Potential habitat identified in desktop assessment for all NoRs | Wetlands with open water, including stock ponds and small streams that retain overhanging marginal vegetation.<br>Rare but widespread in the Auckland region. Reliant on pest predator control (Williams, 2013). | Has the potential to utilise a wide range of open water, wetland locations and urban areas for foraging. However, as this species is reliant on pest control, it is unlikely to be resident or breeding within the NoRs so have not been considered relevant. | Moderate | n/a |
| Dabchick/Weweia<br>(*Poliocephalus rufopectus*) | Threatened – Nationally Increasing | • Incidental observation at NoR 4<br>• Potential habitat identified in desktop assessment throughout most of the NoRs | Small shallow freshwater lakes and ponds with dense marginal vegetation.<br>Uncommon but widespread in the Auckland region (Szabo, 2013). | Has the potential to utilise any freshwater open-water habitat, including stock water ponds, ornamental ponds, and stormwater ponds. Likely to breed in associated marginal wetland vegetation. | Very High | NoR 1, 2, 4, 5, 7, and 8 |

| Species | Conservation Status (Robertson et al., 2021) | Record Source | Distribution and Habitat | Habitat within the Pukekohe Transport Network | Ecological Value | Relevant NoR |
|---|---|---|---|---|---|---|
| Little shag/ Kawaupaka<br>(*Phalacrocorax sulcirostris*) | At Risk – Naturally Uncommon | • iNaturalist (area wide)<br>• eBird (area wide)<br>• Potential habitat identified in desktop assessment for most of the NoRs | Occur in coastal inlets, lakes, and ponds, including stormwater ponds. Roosting and breeding in overhanging trees.<br>Common and widespread in the Auckland region (Armitage, 2013). | Has the potential to utilise any freshwater or coastal open water habitat, including stock water ponds, ornamental ponds, and stormwater ponds, and around Whangapouri, Oira Creek and Ngakoroa streams. | Moderate | NoR 1, 2, 4, 7, and 8 |
| Variable Oystercatcher/ Tōrea pango<br>(*Haematopus unicolor*) | At Risk: Recovering | • iNaturalist (area wide)<br>• eBird (area wide)<br>• Potential habitat identified in desktop assessment for NoR 1 and 2. | Summer migrant to New Zealand arriving spending winter in tropical Pacific islands. As a parasite nester, their range is restricted to host species whitehead, brown creeper, and yellowhead.<br>Absent as a breeding species from Auckland region (except Te Hauturu-o-Toi, Little Barrier Island) but occur on migration passage throughout New Zealand (Gill, 2013). | Has the potential to briefly occur on migration passage across the project area. Can occur in native/exotic forest, scrub, farmland, or urban areas on passage to breeding/winter habitat. | Moderate | NoR 1 and 2 |
| Australasian Bittern/ Matuku-hūrepo<br>(*Botaurus poiciloptilus*) | Threatened – Nationally Critical | • iNaturalist (area wide)<br>• eBird (area wide)<br>• Potential habitat identified within NoR 1, 2, 4, and 8. | Occur in open habitat such as coastal and alpine grasslands, but also utilise modified landscapes such as pasture and scrub within the rural landscape. | Has the potential to utilise wetland habitat within and adjacent to the NoRs. However, habitat suitability is low due to disturbances throughout the landscape (e.g., agricultural activity, urban areas, likely presence of pest species, etc.). | Very High | NoR 1, 2, 4, and 8 |

| Species | Conservation Status (Robertson et al., 2021) | Record Source | Distribution and Habitat | Habitat within the Pukekohe Transport Network | Ecological Value | Relevant NoR |
|---|---|---|---|---|---|---|
| | | | Rare but can occur within a widespread area in the Auckland region (Beauchamp, 2013). | | | |
| White Heron/Kōtuku<br><br>(*Adrea alba*) | Threatened – Nationally Critical | • iNaturalist (area wide)<br>• eBird (area wide)<br>Potential habitat identified within NoR 1, 2, 4, and 8. | Occur mostly in harbours and estuaries but visit freshwater wetland. Build their nests in the crowns of tree ferns overhanging river, under tall kahikatea forest.<br><br>The most causality reason is being hit by cars. | Has the potential to utilise any open habitats such as exotic and indigenous wetlands, kahikatea forests, and farmlands.<br><br>iNaturalist records indicate the presence of White Heron adjacent to NoR 1 and NoR 2. These two NoRs are located close to SEA_M2_29 and have freshwater wetlands present. Therefore, White Herons are likely to occur within or adjacent to the NoRs. Suitable habitat also occurs along NoR 4 and 8. | Very High | NoR 1, 2, 4, and 8 |
| Fernbird/ Mātātā<br><br>*(Poodytes punctatus)* | At Risk: declining | • eBird (area wide)<br>• Potential habitat identified in desktop assessment for NoR 2 and 4. | Many local populations have been lost due to drainage of wetlands and conversion to pasture (Best, 1979).<br><br>Fernbird is a wetland resident. It may occur within flaxland wetlands adjacent to the NoR 4 | Has the potential to utilise any dense wetland vegetation, for foraging and breeding within or adjacent to NoR 2 and 4. This includes native flaxland wetland (WL18). | High | NoR 2 and 4 |
| South Island pied oystercatcher/ Tōrea<br><br>(*Haematopus finschi*) | At Risk: declining | • iNaturalist (area wide)<br>• eBird (area wide) | Dense wetland vegetation.<br><br>Rare but widespread in the Auckland region (Miskelly, 2013). | Has the potential to utilise any dense wetland vegetation, for foraging and breeding within NoR 1 and NoR 2. This | High | NoR 1, 2, 7, and 8 |

| Species | Conservation Status (Robertson et al., 2021) | Record Source | Distribution and Habitat | Habitat within the Pukekohe Transport Network | Ecological Value | Relevant NoR |
|---|---|---|---|---|---|---|
| | | • Potential habitat identified in desktop assessment for NoR1 and 2. | | includes native planted wetlands (PLW) and *Machaerina* sedgeland (WL11). | | |
| Pied shag/Kāruhiruhi<br>(*Phalacrocorax varius*) | At Risk – Recovering | • iNaturalist (area wide)<br>• eBird (area wide)<br>• Incidental observation at NoR 8 and 2. | Breeds mainly on coastal lands and colonise on the western and eastern coast of Auckland.<br>Forage in coastal marine waters, harbours and estuaries but occasionally in freshwater lakes and ponds close to the coast (Powlesland et al. 2008). | Has the potential to utilise any freshwater or coastal open water habitat, including stock water ponds, ornamental ponds, and stormwater ponds, and around Whangapouri Creek and Ngakoroa streams.<br>No breeding or roosting sites were observed during the infield assessments (incidental observations only). | Moderate | NoR 1, 2, 4, 7, and 8 |
| Royal Spoonbill/ Kōtuku ngutupapa<br>(*Platalea regia*) | At Risk: Naturally Uncommon | • iNaturalist (area wide)<br>• eBird (area wide)<br>• Potential habitat identified in desktop assessment for NoR1 and 2. | Wetland vegetation and freshwater lakes and ponds, with dense marginal vegetation.<br>Rare but widespread in the Auckland region (Fitzgerald, 2013). | Has the potential to utilise any dense wetland vegetation, for foraging and breeding. This includes native planted wetlands (PLW1), *Machaerina* sedgeland (WL11) and marginal vegetation associated with stock water ponds, ornamental ponds, and stormwater ponds. | Moderate | NoR 1 and 2 |
| New Zealand falcon/ Kārearea | At Risk: Recovering | • iNaturalist (area wide)<br>• eBird (area wide) | Distributed on mainlands. Breeds in a wide variety of habitats from the coast to above the tree line, and farmed areas where suitable | Has the potential to utilise any exotic and native forests, and farmlands. This includes TL.1, TL.2, TL.3, EF, WF7 and | Moderate | n/a |

| Species | Conservation Status (Robertson et al., 2021) | Record Source | Distribution and Habitat | Habitat within the Pukekohe Transport Network | Ecological Value | Relevant NoR |
|---|---|---|---|---|---|---|
| (*Falco novaeseelandiae*) | | • Potential habitat identified in desktop assessment for all NoRs | bush remains (Barea, 1995; Bell and Lawrence, 2009). | WF9. However, they are transient and not considered relevant for the NoRs | | |
| Kākā \| Kaka<br>(*Nestor meridionalis*) | At Risk: Recovering | • iNaturalist (area wide)<br>• eBird (area wide)<br>• Potential habitat identified in desktop assessment for all NoRs except NoR 6 | Kaka are known to visit the Auckland and Hamilton areas during winter. They have been recorded a few times throughout the Pukekohe area on iNaturalist. They prefer old native forests to build their nest and consume seeds, fruit, nectar, honeydew (Moorhouse 1995). | Has the potential to utilise any exotic and native forests, including TL.1, TL.2, TL.3, EF, MF4, WF7 and WF9. | Moderate | All NoRs, except NoR 6 |
| Spotless crake/Pūweto<br>(*Porzana tabuensis plumbea*) | At Risk – Declining | • Assumed present based on suitable habitat within NoR 1, 2, 4, and 8. | Wetland vegetation and freshwater lakes and ponds, with dense marginal vegetation.<br>Rare but widespread in the Auckland region (Fitzgerald, 2013). | Has the potential to utilise any moderate or larger wetland habitat areas (>1000 m2) for foraging and breeding in all NoRs. | High | NoR 1, 2, 4, and 8 |

### 6.3.4 Herpetofauna

Existing desktop records (Department of Conservation, 2022) confirm the presence of native herpetofauna within and adjacent to the Pukekohe Transport Network. A full list of species (including introduced and naturalised species) is included in Appendix 8. No dedicated lizard surveys were undertaken for the Project. However, opportunistic searches were conducted where possible. A dead copper skink was found within the Burtt Road reserve approximately 50m from the boundary of NoR 1.

Copper skink (At Risk – Declining) are widespread and frequently recorded within highly modified habitats such as exotic scrub and rank grassland (Hitchmough et al. 2021; NZ Herpetological Society. 2021). It is anticipated that the species is likely to occur within and adjacent to all the NoR areas, with the exception of NoR 6 where it is unlikely to occur.

Ornate skink (At Risk – Declining) inhabit forested area, shrubland and vegetated coastlines. It hides amongst leaf litter, dense low foliage, thick rank grass and under rocks and logs (Gill and Whitaker, 2007; Hitchmough et al., 2021; NZ Herpetological Society, 2021). The DOC Bioweb data recorded the presence of ornate skink within Pukekohe. It is anticipated that the species has the potential to occur within and adjacent to all the NoRs, except NoR 6.

Several Gecko species (all At Risk- Declining) have the potential to occur within NoR4. This is further detailed in Table 6-7, including the ecological value for each species.

**Table 6-7 Native herpetofauna likely to occur within suitable habitat in the Pukekohe Transport Network**

| Species | Conservation Status (Melzer et al., 2022; Hitchmough et al., 2021; Burns et al., 2017) | Record Source | Distribution and Habitat | Habitat within the Pukekohe Transport Network | Ecological Value | Relevant NoR |
|---|---|---|---|---|---|---|
| Copper skink *(Oligosoma aeneum)* | Nationally and in Auckland:<br>At Risk – Declining | • DOC Bioweb records (NoR 1, NoR 2, and NoR 4).<br>• Site walkover recorded one dead copper skink adjacent to NoR 1. | Widespread through the North Island. Inhabits within forest and open or shaded areas covered with logs or long grass or deep leaf litter. | Covered with indigenous and exotic forest, dense bushes, rank grasslands along roads and within farmlands. | High | All NoRs (unlikely within NoR 6) |
| Ornate skink<br>*(Oligosoma ornatum)* | Nationally and in Auckland:<br>At Risk – Declining | • DOC Bioweb records (within Pukekohe city)<br>• Potential habitat identified in the desktop assessment (All NoR, except NoR 6) | Widespread through the North Island. Inhabits forested area, shrubland and heavily vegetated coastlines. Covers among leaf litter, in dense low foliage, thick rank grass, under rocks and logs. | Shrubland and forest with sufficient understorey relating to vegetation units EF, TL, PL2, VS5, and mature indigenous forest types. | High | All NoRs, except NoR 6 |
| Auckland Green / Elegant Gecko (*Naultinus elegans*) | Nationally and in Auckland:<br>At Risk – Declining | • Potential habitat identified in the desktop assessment (WF9, WF7, and MF4) | Inhabits forests, including scrubby/regenerating habitat, swamps, scrubland, and mature forest (NZ Herpetological Society, 2021) | Areas with sufficient understorey relating to mature indigenous forest types (WF9, WF7, and MF4). | High | NoR 4 |
| Forest Gecko *(Mokopirirakau granulatus)* | Nationally and in Auckland:<br>At Risk – Declining | • Potential habitat identified in the desktop assessment (WF9, WF7, and MF4) | Inhabits a range of habitats, including swamps, scrubland, mature forests, and rock fields (up to 1400m asl).<br>In the North Island, they appear to favor scrubby/regenerating | Areas with sufficient understorey relating to mature indigenous forest types (WF9, WF7, and MF4). | High | NoR 4 |

| Species | Conservation Status (Melzer et al., 2022; Hitchmough et al., 2021; Burns et al., 2017) | Record Source | Distribution and Habitat | Habitat within the Pukekohe Transport Network | Ecological Value | Relevant NoR |
|---|---|---|---|---|---|---|
| | | | habitats (NZ Herpetological Society, 2021). | | | |
| Pacific Gecko *(Dactylocnemis pacificus)* | Nationally: Not Threatened<br>Auckland: At Risk – Declining | • Potential habitat identified in the desktop assessment (WF9, WF7, and MF4) | Inhabits a range of different habitats, including swamps, scrubland, mature forests, rocky coastlines, back-dunes, rocky islets, and rock outcrops (NZ Herpetological Society, 2021). | Areas with sufficient understorey relating to mature indigenous forest types (WF9, WF7, and MF4). | High | NoR 4 |

### 6.3.5 Invertebrates

An initial desktop review indicated that no native invertebrate species have been recorded within the Pukekohe Transport Network Project area. Based on these findings, and a review of habitat, it is considered that the project effects (district plan) on invertebrates are likely to be Negligible. Therefore, native invertebrate species have not been assessed further in this report.

## 6.4 Freshwater Habitat and Fauna

### 6.4.1 Streams

All potential streams within the Pukekohe Transport Network were mapped (Appendix 0) and classified as either permanent or intermittent (where possible, ephemeral streams were also mapped but not assessed). Figure 6-3 provides an overview of the stream networks anticipated to be crossed by each of the NoRs. Permanent or intermittent streams that were within the NoRs were numbered and assessed. Additionally, all streams that were accessed during site investigations were surveyed using the RHA, the detailed RHA results are included in Appendix 0. Table 6-8 presents details of the streams within the Pukekohe Transport Network, and their corresponding ecological value. Appendix 10 presents the detailed ecological value assessment for streams identified in the Pukekohe Transport Network.

**Table 6-8 Summary of streams identified in the Pukekohe Transport Network**

| Stream Name | Stream ID | Hydroperiod | RHA Category | Ecological Value |
|---|---|---|---|---|
| **NoR 1 – Drury West Arterial** | | | | |
| Ngakaora Stream unnamed tributary * | PK1_S1 | Intermittent | Moderate | Low |
| Ngakaora Stream unnamed tributary ^ | PK1_S2 | Intermittent | Poor | Moderate |
| Ngakaora Stream unnamed tributary * | PK1_S3 | Intermittent | # | Moderate |
| Ngakaora Stream unnamed tributary | PK1_S4 | Permanent | Good | Moderate |
| Ngakaora Stream | PK1_S5 | Permanent | Moderate | Moderate |
| **NoR 2 – Drury to Pukekohe Link** | | | | |
| Ngakaora Stream unnamed tributary* | PK2_S1 | Permanent | # | Moderate |
| Ngakaora Stream unnamed tributary* | PK2_S3 | Intermittent | # | Low |
| Ngakaora Stream unnamed tributary* | PK2_S4 | Intermittent | # | Moderate |

| Stream Name | Stream ID | Hydroperiod | RHA Category | Ecological Value |
|---|---|---|---|---|
| Ngakaora Stream unnamed tributary* | PK2_S5 | Intermittent | # | Low |
| Oira Creek unnamed tributary | PK2_S6 | Permanent | Poor | High |
| Oira Creek | PK2_S7 | Permanent | Moderate | High |
| Oira Creek unnamed tributary | PK2_S8 | Intermittent | Moderate | High |
| Whangapouri Creek unnamed tributary* | PK2_S9 | Intermittent | # | Low |
| Oira Creek unnamed tributary* | PK2_S10 | Intermittent | # | Low |
| Oira Creek unnamed tributary* | PK2_S11 | Intermittent | # | Low |
| Oira Creek unnamed tributary | PK2_S12 | Intermittent | # | Moderate |
| Oira Creek unnamed tributary^ | PK2_S13 | Intermittent | # | Moderate |
| **NoR 3 - Paerata Connections** | | | | |
| Oira Creek unnamed tributary* | PK2_S10 | Intermittent | # | Low |
| **NoR 4 – Pukekohe North-East Arterial** | | | | |
| Whangapouri Creek unnamed tributary | PK4_S1 | Permanent | Moderate | Moderate |
| Whangapouri Creek | PK4_S2 | Permanent | Moderate | Moderate |
| Oira Creek unnamed tributary* | PK4_S3 | Intermittent | Poor | Low |
| Oira Creek unnamed tributary* | PK4_S4 | Permanent | # | Moderate |
| Oira Creek unnamed tributary* | PK4_S5 | Permanent | # | Moderate |
| Oira Creek unnamed tributary* | PK4_S6 | Intermittent | # | Low |
| Oira Creek unnamed tributary | PK4_S7 | Permanent | Good | Moderate |

| Stream Name | Stream ID | Hydroperiod | RHA Category | Ecological Value |
|---|---|---|---|---|
| Whangapouri Creek unnamed tributary | PK4_S8 | Intermittent | Moderate | Moderate |
| Whangapouri Creek unnamed tributary | PK4_S9 | Permanent | Moderate | Moderate |
| **NoR 5 – Pukekohe South-East Arterial** | | | | |
| Tutaenui Stream unnamed tributary | PK5_S1 | Intermittent | Moderate | Low |
| Whangapouri Creek unnamed tributary | PK5_S3 | Intermittent | Good | Moderate |
| Whangapouri Creek unnamed tributary | PK5_S4 | Permanent | Moderate | Moderate |
| **NoR 7 – Pukekohe North-West Arterial** | | | | |
| Whangapouri Creek unnamed tributary^ | PK7_S1 | Intermittent | # | Low |
| Whangapouri Creek unnamed tributary* | PK7_S2 | Intermittent | # | Low |
| **NoR 8 (AC & WDC) – Mill Road and Pukekohe East Road Upgrade** | | | | |
| Tutaenui Stream unnamed tributary^ | PK8_S1 | Intermittent | # | Low |
| Ngakaora Stream unnamed tributary | PK8_S3 | Permanent | Good | High |
| Ngakaora Stream unnamed tributary | PK8_S4 | Intermittent | Moderate | Moderate |
| Ngakaora Stream unnamed tributary^ | PK8_S5 | Intermittent | Moderate | Moderate |

*Note:*
*^ = Ecological feature assessed from roadside or adjacent property boundary due to access restrictions.*
** = Ecological feature assessed at a desktop level due to access restrictions.*
*# = No assessment due to access restrictions (permission to access private property was not obtained).*

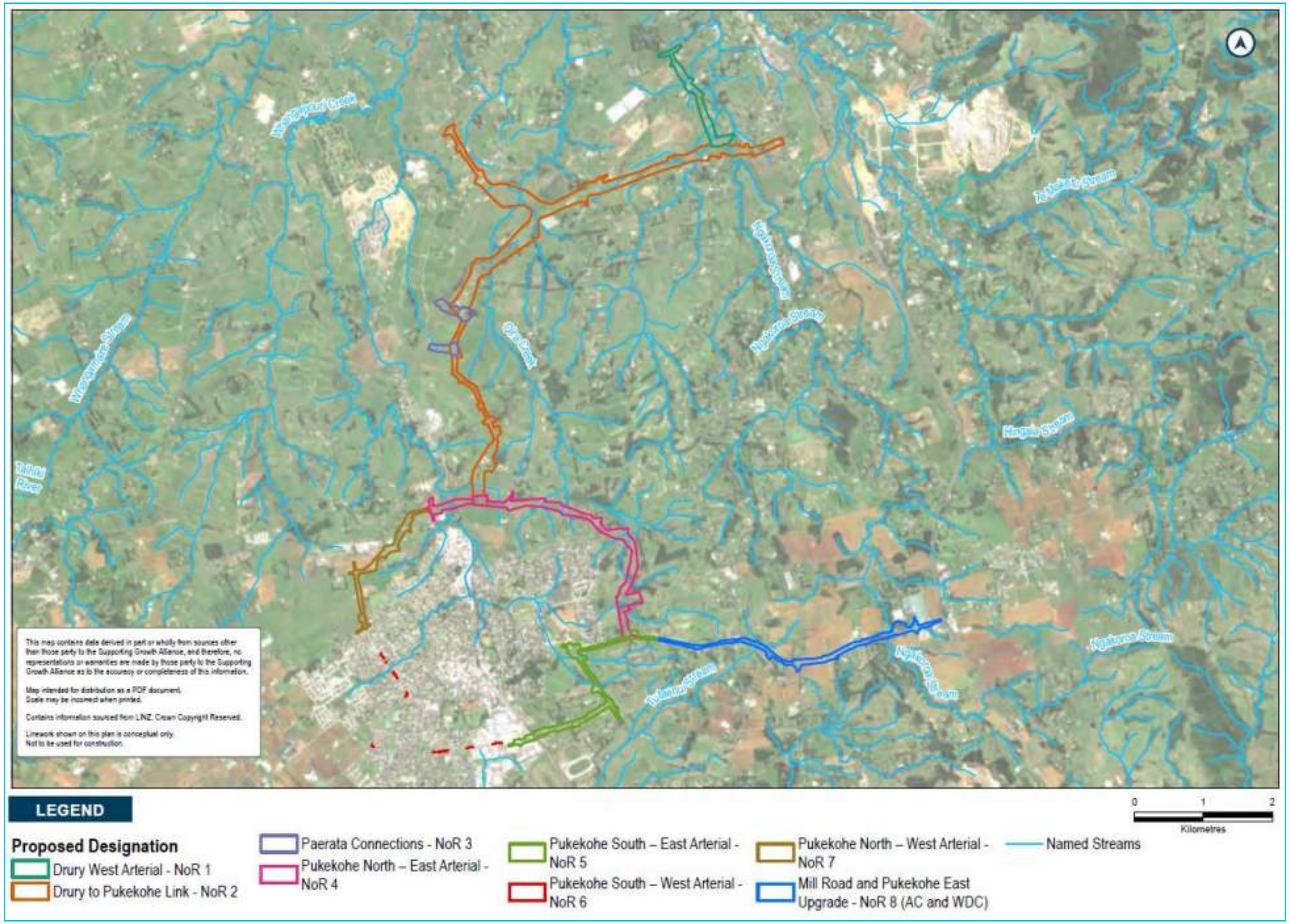



Figure 6-3 Stream networks likely to be crossed by the Pukekohe Transport Network

### 6.4.2 Fish and Macroinvertebrates

The New Zealand Freshwater Fish Database (NZFFD) (Stoffels, 2022) was reviewed for native freshwater fish and freshwater invertebrate records within stream catchments associated with the Pukekohe Transport Network. Of the freshwater fish recorded, two species are classified as ‘At Risk’. Namely, īnanga (*Galaxias maculatus*) and Longfin eel (*Anguilla australis*) (Dunn et al., 2017). The desktop review results are presented in Table 6-9.

While fish surveys were not undertaken, incidental observations confirmed the presence of longfin eel and banded kokopu. One freshwater invertebrate species, koura, has also been recorded within stream catchments adjacent to all NoRs except NoR 6 and 7.

A range of freshwater habitat within the Pukekohe Transport Network that has the potential to support native fish (based on the RHA results), e.g., potential habitat, such as undercut banks, overhanging vegetation and macrophytes, was observed during the infield assessments.

**Table 6-9 Native freshwater fish species recorded within the catchments associated with the Pukekohe Transport Network**

| Common and Scientific name | Conservation Status (Dunn et al., 2017) | Catchment and Relevant NoR | | | |
|---|---|---|---|---|---|
| | | NoR 1, 2, and 8 | NoR 2, 3, and 4 | NoR 2, 4, 5, and 7 | NoR 5 and 8 |
| | | Ngakoroa Stream and unnamed tributaries | Oira Creek and unnamed tributaries | Whangapouri Creek and unnamed tributaries | Tutaenui Stream unnamed tributaries |
| Banded kokopu (*Galaxias fasciatus*) | Not Threatened | ✓ | ✓ | ✓ | NA |
| Common bully (*Gobiomorphus cotidianus*) | Not Threatened | ✓ | NA | NA | ✓ |
| Redfin Bully (*Gobiomorphus huttoni*) | Not Threatened | ✓ | NA | NA | NA |
| Crans bully (*Gobiomorphus basalis*) | Not Threatened | ✓ | ✓ | ✓ | ✓ |
| Inanga (*Galaxias maculatus*) | At Risk - Declining | ✓ | NA | NA | ✓ |

| Common and Scientific name | Conservation Status (Dunn et al., 2017) | Catchment and Relevant NoR | | | |
|---|---|---|---|---|---|
| | | NoR 1, 2, and 8 | NoR 2, 3, and 4 | NoR 2, 4, 5, and 7 | NoR 5 and 8 |
| | | Ngakoroa Stream and unnamed tributaries | Oira Creek and unnamed tributaries | Whangapouri Creek and unnamed tributaries | Tutaenui Stream unnamed tributaries |
| Longfin eel (*Anguilla dieffenbachii*) | At Risk - Declining | ✓ | NA | NA | NA |
| Shortfin eel (*Anguilla australis*) | Not Threatened | ✓ | ✓ | ✓ | ✓ |

## 6.5 Wetland Habitat

There have been limited studies of wetland ecosystems within the general vicinity of the Pukekohe Transport Network. This is likely due to the high levels of modification in the landscape, particularly historical drainage, and reclamation. The Auckland Council floodplain mapping and 'ecosystem potential extent' data set would suggest that the Whangapouri Creek and Ngakaora Stream floodplains were once swamp / floodplain Pūriri and Taraire Forest (WF7, WL18 and WL19). As these habitat types are now almost absent, this would imply the wetlands have been largely converted to agriculture or urban areas. However, extensive modified wetlands remain throughout the landscape. Table 6-10 lists the wetland habitat types that are present within and adjacent to the Pukekohe Transport Network.

Given the extent of modified wetlands throughout the landscape, numerous wetlands were identified within the Pukekohe Transport Network. These were identified and assessed primarily at a desktop level (rapid site investigations were conducted at locations where property access was granted). Details regarding the vegetation cover, NPS-FM classification, potential for supporting TAR species, and ecological value for each wetland are presented in Table 6-11. Appendix 0 provides a map showing the spatial distribution of wetlands.

**Table 6-10 Wetland habitat types (and open water bodies) present within the Pukekohe Transport Network**

| Habitat | Classification | Description of Habitat |
|---|---|---|
| Exotic Wetland | EW | Wetland ecosystems with >50% exotic plant biomass. |
| Open Water | OW | Open water bodies are not natural inland wetlands but instead artificial wetlands that provide a fringe of aquatic wetland species (largely kuawa/lake club rush). |

| Habitat | Classification | Description of Habitat |
|---|---|---|
| Planted Wetland - Native (recent) | PLW.1 | Native restoration plantings with <50% exotic biomass with < 10 years old. |
| *Machaerina* sedge land | WL11 | Sedgeland-rushland wetland type, in depressions and freshwater margins. Species of *Machaerina, Eleocharis*, lake clubrush and locally *Carex* spp. |
| Flaxland* | WL18 | This area is characterised by abundant harakeke, toetoe, kiokio, wetland scrubs and scattered treeland of cabbage trees and kahikatea. This area is categorised as SEA_T_4375. It supports habitats for a diverse range of forest, coastal and wetland native birds, such as Kaka, tui, bellbird and hihi, banded rail, spotless crake, and fernbird. |
| Raupō reedland | WL19 | It occurs on the margins of lakes, lagoons, ponds, and river oxbows and in flooded valleys. This area is dominated by abundant raupō, locally with species of pūrua grass, lake clubrush, jointed twig rush, toetoe, pūkio and harakeke. It supports habitats for a diverse range of wetland native birds including kākā, kererū, tūī, fantail, grey warbler, black swan, paradise shelduck, grey and mallard duck, grey and brown teal, shoveler, Australasian bittern, white-faced heron, banded rail, spotless crake, pūkeko, and harrier (Atkinson and Millener 1991; Worthy and Holdaway 2002). |

*Notes: * = Flaxland only occurs adjacent to NoR4 and not within the designation*.

**Table 6-11 Summary of wetlands identified in the Pukekohe Transport Network**

| Wetland ID | Vegetation/Wetland Type[19] | NPS-FM Classification | Potential for TAR Species | Ecological Value |
|---|---|---|---|---|
| NoR 1 – Drury West Arterial | | | | |
| PK1_W1* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK1_W2* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds but it could support TAR lizards. | Low |
| PK1_W3* | Exotic Wetland (EW) | Natural inland wetland | Potential for Australasian bittern, White heron, Banded rail, Spotless crake, and South Island pied oystercatcher. Likely to support TAR lizards. | Low |
| PK1_W4* | Exotic Wetland (EW) | Natural inland wetland | Potential for Australasian bittern, White heron, Dabchick, Banded rail, Spotless crake, and South Island pied oystercatcher. Likely to support TAR lizards. | Low |
| PK1_W5 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK1_W6 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK1_W7 | Exotic Wetland (EW) | Natural inland wetland | Potential for White heron, Dabchick, Banded, and South Island pied oystercatcher. | Low |
| NoR 2 - Drury to Pukekohe Link | | | | |
| PK2_W1 | Open Water (OW) | Artificial wetland | Potential for Australasian bittern, Dabchick, Banded rail, Spotless crake, and South Island pied oystercatcher. | Low |
| PK2_W2 | Raupō reedland (WL19) | Natural inland wetland | Potential for Australasian bittern, Dabchick, Banded rail, Spotless | Moderate |

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

| Wetland ID | Vegetation/Wetland Type[19] | NPS-FM Classification | Potential for TAR Species | Ecological Value |
|---|---|---|---|---|
| | | | crake, and South Island pied oystercatcher, Fernbird. | |
| PK2_W3 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK2_W4 | Exotic Wetland (EW) | Natural inland wetland | Potential for Australasian bittern, White heron, Banded rail, Spotless crake, and South Island pied oystercatcher. | Low |
| PK2_W5 | Exotic Wetland (EW) | Natural inland wetland | Potential for Australasian bittern, White heron, Dabchick, Banded rail, Spotless crake, and South Island pied oystercatcher, Fernbird | Low |
| PK2_W6* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. Likely to support TAR lizards. | Low |
| PK2_W7* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. Likely to support TAR lizards. | Low |
| PK1_W7 | Exotic Wetland (EW) | Natural inland wetland | Potential for White heron, Dabchick, Banded, and South Island pied oystercatcher. | Low |
| PK2_W8* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. Likely to support TAR lizards. | Low |
| PK2_W9* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail and Spotless crake. Likely to support TAR lizards. | Low |
| PK2_W10* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail and Spotless crake. Likely to support TAR lizards. | Low |
| PK2_W11* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail and Spotless crake. Likely to support TAR lizards. | Low |

| Wetland ID | Vegetation/Wetland Type[19] | NPS-FM Classification | Potential for TAR Species | Ecological Value |
|---|---|---|---|---|
| PK2_W12* | Exotic Wetland (EW) | Natural inland wetland | Potential Habitat for dabchick and spotless crake. Likely to support TAR lizards. | Low |
| PK2_W13* | Open Water (OW) | Artificial wetland | Potential Habitat for dabchick. | Low |
| PK2_W14* | Open Water (OW) | Artificial wetland | Potential Habitat for dabchick. | Low |
| PK2_W15* | Exotic Wetland (EW) | Natural inland wetland | Potential for Australasian bittern, Banded rail and Spotless crake. Likely to support TAR lizards. | Low |
| PK2_W16* | Restored wetland (PLW.1) with an OW feature | PLW.1 = Natural inland wetland | Potential for Banded rail and Spotless crake. | Low |
| PK2_W17* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK2_W18* | Exotic Wetland (EW) | Natural inland wetland | Potential for spotless crake and white heron. | Low |
| PK2_W19* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK2_W20* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK2_W21 | Exotic Wetland (EW) | Natural inland wetland | Potential for Australasian bittern, White heron, Dabchick, Banded rail, Spotless crake, and South Island pied oystercatcher | Low |
| PK2_W22* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, Spotless crake, Australasian bittern, and White heron. | Low |
| PK2_W23 | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, Spotless crake, Australasian bittern, and White heron. | Moderate |
| PK2_W24 | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, Spotless crake, Australasian bittern, and White heron. Likely to support TAR lizards. | Low |

| Wetland ID | Vegetation/Wetland Type[19] | NPS-FM Classification | Potential for TAR Species | Ecological Value |
|---|---|---|---|---|
| PK2_W25^ | Exotic Wetland (EW) | Natural inland wetland | Potential habitat for dabchick and white heron | Low |
| PK2_W26^ | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK2_W27* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK2_W28 | *Machaerina* sedgeland (WL11) | Natural inland wetland | Potential for Banded rail, Spotless crake, Australasian bittern, Fernbird, and White heron. | Moderate |
| PK2_W29* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, Spotless crake, and White heron. | Low |
| PK2_W30 | Exotic Wetland with a portion of resembling WL11 | Natural inland wetland | Unlikely to support TAR birds | Low |
| PK2_W31 | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail and Spotless crake. Likely to support TAR lizards. | Low |
| PK2_W32* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail and Spotless crake. | Low |
| PK2_W33* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail and Spotless crake. | Low |
| PK2_W34* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail and Spotless crake. | Low |
| PK2_W35* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK2_W36* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. Likely to support TAR lizards. | Low |
| PK2_W37 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK2_W38^ | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Negligible |

| Wetland ID | Vegetation/Wetland Type[19] | NPS-FM Classification | Potential for TAR Species | Ecological Value |
|---|---|---|---|---|
| PK2_W39* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, Spotless crake, Australasian bittern, and white heron. Likely to support TAR lizards. | Moderate |
| PK2_W40* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Negligible |
| PK2_W41* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, Spotless crake, Australasian bittern, and white heron. Likely to support TAR lizards. | Moderate |
| PK2_W42* | Open Water (OW) | Artificial wetland | Potential habitat for dabchick and white heron | Negligible |
| NoR 3 - Paerata Connections | | | | |
| PK2_W36* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. Likely to support TAR lizards. | Low |
| PK2_W37 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| NoR 4 – Pukekohe North-East Arterial | | | | |
| PK4_W1 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds | Low |
| PK4_W2 | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, Spotless crake, and white heron | Low |
| PK4_W3* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK4_W4^ | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK4_W5* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. Likely to support TAR lizards. | Low |
| PK4_W6* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. Likely to support TAR lizards. | Low |
| PK4_W7* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. Likely to support TAR lizards. | Low |

| Wetland ID | Vegetation/Wetland Type[19] | NPS-FM Classification | Potential for TAR Species | Ecological Value |
|---|---|---|---|---|
| PK4_W8* | Exotic Wetland (EW) | Natural inland wetland | Potential for Australasian bittern, White heron, Banded rail, Spotless crake, South Island pied oystercatcher, and Fernbird. Likely to support TAR lizards. | Moderate |
| PK4_W9* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail and Spotless crake. | Low |
| PK4_W10 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK4_W11 | Exotic Wetland (EW) | Natural inland wetland | Potential for Dabchick, Banded rail, and Spotless crake. | Low |
| PK4_W12 | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, Spotless crake, Australasian bittern, and White heron. Likely to support TAR lizards. | Low |
| PK4_W13 | Exotic Wetland with planted Kahikatea | Natural inland wetland | Potential for Banded rail, Spotless crake, Australasian bittern, and White heron. Likely to support TAR lizards. | Low |
| PK4_W14 | *Machaerina* sedgeland (WL11) | Natural inland wetland | Potential for Banded rail, Spotless crake, Australasian bittern, and White heron | Moderate |
| NoR 5 – Pukekohe South East Arterial | | | | |
| PK5_W1* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds | Low |
| PK5_W2* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds | Low |
| PK5_W3* | Open Water (OW) | Artificial wetland | Potential for dabchick | Low |
| PK5_W4* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds | Low |
| PK5_W5 | *Machaerina* sedgeland (WL11) | Natural inland wetland | Potential for spotless crake | Moderate |

| Wetland ID | Vegetation/Wetland Type[19] | NPS-FM Classification | Potential for TAR Species | Ecological Value |
|---|---|---|---|---|
| PK5_W6 | Exotic Wetland (EW) with an OW feature | Natural inland wetland | Potential for dabchick | Low |
| PK5_W7 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. Likely to support TAR lizards. | Moderate |
| NoR 7 – Pukekohe North-West Arterial | | | | |
| PK7_W1* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds | Low |
| PK7_W2^ | Exotic Wetland (EW) | Natural inland wetland | Potential for dabchick | Low |
| PK7_W3 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds | Low |
| NoR 8 (AC & WDC) – Mill Road and Pukekohe East Road Upgrade | | | | |
| PK8_W1* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds | Low |
| PK8_W2* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds | Low |
| PK8_W3* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, and Spotless crake | Low |
| PK8_W4 | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail, Spotless crake, and Australasian bittern. | Low |
| PK8_W5* | Exotic Wetland (EW) | Natural inland wetland | Potential for Banded rail and Spotless crake. | Low |
| PK8_W6* | Open Water (OW) | Artificial wetland | Potential for dabchick | Negligible |
| PK8_W7 | Open Water (OW), Exotic Wetland (EW), and portions of Raupō reedland (WL19) | Artificial wetland | Potential for Banded rail, Spotless crake, Australasian bittern, Dabchick, and White heron. | Low |
| PK8_W8 | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Low |
| PK8_W9* | Exotic Wetland (EW) | Natural inland wetland | Unlikely to support TAR birds. | Negligible |
| PK8_W10 | Exotic Wetland (EW) | Natural inland wetland | Potential for dabchick. | Low |

*Notes: ^ = Ecological feature assessed from roadside or adjacent property boundary due to access restrictions.*

** = Ecological feature assessed at a desktop level due to access restrictions.*

# 7 Assessment of Positive Effects

Potential positive effects for the construction and operation of the Pukekohe Transport Network include:

- The introduction of improved blue/green infrastructure, such as stormwater wetlands, swales, and associated landscaping (which will include indigenous vegetation). This network of semi-natural areas will provide a wide range of ecosystem services that will not only contribute to the mitigation of the relevant effects from the proposed Pukekohe Transport Network, but also enhance the ecosystem services provided by natural ecosystems in a modified landscape.
- Landscape planting of berms, embankments, and stormwater wetlands are connected and integrated with retained forest remnants and mature trees, streams, riparian margins, and open space zones. Where applicable, the landscaping is anticipated to enhance the connectivity of some of the remaining natural and semi-natural areas.
- The proposed bat and avifauna mitigation in association with the landscape planting of berms, embankments, and stormwater wetlands is likely to improve ecological connectivity for other native fauna.

In accordance with current Waka Kotahi and Auckland Transport guidelines, it is assumed that all planting will include native vegetation and eco-sourced species.

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

This section assesses the ecological effects of construction and operational activities, which relate to district plan matters under the AUP:OP and also the WDP (Franklin Section) for NoR 8. For each key ecological effect, the assessment details the 'Magnitude of Effect' and subsequent 'Overall level of Effect' (see Appendix 1 for details on assessment methodology) as they relate to the ecological features identified. Impact management and residual effects are presented where the overall level of effect is assessed to be **Moderate** or higher (in accordance with the EIANZ guidelines)[20].

The effects assessment has considered two scenarios – the current ecological baseline and the likely future ecological environment. Refer to Section 5 for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

## 8.1 Overview of Construction and Operational Effects

The potential **construction effects** (direct and indirect) to the terrestrial habitat, bats, birds, and lizards within and adjacent to the Pukekohe Transport Network (as they relate to district plan matters) include:

- Disturbance and displacement bats (including roost sites), birds (including nests), and lizards adjacent to construction activities (e.g., noise, light, vibration, and dust from construction activities). 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 bridges.
- In relation to AUP:OP district plan vegetation[21], the following effects:
- Permanent loss of habitat resulting in fragmentation and edge effects due to the removal of trees during construction.
- Loss of foraging habitat for bats, birds, and lizards due to the removal of trees protected by the AUP:OP district plan.
- Bat roost and bird nest loss through the removal of trees protected by the district plan.
- Mortality or injury to bats, birds, and/or lizards due to the removal of trees protected by the AUP:OP district plan.

In addition, the following construction effects are also applicable to all of the terrestrial habitat within the section of NoR 8 that is located within the Waikato District (WDP – operative and proposed):

- Permanent loss of habitat, fragmentation, and edge effects due to vegetation removal.
- Weed dispersal to previously unaffected areas of indigenous vegetation.
- Loss of foraging habitat for bats, birds, and lizards due to vegetation removal.
- Bat roost and bird nest loss through vegetation removal.

[20] All effects assessed, including low, very low, and negligible effects, are presented in Appendix 11.

[21] As per the Pukekohe Transport Network Assessment of Arboricultural Effects Report, a 'protected tree' is a tree that requires resource consent for alteration (including pruning and works within the root zone) or removal. This includes effects on 'notable trees', effects on trees in Outstanding Natural Feature (ONF), High Natural Character (HNC), Outstanding Natural Landscape (ONL) and Outstanding Natural Character (ONC) overlays, effects on trees in roads, except where adjacent to rural zoned and FUZ land in respect of infrastructure projects, and effects on trees in Open Space zones.

- Mortality or injury to bats, birds, and/or lizards due to vegetation removal.

The potential **operational effects** (direct and indirect) to the terrestrial habitat, bats, birds, and lizards within and adjacent to the Pukekohe Transport Network (as they relate to district plan matters) include:

- Disturbance and displacement of bats (including roost sites), birds (including nests), and lizards due to light, noise, and vibration effects from the presence of the road.
- Loss in connectivity due to permanent habitat loss, and light and noise effects from the road, which leads to fragmentation of terrestrial, wetland and riparian habitat.

## 8.2 Terrestrial Vegetation

Vegetation to be removed that is subject to district plan provisions in the AU:OP, is guided by the findings of the Arboriculture Effects Assessment for the project. Portions of the vegetation within NoR 8 is subject to the Waikato district plan provisions [22]. For a list of trees protected by the district plan provisions (AUP:OP and WDP (Proposed)) refer to Table 6-4. The removal of these trees was taken into consideration for the assessment of:

- The permanent loss of habitat, which may result in fragmentation and edge effects due to the removal of the trees during construction; and
- Weed dispersal to previously unaffected areas of indigenous vegetation.

The above ecological effects related to the removal of these trees[23] is considered Low and as such have not been considered any further in the ecological effects assessment. As such no impact management is recommended for these effects. However, the effect of the loss of these trees on TAR faunal species is considered separately in Sections 8.3 - 8.5.

These effects assessments considered two scenarios – the current ecological baseline and the 'likely future ecological environment' (i.e., allowing for permitted activities). A precautionary approach was applied to considering the level of effect within the likely future ecological environment. The level of effect was assessed as the **same as the baseline**.

## 8.3 Long-tailed bats

### 8.3.1 Construction Effects

Bats may utilise the habitats associated with all the NoRs, except NoR 6, for roosting or foraging (Table 8-1). During construction, night works may be required, and site compounds are likely to be lit

[22] Refer to the Pukekohe Transport Network Assessment of Arboricultural Effects Report for the details on the number of the different species of trees, tree groupings, and the applicable rules that requires that they are protected under district plan provisions. **Note - The Arboricultural Effects Report identified protected trees according to District Plan provisions within NoR 5. However, this was due to only the tree's root zones occurring within the designated boundary, and not the trees. As such these trees were excluded from the Ecological Effects assessment**.

[23] The removal of indigenous vegetation, excluding domestic, ornamental and landscape plantings, within the area of NoR 8 in the Waikato District, is considered a Restricted Discretionary activity under the Proposed Waikato Plan rules (Standard ECO-R16). Indigenous Vegetation: "*Means vegetation that occurs naturally in New Zealand or arrived in New Zealand without human assistance. For the purposes of this plan, domestic or ornamental / landscaping planting or planted shelter belts comprising indigenous species are not included*." As such, the removal of this vegetation is required to be assessed as a district plan provision. However, the only indigenous vegetation within the designation boundary of NoR8 in the Waikato District was a solitary Totara tree (as per the Arboriculture Effects Assessment report).

overnight. Lighting at night has the potential to modify the behaviour of bats if foraging within these areas or roosting in nearby isolated stands of mature trees.

Noise and vibration during construction may also impact bats if they are roosting in the immediate vicinity of the construction works. Although bat foraging has been confirmed within NoR 2, 3, 4, 7, and 8, and within close proximity to the other NoRs (i.e., <2km), ABM surveys at the project scale cannot confirm roost occupation within or adjacent to the proposed designation boundaries. However, it can be assumed that bats will utilise roost sites within the Pukekohe Transport Network (excluding NoR 6) based on:

- confirmed habitat suitability (numerous trees with moderate to high bat roost potential, connected to linear stream corridors and wetlands);
- confirmed foraging presence; and
- frequent utilisation of numerous roosting sites throughout their home range (Smith et al., 2017).

Additionally, bats may be impacted by the removal of vegetation in the NoR 8, which is protected by the AUP:OP in Auckland, and the WDP (operational and proposed) in the Waikato. The removal of vegetation protected under these district plan provisions may result in the following effects:

- loss of foraging habitat (Note – these effects are considered Negligible and are therefore excluded from assessment);
- roost loss; and
- mortality or injury to bats.

**Table 8-1 Habitat where bats could potentially occur within each of the NoRs**

| NoR | Suitable Bat Habitat |
|---|---|
| 1 | Specifically, areas of exotic dominated Treeland (TL.3). |
| 2 | Specifically, areas of Exotic Forest (EF), Treeland – Native-Dominated (TL.1), Treeland – Exotic-Dominated (TL.3), and Pūriri Forest (WF7). |
| 3 | Specifically, areas of Exotic Forest (EF) and Treeland – Exotic-Dominated (TL.3). |
| 4 | Specifically, areas of Exotic Forest (EF), Treeland – Native-Dominated (TL.1), Treeland – Exotic-Dominated (TL.3), Pūriri Forest (WF7), Kahikatea Forest (MF4), Kahikatea, pukatea forest (WF8), and Taraire, tawa, podocarp forest (WF9). |
| 5 | Specifically, areas of Treeland – Native-Dominated (TL.1) and Treeland – Exotic-Dominated (TL.3). |
| 6 | Excluded as bats are highly unlikely to utilise the vegetation within the designated areas. |
| 7 | Specifically, areas of Treeland – Native-Dominated (TL.1) and Treeland – Exotic-Dominated (TL.3). |
| 8 (AC & WDC) | Specifically, areas of Treeland – Native-Dominated (TL.1), Treeland – Mixed Native/Exotic (TL.2), Treeland – Exotic-Dominated (TL.3), Broadleaved species scrub/forest (VS5), and Taraire, tawa, podocarp forest (WF9). |

Table 8-2 details the potential magnitude of effect and subsequent level of effect (with justification) on long-tailed bats (**Very high** ecological value) for each NoR. Only NoRs where the level of effect was **Moderate** or higher are presented, with associated impact management presented in Section 8.3.2.

The effects assessment considered two scenarios – the current ecological baseline and the 'likely future ecological environment' (i.e., allowing for permitted activities). The level of effect within the likely future ecological environment across all NoRs is expected to remain the **same as the baseline**, as the assessment undertaken above is still relevant to the future environment because riparian corridors are likely to remain in the future environment.

**Table 8-2 Summary of disturbance to long-tailed bats, which may result in changes to population dynamics, during construction (Moderate level of effect or higher)**

| Relevant NoR | Activity and Effect Description | Effects Description | Ecological Value | Magnitude | Level of Effect (pre-mitigation) |
|---|---|---|---|---|---|
| NoR 1 | Construction - Disturbance and displacement to roosts (existing) due to construction activities (noise, light, dust etc.) | A new transport corridor, with five stream crossings (the Ngakoroa Stream and unnamed tributaries). Bats were recorded foraging within close proximity (< 2km). Possible bat roosts in exotic vegetation, particularly in areas of exotic dominated Treeland (TL.3). Bats could be disturbed due to construction activity (noise/lighting/vibration) resulting in disturbance and displacement to existing roosts. | Very High | Low | **Moderate** |
| NoR 2 | | A new and upgrade to existing transport corridor, with 14 stream crossings (the Ngakaora Stream, Oira Creek, Whangapouri Creek, and unnamed tributaries of these systems). Bats were recorded foraging within the proposed designation boundary. Possible bat roosts could potentially occur within areas of Exotic Forest (EF), Treeland – Native-Dominated (TL.1), Treeland – Exotic-Dominated (TL.3), and Pūriri Forest (WF7). Bats could be disturbed due to construction activity (noise/lighting/vibration) resulting in disturbance and displacement to existing roosts. | Very High | Low | **Moderate** |
| NoR 3 | | A new transport corridor, with one stream crossing (Oira Creek tributary). Bats were recorded foraging within the proposed designation boundary of the NoR. Possible bat roosts could potentially occur within areas of Exotic Forest (EF), and Treeland – Exotic-Dominated (TL.3). Bats could be disturbed due to construction activity (noise/lighting/vibration) resulting in disturbance and displacement to existing roosts. | Very High | Low | **Moderate** |
| NoR 4 | | A new transport corridor, with nine stream crossings (Oira Creek and Whangapouri Creek unnamed tributaries). Bats were recorded foraging within the proposed designation boundary. Possible bat roosts could potentially occur within areas of Exotic Forest (EF), Treeland – Native-Dominated (TL.1), Treeland – Exotic-Dominated (TL.3), Pūriri Forest (WF7), Kahikatea Forest (MF4), Kahikatea, pukatea forest (WF8), and Taraire, tawa, podocarp forest (WF9). Bats could be disturbed due to construction activity (noise/lighting/vibration) resulting in disturbance and displacement to existing roosts. | Very High | Low | **Moderate** |

| Relevant NoR | Activity and Effect Description | Effects Description | Ecological Value | Magnitude | Level of Effect (pre-mitigation) |
|---|---|---|---|---|---|
| NoR 5 | | A new and upgrade to existing transport corridor, including three stream crossings (Tutaenui Stream and Whangapouri Creek unnamed tributaries). Bats were recorded foraging in close proximity to the NoR (≤ 800m). Possible bat roosts could potentially occur within areas of Treeland – Native-Dominated (TL.1) and Treeland – Exotic-Dominated (TL.3). Bats could be disturbed due to construction activity. | Very High | Low | **Moderate** |
| NoR 7 | | A new and upgrade to existing transport corridor, including two stream crossings (Whangapouri Creek unnamed tributaries). Bats were recorded foraging within the proposed designation boundary of the NoR. Possible bat roosts could potentially occur within areas of Treeland – Native-Dominated (TL.1) and Treeland – Exotic-Dominated (TL.3). Bats could be disturbed due to construction activity. | Very High | Low | **Moderate** |
| NoR 8 | | Upgrade of an existing transport corridor, including four stream crossings (Tutaenui Stream and Ngakaora Stream unnamed tributaries). Bats were recorded foraging within the proposed designation boundary of the NoR. Possible bat roosts could potentially occur within areas of Treeland – Native-Dominated (TL.1), Treeland – Exotic-Dominated (TL.3), and Taraire, tawa, podocarp forest (WF9). Bats could be disturbed due to construction activity. | Very High | Low | **Moderate** |

Table 8-3 Effect of the removal of district plan trees in the Auckland section (AUP:OP), and the removal of vegetation within the Waikato section (WDP operational and proposed), of NoR 8

| Relevant NoR | Activity | Effects Description | Ecological Value | Magnitude | Level of Effect (pre-mitigation) |
|---|---|---|---|---|---|
| NoR 8 (Auckland section) | Roost loss; and<br>Mortality or injury to bats | The impacts associated with the removal of AUP:OP district plan trees within NoR 8. The following trees / tree groups identified in the Arboriculture Effects Assessment report are likely to provide suitable roosting habitat for bats: | Very High | Low | **Moderate** |

| Relevant NoR | Activity | Effects Description | Ecological Value | Magnitude | Level of Effect (pre-mitigation) |
|---|---|---|---|---|---|
| | | • Tree group 8/9, containing – pine (*Pinus radiata*), redwood (*Sequoia sempervirens*) and totara in the front of 131 Pukekohe East Road.<br>• Tree group 8/10 contains – coast banksia (*Banksia integrifolia*), silky oak (*Grevillea robusta*), American sweet gum (*Liquidambar styraciflua*) and tulip tree (*Liriodendron tulipifera*) that are exotic specimen trees planted along the front of 131 Pukekohe East Road.<br>• Tree group 8/15 contains Lawson cypress (*Chamaecyparis lawsoniana*) and English oak (*Quercus robur*) at 197A Pukekohe East Road.<br>• Tree 8/71 is a mature puriri that is a scheduled tree at 203 Mill Road, which is listed in Schedule 10 – Notable Tree Schedule as: 2705.<br>• Tree 8/72 is a coast redwood that is a scheduled tree at 165C Mill Road, which is listed in Schedule 10 – Notable Tree Schedule as: 686<br><br>Given the level of long-tailed bat activity in the wider landscape (refer to section 6.3.2), it is possible that these trees and tree groups could provide an important proportion of roosting habitat in a landscape that has limited remnants of indigenous forest. | | | |
| NoR 8 (Waikato section) | Roost loss; and<br><br>Mortality or injury to bats | The removal of treelands (TL.1 and TL.3) within the Waikato section of NoR 8.<br><br>Given the level of long-tailed bat activity in the wider landscape (refer to section 6.3.2), it is possible that these treelands, and particular the large exotic trees within them, could provide an important proportion of roosting habitat in a landscape that has limited remnants of indigenous forest. | Very High | Low | **Moderate** |

### 8.3.2 Impact Management and Residual Effects During Construction

Construction activities across all NoRs, except NoR 6, are anticipated to have a **Moderate** level of construction related disturbance effects on long-tailed bats. As such, impact management is recommended. A Bat Management Plan (BMP) is recommended as a condition for all NoRs except NoR 6, and some specific conditions apply to the removal of vegetation within NoR 8 only. This should include:

- Bat 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 December through to March).
- Positioning of compounds and laydown areas to avoid relevant habitats (Table 8-1 and Table 8-3).
- Lighting design to reduce light levels and spill from construction areas where required.
- Potential restriction of nightworks around relevant habitats (Table 8-1 and Table 8-3).
- Bat management should be integrated with any regional consent conditions (i.e., BMPs) that may be required for regional compliance.
- Consideration to the provisions of the Wildlife Act including the implementation of a vegetation removal protocol (Bat Roost Protocol v2 DOC, 2021 or equivalent version at time of removal) (**NoR 8 only**)
- Where possible, retain existing mature trees (this is in accordance with the Urban Landscape and Design Management Plan (ULDMP) or the Landscape Management Plan for the Waikato NoR) (NoR 8 only).
- Artificial bat roosts (i.e., bat boxes) should be erected within, or in close proximity to, where suitable roost habitat (i.e., large mature trees) is to be removed in NoR 8. A 1:1 ratio is recommended. The introduction of artificial bat roots will help to mitigate the short-medium term loss of suitable vegetation.

The residual impact is assessed as **Low** post mitigation. No further impact management is anticipated.

### 8.3.3 Operational Effects

The following potential operational related effects have been identified in relation to long-tailed bats within and adjacent to all the NoRs (as they relate to district matters):

- Disturbance and displacement of long-tailed bats and roost sites due to light, noise, and vibration effects from the operation of the road.
- Habitat fragmentation leading to loss in connectivity to long-tailed bats, due to light, noise, and vibration effects from the operation of the road.

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 and can impact on bat movement in the broader landscape. Lighting spillage from street lighting could also disturb commuting and foraging bats at night and adversely affect insect prey populations.

Table 8-4 details the potential magnitude of effect and subsequent level of effect (with justification) on long-tailed bats (**Very high** ecological value) for each NoR. Only NoRs where the level of effect was **Moderate** or higher is presented, with associated impact management presented in section 8.3.4.

The portions of designated areas of NoR 6 are located within an urban environment with limited habitat that is unlikely to support bats. As such, the operation of the road within NoR 6 is unlikely to affect bats (A **Low** level of effect was determined for NoR 6).

The effects assessment considered two scenarios – the current ecological baseline and the 'likely future ecological environment' (i.e., allowing for permitted activities). The level of effect within the likely future ecological environment across all NoRs is expected to remain the **same as the baseline**, as the assessment undertaken above is still relevant to the future environment because riparian corridors are likely to remain in the future environment. As such, Table 8-4 provides the level of effect for both scenarios.

**Table 8-4 Summary of loss in connectivity and disturbance to long-tailed bats, resulting in changes to population dynamics, (Moderate level of effect or higher) during operation for both the baseline and future ecological environment scenarios**

| NoR | Activity and Effect Description | Effects Justification | Ecological Value | Magnitude | Level of Effect (pre-mitigation) |
|---|---|---|---|---|---|
| NoR 1 | Habitat fragmentation leading to loss in connectivity to long-tailed bats, due to light, noise, and vibration effects from the operation of the road. | The new transport corridor is likely to fragment habitat anticipated to be used by bats in the area (i.e., within a 10km radius of the NoR (ZOI)). Of particular concern, is the fragmentation of Ngakoroa Stream riparian corridors and exotic dominated Treeland (TL.3). | Very High | Low | **Moderate** |
| NoR 2 | | The new transport corridor is likely to fragment habitat anticipated to be used by bats in the area (i.e., 10km ZOI). Of particular concern, is the fragmentation of Ngakoroa Stream, Oira Creek, and Whangapouri Creek (and the associated tributaries) riparian corridors and the stands of exotic forest, treelands and Pūriri Forest. | Very High | Low | **Moderate** |
| NoR 3 | | The new transport corridor is likely to fragment habitat anticipated to be used by bats in the area. Of particular concern, is the fragmentation of stands of exotic forest, exotic dominated treelands. | Very High | Low | **Moderate** |
| NoR 4 | | The new transport corridor is likely to fragment habitat anticipated to be used by bats in the area. Of particular concern, is the fragmentation of riparian corridors along the tributaries of the Oira Creek and Whangapouri Creek, and the stands of exotic forest and treelands, and native treelands and forests. | Very High | Low | **Moderate** |
| NoR 5 | | The new and upgrade to the existing transport corridor is likely to fragment habitat anticipated to be used by bats in the area (in the case of the existing road current fragmentation is likely to be enhanced). Of particular concern, is the fragmentation of riparian corridors along tributaries of the Tutaenui Stream and Whangapouri Creek and stands of treelands. | Very High | Low | **Moderate** |

| NoR | Activity and Effect Description | Effects Justification | Ecological Value | Magnitude | Level of Effect (pre-mitigation) |
|---|---|---|---|---|---|
| NoR 7 | | The new and upgrade to the existing transport corridor is likely to fragment habitat anticipated to be used by bats in the area (in the case of the existing road current fragmentation is likely to be enhanced). Of particular concern, is the fragmentation of riparian corridors along tributaries of the Whangapouri Creek and stands of treelands. | Very High | Low | **Moderate** |
| NoR 8 | | The upgrade of an existing transport corridor is likely to further fragment habitat anticipated to be used by bats. Of particular concern, is the fragmentation of riparian corridors along tributaries of the Tutaenui Stream and Ngakoroa Stream and stands of treelands and native forest. | Very High | Low | **Moderate** |
| NoR 1 | Disturbance and displacement of long-tailed bats and roost sites (new and existing) due to light, noise, and vibration effects from the operation of the road. | The new transport corridor will likely cross five streams and be located directly adjacent to exotic dominated treelands along the route. Bats could be disturbed due to the operation of the road. | Very High | Low | **Moderate** |
| NoR 2 | | The new transport corridor will likely cross 14 streams and be located directly adjacent to stands of exotic forests, treelands, and Pūriri Forest along the route. Bats could be disturbed due to the operation of the road. | Very High | Low | **Moderate** |
| NoR 3 | | The new transport corridor will likely cross one streams and be located directly adjacent to stands of exotic forests, and exotic dominated treelands along the route. Bats could be disturbed due to the operation of the road. | Very High | Low | **Moderate** |
| NoR 4 | | The new transport corridor will likely cross nine streams and be located directly adjacent to stands of exotic forests and treelands and native forests and treelands. Bats could be disturbed due to the operation of the road. | Very High | Low | **Moderate** |

| NoR | Activity and Effect Description | Effects Justification | Ecological Value | Magnitude | Level of Effect (pre-mitigation) |
|---|---|---|---|---|---|
| NoR 5 | | The new and upgrade to the existing transport corridor will cross three streams and be located directly adjacent to stands of treelands. Bats could be disturbed due to the operation of the road. | Very High | Low | **Moderate** |
| NoR 7 | | The new and upgrade to the existing transport corridor road will cross two streams and be located directly adjacent to stands of treelands. Bats could be disturbed due to the operation of the road. | Very High | Low | **Moderate** |
| NoR 8 | | The upgrade of an existing transport corridor will cross four streams and be located directly adjacent to stands of treelands and native forest. Bats could be disturbed due to the operation of the road. | Very High | Low | **Moderate** |

### 8.3.4 Impact Management and Residual Effects During Operation

Operational activities across all NoRs, except NoR 6, are anticipated to have a **Moderate** level of operational related fragmentation and disturbance effects on long-tailed bats. As such, impact management is recommended.

A BMP should be developed and it should consider:

- Lighting design to minimise light levels and light spill along the road corridor.
- Potential connectivity effects will be mitigated by introducing hop-overs/underpasses to the Pukekohe Transport Network. Buffer planting along the riparian corridors of the permanent streams crossed by the NoRs (refer to Table 6-8), and where possible retention of existing mature tree features, as well as indicating riparian corridors where planting of mature trees could occur.
- An adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action.

The exact location and extent of planting along the riparian corridors of the permanent streams will need to be confirmed at the detailed design and consenting phase, and developed through the BMP. The recommendation at this stage is that buffer planting should be within and directly adjacent to the NoRs where they intersect with these ecological corridors.

The residual impact is assessed as **Low** post mitigation. No further impact management is anticipated.

## 8.4 Avifauna

### 8.4.1 Construction Effects

Noise, vibration, and lighting disturbance caused by construction activities could potentially displace TAR birds and native birds from suitable nesting and foraging habitat within and adjacent to all NoRs. NoR 6 is unlikely to provide suitable habitat for TAR bird species, which may occur in the area, but some native birds may utilize the planted vegetation and treelands within the NoR.

Threatened and At-Risk, and native birds may also be impacted by the removal of district plan vegetation within NoR 8, and the removal of vegetation within the Waikato section of NoR 8, through the following effects:

- Disturbance and displacement to TAR and native birds due to construction activities (noise, light, dust, etc.);
- Loss of foraging habitat;
- Nest loss; and
- Mortality or injury to birds.

Table 8-5 summarises the NoRs where the level of effect is **Moderate** or higher. The effects assessment has considered two scenarios – the current ecological baseline and the 'likely future ecological environment' (i.e., allowing for permitted activities). The level of effect within the likely future ecological environment across all NoRs is expected to remain the same as the baseline. As such, Table 8-5 provides the level of effect for both scenarios.

The impacts associated with the removal of AUP:OP district plan vegetation within NoR 8, and the removal of vegetation within the Waikato section of NoR 8 (i.e. disturbance and displacement to existing individual trees due to construction activities, loss of foraging habitat, nest loss, and mortality or injury to birds), were all assessed to have a **Low** level of effect on TAR and native birds.

**Table 8-5 Summary of disturbance to avifauna, which may result in changes to population dynamics (Moderate level of effect or higher) during construction**

| Disturbance and displacement to TAR and native birds, and nest sites, resulting from construction activities (for both the current ecological baseline and the likely future ecological environment) | | | | | | |
|---|---|---|---|---|---|---|
| **NoR** | **Conservation Classification** | **Species Included** | **Ecological Value** | **Effect Justification** | **Magnitude** | **Level of Effect (pre-mitigation)** |
| NoR 1 | Threatened | Australasian bittern, White heron, and Dabchick | Very High | A new transport corridor, with five stream crossings is likely to impact suitable habitat for these birds, which includes: wetlands PK1_W3 and PK1_W4&W7 (and the open water adjacent to the wetland), and riparian habitat associated with the Ngakoroa Stream unnamed tributaries. These threatened birds could be disturbed during construction. | Low | **Moderate** |
| NoR 2 | | Australasian bittern, White heron, and Dabchick | | A new transport corridor, with 14 stream crossings is likely to impact suitable habitat for these birds, which includes: wetlands (in particular, but not limited to: PK2_W1-2, W4-5 and PK1_W4&7, PK2_W9-15, W18- 25, W27-29, W31-34, W39, and W42 (includes open water), and riparian habitat associated with the Ngakoroa Stream and Oira Creek unnamed tributaries. These threatened birds could be disturbed during construction. | Low | **Moderate** |
| NoR 4 | | Australasian bittern, White heron, and Dabchick | | A new transport corridor, with nine stream crossings is likely to impact suitable habitat for these birds, which includes: wetlands (in particular, but not limited to: PK4_W2, W5-9, and W12-14 (including open water), and riparian habitat associated with the Whangapouri Creek and Oira Creek unnamed tributaries. These threatened birds could be disturbed during construction. | Low | **Moderate** |
| NoR 5 | | Dabchick | | A new and upgrade to the existing transport corridor road, including three stream crossings is likely to impact suitable habitat for Dabchick, which includes: wetlands (in particular, but not limited to: PK5_W3 and W6 (including open water) and open water associated with the Tutaenui Stream and Whangapouri Creek unnamed | Low | **Moderate** |

| Disturbance and displacement to TAR and native birds, and nest sites, resulting from construction activities (for both the current ecological baseline and the likely future ecological environment) | | | | | | |
|---|---|---|---|---|---|---|
| | | | | tributaries. These threatened birds could be disturbed during construction. | | |
| NoR 7 | | Dabchick | | A new and upgrade to the existing transport corridor road, including three stream crossings is likely to impact suitable habitat for Dabchick, which includes: wetlands (in particular, but not limited to: PK7_W2 (including open water)), and open water associated with the Whangapouri Creek unnamed tributaries. These threatened birds could be disturbed during construction. | Low | **Moderate** |
| NoR 8 | | Australasian bittern, White heron, and Dabchick | | Upgrade of an existing transport corridor, including four stream crossings is likely to impact suitable habitat for these birds, which includes: wetlands (in particular, but not limited to: PK8_W3, W5-7, and W10 (including open water)) and riparian habitat associated with the Ngakoroa Stream unnamed tributaries. These threatened birds could be disturbed during construction. | Low | **Moderate** |
| NoR 1 | At Risk – Declining | Banded rail, Spotless crake, and South Island pied oystercatcher | High | A new transport corridor, with five stream crossings is likely to impact suitable habitat for these birds, which includes: wetlands PK1_W3 and PK1_W4&7 (and the open water adjacent to the wetland), and riparian habitat associated with the Ngakoroa Stream unnamed tributaries. These At Risk - Declining birds could be disturbed during construction. | Low | **Moderate** |
| NoR 2 | | Banded rail, Spotless crake, South Island pied oystercatcher, and Fernbird | | A new transport corridor, with 14 stream crossings is likely to impact suitable habitat for these birds, which includes: wetlands (in particular, but not limited to: PK2_W1-2, W4-5 and PK1_W4&7, PK2_W9-15, W18- 25, W27-29, W31-34, W39, and W42 (includes open water)), and riparian habitat associated with the Ngakoroa Stream and Oira Creek unnamed tributaries. These At Risk-Declining birds could be disturbed during construction. | Low | **Moderate** |

| Disturbance and displacement to TAR and native birds, and nest sites, resulting from construction activities (for both the current ecological baseline and the likely future ecological environment) | | | | | | |
|---|---|---|---|---|---|---|
| NoR 4 | | Banded rail, Spotless crake, South Island pied oystercatcher, and Fernbird | | A new transport corridor, with nine stream crossings is likely to impact suitable habitat for these birds, which includes: wetlands (in particular, but not limited to: PK4_W2, W5-9, and W12-14 (including open water)) and riparian habitat associated with the Whangapouri Creek and Oira Creek unnamed tributaries. These At Risk-Declining birds could be disturbed during construction. | Low | **Moderate** |
| NoR 8 | | Banded rail, South Island pied oystercatcher, and Spotless crake | | Upgrade of an existing transport corridor, including four stream crossings is likely to impact suitable habitat for these birds, which includes: wetlands (in particular, but not limited to: PK8_W3, PK8_W5-7, and W10 (including open water)) and riparian habitat associated with the Ngakaora Stream unnamed tributaries. These At Risk-Declining birds could be disturbed during construction. | Low | **Moderate** |

### 8.4.2 Impact Management and Residual Effects During Construction

An Avifauna Management Plan for all Threatened and At Risk-Declining birds is recommended as a condition on the proposed designation for NoR 1, NoR 2, NoR 4, NoR 5, NoR 7, and NoR 8 (all NoRs except NoR 3 and NoR 6). This should consider the following:

- Pre-construction nesting bird surveys throughout wetlands, riparian habitat (particularly those listed in Table 8-5 above), and forest patches (particularly WF 9, WF 7 and MF 4 within NoR 4).
- Where practical, construction works near wetland habitat (Table 8-5) should commence prior to the bird breeding season (September to February) in order to discourage bird nesting.
- Bird management should be consistent with any regional consent conditions that may be required for regional compliance.
- Consideration of the provisions of the Wildlife Act including timing vegetation removal to avoid the key nesting period (September to February) or where this is not possible, pre-clearance inspections undertaken prior to vegetation removal (wetlands, riparian habitat listed in Table 8-5 above, and forest patches WF 9, WF 7 and MF 4 within NoR 4).

