TE TUPU NGĀTAHI
SUPPORTING GROWTH

VOLUME 4

Airport to Botany Assessment of Ecological Effects

December 2022

Version 1

WAKA KOTAHI
NZ TRANSPORT AGENCY

AT

New Zealand Government

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Glossary of Defined Terms and Acronyms

Acronym/Term	Description
AEE	Assessment of Effects on the Environment report
AUP:OP	Auckland Unitary Plan: Operative in Part
BMP	Bat Management Plan
BRT	Bus Rapid Transit
CVA	Cultural Values Assessments
EcIA	Ecological Impact Assessment
EG	Exotic grassland
EIANZ	Environmental Institute of Australia and New Zealand
MfE	Ministry for the Environment
N/A	Not Applicable
NES:F	National Environmental Standards for Freshwater
NIMT	North Island Main Trunk railway
NoR	Notice of Requirement
NoR 1	Notice of Requirement 1: Airport to Botany Bus Rapid Transit (Botany Town Centre to Rongomai Park)
NoR 2	Notice of Requirement 2: Airport to Botany Bus Rapid Transit (Rongomai Park to Puhinui Station, in the vicinity of Plunket Avenue)
NoR 3	Notice of Requirement 3: Airport to Botany Bus Rapid Transit (Puhinui Station, in the vicinity of Plunket Avenue to SH20/20B Interchange)
NoR 4a	Notice of Requirement 4a: Airport to Botany Bus Rapid Transit (SH20/20B Interchange to Orrs Road)
NoR 4b	Notice of Requirement 4b: Alteration to NZ Transport Agency Designation 6717 – State Highway 20B
NPS:FM	National Policy Statement on Freshwater Management
Programme partners	Te Ākitai Waiohua, Auckland Airport, Auckland Transport and Waka Kotahi
RCA	Road Controlling Authority
RHA	Rapid Habitat Assessment
RMA	Resource Management Act 1991
RP	Regional Plan
RPS	Regional Policy Statement
SEA	Significant Ecological Area

SH1	State Highway 1
SH20	State Highway 20
SH20B	State Highway 20B
SEA	Significant Ecological Areas
SWGP	Southwest Gateway Programme
TAR	Threatened or At Risk
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth
Waka Kotahi	Waka Kotahi NZ Transport Agency
ZOI	Zone of Influence

Executive summary

This Assessment of Ecological Effects report (**Report**) has been prepared to inform the Assessment of Effects on the Environment (**AEE**) for five Notices of Requirement (**NoR**) being sought by Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport for the Airport to Botany project (**Project**). This report assesses the ecological effects of the four proposed NoRs.

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

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

Table 1. Ecological values of terrestrial vegetation types for each NoR (refer Singers et al. 2017 for ecosystem type and code)

Vegetation Type	Abbrev.	NoR 1	NoR 2, Section A	NoR 2, Section B	NoR 2, Section C	NoR 3	NoR 4
Broadleaved species scrub/forest	VS.5	-	-	-	-	-	High
Exotic Grass	EG	Negligible	Negligible	Negligible	Negligible	Negligible	Low
Exotic Scrub	ES	-	-	-	-	-	Low
Exotic Forest	EF	High	-	-	-	-	High
Planted - Native	PL.1	Riparian margins = High Isolated fragments = Low	High	High	-	Low	Low
Planted - Mixed	PL.2	Low	Low	Low	Low	Cambridge Terrace and 252 Puhinui Road = High Other areas = Low	-
Treeland - Mixed	TL.2	-	Low	Low	-	-	-

[1] Only district plan vegetation (trees >4m in high and or in open space) were included as it is an NoR application.