The residual impact was assessed as **Low** post mitigation. No further impact management was anticipated.

### 8.4.3 Operational Effects

The following potential operational related effects have been identified in relation to TAR and native birds within and adjacent to all the NoRs (as they relate to district matters):

- Disturbance and displacement of TAR and native birds (including nest sites) due to light, noise, and vibration effects from the operation of the road.
- Habitat fragmentation leading to loss in connectivity to TAR and native birds, due to light, noise, and vibration effects from the operation of the road.

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 suitable foraging and nesting habitat for TAR and native birds within the broader landscape.

Table 8-6 details the potential magnitude of effect and subsequent level of effect (with justification) on TAR birds for each NoR (further detail regarding how these were determined are provided in Appendix **Error! Reference source not found.**). Only NoRs where the level of effect was **Moderate** or higher is presented, with associated impact management presented in section 8.4.4.

The portions of designated areas of NoR 6 are located within an urban environment with limited habitat that is unlikely to support TAR birds (some native birds may utilise the remaining habitat within these areas). As such, the upgrading of the road within NoR 6 is unlikely to affect birds (a **Low** level of effect was determined for NoR 6 for all TAR and native birds).

The effects assessment considered two scenarios – the current ecological baseline and the 'likely future ecological environment' (i.e., allowing for permitted activities). The level of effect within the likely future ecological environment across all NoRs is expected to remain the **same as the baseline**. As such, Table 8-6 provides the level of effect for both scenarios.

The impacts associated with habitat fragmentation leading to loss in connectivity to TAR and native birds, due to light, noise, and vibration effects from the operation of the road, were all assessed to have a **Low** or **Very Low** level of effect on TAR and native birds. As such no impact management was required.

**Table 8-6 Summary of disturbance to avifauna, resulting in changes to population dynamics, (Moderate level of effect or higher) during operation**

| Disturbance and displacement of TAR and native birds, and nest sites due to light, noise, and vibration effects from the operation of the road | | | | | | |
|---|---|---|---|---|---|---|
| **NoR** | **Conservation Classification** | **Species included** | **Ecological Value** | **Effect Justification** | **Magnitude** | **Level of Effect (pre-mitigation)** |
| NoR 1 | Threatened | Australasian bittern, White heron, and Dabchick | Very High | The operation of the new transport corridor is likely to impact suitable habitat for these birds, which includes wetlands PK1_W3 and PK1_W4 (and the open water adjacent to the wetland), and riparian habitat associated with the Ngakoroa Stream unnamed tributaries. | Low | **Moderate** |
| NoR 2 | | Australasian bittern, White heron, and Dabchick | | The operation of the new transport corridor is likely to impact suitable habitat for these birds, which includes wetlands (in particular, but not limited to: PK2_W1-2, PK2_ W4- and PK1_W4-7, PK2_W9-15, W18- 25, W27-29, W31-34, W39, and W42 (includes open water), and riparian habitat associated with the Ngakoroa Stream and Oira Creek unnamed tributaries. | Low | **Moderate** |
| NoR 4 | | Australasian bittern, White heron, and Dabchick | | The operation of the new transport corridor is likely to impact suitable habitat for these birds, which includes wetlands (in particular, but not limited to: PK4_W2, W5-9, and W12-14 (including open water)), and riparian habitat associated with the Whangapouri Creek and Oira Creek unnamed tributaries. | Low | **Moderate** |
| NoR 5 | | Dabchick | | The operation of the new and existing transport corridor is likely to impact suitable habitat for Dabchick, which includes wetlands (in particular, but not limited to: PK5_W3 and W6 (including open water)), and open water associated with the Tutaenui Stream and Whangapouri Creek unnamed tributaries. | Low | **Moderate** |
| NoR 7 | | Dabchick | | The operation of the new and existing transport corridor is likely to impact suitable habitat for Dabchick, which includes wetlands (in particular, but | Low | **Moderate** |

| Disturbance and displacement of TAR and native birds, and nest sites due to light, noise, and vibration effects from the operation of the road | | | | | | |
|---|---|---|---|---|---|---|
| | | | | not limited to: PK7_W2 (including open water)), and open water associated with the Whangapouri Creek unnamed tributaries. | | |
| NoR 8 | | Australasian bittern, White heron, and Dabchick | | The upgrading of the existing transport corridor is likely to impact suitable habitat for these birds, which includes wetlands (in particular, but not limited to: PK8_W3, W5-7, and W10 (including open water), and riparian habitat associated with the Ngakoroa Stream unnamed tributaries. | Low | **Moderate** |
| NoR 1 | At Risk – Declining | Banded rail, Spotless crake, and South Island pied oystercatcher | High | The operation of the new transport corridor is likely to impact suitable habitat for these birds, which includes wetlands PK1_W3 and PK1_W4 (and the open water adjacent to the wetland), and riparian habitat associated with the Ngakoroa Stream unnamed tributaries. | Low | **Moderate** |
| NoR 2 | | Banded rail, Spotless crake, South Island pied oystercatcher, and Fernbird | | The operation of the new transport corridor is likely to impact suitable habitat for these birds, which includes wetlands (in particular, but not limited to: PK2_W1-2, W4- and PK1_W4-7, W9-15, W18- 25, W27-29, W31-34, W39, and W42 (includes open water), and riparian habitat associated with the Ngakoroa Stream and Oira Creek unnamed tributaries. | Low | **Moderate** |
| NoR 4 | | Banded rail, Spotless crake, South Island pied oystercatcher, and Fernbird | | The operation of the new transport corridor is likely to impact suitable habitat for these birds, which includes wetlands (in particular, but not limited to: PK4_W2, W5-9, and W12-14 (including open water)), and riparian habitat associated with the Whangapouri Creek and Oira Creek unnamed tributaries. | Low | **Moderate** |
| NoR 8 | | Banded rail, South Island pied oystercatcher, and Spotless crake | | The upgrading of the existing transport corridor is likely to impact suitable habitat for these birds, which includes wetlands (in particular, but not limited to: PK8_W3, W5-7, and W10 (including open water), and riparian habitat associated with the Ngakoroa Stream unnamed tributaries. | Low | **Moderate** |

### 8.4.4 Impact Management and Residual Effects During Operation

An Avifauna Management Plan for all Threatened and At Risk-Declining birds is recommended as a condition on the proposed designation for NoR 1, NoR 2, NoR 4, NoR 5, NoR 7, and NoR 8 (all NoRs except NoR 3 and NoR 6). This should consider the following:

- Retention of vegetation near wetland habitat, and riparian habitat (particularly the habitat referenced in Table 8-6above).
- Where practicable, the retention of remaining forest patches, particularly within NoR 4 (i.e., WF 9, WF 7, and MF 4).
- Buffer planting between the road alignment and suitable habitat adjacent to the relevant wetlands and riparian habitats (Table 8-6).

The residual impact is assessed as **Very Low** post mitigation for all relevant NoRs. No further impact management is anticipated.

## 8.5 Herpetofauna

### 8.5.1 Construction Effects

The effects on herpetofauna have been considered against the typical behaviours, habitat preference, and sensitivity of the various species. In general, only two TAR species of skinks are likely to occur within the Pukekohe Transport Network, and there is also the possibility that some gecko species may be present within the remaining forest patched within NoR 4. These species include copper skink (*Oligosoma aeneum*), ornate skink (*Oligosoma ornatum*), Auckland Green / Elegant Gecko (*Naultinus elegans*), Forest Gecko (*Mokopirirakau granulatus*), and Pacific Gecko (*Dactylocnemis pacificus*). The two skink species are considered to be habitat generalists relative to other skink species, requiring either overgrown vegetation or organic refuge that maintains a moist environment. Populations typically occur in greater density within forested areas but have been recorded occurring within roadside vegetation. The only habitat potentially suitable for the three gecko species was considered to be the remaining natural forest patches adjacent to NoR 4. Only small portions of these natural forests extend marginally into NoR 4 (i.e., portions of WF 9, WF 7, and MF 4).

Table 6-7 details the specific habitat that herpetofauna may be utilising across the NoRs. Table 8-7 summarises the NoRs where the level of effect is **Moderate** or higher. Noise, vibration, and lighting disturbance caused by construction activities was considered and excluded as they were assessed to have a Low to Very Low level of effect on herpetofauna across all the relevant NoRs. As such no impact management was required.

The two skink species may also be impacted by the removal of Auckland district plan vegetation within NoR 8 (AUP:OP), and the removal of vegetation within the Waikato section of NoR 8 (WDP operational and proposed), through the following effects:

- Loss of habitat (Note – these effects are considered Negligible are therefore excluded from assessment); and
- Mortality or injury.

The effects assessment considered two scenarios – the current ecological baseline and the 'likely future ecological environment' (i.e., allowing for permitted activities). The level of effect within the likely future ecological environment across all NoRs is expected to remain the **same as the baseline**.

As such, Table 8-7 provides the level of effect for both scenarios.

**Table 8-7 Summary of disturbance to herpetofauna, which may result in changes to population dynamics, through the removal of district plan trees and vegetation within the Waikato District of NoR 8 during construction**

| Relevant NoR | Activity | Effects Description | Ecological Value | Magnitude | Level of Effect (pre-mitigation) |
|---|---|---|---|---|---|
| NoR 8 (Auckland section) | Mortality or injury. | The impacts associated with the removal of AUP:OP district plan vegetation within NoR 8. The following trees / tree groups identified in the Arboriculture Effects Assessment report are likely to provide suitable habitat for herpetofauna:<br>• Tree group 8/9, containing – pine (*Pinus radiata*), redwood (*Sequoia sempervirens*) and totara in the front of 131 Pukekohe East Road.<br>• Tree group 8/10 contains – coast banksia (*Banksia integrifolia*), silky oak (*Grevillea robusta*), American sweet gum (*Liquidambar styraciflua*) and tulip tree (*Liriodendron tulipifera*) that are exotic specimen trees planted along the front of 131 Pukekohe East Road.<br>• Tree groups 8/13 is a linear row of coast redwood growing along the frontage of 131 Pukekohe East Road.<br>• Tree group 8/54 contains puka *(Meryta sinclairii),* tarata and kohuhu at 216 Pukekohe East Road.<br>• Tree group 8/55 is a shelterbelt of Japanese cedar (*Cryptomeria japonica*).<br>• Tree group 8/56 is a row of *Photinia* along the front fenceline at 200 Pukekohe East Road.<br>• Tree groups 8/58 and 8/59 contain camellia, tarata, kohuhu and one melia (*Melia azadarach*) specimen at 196 Pukekohe East Road.<br>• Tree group 8/60 contains – titoki (*Alectryon excelsus*), puka, pohutukawa, tarata, kohuhu and puriri at 190 Pukekohe East Road. | High | Low | **Moderate** |
| NoR 8 (Waikato section) | Mortality or injury. | The removal of vegetation (ES, PL 3, TL.1, and TL.3) within the Waikato section of NoR 8 | High | Low | **Moderate** |

### 8.5.2 Impact Management and Residual Effects During Construction

The removal of district plan vegetation (Auckland section - district plan trees identified in the Pukekohe Assessment of Arboricultural Effects Report), and the vegetation within the Waikato section of the NoR 8 is likely to have a **Moderate** effect on herpetofauna and as such impact management is required. To address effects, a Lizard Management Plan (LMP) for the removal of district plan vegetation within NoR 8 should consider the following:

- Preconstruction surveys and/or habitat potential surveys to confirm (potential) presence and guide further management.
- Timing of the implementation of the LMP.
- A description of methodology for survey, trapping and relocation of lizards rescued including but not limited to: salvage protocols, relocation protocols (including method used to identify suitable relocation site(s)), nocturnal and diurnal capture protocols, supervised habitat clearance/transfer protocols, artificial cover object protocols, and opportunistic relocation protocols.
- A description of the relocation site(s); including discussion of:
    - provision for additional refugia, if required e.g., depositing salvaged logs, wood or debris for newly released native skinks that have been rescued;
    - any protection mechanisms (if required) to ensure the relocation site is maintained (e.g.) covenants, consent notices etc.; and
    - any weed and pest management to ensure the relocation site is maintained as appropriate habitat.
- Monitoring methods, including but not limited to: baseline surveying within the site; baseline surveys outside the site to identify potential release sites for salvaged lizard populations and lizard monitoring sites; ongoing annual surveys to evaluate translocation success; pre and post – translocation surveys; and monitoring of effectiveness of pest control and/or any potential adverse effects on lizards associated with pest control;
- A post-vegetation clearance search for remaining lizards.
- A suitably qualified and experienced ecologist/herpetologist approved to oversee the implementation of the LMP shall certify that the lizard related works have been carried out according to the certified LMP within two weeks of completion of the vegetation clearance works.
- Lizard management should be consistent with any regional consent conditions (and the Wildlife Act 1953) that may be required for regional compliance.

The residual impact is assessed as **Low** post mitigation.

### 8.5.3 Operational Effects

The following potential operational related effects were identified for the two TAR skinks within and adjacent to all the NoRs (except NoR6), and the likely gecko species within the remaining forest patches in NoR 4 (as they relate to district matters):

- Disturbance and displacement of TAR herpetofauna due to light, noise, and vibration effects from the operation of the road.

- Habitat fragmentation leading to loss in connectivity to TAR herpetofauna due to light, noise, and vibration effects from the operation of the road.

The loss of connectivity through the presence of the road and associated disturbance such as operational noise, vibration, and light could lead to an overall reduction in size and quality of suitable habitat for TAR herpetofauna within the broader landscape. However, the overall level of effect due to operational disturbance is assessed as **Low** prior to mitigation. The likely future ecological environment was anticipated to be the same as the baseline.

## 8.6 Cumulative Effects

According to a recent review of international and New Zealand literature (Simcock et al., 2022), the Resource Management Act 1991 does not effectively consider cumulative effects from multiple roads across landscapes. In addition, the delayed nature of effects that occur after initial project completion and/or beyond consenting periods also means such impacts of roads are likely underestimated (**Error! Reference source not found.**).

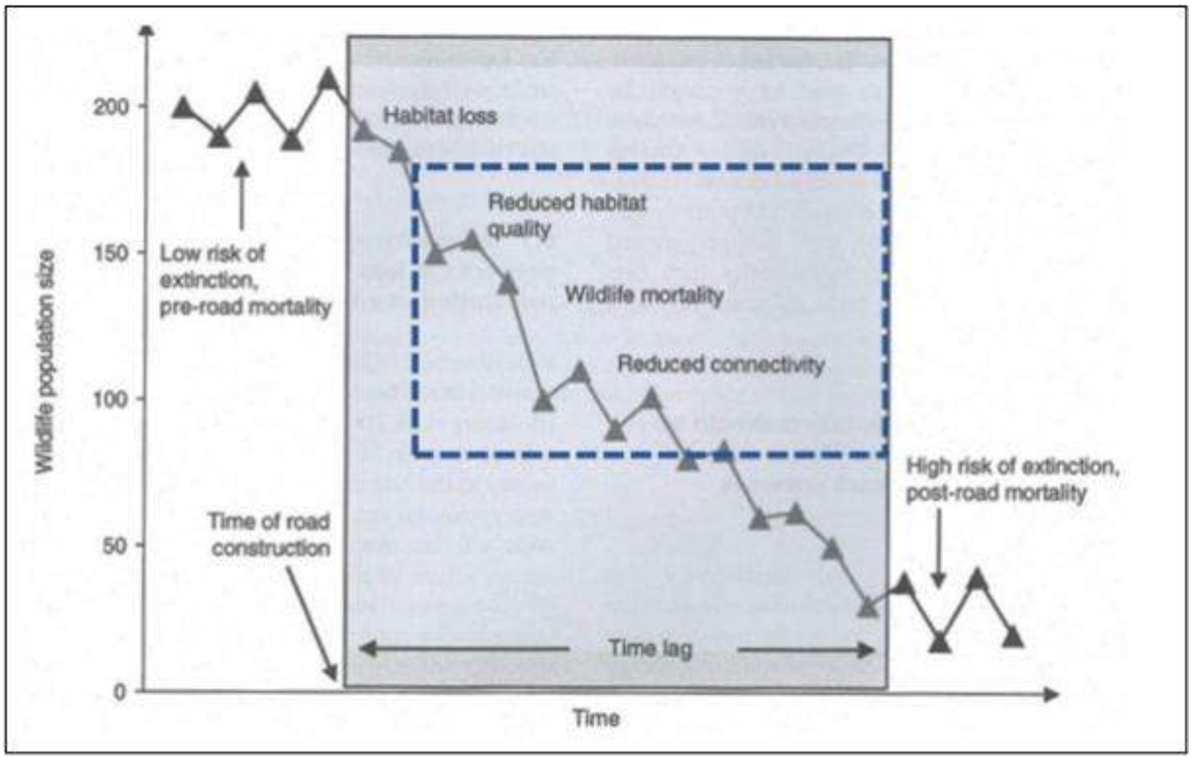



**Figure 8-1 Major ecological impacts of roads and traffic on faunal populations and time lag (in the order of decades, shown in grey). The blue dotted line identifies effects due to road edges excluding the footprint at construction (in Simcock, et al., 2022, adapted by van der Ree et al., 2015, from Forman et al., 2003)**

As stated in the EIANZ Guidelines, an assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single Project under review. Upgrading existing roads and building new transport corridors/stations within the Pukekohe Transport Network Project area combined with urban development (external projects), and the consequences of a changing climate, risk a cumulative effect that does not necessarily require mitigation from the perspective of a singular project.

### 8.6.1 District Cumulative Effects

Mobile native fauna species are expected to use the Pukekohe Transport Network Project area and wider landscape. The Pukekohe Transport Network Project area is predominantly rural as of present, and hence native fauna are expected to be more sensitive to disturbance. Although they may habituate to disturbance by noise, light, and vibration as a consequence of transport corridors, eventually, gradual incremental changes in habitat caused by surrounding urbanisation could discourage nesting/roosting and reduce viability of native fauna over time. Long-tailed bats are more sensitive to disturbance and will require strategic mitigation in tandem with the wider urban development as the future infrastructure develops.

The potential cumulative impacts of lighting from transport corridors and urban growth on bird movement and distribution in the Auckland region is specifically considered within this section, as the Project does not pose a direct risk in isolation. According to Adams et al., (2021) artificial light is abundant in the built environment with many known or suspected impacts on birds. Birds flying at night are known to aggregate around artificial light and collide with illuminated objects, which may result from attraction and/or disorientation. Birds are known to be repelled by light-based deterrents, and artificial light can also change birds' perceptions of habitat quality, resulting in selection or avoidance of illuminated areas.

Transport corridors can act as barriers to the movement of animals, including migratory species, leading to fragmentation of habitats. This can result in reduced genetic diversity, population declines, and changes to community structure. Although an individual NoR or project may have been assessed to have a "Low" effect, considering urban development, the habitat fragmentation is likely to be cumulative and should be considered holistically.

All developments should be aware of the vulnerability and resilience of the receiving environment and the cumulative effects which may arise from multiple development activities within the Project Area.

As urban areas expand and transport infrastructure develops, it is important for collaboration between transport providers, consenting authorities (i.e., Auckland Council), and developers to assess the combined effects of lighting and take measures to mitigate these impacts (at a landscape scale). These measures may include the provision of vegetated (including dark) corridors, wildlife-friendly lighting designs, wildlife crossings, and vegetated buffers to protect sensitive habitats and fauna.

### 8.6.2 Regional Cumulative Effects

The wider area of the Pukekohe Transport Network Project area is rural as of present and large areas are designated to be Future Urban Zone in the future. Regardless of whether the transport corridors are developed, or urbanisation occurs first, construction often involves clearing of vegetation which can lead to the loss of habitat for native plant and animal species. The habitat degradation from ongoing cumulative removal of low value vegetation (which does not necessarily require impact management under EIANZ Guidelines) should be considered at a landscape scale by the consenting authorities in the wider regional context to prevent a decline in biodiversity and changes to ecosystem function and services.

Transport corridors can increase the amount of impervious surface in an area, leading to increased runoff and decreased infiltration of rainwater. This can result in increased erosion and sedimentation in nearby streams and wetlands, and the transport of pollutants from roads into aquatic ecosystems. The increased impervious surface can also alter the natural flow of water in an area by changing the amount and timing of runoff, and by blocking or diverting water. This can lead to changes in the structure and function of streams and wetlands, as well as changes to the groundwater recharge rate. To mitigate adverse effects on hydrology and hydropedology, the use of green infrastructure (at a landscape scale) including riparian planting and stormwater management in the context of external development will be important. Implementing these mitigating measures, and others, will also aid in minimising flooding risks and protecting water quality.

Additionally, ongoing monitoring and adaptive management can help identify and address any unexpected impacts that may arise.

# 9 Design and Future Resource Consent Considerations

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

## 9.1 Terrestrial Ecology

Construction of the road throughout all the NoRs will result in temporary and permanent loss of vegetation, including suitable habitat that is potentially being used by native fauna (long-tailed bats, avifauna, herpetofauna, and invertebrates). Loss of vegetation within the Waikato section of NoR 8 is already subject to district plan controls and is discussed in Section 8.2.

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 9-1.

The terrestrial vegetation to be lost (temporary and permanent) is comprised of both exotic and native vegetation which range from **Negligible** to **High** ecological value (Appendix 6). Some of these areas are likely to provide habitat to native fauna, as discussed in Sections 9.1.1 to 9.1.5.

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 permit applications (if required).

Depending on the potential effects of the project, the resource consent for the project may include a Vegetation Restoration Plan, which may include:

- Revegetation/landscaping of roadside areas;
- Planting/restoration of specific vegetation types in defined areas; and
- Weed and herbicide management.

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

**Table 9-1 Approximate potential area of permanent terrestrial vegetation loss within the road footprint for the Pukekohe Transport Network**

| Feature | Classification* | Approximate Vegetation Loss ($m^2$) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | NoR R1 | NoR R2 | NoR R3 | NoR R4 | NoR R5 | NoR R6 | NoR R7 | NoR R8** |
| Brown Field* | BF | 16541 | * | * | * | * | * | * | * |
| Exotic Forest – Native Understory Dominated / Exotic Understory Dominated | EF.1 / EF.2 | 0 | 4071 | 4061 | 2927 | 0 | 0 | 0 | 0 |
| Exotic Grassland* | EG | 11438 | * | * | * | * | * | * | 3868 |
| Exotic Scrub | ES | 2253 | 5406 | * | 6190 | * | * | 3552 | 7728 |
| Kahikatea forest | MF4 | 0 | 0 | 0 | 49 | 0 | 0 | 0 | 0 |
| Planted Vegetation – Native (recent) | PL.1 | 0 | 1413 | 0 | 1278 | 1286 | 0 | 283 | 566 |
| Planted Vegetation - Native (mature) | PL.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Planted Vegetation – Amenity | PL.3 | 2586 | 14848 | 1344 | 3630 | 6452 | 121 | 3860 | 9230 |
| Treeland – Native-Dominated | TL.1 | 0 | 2445 | 0 | 999 | 1134 | 32 | 2013 | 373 |
| Treeland – Mixed Native/Exotic | TL.2 | 0 | 1396 | 0 | 0 | 0 | 0 | 0 | 2046 |
| Treeland – Exotic-Dominated | TL.3 | 7162 | 20557 | 281 | 7739 | 4242 | 34 | 1957 | 2071 |
| Broadleaved species scrub/forest | VS5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2131 |
| Pūriri Forest | WF7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kahikatea, pukatea forest | WF8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Taraire, tawa, podocarp forest | WF9 | 0 | 0 | 0 | 408 | 0 | 0 | 0 | 280 |

*Notes: * = Not all degraded / transformed areas were mapped during the assessment.** Includes all vegetation within Auckland and Waikato*

### 9.1.1 Significant Ecological Areas / Significant Natural Areas

There is one small portion of terrestrial vegetation classified as SEA (SEA_T_4375) that occurs within the proposed designation boundary for NoR 4 (Figure 9 1). At the time of undertaking this assessment the proposed design of the road and bridge (i.e., the construction footprint) avoided the small portion of SEA within the designated area along NoR 4. As the current proposed design / footprint allows for the avoidance of the SEA, all future potential amendments to the design/footprint should also avoid the SEA (i.e., as per the application of the mitigation hierarchy). It is anticipated that through the detailed design phase and future regional consenting process there will be further opportunities to minimise and mange potential impacts on the SEA including protection of the SEA during construction.

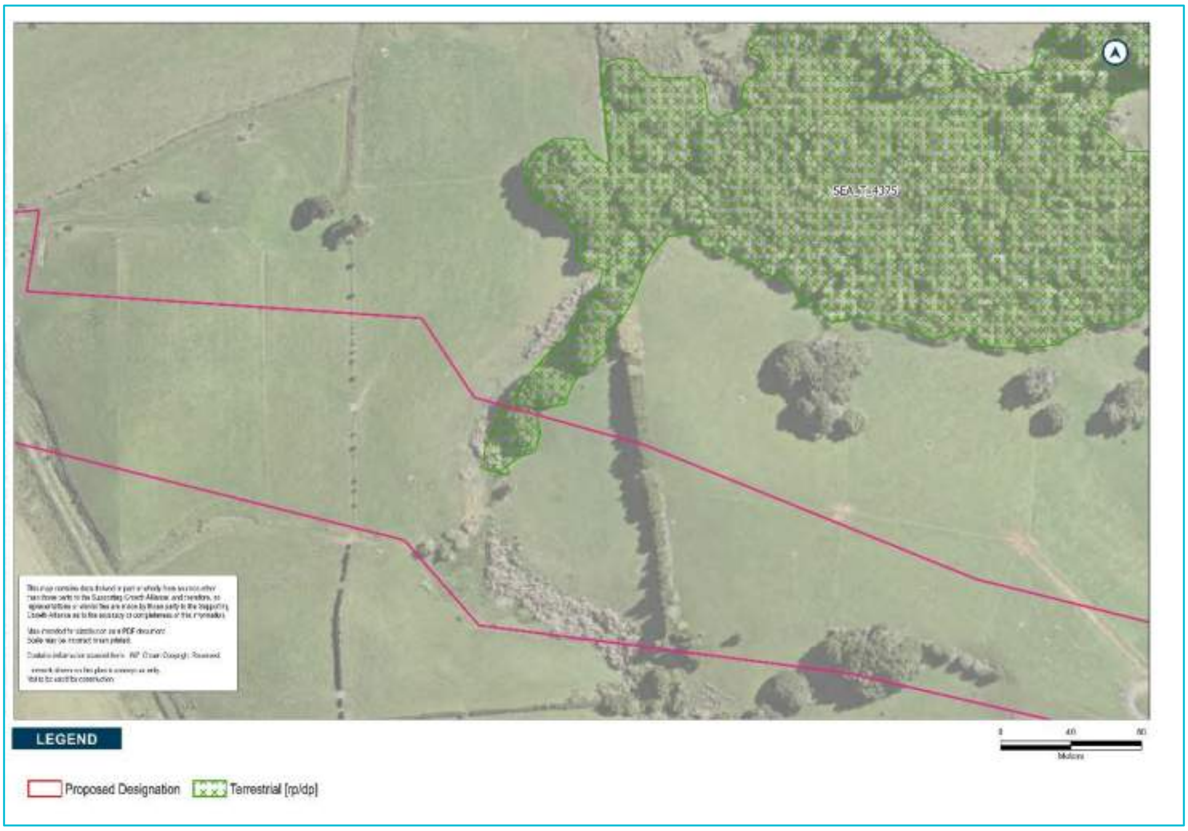



**Figure 9-1 SEA within the proposed designation for NoR 4**

With regards to the NPS-IB, indicative mapping of high value habitat areas was considered when assessing route options, selecting preferred alignments, and confirming designation boundaries (noting these areas are subject to confirmation as SNAs through future assessment and plan change processes by Auckland Council). Along with existing SEAs (which are considered the Auckland equivalent of SNAs in the NPS-IB), other high value habitat areas and areas supporting highly mobile fauna were considered in the development and assessment of options for the project, as well as design refinement of the preferred options. Identified / indicative biodiversity areas have therefore been avoided where practicable, in line with the effects management hierarchy. This is further detailed in Appendix 12.

It is noted that all Significant Natural Areas in the Waikato jurisdiction have been avoided through design refinement.

It is considered that the Pukekohe Transport Network is consistent with the objectives and policies of the AUP and NPS-IB because option development and assessment considered existing and likely sensitive ecological features and environments. Furthermore, the policy allows for infrastructure in sensitive areas like SNAs and SEAs where it can be demonstrated that significant effects have been avoided where practicable, and the infrastructure has an operational need to be located in a particular area.

### 9.1.2 Long-tailed bats

Mature vegetation in suitable habitat areas (as identified in section 6) may provide potential habitat for bat roosts and facilitate bat movement in the broader landscape (Smith et al., 2017). The presence of bats and roosts will need to be re-assessed prior to obtaining any regional resource consents for vegetation removal (relevant under regional matters) and to support an application for a wildlife permit. Mortality or injury to bats due to vehicle movement (i.e., resulting from the presence of the infrastructure) should be included in the reassessment.

The presence of bat habitat and bat roosts will require a BMP under regional consents. The objectives of bat management will be to:

- 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.

### 9.1.3 Avifauna

Native birds as identified in Section 6.3.3 have the potential to be present within the Pukekohe Transport Network. The habitats that the birds may utilise are detailed in Sections 6.3.3 and 8.4. Vegetation clearance required for construction could result in the loss of these habitats and any vegetation clearance within the bird nesting season (September – February) will need to be managed in accordance with the Wildlife Act 1953.

Native birds will need to be assessed prior to obtaining any regional resource consents for vegetation removal (relevant under regional matters). Mortality or injury to birds due to vehicle movement (i.e., resulting from the presence of the infrastructure) should be included in the assessment.

### 9.1.4 Herpetofauna

Native herpetofauna are detailed within section 6.3.4 and are likely to be present within vegetation impacted by the Pukekohe Transport network Project (i.e., the two skink species within all NoRs except NoR 6, and the gecko species within NoR 4). Therefore, there is potential that site clearance required for construction could kill or injure native herpetofauna species and result in the removal of their habitat. Native herpetofauna will need to be assessed prior to obtaining any regional resource consents for vegetation removal and managed in accordance with the Wildlife Act 1953. To address effects, a LMP, which considers the conditions outlined in section 8.5.2 will likely be required for all NoRs except NoR 6.

### 9.1.5 Invertebrates

Impact management will be required under the Wildlife Act to prevent killing or injuring of any native invertebrate species. Therefore, native invertebrates will need to be assessed prior to obtaining any regional resource consents for vegetation removal.

## 9.2 Freshwater Ecology

The construction of the projects will potentially directly impact 35 streams, ranging from **Low** to **High** ecological value. Stream reclamation will be required to accommodate the project works. The approximate permanent and intermittent stream loss for the Project is presented in Table 9-2. These calculations will require re-evaluation as part of the future regional consent process. Stream Ecological Valuation assessments will need to be undertaken to inform the re-evaluation. All assessed streams have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features.

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 and specific requirements of the National Policy for Freshwater Management (2022) for instream works, earthworks and vegetation removal, impact management will also be required for fish salvage and relocation, sediment control and management of the riparian condition.

**Table 9-2 Potential stream loss (permanent and intermittent) within the Pukekohe Transport Network**

| Stream ID | Hydroperiod | Ecological Value | Estimate of potential length lost (m)* |
|---|---|---|---|
| **NoR 1 – Drury West Arterial** | | | |
| PK1_S1 | Intermittent | Low | 80 |
| PK1_S2 | Intermittent | Moderate | 30 |
| PK1_S3 | Intermittent | Moderate | 30 |
| PK1_S4 | Permanent | Moderate | 70 |
| PK1_S5 | Permanent | Moderate | 30 |
| **Total** | | | **240** |
| **NoR 2 – Drury Pukekohe Link** | | | |
| PK2_S1 | Permanent | Moderate | 20 |
| PK2_S3 | Intermittent | Low | 20 |
| PK2_S4 | Intermittent | Moderate | 230 |

| Stream ID | Hydroperiod | Ecological Value | Estimate of potential length lost (m)* |
|---|---|---|---|
| PK2_S5 | Intermittent | Low | 50 |
| PK2_S6 | Permanent | High | 40 |
| PK2_S7 | Permanent | High | 20 |
| PK2_S8 | Intermittent | Low | 0 |
| PK2_S9 | Intermittent | Low | 20 |
| PK2_S10 | Intermittent | Low | 60 |
| PK2_S11 | Intermittent | Low | 10 |
| PK2_S12 | Intermittent | Moderate | 0 |
| PK2_S13 | Intermittent | Moderate | 30 |
| **Total** | | | **500** |
| **NoR 3 – Paerata Connections** | | | |
| PK2_S10 | Intermittent | Low | 60 |
| **Total** | | | **60** |
| **NoR 4 – Pukekohe North-East Arterial** | | | |
| PK4_S1 | Permanent | Moderate | 40 |
| PK4_S2 | Permanent | Moderate | 30 |
| PK4_S3 | Intermittent | Low | 30 |
| PK4_S4 | Permanent | Moderate | 5 |
| PK4_S5 | Permanent | Moderate | 5 |
| PK4_S6 | Intermittent | Low | 20 |
| PK4_S7 | Permanent | Moderate | 20 |
| PK4_S8 | Intermittent | Moderate | 30 |
| PK4_S9 | Permanent | Moderate | 20 |
| **Total** | | | **200** |
| **NoR 5- Pukekohe South-East Arterial** | | | |
| PK5_S1 | Intermittent | Low | 20 |
| PK5_S3 | Intermittent | Moderate | 60 |
| PK5_S4 | Permanent | Moderate | 10 |

| Stream ID | Hydroperiod | Ecological Value | Estimate of potential length lost (m)* |
|---|---|---|---|
| **Total** | | | **90** |
| **NoR 7 – Pukekohe North-West Arterial** | | | |
| PK7_S1 | Permanent | Moderate | 10 |
| PK7_S2 | Permanent | Moderate | 120 |
| **Total** | | | **130** |
| **NoR 8 – Mill Road and Pukekohe East Road Upgrade** | | | |
| PK8_S1 | Permanent | Low | 20 |
| PK8_S2 | Intermittent | Low | 0 |
| PK8_S3 | Permanent | High | 40 |
| PK8_S4 | Intermittent | Moderate | 160 |
| PK8_S5 | Intermittent | Moderate | 20 |
| **Total** | | | **240** |

*Notes: * = All potential stream loss measurements are indicative. The measurements are based on a potential route option and an approximate measurement of loss.*

## 9.3 Wetland Ecology

Approximate wetland extent and value has been determined. This was achieved through a desktop wetland delineation for all of the NoR options along with a proxy based assessment of ecological value (i.e., catchment condition, vegetation cover, and the relationship with other ecological features).

The construction of the Pukekohe Transport Network is likely to impact extensive wetland habitat, both natural and artificial. The ecological value of the wetlands ranges from **Negligible** to **Moderate** ecological value. Based on the current preliminary design/footprint direct wetland loss is likely to occur (Table 9-3). These calculations will require re-evaluation as part of the future regional consent process. Specific requirements of the National Policy for Freshwater Management (2022) will also need to be taken into consideration. Of particular importance will be the need to:

- delineate the wetlands according to acceptable protocols (e.g., Ministry for the Environment, 2022);
- determine wetland functionality (i.e., ecosystem services provided by the wetlands);
- determine wetland condition/health; and
- determine whether any of the wetlands are suitable habitats for TAR species.

**Table 9-3 Approximate potential wetland loss within the Pukekohe Transport Network**

| Wetland ID | Wetland / Open Water* | Ecological Value | Potential Loss ($m^2$) |
|---|---|---|---|
| **NoR 1 – Drury West Arterial** | | | |

| Wetland ID | Wetland / Open Water* | Ecological Value | Potential Loss ($m^2$) |
|---|---|---|---|
| PK1_W1 – W7* | EW | Low | 1866 |
| | OW | Negligible | 42 |
| **Total** | | | **2130** |
| **NoR 2 – Drury Pukekohe Link** | | | |
| PK2_W1-W42 | EW | Low | 30291 |
| | OW | Negligible / Low | 1747 |
| | PLW.1 | Low | 288 |
| **Total** | | | **33595** |
| **NoR 3 – Paerata Connections** | | | |
| PK2 -W36-W37 | EW | Low | 1175 |
| **Total** | | | **1175** |
| **NoR 4 – Pukekohe North-East Arterial** | | | |
| PK4_W1-W14 | EW | Low | 6227 |
| | WL11 | Moderate | 87 |
| **Total** | | | **6087** |
| **NoR 5- Pukekohe South-East Arterial** | | | |
| PK52_W1-W5 | EW | Low | 1024 |
| | OW | Low | 149 |
| | WL11 | Moderate | 94 |
| **Total** | | | **1580** |
| **NoR 7 – Pukekohe North-West Arterial** | | | |
| PK7_W1-W3 | EW | Low | 1349 |
| | OW | Low | 66 |
| **Total** | | | **1392** |
| **NoR 8 – Mill Road and Pukekohe East Road Upgrade** | | | |
| PK8_W1-W10 | EW | Low | 3670 |
| | OW | Negligible / Low | 921 |
| | WL19 (artificial habitat) | Moderate | 619 |
| **Total** | | | **4712** |

*Notes: * = Artificial wetlands (i.e., most of the open water bodies) are included in the calculation of approximate wetland loss at this stage. This provides a conservative estimate of the wetland loss likely to occur.*

The wetland assessment to inform the future regional consent process should also assess the opportunities for wetland restoration / enhancement, and where required outline additional mitigation where avoidance is not feasible. This may include offsets and/or compensation.

# 10 Conclusion

This report has considered the actual and potential ecological effects associated with the construction, operation, and maintenance of the Pukekohe Transport Network Project. The focus was on ecological effects pertaining to district plan matters, and providing recommendation which may be implemented to avoid, remedy, and/or mitigate these likely effects.

The district matter ecological effects relevant to construction and operation, prior to any mitigation, were assessed. All ecological effects assessed to be **Moderate** or higher required mitigation. These effects included:

- Effects on long-tailed bats and their roosts due the removal of district plan (Auckland and Waikato) trees within NoR 8
- Effects on TAR herpetofauna species due to the removal of district plan (Auckland and Waikato) vegetation in NoR 8
- Disturbance and displacement to TAR and native birds, and nest sites, resulting from construction activities.
- Habitat fragmentation leading to loss in connectivity to long-tailed bats, due to light, noise, and vibration effects from the operation of the road.
- Disturbance and displacement of long-tailed bats and roost sites due to light, noise, and vibration effects from the operation of the road.
- Disturbance and displacement of TAR and native birds (including nest sites) due to light, noise, and vibration effects from the operation of the road.
- Habitat fragmentation leading to loss in connectivity to TAR and native birds, due to light, noise, and vibration effects from the operation of the road.

The recommended mitigation to reduce the **Moderate** or higher ecological effects relevant to construction and operation of the Pukekohe Transport Network included:

- A BMP for all NoRs except NoR 6, and some specific conditions for NoR 8 only. The BMP should include:
  - Bat surveys prior to construction to confirm presence/likely absence.
  - Confirmation of maternity roosts may require a seasonal restriction on construction activity (no or restricted construction during December through to March).
  - Positioning of compounds and laydown areas to avoid relevant habitats (refer to Table 8-1).
  - Lighting design to reduce light levels and spill from construction areas.
  - Restriction of nightworks around relevant habitats (refer to Table 8-1).
  - Bat management should be integrated with any regional consent conditions that may be required for regional compliance.
  - Lighting design to minimise light levels and light spill along the road corridor.
  - Buffer planting should focus on the riparian corridors of the permanent streams crossed by the NoRs (refer to Table 6-8), and where possible retaining of existing mature tree features, as well as indicating riparian corridors where planting of mature trees could occur.
  - Consideration to the provisions of the Wildlife Act including the implementation of a vegetation removal protocol (Bat Roost Protocol v2 DOC, 2021 or equivalent version at time of removal) (NoR 8).
  - Where possible, retain existing mature trees (this is in accordance with the Urban Design and Landscape Management Plan) (NoR 8).

  - Artificial bat roosts (i.e., Bat boxes) should be erected within, or in close proximity to, where suitable roost habitat (i.e., large mature trees) is to be removed in NoR 8. A 1:1 ratio is recommended. The introduction of artificial bat roots will help to mitigate the short-medium term loss of suitable vegetation.
  - An adaptive management framework that will outline bat activity thresholds, robust monitoring, and potential corrective action.
- An Avifauna Management Plan for all Threatened and At Risk-Declining birds is recommended as a condition on the proposed designation for NoR 1, NoR 2, NoR 4, NoR 5, NoR 7, and NoR 8 (all NoRs except NoR 3 and NoR 6). This should consider the following:
  - Pre-construction nesting bird surveys throughout wetlands, riparian habitat, and remaining native forest patches (refer to Table 8-5).
  - Where practical, construction works near wetland habitat (Table 8-5) should commence prior to the bird breeding season (September to February) in order to discourage bird nesting.
  - Bird management should be consistent with any regional consent conditions that may be required for regional compliance.
  - Consideration of the provisions of the Wildlife Act including timing vegetation removal to avoid the key nesting period (September to February) or where this is not possible, pre-clearance inspections undertaken prior to vegetation removal (wetlands, riparian habitat listed in Table 8-5 above, and forest patches WF 9, WF 7 and MF 4 within NoR 4).
  - Retention of vegetation near wetland habitat, riparian habitat, and forest habitat (refer to Table 8-6).
  - Where practicable, the retention of remaining forest patches, particularly that marginally extend into NoR 4 (i.e., WF 9, WF 7, and MF 4).
  - Buffer planting between the road alignment and suitable habitat adjacent to the relevant wetlands and riparian habitats (Table 8-6).
- A LMP for the removal of district plan trees (Auckland section - district plan trees identified in the Pukekohe Assessment of Arboricultural Effects Report), and the removal of vegetation within the Waikato section of the NoR 8. This should consider the following:
  - Preconstruction surveys and/or habitat potential surveys to confirm (potential) presence and guide further management.
  - Timing of the implementation of the LMP.
  - A description of methodology for survey, trapping and relocation of lizards rescued including but not limited to: salvage protocols, relocation protocols (including method used to identify suitable relocation site(s)), nocturnal and diurnal capture protocols, supervised habitat clearance/transfer protocols, artificial cover object protocols, and opportunistic relocation protocols.
  - A description of the relocation site(s); including discussion of:
    - provision for additional refugia, if required e.g., depositing salvaged logs, wood or debris for newly released native skinks that have been rescued;
    - any protection mechanisms (if required) to ensure the relocation site is maintained (e.g.) covenants, consent notices etc.; and
    - any weed and pest management to ensure the relocation site is maintained as appropriate habitat.
  - Monitoring methods, including but not limited to: baseline surveying within the site; baseline surveys outside the site to identify potential release sites for salvaged lizard populations and lizard monitoring sites; ongoing annual surveys to evaluate translocation success; pre and

post – translocation surveys; and monitoring of effectiveness of pest control and/or any potential adverse effects on lizards associated with pest control;
- A post-vegetation clearance search for remaining lizards.
- A suitably qualified and experienced ecologist/herpetologist approved to oversee the implementation of the LMP shall certify that the lizard related works have been carried out according to the certified LMP within two weeks of completion of the vegetation clearance works.
- Lizard management should be consistent with any regional consent conditions (and the Wildlife Act 1953) that may be required for regional compliance.

The residual impacts from the **Moderate** or higher ecological effects were all assessed as **Low** post mitigation. As such, no further impact management was anticipated.

Consideration was also given to future regional resource consenting matters. A range of ecological assessments are likely to be required to inform the regional consenting process. These may include, but are not limited to:

- Detailed habitat and fauna surveys may be required to inform an EcIA which will be used to support future regional resource consent.
- The presence of bat habitat and bat roosts will require a BMP.
- Native birds will need to be assessed prior to obtaining any regional resource consents for vegetation removal. Mortality or injury to birds due to vehicle movement will also need to be included in the assessment.
- Native herpetofauna and invertebrates will need to be assessed prior to obtaining any regional resource consents for vegetation removal.
- Stream Ecological Valuation assessments will need to be undertaken to inform the re-evaluation of streams. All assessed streams have been modified and degraded to varying degrees and there is an opportunity to restore riparian habitat along these features. Fish salvage and relocation, sediment control and management of the riparian condition will also be required.
- A detailed wetland assessment, including delineation and functional assessments, will be required to inform the regional resource consent. Opportunities for wetland restoration and / or enhancement will also need to be assessed.

In addition, it was noted that the cumulative effect of all the NoRs proposed within the Pukekohe Transport Network Project requires further consideration, along with other key drivers of change. A more comprehensive cumulative ecological effects assessment should be undertaken early in the resource consenting process.

# 11 References

Adams, C.A., Fernández-Juricic, E., Bayne, E.M. et al. 2021. Effects of artificial light on bird movement and distribution: a systematic map. Environ Evid 10, 37 (2021). https://doi.org/10.1186/s13750-021-00246-8

Armitage, I. 2013. updated 2017. Little black shag. In Miskelly, C.M. (ed.) New Zealand Birds Online. Retrieved from: www.nzbirdsonline.org.nz

Atkinson, I.A.E.; Millener, P.R. 1991. An ornithological glimpse into New Zealand's pre-human past, Pp 129-192 In: Acta XX Congressus Internationalis Ornithologici. Christchurch, New Zealand, 2-9 December 1990.

Barea, L.P. 1995. Habitat use, diet and nest site selection of forest-dwelling New Zealand falcons (Falco novaeseelandiae Gmelin 1788) in a forested habitat. Unpublished MSc thesis, University of Waikato, Hamilton.

Beauchamp, A.J. 2013. updated 2017. Australasian bittern. In Miskelly, C.M. (ed.) New Zealand Birds Online. Retrieved from: www.nzbirdsonline.org.nz

Bell, D.; Lawrence, S. 2009. New Zealand falcon (Falco novaeseelandiae) distribution survey 2006–09. Notornis 56: 217–221.

Bellingham, M. 2012. Evidence to the Environment Court on appeal of Mangawhai Harbour Restoration Soc. vs Northland RC

Bellingham M. 2013. Banded rail. In Miskelly, C.M. (ed.) New Zealand Birds Online. Retrieved from: www.nzbirdsonline.org.nz

Best, H.A. 1979. Food and foraging of the Snares fernbird. New Zealand Journal of Zoology 6: 481-488.

Clapcott, J. E. 2015. National Rapid Habitat Assessment Protocol Development for Streams and Rivers. Prepared for Northland Regional Council. Report Number 2649. Cawthron Institute: Nelson, New Zealand.

Clarke, D. 2023. Te rapu ngā pekapeka o Franklin Finding Franklin Bats. Second stakeholder report for summer 2022 – 2023 surveys. EcoQuest Education Foundation Te Rarangahau Taiao. Unpublished.

Clarke, D. 2022. Te rapu ngā pekapeka o Franklin Finding Franklin Bats. Stakeholder report for 2022. EcoQuest Education Foundation Te Rarangahau Taiao. Unpublished.

Clout, M.N.; Hay, J.R. 1989. The importance of birds as browsers, pollinators and seed dispersers in New Zealand forests. New Zealand Journal of Ecology 12 (Supplement): 27-33.

Craig, J.L.; Mitchell, N.D. 2021. Measuring conservation status in New Zealand birds: re-evaluating banded dotterel and black-fronted tern as case studies. Notornis 68: 147-160

Davies, S.J. 1997. Population structure, morphometrics, moult, migration, and wintering of the wrybill (Anarhynchus frontalis). Notornis 44: 1-14.

Dowding, J.E.; Moore, S.J. 2006. Habitat networks of indigenous shorebirds in New Zealand. Science for Conservation 261. Department of Conservation, Wellington.

Dunn, N. R., Allibone, R. M., Closs, G., Crow, S., David, B. O., Goodman, J., ... & Rolfe, J. R. (2018). Conservation status of New Zealand freshwater fishes, 2017. Publishing Team, Department of Conservation.

Fitzgerald, N. 2013. updated 2017. Spotless crake. In Miskelly, C.M. (ed.) New Zealand Birds Online. Retrieved from: www.nzbirdsonline.org.nz

Forman, R. T. T., Sperling, D., Bissonette, J. A., Clevenger, A. P., Cutshall, C. D., Dale, V. H., Fahrig, L., France, R., Goldman, C. R., Heanue, K., Jones, A., Swanson, F. K., Turrentine, T., & Winter, T. C., 2003. Road ecology: Science and solutions. Island Press. Gill, B.J., and Whitaker, A.H. 2007. New Zealand frogs and reptiles. Auckland: David Bateman Limited.

Gill, B.J. 2013. updated 2017. Variable oystercatcher. In Miskelly, C.M. (ed.) New Zealand Birds Online. Retrieved from: www.nzbirdsonline.org.nz

Hitchmough, R. A., Barr, B., Knox, C., Lettink, M., Monks, J. M., Patterson, G. B., Reardon, J. T., Winkel, D. van, Rolfe, J., and Michel, P. (2021). Conservation status of New Zealand reptiles. In New Zealand Threat Classification Series 35. Department of Conservation. https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs35entire.pdf

Kelly, D.; Ladley, J.L.; Robertson, A.W.; Anderson, S.H.; Wotton, D.M.; Wiser, S.K. 2010. Mutualisms with the wreckage of an avifauna: the status of bird pollination and fruit dispersal in New Zealand. New Zealand Journal of Ecology 34: 66-85.

McEwen, W. M. 1987. Ecological regions and districts of New Zealand. New Zealand Biological Resources Centre Publication, 5, Part 1: Wellington, Department of Conservation.

Melzer, S., Hitchmough, R., van Winkel, D., Wedding, C., Chapman, S., & Rixon, M. (2022). Conservation status of reptile species in Tāmaki Makaurau. In *Auckland Council Technical Report, TR2022/3*. Auckland Council. https://knowledgeauckland.org.nz/publications/conservation-status-of-reptile-species-in-tāmaki-makaurau-auckland/

Ministry for the Environment. 2022. Wetland delineation protocols. Wellington: Ministry for the Environment.

Miskelly, C.M. 2013. South Island pied oystercatcher. In Miskelly, C.M. (ed.) New Zealand Birds Online. Retrieved from: www.nzbirdsonline.org.nz

Moorhouse, R.J.; Greene, T. 1995. Identification of fledgling and juvenile North Island kaka. *Notornis 42*: 187-196.

NZ Herpetological Society. 2021. Herpetofauna Index. The New Zealand Herpetological Society. https://www.reptiles.org.nz/herpetofauna-index

O'Donnell, C. F. J., Borkin, K. M., Christie, J. E., Lloyd, B., Parsons, S. & Hitchmough, R. A. 2018. Conservation status of New Zealand bats, 2017. New Zealand Threat Classification Series 21. Department of Conservation, Wellington. 4 p.

Powlesland, R.G.; Sharp, S.E.; Smith, A.N.H. 2008. Aspects of the breeding biology of the pied shag (Phalacrocorax varius) at Makara Beach, Wellington, New Zealand. Notornis 55: 69-76.

Roper-Lindsay, J., Fuller, S. A., Hooson, S., Sanders, M. D. and Ussher, G. T. (EIANZ) 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition. Melbourne: Environment Institute of Australia and New Zealand.

Simcock, R., Innes, J., Samarasinghe, O., Lambie, S., Peterson, P., Glen, A., & Faville, N. (2022). Road edge-effects on ecosystems: A review of international and New Zealand literature, an assessment method for New Zealand roads, and recommended actions (Waka Kotahi NZ Transport Agency research report 692).

Singers, N., Osborne, B., Lovegrove, T., Jamieson, A., Boow, J., Sawyer, J., Hill, K., Andrews, J., Hill, S. and Webb, C. 2017. Indigenous terrestrial and wetland ecosystems of Auckland. Auckland Council: Auckland, New Zealand.

Smith, D, Borkin, K., Jones, C., Lindberg, S., Davies, F., and Eccles, G. 2017. Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature. NZ Transport Agency research report 623. 249pp.

Storey, R. and Wadhwa, S. 2009. An assessment of the lengths of permanent, intermittent and ephemeral streams in Auckland region. Auckland Council Technical Report 2009/028.

Szabo, M.J. 2013. updated 2017. New Zealand dabchick. In Miskelly, C.M. (ed.) New Zealand Birds Online. Retrieved from: www.nzbirdsonline.org.nz

Turner. J. and Cunningham. C. 2020. Waikato District Plan Review Significant Natural Areas Assessment. WSP. Unpublished.

Van Der Ree, R., Smith, D. J., & Grilo, C. (2015). The ecological effects of linear infrastructure and traffic: challenges and opportunities of rapid global growth. *Handbook of road ecology*, 1-9.

Walker, S., Price, R., Rutledge, D. (2008) New Zealand's remaining indigenous cover: recent changes and biodiversity protection needs. Science for Conservation 284. Department of Conservation, Wellington.

Whitaker, A.H. 1987. The roles of lizards in New Zealand plant reproductive strategies. New Zealand Journal of Botany 25: 315-328.

Williams, M.J. 2013. updated 2020. Red bill gul. In Miskelly, C.M. (ed.) New Zealand Birds Online. Retrieved from: www.nzbirdsonline.org.nz

Worthy, T.H; Holdaway, R.N. 2002. The lost world of the moa: Prehistoric life of New Zealand.

TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Appendix 1

## Ecological Impact Assessment Methodology

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

# 1 Appendix 1 – 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 11-1 for terrestrial ecological value and Table 11-2 aquatic ecological value

**Table 11-1 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 11-2 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 |

| Representativeness (including SEV, RHA and ecological integrity) |
|---|
| Riparian habitat modification |
| 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 methods 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 11-3.

**Table 11-3 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 11-4.

**Table 11-4 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 be fundamentally changed 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 11-5.

**Table 11-5 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 11-6.

**Table 11-6 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 |

*Note = The ecological effect matrix is not a rigid matrix but rather a guideline to help assign an appropriate effect. Specialist expertise can be used to adjust the ratings when deem appropriate (e.g., when applying a conservative approach, it would be appropriate to score a Moderate ecological effect for a high Value, and low Magnitude).*

From Table 11-6, 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; and
- **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 structed methods were employed to assess cumulative impacts, but where relevant descriptions of potential cumulative effects have been provided.

TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Appendix 2

## Regional Plan, District Plan and Wildlife Act Matters

# 2 Appendix 2 – Regional Plan, District Plan and Wildlife Act Matters

**Table 11-7 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:<br>• a rural zone<br>• riparian margins<br>• coastal areas<br>• SEAs<br>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:<br>• Roads<br>• Public spaces<br>• ONFs<br>• ONLs<br>• HNCs<br>• 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. | | ✓ | ✓ |

| Ecological feature | Activity | Ecological Effect | AUP:OP District Plan provisions | AUP:OP Regional Plan provisions | Wildlife Act (1953) |
|---|---|---|---|---|---|
| | 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). | ✓ | | ✓ |
| **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 of watercourses and water level/flow/ periodicity changes. | Detrimental effects on habitats including plant composition and fauna. | | ✓ | |

| Ecological feature | Activity | Ecological Effect | AUP:OP District Plan provisions | AUP:OP Regional Plan provisions | Wildlife Act (1953) |
|---|---|---|---|---|---|
| | | | | | |
| **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** | | | | | |
| **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. | | | ✓ |

| Ecological feature | Activity | Ecological Effect | AUP:OP District Plan provisions | AUP:OP Regional Plan provisions | Wildlife Act (1953) |
|---|---|---|---|---|---|
| | 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. | ✓ | | ✓ |
| | 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. | | ✓ | |

**Table 11-8: Ecological effects of Pukekohe Transport Network broken down into matters concerning Waikato District Plan (Franklin Section), Waikato District Plan (Proposed) and Waikato Regional Plan.**

| Ecological feature | Activity | Ecological Effect | Waikato District Plan | Waikato Regional Plan |
|---|---|---|---|---|
| **Construction** | | | | |
| **Terrestrial habitat** | Vegetation removal | 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. | Loss of foraging habitat. | | |
| | Construction activities (Noise, light, dust etc.). | Disturbance and displacement to roosts and to individuals (existing). | | |
| **Birds (native)** | Vegetation removal. | Net loss. | √ | |
| | 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. | √ | |
| | 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. | | √ |

| Ecological feature | Activity | Ecological Effect | Waikato District Plan | Waikato Regional Plan |
|---|---|---|---|---|
| **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 of 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. | | ✓ |
| **Operational** | | | | |
| **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. | ✓ | ✓ |
| **Bats** | 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. | ✓ | ✓ |
| **Birds (native)** | 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. | ✓ | ✓ |
| **Herpetofauna (native)** | 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. | ✓ | ✓ |
| **Freshwater habitat –** | Vehicle (cartage) movement - risk of spills of potential toxins (oil, milk, chemicals). | Temporary degradation of instream/wetland habitat and water quality. | | ✓ |

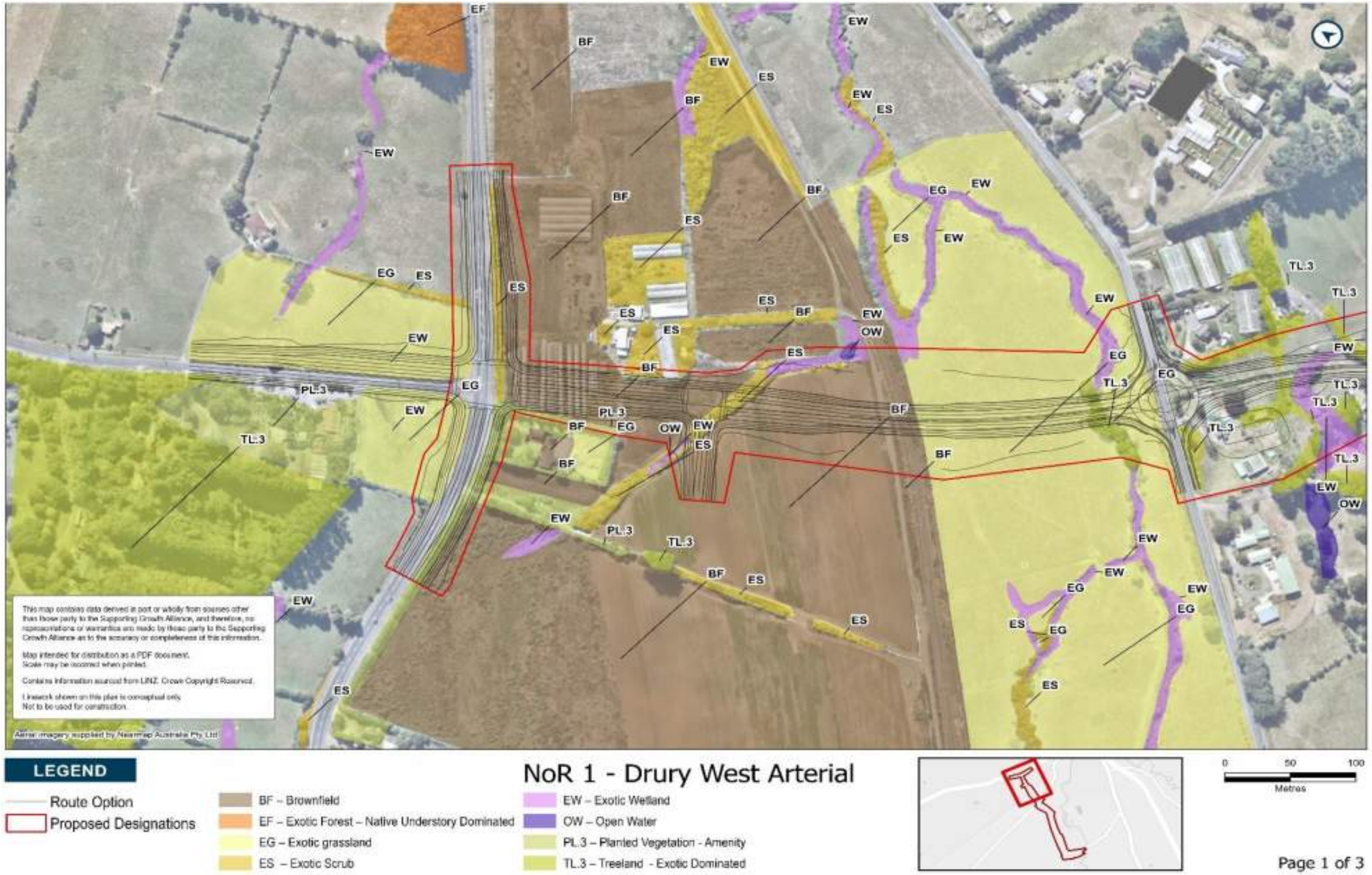
| Ecological feature | Activity | Ecological Effect | Waikato District Plan | Waikato Regional Plan |
|---|---|---|---|---|
| **wetland or stream (including riparian margins)** | Presence of bridge. | Shading leading to change in ecosystem structure. | | √ |
| | Gradual change in hydrology from presence 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. | | √ |

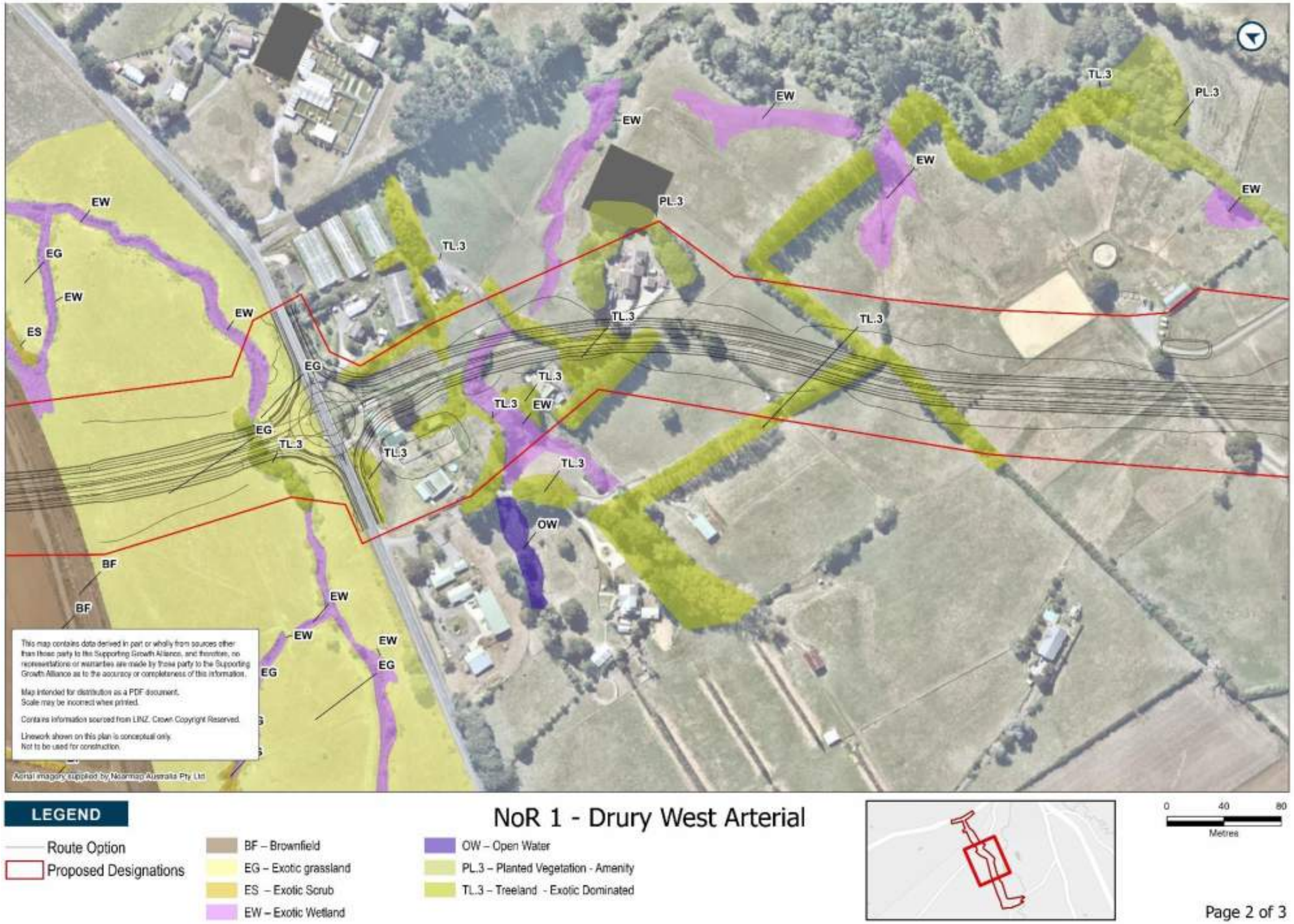
# Appendix 3

## Ecological Maps

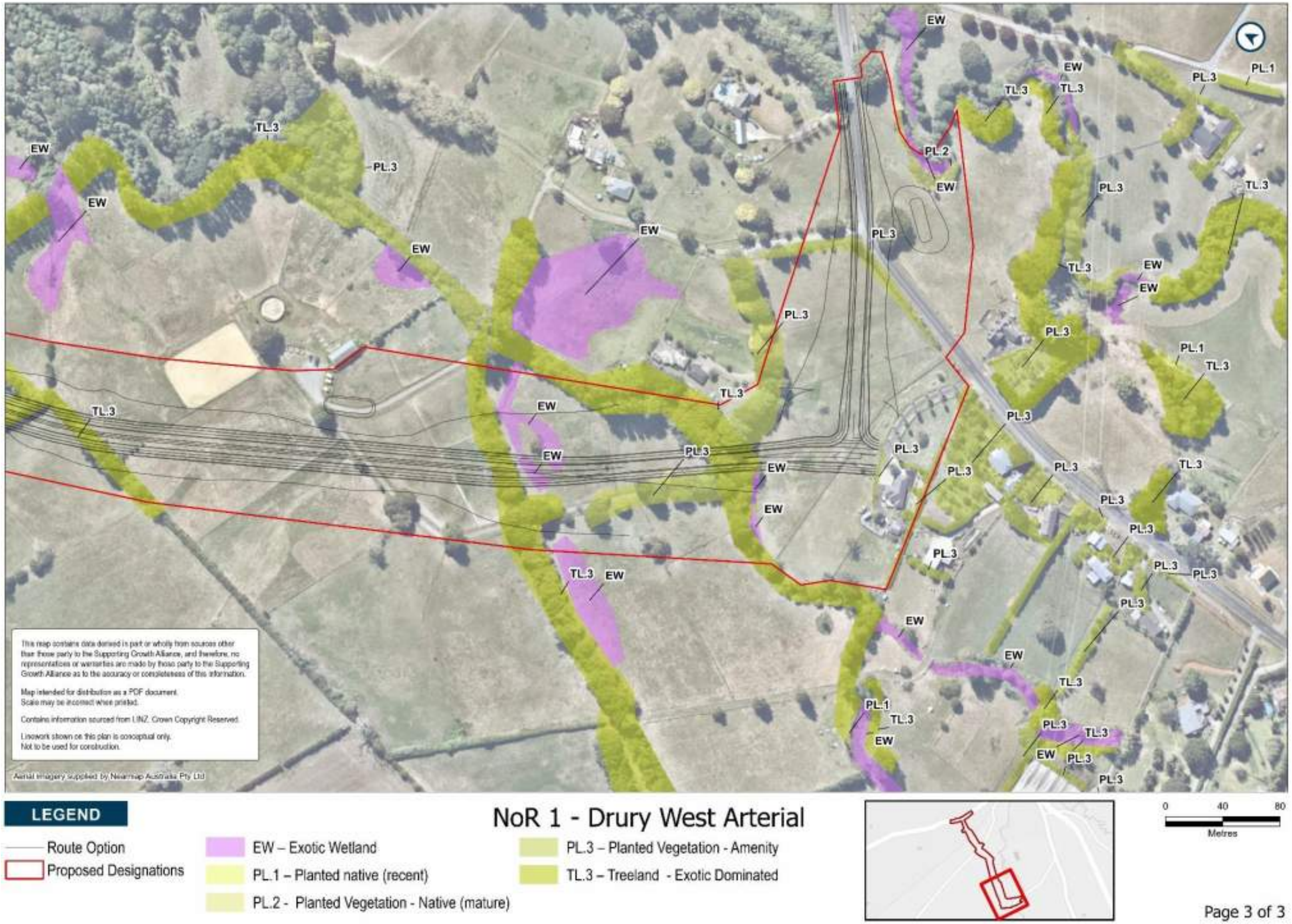
# 3 Appendix 3 – Ecological Maps

## 3.1 Terrestrial and Wetland Maps Related to NoR 1



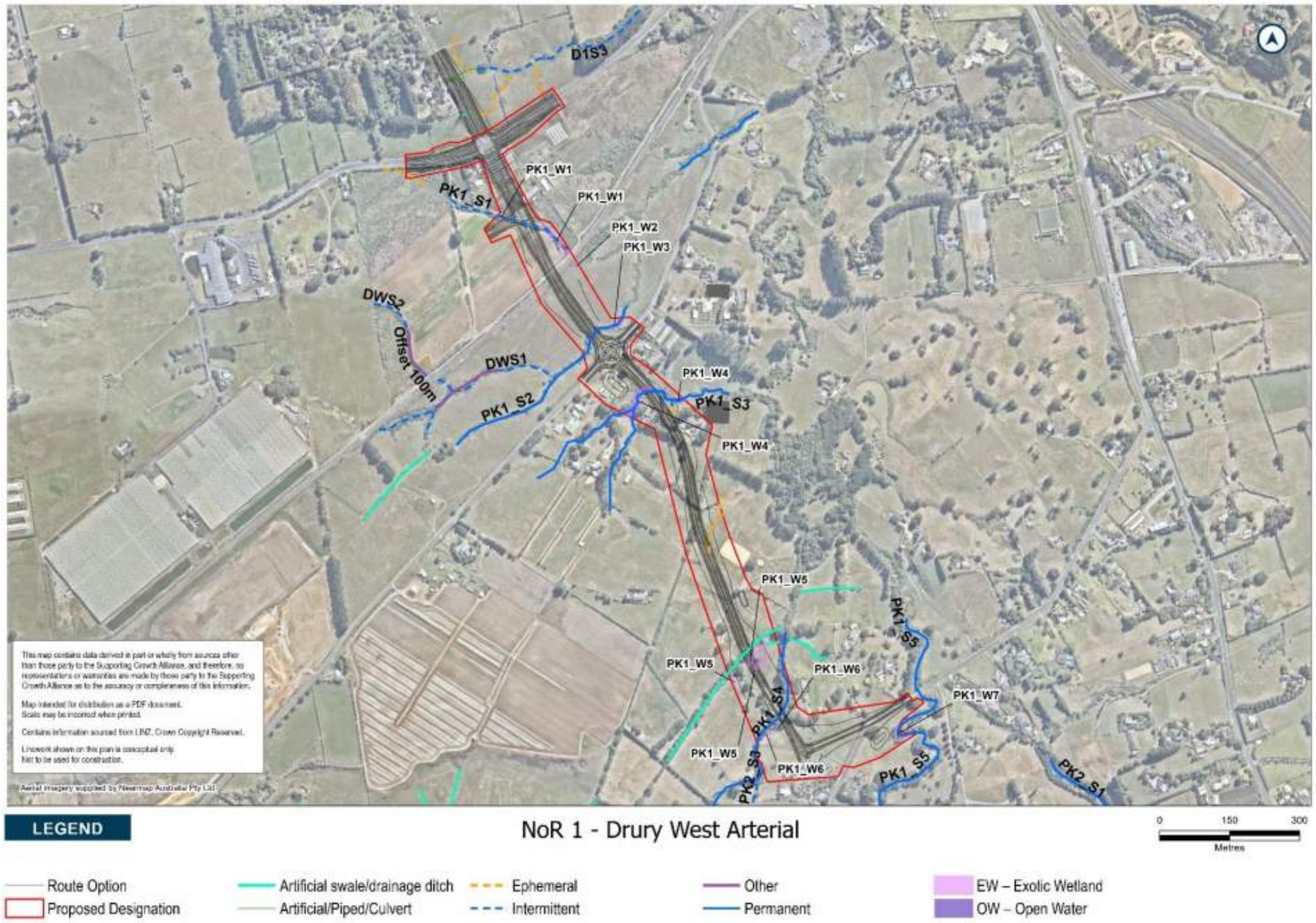


EW
EG
ES
BF
TL.3
PL.3
OW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designations
BF – Brownfield
EG – Exotic grassland
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
NoR 1 - Drury West Arterial
0
40
80
Metres
Page 2 of 3

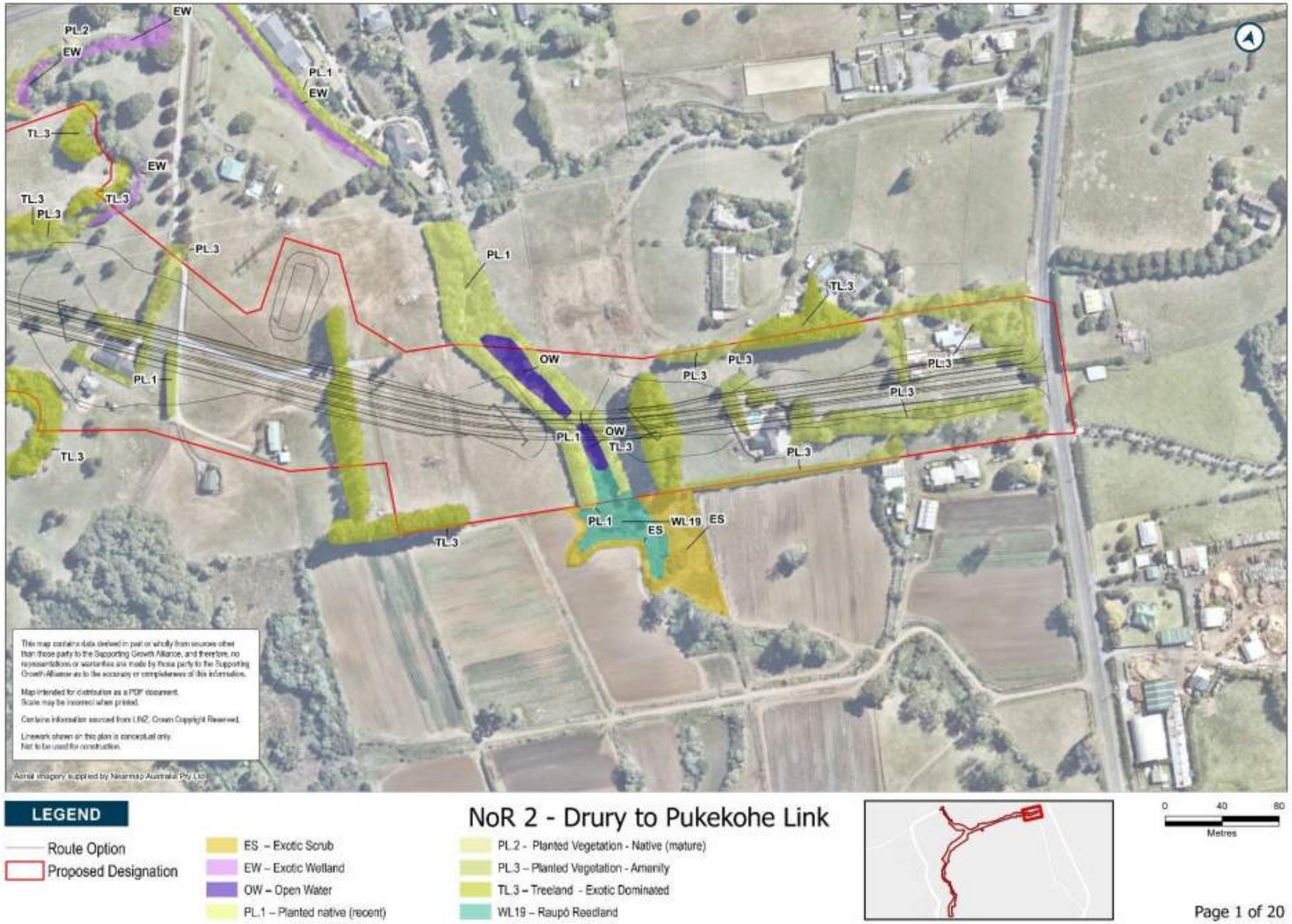


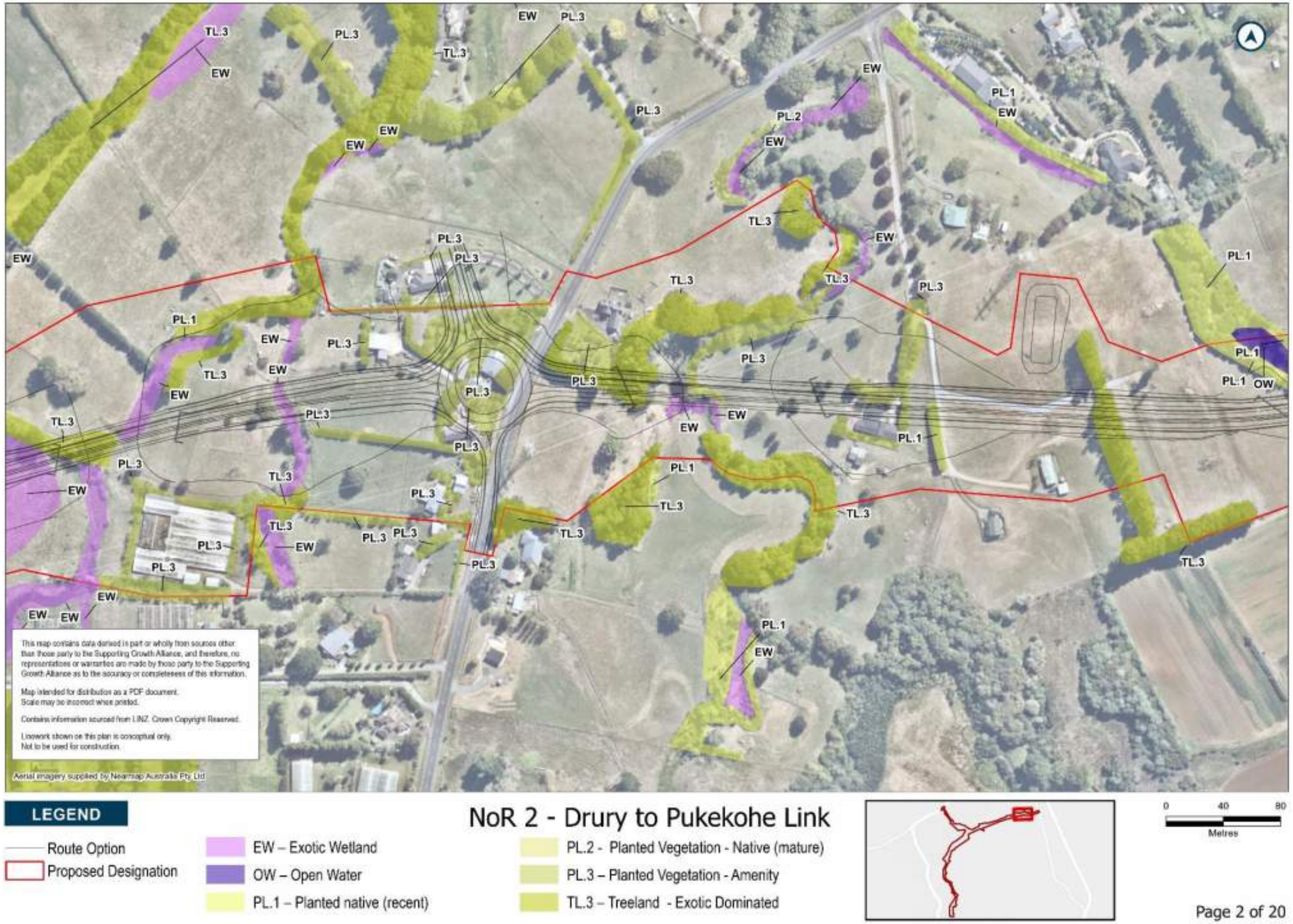
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
EW
TL.3
PL.3
PL.1
PL.2
LEGEND
Route Option
Proposed Designations
EW – Exotic Wetland
PL.1 – Planted native (recent)
PL.2 - Planted Vegetation - Native (mature)
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
NoR 1 - Drury West Arterial
0
40
80
Metres
Page 3 of 3

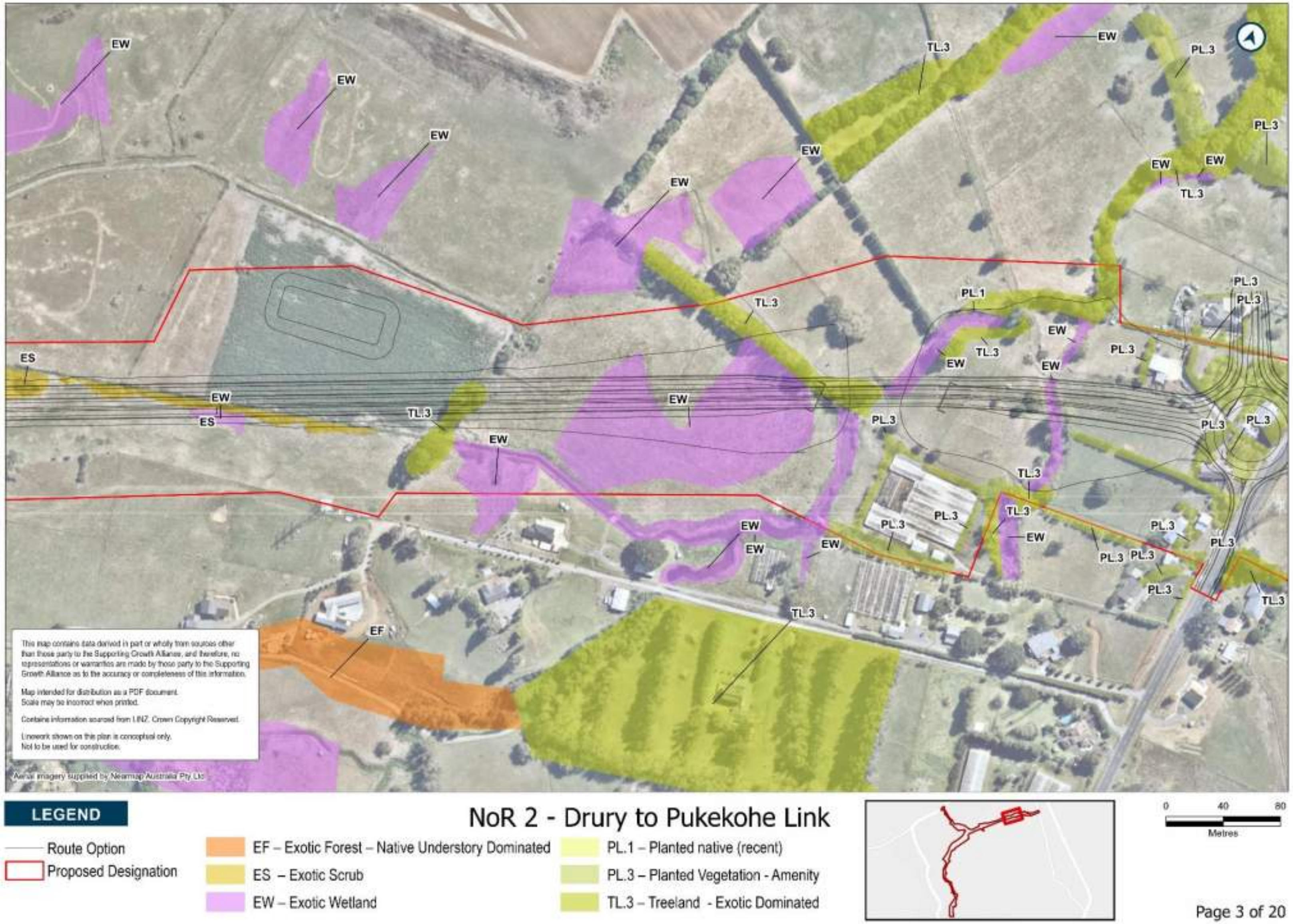
## 3.2 Wetland and Stream Map Related to NoR 1

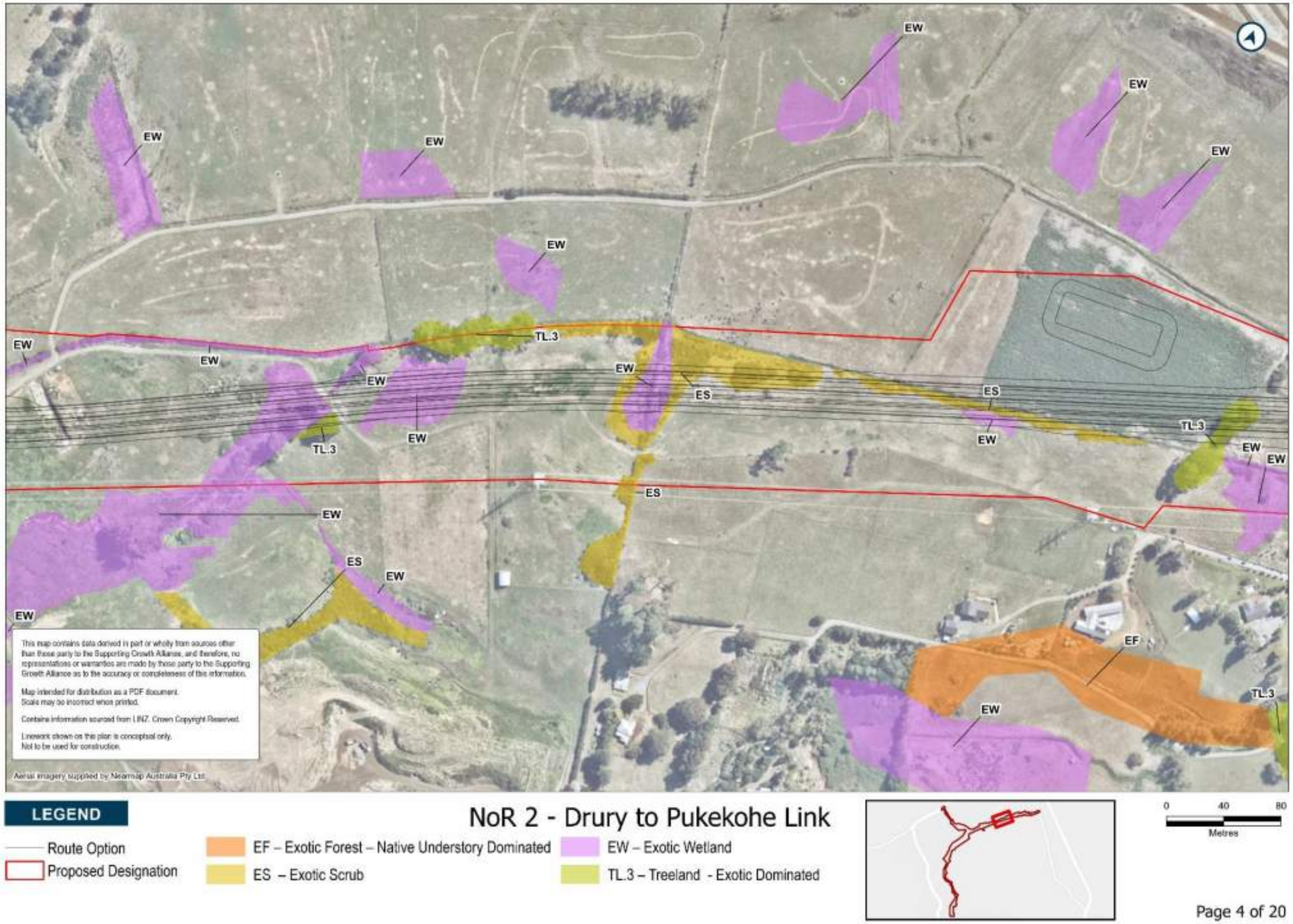


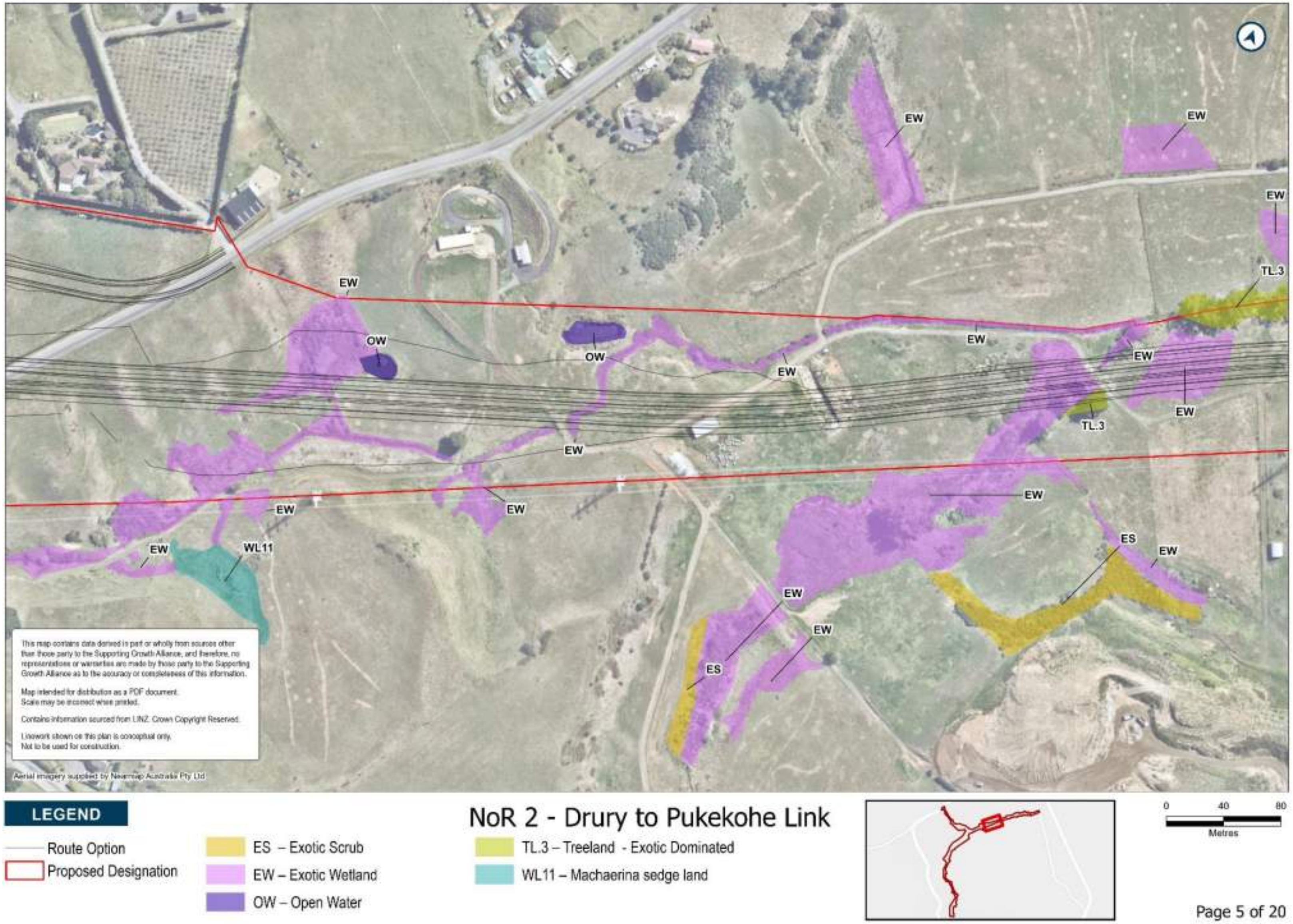
## 3.3 Terrestrial and Wetland Maps Related to NoR 2

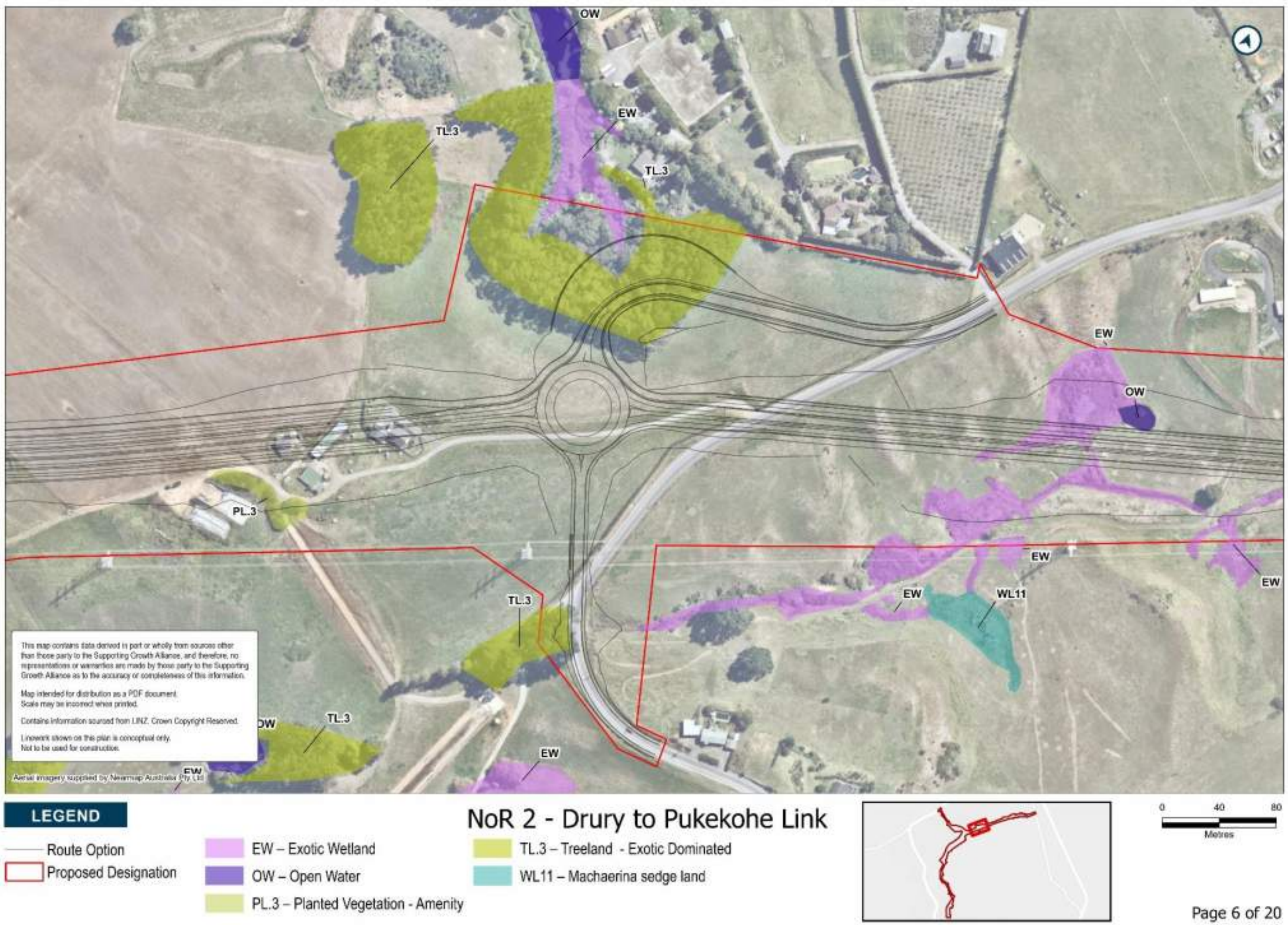


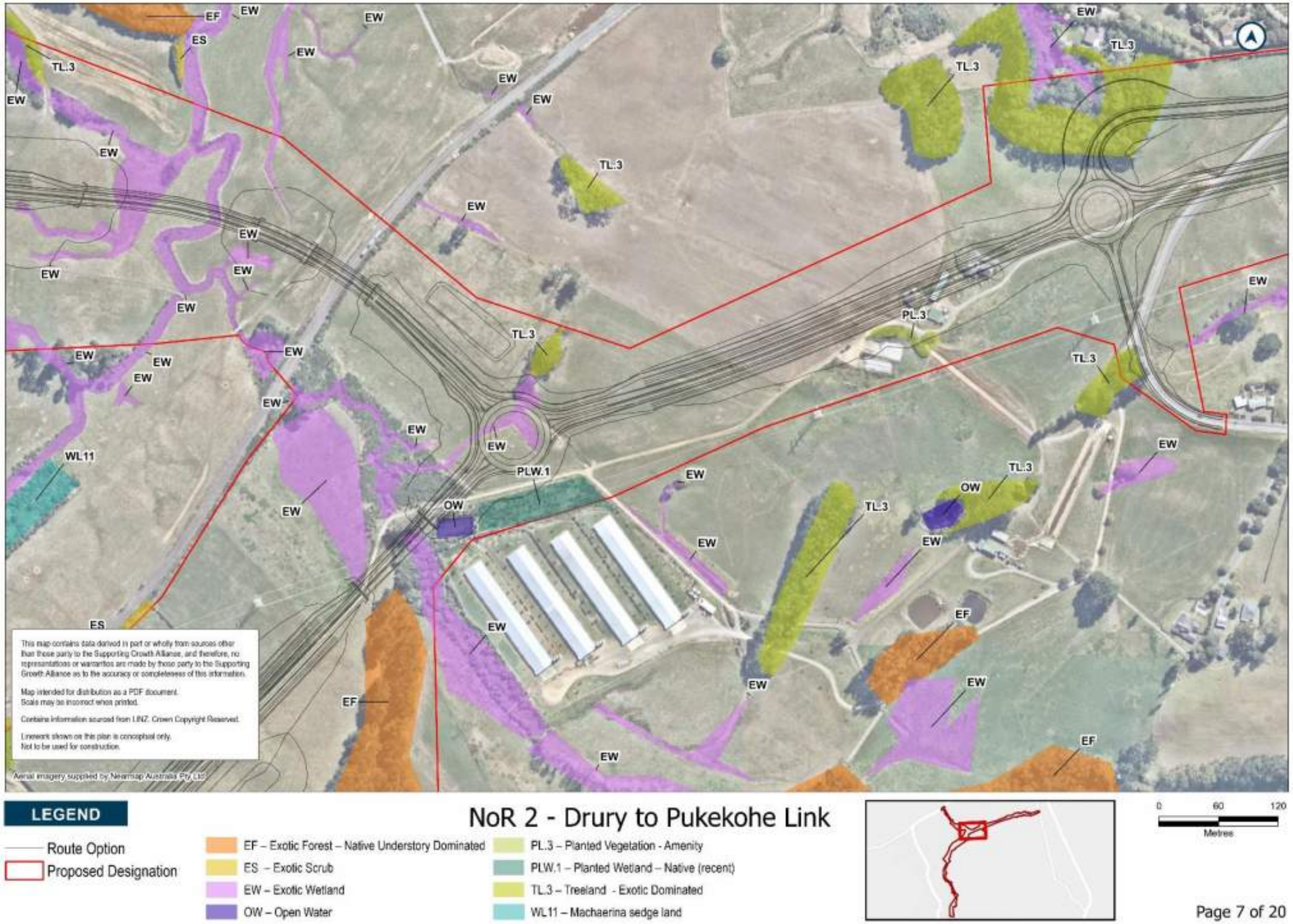

This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.2 - Planted Vegetation - Native (mature)
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
NoR 2 - Drury to Pukekohe Link
0
40
80
Metres
Page 2 of 20

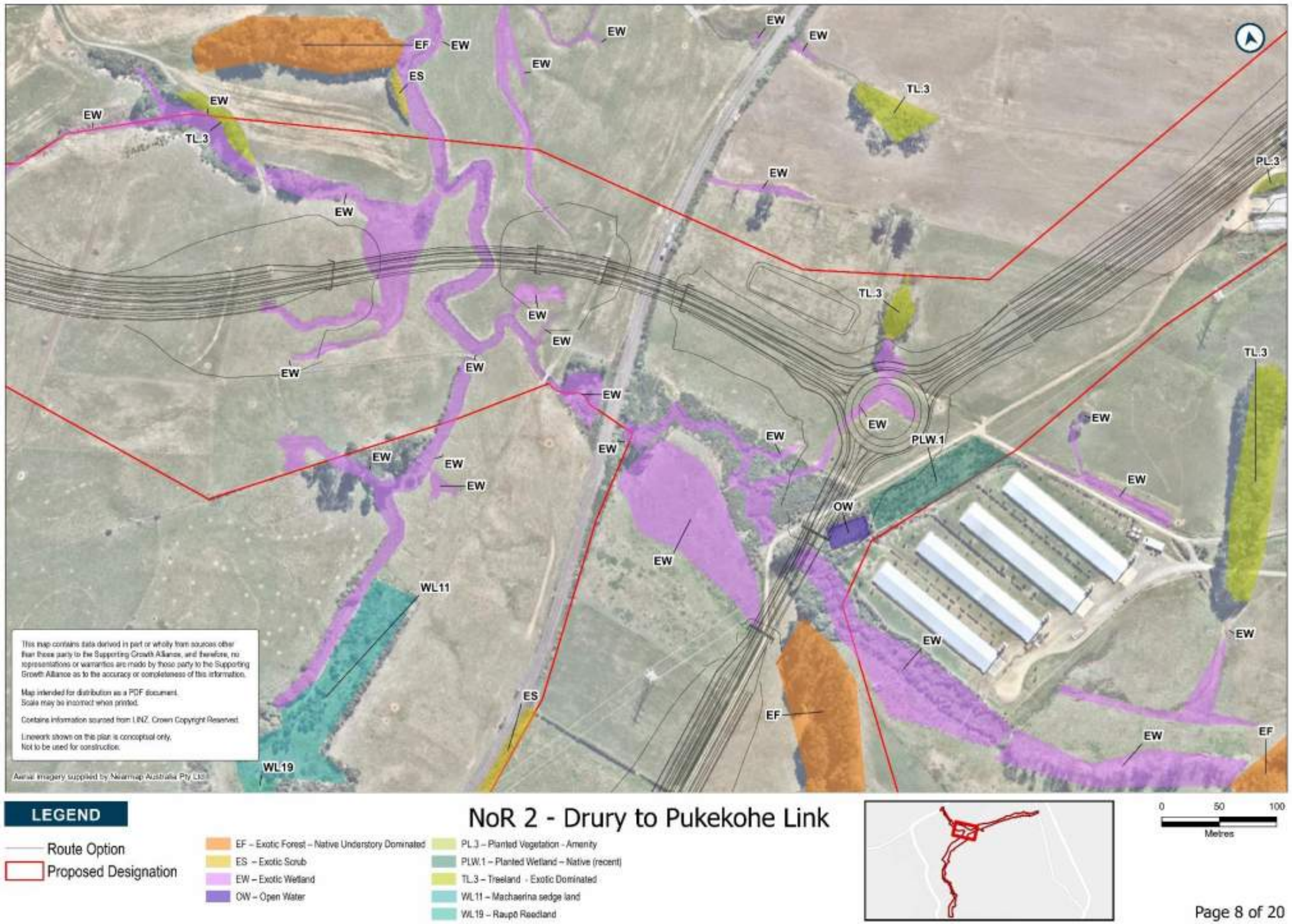

NoR 2 - Drury to Pukekohe Link
EW
ES
EF
TL.3
PL.1
PL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EF – Exotic Forest – Native Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
0
40
80
Metres
Page 3 of 20


EW
TL.3
ES
EF
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd.
LEGEND
Route Option
Proposed Designation
EF – Exotic Forest – Native Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
TL.3 – Treeland - Exotic Dominated
NoR 2 - Drury to Pukekohe Link
0
40
80
Metres
Page 4 of 20

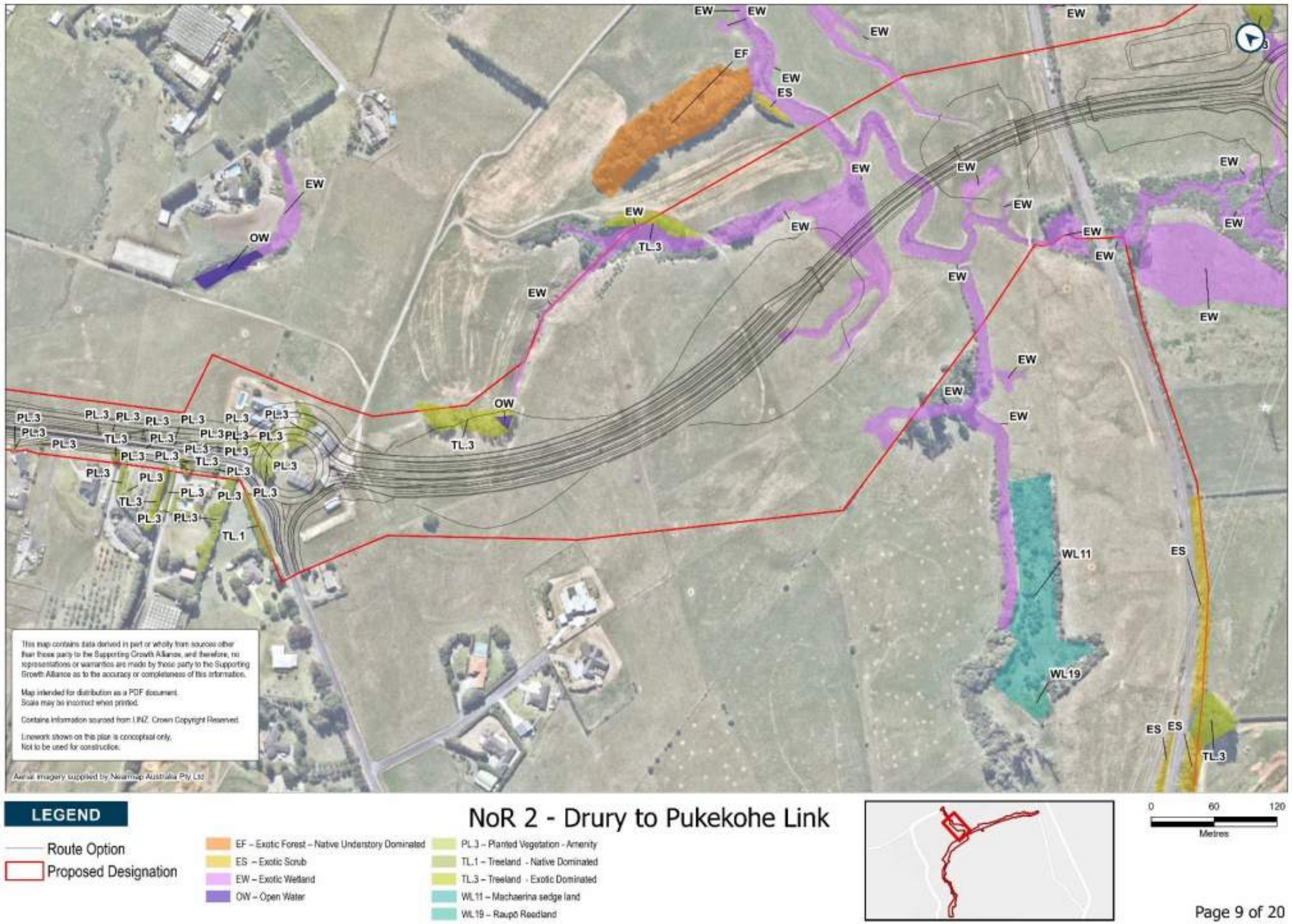

EW
OW
WL11
ES
TL.3
This map contains data derived is part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
NoR 2 - Drury to Pukekohe Link
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
0
40
80
Metres
Page 5 of 20

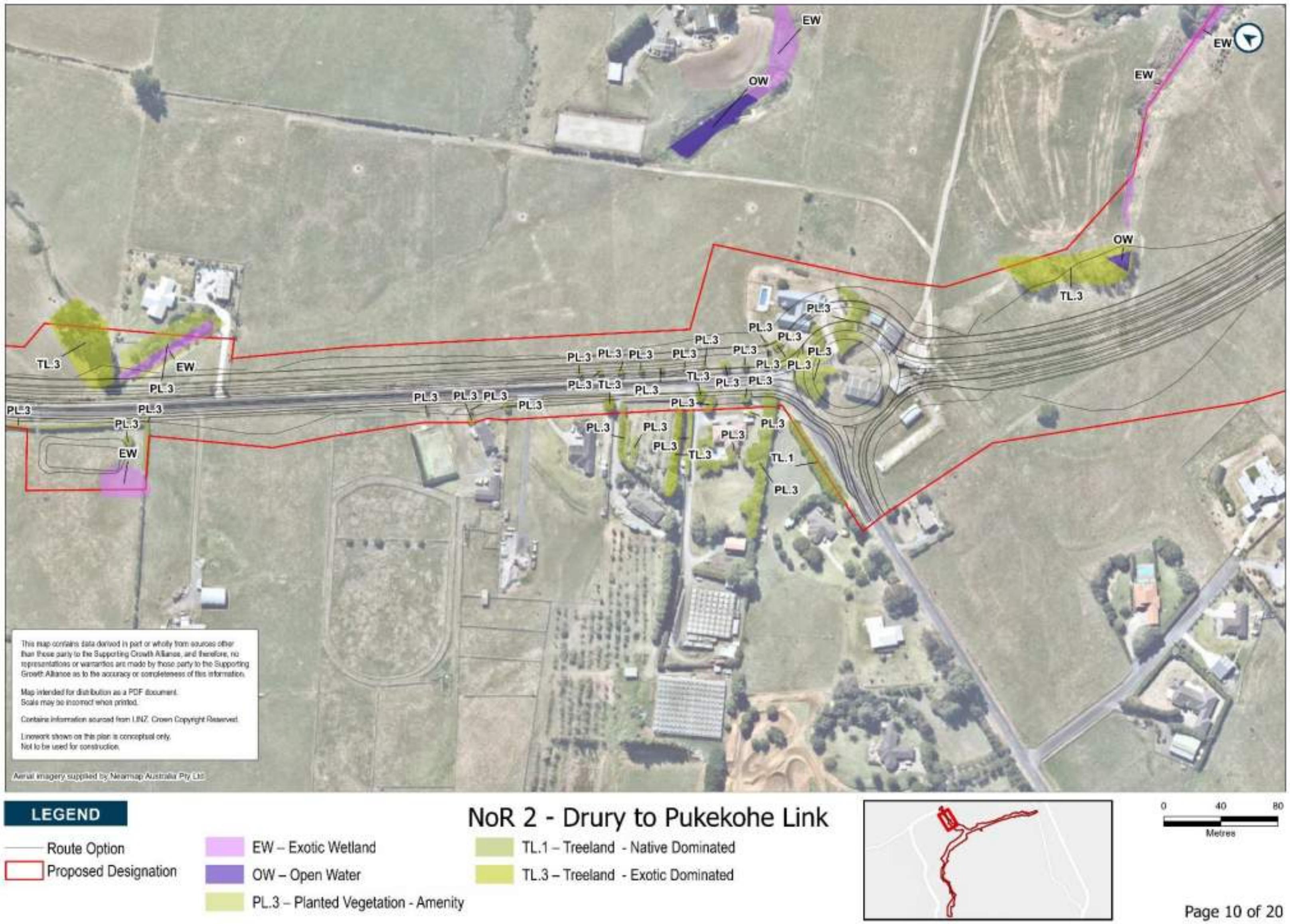

OW
EW
TL.3
TL.3
EW
OW
PL.3
TL.3
EW
EW
WL11
EW
TL.3
OW
EW
EW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EW – Exotic Wetland
OW – Open Water
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
NoR 2 - Drury to Pukekohe Link
0
40
80
Metres
Page 6 of 20


EF
ES
EW
TL.3
WL11
PL.3
PLW.1
OW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EF – Exotic Forest – Native Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.3 – Planted Vegetation - Amenity
PLW.1 – Planted Wetland – Native (recent)
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
NoR 2 - Drury to Pukekohe Link
0
60
120
Metres
Page 7 of 20



This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
EF
ES
EW
TL.3
PL.3
PLW.1
OW
WL11
WL19
LEGEND
Route Option
Proposed Designation
EF – Exotic Forest – Native Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.3 – Planted Vegetation - Amenity
PLW.1 – Planted Wetland – Native (recent)
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
WL19 – Raupō Reedland
NoR 2 - Drury to Pukekohe Link
0
50
100
Metres
Page 8 of 20


NoR 2 - Drury to Pukekohe Link
LEGEND
Route Option
Proposed Designation
EF – Exotic Forest – Native Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
WL19 – Raupō Reedland
0
60
120
Metres
Page 9 of 20
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
EW
EF
ES
OW
TL.3
TL.1
PL.3
WL11
WL19


EW
OW
TL.3
PL.3
TL.1
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EW – Exotic Wetland
OW – Open Water
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
NoR 2 - Drury to Pukekohe Link
0
40
80
Metres
Page 10 of 20

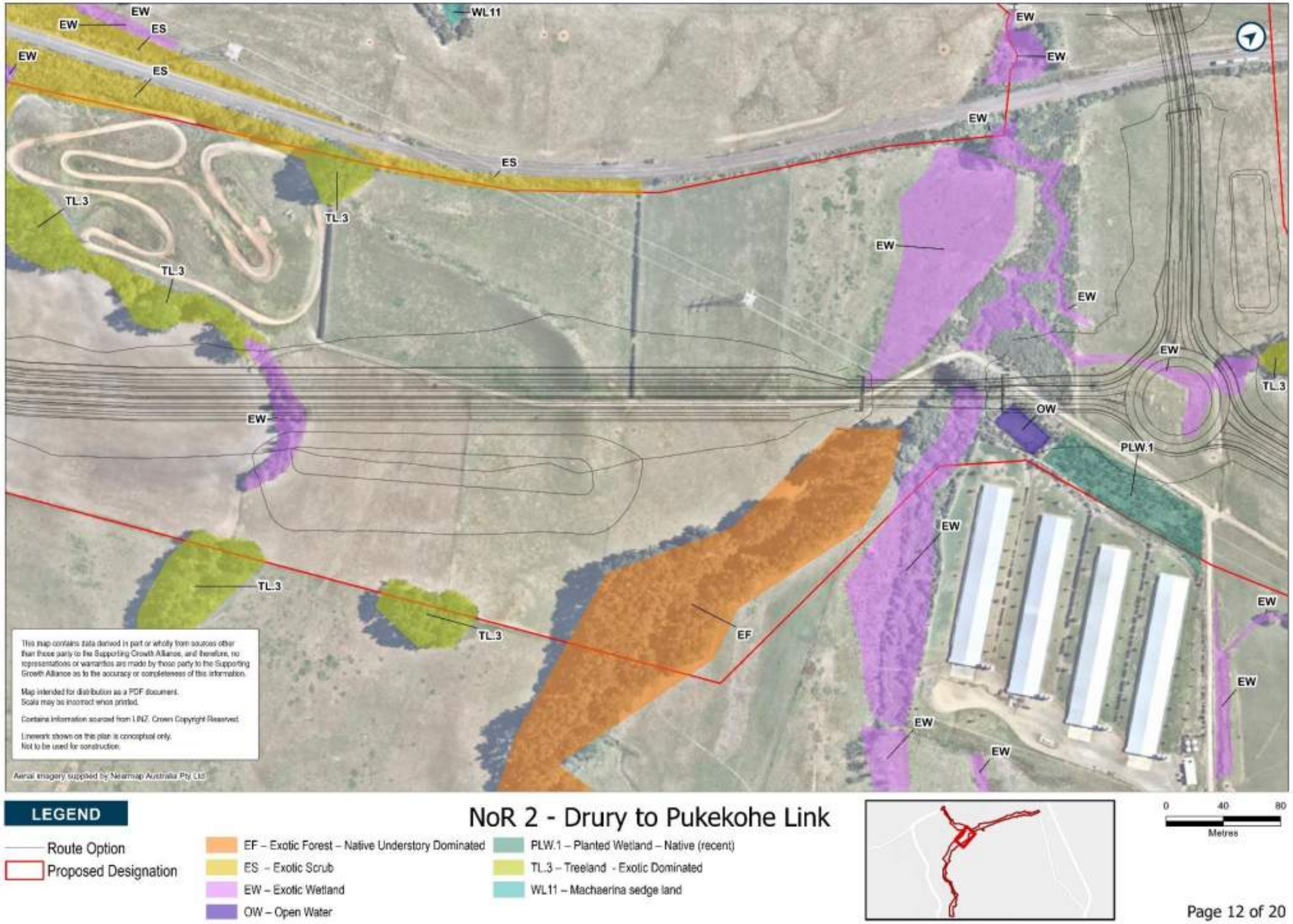

**LEGEND**

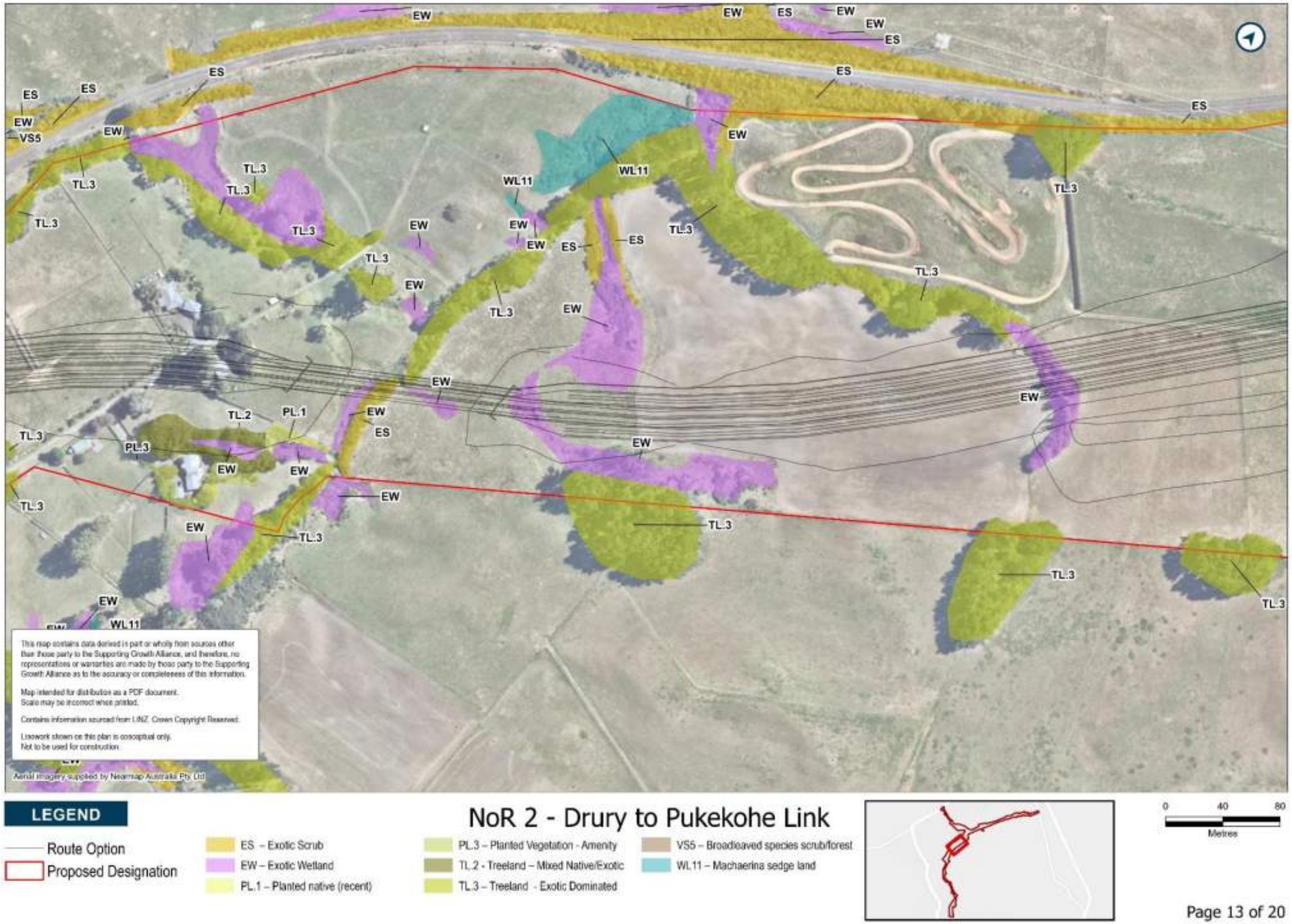
- Route Option
- Proposed Designation
- EW – Exotic Wetland
- PL.3 – Planted Vegetation - Amenity
- TL.3 – Treeland - Exotic Dominated

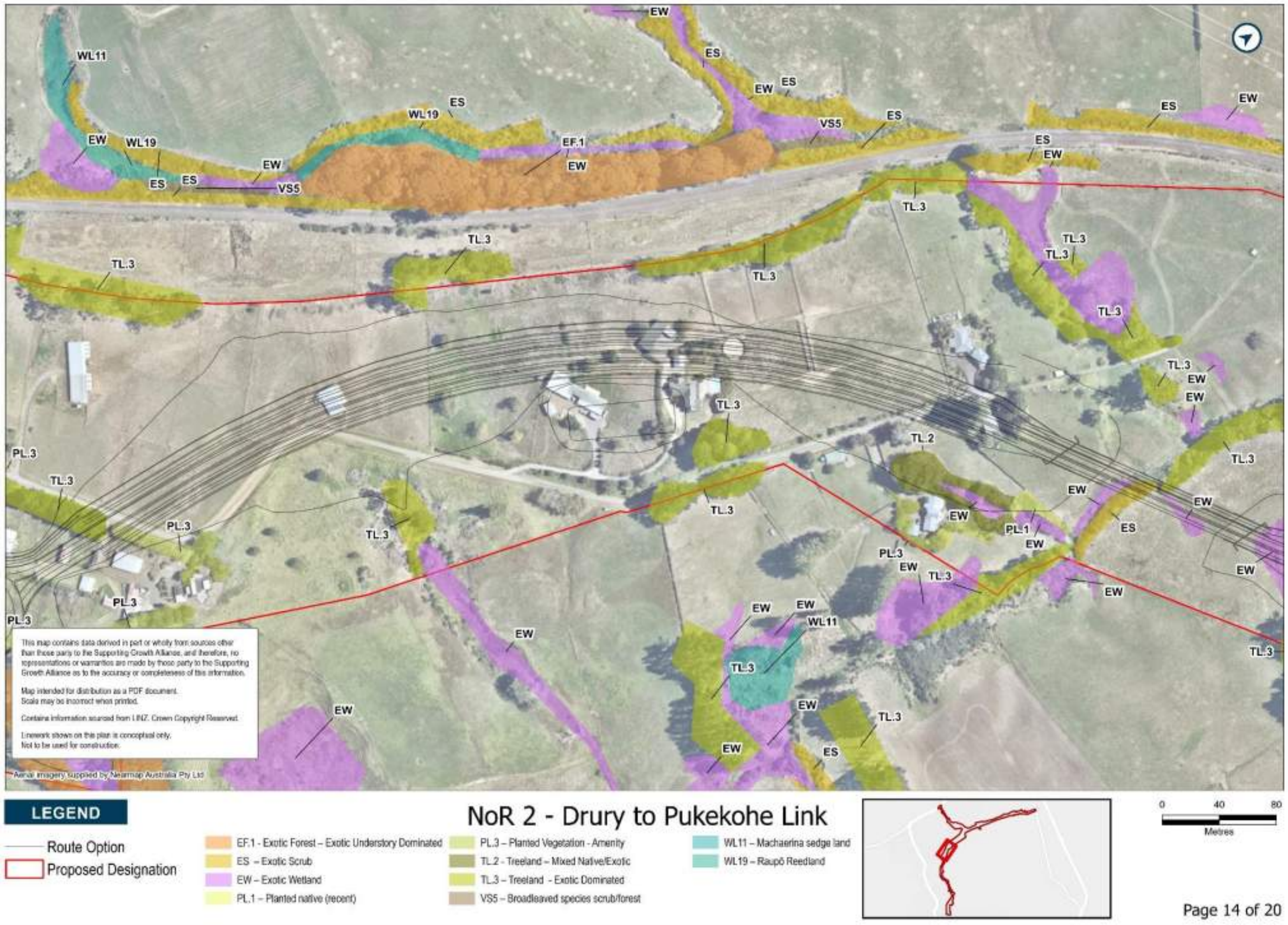
## NoR 2 - Drury to Pukekohe Link

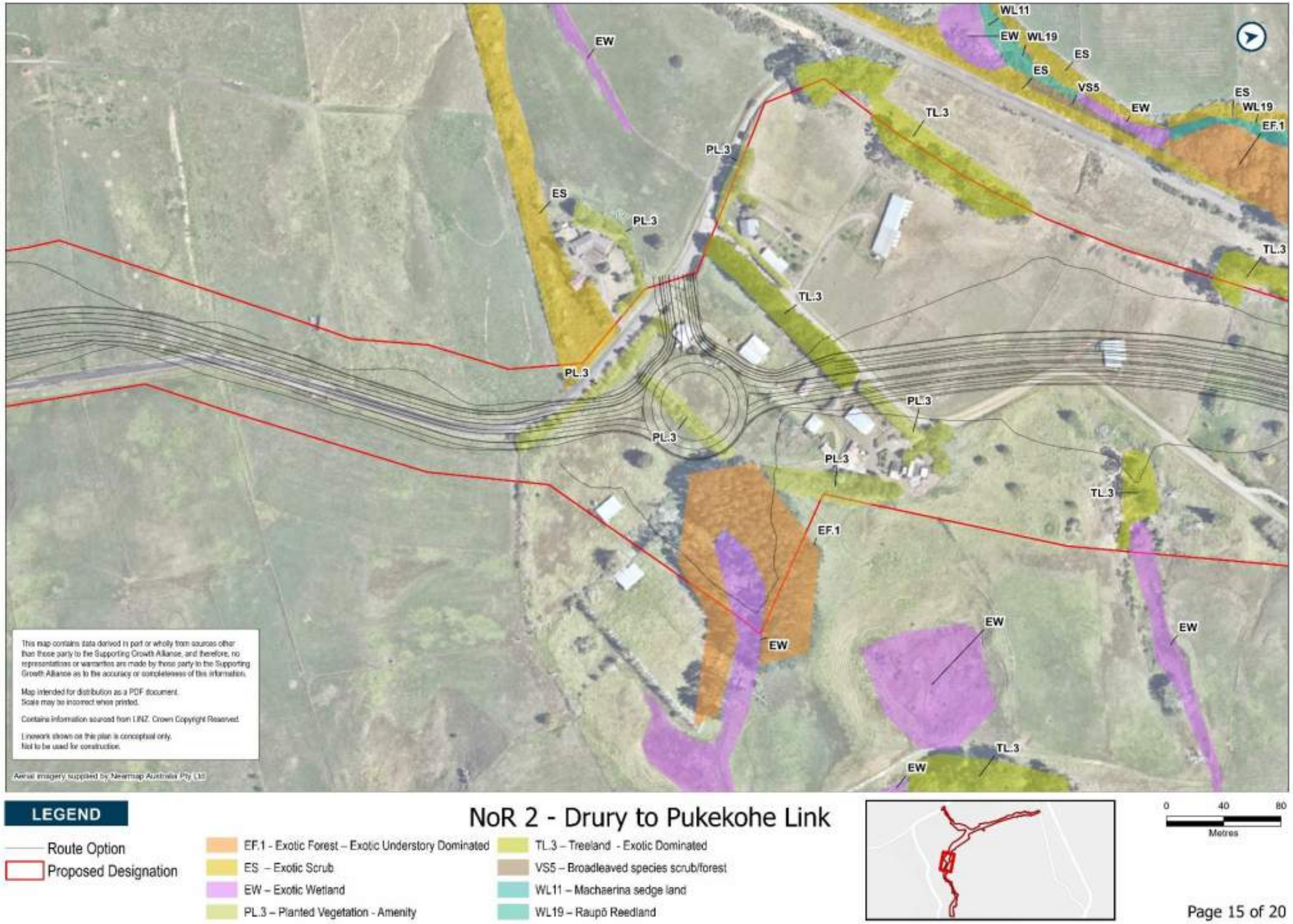
0 50 100
Metres

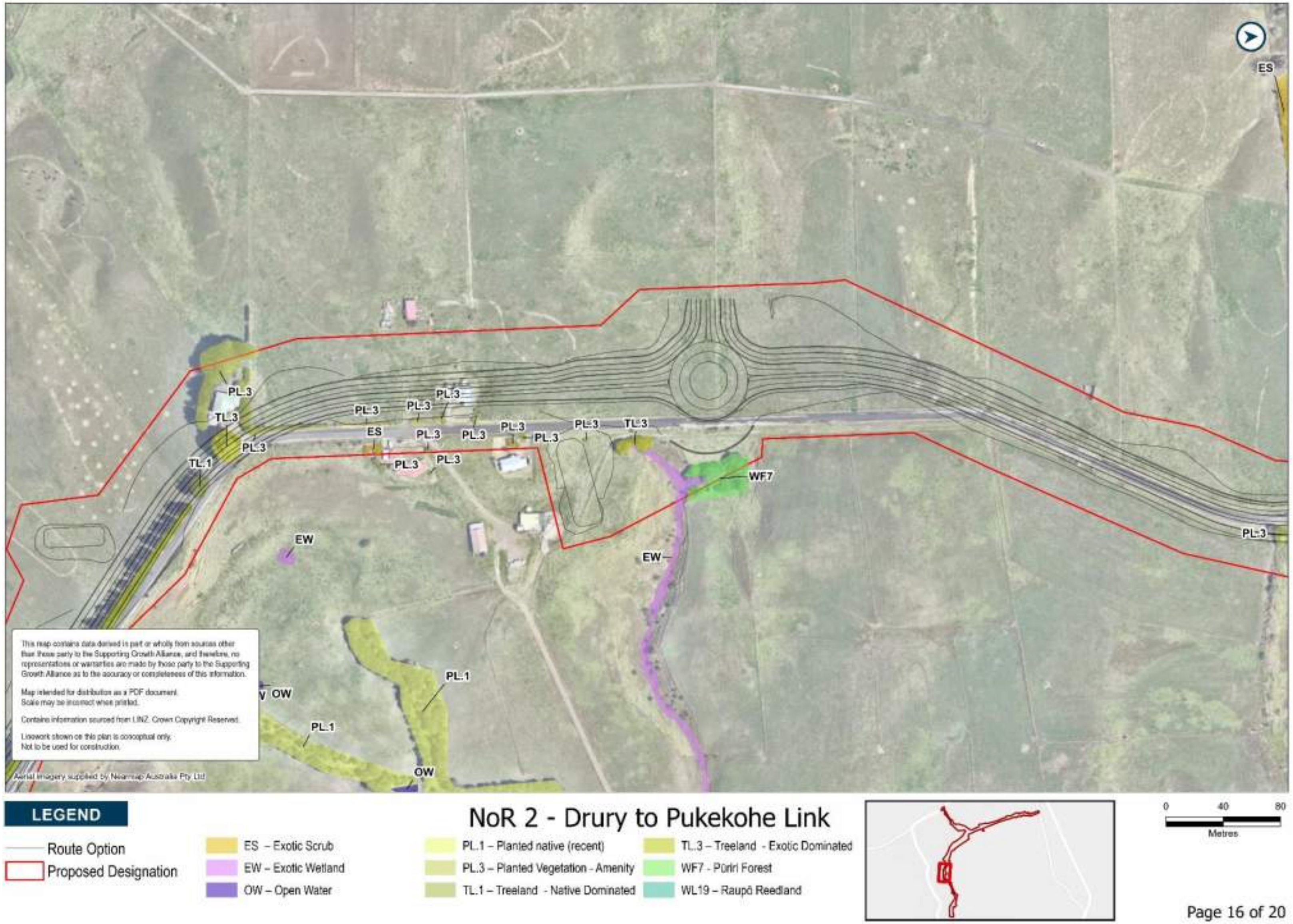
Page 11 of 20


EW
EW
ES
ES
WL11
EW
EW
EW
EW
ES
TL.3
TL.3
TL.3
EW
EW
EW
TL.3
EW
OW
PLW.1
EW
TL.3
TL.3
EF
EW
EW
EW
EW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EF – Exotic Forest – Native Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PLW.1 – Planted Wetland – Native (recent)
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
NoR 2 - Drury to Pukekohe Link
0 40 80
Metres
Page 12 of 20

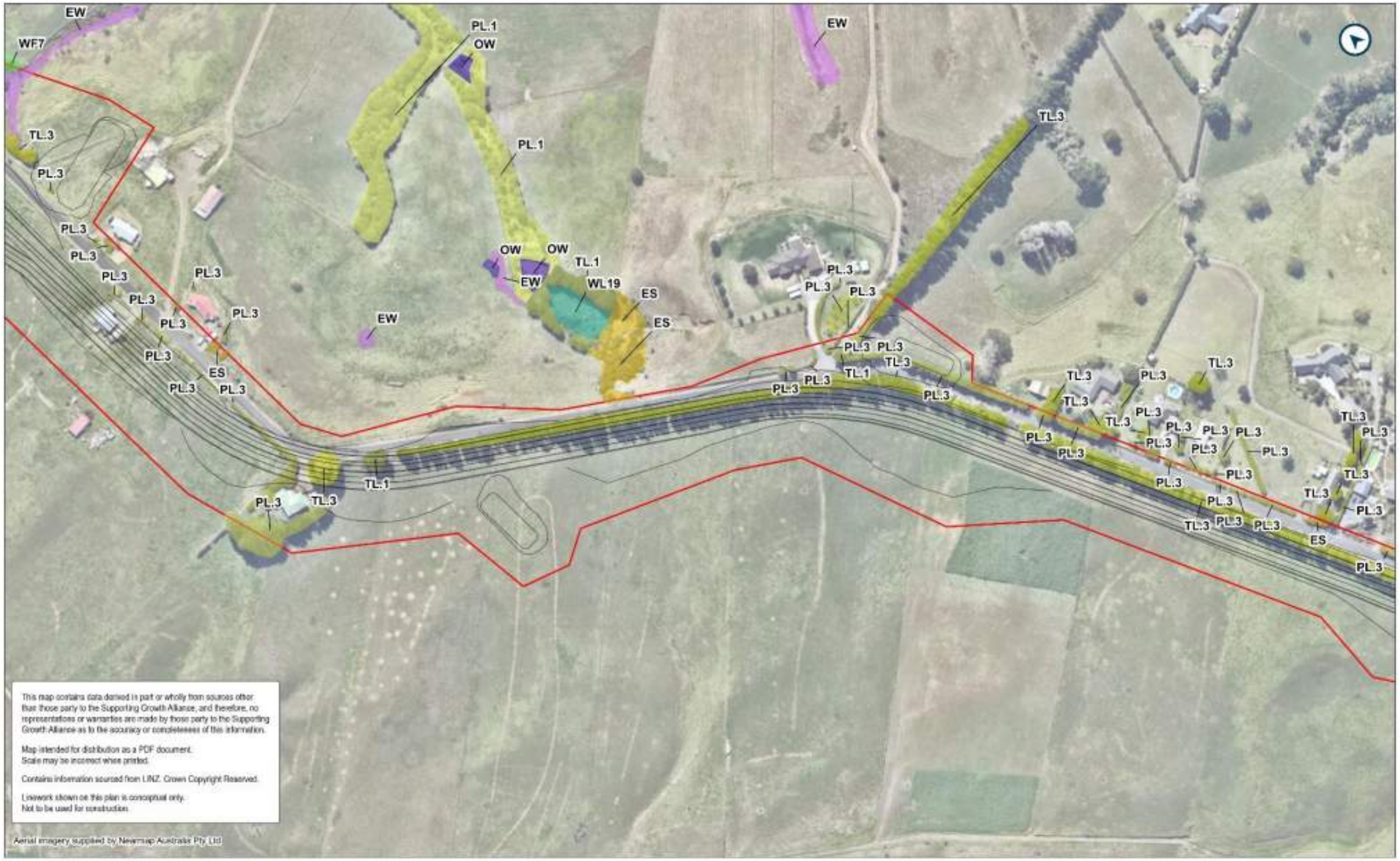

NoR 2 - Drury to Pukekohe Link
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.2 - Treeland – Mixed Native/Exotic
TL.3 – Treeland - Exotic Dominated
VS5 – Broadleaved species scrub/forest
WL11 – Machaerina sedge land
0 40 80
Metres
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
Page 13 of 20


This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EF.1 - Exotic Forest – Exotic Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.2 - Treeland – Mixed Native/Exotic
TL.3 – Treeland - Exotic Dominated
VS5 – Broadleaved species scrub/forest
WL11 – Machaerina sedge land
WL19 – Raupō Reedland
NoR 2 - Drury to Pukekohe Link
0
40
80
Metres
Page 14 of 20


EW
WL11
EW WL19
ES
ES
VS5
EW
ES
WL19
EF.1
TL.3
PL.3
ES
PL.3
TL.3
TL.3
PL.3
PL.3
PL.3
PL.3
TL.3
EF.1
EW
EW
EW
TL.3
EW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EF.1 - Exotic Forest – Exotic Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
VS5 – Broadleaved species scrub/forest
WL11 – Machaerina sedge land
WL19 – Raupō Reedland
NoR 2 - Drury to Pukekohe Link
0 40 80
Metres
Page 15 of 20



ES
PL.3
TL.3
PL.3
PL.3
PL.3
PL.3
ES
PL.3
PL.3
PL.3
PL.3
PL.3
TL.3
TL.1
PL.3
PL.3
WF7
EW
EW
PL.3
PL.1
OW
PL.1
OW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF7 - Pūriri Forest
WL19 – Raupō Reedland
NoR 2 - Drury to Pukekohe Link
0
40
80
Metres
Page 16 of 20