Treeland - Exotic	TL.3	-	-	-	Low	-	High

Table 2. Ecological values of District Plan trees for each NoR

Vegetation Type	NoR 1	NoR 2, Section A	NoR 2, Section B	NoR 2, Section C	NoR 3	NoR 4
District plan trees	Low	Low	Low	Low	Low	-

Table 3. Ecological values of terrestrial fauna for each NoR

Fauna Type	NoR 1	NoR 2, Section A	NoR 2, Section B	NoR 2, Section C	NoR 3	NoR 4
Bats	Very High	Very High	-	-	-	-
Birds	High	Low	Low	Low	Low	High
Lizards	High	High	High	-	High	High

Table 4. Ecological values of streams and other non-wetland freshwater habitats for each NoR

Stream	NoR 1	NoR 2, Section A	NoR 2, Section B	NoR 2, Section C	NoR 3	NoR 4
Pakuranga Creek Tributary	High					
Taraire Creek Tributary A*	Moderate					
Taraire Creek	High					
Taraire Creek Tributary B	Low					
Ōtara Creek Tributary	Moderate**					
Puhinui Creek Tributary A			Low			
Puhinui A P.2			Negligible			
Puhinui A P.3			Negligible			
University.1			Negligible			
Puhinui Creek Tributary B				Low		
Waokauri Creek Tributary A						Moderate
Waokauri Creek Tributary B						Low
Waokauri Creek Tributary C*						Moderate
Waokauri Creek Tributary D						High

Waokauri Creek Tributary E						Moderate
Waokauri C P.1						Negligible
SH20 B Swales 1 to 4						Negligible

Notes: * = Stream directly impacted by road alignment.

** = Stream straddles designation boundary; but for conciseness has only been assessed within the NoR 1 section of this report

Table 5. Ecological values of wetlands for each NoR

Wetland	NPS-FM	NoR 1	NoR 2, Section A	NoR 2, Section B	NoR 2, Section C	NoR 3	NoR 4
Botany W.1	Artificial	Low					
Pakuranga W.1	Natural Wetland	High					
Taraire A W.1	Natural Wetland	High					
Taraire A W.2	Natural Wetland	High					
Sancta Maria W.1	Artificial	Moderate					
Taraire W.1	Natural wetland	High					
Taraire W.2	Natural wetland	Low					
Ōtara W.1	Natural wetland	High**					
University W.1	Constructed wetland			Low			
Puhinui Station W.1	Constructed wetland					Low	
Puhinui Station W.2	Constructed wetland					Low	
Waokauri A.1	Natural Wetland						Moderate
Waokauri A.2	Induced Wetland						Moderate
Waokauri B.1*	Natural Wetland						Low
Waokauri C.1*	Natural wetland						High

Waokauri C.2	Natural wetland						Low
Waokauri D.1	Natural wetland						High
Waokauri E.1*	Natural Wetland						Moderate

Notes: * = Wetland directly impacted by road alignment.

** = Wetland straddles designation boundary; but for conciseness has only been assessed within the NoR 1 section of this report

Table 6 to Table 9 provide summaries of district matter ecological effects during construction prior to any mitigation. The summary represents the level of effect for the baseline and likely future ecological environment activities as one where they are the same[2]. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Construction effect mitigation measures will include:

- A Bat Management Plan (**BMP**) for NoR 1 and NoR 2 Section A. Details of the BMP will depend on bat habitat present at the time of construction, and is likely to include bat habitat surveys prior to construction, siting of compounds and laydown areas to avoid bat habitat, lighting design to reduce light levels and spill from construction areas and restriction of nightworks around bat habitat;
- Bird management will be required for NoR 1, NoR 2 Section A and NoR. Considerations for bird management will include a bird survey prior to construction to confirm Threatened or At Risk (**TAR**) species are not present and to provide guidance if TAR species are present, including the avoidance of the bird breeding season (September to February) during construction; and
- The residual (post-mitigation) level of effect for all construction effects are considered Negligible or Low.

Table 6. Summary of ecological effects during construction prior to mitigation for district plan trees

Construction - Terrestrial vegetation (district plan)	
NoR	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees only)
NoR 1	Very Low
NoR 2, Section A	Very Low
NoR 2, Section B	Very Low
NoR 2, Section C	Very Low
NoR 3	Very Low
NoR 4	-

Table 7. Summary of ecological effects during construction prior to mitigation for bats

Construction - Bats

[2] The effects assessment considered the baseline and the likely future environment as the construction of the road will only occur more than 10 years in the future.