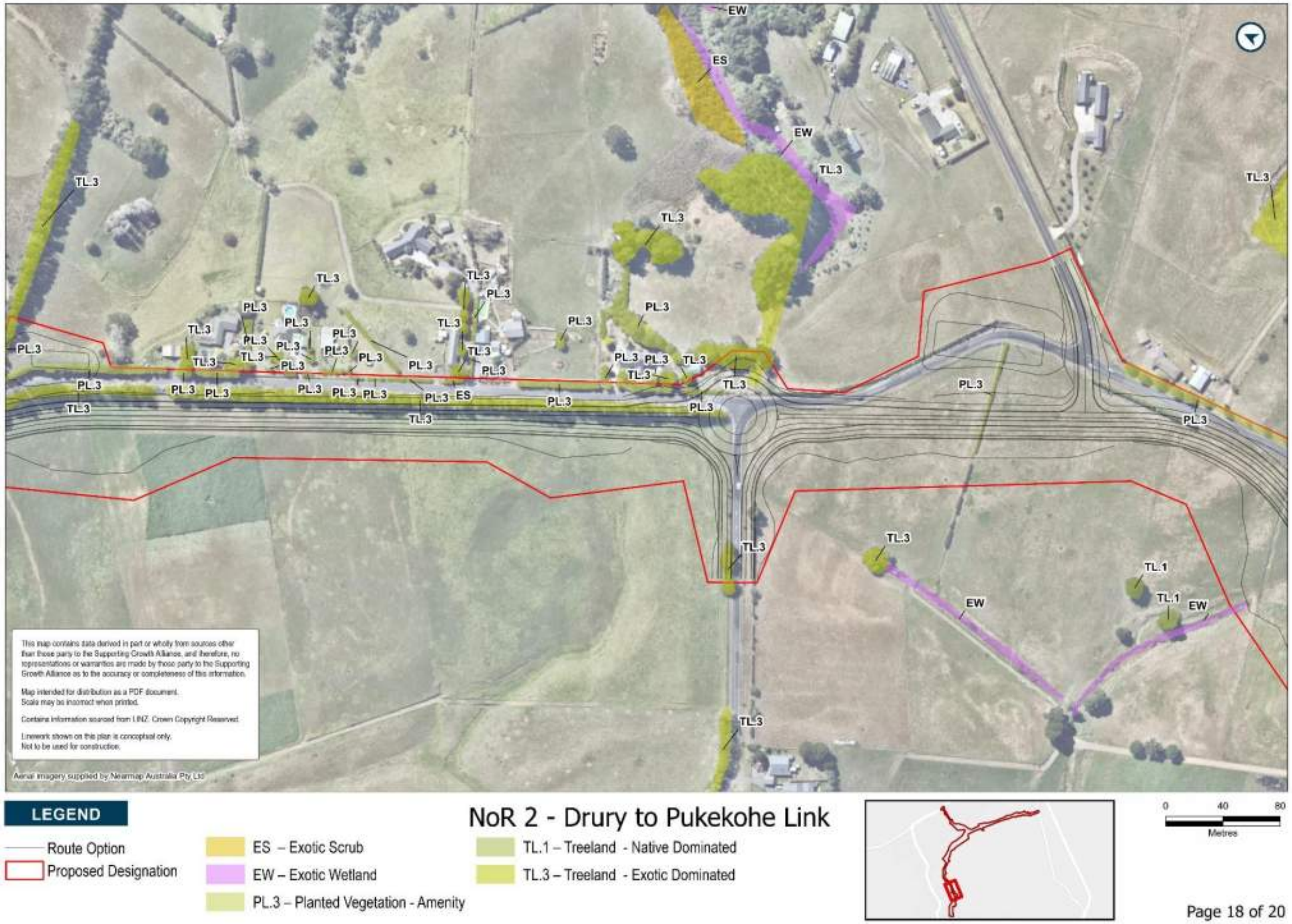

## LEGEND

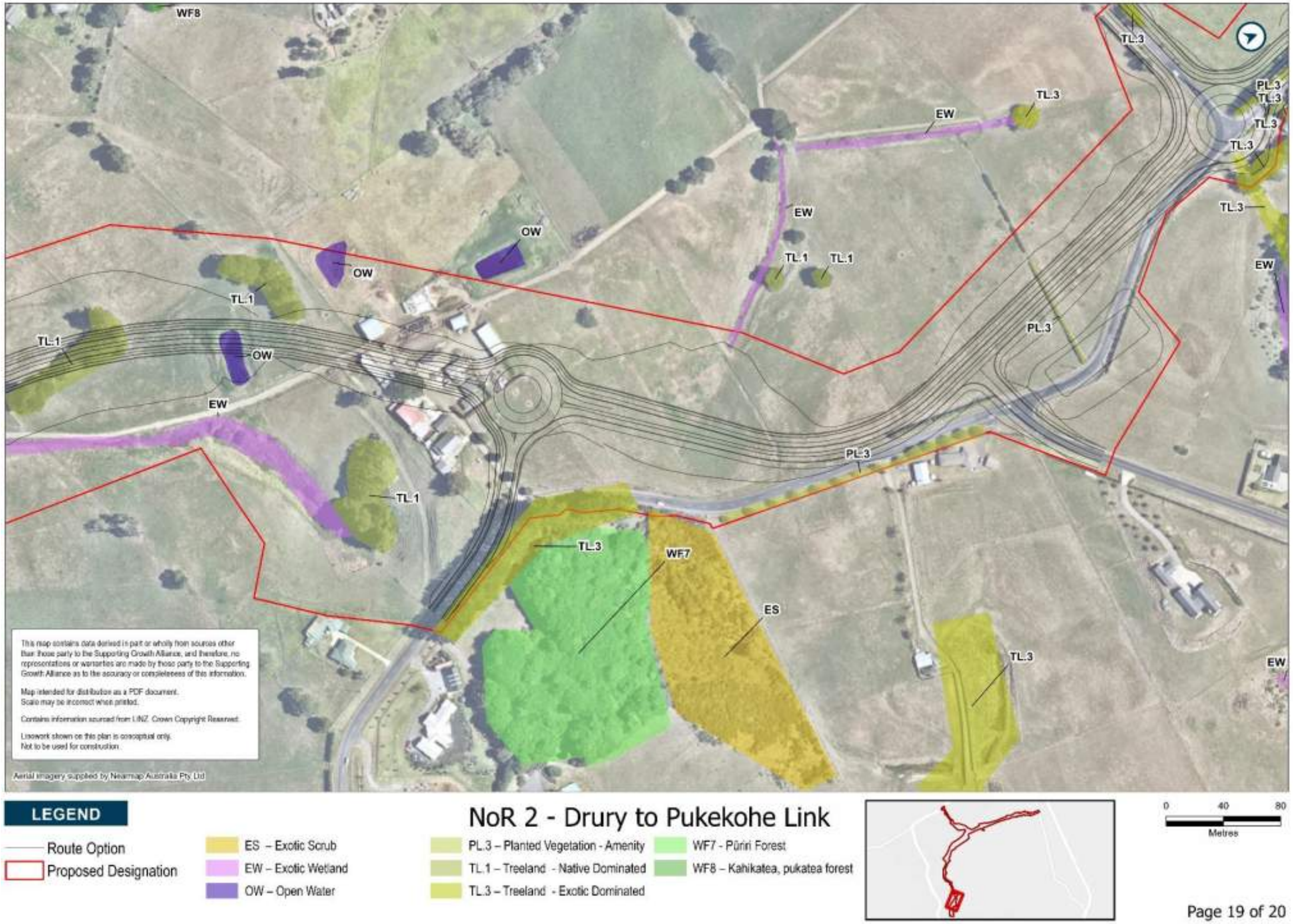
- Route Option
- Proposed Designation
- ES – Exotic Scrub
- EW – Exotic Wetland
- OW – Open Water
- PL.1 – Planted native (recent)
- PL.3 – Planted Vegetation - Amenity
- TL.1 – Treeland - Native Dominated
- TL.3 – Treeland - Exotic Dominated
- WF7 - Pūriri Forest
- WL19 – Raupō Reedland

# NoR 2 - Drury to Pukekohe Link

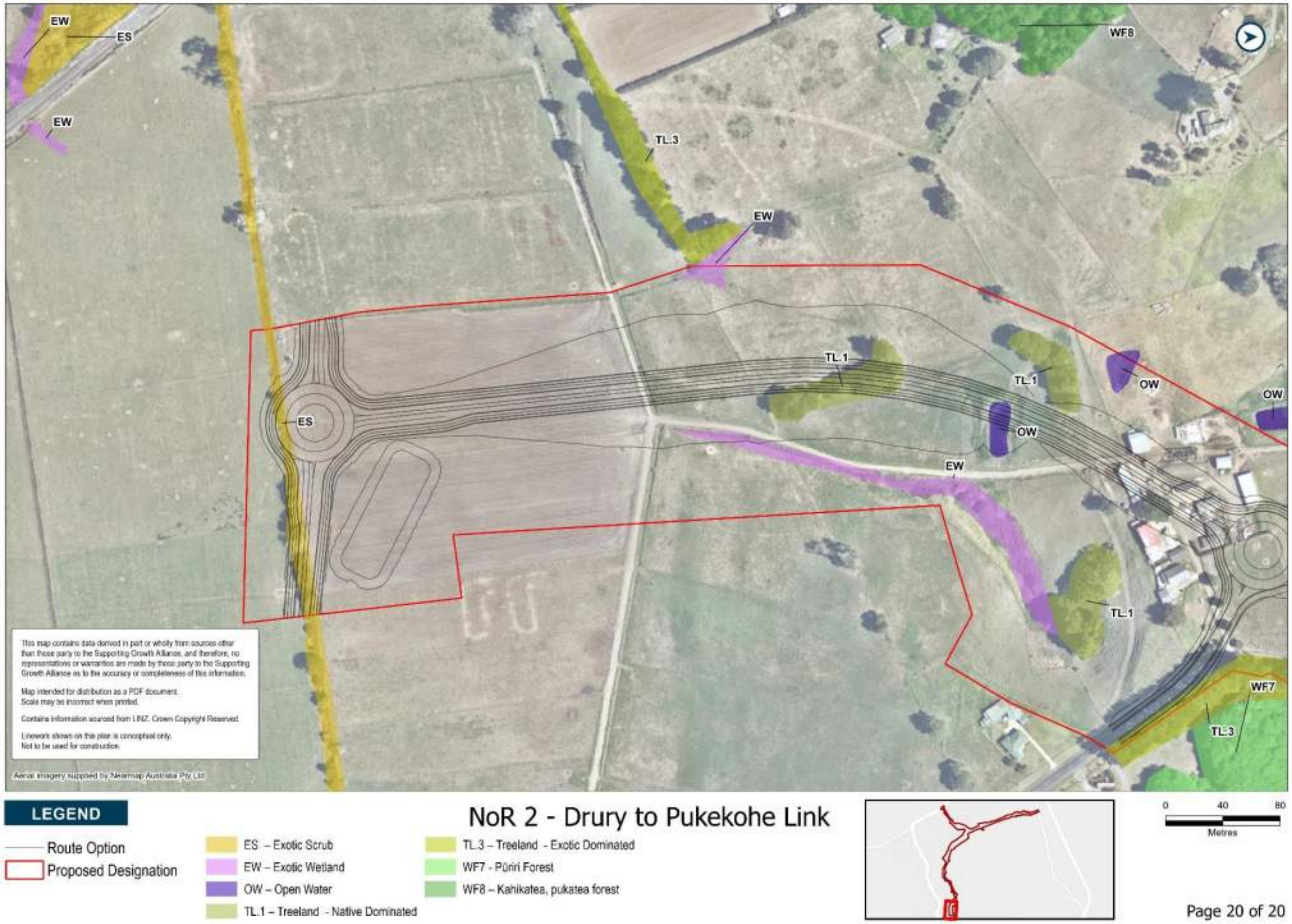
0 40 80
Metres

Page 17 of 20

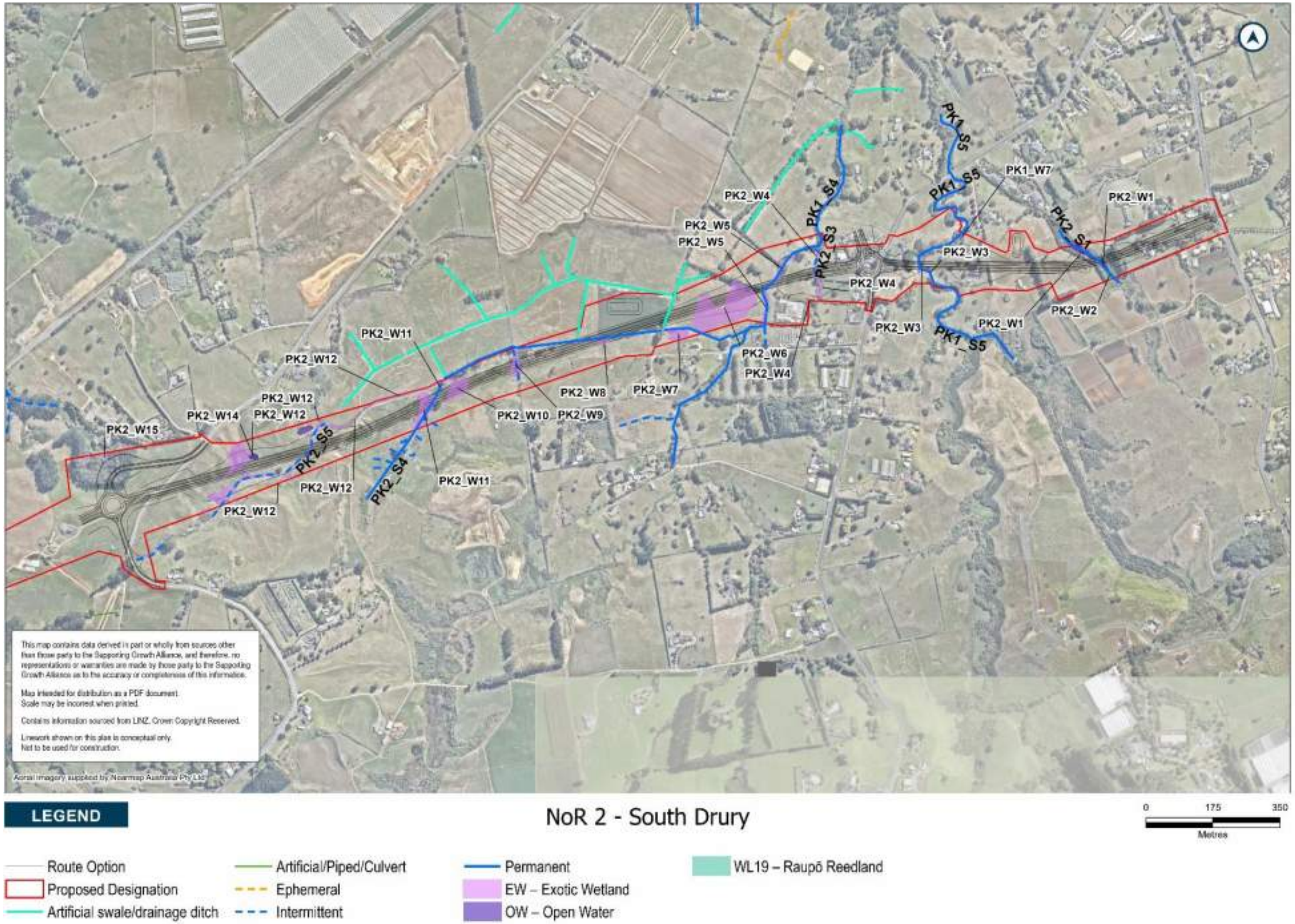

EW
ES
EW
TL.3
TL.3
TL.3
PL.3
PL.3
TL.3
PL.3
ES
TL.1
EW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
NoR 2 - Drury to Pukekohe Link
0 40 80
Metres
Page 18 of 20

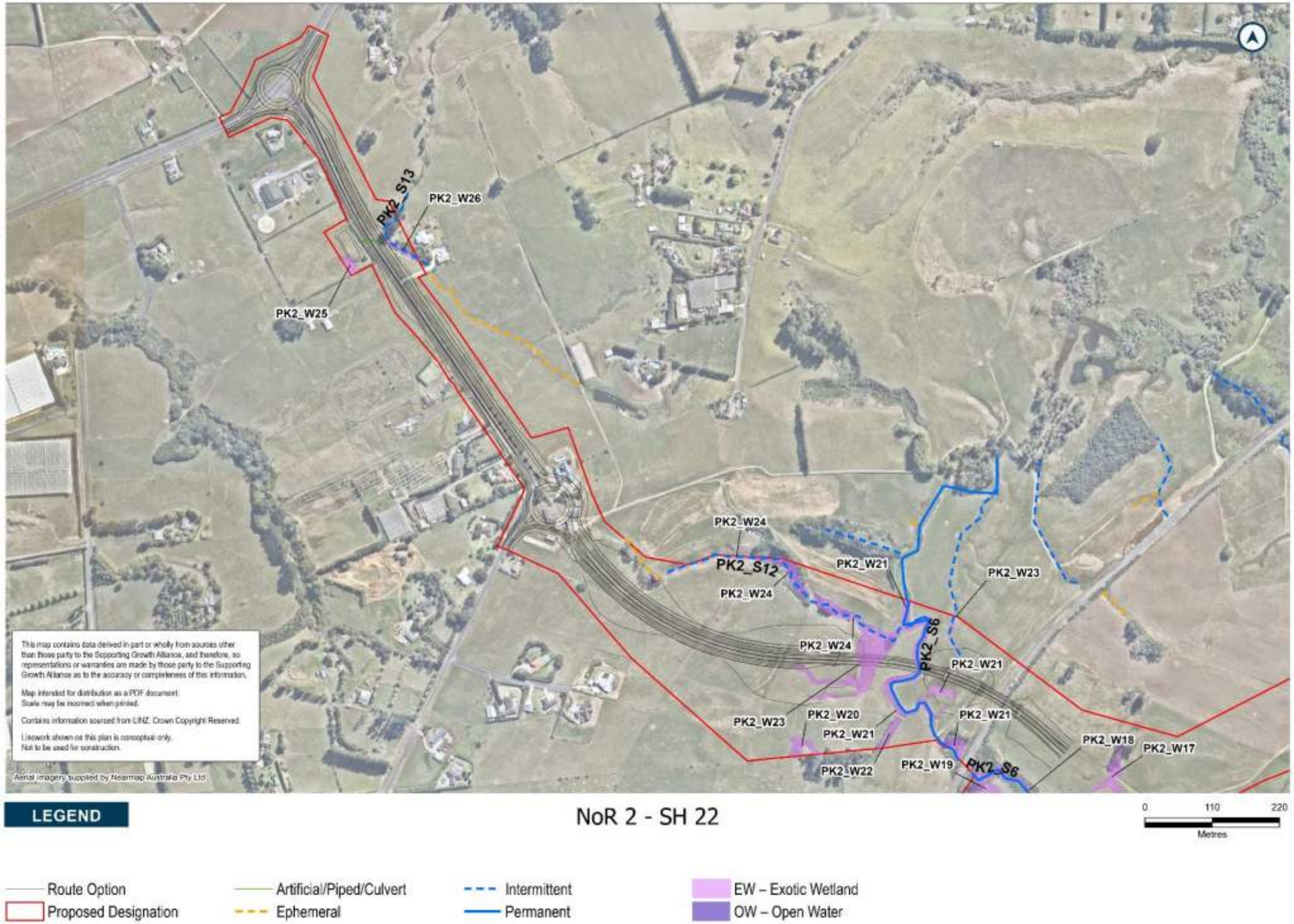


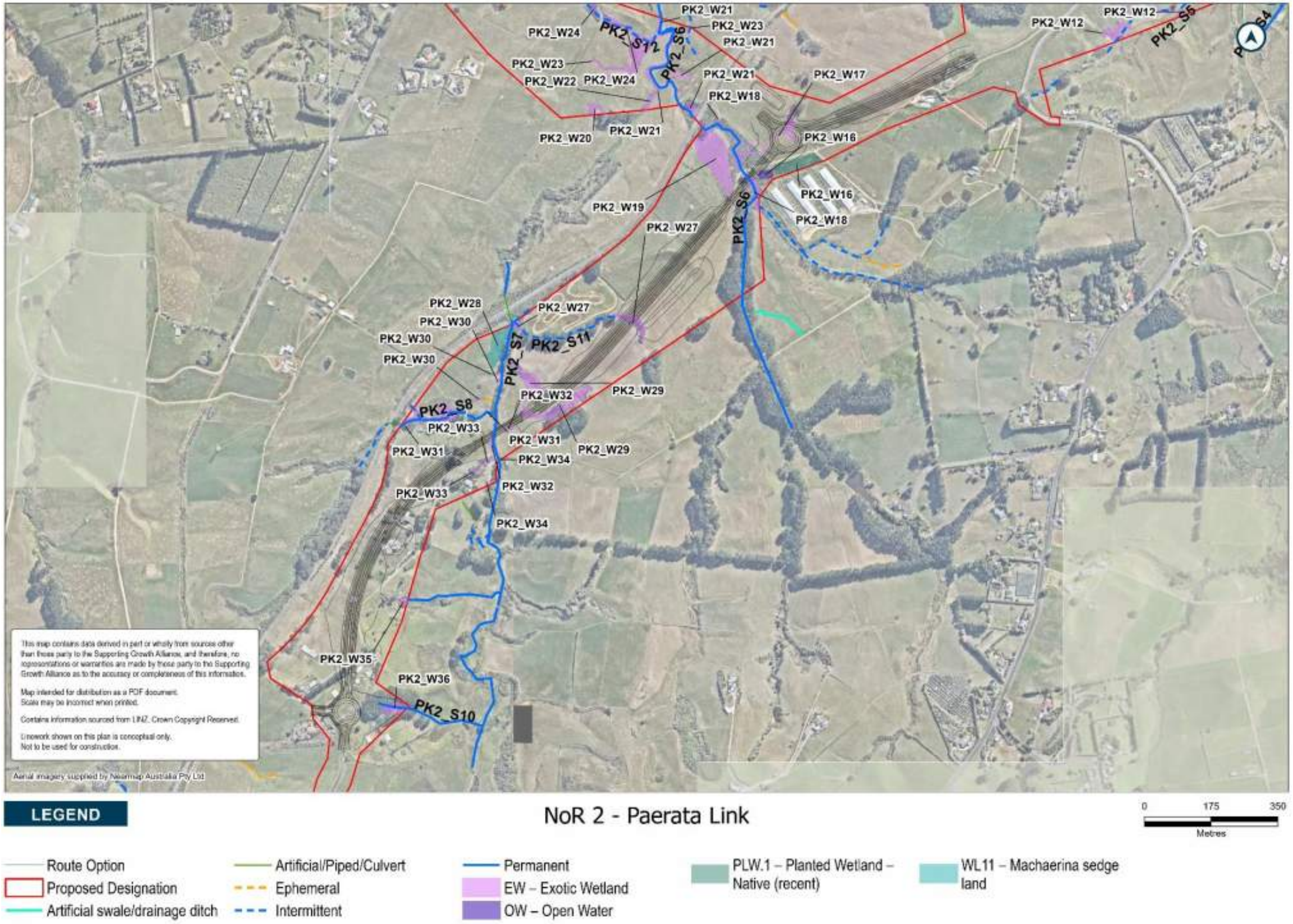
WF8
TL.3
PL.3
TL.3
EW
TL.3
TL.3
EW
TL.3
OW
OW
TL.1
TL.1
EW
TL.1
TL.1
OW
PL.3
EW
PL.3
TL.1
TL.3
WF7
ES
TL.3
EW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF7 - Pūriri Forest
WF8 – Kahikatea, pukatea forest
NoR 2 - Drury to Pukekohe Link
0
40
80
Metres
Page 19 of 20

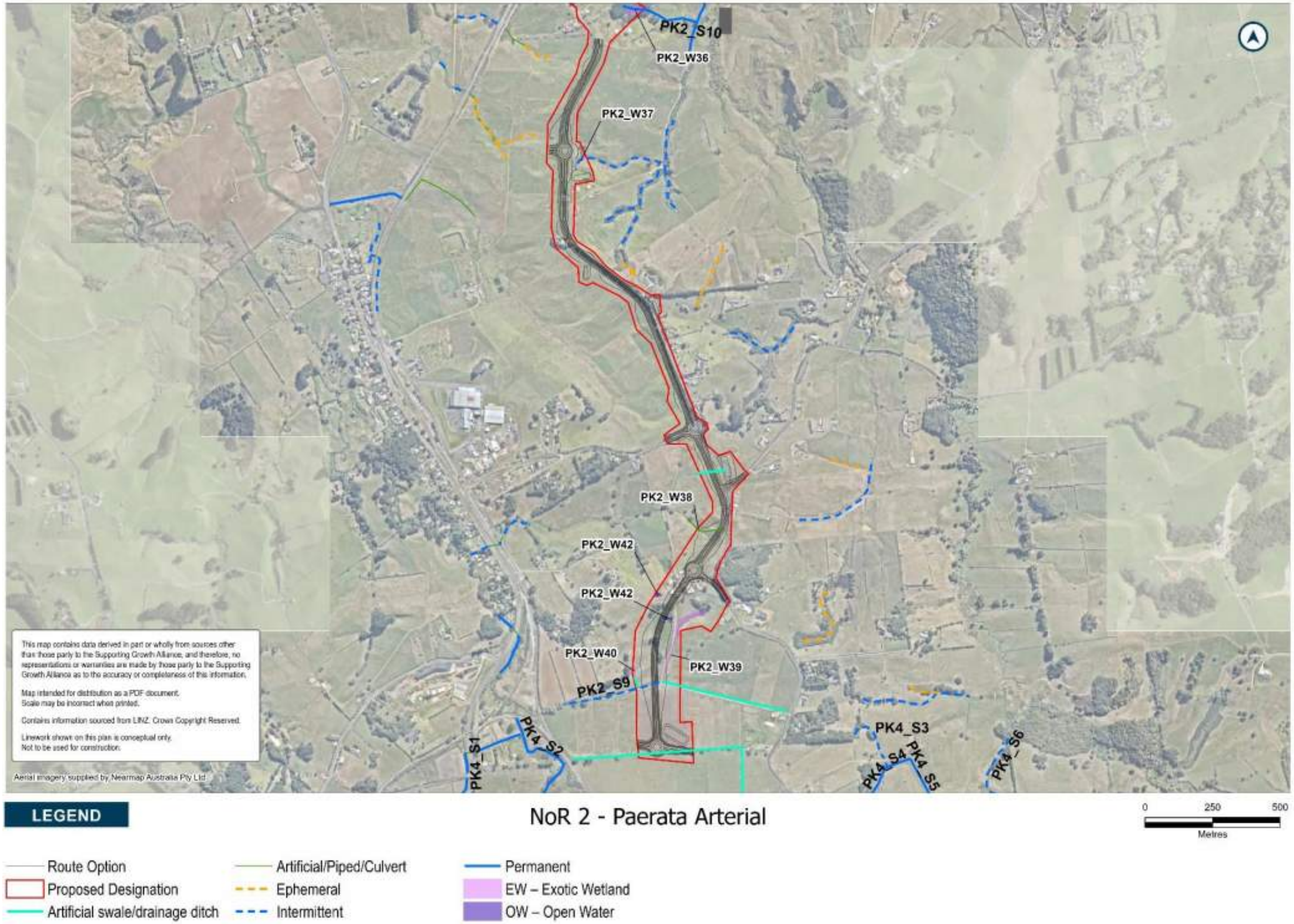

EW
ES
EW
TL.3
WF8
EW
TL.1
TL.1
OW
OW
OW
ES
EW
TL.1
WF7
TL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF7 - Pūriri Forest
WF8 – Kahikatea, pukatea forest
NoR 2 - Drury to Pukekohe Link
0
40
80
Metres
Page 20 of 20

## 3.4 Wetland and Stream Map Related to NoR 2

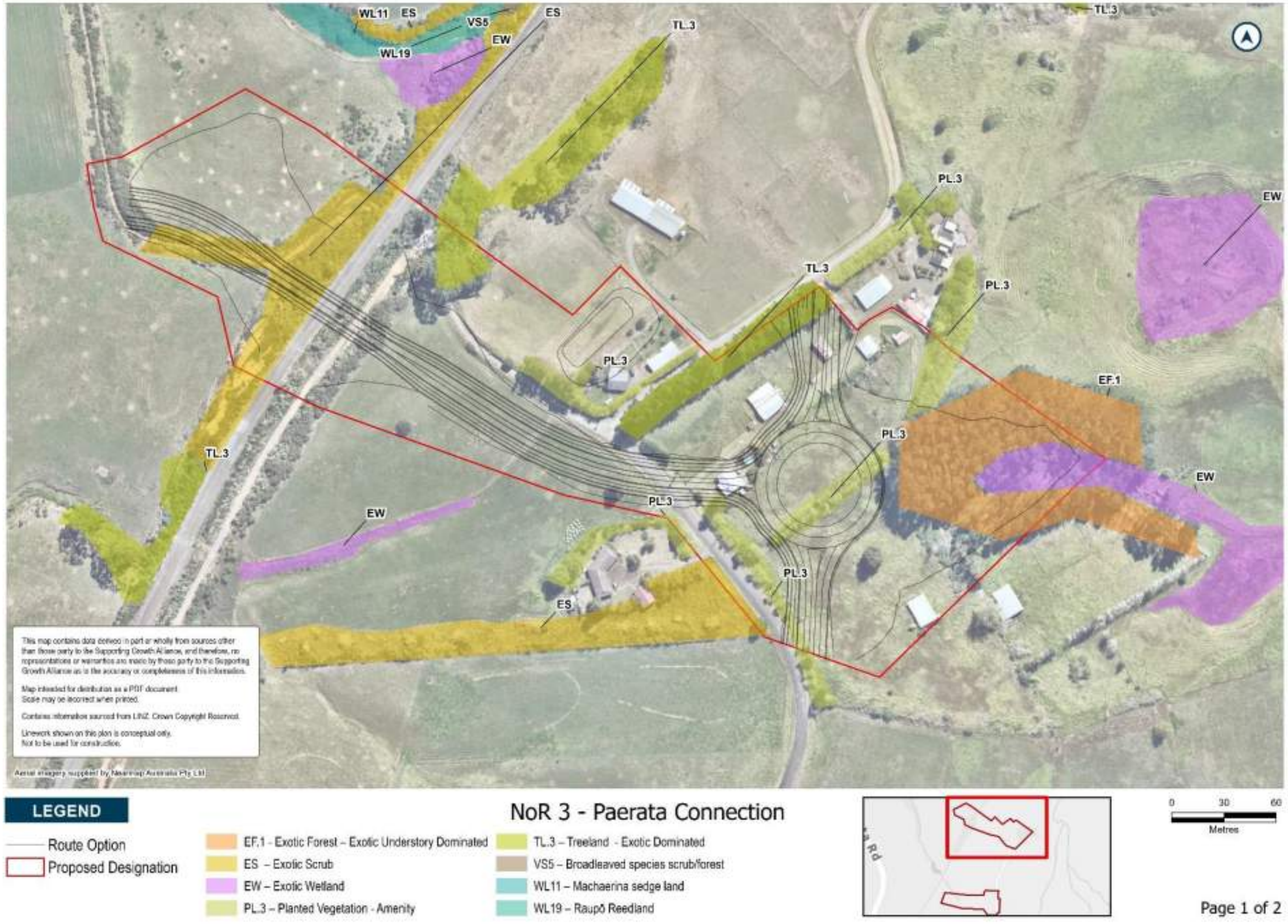


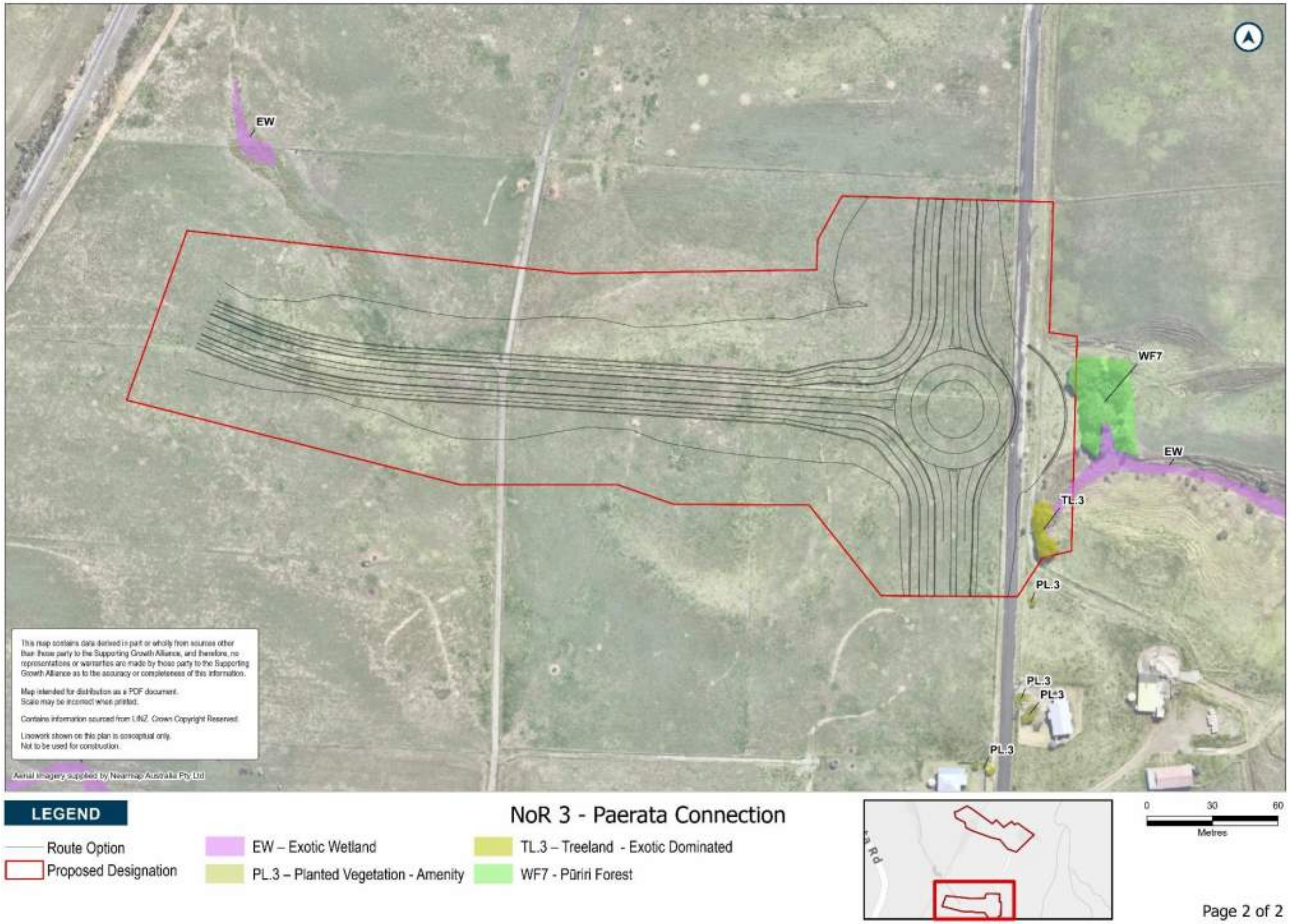

PK2_S13
PK2_W26
PK2_W25
PK2_W24
PK2_S12
PK2_W24
PK2_W21
PK2_W23
PK2_S6
PK2_W24
PK2_W21
PK2_W23
PK2_W20
PK2_W21
PK2_W21
PK2_W22
PK2_W19
PK2_S6
PK2_W18
PK2_W17
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
NoR 2 - SH 22
0
110
220
Metres
Route Option
Proposed Designation
Artificial/Piped/Culvert
Ephemeral
Intermittent
Permanent
EW – Exotic Wetland
OW – Open Water


PK2_W21
PK2_W23
PK2_W21
PK2_W24
PK2_S12
PK2_S6
PK2_W23
PK2_W22
PK2_W24
PK2_W21
PK2_W18
PK2_W17
PK2_W12
PK2_W12
PK2_S5
PK2_W20
PK2_W21
PK2_W16
PK2_W19
PK2_W16
PK2_W18
PK2_W27
PK2_S6
PK2_W28
PK2_W27
PK2_W30
PK2_W30
PK2_S7
PK2_S11
PK2_W30
PK2_W29
PK2_W32
PK2_S8
PK2_W33
PK2_W31
PK2_W31
PK2_W29
PK2_W34
PK2_W32
PK2_W33
PK2_W34
PK2_W35
PK2_W36
PK2_S10
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
NoR 2 - Paerata Link
0
175
350
Metres
Route Option
Proposed Designation
Artificial swale/drainage ditch
Artificial/Piped/Culvert
Ephemeral
Intermittent
Permanent
EW – Exotic Wetland
OW – Open Water
PLW.1 – Planted Wetland – Native (recent)
WL11 – Machaerina sedge land

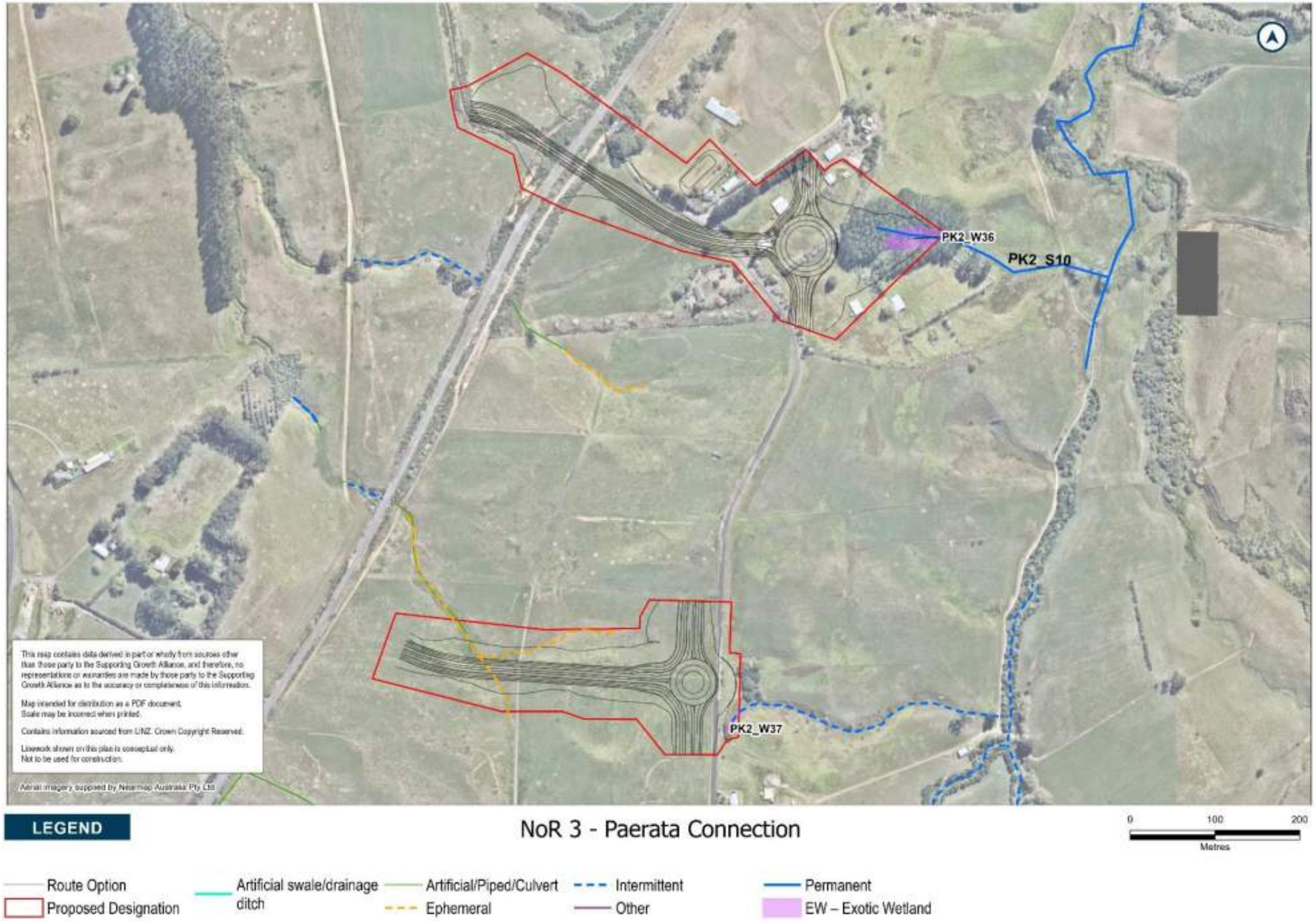

PK2_S10
PK2_W36
PK2_W37
PK2_W38
PK2_W42
PK2_W42
PK2_W40
PK2_W39
PK2_S9
PK4_S1
PK4_S2
PK4_S3
PK4_S4
PK4_S5
PK4_S6
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
NoR 2 - Paerata Arterial
0
250
500
Metres
Route Option
Proposed Designation
Artificial swale/drainage ditch
Artificial/Piped/Culvert
Ephemeral
Intermittent
Permanent
EW – Exotic Wetland
OW – Open Water

## 3.5 Terrestrial and Wetland Maps Related to NoR 3

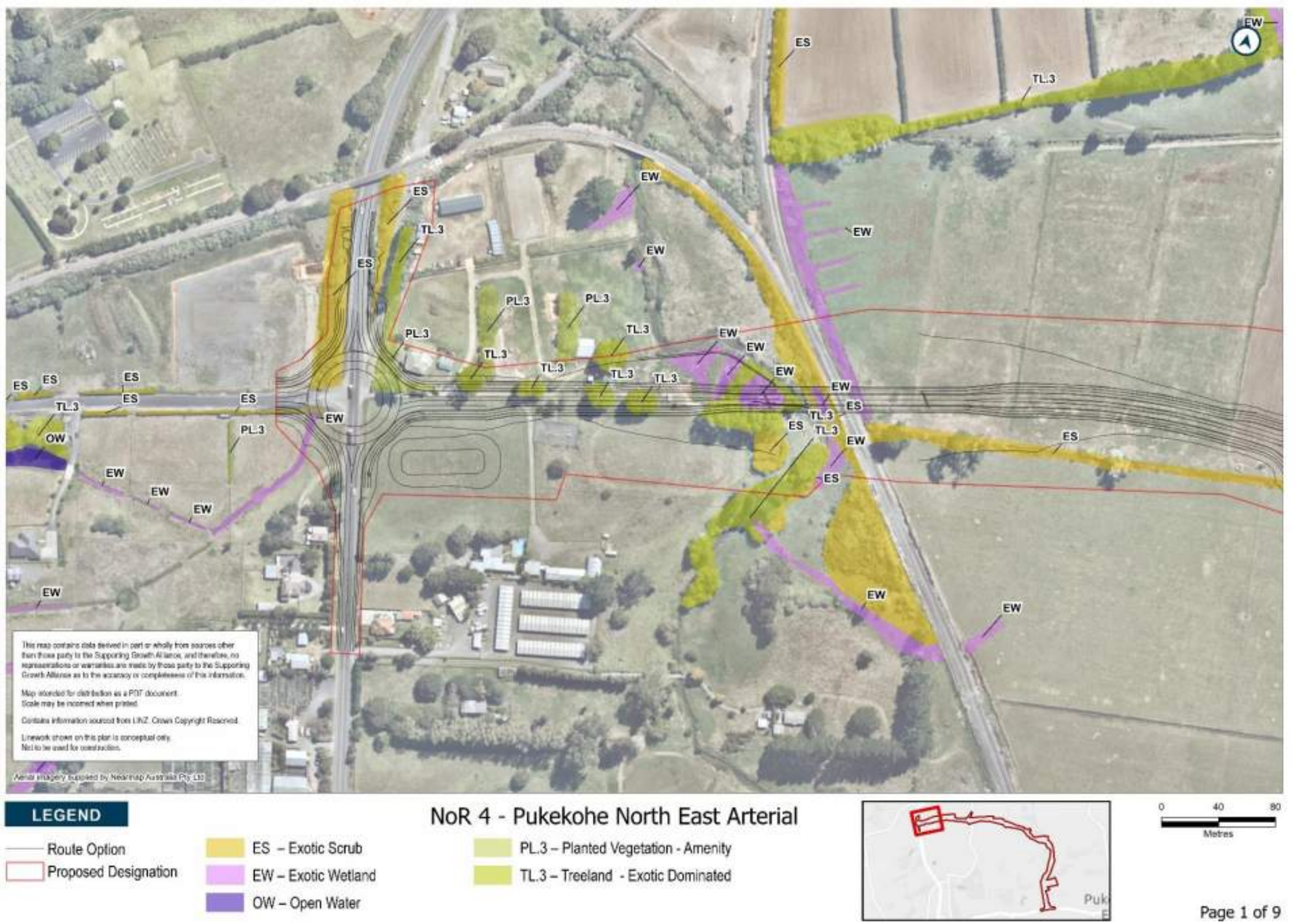


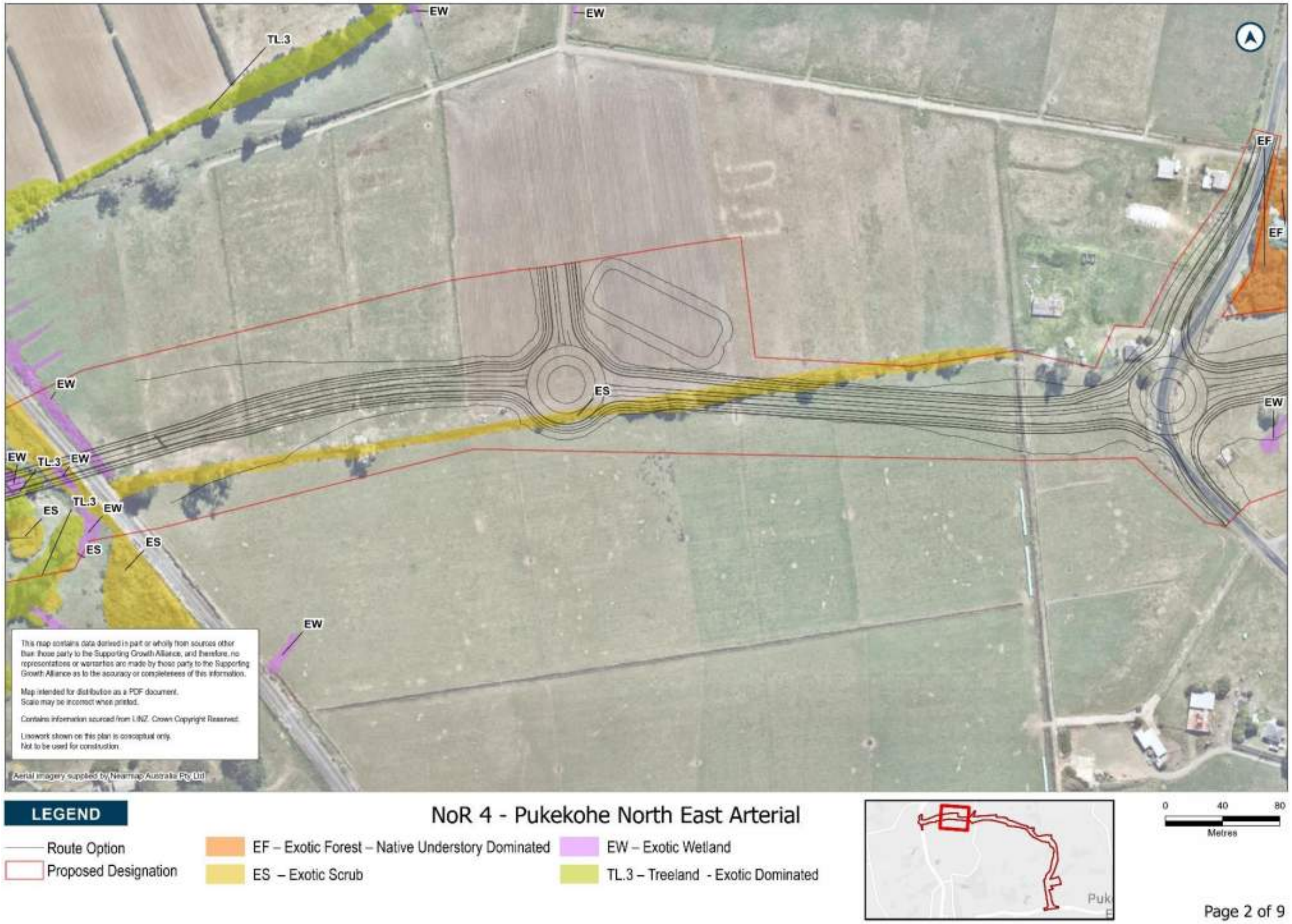

EW
WF7
EW
TL.3
PL.3
PL.3
PL.3
PL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EW – Exotic Wetland
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
WF7 - Pūriri Forest
NoR 3 - Paerata Connection
0
30
60
Metres
Page 2 of 2

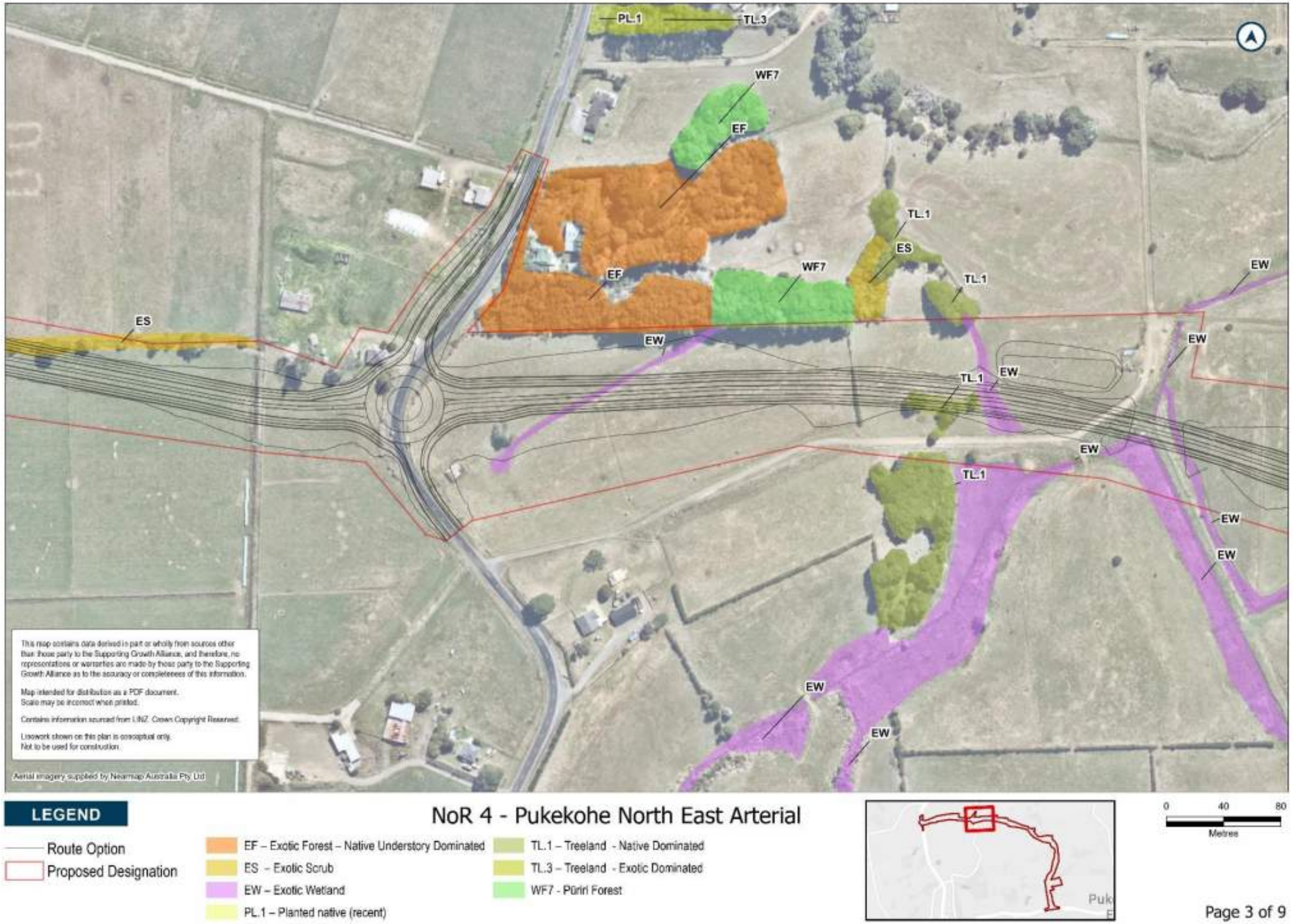
## 3.6 Wetland and Stream Maps Related to NoR 3



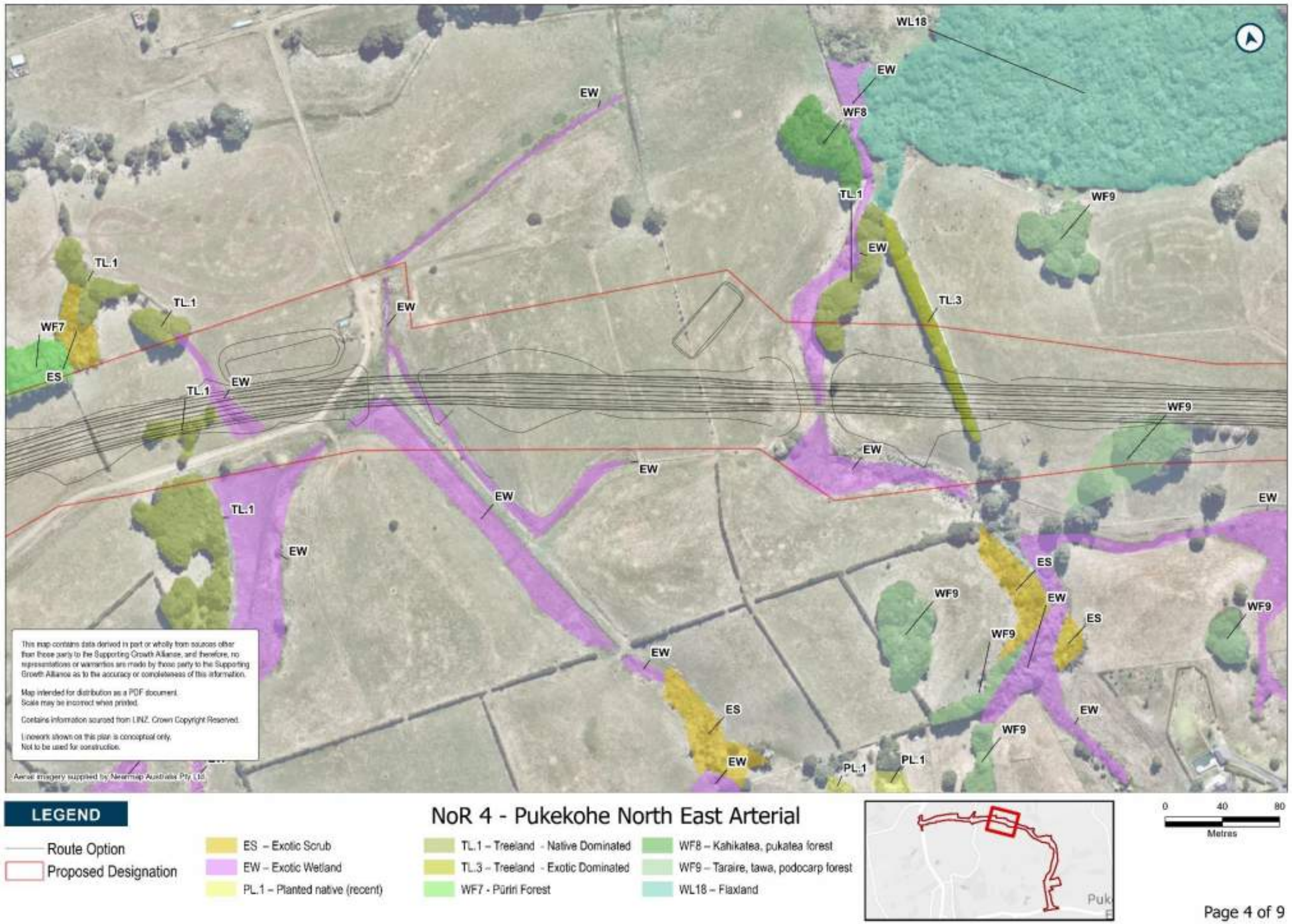
## 3.7 Terrestrial and Wetland Maps Related to NoR 4

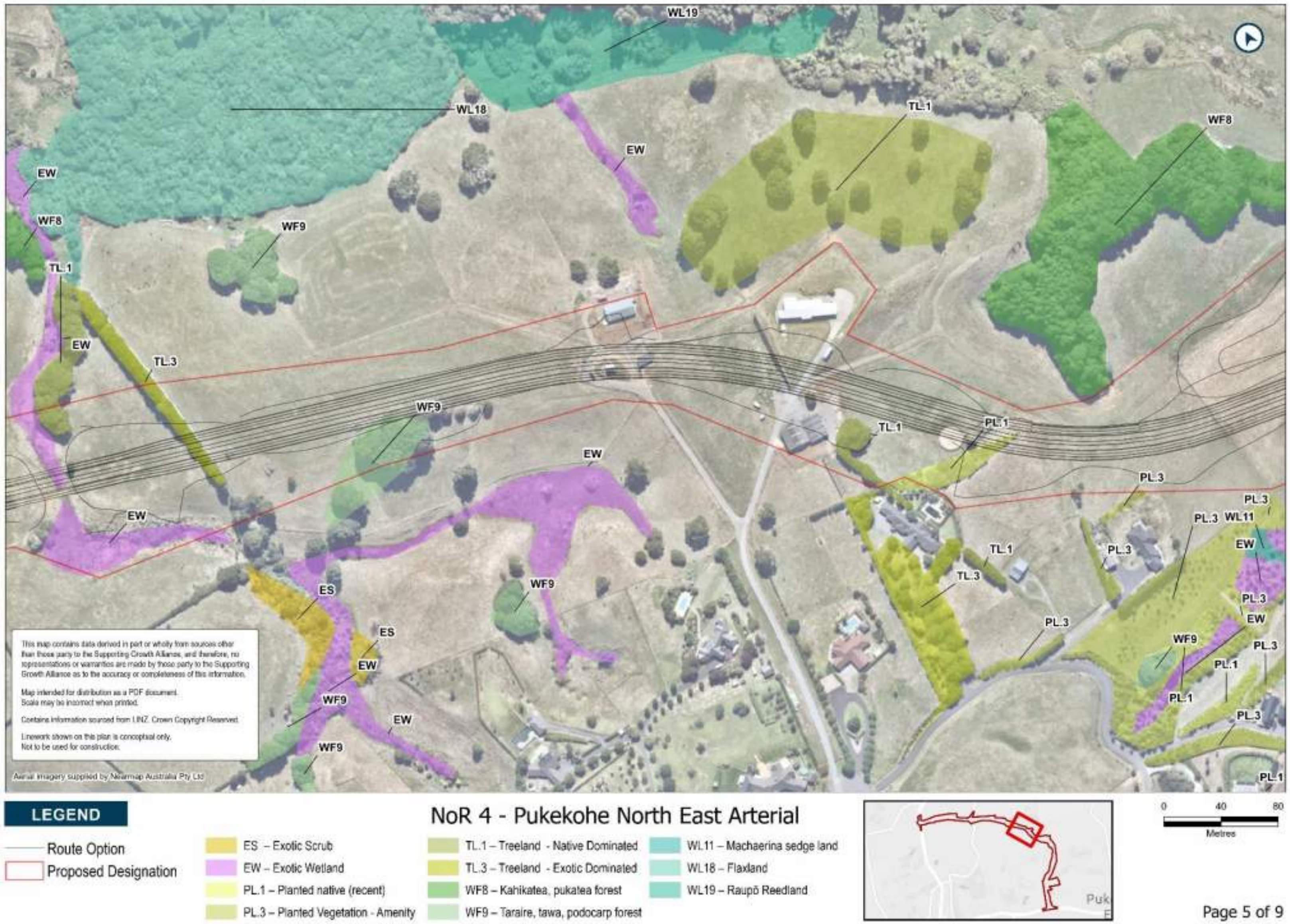


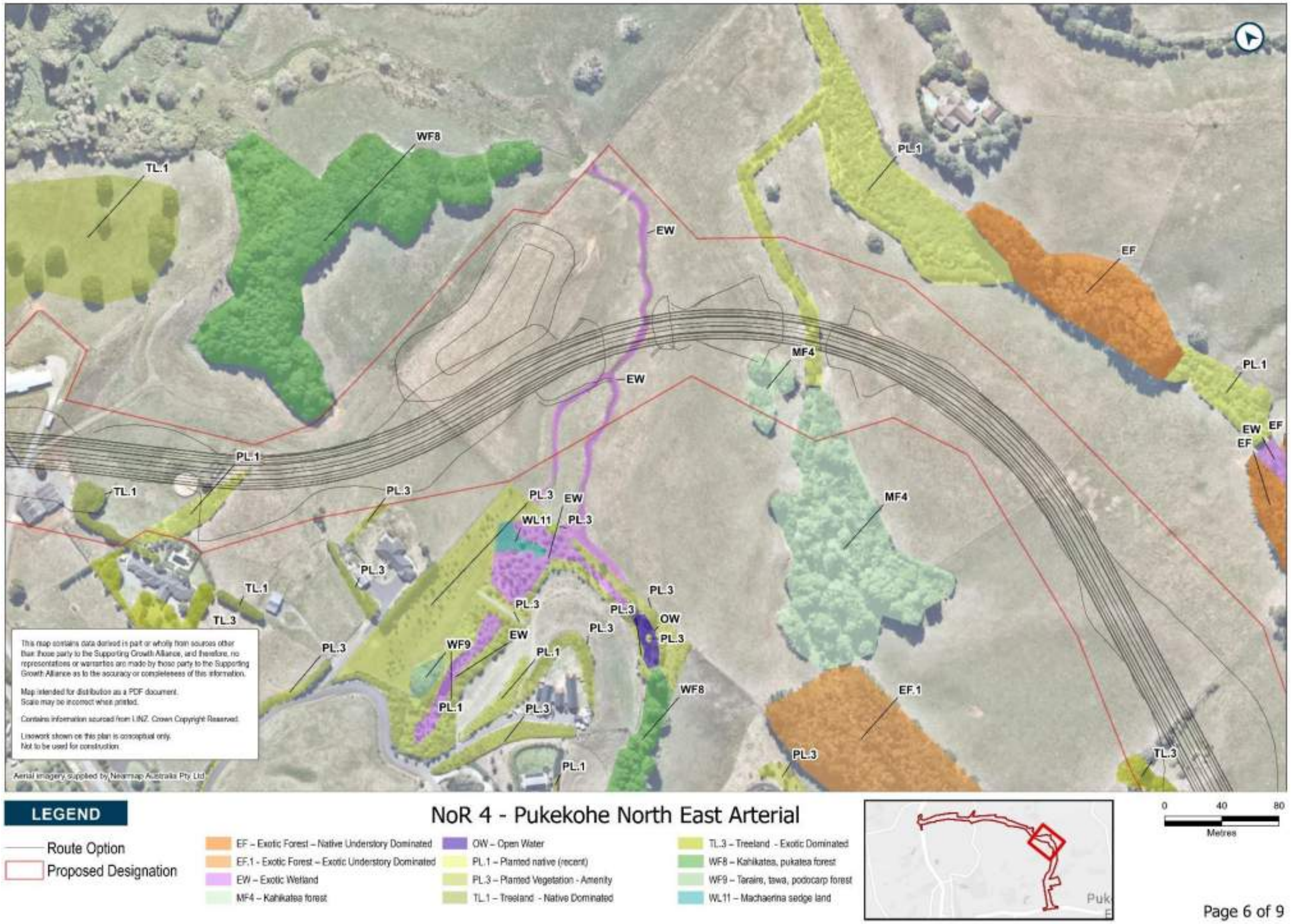

EW
EW
TL.3
EF
EF
EW
ES
EW
EW
TL.3
EW
TL.3
EW
ES
ES
ES
EW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
NoR 4 - Pukekohe North East Arterial
Route Option
Proposed Designation
EF – Exotic Forest – Native Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
TL.3 – Treeland - Exotic Dominated
0
40
80
Metres
Page 2 of 9



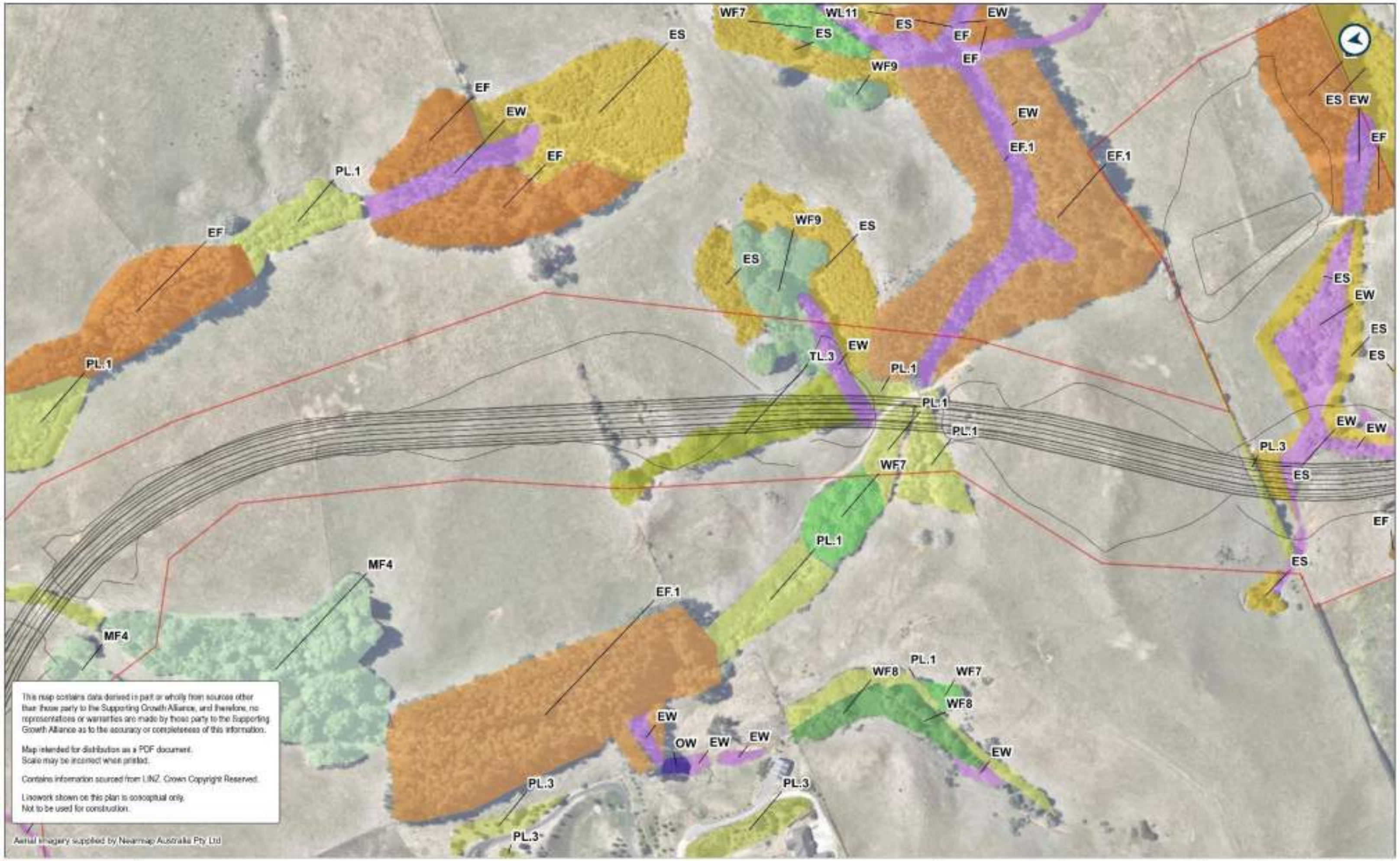
PL.1
TL.3
WF7
EF
EF
TL.1
ES
WF7
TL.1
EW
ES
EW
EW
TL.1
EW
EW
TL.1
EW
EW
EW
EW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EF – Exotic Forest – Native Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
PL.1 – Planted native (recent)
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF7 - Pūriri Forest
NoR 4 - Pukekohe North East Arterial
0
40
80
Metres
Page 3 of 9


WL18
EW
WF8
TL.1
WF9
EW
TL.3
TL.1
TL.1
WF7
ES
EW
TL.1
EW
WF9
EW
EW
EW
EW
TL.1
EW
ES
EW
WF9
ES
WF9
WF9
EW
WF9
EW
ES
EW
PL.1
PL.1
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
PL.1 – Planted native (recent)
NoR 4 - Pukekohe North East Arterial
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF7 - Pūriri Forest
WF8 – Kahikatea, pukatea forest
WF9 – Taraire, tawa, podocarp forest
WL18 – Flaxland
0
40
80
Metres
Page 4 of 9


NoR 4 - Pukekohe North East Arterial
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF8 – Kahikatea, pukatea forest
WF9 – Taraire, tawa, podocarp forest
WL11 – Machaerina sedge land
WL18 – Flaxland
WL19 – Raupō Reedland
0 40 80
Metres
Page 5 of 9



WF8
TL.1
PL.1
EW
EF
MF4
PL.3
WL11
OW
WF9
EF.1
TL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
NoR 4 - Pukekohe North East Arterial
EF – Exotic Forest – Native Understory Dominated
EF.1 - Exotic Forest – Exotic Understory Dominated
EW – Exotic Wetland
MF4 – Kahikatea forest
OW – Open Water
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF8 – Kahikatea, pukatea forest
WF9 – Taraire, tawa, podocarp forest
WL11 – Machaerina sedge land
0
40
80
Metres
Page 6 of 9



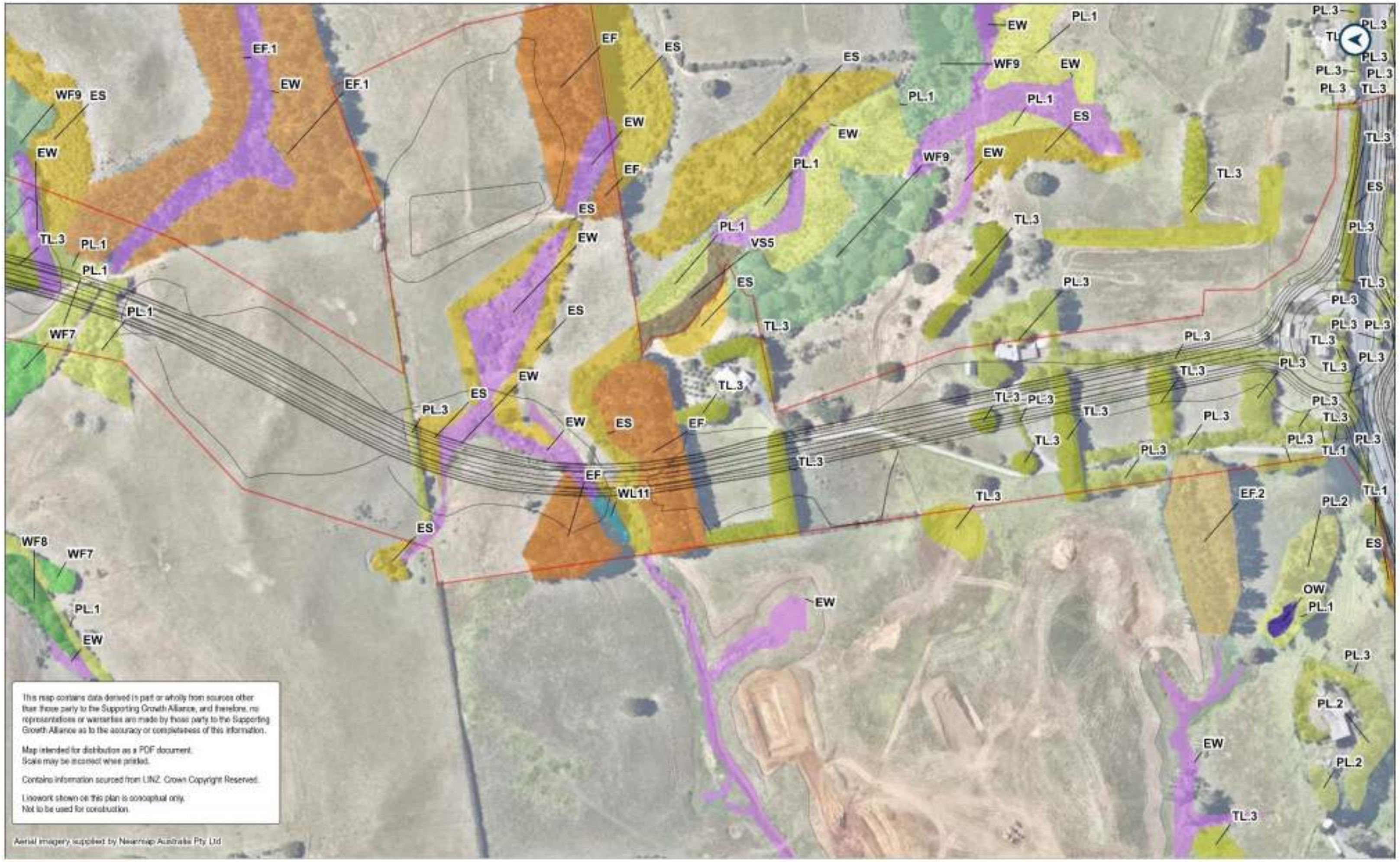

**LEGEND**

NoR 4 - Pukekohe North East Arterial

- Route Option
- Proposed Designation
- EF – Exotic Forest – Native Understory Dominated
- EF.1 - Exotic Forest – Exotic Understory Dominated
- ES – Exotic Scrub
- EW – Exotic Wetland
- MF4 – Kahikatea forest
- OW – Open Water
- PL.1 – Planted native (recent)
- PL.3 – Planted Vegetation - Amenity
- TL.3 – Treeland - Exotic Dominated
- WF7 - Pūriri Forest
- WF8 – Kahikatea, pukatea forest
- WF9 – Taraire, tawa, podocarp forest
- WL11 – Machaerina sedge land


0 40 80
Metres

Page 7 of 9



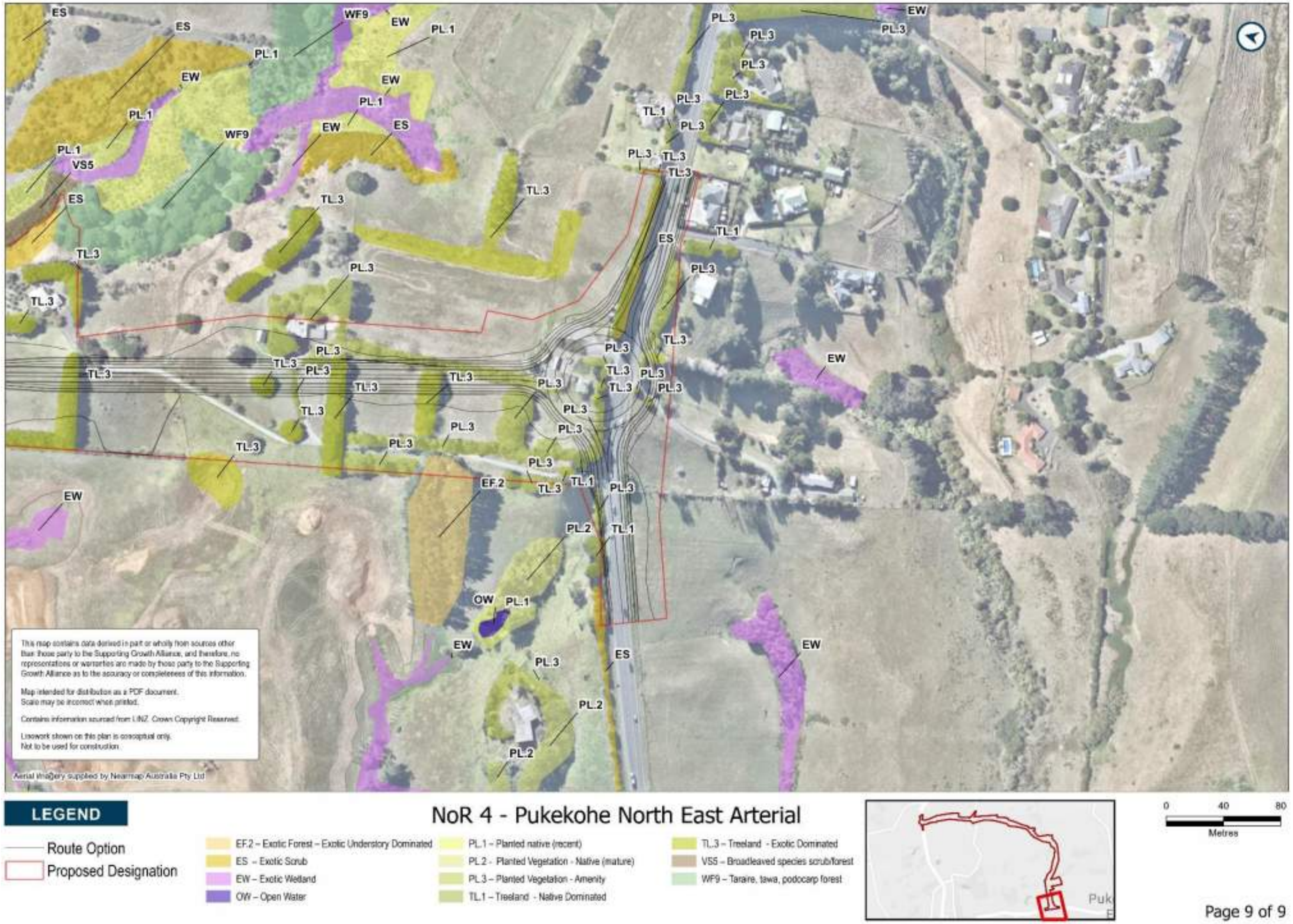

## NoR 4 - Pukekohe North East Arterial

**LEGEND**

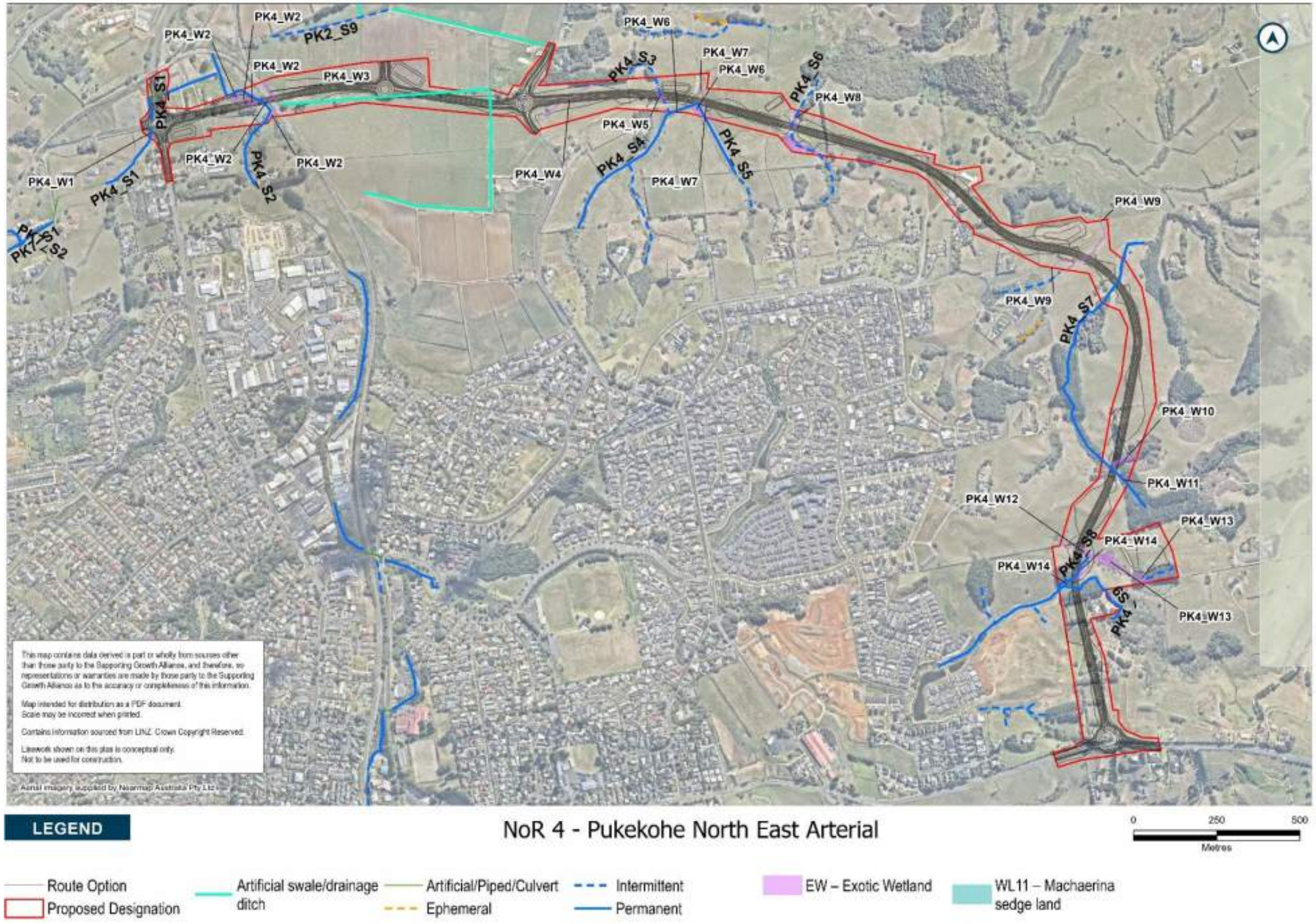
- Route Option
- Proposed Designation
- EF – Exotic Forest – Native Understory Dominated
- EF.1 - Exotic Forest – Exotic Understory Dominated
- EF.2 – Exotic Forest – Exotic Understory Dominated
- ES – Exotic Scrub
- EW – Exotic Wetland
- OW – Open Water
- PL.1 – Planted native (recent)
- PL.2 - Planted Vegetation - Native (mature)
- PL.3 – Planted Vegetation - Amenity
- TL.1 – Treeland - Native Dominated
- TL.3 – Treeland - Exotic Dominated
- VS5 – Broadleaved species scrub/forest
- WF7 - Pūriri Forest
- WF8 – Kahikatea, pukatea forest
- WF9 – Taraire, tawa, podocarp forest

0 40 80
Metres

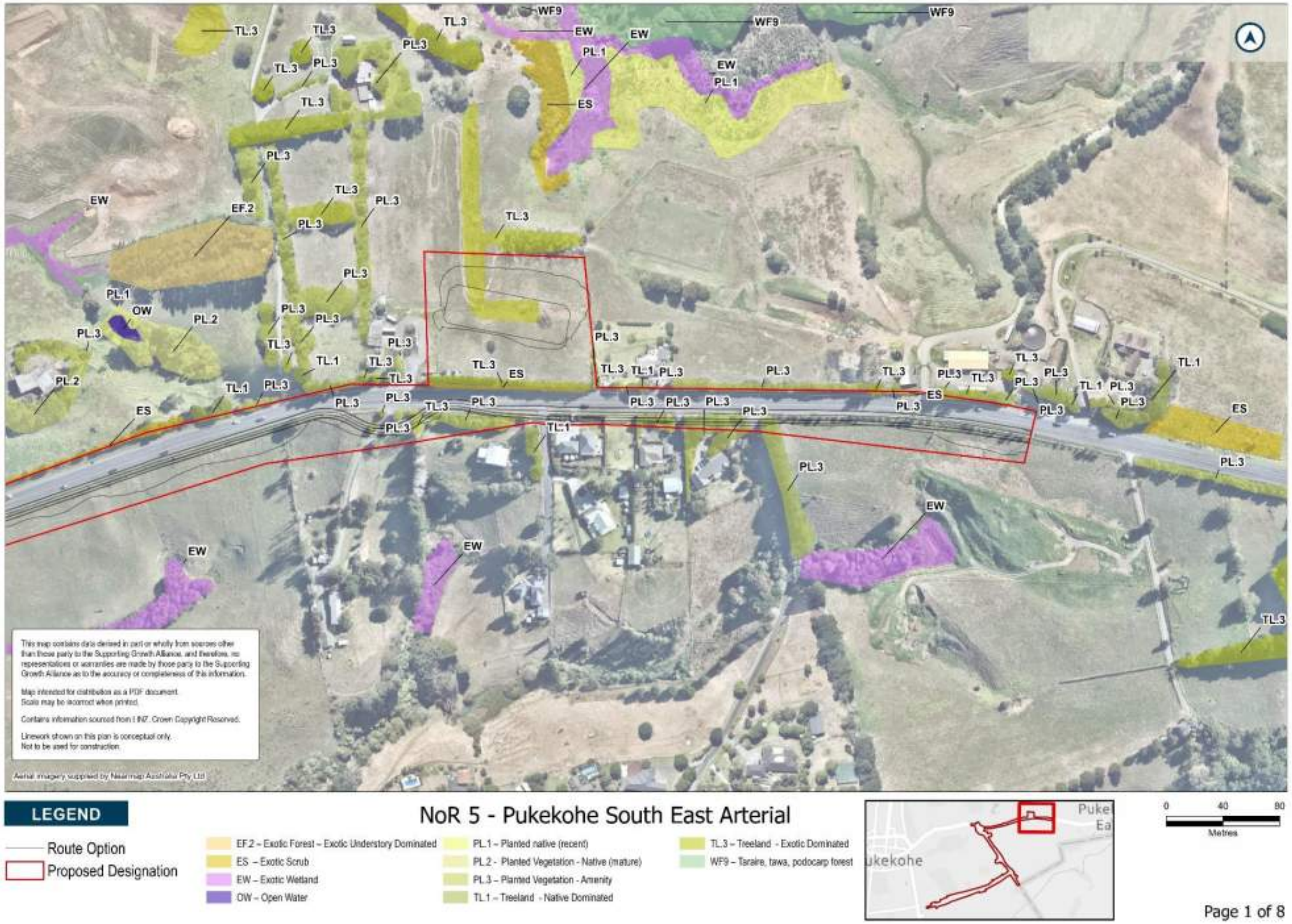
Page 8 of 9

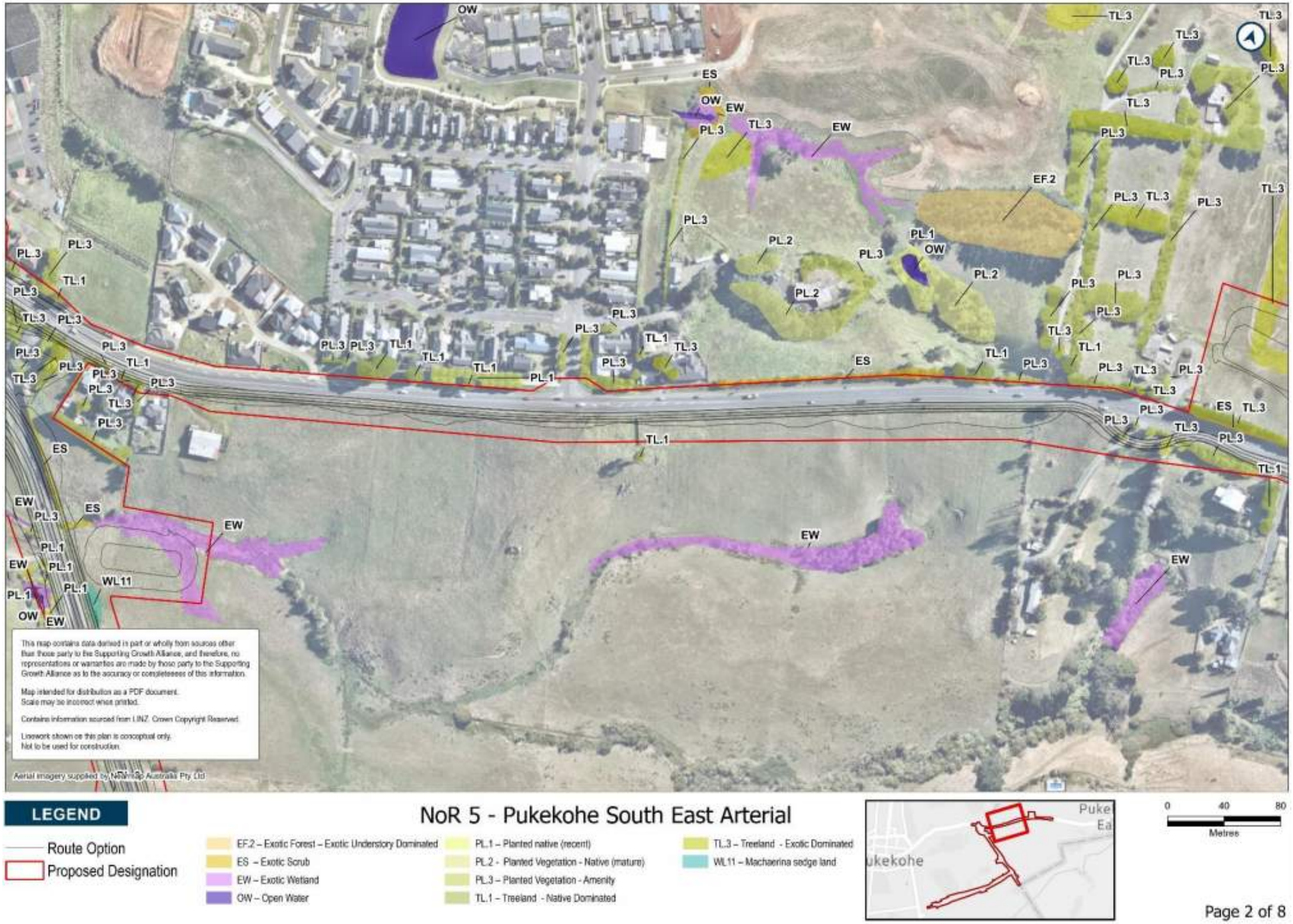

This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
NoR 4 - Pukekohe North East Arterial
Route Option
Proposed Designation
EF.2 – Exotic Forest – Exotic Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.2 - Planted Vegetation - Native (mature)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
VS5 – Broadleaved species scrub/forest
WF9 – Taraire, tawa, podocarp forest
0
40
80
Metres
Page 9 of 9

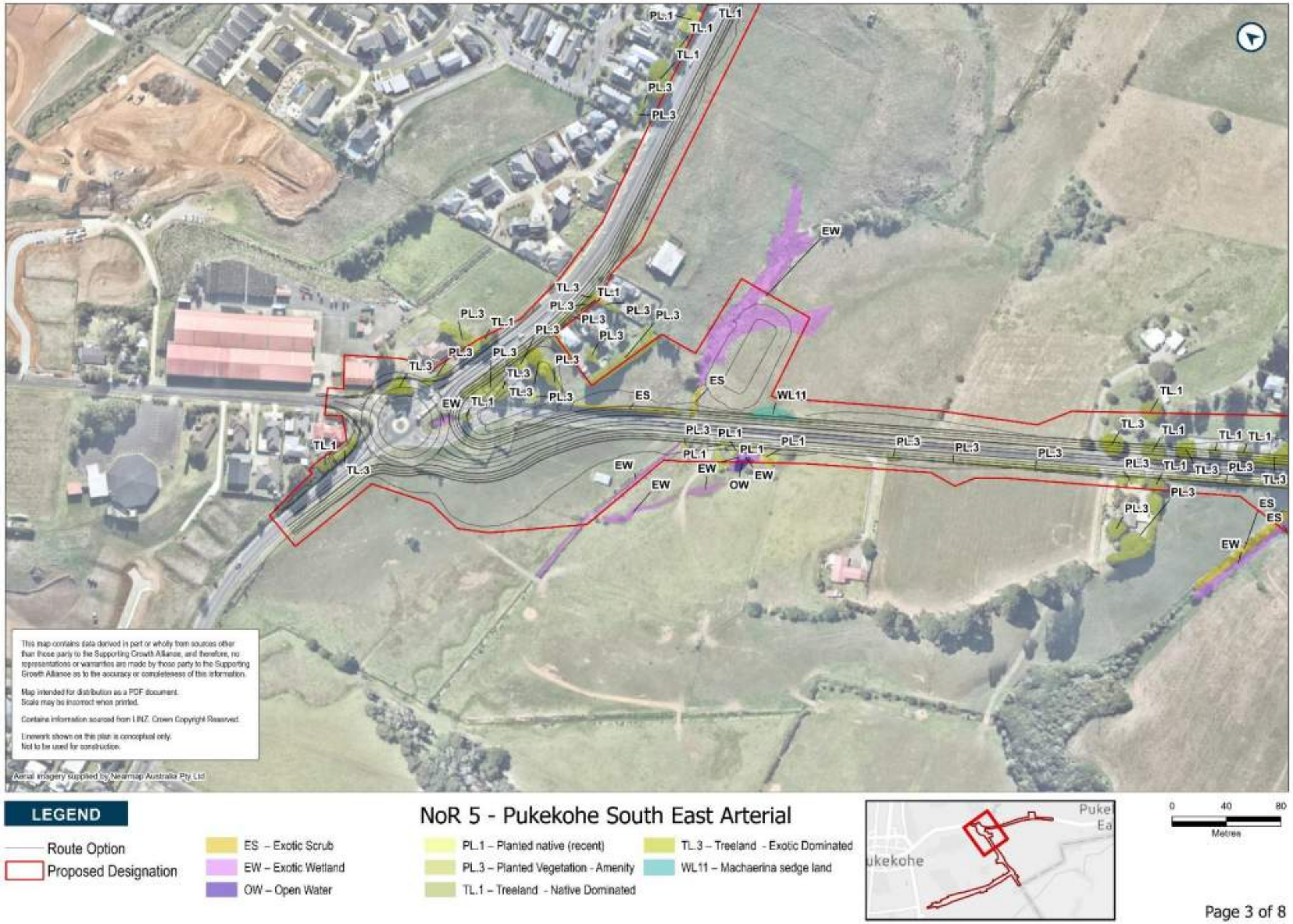
## 3.8 Wetland and Stream Maps Related to NoR 4

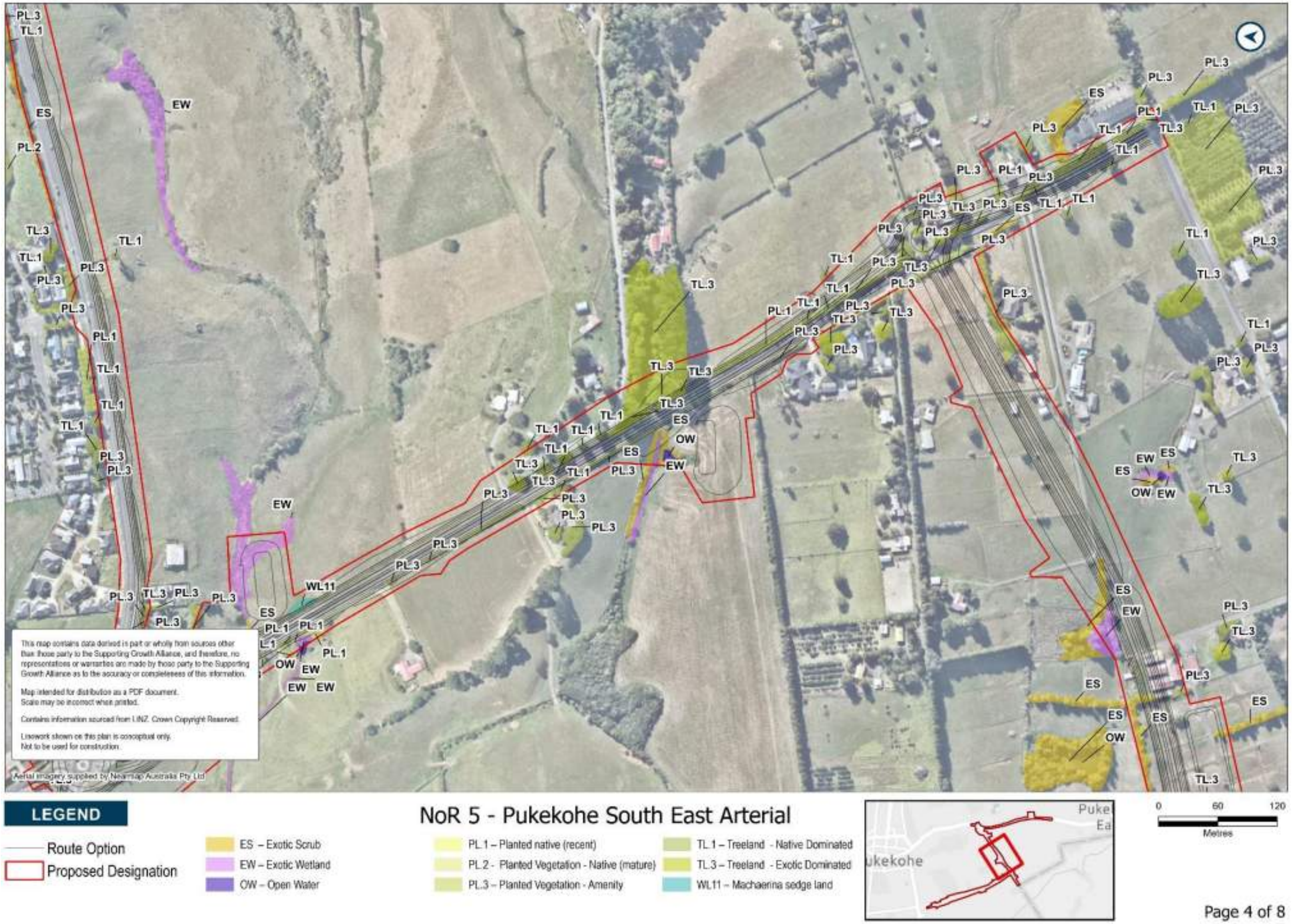


## 3.9 Terrestrial and Wetland Maps Related to NoR 5

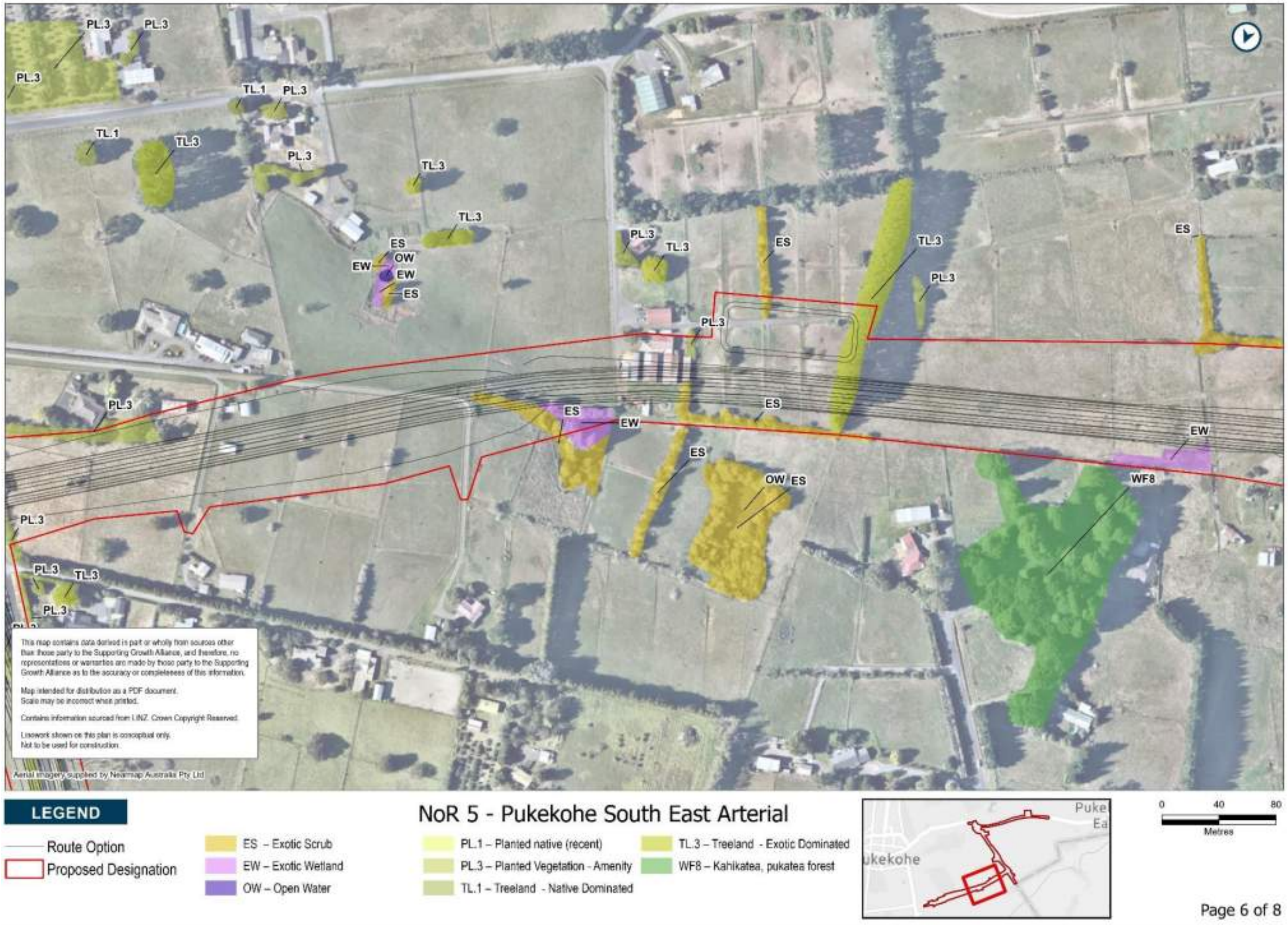


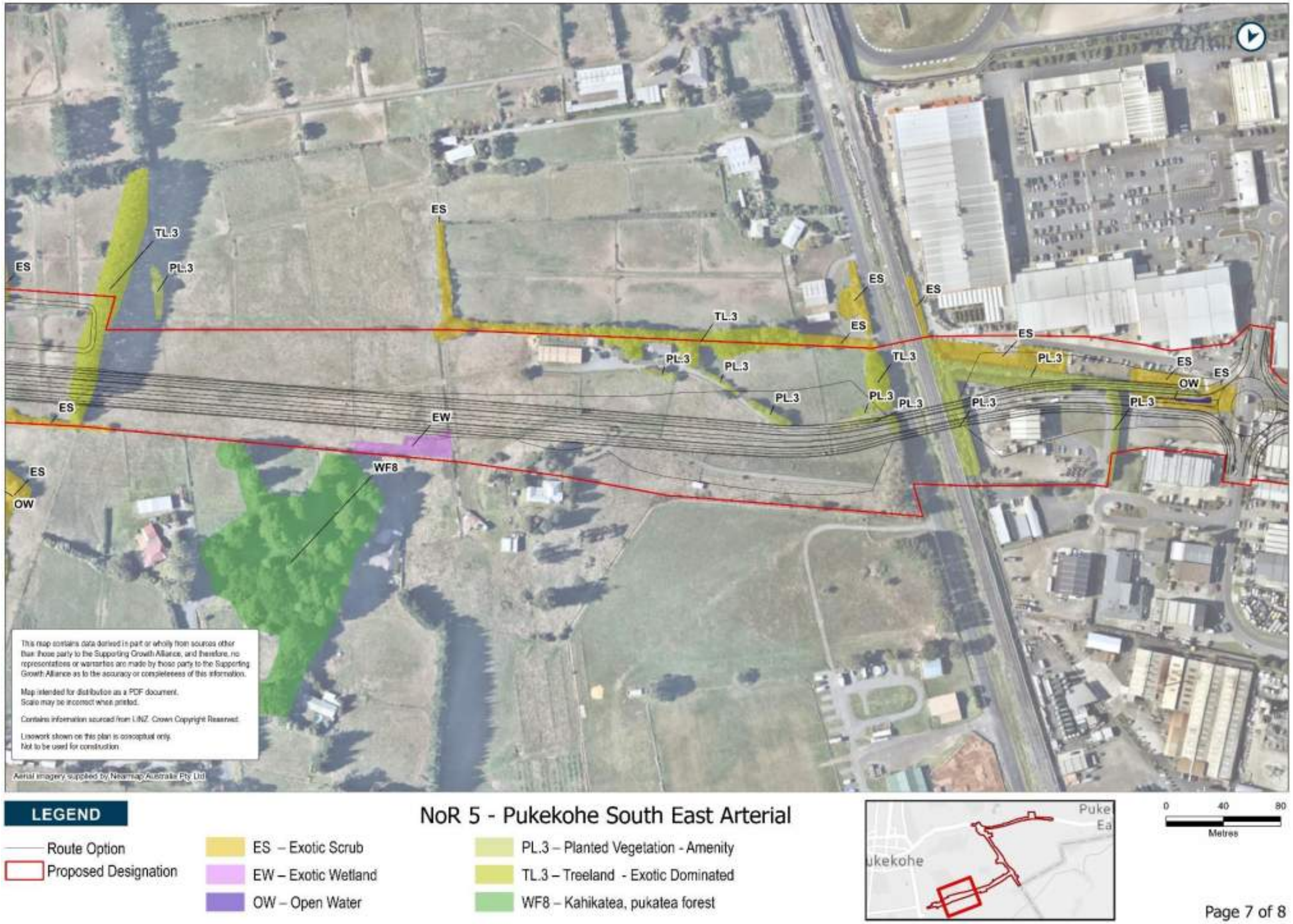

This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
EF.2 – Exotic Forest – Exotic Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.2 - Planted Vegetation - Native (mature)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
NoR 5 - Pukekohe South East Arterial
Metres
0
40
80
Page 2 of 8

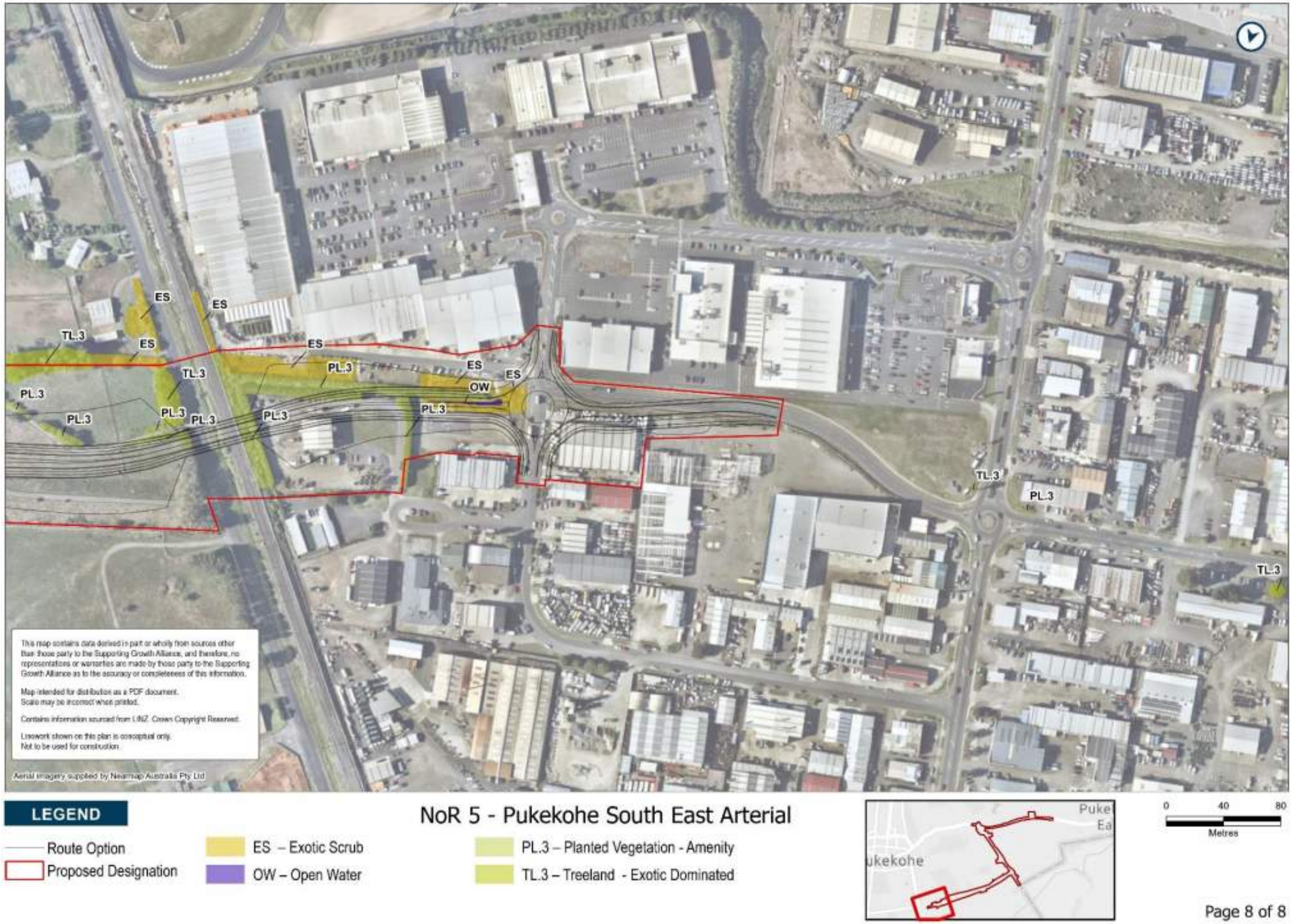

This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
NoR 5 - Pukekohe South East Arterial
0 40 80
Metres
Page 3 of 8


NoR 5 - Pukekohe South East Arterial
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.2 - Planted Vegetation - Native (mature)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
0
60
120
Metres
Pukekohe
Page 4 of 8

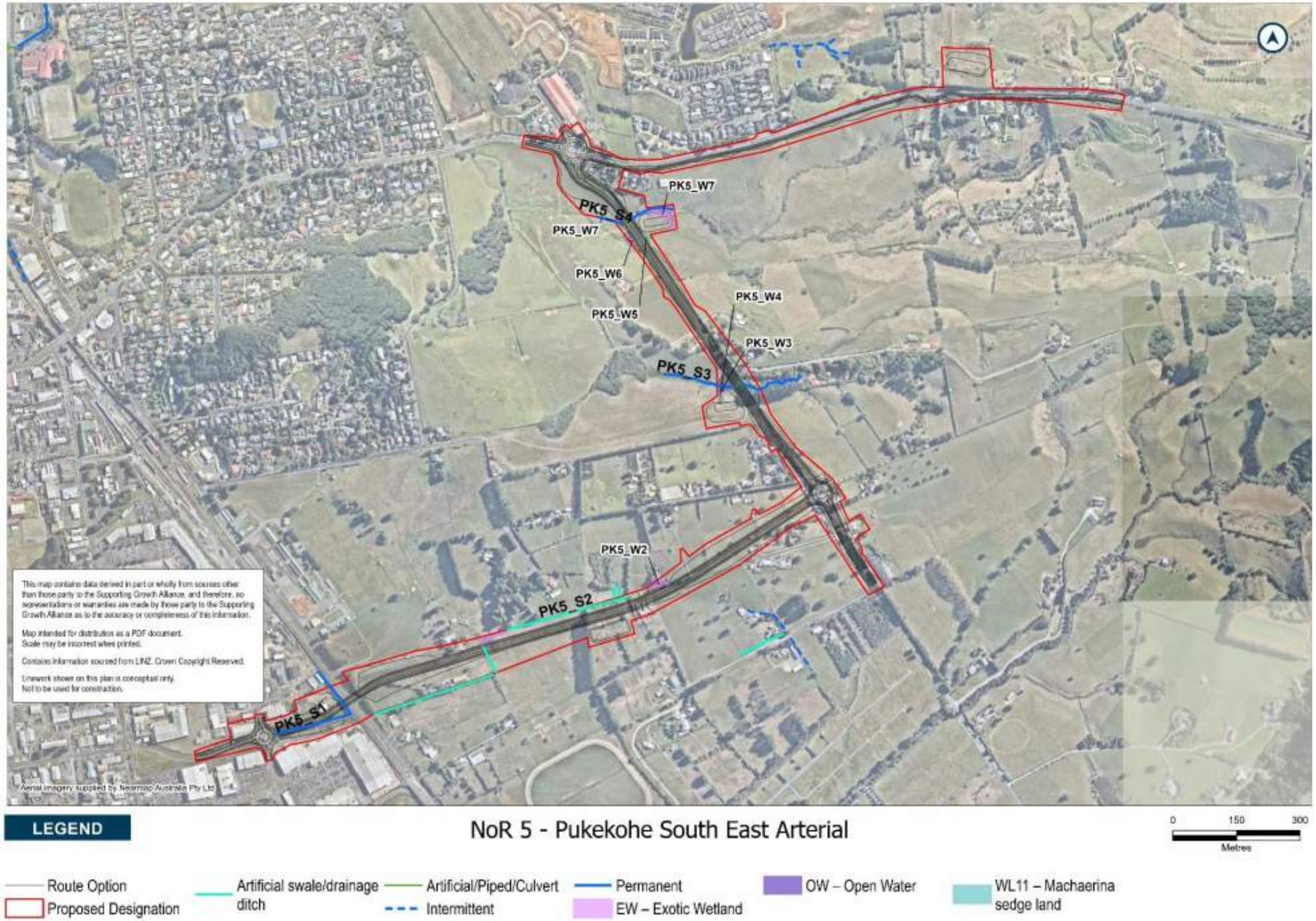
NoR 5 - Pukekohe South East Arterial
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
0 40 80
Metres
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
Pukekohe
Page 5 of 8


This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF8 – Kahikatea, pukatea forest
NoR 5 - Pukekohe South East Arterial
0
40
80
Metres
Page 6 of 8

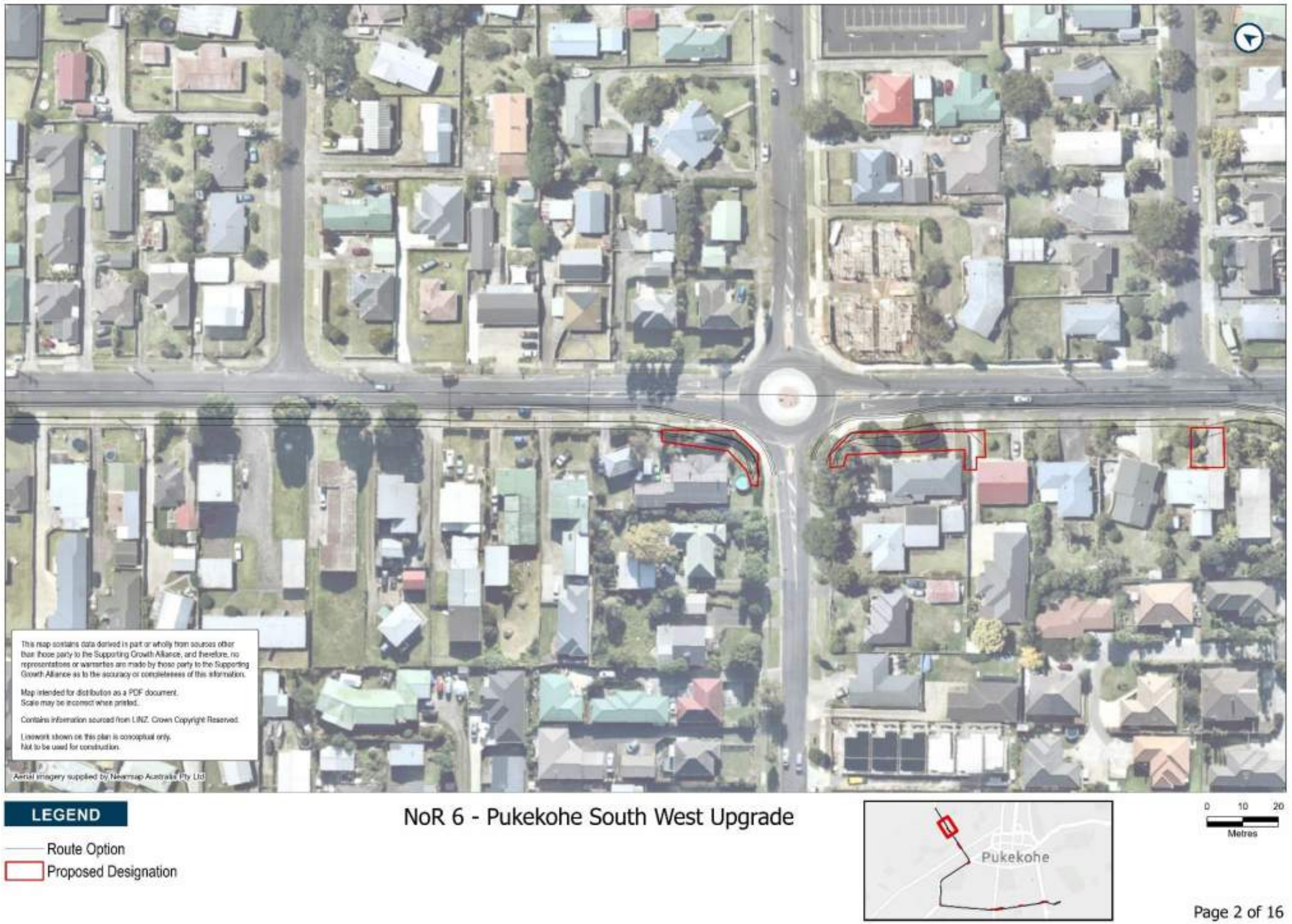

ES
TL.3
PL.3
ES
TL.3
ES
ES
ES
TL.3
PL.3
PL.3
PL.3
PL.3
PL.3
TL.3
ES
PL.3
ES
ES
OW
PL.3
EW
ES
WF8
ES
OW
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
WF8 – Kahikatea, pukatea forest
NoR 5 - Pukekohe South East Arterial
ukekohe
0
40
80
Metres
Page 7 of 8


ES
ES
TL.3
ES
ES
PL.3
ES
ES
OW
TL.3
PL.3
PL.3
PL.3
PL.3
PL.3
PL.3
TL.3
PL.3
TL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
OW – Open Water
NoR 5 - Pukekohe South East Arterial
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
Puke
Ea
ukekohe
0
40
80
Metres
Page 8 of 8

## 3.10 Wetland and Stream Maps Related to NoR 5



## 3.11 Terrestrial and Wetland Maps Related to NoR 6


This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0
10
20
Metres
Page 2 of 16


PL.3
TL.1
TL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0
10
20
Metres
Page 3 of 16

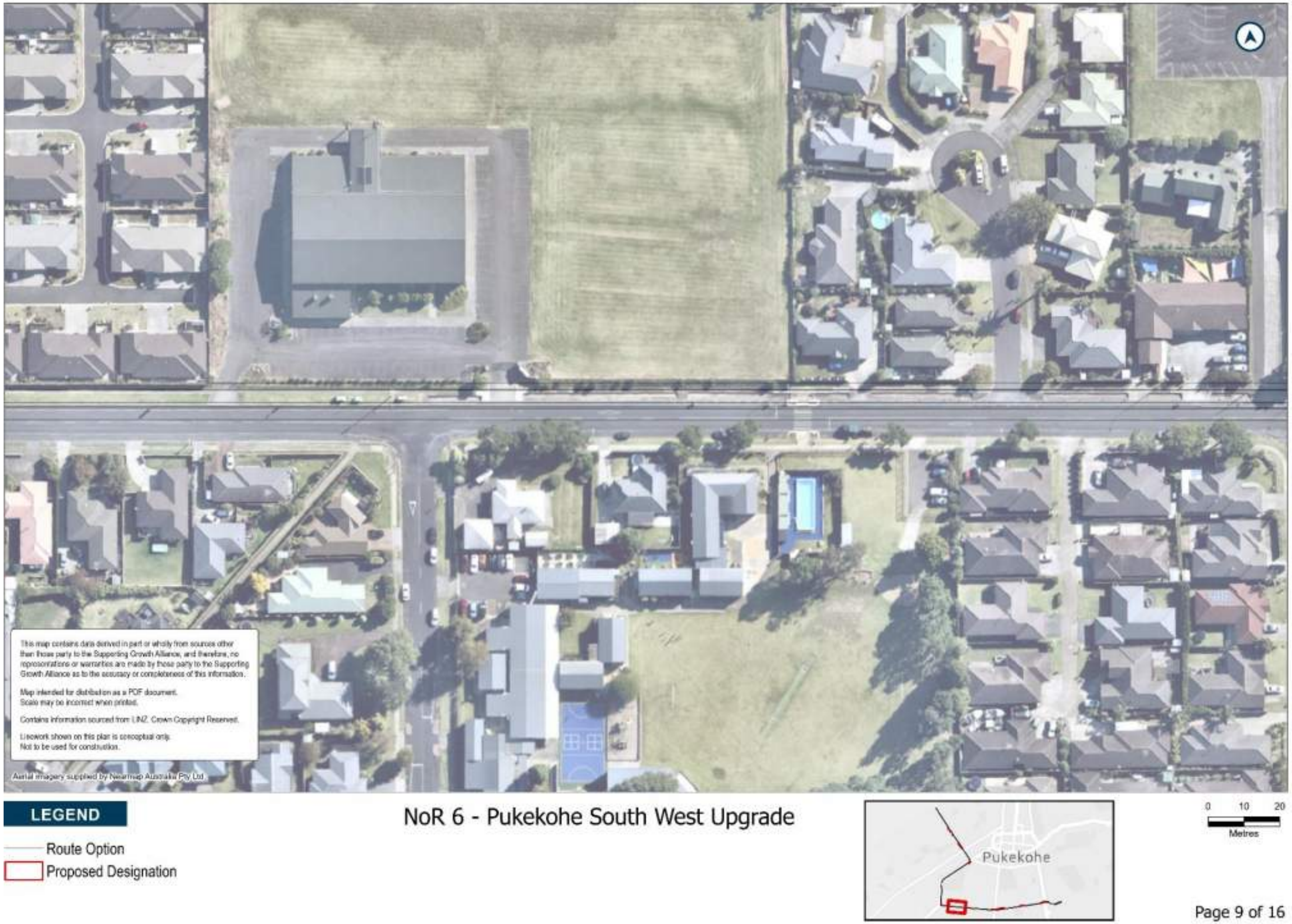
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0 10 20
Metres
Page 4 of 16


This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0 10 20
Metres
Page 5 of 16


This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0
10
20
Metres
Page 6 of 16


ES
TL.3
TL.3
PL.3
TL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0 10 20
Metres
Page 7 of 16


TL.3
ES
TL.3
TL.3
PL.3
ES
TL.3
ES
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0 10 20
Metres
Page 8 of 16


This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd.
LEGEND
Route Option
Proposed Designation
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0
10
20
Metres
Page 9 of 16

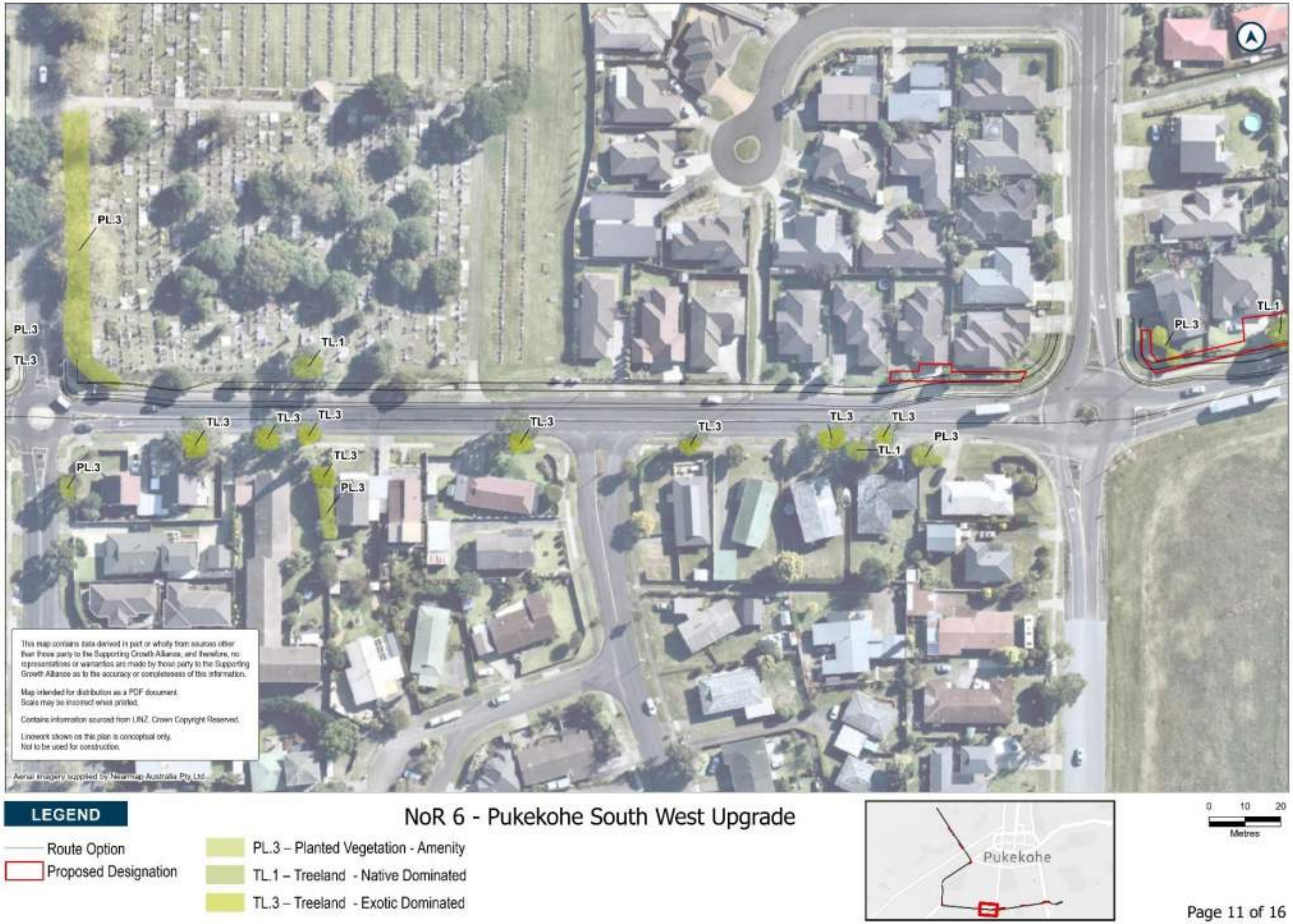

**LEGEND**

NoR 6 - Pukekohe South West Upgrade

- Route Option
- Proposed Designation
- PL.3 – Planted Vegetation - Amenity
- TL.1 – Treeland - Native Dominated
- TL.3 – Treeland - Exotic Dominated


0 10 20
Metres

Page 10 of 16

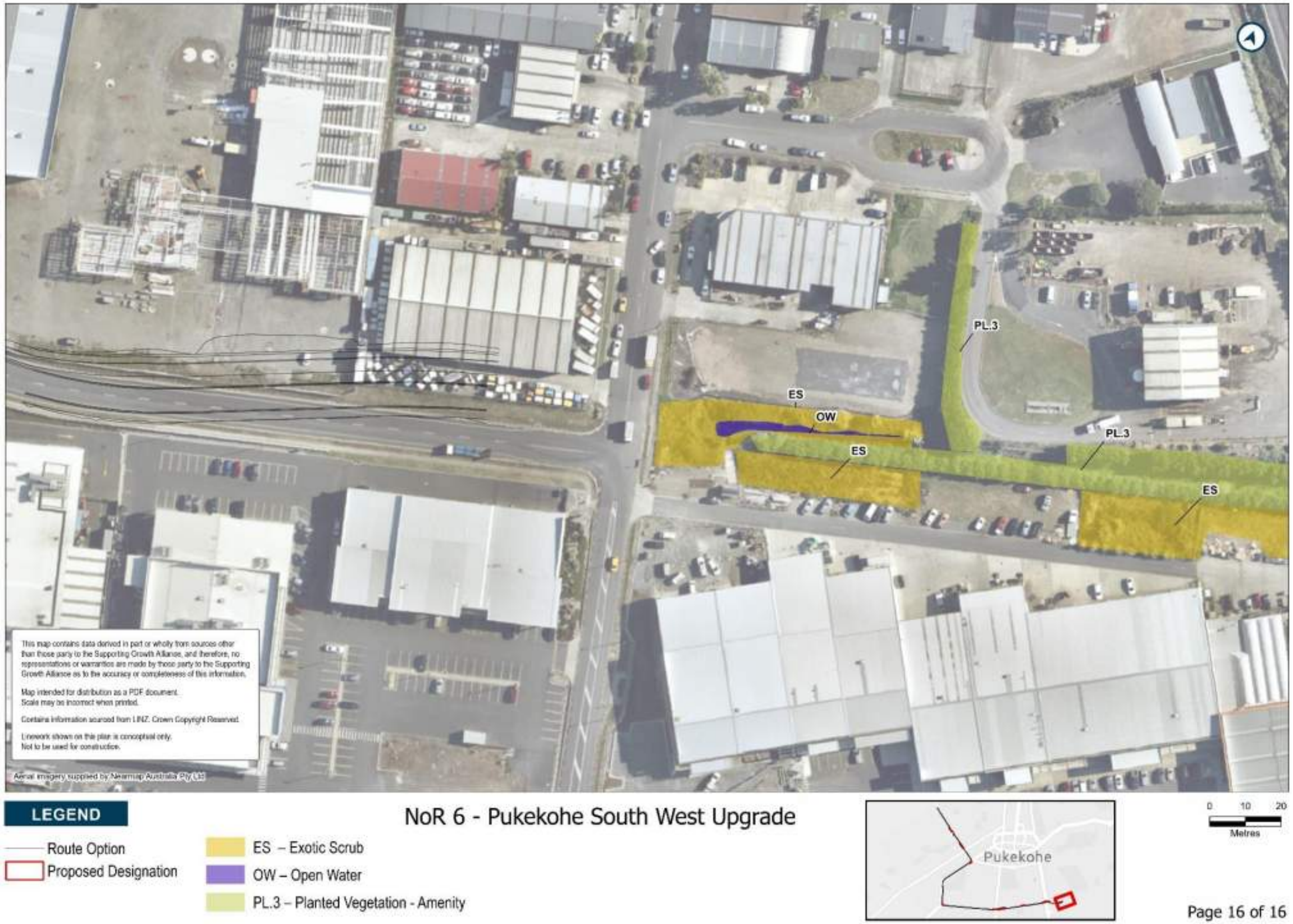

PL.3
PL.3
TL.3
TL.1
TL.1
PL.3
TL.3
TL.3
TL.3
TL.3
TL.3
TL.3
TL.3
TL.3
TL.3
PL.3
TL.1
PL.3
PL.3
TL.3
PL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0 10 20
Metres
Page 11 of 16


PL.3
TL.1
PL.3
PL.3
PL.3
PL.3
TL.3
TL.3
PL.3
PL.3
PL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0 10 20
Metres
Page 12 of 16

PL.3
TL.3
TL.3
PL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0 10 20
Metres
Page 13 of 16

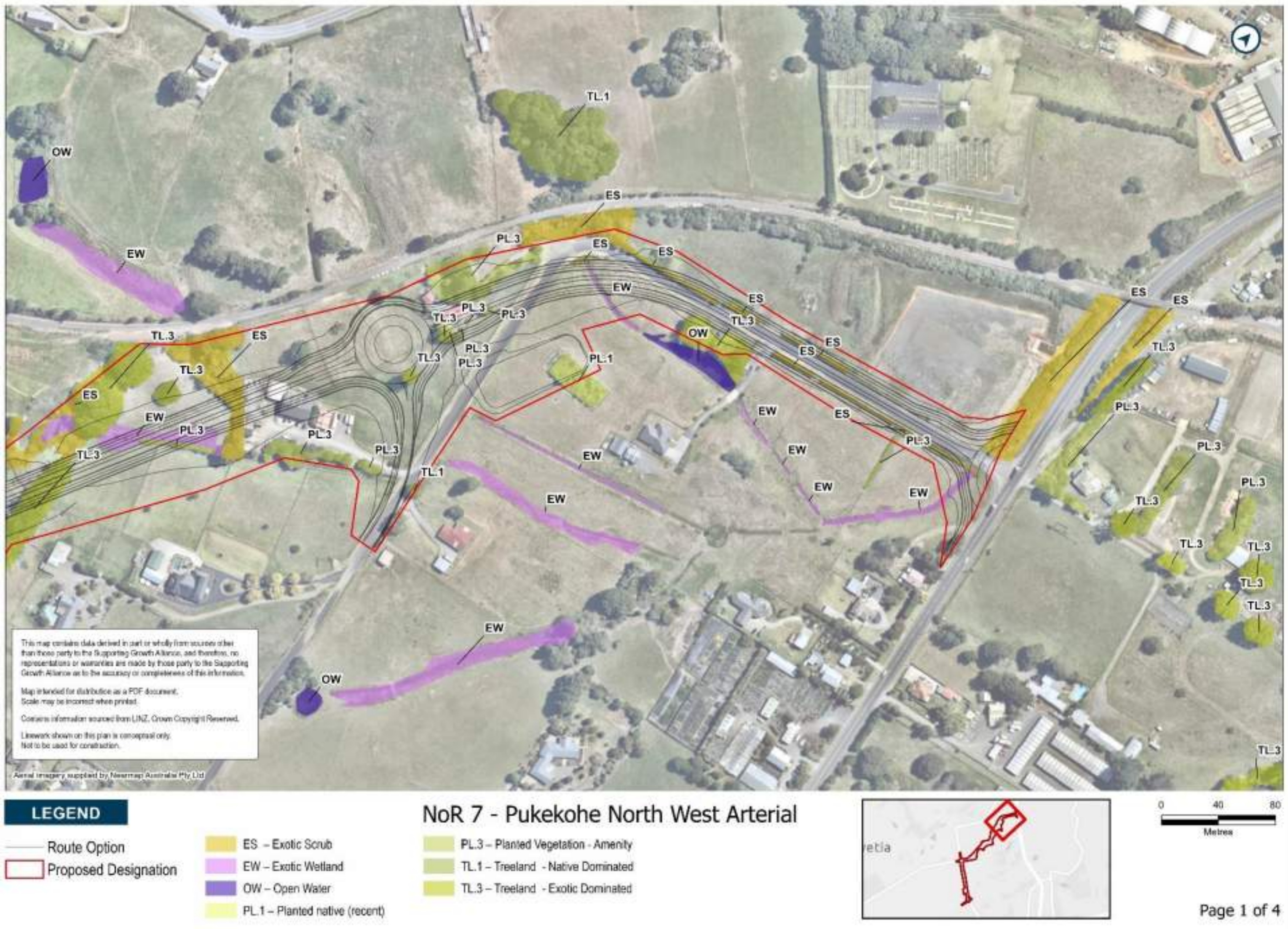

PL.3
TL.3
PL.3
PL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0 10 20
Metres
Page 14 of 16

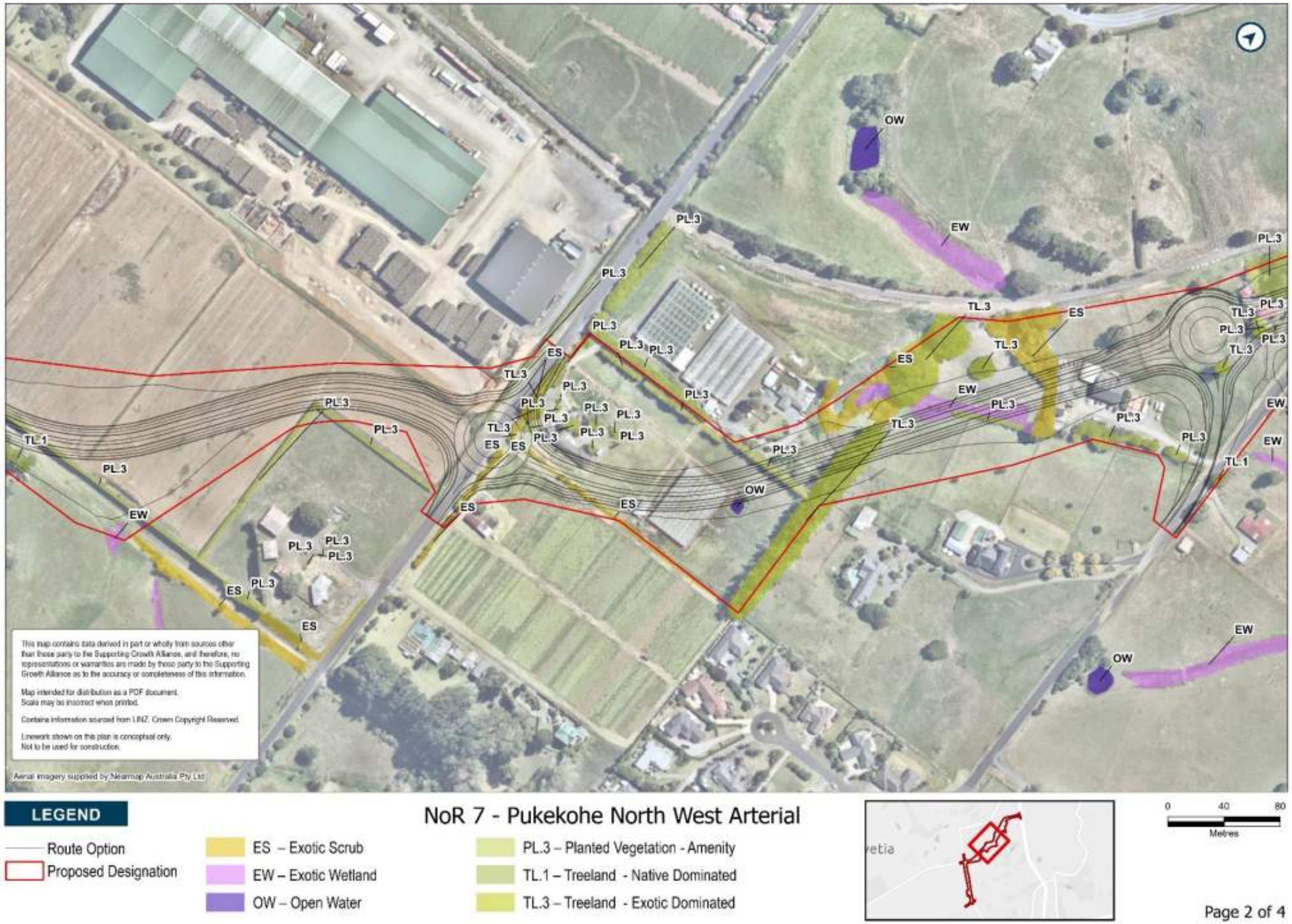

PL.3
TL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
PL.3 – Planted Vegetation - Amenity
TL.3 – Treeland - Exotic Dominated
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0
10
20
Metres
Page 15 of 16