NoR	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Loss of foraging habitat due to vegetation removal - District plan only	Kill or injure individual bats due to vegetation removal - District plan only
NoR 1	Moderate	N/A	N/A
NoR 2, Section A	Moderate	N/A	N/A
NoR 2, Section B	-	-	-
NoR 2, Section C	-	-	-
NoR 3	-	-	-
NoR 4	-	-	-

Table 8. Summary of ecological effects during construction prior to mitigation for birds

Construction - Birds		
NoR	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.) - Non-TAR	Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill birds
NoR 1	High	Low
NoR 2, Section A	High	Low
NoR 2, Section B	Low	Low
NoR 2, Section C	Low	Low
NoR 3	Low	Low
NoR 4	High	N/A

Table 9. Summary of ecological effects during construction prior to mitigation for lizards

Construction – Lizards	
NoR	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)
NoR 1	Very Low
NoR 2, Section A	Very Low
NoR 2, Section B	Very Low
NoR 2, Section C	N/A
NoR 3	Very Low
NoR 4	Very Low

Table 10 to Table 12 provide summaries of district plan matter operational effects due to the presence of the road resulting in disturbance or loss in connectivity to bats, birds and lizards. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed.

Operational effects mitigation measures will include a BMP. The BMP will include buffer planting along road corridors associated with stream crossings[3] and lighting design along strategic location of the road (stream crossings).

The residual level of effect for operational effects are considered **Low** or **Very Low**.

Table 10. Summary of ecological effects during operation prior to mitigation for bats

Operation - Bats		
NoR	Loss in habitat connectivity due to presence of the upgraded roadway and associated noise and lighting	Kill or injuring - vehicle strike
NoR 1	Moderate	Low
NoR 2, Section A	Moderate	Low
NoR 2, Section B	N/A	N/A
NoR 2, Section C	N/A	N/A
NoR 3	N/A	N/A
NoR 4	N/A	N/A

Table 11. Summary of ecological effects during operation prior to mitigation for birds

Operation - Birds			
NoR	Disturbance - presence of the road	Loss in connectivity - presence of the road	Kill or injuring - vehicle strike
NoR 1	Low		Very Low
NoR 2, Section A	Very Low		Very Low
NoR 2, Section B	Very Low		Very Low
NoR 2, Section C	Very Low		Very Low
NoR 3	Very Low		Very Low
NoR 4	Low		Very Low

Table 12. Summary of ecological effects during operation prior to mitigation for lizards

Operation - Lizards			
NoR	Disturbance - presence of the road	Loss in connectivity - presence of the road	Kill or injuring - vehicle strike
NoR 1	Low		Very Low
NoR 2, Section A	Low		Very Low
NoR 2, Section B	Low		Very Low
NoR 2, Section C	N/A		N/A

[3] The extent of buffer planting is not specifically defined in this report as the requirements may change in the future. For example, stream corridors may have no or immature buffer planting under present conditions that may change in the future. The requirement to provide buffer planting and/or retain trees (that already meet the function of buffer planting) is likely to include the area between the road embankment and the designation boundary to a minimum distance of 10 m on either side of stream crossings (noting that buffer planting can occur on the road embankments).

NoR 3	Low	Very Low
NoR 4	Low	Very Low

1 Introduction

1.1 Purpose and scope of this Report

This Assessment of Ecological Effects report (**Report**) has been prepared to inform the Assessment of Effects on the Environment (**AEE**) for five Notices of Requirement (**NoR**) being sought by Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport for the Airport to Botany project (**Project**) under the Resource Management Act 1991 (**RMA**). Specifically, this Report considers the actual and potential effects associated with the construction and operation of the Project on the existing and likely future environment as it relates to terrestrial ecological effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

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 within each NoR, and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this Report and have been considered as part of this assessment of terrestrial and freshwater ecological effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this Report for clarity.