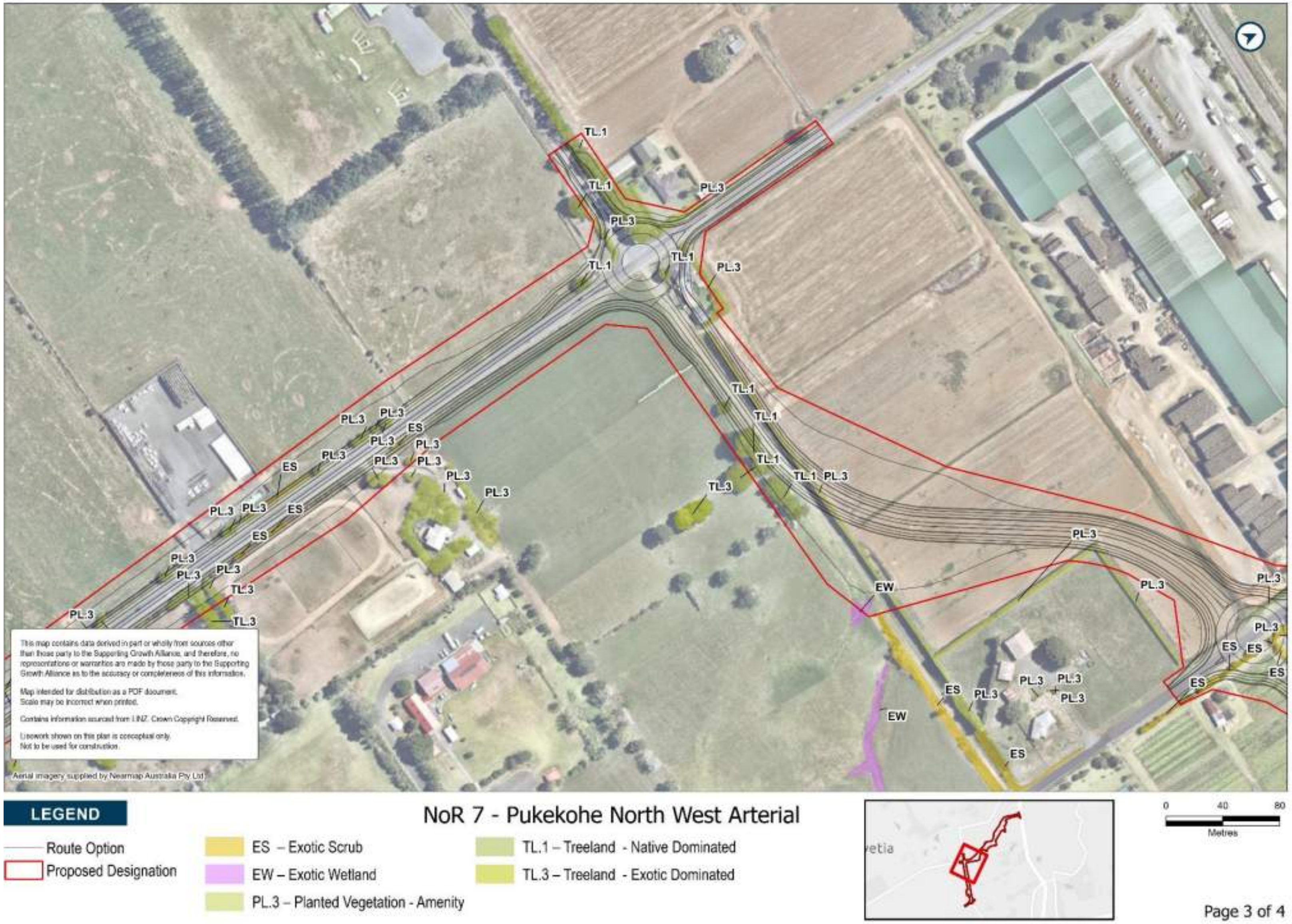

PL.3
ES
OW
ES
PL.3
ES
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
OW – Open Water
PL.3 – Planted Vegetation - Amenity
NoR 6 - Pukekohe South West Upgrade
Pukekohe
0
10
20
Metres
Page 16 of 16

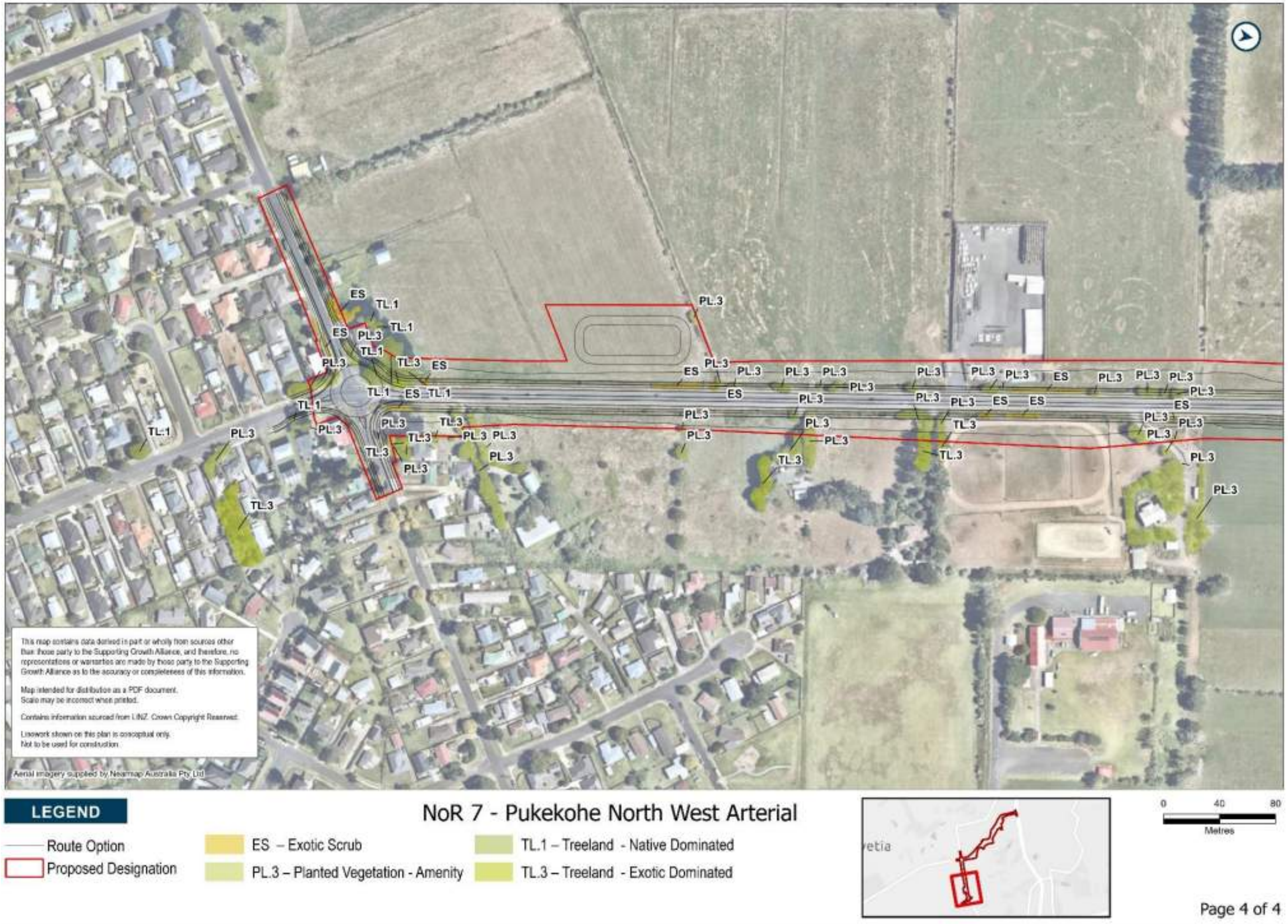
## 3.12 Wetland and Stream Maps Related to NoR 6

## 3.13 Terrestrial and Wetland Maps Related to NoR 7

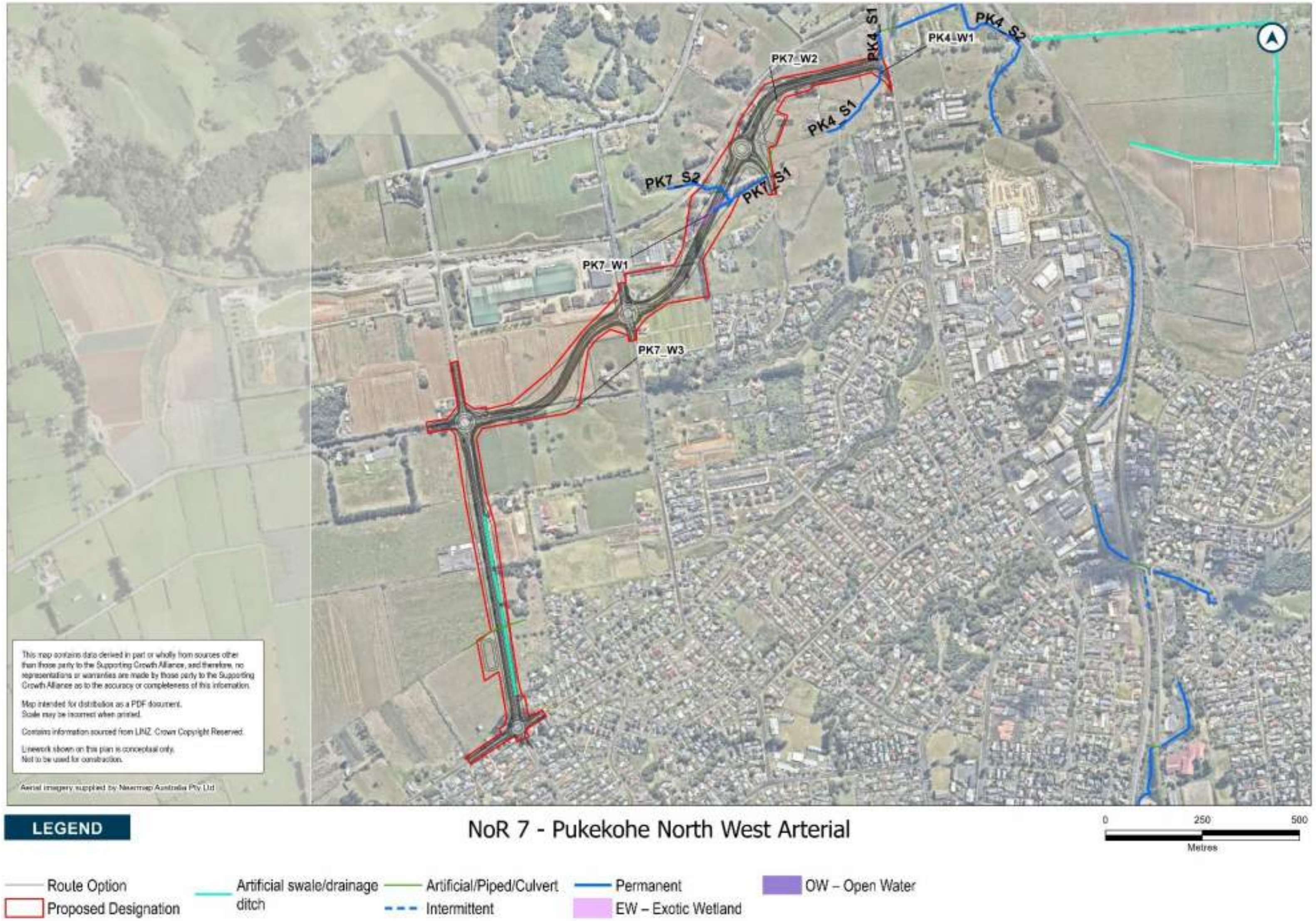



OW
EW
PL.3
TL.3
ES
EW
TL.1
TL.3
OW
ES
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
NoR 7 - Pukekohe North West Arterial
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
0
40
80
Metres
Page 2 of 4

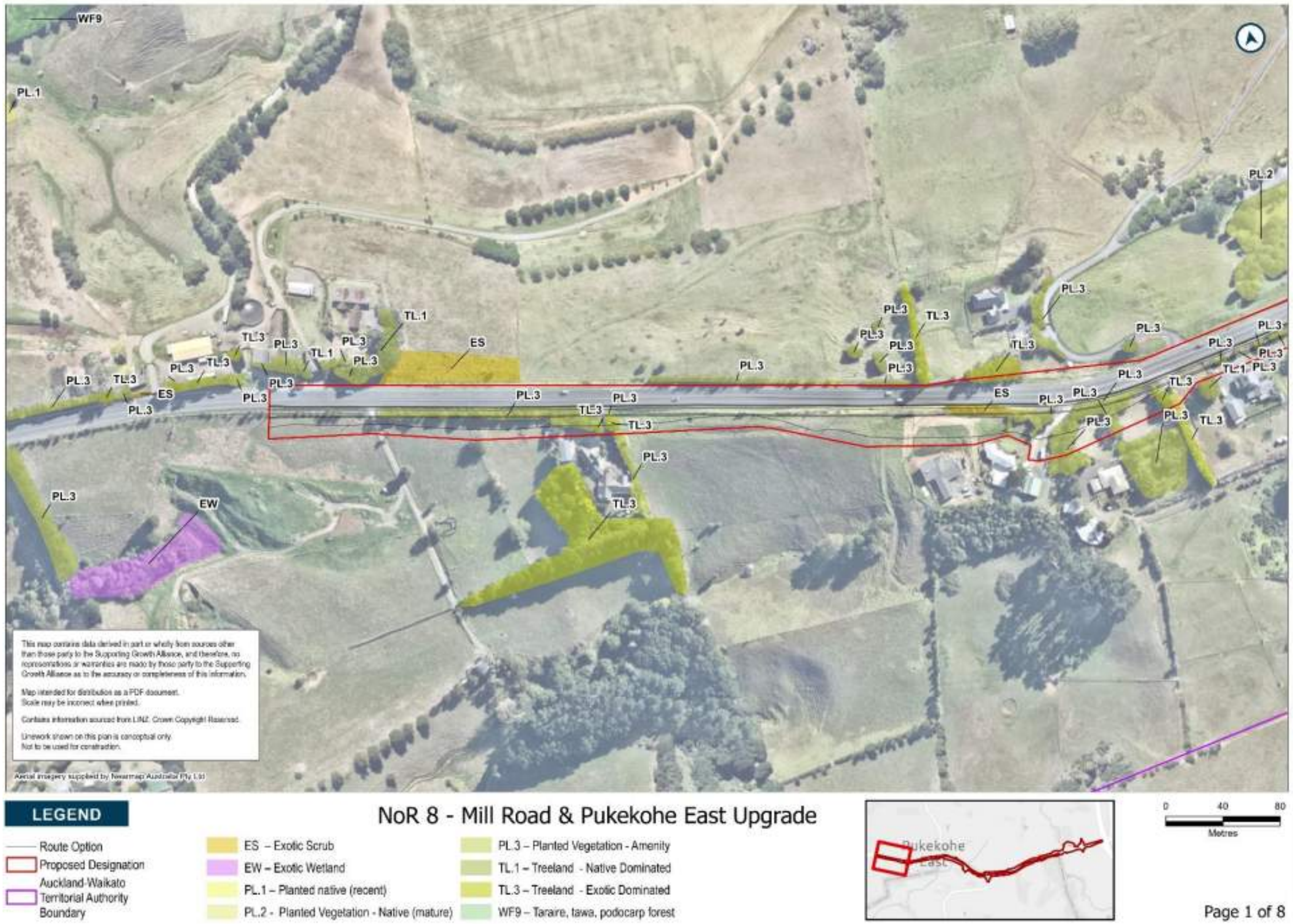

This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
NoR 7 - Pukekohe North West Arterial
0 40 80
Metres
Page 3 of 4


This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
NoR 7 - Pukekohe North West Arterial
0
40
80
Metres
Page 4 of 4

## 3.14 Wetland and Stream Maps Related to NoR 7



## 3.15 Terrestrial and Wetland Maps Related to NoR 8



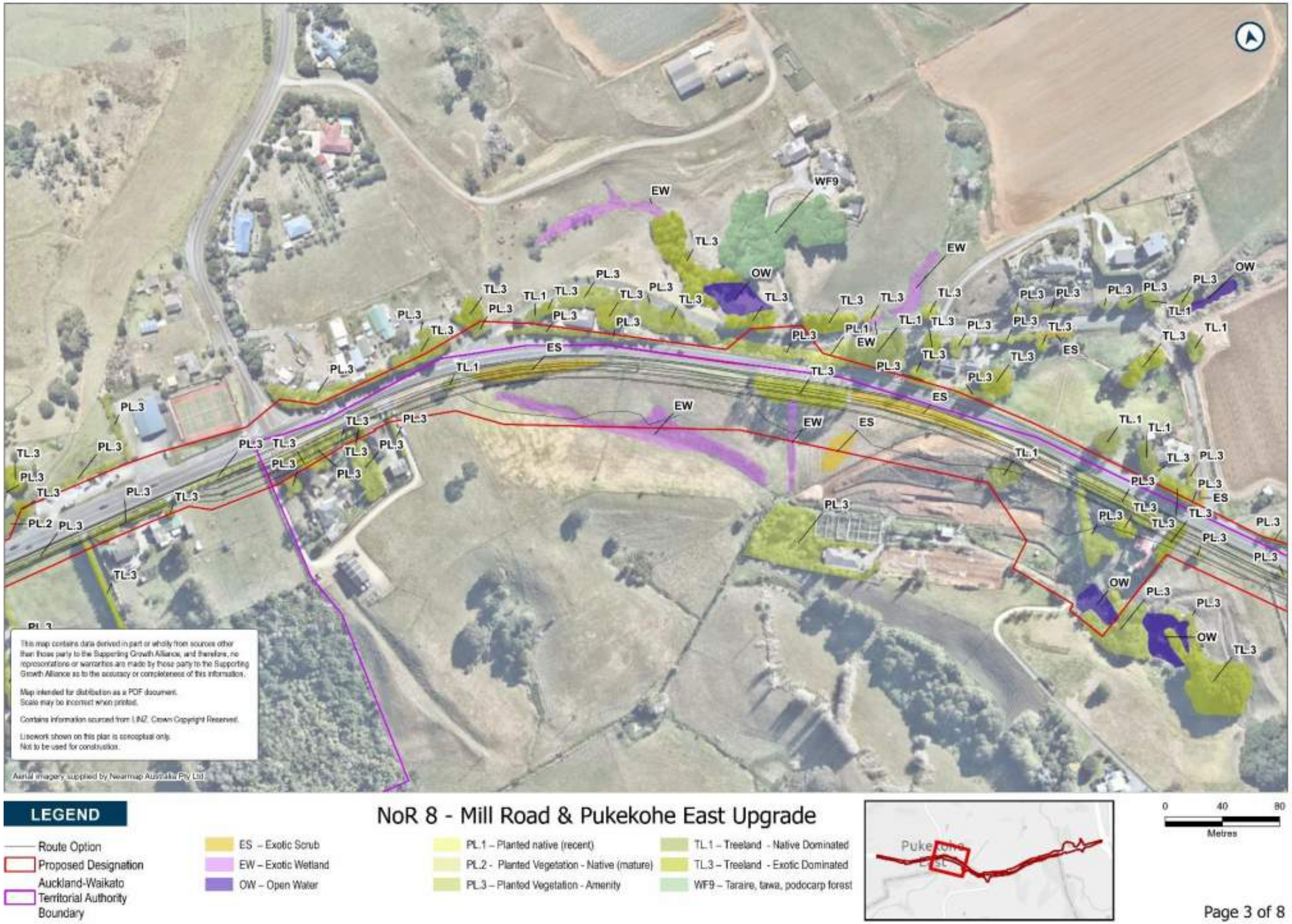

**LEGEND**

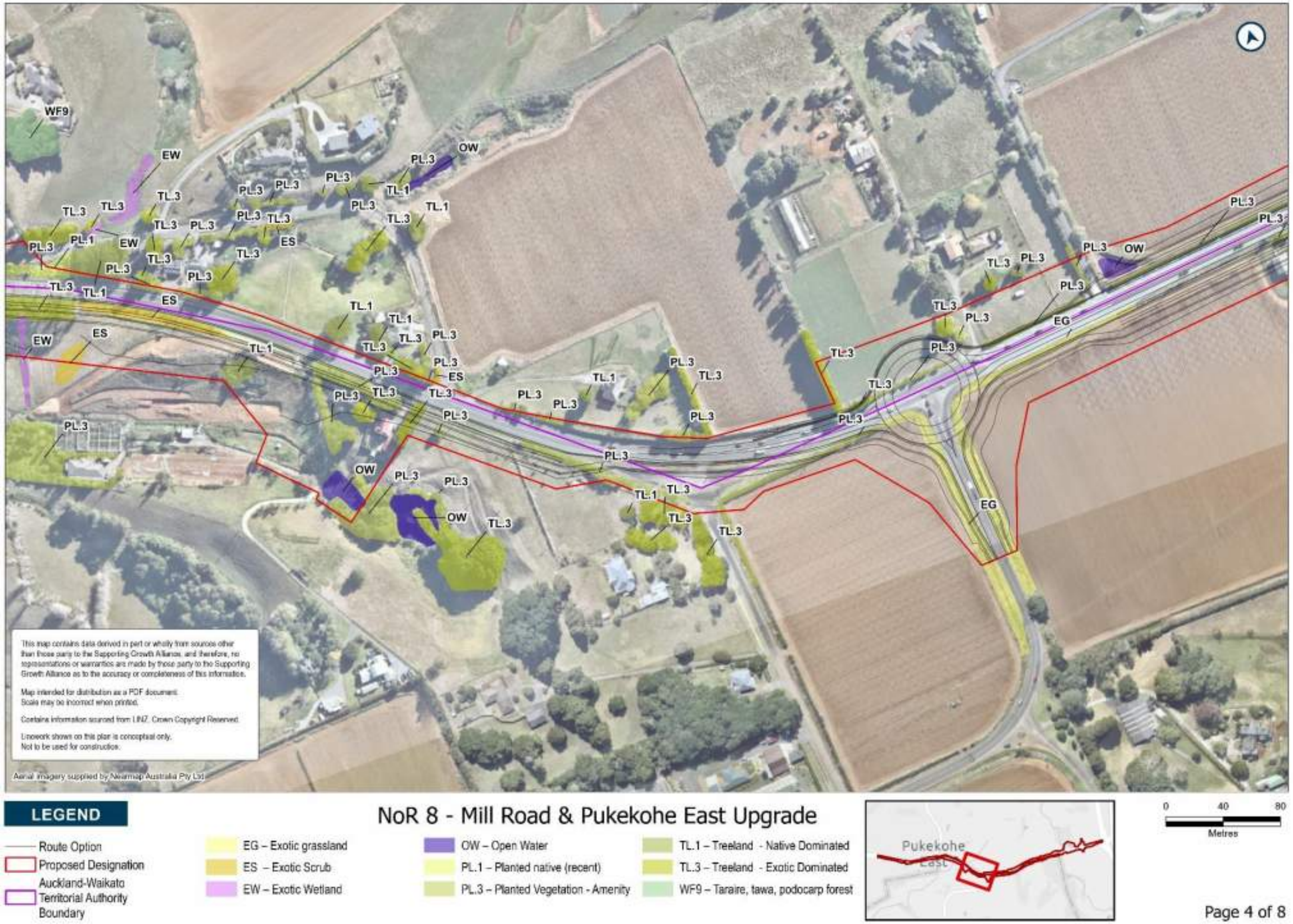
## NoR 8 - Mill Road & Pukekohe East Upgrade

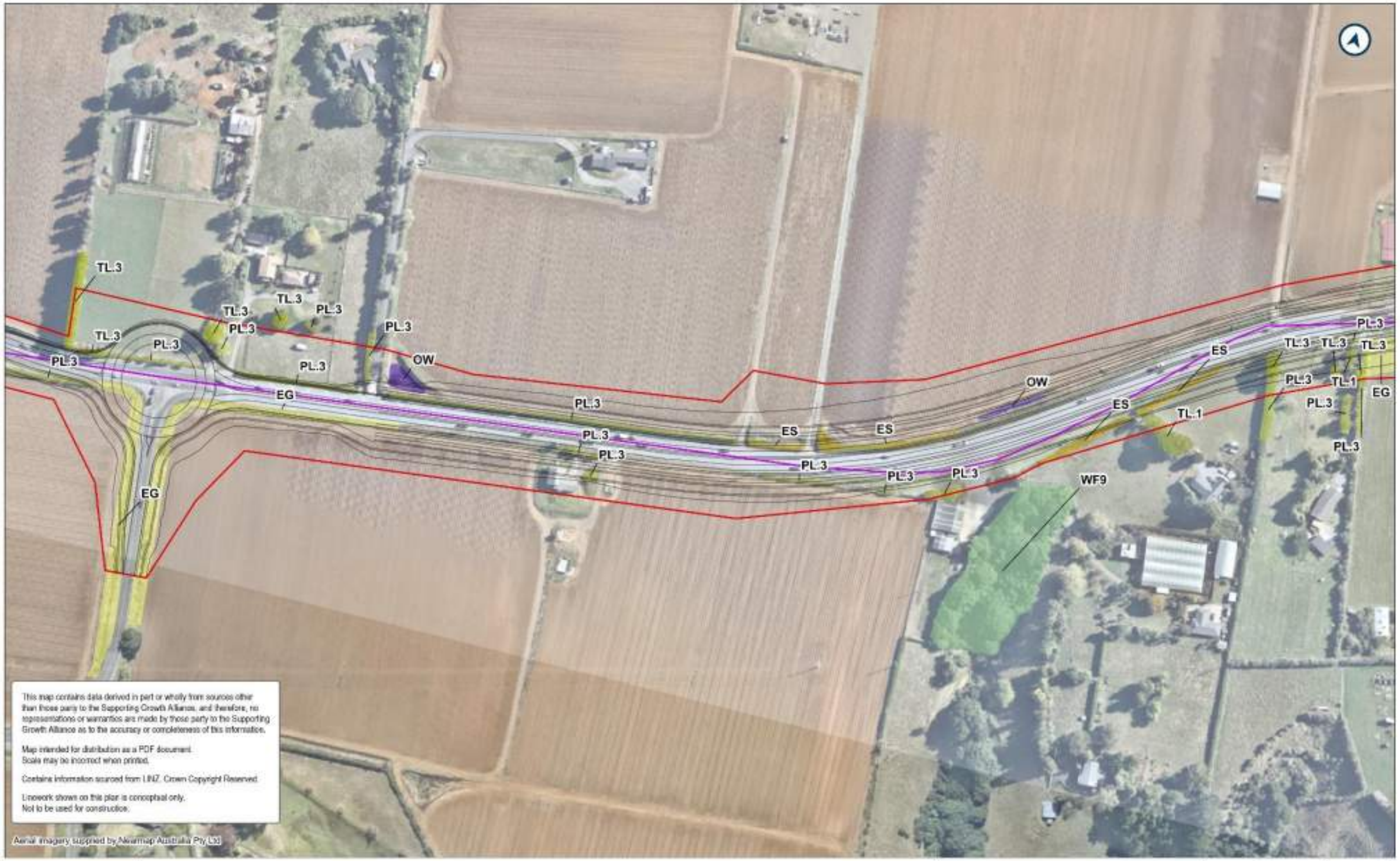
- Route Option
- Proposed Designation
- Auckland-Waikato Territorial Authority Boundary
- ES – Exotic Scrub
- EW – Exotic Wetland
- PL.2 - Planted Vegetation - Native (mature)
- PL.3 – Planted Vegetation - Amenity
- TL.1 – Treeland - Native Dominated
- TL.3 – Treeland - Exotic Dominated

0 40 80
Metres

Page 2 of 8


NoR 8 - Mill Road & Pukekohe East Upgrade
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
Auckland-Waikato Territorial Authority Boundary
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.2 - Planted Vegetation - Native (mature)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF9 – Taraire, tawa, podocarp forest
0
40
80
Metres
Page 3 of 8
EW
WF9
TL.3
EW
OW
PL.3
TL.3
TL.1
PL.3
ES
TL.1
PL.3
TL.3
PL.2
OW


WF9
EW
OW
ES
EG
TL.1
TL.3
PL.1
PL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
Auckland-Waikato Territorial Authority Boundary
EG – Exotic grassland
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WF9 – Taraire, tawa, podocarp forest
NoR 8 - Mill Road & Pukekohe East Upgrade
Pukekohe East
0
40
80
Metres
Page 4 of 8



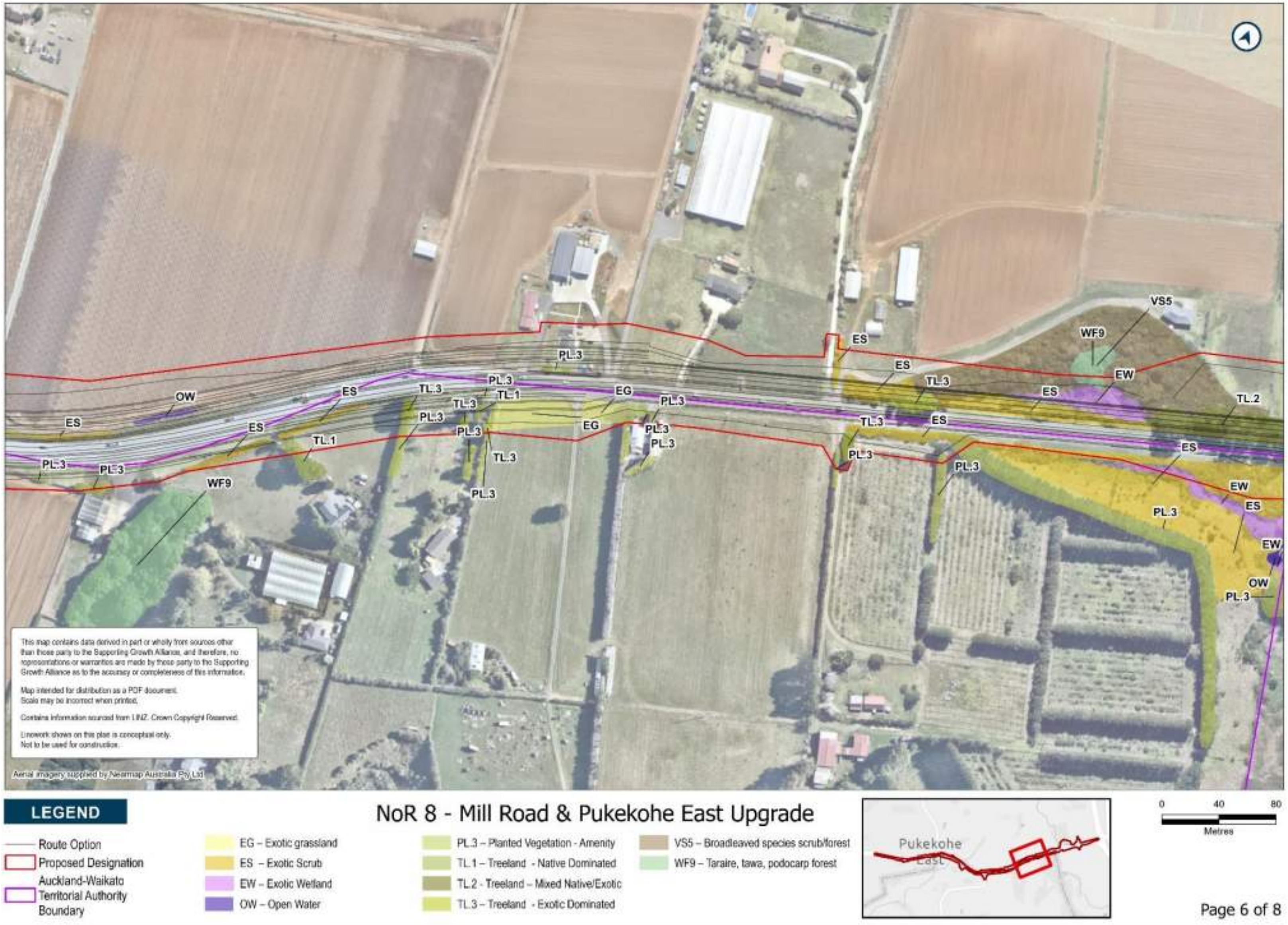

**LEGEND**

- Route Option
- Proposed Designation
- Auckland-Waikato Territorial Authority Boundary
- EG – Exotic grassland
- ES – Exotic Scrub
- OW – Open Water
- PL.3 – Planted Vegetation - Amenity
- TL.1 – Treeland - Native Dominated
- TL.3 – Treeland - Exotic Dominated
- WF9 – Taraire, tawa, podocarp forest

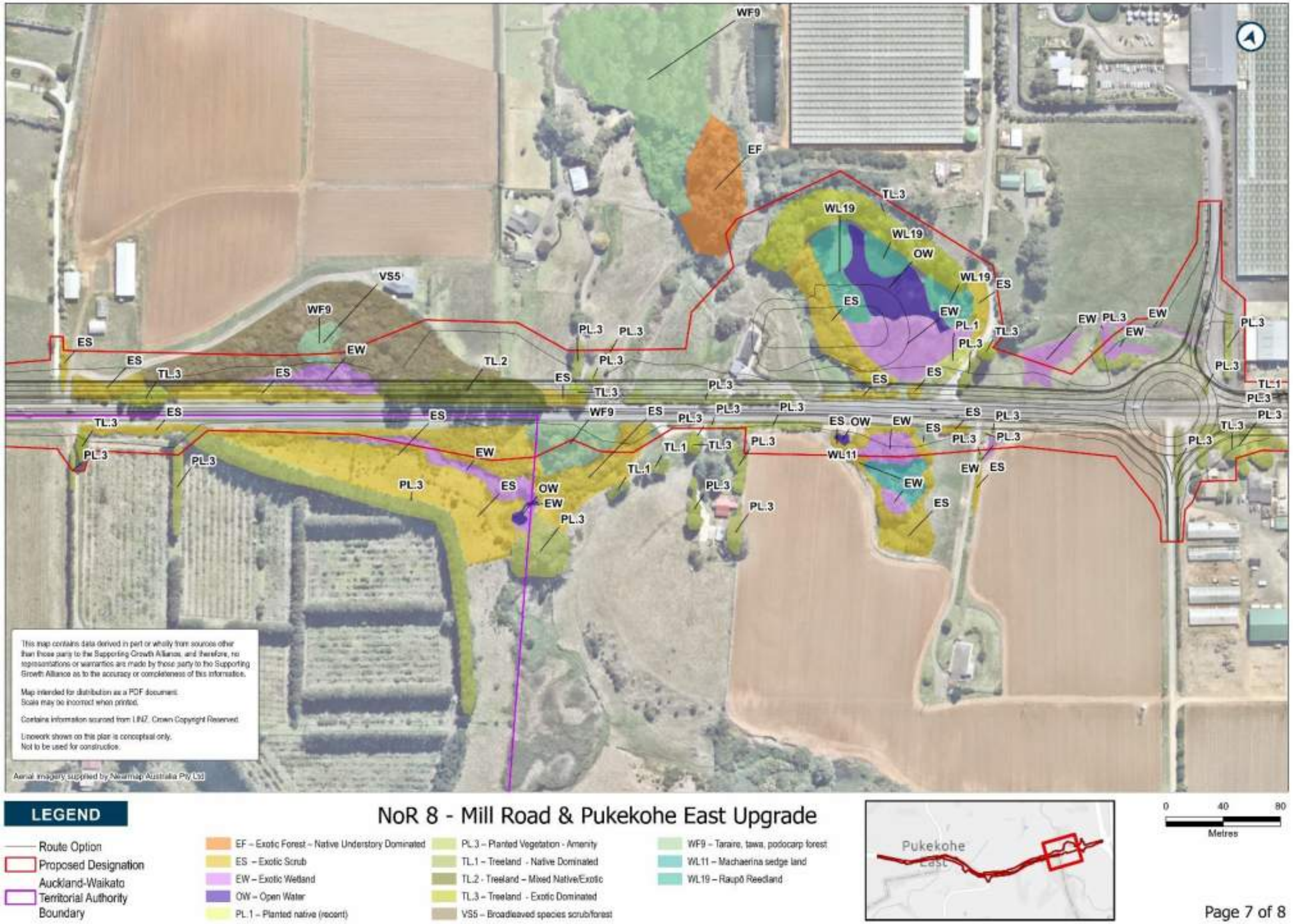
## NoR 8 - Mill Road & Pukekohe East Upgrade


0 40 80
Metres

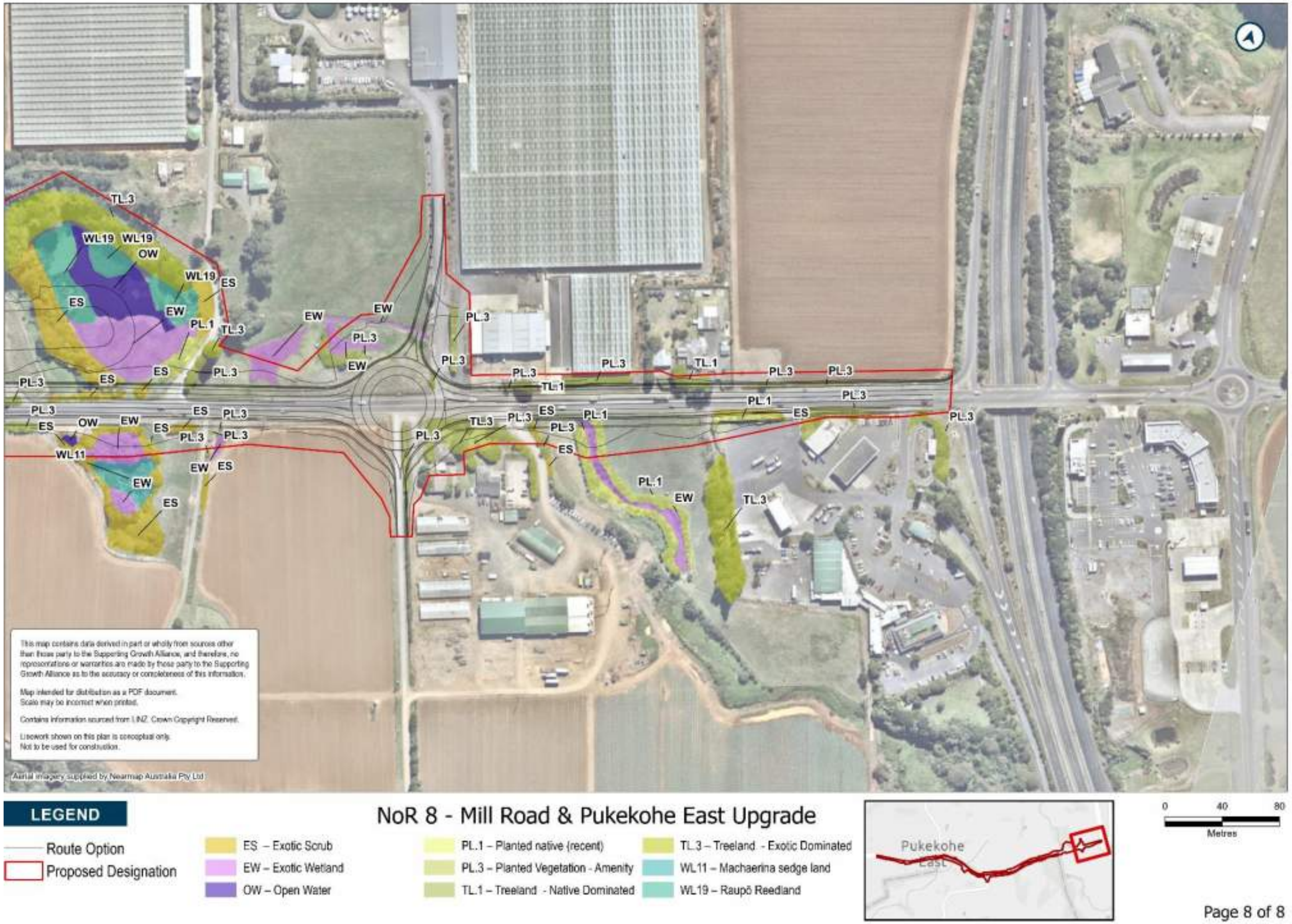
Page 5 of 8



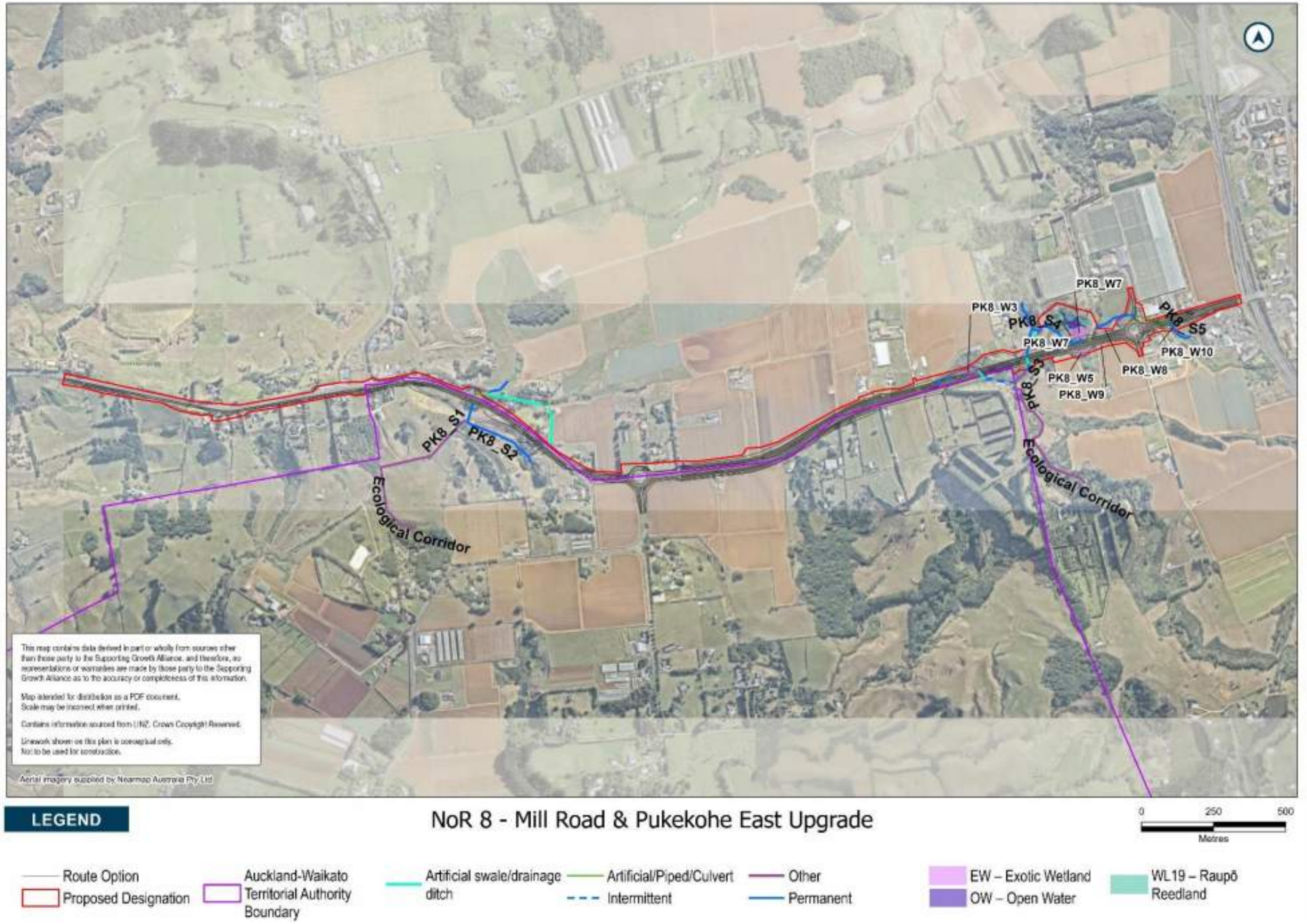
ES
PL.3
PL.3
OW
ES
WF9
TL.1
ES
TL.3
PL.3
TL.3
PL.3
PL.3
TL.1
TL.3
PL.3
PL.3
EG
EG
PL.3
PL.3
PL.3
ES
ES
TL.3
TL.3
ES
PL.3
PL.3
VS5
WF9
EW
ES
TL.2
ES
EW
ES
PL.3
EW
OW
PL.3
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document.
Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only.
Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
Route Option
Proposed Designation
Auckland-Waikato Territorial Authority Boundary
EG – Exotic grassland
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.2 - Treeland – Mixed Native/Exotic
TL.3 – Treeland - Exotic Dominated
VS5 – Broadleaved species scrub/forest
WF9 – Taraire, tawa, podocarp forest
NoR 8 - Mill Road & Pukekohe East Upgrade
Pukekohe
East
0
40
80
Metres
Page 6 of 8



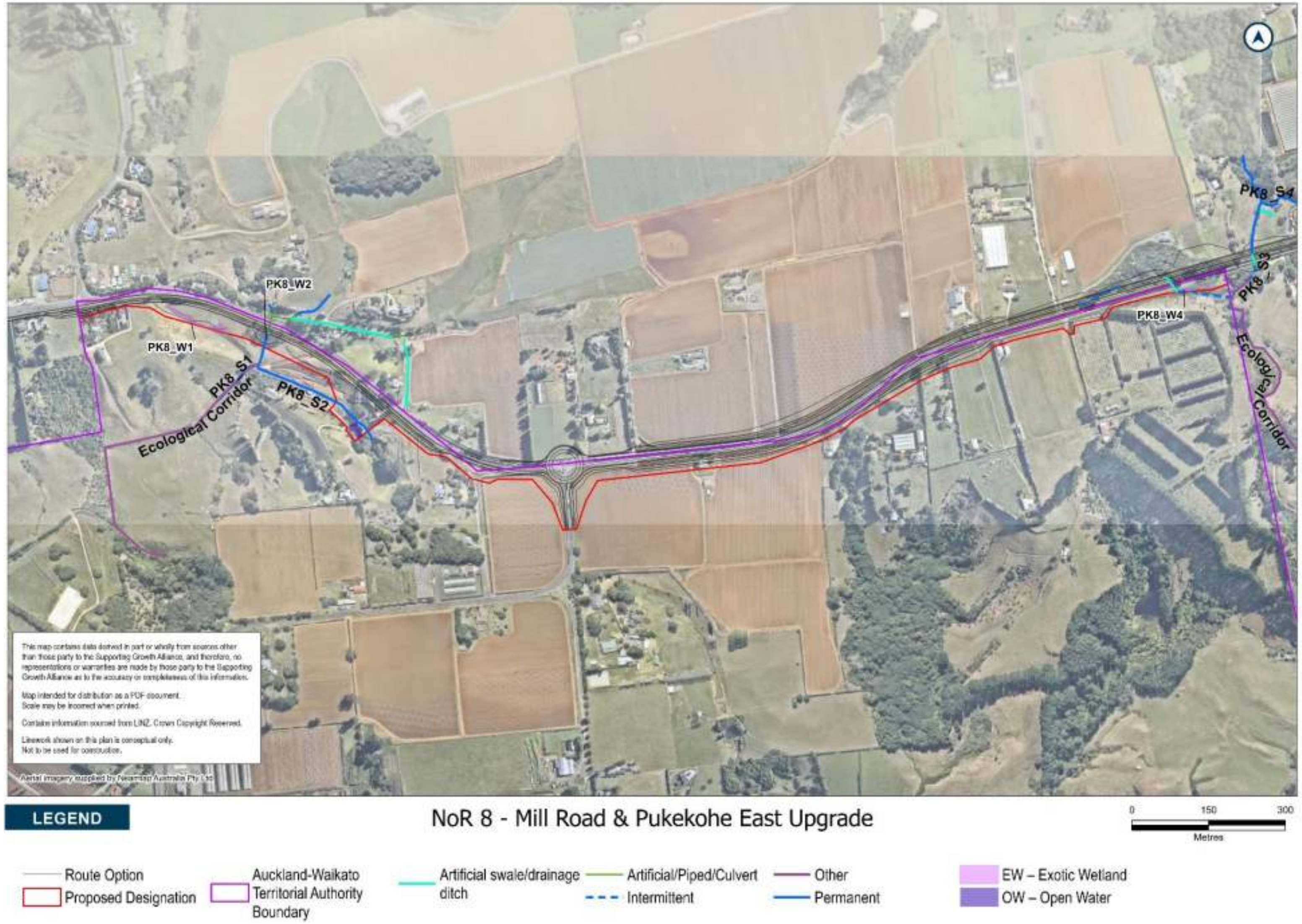
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
LEGEND
NoR 8 - Mill Road & Pukekohe East Upgrade
Route Option
Proposed Designation
Auckland-Waikato Territorial Authority Boundary
EF – Exotic Forest – Native Understory Dominated
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.2 - Treeland – Mixed Native/Exotic
TL.3 – Treeland - Exotic Dominated
VS5 – Broadleaved species scrub/forest
WF9 – Taraire, tawa, podocarp forest
WL11 – Machaerina sedge land
WL19 – Raupō Reedland
Pukekohe East
0 40 80
Metres
Page 7 of 8


NoR 8 - Mill Road & Pukekohe East Upgrade
LEGEND
Route Option
Proposed Designation
ES – Exotic Scrub
EW – Exotic Wetland
OW – Open Water
PL.1 – Planted native (recent)
PL.3 – Planted Vegetation - Amenity
TL.1 – Treeland - Native Dominated
TL.3 – Treeland - Exotic Dominated
WL11 – Machaerina sedge land
WL19 – Raupō Reedland
Pukekohe East
0 40 80
Metres
Page 8 of 8
This map contains data derived in part or wholly from sources other than those party to the Supporting Growth Alliance, and therefore, no representations or warranties are made by those party to the Supporting Growth Alliance as to the accuracy or completeness of this information.
Map intended for distribution as a PDF document. Scale may be incorrect when printed.
Contains information sourced from LINZ. Crown Copyright Reserved.
Linework shown on this plan is conceptual only. Not to be used for construction.
Aerial imagery supplied by Nearmap Australia Pty Ltd
TL.3
WL19
OW
ES
EW
PL.1
PL.3
TL.1
WL11

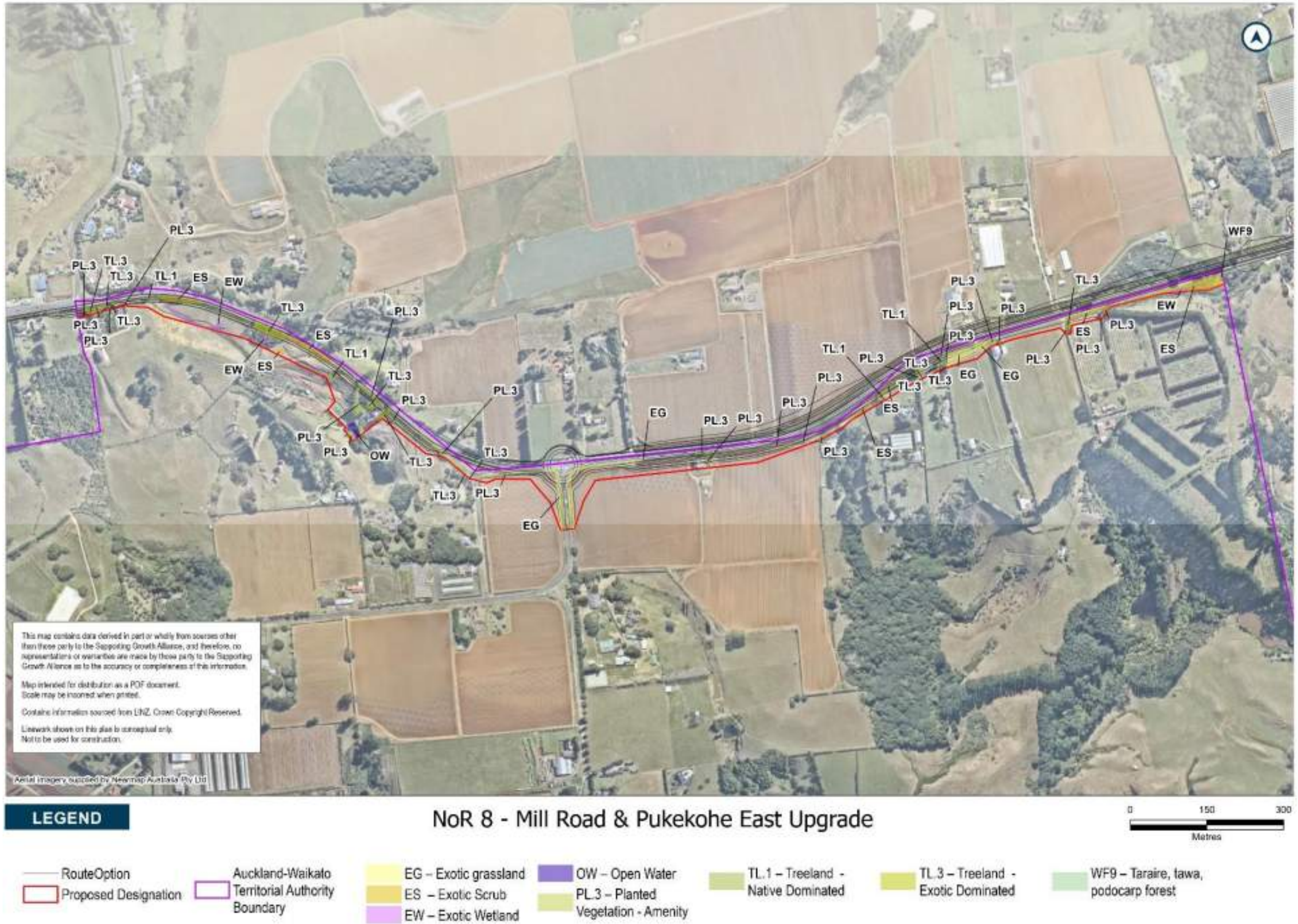
## 3.16 Wetland and Stream Maps within Auckland District portion of NoR 8



## 3.17 Wetland and Stream Maps within Waikato District portion of NoR 8



## 3.18 Broad vegetation types within the Waikato District portion of NoR 8



TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Appendix 4

## Significant Ecological Areas and Significant Natural Areas

# 4 Appendix 4 – Significant Ecological Areas and Significant Natural Areas

**Table 11-9 SEA areas present within the project area**

| SEA | Criteria met for SEA Classification | SEA Description | Relevant NoR |
|---|---|---|---|
| SEA_M2_29a | - | This area is comprised of a variety of intertidal habitats ranging from sandy mud intertidal flats to current-exposed rocky reefs and a variety of saline vegetation. Healthy and often expanding areas of mangroves grow in the shelter of the Whangamaire Stream and Drury and Whangapouri Creeks and in the southern half of the Whangapouri Creek are notable eelgrass (Zostera) beds. Wading bird roosting area, including an important area for pied stilt, banded rail and wrybill. | NoR 1 |
| SEA_T_215 | 1,2,3 | Representative of <10% natural WF7 (4.56 ha), WF8 (6.28 ha). Threatened Ecosystems: Kahikatea-pukatea forest, WF8(6.3ha), Pūriri forest, WF7. Consists of diverse habitat types, including WF8,WF7 and VS2. It provides habitat for Threatened and/or At Risk bird and fish species such as redfin bully and longfin eel | NoR 1 |
| SEA_T_4366 | 1.2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 4 and NoR 8 |
| SEA_T_4367 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 4 and NoR 8 |
| SEA_T_4369 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 4 and NoR 8 |
| SEA_T_4370 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 4 and NoR 8 |
| SEA_T_4371 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest (1.35 ha). | NoR 4 and NoR 8 |
| SEA_T_4372 | 1,2 | Representative of <10% natural extent within Eco District Taraire-tawa-podocarp forest, WF9 (3.57 ha). | NoR 4 and NoR 8 |
| SEA_T_4373 | 1 | Representative of <10% natural extent within Eco District Taraire-tawa-podocarp forest, WF9. | NoR 4 and NoR 8 |
| SEA_T_4374 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 4, NoR 5 and NoR 8 |
| SEA_T_4375 | 1,2,3 | Representative of <10% natural extent within Eco District WF8. Threatened Ecosystems: Kahikatea-pukatea forest. Consists of diverse habitat types including WF8 and WL19. | NoR 2, NoR 4 and NOR 8 |

| SEA | Criteria met for SEA Classification | SEA Description | Relevant NoR |
|---|---|---|---|
| | | | |
| SEA_T_4376 | 1,2 | Representative of <10% natural extent within Eco District: and threatened ecosystem WF7 Pūriri forest. | NoR 2 and NoR 4 |
| SEA_T_4377 | 1 | Representative of <10% natural extent within Eco District: Taraire-tawa-podocarp forest, WF9. | NoR 2 and NoR 4 |
| SEA_T_4378 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 2 and NoR 4 |
| SEA_T_4379 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 2 and NoR 4 |
| SEA_T_4380 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 2, NoR 3, NoR 4 and NoR 7 |
| SEA_T_4381 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF8 Kahikatea-pukatea forest, WF8(0.8ha). | NoR 2, NoR 3 and NoR 4 |
| SEA_T_4382 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 2, NoR 3 and NoR 4 |
| SEA_T_4383 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 2, NoR 3, NoR 4 and NoR 7 |
| SEA_T_4384 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. It provides habitat for Threatened freshwater species, such as longfin eel and Inanga and terrestrial species, such as Kaikomako. | NoR 2, NoR 3, NoR 4 and NoR 7 |
| SEA_T_4385 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 2, NoR 3, NoR 4 and NoR 7 |
| SEA_T_4386 | 1 | Representative of <10% natural extent within Eco District Taraire-tawa-podocarp forest, WF9. | NoR 5 |
| SEA_T_4457 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 (4.04 ha). | NoR 2, NoR 4 and NoR 7 |
| SEA_T_4484 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 2 and NoR 3 |

| SEA | Criteria met for SEA Classification | SEA Description | Relevant NoR |
|---|---|---|---|
| SEA_T_4485 | 1 | Representative of <10% natural extent within Eco District and threatened ecosystem Taraire-tawa-podocarp forest, WF9 (1.05 ha). | NoR 7 |
| SEA_T_4503 | 1,2,3 | Threatened Ecosystems: Machaerina sedgeland, WL11(0.1ha), Representative of <10% natural extent within Eco District Pūriri forest, WF7. Consists of diverse habitat type including WF7 and WL11 | NoR 2 and NoR |
| SEA_T_4505 | 1,2,3 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest (1.81 ha). It consists of diverse habitat types, including MF4 and WF7. | NoR 2, NoR 3 and NoR 4 |
| SEA_T_4507 | 1 | Representative of <10% natural Pūriri forest, WF7 (2.39 ha). | NoR 4 and NoR 8 |
| SEA_T_4508 | 1 | Representative of <10% natural Pūriri forest, WF7. | NoR 8 |
| SEA_T_4510 | 2 | It contains Threatened Ecosystems including Pūriri forest, WF7. | NoR 4, NoR 5 and NoR 8 |
| SEA_T_5281 | 1,2 | Representative of <10% natural WF7 Pūriri forest. | NoR 1, NoR 2 and NoR 7 |
| SEA_T_5283 | 1,2,3,4 | It contains Pūriri forest, WF7, Kahikatea-pukatea forest, WF8. It buffers to other protected areas and provides habitat for Threatened plant species including King fern. | NoR 4, NoR 5, NoR and NoR 8 |
| SEA_T_5295 | 1,4 | Representative of <10% natural extent within Eco District and provides habitat for threatened ecosystem including WF7 Pūriri forest. | NoR 8 |
| SEA_T_5344 | 1,2,3 | Representative of <10% natural extent within Eco District and threatened ecosystem Pūriri forest WF7 (3.35 ha), It consist of diverse habitat type including WF7 and WL19. | NoR 4 and NoR 8 |
| SEA_T_5351 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. It provides habitat for Threatened plant species including Pōporo. | NoR 2, NoR 3, NoR 4 and NoR 7 |
| SEA_T_5352 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest. | NoR 2, NoR 3, NoR 4 and NoR 7 |

| SEA | Criteria met for SEA Classification | SEA Description | Relevant NoR |
|---|---|---|---|
| SEA_T_5353 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem WF7 Pūriri forest forest. | NoR 2, NoR 3, NoR 4 and NoR 7 |
| SEA_T_536 | 1,2 | Representative of <10% natural and Threatened Ecosystems Kahikatea-pukatea forest, WF8. | NoR 5 |
| SEA_T_5384 | 1,2,3 | Representative of <10% natural and Threatened Ecosystems Kahikatea-pukatea forest, WF8 (2.4 ha). It provides habitats for Threatened plant species including swamp maire. | NoR 7 and NoR |
| SEA_T_78 | 1,2 | Representative of <10% Threatened ecosystem including Kahikatea forest, MF4 | NoR 1 and NoR 2 |
| SEA_T_79 | 1,2,3 | Representative of <10% natural extent within Eco District and threatened ecosystem Pūriri forest WF7 (1.08 ha). Habitat diversity: WF7. | NoR 1 and NoR 2 |
| SEA_T_80 | 1,2 | Representative of <10% natural extent within Eco District and threatened ecosystem Pūriri forest WF7 (1.61 ha). It provides habitats for Threatened plant species, including swamp maire. | NoR 1 and NoR 2 |
| SEA_T_81 | 1,2 | Representative of <10% natural and Threatened Ecosystems Pūriri forest, WF7 (1.3 ha). | NoR 1 and NoR 2 |
| SEA_T_90 | 1 | Representative of <10% natural Pūriri forest, WF7 (1.83 ha). | NoR 4, NoR 5 and NoR 8 |
| SEA_T_91 | 1,2 | Representative of <10% natural and Threatened ecosystem including Kahikatea forest, MF4. It provides a habitat for Threatened plant species, including swamp maire. | NoR 4, NoR 5 and NoR 8 |
| SEA_T_94 | 1,2 | Representative of <10% natural<br>the extent within Eco District and threatened ecosystem Kahikatea forest, MF4 | NoR 2, NoR 3 and NoR 7 |
| SEA_T_95 | 1,2,3 | Representative of <10% natural and Threatened Kahikatea-pukatea forest, WF8 | NoR 2 and NoR 3 |
| SEA_T_97 | 3,4 | Representative of <10% natural and Threatened Kahikatea-pukatea forest, WF8. It supports typical species richness and acts as a migration pathway. | NoR 5 |
| SEA_T_98 | 1,2 | Representative of <10% natural and Threatened Kahikatea-pukatea forest, WF8. It provides a habitat for Threatened plant species, including swamp maire. | NoR 5 |

**Table 11-10 SNA areas present within the project area**

| SNA/Address | Criteria met for SNA Classification | SNA Description | Relevant NoR |
|---|---|---|---|
| ENV-2022-AKL-000073 | Criteria 1 of Section 11A of the Waikato Regional Policy Statement | A set of three natural areas located in private property on Mill Road, was assessed by Franklin Council and Wiakato District Council to protect its ecological values. This area is comprised of a variety of native forest and confiner planted and exotic scrub habitats. The covenanted forest is decided to set aside for its indigenous vegetation or habitat for indigenous fauna (Turner and Cunningham 2020). | NoR 8 |
| Ellis Property, Turbott Road, Pukekohe | Objective 5B.2.3 – Conservation Subdivision Provisions of Franklin District Plan | The area is predominately covered with old growth Pūriri, juvenile nikau, titoki, totara, and lace bark. This area contains variety of vascular flora species. The area is well represented of indigenous forest. Native birds such as tui, shining cuckoo, long-tailed cuckoo and morepork inhabitant within this area. | NoR 8 |
| 725 Harrisville Road, Pukekohe East | Objective 5B.2.3 – Conservation Subdivision Provisions of Franklin District Plan | The area, located within a private property was assessed by Franklin Council to undertake under Conservation Lot Subdivision plan. This area is comprised of native forest, wetland and regenerating bush. The forest area is dominated by taraire, titoki, totara, karaka, kohekohe. The wetland contains indigenous riparian vegetations, such as sedge, kiokio, maire tiwake, and oioi. | NoR 8 |

# Appendix 5

## Terrestrial vegetation type and classification

# 5 Appendix 5 – Terrestrial vegetation type and classification

**Table 11-11 Description of the terrestrial vegetation types present within the Project Area**

| Habitat | Classification | Description of Habitat |
|---|---|---|
| Brown Field (includes cropland) | BF | This definition includes Industrial zones, metaled car parks, rail corridors, unmanaged or managed land within urban settings, median road strips, pavements, and cracks in concrete. The substrate includes metal (stone chip) and concrete surfaces. Largely exotic herb fields (weeds) and rare 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. Generally used to describe single-species forestry plantations.<br>This level of distinction was used for desktop habitat assessment, where the understory vegetation was not assessed. |
| Exotic Forest | EF.1 | Forest vegetation with >50% native understorey and/or groundcover biomass. Generally used to describe when exotic canopy species are dominant. |
| Exotic Grassland | EG | Grassland is dominated by exotic species. This includes pasture, garden lawns and sports pitches. |
| Exotic Scrub | ES | Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. The future trajectory is uncertain. Dominant species include gorse, woolly nightshade and privet species. |
| Pōhutukawa, pūriri, broadleaved forest | MF4 | This broadlevead forest is dominated by pōhutukawa, pūriri and kohekohe most common and, locally, taraire, karaka, tawa, tītoki, mangeao, rewarewa, puka, tawāpou, ngaio and nīkau. It is categorised as SEA_T_91. This area provides habitats for a diverse range of invertebrates, amphibians, reptiles, birds and bats (Atkinson & Millener 1991; Worthy & Holdaway 2002). |
| Planted Vegetation – Native (recent) | PL.1 | Native restoration plantings with <50% exotic biomass. Recently planted native scrub and forest <20 years old. |
| Planted Vegetation - Native (mature) | PL.2 | Native restoration plantings with <50% exotic biomass. Mature planted native scrub and forest >20 years old. |
| Planted Vegetation – Exotic (amenity) | PL.3 | Exotic amenity plantings. This includes planted exotic vegetation within parks, amenity areas and private gardens. |

| Habitat | Classification | Description of Habitat |
| --- | --- | --- |
| Treeland – Native-Dominated | TL.1 | Tree canopy covers 20-80%. Native-dominated: >75% native tree cover. For the purposes of mapping, this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopies of mature trees within gardens, farms and amenity areas. |
| Treeland – Native-Dominated | TL.2 | Tree canopy cover 20-80%. Mixed native/exotic: with 25-75% native tree cover. For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms, and amenity areas. |
| Treeland – Exotic-Dominated | TL.3 | Tree canopy covers 20-80%: <25% native with exotic tree cover dominant. For the purposes of mapping, this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopies of mature trees within gardens, farms and amenity areas. |
| Broadleaved species scrub/forest | VS5 | These areas are dominated by short-lived species commonly found in the sub-canopy or on the margins of mature forests. Throughout its range, it may include species of Coprosma (especially karamū, shining karamū and kanono), Peudopanax, Pittosporum, tree daisy, hebe, lacebark, rangiora, tutu, putaputawētā, māhoe, māpou and wineberry. They support frugivores, such as kererū and kōkako, along with insectivorous and frugivorous birds, such as whitehead, tomtit, robin, hihi, bellbird, tūī. |
| Pūriri Forest | WF7 | Remnant/regenerating pūriri, tōtara forest. Occurs on recent alluvial terraces and floodplain/river valleys. Secondary successions are dominated by podocarp trees, notably totara. This area is marked as SEA_T_4380. |
| Kahikatea, pukatea forest | WF8 | This ecosystem is essentially a swamp forest growing on soils with seasonally high-water tables. This ecosystem is dominated by podocarp–broadleaved forests with emergent trees, a canopy of kahikatea and pukatea, and, locally, rimu. In some years, the mast fruiting of kahikatea would have provided an abundant food source for kākāpō, kākā, kākāriki, kererū, tūī, bellbird, huia, saddleback, kōkakoand piopio, along with the larger gecko species (Whitaker 1987; Clout & Hay 1989; Kelly et al. 2010). This area is marked as SEA_T_4375. |
| Taraire, tawa, podocarp forest | WF9 | This area is characterised by large emergent rimu and northern rātā, with kahikatea in gullies emerging over a broadleaved canopy of abundant taraire, kohekohe, tōwai and tawa. It is categorised as SEA_T_4374 and SEA_T_4464. It supports a diverse range of invertebrates, amphibians, reptiles, birds and bats (Atkinson & Millener 1991; Worthy & Holdaway 2002) |

TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Appendix 6

## Terrestrial Value Assessment

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

# 6 Appendix 6 – Terrestrial Value Assessment

## 6.1 NoR 1 - Drury West Arterial

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | |
|---|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK1-EG** | **PK1-ES** | **PK1-PL.2** | **PK1-PL.3** | **PK1-TL.3** | **PK1-BF** | **Justification** |
| **Representativeness** | **1** | **2** | **3** | **1** | **2** | **1** | |
| Typical structure and composition | 1 | 2 | 2 | 1 | 2 | 1 | BF, EG: <10% of the species are indigenous value score 1<br>ES, PL.3, TL.3: 10-50% of the species are indigenous value score 2 |
| Indigenous representation | 1 | 1 | 3 | 1 | 2 | 1 | BF, EG, ES, PL.3: Habitats have been significantly altered by human activities (exotic dominated).<br>TL.3: Habitat and species have been affected by human activities. |
| **Rarity/distinctiveness** | **1** | **1** | **2** | **2** | **2** | **1** | |
| Species of conservation significance | | | | | | | |
| Species (habitat) of conservation significance | 1 | 1 | 2 | 2 | 2 | 1 | EG, ES, PL.3, TL.3 may include Totara, Karo, Matipo, Nikau, Ponga, pine, polar that provide potential habitat for Copper and ornate skinks, NZ falcon, long-tailed bats, Kaka, Kereru |
| Range restricted or endemic species | | | | | | | |
| Distinctive ecological values | | | | | | | |
| **Diversity and pattern** | **1** | **1** | **2** | **1** | **2** | **0** | |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | |
|---|---|---|---|---|---|---|---|
| Habitat diversity | 1 | 1 | 2 | 1 | 1 | | Indigenous terrestrial forests value score 3<br>PL.1 and TL.1 value score 2<br>Mixed native/exotic plantings value score 1 |
| Species diversity | 1 | 1 | 1 | 1 | 1 | | |
| Patterns in habitat use | | | | | 2 | | TL.3 rated high due to potential seasonal utilisation by long-tailed bat and copper/ornate skink. |
| **Ecological context** | **1** | **2** | **2** | **2** | **3** | **0** | |
| Size, shape, and buffering | | 1 | 2 | 1 | 1 | | ES, PL.3, TL.3, create buffering around permanent stream represent <10% of original habitat type value score 1 |
| Sensitivity to change | | | 2 | 1 | 1 | | Intact habitat with no residual sensitive receptors? |
| Ecological networks (linkages, pathways, migration) | 1 | 2 | 2 | 2 | 3 | | All habitats (excluding BF) are locally an important breeding and feeding link in terms of connectivity for the survival of species (e.g. native birds).<br><br>Aged woody structure (TL.3) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats. |
| Protected status | | | | | | | |
| Sum | 4 | 6 | 9 | 6 | 9 | 2 | |
| **Combined value** | Negligible | Low | Moderate | Low | Moderate | Negligible | |

## 6.2 NoR 2 - Drury-Pukekohe Link

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK2-EG** | **PK2-ES** | **PK2-EF** | **PK2-PL.1** | **PK2-PL.3** | **PK2-TL.1** | **PK2-TL.3** | **PK2-WF7** | **Justification** |
| **Representativeness** | **1** | **2** | **3** | **3** | **2** | **3** | **2** | **4** | |
| Typical structure and composition | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | BF, EG, ES, PL.3, TL.3: Habitats have been significantly modified by human activities. It's grouped as FUZ and Rural. |
| Indigenous representation | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 4 | BF, EG: <10% of the species are indigenous.<br>ES, PL.3, TL.3: 10-50% of the species are indigenous.<br>PL.1, TL.1, WF7, EF >50% of the species are indigenous. |
| **Rarity/distinctiveness** | **0** | **2** | **3** | **3** | **2** | **3** | **2** | **4** | |
| Species of conservation significance | | | | | | | | | |
| Species (habitat) of conservation significance | | 2 | 3 | 3 | 2 | 3 | 2 | 4 | WF7 Puriri forest Critically Endangered, value score 4<br>Native terrestrial species, value score 3 |
| Range restricted or endemic species | | | | | | | | | |
| Distinctive ecological values | | | | | | | | 3 | WF7 with regional critically endangered status provide distinctive ecological value for ecosystem, value score 3 |
| **Diversity and pattern** | **1** | **1** | **2** | **2** | **1** | **2** | **2** | **3** | |
| Habitat diversity | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 3 | Indigenous terrestrial forests value score 3<br>PL.1 and TL.1 value score 2 |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Mixed native/exotic plantings value score 1 |
| Species diversity | | | | | | | | | |
| Patterns in habitat use | | | | | | | 2 | 3 | WF7 supports a diverse range of invertebrates, amphibians, reptiles, birds and bats. |
| **Ecological context** | **0** | **0** | **3** | **2** | **2** | **2** | **3** | **4** | |
| Size, shape and buffering | | | **3** | 2 | | 2 | 1 | 4 | WF7 represent >20% of original habitat type value score 4<br>EF represent >10-20% of original habitat type value score 3<br>ES, PL.3, TL.3, create buffering around permanent stream TL.1 and PL.1 represent <10% of original habitat type value score 2 |
| Sensitivity to change | | | | 2 | | 2 | 1 | 2 | One small patch of WF7, PL.1 and TL.1 was planted on 401 Sim Road, it includes native plant species, including puriri, matipo, five finger, Kawakawa, Kanuka which are sensitive to anthropogenic changes |
| Ecological networks (linkages, pathways, migration) | | | 3 | 2 | 2 | 2 | 3 | 3 | All habitats (excluding BF) are locally an important breeding and feeding link in terms of connectivity for the survival of species (e.g. native birds).<br><br>Planted shrubs and aged woody structure (PL.3 and TL.1 TL.3, EF) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and TAR bird species such as Kaka and NZ falcon. |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Protected status | | | | | | | | Auckland Indigenous terrestrial forests categorised WF7 as Regional Critical Endangered. It is not mapped in Auckland Council geomap and not protected. It's artificially planted. |
| Sum | 2 | 5 | 11 | 10 | 7 | 10 | 9 | 15 | |
| **Combined value** | Negligible | Low | Moderate | Moderate | Low | Moderate | Moderate | High | |

## 6.3 NoR 3 - Paerata Connections

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | |
|---|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK3-EG** | **PK3-ES** | **PK3-BF** | **PK3-PL.3** | **PK3-TL.3** | **PK3-EF** | **Justification** |
| **Representativeness** | **1** | **1** | **1** | **2** | **2** | **3** | |
| Typical structure and composition | 1 | 1 | 1 | 2 | 2 | 2 | BF, EG, ES, PL.3, TL.3: Habitats have been significantly modified by human activities. It's grouped as FUZ and Rural. |
| Indigenous representation | 1 | 1 | 1 | 2 | 2 | 3 | BF, EG: <10% of the species are indigenous. ES, PL.3, TL.3: 10-50% of the species are indigenous. |
| **Rarity/distinctiveness** | **1** | **2** | **1** | **2** | **2** | **3** | |
| Species of conservation significance | | | | | | | |
| Species (habitat) of conservation significance | 1 | 2 | 1 | 2 | 2 | 3 | Mixed planted species value score 2 |
| Range restricted or endemic species | | | | | | | |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | |
|---|---|---|---|---|---|---|---|
| Distinctive ecological values | | | | | | | |
| **Diversity and pattern** | **1** | **1** | **1** | **1** | **2** | **2** | |
| Habitat diversity | 1 | 1 | 1 | 1 | 1 | 2 | Mixed native/exotic plantings value score 1 |
| Species diversity | | | | | 1 | | |
| Patterns in habitat use | | | | | 2 | | |
| **Ecological context** | **0** | **2** | **0** | **2** | **3** | **3** | |
| Size, shape and buffering | | | | | 1 | **3** | WF7 represent >20% of original habitat type value score 4<br>EF represent >10-20% of original habitat type value score 3<br>ES, PL.3, TL.3, create buffering around permanent stream TL.1 and PL.1 represent <10% of original habitat type value score 2 |
| Sensitivity to change | | | | | 1 | | |
| Ecological networks (linkages, pathways, migration) | | 2 | | 2 | 3 | 3 | All habitats (excluding BF) are locally an important breeding and feeding link in terms of connectivity for the survival of species (e.g. native birds).<br><br>Planted shrubs and aged woody structure (PL.3 and TL.3) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats. |
| Protected status | | | | | | | |
| Sum | 3 | 6 | 3 | 7 | 9 | 11 | |
| **Combined value** | Negligible | Low | Negligible | Low | Moderate | Moderate | |

## 6.4 NoR 4 - Pukekohe North-East Arterial

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK4-EG** | **PK 4-ES** | **PK4-MF4** | **PK4-EF** | **PK4-EF.1** | **PK4-PL.1** | **PK4 - PL3** | **PK4-TL.1** | **PK4-TL.3** | **PK4-WF9** | **PK4_ WF8** | **PK4-BF** | **PK4-WF7** | **Justification** |
| **Representativeness** | **1** | **2** | **4** | **3** | **3** | **3** | **2** | **3** | **2** | **4** | **4** | **1** | **4** | |
| Typical structure and composition | 1 | 2 | 4 | 3 | 3 | 3 | 2 | 3 | 2 | 4 | 4 | 1 | 3 | BF, EG, ES, PL.3, TL.3: Habitats have been significantly modified by human activities. It's grouped as FUZ and Rural. |
| Indigenous representation | 1 | 1 | 4 | 2 | 3 | 3 | 2 | 3 | 2 | 4 | 4 | 1 | 4 | EG: <10% of the species are indigenous.<br>ES, PL.3, TL.3: 10-50% of the species are indigenous.<br>PL.1, TL.1, WF9, EF.1, EF, MF4, WF9, WF8 >50% of the species are indigenous. |
| **Rarity/distinctiveness** | **0** | **2** | **4** | **2** | **2** | **2** | **2** | **3** | **2** | **3** | **4** | **1** | **4** | |
| Species of conservation significance | | | | | | | | | | | | | | |
| Species (habitat) of conservation significance | | 2 | 4 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 4 | 1 | 4 | MF4 Kahikatea forest, WF8, Kahikatea, Pukatea forest, Critically Endangered, value score 4<br>WF9 Taraire, tawa, podocarp forest Endangered, value score 3<br>Native terrestrial species, value score 4 |
| Range restricted or endemic species | | | | | | | | | | | | | | |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Distinctive ecological values | | | 3 | | | | | | | 2 | 3 | | 3 | At regional scale MF4, WF8, value score 3 and WF9 at catchment level, value score 2, provide distinctive ecological value for wide range of species. |
| **Diversity and pattern** | **1** | **2** | **3** | **2** | **2** | **2** | **1** | **2** | **2** | **3** | **3** | **0** | **3** | |
| Habitat diversity | 1 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 3 | | 3 | Indigenous terrestrial forests value score 3<br>PL.1 and TL.1 value score 2<br>Mixed native/exotic plantings value score 1 |
| Species diversity | | | | | | | | | | | | | | |
| Patterns in habitat use | | | 3 | | | | | | 2 | 3 | 3 | | 3 | WF8, WF9 and MF4 supports a diverse range of invertebrates, amphibians, reptiles, birds and bats. |
| **Ecological context** | **0** | **0** | **3** | **3** | **3** | **3** | **2** | **3** | **3** | **3** | **3** | **0** | **4** | |
| Size, shape and buffering | | | 3 | 3 | 3 | 2 | | 2 | | 3 | 3 | | 4 | WF8, WF9, MF4 represent >20% of original habitat type value score 4<br>EF and EF.1 represent >10-20% of original habitat type value score 3<br>TL.1 and PL.1 represent <10% of original habitat type value score 2 |
| Sensitivity to change | | | | | | | | | | | | | 2 | |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ecological networks (linkages, pathways, migration) | | | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | | 3 | All habitats (excluding BF) are locally an important breeding and feeding link in terms of connectivity for the survival of species (e.g. native birds).<br><br>Planted shrubs and aged woody structure (PL.3 and TL.1 TL.3, EF) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and TAR bird species such as Kaka and NZ falcon. |
| Protected status | | | | | | | | | | | | | | Auckland Indigenous terrestrial forests categorised WF8, WF9, MF4 as Regional Critical Endangered. |
| Sum | 2 | 6 | 14 | 10 | 10 | 10 | 7 | 11 | 9 | 13 | 14 | 2 | 15 | |
| **Combined value** | Negligible | Low | High | Moderate | Moderate | Moderate | Low | Moderate | Moderate | High | High | Negligible | High | |

## 6.5 NoR 5 - Pukekohe South-East Arterial

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK5-EG** | **PK5-ES** | **PK5-BF** | **PK5-PL.1** | **PK5-PL3** | **PK5-TL.1** | **PK5-TL.3** | **Justification** |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Representativeness** | **1** | **2** | **1** | **3** | **2** | **3** | **2** | |
| Typical structure and composition | 1 | 1 | 1 | 3 | 2 | 3 | 2 | |
| Indigenous representation | 1 | 2 | 1 | 3 | 2 | 3 | 2 | EG: <10% of the species are indigenous.<br>ES, PL.3, TL.3: 10-50% of the species are indigenous.<br>PL.1, TL.1>50% of the species are indigenous. |
| **Rarity/distinctiveness** | **1** | **1** | **1** | **3** | **2** | **3** | **2** | |
| Species of conservation significance | | | | | | | | |
| Species (habitat) of conservation significance | 1 | 1 | 1 | 3 | 2 | 3 | 2 | Native plant species (PL.1 and TL.1), such as Nikau, Mamaku, Pohutukawa, Black Matipo, value score 3<br>Mixed native and exotic plantings (PL.3 and TL.3) value score 2 |
| Range restricted or endemic species | | | | | | | | |
| Distinctive ecological values | | | | | | | | |
| **Diversity and pattern** | **0** | **0** | **0** | **2** | **1** | **2** | **2** | |
| Habitat diversity | | | | 2 | 1 | 2 | 1 | PL.1 and TL.1 value score 2<br>Mixed native/exotic plantings value score 1 |
| Species diversity | | | | | | | | |
| Patterns in habitat use | | | | | | 2 | 2 | |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Ecological context** | **0** | **2** | **0** | **2** | **2** | **3** | **3** | |
| Size, shape and buffering | | 1 | | 2 | | 2 | | TL.1 and PL.1 represent <10% of original habitat type value score 2 |
| Sensitivity to change | | | | | | | | |
| Ecological networks (linkages, pathways, migration) | | 2 | | 2 | 2 | 3 | 3 | All habitats (excluding BF) are locally an important breeding and feeding link in terms of connectivity for the survival of species (e.g. native birds).<br><br>Planted shrubs and aged woody structure (PL.1,PL.3 and TL.1, TL.3) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and TAR bird species such as Kaka and NZ falcon. |
| Protected status | | | | | | | | |
| Sum | 2 | 5 | 2 | 10 | 7 | 11 | 9 | |
| **Combined value** | Negligible | Low | Negligible | Moderate | Low | Moderate | Moderate | |

## 6.6 NoR 7 - Pukekohe North-West Arterial

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | |
|---|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK7-EG** | **PK7-ES** | **PK7-BF** | **PK7-PL3** | **PK7-TL.1** | **PK7-TL.3** | **Justification** |
| **Representativeness** | **1** | **2** | **1** | **2** | **3** | **2** | |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | |
|---|---|---|---|---|---|---|---|
| Typical structure and composition | 1 | 1 | 1 | 2 | 3 | 2 | |
| Indigenous representation | 1 | 2 | 1 | 2 | 3 | 2 | EG: <10% of the species are indigenous.<br>ES, PL.3, TL.3: 10-50% of the species are indigenous.<br>PL.1, TL.1>50% of the species are indigenous. |
| **Rarity/distinctiveness** | **1** | **1** | **1** | **2** | **3** | **2** | |
| Species of conservation significance | | | | | | | |
| Species (habitat) of conservation significance | 1 | 1 | 1 | 2 | 3 | 2 | Native plant species (TL.1), such as Puriri, Pohutukawa, Totara value score 3<br>Mixed native and exotic plantings (PL.3 and TL.3) value score 2 |
| Range restricted or endemic species | | | | | | | |
| Distinctive ecological values | | | | | | | |
| **Diversity and pattern** | **0** | **1** | **0** | **1** | **2** | **2** | |
| Habitat diversity | | 1 | | 1 | 2 | 1 | PL.1 and TL.1 value score 2<br>Mixed native/exotic plantings value score 1 |
| Species diversity | | | | | | | |
| Patterns in habitat use | | | | | | 2 | |
| **Ecological context** | **1** | **1** | **1** | **2** | **2** | **3** | |
| Size, shape and buffering | 1 | 1 | 1 | 1 | 2 | 1 | TL.1 represent <10% of original habitat type value score 2 |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | |
|---|---|---|---|---|---|---|---|
| Sensitivity to change | | | | | | 1 | |
| Ecological networks (linkages, pathways, migration) | | | | 2 | 2 | 3 | All habitats (excluding BF) are locally an important breeding and feeding link in terms of connectivity for the survival of species (e.g. native birds).<br><br>Planted shrubs and aged woody structure (PL.3 and TL.1 TL.3, EF) increase stepping stone value (connecting other areas of ecological value) for long-tailed bats and TAR bird species such as Kaka and NZ falcon. |
| Protected status | | | | | | | |
| Sum | 3 | 5 | 3 | 7 | 10 | 9 | |
| **Combined value** | Negligible | Low | Negligible | Low | Moderate | Moderate | |

## 6.7 NoR 8 - Mill Road and Pukekohe East Road Upgrade

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK8-EG** | **PK8 -ES** | **PK8-BF** | **PK8-PL.1** | **PK8-PL3** | **PK8-TL.1** | **PK8-TL.2** | **PK8-TL.3** | **PK8-VS5** | **PK8-WF9** | **Justification** |
| **Representativeness** | **1** | **2** | **1** | **3** | **2** | **3** | **3** | **2** | **3** | **4** | |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Typical structure and composition | 1 | 1 | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 4 | BF, EG, ES, PL.3, TL.3: Habitats have been significantly modified by human activities. It's grouped as FUZ and Rural - Mixed Rural zone. |
| Indigenous representation | 1 | 2 | 1 | 3 | 2 | 3 | 3 | 2 | 3 | 4 | EG: <10% of the species are indigenous.<br>ES, PL.3, TL.3: 10-50% of the species are indigenous.<br>PL.1, TL.2, TL.1, WF9,VS5>50% of the species are indigenous. |
| **Rarity/distinctiveness** | **1** | **1** | **1** | **3** | **2** | **3** | **3** | **2** | **3** | **4** | |
| Species of conservation significance | | | | | | | | | | | |
| Species (habitat) of conservation significance | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 2 | 3 | 4 | WF9 Taraire, tawa, podocarp forest Endangered, value score 4<br>Native terrestrial species (TL.1, TL.2, TL.3, VS5), value score 3<br>Mixed native/exotic plantings (TL.3 and PL.3) value score 2<br><br>One small patch of WF9 falls within Waikato Region, 52 Mill Road. |
| Range restricted or endemic species | | | | | | | | | | | |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Distinctive ecological values | | | | | | | | | 2 | 3 | WF9 with regional endangered conservation status value score 3 at regional level. VS5 with least concern at regional level but provide distinctive ecological value at catchment level, value score 2. |
| **Diversity and pattern** | **1** | **1** | **1** | **2** | **1** | **2** | **2** | **2** | **3** | **3** | |
| Habitat diversity | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 3 | 3 | Indigenous terrestrial forests value score 3<br>PL.1 and TL.1 value score 2<br>Mixed native/exotic plantings value score 1 |
| Species diversity | | | | | | | | | | | |
| Patterns in habitat use | | | | | | | | 2 | 3 | 3 | WF9n VS5 supports a diverse range of invertebrates, amphibians, reptiles, birds and bats. |
| **Ecological context** | **0** | **2** | **0** | **2** | **2** | **2** | **3** | **3** | **0** | **3** | |
| Size, shape and buffering | | 1 | | 2 | | 2 | 2 | 1 | | 3 | |
| Sensitivity to change | | | | 2 | | 2 | 2 | 1 | | | |
| Ecological networks (linkages, pathways, migration) | | 2 | | 2 | 2 | 2 | 3 | 3 | | | |
| Protected status | | | | | | | | | | | Auckland Indigenous terrestrial forests categorised WF9 and VS5 as Regional Critical Endangered. It is not mapped in Auckland Council geomap and not protected. It's artificially planted. |

| Terrestrial | Habitat, Vegetation Units or Species | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sum | 3 | 6 | 3 | 10 | 7 | 10 | 11 | 9 | 9 | 14 | |
| **Combined value** | Negligibl e | Low | Negligibl e | Moderat e | Low | Moderat e | Moderat e | Moderat e | Moderat e | High | |

TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Appendix 7

## Pukekohe Bat Survey Report

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

## Document Status

| Responsibility | Name |
|---|---|
| Author | Dannie Cullen |
| Reviewer | Ian Bredin/Fiona Davies |
| Approver | Helen Hicks |

# Table of Contents



# Appendices



# Table of Figures

# Table of Tables

# Introduction

## Background

As part of the Supporting Growth Programme, Te Tupu Ngātahi Supporting Growth (SG) is preparing eight Notices of Requirement (NoRs), on behalf of Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT) as requiring authorities, to designate land for the Pukekohe Transport Network, under the Resource Management Act 1991 (RMA). The Pukekohe Transport Network (including all associated NoRs) are hereinafter referred to as the 'Project'.

The Project comprises eight NoRs through Pukekohe, Paerata, and Drury. An overview of the Project is provided in Figure 0-1 below.

This report should be read alongside the Assessment of Effects on the Environment and the Assessment of Ecological Effects reports, which contain further details on the history and context of the Project.

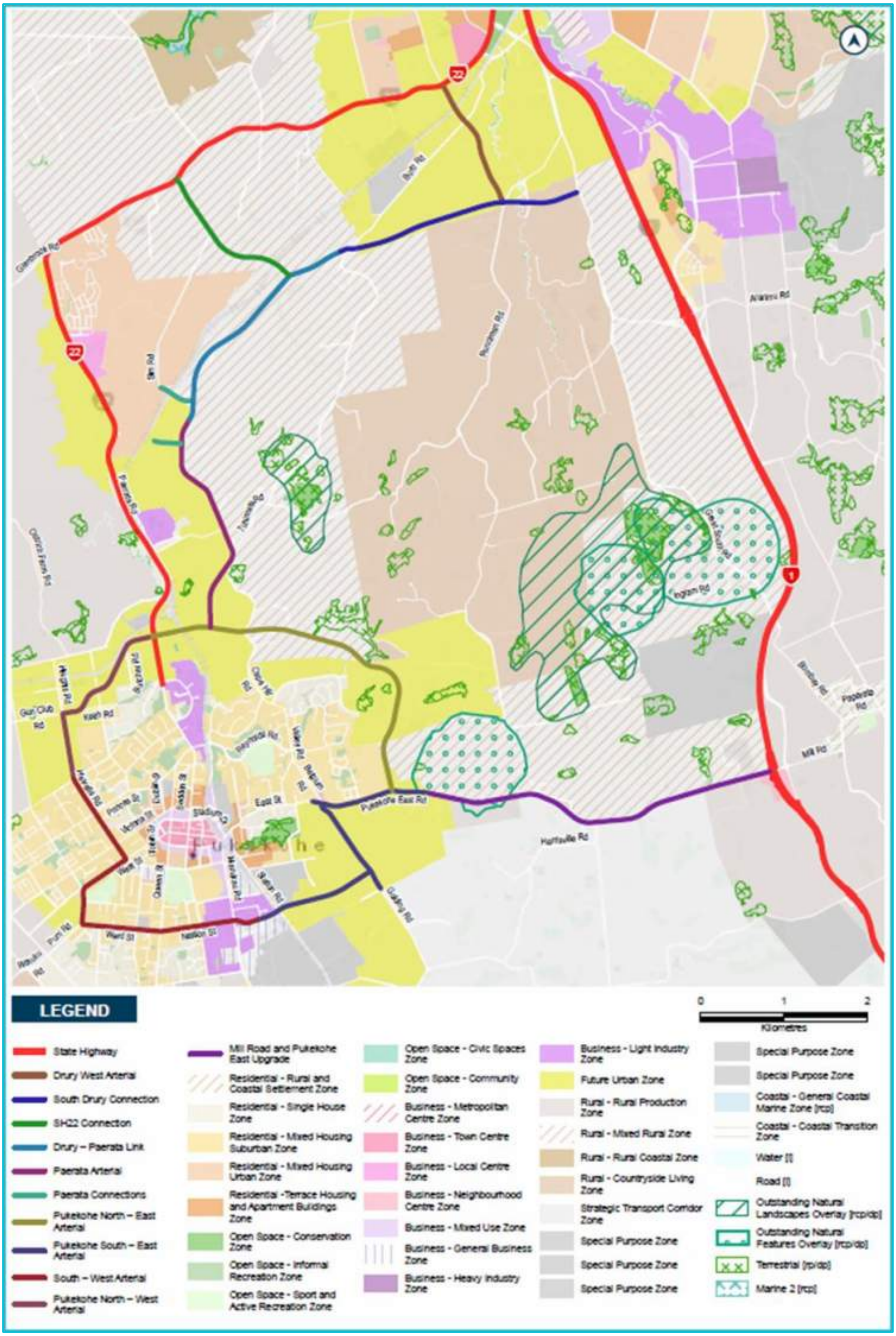



Figure 0-1 Pukekohe Transport Network Overview

# Acoustic Monitoring

Long-tailed bats (pekapeka) (*Chalinolobus tuberculatus*) are considered ‘Threatened – Nationally Critical’ (O’Donnell *et al.,* 2018) and are known to be present within the Pukekohe area (Department of Conservation (DOC), 2022; Clarke, 2022; Clarke, 2023). In order to gain an understanding of the habitat features that are of value to long-tailed bats within the Project Zone of Influence, acoustic monitoring for bats was undertaken at an areawide level in January and then again April/May 2023.

# Methodology

## Acoustic Monitoring

Automatic Bat Monitors (ABM)s (Song Meter SM4BAT-FS Ultrasonic Bat Detectors with SMM-U2 microphones) were deployed across the Project area. ABMs were deployed in two separate survey sessions. The first (January/February 2023) was completed within the bat maternity period (December - February) and the second (April/May 2023) within the bat mating season (March - May). The intent of surveying in two sessions was to cover any potential changes in bat activity patterns between the maternity and mating seasons.

Once deployed, ABMs were pre-set to start recording 60 minutes before sunset, and cease recording 60 minutes after sunrise (a 'night'). Each ABM was left in-situ for at-least 14 nights with suitable weather conditions (O'Donnell & Sedgeley, 2001). Suitable weather conditions for ABM surveys have been defined by Department of Conservation (2021) as:

- Temperature 10°C or greater for the first four hours after official sunset time for the North Island.
- Precipitation < 2.5 mm in the first 2 hours after official sunset, and < 5 mm in the first 4 hours after official sunset.

### January/February 2023 Survey

ABMs were placed in a network within habitats that would be affected by the Project and would provide suitable habitat for bat roosting, foraging, and commuting. Specifically, pre-determined survey locations were selected based on the current understanding of habitats that are favoured by bats, existing bat records (DOC, 2022), and a heat map produced by Auckland Council (Crewther, 2016). Pre-determined survey locations were limited by access to private property as detailed further in Section 0.

A total of 24 ABMs were left in-situ during the period 19 January 2023 until 9 February 2023. The locations of the January/February 2023 survey sites are detailed in Table 0-1 and presented in Figure 0-1.

**Table 0-1 January 2023 ABM survey locations**

| Site | Latitude (Y) | Longitude (X) |
|---|---|---|
| Jan #1 | -37.19603 | 174.95275 |
| Jan #2 | -37.19521 | 174.97327 |
| Jan #3 | -37.19482 | 174.97194 |
| Jan #4 | -37.18587 | 174.95609 |
| Jan #5 | -37.19016 | 174.92371 |
| Jan #6 | -37.18773 | 174.93013 |
| Jan #7 | -37.20201 | 174.92631 |

| Site | Latitude (Y) | Longitude (X) |
|---|---|---|
| Jan #8 | -37.20042 | 174.91738 |
| Jan #9 | -37.21674 | 174.90845 |
| Jan #10 | -37.20187 | 174.88940 |
| Jan #11 | -37.18589 | 174.89671 |
| Jan #12 | -37.18663 | 174.90512 |
| Jan #13 | -37.17854 | 174.90158 |
| Jan #14 | -37.16861 | 174.89441 |
| Jan #15 | -37.15237 | 174.90092 |
| Jan #16 | -37.14683 | 174.90676 |
| Jan #17 | -37.16425 | 174.91748 |
| Jan #18 | -37.17780 | 174.89457 |
| Jan #19 | -37.13260 | 174.94662 |
| Jan #20 | -37.12851 | 174.94339 |
| Jan #21 | -37.11224 | 174.94362 |
| Jan #22 | -37.13062 | 174.94967 |
| Jan #23 | -37.13018 | 174.94647 |
| Jan #24 | -37.11580 | 174.94423 |

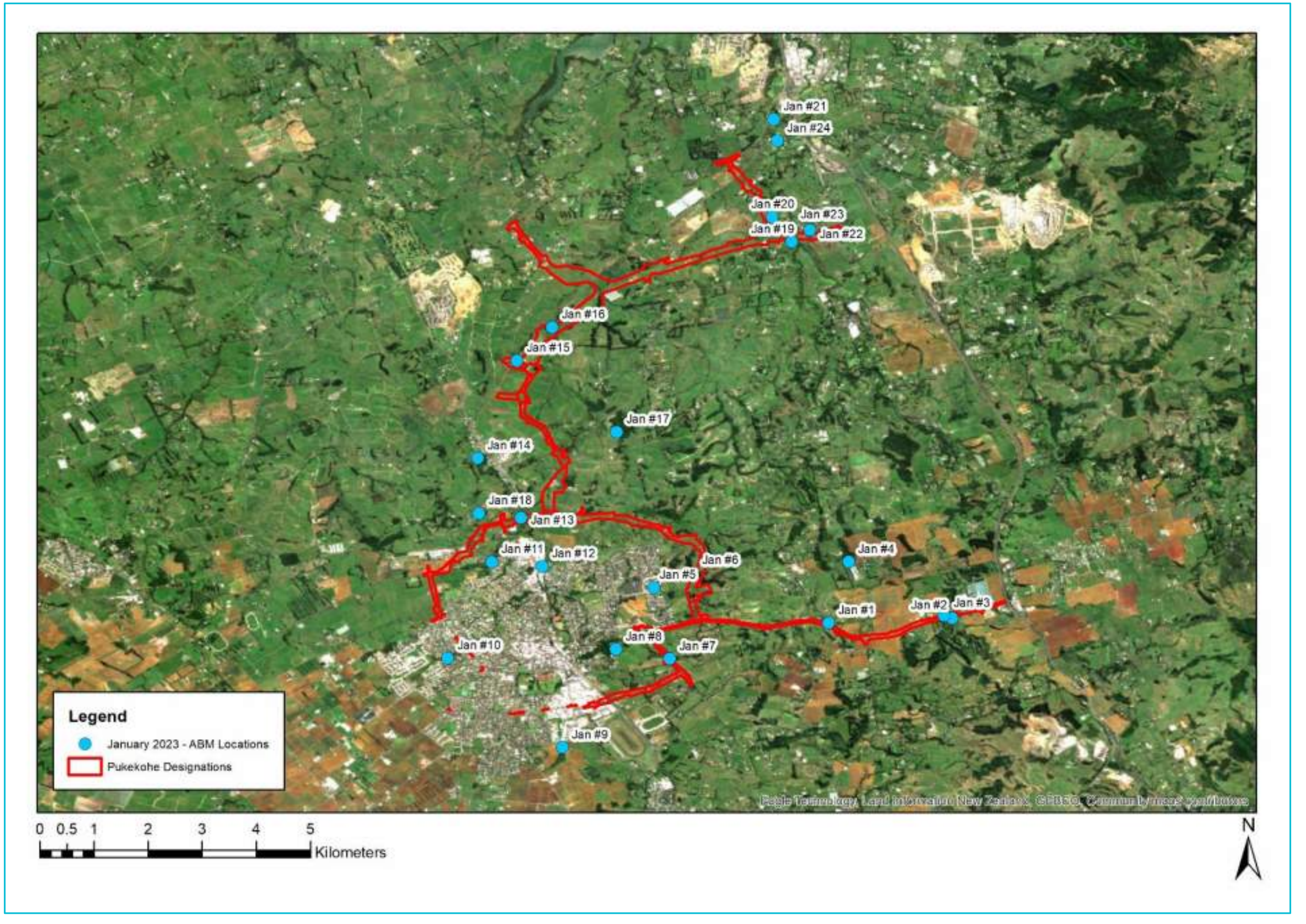



Figure 0-1 ABM locations (January/February 2023 survey)

## April/May 2023 Survey

Due to improved access to private property, the April/May 2023 survey focused on areas that were inaccessible during the first survey, including locations that were specific to the stream and river corridors associated with each NoR.

A total of 26 ABMs were left in-situ from 17 April 2023 until 7 May 2023. The locations of the April/May 2023 survey sites are detailed in Table 0-2 and presented in Figure 0-2. Some ABM locations from the first survey were repeated/within proximity to the first survey locations.

**Table 0-2 April/May 2023 ABM survey locations**

| Site | Latitude (Y) | Longitude (X) |
|---|---|---|
| Apr #1 | -37.19373 | 174.97394 |
| Apr #2 | -37.19491 | 174.97364 |
| Apr #3 | -37.19614 | 174.95202 |
| Apr #4 | -37.20190 | 174.92593 |
| Apr #5 | -37.20920 | 174.91618 |
| Apr #6 | -37.20221 | 174.88817 |
| Apr #7 | -37.18773 | 174.88802 |
| Apr #8 | -37.18268 | 174.89376 |
| Apr #9 | -37.18000 | 174.89618 |
| Apr #10 | -37.17852 | 174.90155 |
| Apr #11 | -37.17807 | 174.91158 |
| Apr #12 | -37.17731 | 174.91470 |
| Apr #13 | -37.18163 | 174.92688 |
| Apr #14 | -37.18844 | 174.93133 |
| Apr #15 | -37.18728 | 174.93131 |
| Apr #16 | -37.19129 | 174.93151 |
| Apr #17 | -37.15831 | 174.90240 |
| Apr #18 | -37.15234 | 174.90098 |
| Apr #19 | -37.14681 | 174.90673 |
| Apr #20 | -37.13908 | 174.92265 |
| Apr #21 | -37.13756 | 174.91096 |
| Apr #22 | -37.13236 | 174.90279 |

| Site | Latitude (Y) | Longitude (X) |
|---|---|---|
| Apr #23 | -37.13130 | 174.94625 |
| Apr #24 | -37.13110 | 174.95022 |
| Apr #25 | -37.12587 | 174.94179 |
| Apr #26 | -37.12870 | 174.94335 |

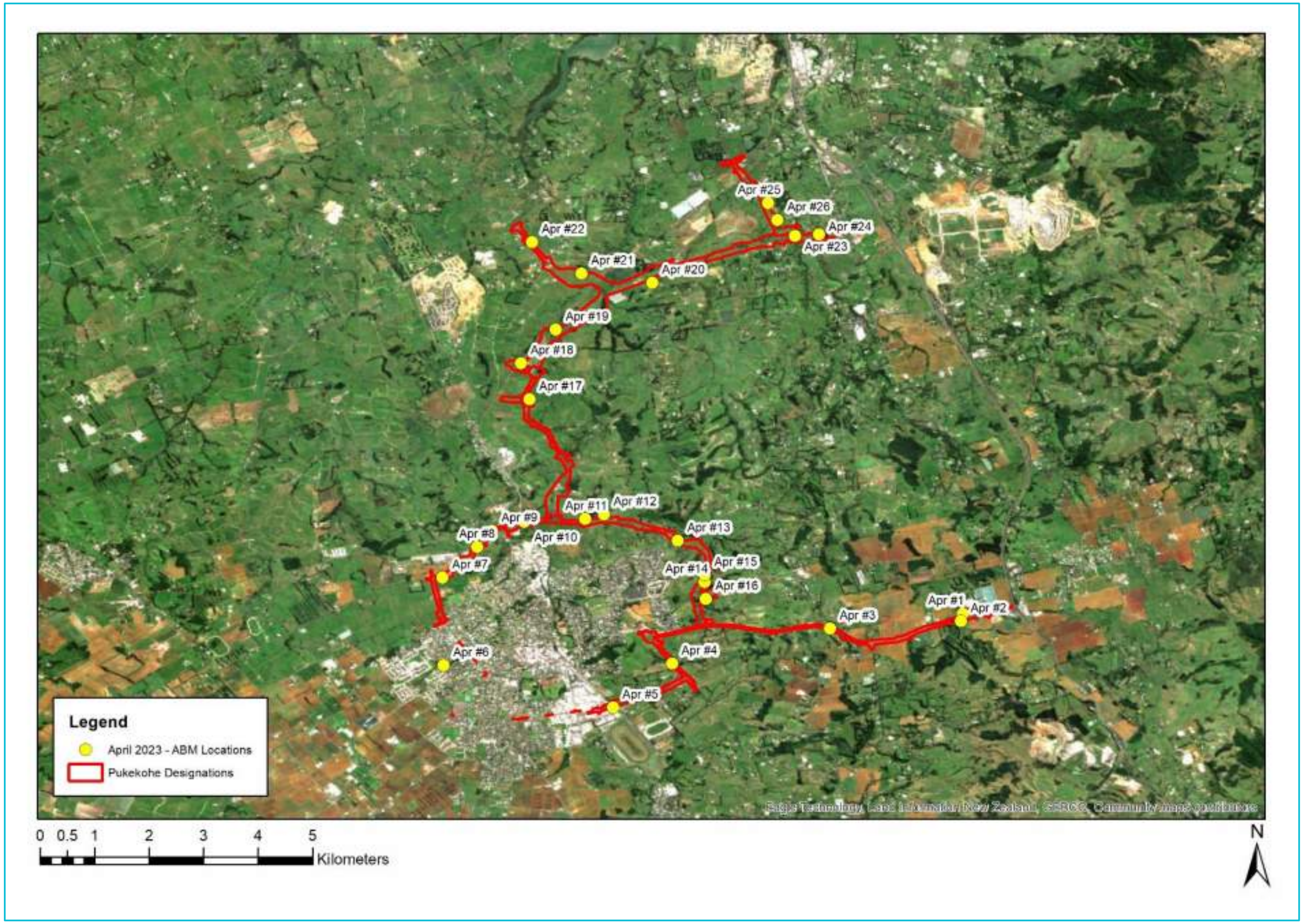



Figure 0-2 ABM locations (April 2023 survey)

# Data Analysis

## 1.1.1 Long-tailed bat detection and behaviour

The ABM recordings were analysed by an experienced ecologist using Kaleidoscope Pro Analysis[1] software. Confirmed bat recordings (several bat echolocation calls recorded in a sound file) were further classified into:

- Echolocation calls i.e., regularly-spaced calls;
- Echolocation calls with foraging calls (feeding buzzes); and
- Echolocation calls with social calls.

The ABM data was removed from the analysis of trends if there was instrument error or weather conditions overnight were suboptimal for bat activity. Weather data for the survey period was provided by the nearest NIWA CliFlo weather station with relevant data available (Pukekohe Ews, Agent 2006)[2] and the weather conditions during this period are included in Appendix 1.

## 1.1.2 First and Last Bat Pass

A review of the ABM data was undertaken to determine when the first and last bat pass was detected in comparison with sunset or sunrise time (data collected from the Time and Date website[3]). The purpose of this analysis was to gain an understanding as to whether bats could potentially be roosting in close proximity to an ABM site. Griffiths (2007) found that long-tailed bats emerged on average 30.1 ± 1.5 minutes after sunset and between January – February bats returned to their roost just before sunrise. However, by March bats were observed to be returning earlier to their roosts and by the end of May they returned as early as 40 minutes after emerging.

The following information was reviewed:

- Percentage of nights at each site where first/last bat pass is recorded within 30 minutes of sunset/sunrise;
- First and last bat pass recorded at each site during the survey period; and
- Minimum time difference between sunset/sunrise and the first/last bat pass.

[1] https://www.wildlifeacoustics.com/download/kaleidoscope-software.
[2] https://cliflo.niwa.co.nz/
[3] https://www.timeanddate.com

# Results

## January 2023

Table 0-1 and Figure 0-1 present the overall results of the bat surveys completed for the Pukekohe Transport Network during the January/February 2023 survey. Raw survey data is included in Appendix 2.

Five of the 24 ABM sites (January sites #9, #14, #15, #16, and #17) detected bat activity during the survey period. The site with the greatest number of bat passes was Jan #17 with 283 bat passes recorded during the survey (Figure 0-2). At site Jan #17, 65 of these bat passes were classified as foraging calls, and no foraging calls were recorded at the other sites. Additionally, no social calls were recorded at any of the sites.

Bat passes were recorded within 30 minutes of sunset at site Jan #17, with 33% of nights recording a first bat pass within 30 minutes of sunset (Appendix 3). No other sites recorded bat passes within 30 minutes of sunset or sunrise. The lowest minimum time difference between sunset and first bat pass was at site Jan #17, with a time of 13 minutes. The site with the lowest minimum time difference between sunrise and last bat pass was at also at site Apr #17, with a time of 34 minutes.

**Table 0-1 January 2023 survey results of sites with bat activity**

| Site | Total Number of Echolocation Calls[4] | Total Number of Foraging Calls | Total Number of Social Calls |
|---|---|---|---|
| Jan #9 | 1 | 0 | 0 |
| Jan #14 | 17 | 0 | 0 |
| Jan #15 | 1 | 0 | 0 |
| Jan #16 | 2 | 0 | 0 |
| Jan #17 | 283 | 65 | 0 |

[4] Total number of echolocation calls includes foraging and social calls.

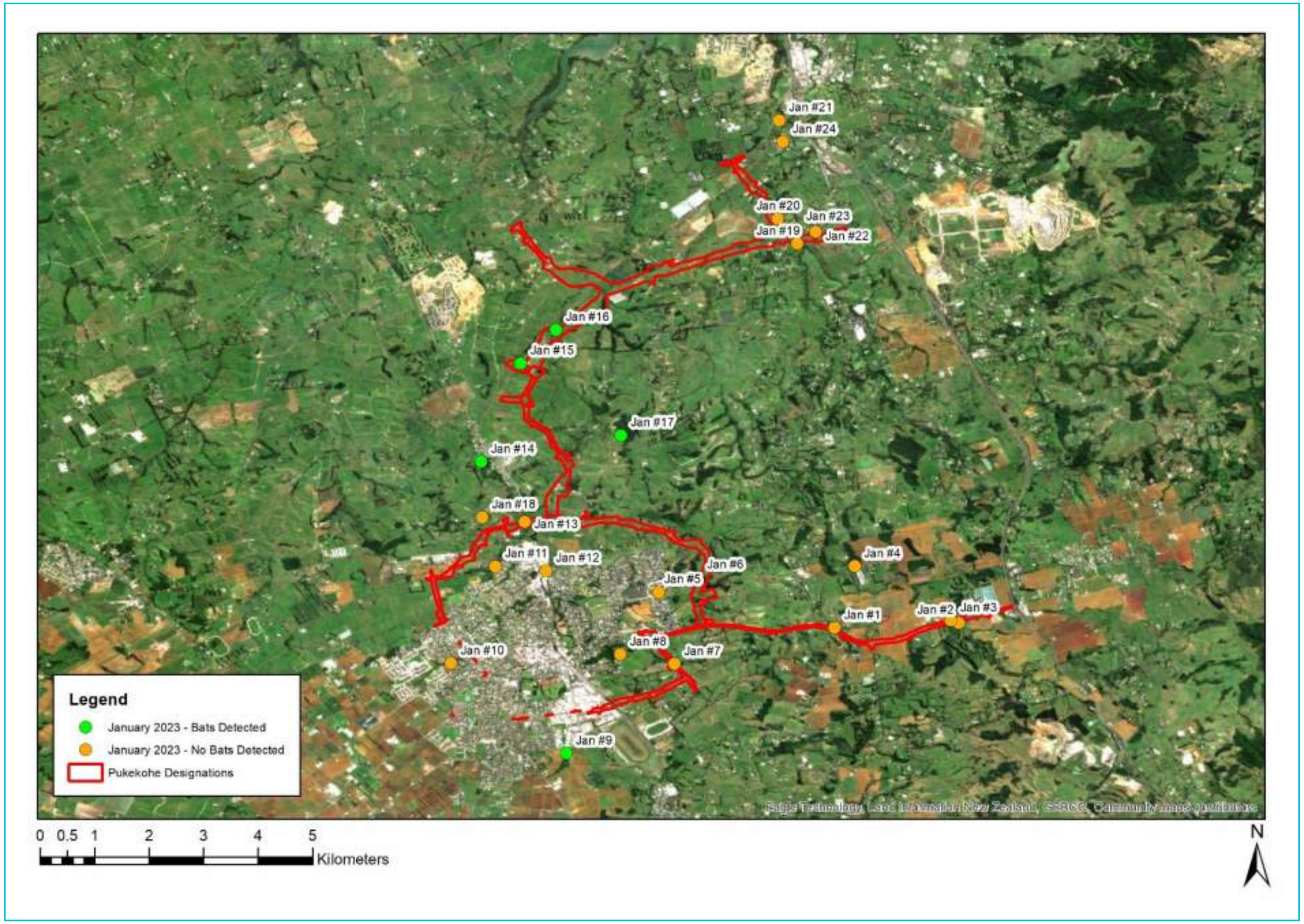



Figure 0-1 Long-tailed bat presence/absence (January 2023 survey)

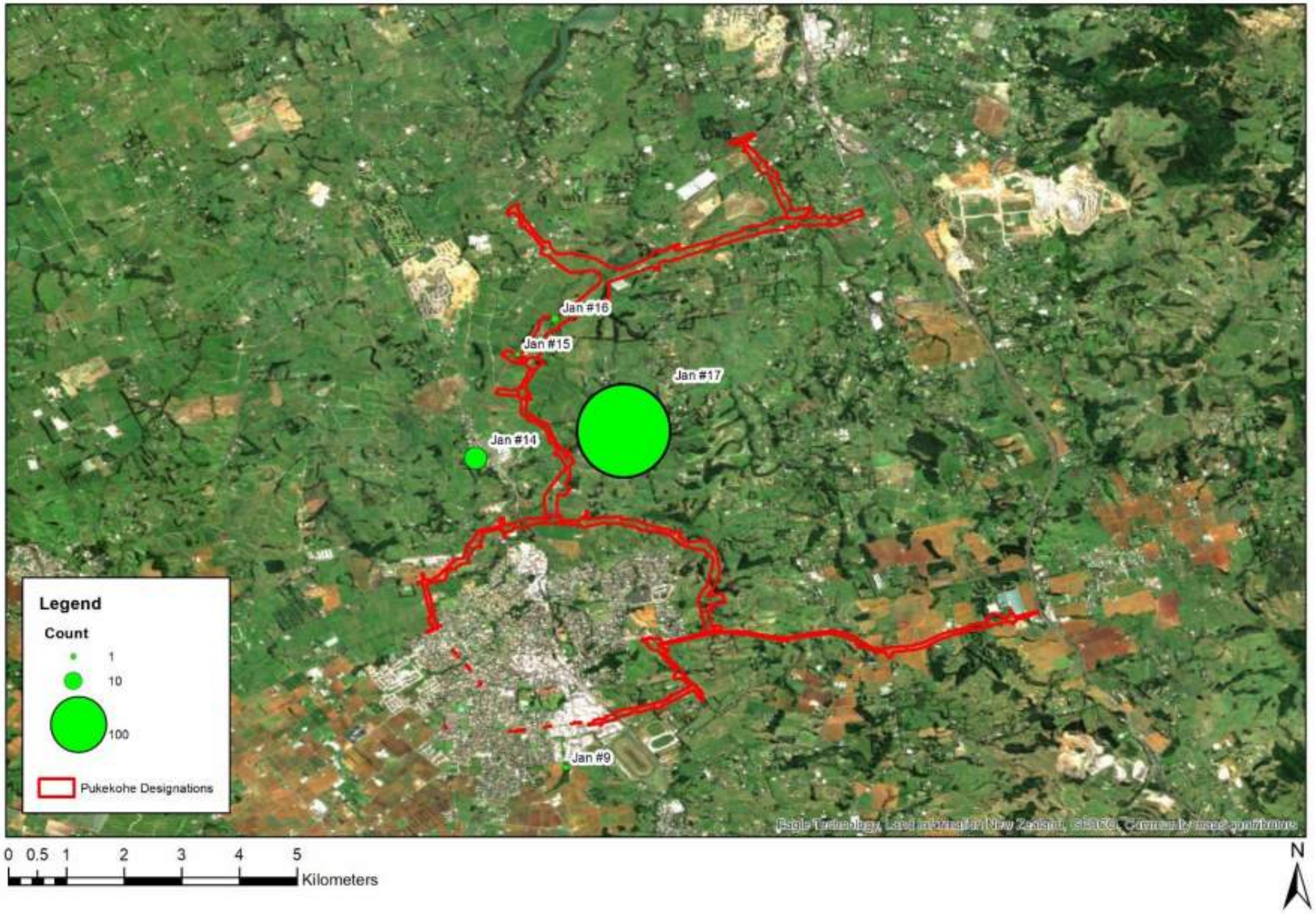



**Figure 0-2 Sites with confirmed long-tailed bat presence (January 2023 survey). Proportional symbology indicates the relative proportion of bat passes in relation to the site with the highest number of bat passes (Jan #17).**

## April/May 2023

Table 0-2 and Figure 0-3 present the overall results of the bat surveys completed for the Pukekohe Transport Network during the April 2023 survey. Raw survey data is included in Appendix 2.

A total of nine of the 26 ABM sites detected bat activity during the survey period (April sites #2, #7, #10, #13, and #16 to #20). The site with the greatest number of bat passes was Apr #20 with 173 bat passes recorded during the survey (Figure 0-4). At site Apr #20, one of these bat passes was classified as a foraging call, and no foraging calls were recorded at the other sites. Additionally, no social calls were recorded at any of the sites.

No bat passes were recorded within 30 minutes of sunset or sunrise (Appendix 3). The site with the lowest minimum time difference between sunset and first bat pass was at site Apr #18, with a time of 33 minutes. The site with the lowest minimum time difference between sunrise and last bat pass was at site Apr #17, with a time of 1 hour 14 minutes.

**Table 0-2 April 2023 survey results of sites with bat activity**

| Site | Total Number of Echolocation Calls[5] | Total Number of Foraging Calls | Total Number of Social Calls |
|---|---|---|---|
| Apr #2 | 1 | 0 | 0 |
| Apr #7 | 1 | 0 | 0 |
| Apr #10 | 2 | 0 | 0 |
| Apr #13 | 1 | 0 | 0 |
| Apr #16 | 1 | 0 | 0 |
| Apr #17 | 5 | 0 | 0 |
| Apr #18 | 3 | 0 | 0 |
| Apr #19 | 54 | 0 | 0 |
| Apr #20 | 173 | 1 | 0 |

[5] Total number of echolocation calls includes foraging and social calls.

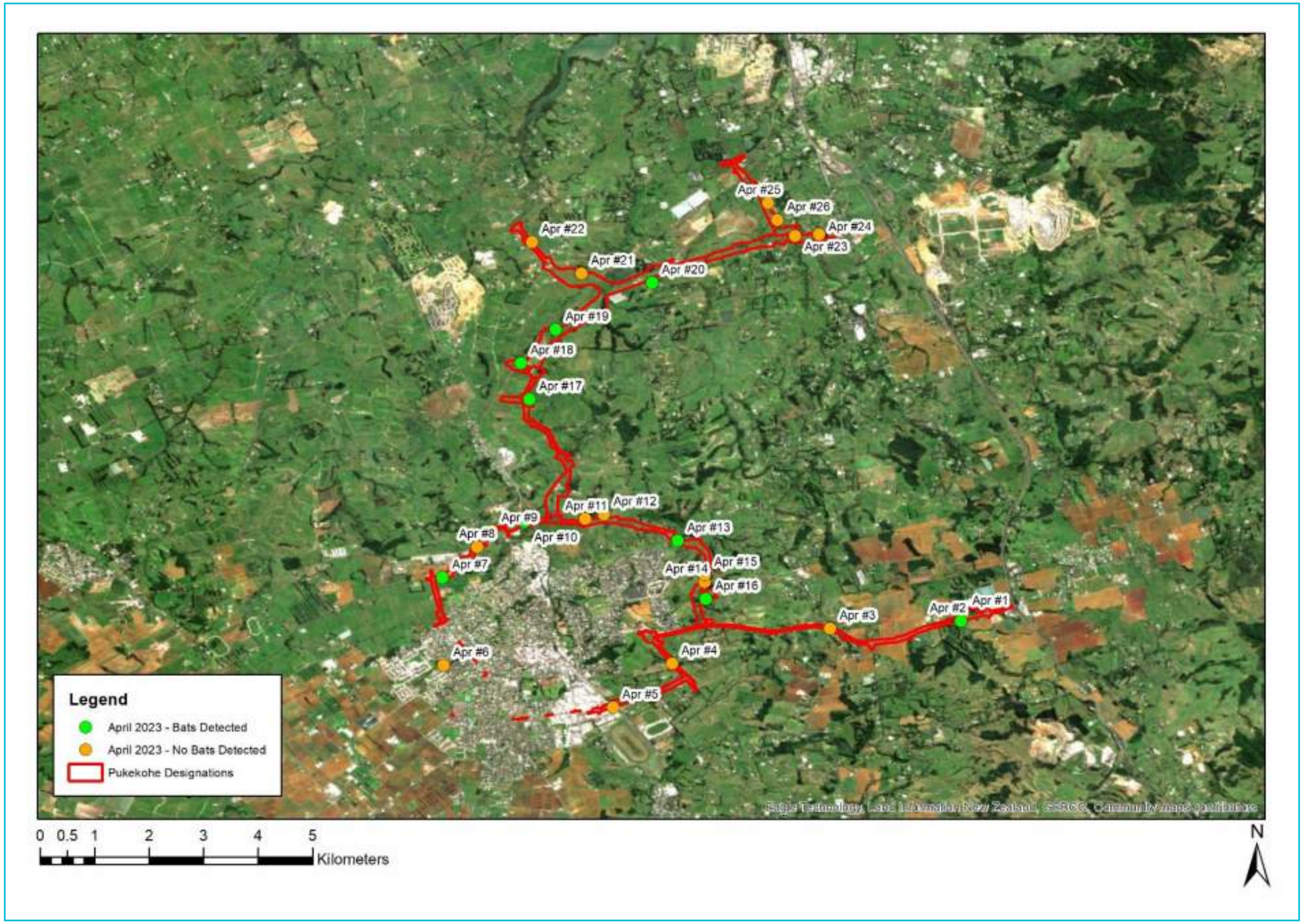



**Figure 0-3 Long-tailed bat presence/absence (April 2023 survey)**

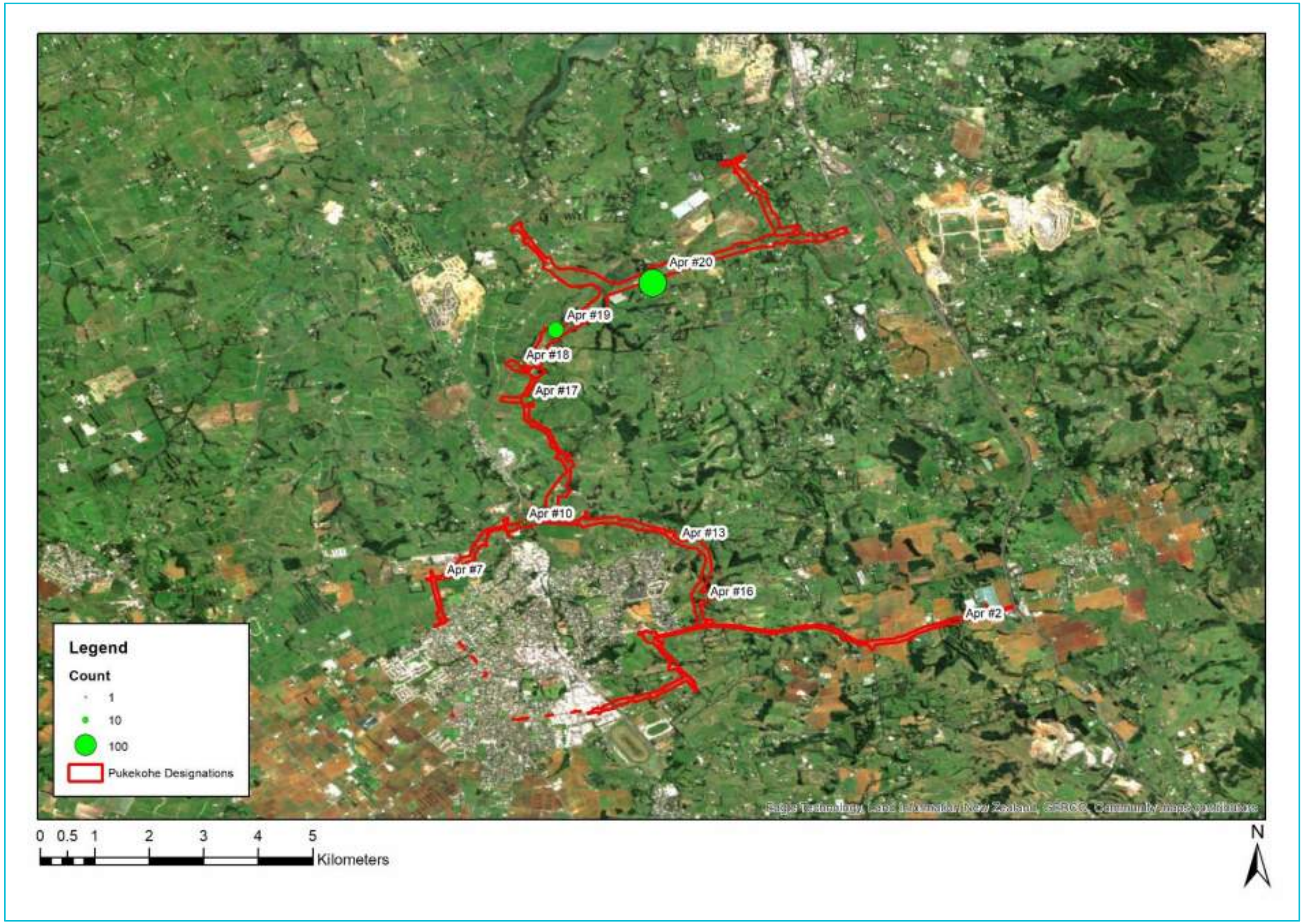



**Figure 0-4 Sites with confirmed long-tailed bat presence (April 2023 survey). Proportional symbology indicates the relative proportion of bat passes in relation to the site with the highest number of bat passes (Apr #20).**

## Survey Limitations

Some survey locations were limited by access to private property. If access was not available for a pre-determined survey location, then an alternative survey location as close as possible to the original survey site was used.

Instrument error was recorded during both the January/February 2023 and April/May 2023 surveys. An overview of when and where instrument error occurred is included in Appendix 2.

# Conclusion

Both the January 2023 and April 2023 surveys found evidence of long-tailed bat presence in the Project area. Bats were observed to be most active during the January/February 2023 survey (bat maternity period) with a mean number of 16.65 bat passes per night recorded at site #17. During the April/May 2023 survey, the mean number of bat passes per night was lower (with the highest mean number of 9.11 bat passes per night recorded at site #20), however bats were detected at more sites (nine sites during the April/May 2023 survey, and five sites during the January/February 2023 survey).

A total of 65 foraging calls were recorded during the January/February 2023 survey at site Jan #17, and one foraging call was recorded during the April/May 2023 survey at site Apr #20. Social calls were not recorded during either survey. Additionally, long-tailed bat activity was recorded at some sites during both surveys, these sites are presented in Table 0-1.

**Table 0-1 Sites where long-tailed bat activity was recorded during both surveys**

| January 2023 Site | April 2023 Site | Habitat Description |
|---|---|---|
| Jan #2 | Apr #2 | Located south of Mill Road, along Ngakoroa Stream, in an area of regenerating taraire, tawa, podocarp forest (WF9) and exotic scrub (ES). |
| Jan #15 | Apr #18 | Located approximately 20 metres east of the North Island Main Trunk (NIMT), in an area of exotic-dominated treeland (TL.3). |
| Jan #16 | Apr #19 | Located approximately 170 metres east of the NIMT, in an area of exotic-dominated treeland (TL.3) adjacent to a permanent stream. |

Analysis of the first and last bat pass suggests that there is potential for bat roosts to be present within the immediate vicinity of January/February site #17 (located in an area of native forest adjacent to Oira Creek in Coulthards Scenic Reserve).

The ABM surveys confirmed bat activity in NoR 2, 3, 4, 7, and 8. Using the information obtained from the surveys, the results support the findings of previous survey work (Clarke, 2022; Clarke, 2023) that bats are present, active and potentially roosting in the Pukekohe Transport Network Project area. They are likely to form part of a resident bat population that are roosting in forest remnants across the Franklin District.

# References

Clarke, D. 2023. Te rapu ngā pekapeka o Franklin Finding Franklin Bats. Second stakeholder report for summer 2022 – 2023 surveys. EcoQuest Education Foundation Te Rarangahau Taiao. Unpublished.

Clarke, D. 2022. Te rapu ngā pekapeka o Franklin Finding Franklin Bats. Stakeholder report for 2022. EcoQuest Education Foundation Te Rarangahau Taiao. Unpublished.

Crewther, K. 2016. Report on modelled distribution of long-tailed bats in the Auckland Region. Prepared for Auckland Council, April 2016.

Department of Conservation. (2021). Protocols for minimising the risk of felling bat roosts (Bat Roost Protocols (BRP)). Version 2.

Department of Conservation. (2022). Bioweb results for bats.

Griffiths (2007). Activity patterns of long-tailed bats (Chalinolobus tuberculatus) in a rural landscape, South Canterbury, New Zealand. New Zealand Journal of Zoology, 34(3), 247-258. DOI 10.1080/0301422070951008.

O'Donnell, C. F. J. & Sedgeley, J. A. (2001). Guidelines for surveying and monitoring long-tailed bat populations using line transects. DOC science internal series 12. New Zealand Department of Conservation.

O'Donnell, C. F. J., Borkin, K. M., Christie, J. E., Lloyd, B., Parsons, S. & Hitchmough, R. A. (2018). Conservation status of New Zealand bats, 2017. New Zealand Threat Classification Series 21. Department of Conservation, Wellington. 4 p.

Smith, D., Borkin, K., Jones, C., Lindberg, S., Davies, F. & Eccles, G. (2017). Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature. Research report 623, 249 p. NZ Transport Agency: Wellington; New Zealand.

# 1 Appendix 1 - Weather Conditions

Analysis of the nightly weather against the criteria described in Section 0 led to the exclusion of data whilst the ABMs were in situ during the 2023 surveys. The dates that met weather criteria and were selected for data analysis are presented in Table 1 and Table 2.

**Table 1 Weather conditions during the January 2023 survey**

| Date | Minimum temperature in first four hours after sunset (°C) | Total rainfall in first two hours after sunset (mm) | Total rainfall in first four hours after sunset (mm) | Suitable Weather Conditions? |
|---|---|---|---|---|
| 19-Jan-23 | 15.4 | 0.0 | 0.0 | ✓ |
| 20-Jan-23 | 16.3 | 0.0 | 0.0 | ✓ |
| 21-Jan-23 | 16.6 | 0.0 | 0.0 | ✓ |
| 22-Jan-23 | 15.0 | 0.0 | 0.0 | ✓ |
| 23-Jan-23 | 13.5 | 0.0 | 0.0 | ✓ |
| 24-Jan-23 | 16.4 | 0.0 | 0.0 | ✓ |
| 25-Jan-23 | 14.6 | 0.0 | 0.0 | ✓ |
| 26-Jan-23 | 16.8 | 0.4 | 0.8 | ✓ |
| 27-Jan-23 | 16.5 | 84.2 | 95.8 | X |
| 28-Jan-23 | 19.0 | 0.0 | 0.0 | ✓ |
| 29-Jan-23 | 17.8 | 3.0 | 4.0 | ✓ |
| 30-Jan-23 | 17.2 | 0.0 | 0.0 | ✓ |
| 31-Jan-23 | 18.1 | 0.0 | 0.0 | ✓ |
| 1-Feb-23 | 18.7 | 0.0 | 0.0 | ✓ |
| 2-Feb-23 | 19.3 | 0.2 | 0.4 | ✓ |
| 3-Feb-23 | 19.4 | 0.6 | 0.9 | ✓ |
| 4-Feb-23 | 18.8 | 0.0 | 0.0 | ✓ |
| 5-Feb-23 | 18.3 | 3.4 | 6.6 | X |
| 6-Feb-23 | 16.7 | 0.0 | 0.0 | ✓ |
| 7-Feb-23 | 14.8 | 0.0 | 0.0 | ✓ |
| 8-Feb-23 | 15.2 | 0.0 | 0.0 | ✓ |
| 9-Feb-23 | 13.5 | 0.0 | 0.0 | ✓ |

**Table 2 Weather conditions during the April 2023 survey**

| Date | Minimum temperature in first four hours after sunset (°C) | Total rainfall in first two hours after sunset (mm) | Total rainfall in first four hours after sunset (mm) | Suitable Weather Conditions? |
|---|---|---|---|---|
| 17-Apr-23 | 15.3 | 0.0 | 0.0 | ✓ |
| 18-Apr-23 | 18.3 | 0.0 | 0.0 | ✓ |
| 19-Apr-23 | 18.4 | 0.0 | 0.0 | ✓ |
| 20-Apr-23 | 18.4 | 0.0 | 0.0 | ✓ |
| 21-Apr-23 | 17.4 | 3.6 | 4.6 | X |
| 22-Apr-23 | 17.6 | 0.0 | 0.0 | ✓ |
| 23-Apr-23 | 15.0 | 0.0 | 0.0 | ✓ |
| 24-Apr-23 | 10.4 | 0.0 | 0.0 | ✓ |
| 25-Apr-23 | 14.8 | 0.0 | 0.0 | ✓ |
| 26-Apr-23 | 14.2 | 0.0 | 0.0 | ✓ |
| 27-Apr-23 | 12.3 | 0.0 | 0.0 | ✓ |
| 28-Apr-23 | 12.6 | 0.0 | 0.0 | ✓ |
| 29-Apr-23 | 14.5 | 0.0 | 0.0 | ✓ |
| 30-Apr-23 | 17.0 | 0.8 | 0.8 | ✓ |
| 1-May-23 | 18.2 | 0.2 | 0.4 | ✓ |
| 2-May-23 | 17.1 | 0.0 | 0.0 | ✓ |
| 3-May-23 | 17.7 | 0.0 | 0.0 | ✓ |
| 4-May-23 | 15.8 | 1.7 | 10.2 | X |
| 5-May-23 | 17.1 | 0.6 | 0.7 | ✓ |
| 6-May-23 | 16.0 | 1.9 | 1.9 | ✓ |
| 7-May-23 | 15.9 | 0.0 | 0.0 | ✓ |

# 2 Appendix 2 - Survey Results

## January 2023

| Date | Site | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan #1 | Jan #2 | Jan #3 | Jan #4 | Jan #5 | Jan #6 | Jan #7 | Jan #8 | Jan #9 | Jan #10 | Jan #11 | Jan #12 | Jan #13 | Jan #14 | Jan #15 | Jan #16 | Jan #17 | Jan #18 | Jan #19 | Jan #20 | Jan #21 | Jan #22 | Jan #23 | Jan #24 |
| **19-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **20-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **21-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **22-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **23-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **24-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **25-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **26-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **27-Jan-23** | Weather conditions unsuitable. | | | | | | | | | | | | | | | | | | | | | | | |
| **28-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **29-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **30-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **31-Jan-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1-Feb-23** | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2-Feb-23** | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3-Feb-23** | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4-Feb-23** | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **5-Feb-23** | Weather conditions unsuitable. | | | | | | | | | | | | | | | | | | | | | | | |
| **6-Feb-23** | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **7-Feb-23** | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8-Feb-23** | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 6 | N/A | N/A | N/A | 0 | N/A | N/A | 0 | 0 | 0 | 0 |
| **9-Feb-23** | 0 | 0 | 0 | 0 | N/A | N/A | E | 0 | 0 | 0 | 0 | 0 | N/A | N/A | N/A | N/A | N/A | 0 | N/A | N/A | 0 | 0 | 0 | 0 |
| **Total Count of Bat Passes** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **17** | **1** | **2** | **283** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **# Valid Nights Recorded** | **20** | **20** | **20** | **20** | **19** | **19** | **12** | **20** | **20** | **20** | **20** | **19** | **18** | **18** | **17** | **17** | **17** | **19** | **17** | **17** | **19** | **19** | **19** | **19** |

| Date | Site | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan #1 | Jan #2 | Jan #3 | Jan #4 | Jan #5 | Jan #6 | Jan #7 | Jan #8 | Jan #9 | Jan #10 | Jan #11 | Jan #12 | Jan #13 | Jan #14 | Jan #15 | Jan #16 | Jan #17 | Jan #18 | Jan #19 | Jan #20 | Jan #21 | Jan #22 | Jan #23 | Jan #24 |
| **Mean bat passes per night** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.05** | **0.00** | **0.00** | **0.00** | **0.00** | **0.94** | **0.06** | **0.12** | **16.65** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** | **0.00** |

Notes: N/A = ABM not deployed. E = Instrument error. Highlighted blue cells = Number of bat calls.

## April 2023

| Date | Site | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Apr #1 | Apr #2 | Apr #3 | Apr #4 | Apr #5 | Apr #6 | Apr #7 | Apr #8 | Apr #9 | Apr #10 | Apr #11 | Apr #12 | Apr #13 | Apr #14 | Apr #15 | Apr #16 | Apr #17 | Apr #18 | Apr #19 | Apr #20 | Apr #21 | Apr #22 | Apr #23 | Apr #24 | Apr #25 | Apr #26 |
| **17-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | N/A | N/A | N/A | N/A | E | N/A | 18 | N/A | N/A | N/A | N/A | N/A | N/A |
| **18-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | E | 1 | 37 | 0 | 0 | 0 | 0 | 0 | 0 |
| **19-Apr-23** | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | E | 0 | 0 | 0 | 0 | 0 | 0 | E | 1 | 18 | 0 | 0 | 0 | 0 | 0 | 0 |
| **20-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 41 | 17 | 0 | 0 | 0 | 0 | 0 | 0 |
| **21-Apr-23** | Weather conditions unsuitable. | | | | | | | | | | | | | | | | | | | | | | | | | |
| **22-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **23-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | E | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **24-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **25-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **26-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **27-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| **28-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **29-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| **30-Apr-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 76 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1-May-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2-May-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3-May-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4-May-23** | Weather conditions unsuitable. | | | | | | | | | | | | | | | | | | | | | | | | | |
| **5-May-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **6-May-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 1 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **7-May-23** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Date | Site | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Apr #1 | Apr #2 | Apr #3 | Apr #4 | Apr #5 | Apr #6 | Apr #7 | Apr #8 | Apr #9 | Apr #10 | Apr #11 | Apr #12 | Apr #13 | Apr #14 | Apr #15 | Apr #16 | Apr #17 | Apr #18 | Apr #19 | Apr #20 | Apr #21 | Apr #22 | Apr #23 | Apr #24 | Apr #25 | Apr #26 |
| **Total Count of Bat Passes** | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | - | 0 | 1 | 0 | 0 | 1 | 5 | 3 | 54 | 173 | 0 | 0 | 0 | 0 | 0 | 0 |
| **# Valid Nights Recorded** | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | - | 19 | 19 | 18 | 18 | 18 | 18 | 16 | 15 | 19 | 18 | 18 | 18 | 18 | 18 | 18 |
| **Mean bat passes per night** | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.11 | - | 0.00 | 0.05 | 0.00 | 0.00 | 0.06 | 0.28 | 0.19 | 3.60 | 9.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Notes: N/A = ABM not deployed. E = Instrument error. Highlighted blue cells = Number of bat calls.

# 3 Appendix 3 - First and Last Bat Pass Results

**Table 3 Times in which the first and last bat call was recorded each night, in relation to sunset and sunrise times (January 2023 survey)**

| Site | Sunset | | | Sunrise | | |
|---|---|---|---|---|---|---|
| | First bat pass recorded during the survey period (hh:mm) | Minimum time difference between sunset and first bat pass (h:mm) | Percentage of nights where first bat pass is within 30 minutes of sunset (%) | Last bat pass recorded during the survey period (hh:mm) | Minimum time difference between last bat pass and sunrise (h:mm) | Percentage of nights where last bat pass is within 30 minutes of sunrise (%) |
| Jan #9 | 22:28 | 2:02 | 0.00 | 22:28 | 8:12 | 0.00 |
| Jan #14 | 21:36 | 1:06 | 0.00 | 04:58 | 1:35 | 0.00 |
| Jan #15 | 01:17 | 4:40 | 0.00 | 01:17 | 5:08 | 0.00 |
| Jan #16 | 01:30 | 4:52 | 0.00 | 02:41 | 3:45 | 0.00 |
| Jan #17 | 20:48 | 0:13 | 33.33 | 05:56 | 0:34 | 0.00 |

**Table 4 Times in which the first and last bat call was recorded each night, in relation to sunset and sunrise times (April 2023 survey)**

| Site | Sunset | | | Sunrise | | |
|---|---|---|---|---|---|---|
| | First bat pass recorded during the survey period (hh:mm) | Minimum time difference between sunset and first bat pass (h:mm) | Percentage of nights where first bat pass is within 30 minutes of sunset (%) | Last bat pass recorded during the survey period (hh:mm) | Minimum time difference between last bat pass and sunrise (h:mm) | Percentage of nights where last bat pass is within 30 minutes of sunrise (%) |
| Apr #2 | 22:56 | 4:07 | 0.00 | 22:56 | 8:52 | 0.00 |
| Apr #7 | 20:14 | 1:26 | 0.00 | 20:14 | 11:35 | 0.00 |
| Apr #10 | 23:21 | 4:32 | 0.00 | 00:39 | 7:13 | 0.00 |
| Apr #13 | 03:25 | 8:46 | 0.00 | 03:25 | 4:31 | 0.00 |
| Apr #16 | 21:01 | 2:13 | 0.00 | 21:01 | 10:48 | 0.00 |
| Apr #17 | 20:07 | 1:31 | 0.00 | 06:47 | 1:14 | 0.00 |
| Apr #18 | 19:15 | 0:33 | 0.00 | 00:28 | 7:23 | 0.00 |
| Apr #19 | 19:39 | 1:05 | 0.00 | 06:03 | 1:46 | 0.00 |
| Apr #20 | 19:58 | 1:06 | 0.00 | 06:14 | 1:37 | 0.00 |

# Appendix 8

## List of Faunal Records

# 8 Appendix 8 – List of Faunal Records

**Table 11-12 Desktop bird records within 2 km of the NoRs**

| Species | Conservation Status (Robertson et al., 2021) | Record Source | Relevant NoR |
|---|---|---|---|
| New Zealand Pigeon/ Kereru*<br>(*Hemiphaga novaeseelandiae*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Silvereye/ Tauhou*<br>(*Zosterops lateralis*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Mallard/ Rakiraki*<br>(*Anas platyrhynchos*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Ring-necked pheasant*<br>(*Phasianus colchicus*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs except NoR 6 |
| Red-billed gull/Tarāpunga*<br>(Chroicocephalus novaehollandiae scopulinus) | At Risk: declining | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Wild turkey<br>(*Meleagris gallopavo*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs except NoR 6 |
| Grey Warbler/Riroriro*<br>(*Gerygone igata*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Tui*<br>(*Prosthemadera novaeseelandiae*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Fantail/Pīwakawaka*<br>(*Rhipidura fuliginosa*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Little shag/ Kawaupaka*<br>(Phalacrocorax sulcirostris) | At Risk: Naturally Uncommon | • iNaturalist (area wide)<br>• eBird (area wide) | NoR 1, NoR 2, NoR 4 and NoR 8 |
| Greenfinch*<br>(*Chloris chloris*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Pukeko*<br>(*Porphyrio melanotus*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Welcome swallow/Warou*<br>(*Hirundo neoxena*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| White-faced heron/Matuku moana*<br>(*Egretta novaehollandiae*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs except NoR 6 |

| Species | Conservation Status (Robertson et al., 2021) | Record Source | Relevant NoR |
|---|---|---|---|
| White Heron/ Kōtuku * (*Ardea alba*) | Threatened – Nationally Critical | • iNaturalist (area wide)<br>• eBird (area wide) | NoR 1 and NoR 2 |
| Spur-winged plover* (*Vanellus miles*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Dabchick/Weweia (*Poliocephalus rufopectus*) | Threatened – Nationally Increasing | • iNaturalist (area wide)<br>• eBird (area wide) | NoR 1, NoR2, NoR 4, NoR 5, NoR 7 and NoR 8 |
| Banded rail (*Gallirallus philippensis assimilis*) | At Risk – Declining | • iNaturalist (area wide)<br>• eBird (area wide) | NoR 1, NoR 2 and NoR 4 |
| Banded dotterel/Pohowera (*Charadrius bicinctus bicinctus*) | Threatened: Nationally Vulnerable | • iNaturalist (area wide)<br>• eBird (area wide) | NoR 1 and NoR 2 |
| Wrybill/ Ngutu pare (*Anarhynchus frontalis*) | At Risk: Recovering | • iNaturalist (area wide)<br>• eBird (area wide) | NoR 1 and NoR 2 |
| Variable Oystercatcher/ Tōrea pango (*Haematopus unicolor*) | At Risk: Recovering | • iNaturalist (area wide)<br>• eBird (area wide)) | NoR 1 and NoR 2 |
| Australasian Bittern/ Matuku-hūrepo (*Botaurus poiciloptilus*) | Threatened – Nationally Critical | • iNaturalist (area wide)<br>• eBird (area wide) | NoR 1, NoR 2, NoR4 and NoR 8 |
| Royal Spoonbill/ Kōtuku ngutupapa (*Platalea regia*) | At Risk: Naturally Uncommon | • iNaturalist (area wide)<br>• eBird (area wide) | NoR 1 and NoR 2 |
| New Zealand falcon/ Kārearea (*Falco novaeseelandiae*) | At Risk: Recovering | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Pied shag/Kāruhiruhi* (*Phalacrocorax varius*) | Pied shag/Kāruhiruhi | • iNaturalist (area wide)<br>• eBird (area wide) | NoR 1, NoR 2, NoR 4 and NoR 8 |
| House sparrow* (*Passer domesticus*) | Introduced and Naturalised | • iNaturalist (area wide)<br>eBird (area wide) | All NoRs |
| Common Indian Myna/ Maina* (*Acridotheres tristis*) | Introduced and Naturalised | • iNaturalist (area wide)<br>eBird (area wide) | All NoRs |
| Australasian Harrier/Kāhu* (*Circus approximans*) | Not Threatened | • iNaturalist (area wide)<br>eBird (area wide) | All NoRs except NoR 6 |
| Song thrush/ Manu-kai-hua-rakau* (*Turdus philomelos*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Blackbird/ Manu pango* (*Turdus merula*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |

| Species | Conservation Status (Robertson et al., 2021) | Record Source | Relevant NoR |
|---|---|---|---|
| Sacred kingfisher/ Kōtare* (*Todiramphus sanctus*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Eastern Rosella/ Kākā uhi whero* (*Platycercus eximius*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Eurasian Skylark/ Kairaka* (*Alauda arvensis*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs except NoR 6 |
| Canada Goose/ Kuihi* (*Branta canadensis*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| African Collared Dove* (*Streptopelia roseogrisea*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| European Greenfinch* (*Chloris chloris*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| California Quail* (*Callipepla californica*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| European Starling/ Tāringi* (*Sturnus vulgaris*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| European Goldfinch/ Kōurarini* (*Carduelis carduelis*) | Introduced and Naturalised | • iNaturalist (area wide)<br>eBird (area wide) | All NoRs |
| Paradise Shelduck/ Pūtangitangi* (*Tadorna variegata*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Morepork/ Ruru* (*Ninox novaeseelandiae*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Yellowhammer/ Hurukōwhai* (*Emberiza citrinella*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Australian Magpie/ Makipai* (*Gymnorhina tibicen* ) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |

Note: * = Incidental observations.

**Table 11-13 Desktop herpetofauna records within 5 km of the NoRs**

| Species | Conservation Status (Robertson et al., 2021) | Record Source | Relevant NoR |
|---|---|---|---|
| Copper skink*<br>*(Oligosoma aeneum)* | At Risk – Declining | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Ornate skink<br>*(Oligosoma ornatum)* | At Risk – Declining | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Plague skink*<br>(*Lampropholis delicata*) | Not Threatened | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |
| Green and Golden Bell Frog*<br>(*Litoria aurea*) | Introduced and Naturalised | • iNaturalist (area wide)<br>• eBird (area wide) | All NoRs |

Note: * = Incidental observations.

# Appendix 9

## Rapid Habitat Assessment Results

# 9 Appendix 9 - Rapid Habitat Assessment Results

### Table 11-14 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* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PK1_S1 | 6 | 4 | 4 | 3 | 4 | 4 | 1 | 5 | 5 | 6 | 42 | M |
| PK1_S2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 | P |
| PK1_S4 | 9 | 9 | 1 | 1 | 8 | 6 | 7 | 4 | 5 | 9 | 65 | G |
| PK1_S5 | 4 | 4 | 1 | 6 | 5 | 5 | 9 | 4 | 3 | 2 | 43 | M |
| PK2_S6 | 5 | 4 | 1 | 4 | 2 | 2 | 8 | 2 | 3 | 5 | 36 | P |
| PK2_S7 | 2 | 8 | 1 | 8 | 6 | 7 | 9 | 5 | 4 | 5 | 55 | M |
| PK2_S8 | 5 | 6 | 1 | 6 | 6 | 2 | 7 | 3 | 2 | 6 | 44 | M |
| PK4_S1 | 9 | 8 | 2 | 4 | 9 | 1 | 8 | 3 | 6 | 8 | 58 | M |
| PK4_S2 | 4 | 9 | 1 | 8 | 9 | 8 | 7 | 5 | 5 | 1 | 57 | M |
| PK4_S3 | 3 | 4 | 1 | 4 | 3 | 2 | 8 | 2 | 6 | 4 | 37 | P |
| PK4_S7 | 5 | 8 | 2 | 8 | 6 | 7 | 8 | 7 | 9 | 10 | 70 | G |
| PK4_S8 | 3 | 6 | 1 | 4 | 4 | 2 | 7 | 5 | 6 | 6 | 44 | M |
| PK4_S9 | 8 | 8 | 4 | 6 | 6 | 7 | 1 | 6 | 8 | 7 | 61 | M |
| PK5_S1 | 5 | 9 | 5 | 8 | 5 | 5 | 9 | 4 | 3 | 2 | 55 | M |
| PK5_S3 | 9 | 4 | 1 | 2 | 9 | 5 | 8 | 6 | 8 | 10 | 62 | G |
| PK5_S4 | 3 | 7 | 1 | 5 | 8 | 1 | 8 | 3 | 4 | 7 | 47 | M |
| PK8_S3 | 9 | 9 | 4 | 10 | 5 | 3 | 9 | 5 | 6 | 9 | 69 | G |
| PK8_S4 | 2 | 8 | 2 | 6 | 6 | 6 | 1 | 5 | 6 | 4 | 46 | M |
| PK8_S5 | 4 | 2 | 1 | 3 | 10 | 1 | 8 | 7 | 7 | 10 | 53 | M |

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

# Appendix 10

## Aquatic Value Assessment

# 10 Appendix 10 – Aquatic Value Assessment

## 10.1 NoR 1 - Drury West Arterial

| **Aquatic** | **Stream Reach/Type** | | | | | |
|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK1_S1** | **PK1_S2** | **PK1_S3** | **PK1_S4** | **PK1_S5** | |
| **Representativeness (including SEV, RHA and ecological integrity)** | **2** | **1** | **2** | **2** | **2** | PK1_S1, S2, and S3 were not assessed infield. Permission to access the relevant properties was not obtained in time. The RHA results were taken from the 2020 South Wide Project for PK1_S1 & S2. |
| Instream habitat modification | | | | | | |
| Riparian habitat modification | 1 | 1 | 1 | 2 | 1 | Riparian features have been significantly altered by human activities. PK1_S4 slightly less, or has been allowed to recover to provide some riparian habitat. |
| RHA score relative to potential score | 2 | 1 | 2 | 2 | 2 | RHA scores:<br>PK1_S1: 42<br>PK1_S2: 10<br>PK1_S3: Not assessed<br>PK1_S4: 65<br>PK1_S5: 43 and 39 |
| **Rarity/distinctiveness** | **1** | **3** | **3** | **3** | **3** | |
| Species of conservation significance | 1 | 3 | 3 | 3 | 3 | Īnanga (At Risk - Declining) and longfin eel (At Risk – Declining) have been recorded in the wider catchment associated with NoR R1 (Ngakoroa Stream). There is a high likelihood that these species utilise permanent streams. |
| Range restricted or endemic species | | | | | | |
| Stream type (rare or distinctive) | | | | | | |
| Distinctive ecological values (ecosystem services) | | | | | | |
| **Diversity and pattern** | **1** | **2** | **2** | **3** | **2** | |
| Level of natural diversity | 1 | 2 | 2 | 3 | 2 | Instream habitat diversity proxy |
| Species diversity | | | | | | |

| **Aquatic** | **Stream Reach/Type** | | | | | |
|---|---|---|---|---|---|---|
| Complexity of community | | | | | | |
| **Ecological context (Ecosystem services, importance and sensitivity)** | **3** | **3** | **3** | **4** | **4** | |
| Stream order | | 1 | 1 | 3 | 3 | Pk1_S1 stream order = 0<br>PK1_S2 Stream order = 1<br>PK1_S3 Stream order = 1<br>PK1_S4 Stream order = 3<br>PK1_S5 Stream order = 3 |
| Hydroperiod | 3 | 3 | 3 | 4 | 4 | |
| Sensitivity to flow and water quality modification | | | | | | |
| Connectivity and migration | 1 | 2 | 2 | 3 | 3 | Ecological connectivity in the wider landscape |
| Protected status | | | | | | |
| Sum | 7 | 9 | 10 | 12 | 11 | |
| **Combined value** | Low | Moderate | Moderate | Moderate | Moderate | |

## 10.2 NoR 2 - Drury-Pukekohe Link

| **Aquatic** | **Stream Reach/Type** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK2_S1** | **PK1_S5** | **PK2_S3** | **PK1_S4** | **PK2_S4** | **PK2_S5** | **PK2_S6** | **PK2_S7** | **PK2_S8** | **PK2_S9** | **PK2_S10** | **PK2_S11** | **PK2_S12** | **PK2_S13** | |
| **Representativeness (including SEV, RHA and ecological integrity)** | **2** | **2** | **1** | **2** | **1** | **1** | **3** | **3** | **2** | **1** | **2** | **3** | **2** | **2** | PK2_S1,S3, S4,S5, S9-11, and S13 were not assessed infield. Permission to access the relevant properties was not obtained in time. |
| Instream habitat modification | | | | | | | | | | | | | | | |
| Riparian habitat modification | 2 | 1 | 1 | 2 | 1 | 1 | 3 | 3 | 1 | 1 | 2 | 3 | 2 | 2 | Riparian features have been altered, mostly |

| **Aquatic** | **Stream Reach/Type** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | significantly altered, by human activities. |
| Invertebrate assemblage representation | | | | | | | | | | | | | | | |
| Fish assemblage representation | | | | | | | | | | | | | | | |
| SEV scores relative to potential score | | | | | | | | | | | | | | | |
| RHA score relative to potential score | | 2 | | 2 | | | 1 | 3 | 2 | | | | | | RHA scores:<br>PK1_S1: Not assessed<br>PK2_S2: 56<br>PK2_S3: Not assessed<br>PK2_S4: Not assessed<br>PK2_S5: Not assessed<br>PK2_S6: 35<br>PK1_S4: 65<br>PK2_S7: 70<br>PK2_S8: 44<br>PK2_S9: Not assessed |
| **Rarity/distinctiveness** | **3** | **3** | **1** | **3** | **3** | **3** | **3** | **3** | **1** | **1** | **1** | **1** | **3** | **3** | |
| Species of conservation significance | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 3 | 3 | Īnanga (At Risk - Declining) and longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with NoR R1 (Ngakoroa Stream). There is a high likelihood that these species utilise permanent streams. |
| Range restricted or endemic species | | | | | | | | | | | | | | | |
| Stream type (rare or distinctive) | | | | | | | | | | | | | | | |
| Distinctive ecological values (ecosystem services) | | | | | | | | | | | | | | | |
| **Diversity and pattern** | **2** | **2** | **2** | **3** | **2** | **2** | **3** | **3** | **2** | **2** | **2** | **2** | **2** | **2** | |
| Level of natural diversity | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | Instream habitat diversity proxy |

| Aquatic | Stream Reach/Type | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species diversity | | | | | | | | | | | | | | | |
| Complexity of community | | | | | | | | | | | | | | | |
| **Ecological context (Ecosystem services, importance and sensitivity)** | **4** | **4** | **2** | **4** | **3** | **2** | **4** | **4** | **3** | **2** | **2** | **2** | **2** | **3** | |
| Stream order | 1 | 3 | | 3 | 2 | 1 | 2 | 3 | | | | | | 1 | |
| Hydroperiod | 4 | 4 | 2 | 4 | 3 | 2 | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | |
| Sensitivity to flow and water quality modification | | | | | | | | | | | | | | | |
| Connectivity and migration | 2 | 3 | 1 | 3 | 3 | 2 | 3 | 4 | 1 | 1 | 1 | 1 | 1 | 2 | Ecological connectivity in the wider landscape |
| Protected status | | | | | | | | | | | | | | | |
| Sum | 11 | 11 | 6 | 12 | 9 | 8 | 13 | 13 | 8 | 6 | 7 | 8 | 9 | 10 | |
| **Combined value** | Moderate | Moderate | Low | Moderate | Moderate | Low | High | High | Low | Low | Low | Low | Moderate | Moderate | |

## 10.3 NoR 3 - Paerata Connections

| Aquatic | | |
|---|---|---|
| **Attributes to be considered** | **PK2_S10** | |
| **Representativeness (including SEV, RHA and ecological integrity)** | **2** | PK2_S1,S3, S4,S5, S9-11, and S13 were not assessed infield. Permission to access the relevant properties was not obtained in time. |
| Instream habitat modification | | |
| Riparian habitat modification | 2 | Riparian features have been altered, mostly significantly altered, by human activities. |
| Invertebrate assemblage representation | | |
| Fish assemblage representation | | |

| Aquatic | | |
|---|---|---|
| SEV scores relative to potential score | | |
| RHA score relative to potential score | | RHA scores:<br>PK1_S1: Not assessed<br>PK2_S2: 56<br>PK2_S3: Not assessed<br>PK2_S4: Not assessed<br>PK2_S5: Not assessed<br>PK2_S6: 35<br>PK1_S4: 65<br>PK2_S7: 70<br>PK2_S8: 44<br>PK2_S9: Not assessed |
| **Rarity/distinctiveness** | **1** | |
| Species of conservation significance | 1 | Īnanga (At Risk - Declining) and longfin eel (At Risk – Declining) has been recorded in the wider catchment associated with NoR R1 (Ngakoroa Stream). There is a high likelihood that these species utilise permanent streams. |
| Range restricted or endemic species | | |
| Stream type (rare or distinctive) | | |
| Distinctive ecological values (ecosystem services) | | |
| **Diversity and pattern** | **2** | |
| Level of natural diversity | 2 | Instream habitat diversity proxy |
| Species diversity | | |
| Complexity of community | | |
| **Ecological context (Ecosystem services, importance and sensitivity)** | **2** | |
| Stream order | | |
| Hydroperiod | 2 | |
| Sensitivity to flow and water quality modification | | |
| Connectivity and migration | 1 | Ecological connectivity in the wider landscape |
| Protected status | | |
| Sum | 7 | |
| **Combined value** | Low | |

## 10.4 NoR 4 - Pukekohe North-East Arterial

| Aquatic | Stream Reach/Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Attributes to be considered** | **PK4_S 1** | **PK4_S 2** | **PK4 _S3** | **PK4_S 4** | **PK4_S 5** | **PK4 _S6** | **PK4_S 7** | **PK4_S 8** | **PK4_S 9** | |
| **Representativeness (including SEV, RHA and ecological integrity)** | **2** | **2** | **1** | **1** | **1** | **1** | **2** | **2** | **2** | PK4_S4,S5, and S6 were not assessed infield. Permission to access the relevant properties was not obtained in time. |
| Instream habitat modification | | | | | | | | | | |
| Riparian habitat modification | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | Riparian features have been altered, mostly significantly altered, by human activities. |
| RHA score relative to potential score | 2 | 2 | 1 | | | | 2 | 2 | 2 | Instream RHA scores:<br>PK4_S1:58<br>PK4_S2: 57 and 39<br>PK4_S3: 37<br>PK2_S4: Not assessed<br>PK2_S5: Not assessed<br>PK2_S6: Not assessed<br>PK4_S7: 55<br>PK4_S8: 44<br>PK4_S9: 61 |
| **Rarity/distinctiveness** | **3** | **3** | **1** | **2** | **2** | **2** | **3** | **2** | **3** | |
| Species of conservation significance | 3 | 3 | 1 | 2 | 2 | 2 | 3 | 2 | 3 | Īnanga (At Risk - Declining) and longfin eel (At Risk – Declining) has been recorded in the wider catchment. There is a high likelihood that these species utilise permanent streams. |
| **Diversity and pattern** | **0** | **3** | **2** | **2** | **2** | **2** | **3** | **2** | **2** | |
| Level of natural diversity | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | |
| Species diversity | | | | | | | | | | |
| Complexity of community | | | | | | | | | | |

| Aquatic | Stream Reach/Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ecological context (Ecosystem services, importance and sensitivity)** | **4** | **4** | **3** | **4** | **4** | **3** | **4** | **3** | **4** | |
| Stream order | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 2 | 2 | |
| Hydroperiod | 4 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 4 | |
| Sensitivity to flow and water quality modification | | | | | | | | | | |
| Connectivity and migration | 2 | 4 | 1 | 3 | 1 | 1 | 2 | 2 | 2 | Connectivity and migration scores based on stream order (proxy). |
| Protected status | | | | | | | | | | |
| Sum | 9 | 12 | 7 | 9 | 9 | 8 | 12 | 9 | 11 | |
| **Combined value** | Moderate | Moderate | Low | Moderate | Moderate | Low | Moderate | Moderate | Moderate | |

## 10.5 NoR 5 - Pukekohe South-East Arterial

| Aquatic | Stream Reach/Type | | | |
|---|---|---|---|---|
| **Attributes to be considered** | **PK5_S1** | **PK5_S3** | **PK5_S4** | |
| **Representativeness (including SEV, RHA and ecological integrity)** | **2** | **2** | **2** | |
| Instream habitat modification | | | | |
| Riparian habitat modification | 1 | 2 | 1 | Riparian features have been altered, mostly significantly altered, by human activities. |
| RHA score relative to potential score | 2 | 2 | 2 | PK5_S1 : 55<br>PK5_S3 62<br>PK5_S4 47 |
| **Rarity/distinctiveness** | **1** | **3** | **3** | |
| Species of conservation significance | 1 | 3 | 3 | No TAR have been recorded. However, suitable habitat for longfin eel is present, and S3&4 have good connectivity |

| Aquatic | Stream Reach/Type | | | |
|---|---|---|---|---|
| **Diversity and pattern** | **2** | **2** | **1** | |
| Level of natural diversity | 2 | 2 | 1 | |
| Species diversity | | | | |
| Complexity of community | | | | |
| **Ecological context (Ecosystem services, importance and sensitivity)** | **2** | **3** | **4** | |
| Stream order | 1 | 1 | 2 | |
| Hydroperiod | 2 | 3 | 4 | |
| Connectivity and migration | 2 | 2 | 2 | Connectivity and migration scores based on stream order (proxy). |
| Protected status | | | | |
| Sum | 7 | 10 | 10 | |
| **Combined value** | Low | Moderate | Moderate | |

## 10.6 NoR 7 - Pukekohe North-West Arterial

| Aquatic | Stream Reach/Type | | |
|---|---|---|---|
| **Attributes to be considered** | **PK7_S1** | **PK7_S2** | |
| **Representativeness (including SEV, RHA and ecological integrity)** | **2** | **2** | PK7_S2 was not assessed infield. Permission to access the relevant properties was not obtained in time. |
| Instream habitat modification | | | |
| Riparian habitat modification | 2 | 1 | Riparian features have been significantly altered by human activities |
| RHA score relative to potential score | 2 | 2 | RHA scores:<br>PK7_S1: 40<br>PK7_S2: Not Assessed |

| Aquatic | Stream Reach/Type | | |
|---|---|---|---|
| **Rarity/distinctiveness** | **1** | **1** | |
| Species of conservation significance | 1 | 1 | |
| **Diversity and pattern** | **2** | **2** | |
| Level of natural diversity | 2 | 2 | |
| Species diversity | | | |
| Complexity of community | | | |
| **Ecological context (Ecosystem services, importance and sensitivity)** | **4** | **4** | |
| Stream order | | | |
| Hydroperiod | 4 | 4 | All streams are permanent |
| Sensitivity to flow and water quality modification | | | |
| Connectivity and migration | 1 | 1 | Connectivity and migration scores based on stream order (proxy). |
| Protected status | | | |
| Sum | 9 | 9 | |
| **Combined value** | Moderate | Moderate | |

## 10.7 NoR 8 - Mill Road and Pukekohe East Road Upgrade

| Aquatic | Stream Reach/Type | | | | |
|---|---|---|---|---|---|
| **Attributes to be considered** | **PK8_S1** | **PK8_S3** | **PK8_S4** | **PK8_S5** | |
| **Representativeness (including SEV, RHA and ecological integrity)** | **1** | **3** | **2** | **2** | |
| Instream habitat modification | | | | | |
| Riparian habitat modification | 1 | 2 | 2 | 1 | Riparian features have been significantly or moderately altered by human activities |

| Aquatic | Stream Reach/Type | | | | |
|---|---|---|---|---|---|
| RHA score relative to potential score | | 3 | 2 | 2 | Instream RHA scores:<br>PK8_S1: Not assessed<br>PK8_S3: 69 / 70<br>PK8_S4: 46<br>PK2_S5: 53 |
| **Rarity/distinctiveness** | **1** | **3** | **3** | **3** | |
| Species of conservation significance | 1 | 3 | 3 | 3 | Long fin eel recorded upstream Tutaenui stream tributary. Suitable habitat for longfin eel is present in S3-5. |
| Stream type (rare or distinctive) | | | | | |
| Distinctive ecological values (ecosystem services) | | | | | |
| **Diversity and pattern** | **2** | **3** | **2** | **2** | |
| Level of natural diversity | 2 | 3 | 2 | 2 | Hydraulic heterogeneity scores in RHA |
| Species diversity | | | | | Kai carp was observed. Common bully, Common smelt was recorded. Long fin eel recorded upstream Tutaenui stream tributary. |
| Complexity of community | | | | | |
| **Ecological context (Ecosystem services, importance and sensitivity)** | **3** | **4** | **2** | **2** | |
| Stream order | 2 | 3 | 1 | 1 | |
| Hydroperiod | 3 | 4 | 2 | 2 | |
| Sensitivity to flow and water quality modification | | | | | |
| Connectivity and migration | 2 | 4 | 2 | 2 | Connectivity and migration scores based on stream order (proxy). |
| Protected status | | | | | |
| Sum | 7 | 13 | 9 | 9 | |
| **Combined value** | Low | High | Moderate | Moderate | |

# Appendix 11

## Impact Assessments

| NoR 1 - Drury West | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Construction | Notice/vibration/Dust | PK1_Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Suitable roost sites occur within and adjacent to NoR1 - Riparian habitat along the Ngakaora Stream and tributaries, and tall stands of exotic treelands. Therefore, it is possible that these will be impacted during construction. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | PK1_Bats | 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 | Current conditions<br>The loss of habitat and connectivity is likely given that the majority of the route will be a new road through rural areas that are likely to support bats. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK1_Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to bats. Given the threat status of the bats it is important to assess this effect. | Direct | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK1_Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Current conditions<br>Lighting (road lighting and vehicle lights) and noise from vehicles moving through the area (general increase in noise levels) is anticipated to deter bats, particularly where there is no buffering habitat. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | PK1_Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable roost sites occur within and adjacent to NoR1. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | PK1_Bats | 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 | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK1_Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Likely future conditions<br>Same as bseline. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK1_Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Likely future conditions<br>Future urban zones are likely to introduce lighting and noise, which may deter bats. However, the effect of lighting and noise is unlikely to change significantly from baseline. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | | Likely (>40-70% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. G | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | Threatened Species | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All of the Threatened species utilize wetland and/or open water habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Threatened Species | Very High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Threatened Species | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Threatened Species | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | All other AR species | Moderate | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All other TAR species utilize treelands and/or wetland/riparian habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities is likely to occur. | Indirect | Local | Short-term (<5 years) | | Likely (>40-70% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other AR species | Moderate | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | All other AR species | Moderate | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | All other AR species | Moderate | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the other TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | Infrequently | Likely (>40-70% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | At-Risk-Declining Species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All of the At-Risk declining species utilize wetland and/or open water habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Infrequently | Likely (>40-70% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | At-Risk-Declining Species | High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | At-Risk-Declining Species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | At-Risk-Declining Species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |

| NoR 1 - Drury West | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Construction | Notice/vibration/Dust | Threatened Species | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR1. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | | Likely (>40-70% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Threatened Species | Very High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Threatened Species | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Threatened Species | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | All other AR species | Moderate | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR1. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | | Likely (>40-70% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other AR species | Moderate | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | All other AR species | Moderate | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | All other AR species | Moderate | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are unlikely to disturb or displace non-TAR species significantly. | Indirect | Local | Short-term (<5 years) | | Unlikely (20-40% chance) | Partially | Negligible | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | At-Risk-Declining Species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR1. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | | Likely (>40-70% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | At-Risk-Declining Species | High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | At-Risk-Declining Species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | At-Risk-Declining Species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Current conditions<br>Disturbance and displacement of both skink species is unlikely to occur. Some populations inhabiting suitable habitats within, or in close proximity, to the project site, may be affected. However, the population dynamics within these localised populations is unlikely to be effected. | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Current conditions<br>While the NoR includes large portions of new road and expansions of existing roads, which intersects with some potential habitat for the skinks, it is unlikely that loss in connectivity will occur. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Current conditions<br>As the NoRs include large portions of new road and expansions of existing roads, which intersects with potential skink habitat. the population dynamics within these localised populations is unlikely to be disturbed by lighting and noise resulting from the use of the road. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicles use of the new road/road segments may result in ongoing, albeit infrequent, 'road-kills'. | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Same as baseline | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |

| NoR 1 - Drury West | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |

| NoR 2 - Pukekohe Link | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Construction | Notice/vibration/Dust | PK2_Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Bats and suitable roost sites occur within and adjacent to NoR2. Suitable roost sites include riparian habitat associated with Oira Creek, Whangapouri Creek, and Ngakoroa Stream tributaries, and also tall stands of native and exotic trees along the NoR. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | PK2_Bats | 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 | Current conditions<br>The loss of habitat and connectivity is likely given that the majority of the route will be a new road through rural areas that support bats (presence confirmed). | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Moderate | Moderate |
| Operation | Vehicle movement | PK2_Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to bats. Given the threat status of the bats it is important to assess this effect. | Direct | <Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK2_Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Current conditions<br>Lighting (road lighting and vehicle lights) and noise from vehicles moving through the area (general increase in noise levels) is anticipated to deter bats, particularly where there is no buffering habitat. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | PK2_Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable roost sites occur within and adjacent to NoR2. Therefore, it is likely that that these will be impacted during construction. Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Presence of the road | PK2_Bats | 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 | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK2_Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Likely future conditions<br>Same as bseline. | Direct | <Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK2_Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Likely future conditions<br>Future urban zones are likely to introduce lighting and noise, which may deter bats. However, the effect of lighting and noise is unlikely to change significantly from baseline. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | Threatened & At-Risk-Declining Species | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All of the Threatened and At-Risk declining species utilize wetland and/or open water habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | All other TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All other TAR species utilize treelands and/or wetland/riparian habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other TAR species | High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | All other TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | All other TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the other TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are unlikely to disturb or displace non-TAR species significantly. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |

**NoR 2 - Pukekohe Link**

| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Construction | Notice/vibration/Dust | Threatened & At-Risk-Declining Species | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR2. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | All other TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR2. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other TAR species | High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | All other TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | All other TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction-Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Current conditions<br>Disturbance and displacement of both skink species is unlikely to occur. Some populations inhabiting suitable habitats within, or in close proximity, to the project site, may be affected. However, the population dynamics within these localised populations is unlikely to be effected. | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Current conditions<br>While the NoR includes large portions of new road and expansions of existing roads, which intersects with some potential habitat for the skinks, it is unlikely that loss in connectivity will occur. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Current conditions<br>As the NoRs include large portions of new road and expansions of existing roads, which intersects with potential skink habitat. the population dynamics within these localised populations is unlikely to be disturbed by lighting and noise resulting from the use of the road. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicles use of the new road/road segments may result in ongoing, albeit infrequent, 'road-kills'. | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction-Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Same as baseline | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |

| NoR 3 - Paerata Connections | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Construction | Notice/vibration/Dust | Pk3-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Bats and suitable roost sites occur within and adjacent to NoR3. Suitable roost sites include riparian habitat associated with an Oira Creek tributary, and also mature stands of exotic tall trees and bushes. | Indirect | Local | Temporary (days or months) | Periodically | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Presence of the road | Pk3-Bats | 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 | Current conditions<br>The loss of habitat and connectivity is likely given that the majority of the route will be a new road through rural areas that support bats. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | Pk3-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to bats. Given the threat status of the bats it is important to assess this effect. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Pk3-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Current conditions<br>Lighting (road lighting and vehicle lights) and noise from vehicles moving through the area (general increase in noise levels), is anticipated to deter bats, particularly where there is no buffering habitat. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Pk3-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Temporary (days or months) | Periodically | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Presence of the road | Pk3-Bats | 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 | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | Pk3-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Likely future conditions<br>Same as baseline. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Pk3-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Likely future conditions<br>Future urban zones are likely to introduce lighting and noise, which may deter bats. However, the effect of lighting and noise is unlikely to change significantly from baseline. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | Continuously | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. | Direct | Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | All other TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All other TAR species utilize treelands and/or wetland/riparian habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other TAR species | High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | Continuously | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | All other TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | All other TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the other TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are unlikely to disturb or displace non-TAR species significantly. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | Continuously | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | All other TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Limited suitable habitat occurs within and adjacent to NoR3. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other TAR species | High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | Continuously | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | All other TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | All other TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |

| NoR 3 - Paerata Connections | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Construction | Notice/vibration/Dust | Copper skink | High | Construction-Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Current conditions<br>Disturbance and displacement of skinks is unlikely to occur. Some populations inhabiting suitable habitats within, or in close proximity, to the project site, may be affected. However, the population dynamics within these localised populations is unlikely to be effected. | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Current conditions<br>While the NoR includes large portions of new road and expansions of existing roads, which intersects with some potential habitat for the skinks, it is unlikely that loss in connectivity will occur. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Current conditions<br>As the NoRs include large portions of new road and expansions of existing roads, which intersects with potential skink habitat. the population dynamics within these localised populations is unlikely to be disturbed by lighting and noise resulting from the use of the road. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicles use of the new road/road segments may result in ongoing, albeit infrequent, 'road-kills'. | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Notice/vibration/Dust | Copper skink | High | Construction-Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Same as baseline | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |

| NoR 4 - Pukekohe North-East Arterial | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Phase** | **Project Activity** | **Resource Unit (Habitat/Species)** | **Ecological Value** | **Effect Description Main** | **Effect Description Detailed** | **Effects Description Manual** | **Type** | **Extent (ZOI)** | **Duration** | **Frequency** | **Likelihood** | **Reversibility** | **Magnitude (pre-mitigation)** | **Level of Effect (Pre-mitigation)** |
| Construction | Notice/vibration/Dust | PK4-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Suitable roost sites occur within and adjacent to NoR4. These include: tall stands of indigenous and exotic trees, and large stands of bushes, adjacent SEA, and riparian habitat associated with Oira Creek and Whangapouri Creek unnamed tributaries. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Presence of the road | PK4-Bats | 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 | Current conditions<br>The loss of habitat and connectivity is likely given that the majority of the route will be a new road through rural areas that potentially support bats. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK4-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to bats. Given the threat status of the bats it is important to assess this effect. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK4-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Current conditions<br>Lighting (road lighting and vehicle lights) and noise from vehicles moving through the area (general increase in noise levels) is anticipated to deter bats, particularly where there is no buffering habitat. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | PK4-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Presence of the road | PK4-Bats | 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 | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK4-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Likely future conditions<br>Same as baseline. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK4-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Likely future conditions<br>Future urban zones are likely to introduce lighting and noise, which may deter bats. However, the effect of lighting and noise is unlikely to change significantly from baseline. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | Threatened & At-Risk-Declining Species | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All of the Threatened and At-Risk declining species utilize wetland and/or open water habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | All other TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All other TAR species utilize treelands and/or wetland/riparian habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other TAR species | High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | All other TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | All other TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the other TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are unlikely to disturb or displace non-TAR species significantly. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |

## NoR 4 - Pukekohe North-East Arterial

| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | Threatened & At-Risk-Declining Species | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR4. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | All other TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR4. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other TAR species | High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | All other TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | All other TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | Copper skink, ornate skink, and geckos (Elegant/Forest/Pacific) | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Disturbance and displacement of both skink species and gecko species is unlikely to occur. Some populations inhabiting suitable habitats within, or in close proximity, to the project site, may be affected. However, the population dynamics within these localised populations is unlikely to be effected. | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper skink, ornate skink, and geckos (Elegant/Forest/Pacific) | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Current conditions<br>While the NoR includes large portions of new road and expansions of existing roads, which intersects with some potential habitat for the skinks and geckos, it is unlikely that loss in connectivity will occur. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper skink, ornate skink, and geckos (Elegant/Forest/Pacific) | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Current conditions<br>As the NoRs include large portions of new road and expansions of existing roads, which intersects with potential skink and gecko habitat. the population dynamics within these localised populations is unlikely to be disturbed by lighting and noise resulting from the use of the road. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper skink, ornate skink, and geckos (Elegant/Forest/Pacific) | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicles use of the new road/road segments may result in ongoing, albeit infrequent, 'road-kills'. | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Notice/vibration/Dust | Copper skink, ornate skink, and geckos (Elegant/Forest/Pacific) | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, light, dust etc.) | Same as baseline | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper skink, ornate skink, and geckos (Elegant/Forest/Pacific) | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper skink, ornate skink, and geckos (Elegant/Forest/Pacific) | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper skink, ornate skink, and geckos (Elegant/Forest/Pacific) | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |

| NoR 5 - Pukekohe South-East Arterial | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Construction | Notice/vibration/Dust | PK5-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Suitable roost sites occur within and adjacent to NoR5. These include: tall stands of indigenous and exotic trees, farmlands with scattered treelands, and Tutaenui Stream and Whangapouri Creek unnamed tributaries. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Presence of the roads | PK5-Bats | 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 | Current conditions<br>The loss of habitat and connectivity is likely given that the part of the route will be a new road through rural areas that potentially support bats. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK5-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to bats. Given the threat status of the bats it is important to assess this effect. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK5-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Current conditions<br>Lighting (road lighting and vehicle lights) and noise from vehicles moving through the area (general increase in noise levels) is anticipated to deter bats, particularly where there is no buffering habitat. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | PK5-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Presence of the roads | PK5-Bats | 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 | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK5-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK5-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Likely future conditions<br>Future urban zones are likely to introduce lighting and noise, which may deter bats. However, the effect of lighting and noise is unlikely to change significantly from baseline. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | TAR species | High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are unlikely to disturb or displace non-TAR species significantly. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR4. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | TAR species | High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |

| NoR 5 - Pukekohe South-East Arterial | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Construction | Notice/vibration/Dust | Dabchick | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Dabchicks utilize wetland and/or open water habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Dabchick | Very High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Dabchick | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Dabchick | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, Dabchicks could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Dabchick | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR5. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Dabchick | Very High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Dabchick | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Dabchick | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Current conditions<br>Disturbance and displacement of both skink species is unlikely to occur. Some populations inhabiting suitable habitats within, or in close proximity, to the project site, may be affected. However, the population dynamics within these localised populations is unlikely to be effected. | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Current conditions<br>While the NoR includes large portions of new road and expansions of existing roads, which intersects with some potential habitat for the skinks, it is unlikely that loss in connectivity will occur. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Current conditions<br>As the NoRs include large portions of new road and expansions of existing roads, which intersects with potential skink habitat. the population dynamics within these localised populations is unlikely to be disturbed by lighting and noise resulting from the use of the road. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicles use of the new road/road segments may result in ongoing, albeit infrequent, 'road-kills'. | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Same as baseline | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |

## NoR 6 - Paerata South-West Upgrade

| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Construction | Notice/vibration/Dust | PK5-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Roost sites unlikely to occur within the designation. | Indirect | <Local | Temporary (days or months) | Frequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Presence of the roads | PK5-Bats | 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 | Current conditions<br>The loss of habitat and connectivity is highly unlikely. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | PK5-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to bats. Given the threat status of the bats it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK5-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Current conditions<br>Existing conditions are likely to deter bats. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Construction | Notice/vibration/Dust | PK5-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>No change from baseline. | Indirect | <Local | Temporary (days or months) | Frequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Presence of the roads | PK5-Bats | 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 | Likely future conditions<br>No change from baseline. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | PK5-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Likely future conditions<br>No change from baseline. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK5-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Likely future conditions<br>No change from baseline. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | Continuously | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. | Direct | Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are unlikely to disturb or displace non-TAR species significantly. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | Continuously | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | Infrequently | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | Copper skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Current conditions<br>Disturbance and displacement of skinks is unlikely to occur. | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Current conditions<br>Disturbance and displacement of skinks is unlikely to occur. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Current conditions<br>Disturbance and displacement of skinks is unlikely to occur. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicles use of the new road/road segments may result in ongoing, albeit infrequent, 'road-kills'. | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Notice/vibration/Dust | Copper skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Same as baseline | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |

| NoR 7 - Pukekohe North-West Arterial | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Construction | Notice/vibration/Dust | PK7-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Suitable roost sites occur within and adjacent to NoR7. These include: tall stands of indigenous and exotic trees and large stands of bushes, along with Whangapouri Creek unnamed tributaries. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | PK7-Bats | 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 | Current conditions<br>The loss of habitat and connectivity is likely given that the part of the route will be a new road through rural areas that potentially support bats. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK7-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to bats. Given the threat status of the bats it is important to assess this effect. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK7-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Current conditions<br>Lighting (road lighting and vehicle lights) and noise from vehicles moving through the area (general increase in noise levels) is anticipated to deter bats, particularly where there is no buffering habitat. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | PK7-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | PK7-Bats | 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 | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK7-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK7-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Likely future conditions<br>Future urban zones are likely to introduce lighting and noise, which may deter bats. However, the effect of lighting and noise is unlikely to change significantly from baseline. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | TAR species | High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are unlikely to disturb or displace non-TAR species significantly. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR4. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | TAR species | High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |

| NoR 7 - Pukekohe North-West Arterial | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Phase** | **Project Activity** | **Resource Unit (Habitat/Species)** | **Ecological Value** | **Effect Description Main** | **Effect Description Detailed** | **Effects Description Manual** | **Type** | **Extent (ZOI)** | **Duration** | **Frequency** | **Likelihood** | **Reversibility** | **Magnitude (pre-mitigation)** | **Level of Effect (Pre-mitigation)** |
| Construction | Notice/vibration/Dust | Dabchick | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Dabchicks utilize wetland and/or open water habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Dabchick | Very High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Dabchick | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Dabchick | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, Dabchicks could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Dabchick | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to NoR5. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Dabchick | Very High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Dabchick | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Dabchick | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Current conditions<br>Disturbance and displacement of both skink species is unlikely to occur. Some populations inhabiting suitable habitats within, or in close proximity, to the project site, may be affected. However, the population dynamics within these localised populations is unlikely to be effected. | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Current conditions<br>While the NoR includes large portions of new road and expansions of existing roads, which intersects with some potential habitat for the skinks, it is unlikely that loss in connectivity will occur. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Current conditions<br>As the NoRs include large portions of new road and expansions of existing roads, which intersects with potential skink habitat. the population dynamics within these localised populations is unlikely to be disturbed by lighting and noise resulting from the use of the road. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicles use of the new road/road segments may result in ongoing, albeit infrequent, 'road-kills'. | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Same as baseline | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |

## NoR 8 - Mill Road and Pukekohe East Upgrade

| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Construction | Notice/vibration/Dust | PK8-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>Suitable roost sites occur within and adjacent to NoR8. These include: tall stands of indigenous trees (WF9), exotic treelands, large stand of bushes, along with riparian habitat along the Tutaenui Stream and Ngakoroa Stream unnamed tributaries | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Partially | Low | Moderate |
| Construction | Vegetation removal | PK8-Bats | Very High | Construction- Bats | Loss of foraging habitat due to vegetation removal | Waikato portion of NoR. While there are portions of WF9 in the designated area the route has been redesigned to avoid them. Leaving only the loss of small patches of TL3, TL1, and ES. These are currently located close to the existing road, and therefore are highly unlikely to support bats. | Direct | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Partially | Low | Moderate |
| Construction | Vegetation removal | PK8-Bats | Very High | Construction- Bats | Roost loss through vegetation removal | Waikato portion of NoR. Small patches of TL3, TL1, and ES will be lost. These are currently located close to the existing road, and therefore are highly unlikely to be suitable roost sites for bats. | Direct | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Partially | Low | Moderate |
| Construction | Vegetation removal | PK8-Bats | Very High | Construction- Bats | Kill or injure individual bats due to vegetation removal | Current conditions<br>Waikato portion. While highly unlikely, during construction it is possible that vehicles could result in the mortality or injury to bats. | Direct | Local | Temporary (days or months) | Infrequently | Likely (>40-70% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | PK8-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to bats. Given the threat status of the bats it is important to assess this effect. | Direct | Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | PK8-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Current conditions<br>Lighting (road lighting and vehicle lights) and noise from vehicles moving through the area (general increase in noise levels) is anticipated to deter bats, particularly where there is no buffering habitat. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Presence of the road | PK8-Bats | 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 | Current conditions<br>The loss of habitat and connectivity is likely given the increase to a 4 lane road and the presence of habitat that likely supports bats. This includes: tall stands of indigenous trees (WF9), exotic treelands, large stand of bushes, along with riparian habitat along the Tutaenui Stream and Ngakoroa Stream unnamed tributaries | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | PK8-Bats | Very High | Construction- Bats | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Impacts unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Temporary (days or months) | Frequently | Likely (>40-70% chance) | Partially | Low | Moderate |
| Construction | Vegetation removal | PK8-Bats | Very High | Construction- Bats | Loss of foraging habitat due to vegetation removal | Likely future conditions<br>Waikato portion of NoR. While there are portions of WF9 in the designated area the route has been redesigned to avoid them. Leaving only the loss of small patches of TL3, TL1, and ES. These are currently located close to the existing road, and therefore are unlikely to support bats. | Direct | Local | Permanent (>25 years) | Infrequently | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Vehicle movement | PK8-Bats | Very High | Operation- Bats | Kill or injure individual due to vehicle movement (infrastructure use) | Likely future conditions<br>Same as baseline. | Direct | <Local | Permanent (>25 years) | Infrequently | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Operation | Lighting and noise | PK8-Bats | Very High | Operation- Bats | Disturbance and displacement of (new and existing) roosts and individuals due to lighting and noise/vibration | Likely future conditions<br>The lighting (road lighting and vehicle lights) and noise from vehicles moving through the area (increase due to a 4 lane road along a portion of the NoR), is still anticipated to contribute to deterring bats, particularly in rural areas. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Operation | Presence of the road | PK8-Bats | 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 | Likely future conditions<br>The expansion of the urban zone is likely to impact on bat habitat and connectivity. However, the loss of habitat and connectivity due to the proposed road is still likely given that sections of the route will still be in rural areas that are anticipated to continue to support bats. | Indirect | Local | Permanent (>25 years) | | Likely (>40-70% chance) | Irreversible | Low | Moderate |
| Construction | Vegetation removal | PK8-Bats | Very High | Construction- Bats | Roost loss through vegetation removal | Waikato portion of NoR. Small patches of TL3, TL1, and ES will be lost. These are currently located close to the existing road, and therefore are highly unlikely to be suitable roost sites for bats. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Partially | Negligible | Low |
| Construction | Vegetation removal | PK8-Bats | Very High | Construction- Bats | Kill or injure individual bats due to vegetation removal | Likely future conditions<br>Same as baseline. | Direct | <Local | Temporary (days or months) | Infrequently | Highly Likely (70-90% chance) | Irreversible | Negligible | Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are highly unlikely to disturb or displace non-TAR species significantly (i.e., where it would result in changes to the population dynamics). | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that disturbance and displacement will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | Threatened & At-Risk-Declining Species | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All of the Threatened and At-Risk declining species utilize wetland and/or open water habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may to occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | All other TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Current conditions<br>All other TAR species utilize treelands and/or wetland/riparian habitats. Given the extent of these habitats within and adjacent to the NoR, disturbance and displacement due to construction activities may occur. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other TAR species | High | Operation- Birds (native) | 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 | Current conditions<br>The bird species are considered highly mobile species in this area, with high dispersal. Therefore, it is unlikely that loss in connectivity will result in changes to the population dynamics. | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |

| NoR 8 - Mill Road and Pukekohe East Upgrade | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase | Project Activity | Resource Unit (Habitat/Species) | Ecological Value | Effect Description Main | Effect Description Detailed | Effects Description Manual | Type | Extent (ZOI) | Duration | Frequency | Likelihood | Reversibility | Magnitude (pre-mitigation) | Level of Effect (Pre-mitigation) |
| Operation | Vehicle movement | All other TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicle use of the road could result in mortality or injury to birds. Given the threat status of the birds it is important to assess this effect. | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | All other TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Current conditions<br>Due to the local extent of effect, the other TAR species could be disturbed by noise, light and vibration from the road. | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Notice/vibration/Dust | Non-TAR species | Low | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>The non-TAR bird species are likely to use a range of habitats adjacent to the NoR. Construction activities are unlikely to disturb or displace non-TAR species significantly. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Operation | Presence of the road | Non-TAR species | Low | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | Non-TAR species | Low | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | Non-TAR species | Low | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Notice/vibration/Dust | Threatened & At-Risk-Declining Species | Very High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to the NoR. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Moderate |
| Operation | Presence of the road | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Vehicle movement | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Operation | Lighting and noise | Threatened & At-Risk-Declining Species | Very High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Moderate |
| Construction | Notice/vibration/Dust | All other TAR species | High | Construction- Birds | Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.) | Likely future conditions<br>Suitable habitat occurs within and adjacent to the NoR. Impacts are unlikely to change from baseline where effects are associated with stream/wetland corridors. | Indirect | Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Partially | Low | Low |
| Operation | Presence of the road | All other TAR species | High | Operation- Birds (native) | 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 | Same as baseline | Indirect | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Vehicle movement | All other TAR species | High | Operation- Birds (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Direct | Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Operation | Lighting and noise | All other TAR species | High | Operation- Birds (native) | Disturbance and displacement of (new and existing) nests and individuals due to lighting and noise/vibration | Same as baseline | Indirect | Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Vegetation removal | Non-TAR species | Low | Construction- Birds | Loss of foraging habitat due to vegetation removal | Waikato section (both current & future ecological conditions - significant change within the NoR is unlikely) | Direct | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Partially | Low | Very Low |
| Construction | Vegetation removal | Non-TAR species | Low | Construction- Birds | Nest loss due to vegetation removal | Waikato section (both current & future ecological conditions - significant change within the NoR is unlikely) | Direct | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Very Low |
| Construction | Vegetation removal | Non-TAR species | Low | Construction- Birds | Kill or injure individual due to vegetation removal | Waikato section (both current & future ecological conditions - significant change within the NoR is unlikely) | Direct | <Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Vegetation removal | All other TAR species | High | Construction- Birds | Loss of foraging habitat due to vegetation removal | Waikato section (both current & future ecological conditions - significant change within the NoR is unlikely) | Direct | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Partially | Low | Low |
| Construction | Vegetation removal | All other TAR species | High | Construction- Birds | Nest loss due to vegetation removal | Waikato section (both current & future ecological conditions - significant change within the NoR is unlikely) | Direct | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Construction | Vegetation removal | All other TAR species | High | Construction- Birds | Kill or injure individual due to vegetation removal | Waikato section (both current & future ecological conditions - significant change within the NoR is unlikely) | Direct | <Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Vegetation removal | Threatened & At-Risk-Declining Species | Very High | Construction- Birds | Loss of foraging habitat due to vegetation removal | Waikato section (both current & future ecological conditions - significant change within the NoR is unlikely) | Direct | <Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Partially | Negligible | Low |
| Construction | Vegetation removal | Threatened & At-Risk-Declining Species | Very High | Construction- Birds | Nest loss due to vegetation removal | Waikato section (both current & future ecological conditions - significant change within the NoR is unlikely) | Direct | <Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Construction | Vegetation removal | Threatened & At-Risk-Declining Species | Very High | Construction- Birds | Kill or injure individual due to vegetation removal | Waikato section (both current & future ecological conditions - significant change within the NoR is unlikely) | Direct | <Local | Permanent (>25 years) | | Highly Unlikely (<20% chance) | Irreversible | Negligible | Low |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction-Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Current conditions<br>Disturbance and displacement of both skink species is unlikely to occur. Some populations inhabiting suitable habitats within, or in close proximity, to the project site, may be affected. However, the population dynamics within these localised populations is unlikely to be effected. | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Current conditions<br>While the NoR includes large portions of new road and expansions of existing roads, which intersects with some potential habitat for the skinks, it is unlikely that loss in connectivity will occur. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Current conditions<br>As the NoRs include large portions of new road and expansions of existing roads, which intersects with potential skink habitat. the population dynamics within these localised populations is unlikely to be disturbed by lighting and noise resulting from the use of the road. | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |

| NoR 8 - Mill Road and Pukekohe East Upgrade | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Phase** | **Project Activity** | **Resource Unit (Habitat/Species)** | **Ecological Value** | **Effect Description Main** | **Effect Description Detailed** | **Effects Description Manual** | **Type** | **Extent (ZOI)** | **Duration** | **Frequency** | **Likelihood** | **Reversibility** | **Magnitude (pre-mitigation)** | **Level of Effect (Pre-mitigation)** |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Current conditions<br>Vehicles use of the new road/road segments may result in ongoing, albeit infrequent, 'road-kills'. | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Notice/vibration/Dust | Copper and ornate skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Same as baseline | Indirect | <Local | Short-term (<5 years) | Frequently | Unlikely (20-40% chance) | Totally | Negligible | Very Low |
| Operation | Presence of the road | Copper and ornate skink | High | Operation- Herpetofauna (native) | 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 due to the presence of the infrastructure | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Lighting and noise | Copper and ornate skink | High | Operation- Herpetofauna (native) | Disturbance of nocturnal lizard behaviour due to lighting associated with the infrastructure use | Same as baseline | Indirect | <Local | Permanent (>25 years) | | Unlikely (20-40% chance) | Irreversible | Low | Low |
| Operation | Vehicle movement | Copper and ornate skink | High | Operation- Herpetofauna (native) | Kill or injure individual due to vehicle movement (infrastructure use) | Same as baseline | Indirect | <Local | Permanent (>25 years) | Infrequently | Highly Unlikely (<20% chance) | Irreversible | Negligible | Very Low |
| Construction | Vegetation removal | Copper and ornate skink | High | Construction- Herpetofauna (native) | Lizard habitat loss due to vegetation removal | Vegetation removal may have an impact on the herpetofauna species. | Direct | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Irreversible | Moderate | Moderate |
| Construction | Vegetation removal | Copper and ornate skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | | Direct | <Local | Permanent (>25 years) | | Likely (>40-70% chance) | Partially | Low | Low |
| Construction | Vegetation removal | Copper and ornate skink | High | Construction- Herpetofauna (native) | Kill or injure individual due to vegetation removal | | Direct | <Local | Permanent (>25 years) | Infrequently | Likely (>40-70% chance) | Irreversible | Low | Low |
| Construction | Vegetation removal | Copper and ornate skink | High | Construction- Herpetofauna (native) | Lizard habitat loss due to vegetation removal | Same as baseline | Direct | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Irreversible | Moderate | Moderate |
| Construction | Vegetation removal | Copper and ornate skink | High | Construction- Herpetofauna (native) | Disturbance and displacement of individuals (existing) due to construction activities (noise, dust etc.) | Same as baseline | Direct | <Local | Permanent (>25 years) | | Likely (>40-70% chance) | Partially | Low | Low |
| Construction | Vegetation removal | Copper and ornate skink | High | Construction- Herpetofauna (native) | Kill or injure individual due to vegetation removal | Same as baseline | Direct | <Local | Permanent (>25 years) | Infrequently | Likely (>40-70% chance) | Irreversible | Low | Low |
| Construction | Vegetation removal | PK8-ES | Low | Construction- Terrestrial habitat | Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal | The patches of exotic scrub are dominated by invasive species such as gorse and privet species, and these patches occur along the existing Pukekohe East / Mill Road. These is a low likelihood of fragmentation and edge effects. | Direct | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Irreversible | Moderate | Low |
| Construction | Vegetation removal | PK8-PL3 | Low | Construction- Terrestrial habitat | Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal | The magnitude of effect is assessed as Low due to the low likelihood that fragmentation and edge effect will occur despite the likely removal of the vegetation. | Direct | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Irreversible | Moderate | Low |
| Construction | Vegetation removal | PK8-TL.1 | Low | Construction- Terrestrial habitat | Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal | Solitary Totara tree | Direct | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Totally | Moderate | Low |
| Construction | Vegetation removal | PK8-TL.3 | Low | Construction- Terrestrial habitat | Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal | This includes patches of exotic dominated treelands scattered along the existing Pukekohe East / Mill Road. There is a low likelihood that fragmentation and edge effect will occur despite the likely removal of the vegetation. | Direct | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Irreversible | Moderate | Low |
| Construction | Vegetation removal | PK8-ES | Low | Construction- Terrestrial habitat | Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity due to earthworks and bare earth surfaces | Without appropriate mitigation weed dispersal is likely to occur. | Indirect | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Totally | Moderate | Low |
| Construction | Vegetation removal | PK8-PL3 | Low | Construction- Terrestrial habitat | Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity due to earthworks and bare earth surfaces | Without appropriate mitigation weed dispersal is likely to occur. | Indirect | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Totally | Moderate | Low |
| Construction | Vegetation removal | PK8-TL.1 | Low | Construction- Terrestrial habitat | Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity due to earthworks and bare earth surfaces | Solitary Totara tree | Indirect | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Totally | Moderate | Low |
| Construction | Vegetation removal | PK8-TL.3 | Low | Construction- Terrestrial habitat | Weed dispersal to previously unaffected areas of indigenous vegetation, reduction in terrestrial biodiversity due to earthworks and bare earth surfaces | Without appropriate mitigation weed dispersal is likely to occur. | Indirect | <Local | Permanent (>25 years) | | Highly Likely (70-90% chance) | Totally | Moderate | Low |

TE TUPU NGĀTAHI
SUPPORTING GROWTH

# Appendix 12

## Route Refinement

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

# 12 Appendix 12 – Route Refinement

**Table 11-15: Drury West Arterial - NoR 1 Ecology Design Development and Mitigation**

| Ecological Concern Before Design Refinement | Mitigation through Design |
|---|---|
| Known, streams, and wetlands associated with the tie-in with Drury West Drury West Railway Station Ngaakooroa, Rail Station Park N' Ride.<br>• Ngakoroa stream / wetland loss due to a long culvert<br>• Site compounds within close proximity to stream / wetlands.<br>• Stormwater wetlands within close proximity to natural stream / wetlands. | • The placement of stormwater wetlands to reduce environmental effects on the Ngakoroa stream and riparian corridor.<br>• Minimum 10m setback of the site compounds confirmed. |
| • Stormwater wetlands (associated with Burtt Road) within close proximity to natural stream / wetlands.<br>• Natural stream / wetland loss through long culvert. | • Stormwater wetland redesigned and relocated outside of the wetland. |
| • Stormwater wetlands (associated with / near Runciman Road) close to natural stream / wetlands. Current design results in stream / wetland loss (resulting from two proposed locations of wetlands). No culvert shown – assumption that streams will be diverted under large viaduct. | • The placement of stormwater wetlands to reduce environmental effects on the natural wetland / riparian corridor.<br>• The position and intersection spacing for the tie ins with Runciman Road.<br>• Redesign of bridge and relocated placement of bridge to limit stream/wetland loss and maintain the riparian corridor. |

**Table 11-16: Drury – Pukekohe Link NoR 2 Ecology Design Development and Mitigation**

| Ecological Concern of Design Before Refinement | Mitigation through Design |
|---|---|
| Large area of wetland loss due to extent of fill within the floodplain (along the South Drury Connection Segment, near Burtt Road roundabout)<br>Smaller impact on exotic vegetation with bat habitat potential. | • There is adequate space within the designation boundary to provide opportunity for restoration activities.<br>• Exotic trees with potential to support bats are likely to be avoided. |

| Ecological Concern of Design Before Refinement | Mitigation through Design |
|---|---|
| Several smaller areas of wetland loss, and more significant (140-180m) of stream loss (along the South Drury Connection Segment (west of NoR 1 and NoR 2 connection) | • Realignment of designation to reduce wetland loss.<br>• Redesign of the stormwater wetland to limit footprint.<br>• Reduced stream loss.<br>• Reduced diversion requirements. |
| Potential for fragmentation (near Ngakoroa Stream) (Along the South Drury Connection Segment, east of NoR 1 and NoR 2 connection)<br>Other ecological features include identified wetland. Bats are not confirmed | • Redesign of stormwater wetland.<br>• Redesign to limit impact to riparian corridors & wetlands.<br>• Design allows for retaining of large mature trees along riparian corridors. |
| 40 - 50m of stream loss (along the northern section of the SH22 Connection segment). | • Redesign of stormwater wetland.<br>• Redesign to limit impact to wetland habitat. |
| Area of wetland loss (along the SH22 Connection segment, near the roundabout connecting to Drury – Paerata Link Segment).<br>Recommend bridge over wetland / floodplain and redesign of stormwater wetlands to avoid existing wetlands (e.g., two smaller stormwater wetlands either side of existing natural wetland). | • Major route redesign, which includes a bridge.<br>• Redesign and relocation of the stormwater wetlands.<br>• Reduced impact to wetlands and stream/riparian habitat.<br>• There is adequate space within the designation boundary to provide opportunity for restoration activities. |
| Potential wetland loss with no culvert (Drury – Paerata Link - north of connection with NoR 3),<br>Potential bat habitat, (not confirmed), | • Major route realignment and increase of designated area. Realignment to avoid a WL11 and exotic wetland.<br>• Realignment of designation reduces impact to the riparian/stream corridor<br>• There is adequate space within the designation boundary to provide opportunity for restoration activities. |
| Potential for wetland loss with no culvert shown (along the Drury – Paerata Link Segment - near the connection to NoR 3<br>Impacts on small stand of indigenous vegetation WF7 Pūriri forest. | • Route realigned / shifted to avoid the WF7 forest stand and wetlands.<br>• Stormwater wetland relocated and redesigned to avoid the wetland and forest. |

| Ecological Concern of Design Before Refinement | Mitigation through Design |
|---|---|
| Potential wetland loss with no culvert shown (along Paerata Arterial Segment - near Cape Hill Road / Sim Road),<br>Small impacts on mature native trees (mostly totara).<br>Bats in SEA_T_4380, are not confirmed, however, loss of large pines will impact existing 'hop-over' vegetation. | • Realignment of the route to avoid most of the large wetland and a stand of mature native trees (mostly Totara).<br>• Design Avoids SEA_T_4380.<br>• Limited impacts to the SEA and the likely bat population.<br>• There is adequate space within the designation boundary to provide opportunity for restoration activities. |

**Table 11-17: Pukekohe North East Arterial – NoR 4 Ecology Design Development and Mitigation**

| Ecological Concern of Design Before Refinement | Mitigation through Design |
|---|---|
| Approximately 25m of stream loss and wetland loss at Butcher Road junction. | • Redesign and relocation of the stormwater wetland |
| Several wetland areas lost (along the Pukekohe North East Arterial, between Cape Hill Road and SEA_T_4375)<br>Stormwater wetland impacts two natural wetland areas, redesign required to avoid wetland loss.<br>Bats not confirmed but potential to occur within SEA_T_4375, and along tree lines. Opportunity to retain and enhance hop over vegetation. | • Redesign and relocation of the stormwater wetland.<br>• There is adequate space within the designation boundary to provide opportunity for restoration activities.<br>• Site compounds confirmed to be located outside of the required setback (10m).<br>• Largely avoids SEA_T_4375, however, is included in designated area. This is to allow area for a bridge to be constructed over a tributary of a stream. Current route alignment allows for avoidance of the SEA. |
| Small stand of indigenous vegetation (potentially totara) (long the Pukekohe North East Arterial, from SEA_T_4375 eastwards). Despite apparent avoidance with retaining structures adjacent to SEA, likely to still impact vegetation during construction, including installation of proposed stormwater culvert.<br>Bats not confirmed but potential to occur within SEA_T_4375,.and along tree lines. | • Redesign of the stormwater wetland.<br>• Realignment of the designated area to avoid eastern section of SEA_T_4375 (north of 43 Grace James Road, but on Lot 2 DP 487557)<br>• Route design to avoid WF9 stand of indigenous vegetation. |

| Ecological Concern of Design Before Refinement | Mitigation through Design |
|---|---|
| Small stand of indigenous vegetation (Kahikatea) lost to bridge construction. (Along the Pukekohe North East Arterial, from, the eastern extent of Grace James Road, southwards.)<br>• Bats not confirmed but potential to occur within SEA_T_4374 and along stream corridor. | • Realignment of the route to avoid a stand of indigenous vegetation.<br>• Redesign and relocation of the stormwater wetland.<br>• There is adequate space within the designation boundary to provide opportunity for restoration activities. |
| • Small stand of indigenous vegetation (WF9: potentially - Taraire, tawa, podocarp forest) (along the Pukekohe North East Arterial.) Likely unavoidable but extensive replanting recommended by ecologists.<br>• Bats not confirmed but potential to occur along stream corridor. | • Realignment of the route to avoid small stand of indigenous vegetation (WF9: potentially - Taraire, tawa, podocarp forest) and wetlands.<br>• Redesign and relocation of the stormwater wetland. |

**Table 11-18: Pukekohe South East Arterial NoR 5 Ecology Design Development and Mitigation**

| Ecological Concern of Design Before Refinement | Mitigation through Design |
|---|---|
| Southeast of the Pukekohe Showgrounds, there is potential wetland feature impacted by earthworks.<br>Unconfirmed stream / drain in location of the stormwater wetland | • Redesign and relocation of the stormwater wetland. |
| Potential for stream loss (north of Golding Road,)<br>Bats not confirmed but potential to occur along stream corridor. | • Redesign of the stormwater wetland to limit impact to wetland. |

**Table 11-19: Pukekohe North West Arterial NoR 7 Ecology Design Development and Mitigation**

| Ecological Concern of Design Before Refinement | Mitigation through Design |
|---|---|
| • Small stand of mature indigenous vegetation (totara) southeast of the intersection between Heights Road and Gun Club Road impacted by designation. | • Realignment of route to avoid small stand of mature indigenous vegetation (totara). |
| • 140m and 70m stream loss and associated wetlands near Butcher Road proposed roundabout. | • Redesign and relocation of the stormwater wetland. |

**Table 11-20: Mill Road and Pukekohe East Road Upgrade - NoR 8 Ecology Design Development and Mitigation**

| Ecological Concern of Design Before Refinement | Mitigation through Design |
|---|---|
| • Several small areas of wetland loss (near Morgan Road)<br>• Stormwater wetland impacts on natural wetlands<br>• Potential for 220m of stream loss to accommodate the proposed stormwater wetland (impacts four small stream branches) | • Removal of the stormwater wetland.<br>• Redesign of the designated boundary.<br>• Reduced stream and wetland loss. |
| • Impacts on mature indigenous vegetation WF9 Taraire, tawa, podocarp forest, on the southern side of Mill Road, within the Waikato jurisdiction. This is connected to Significant Natural Area (SNA) (Waikato). | • Redesign and designation boundary adjustment.<br>• Updated designation to avoid WF9 forest stand.<br>• Updated designation to avoid SNA (near 42 Mill Road, Pukekohe) (Waikato) |
| Impacts on wetland and indigenous vegetation (regenerating broadleaf scrub VS5). due to earthworks (Near the Eastern extent of Waikato boarder (along Mill Road), on the northern side of the designation)<br>Impacts to riparian corridor is esplanade reserve and wetland<br>Riparian vegetation impacted on the southern side of Mill Road. This includes regenerating indigenous WF9: Taraire, tawa, podocarp forest. (Including 10 large Kauri trees | • Major realignment of the route<br>• Redesign of the road to reduce the footprint, limiting impact to the adjacent vegetation / wetlands / stream. |

| Ecological Concern of Design Before Refinement | Mitigation through Design |
| --- | --- |
| Culvert extension resulting in stream loss on a large high value stream. The existing culvert is approximately 20m long, and the design proposed will extend to 60 - 80m loss of high value stream.<br><br>Bats not confirmed yet but the mature native and exotic trees on both sides, likely create an existing bat corridor (hop-over vegetation). | |
| loss of wetland habitat on both sides and stream loss towards eastern extent of proposed Mill Road Upgrade, | • Redesign and relocation of the stormwater wetland.<br>• Location of the stormwater wetland across an existing artificial wetland system to avoid affecting the natural stream/wetland corridor |