1.2 Report structure

To provide a clear assessment of each NoR, this Report follows the structure set out in the AEE. That is, each notice has been separated out into its own section, and each section contains an assessment of the actual and potential effects for the specific NoR. Where appropriate, measures to avoid, remedy or mitigate effects are recommended.

Each section is arranged in geographical order, starting from the westernmost point of the proposed NoR, to the easternmost point. Table 13 below describes the extent of each section, and where the description of effects can be found in this Report.

Table 13 Report structure

Sections	Section number
Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	4
Identification and description of the existing and likely receiving ecological environment;	7.1, 8.1, 9.1, 10.1
Assessment of general ecological matters for all Airport to Botany Bus Rapid Transit NoRs	6
Assessment of specific ecological matters for Airport to Botany Bus Rapid Transit NoR 1	7.4
Assessment of specific ecological matters for Airport to Botany Bus Rapid Transit NoR 2	8.2.3, 8.3.3, 8.4.3,
Assessment of specific ecological matters for Airport to Botany Bus Rapid Transit NoR 3	9.4
Assessment of specific ecological matters for Airport to Botany Bus Rapid Transit NoRs 4a and 4b	10.4

2 Project Description

The overall Project is proposed to be an 18 km fast, high capacity, reliable, and frequent Bus Rapid Transit (**BRT**) connection with twelve stations. It is part of Auckland's wider Rapid Transit Network (**RTN**) connecting Auckland Airport and its employment areas with major urban centres including Manukau and Botany.

As set out in the AEE, this Report specifically relates to a portion of the overall Project (approximately 14.9 km) which extends from the Botany Town Centre in the vicinity of Leixlep Lane to Orrs Road in the Puhinui peninsula, off SH20B. The Project primarily involves the upgrade and widening of existing transport corridors to provide for a dedicated BRT corridor and high-quality walking and cycling facilities.

Nine BRT stations are proposed as part of the Project. These stations are generally located at signalised intersections and will be staggered on either side of the intersection.

These stations are situated in the following locations:

- Smales Road;
- Accent Drive;
- Ormiston Road – Botany Junction Shopping Centre;
- Dawson Road;
- Diorella Drive;
- Ronwood Avenue (Manukau Central);
- Manukau Station;
- Puhinui Road/Lambie Drive; and
- Puhinui Station.

As part of the Project, two new structures are proposed:

- A BRT bridge crossing the North Island Main Trunk (NIMT) and connecting to the concourse level of the Puhinui Station; and
- A southbound ramp from SH20B to SH20.

Upgrades to existing structures are proposed at the:

- Bridge over Ōtara Creek (NoR 1);
- Bridge over SH1 (NoR 2);
- Bridge over NIMT (NoR 3); and
- Bridge over Waokauri Creek (NoR 4a).

Figure 1: Overview of the Project and NoR packages

Table 14: Overview of NoRs

Notice	Description	Requiring Authority
NoR 1	Bus Rapid Transit corridor and high quality walking and cycling facilities from Botany Town Centre to Rongomai Park	Auckland Transport
NoR 2	Bus Rapid Transit corridor and high quality walking and cycling facilities from Rongomai Park to Puhinui Interchange, in the vicinity of Plunket Avenue	Auckland Transport
NoR 3	Bus Rapid Transit corridor and high quality walking and cycling facilities from Puhinui Interchange, in the vicinity of Plunket Avenue to SH20/SH20B Interchange	Auckland Transport
NoR 4a	Bus Rapid Transit corridor and high quality walking and cycling facilities from SH20B/20 Interchange to Orrs Road	Auckland Transport
NoR 4b	Alteration to designation 6717 to provide for the widening of SH20B, including a southbound on-ramp onto SH20, high quality walking and cycling facilities and enable a Bus Rapid Transit corridor	NZ Transport Agency

3 Assessment approach

3.1 EcIA asessment

This assessment generally follows the EcIA Guidelines for use in New Zealand published by the Environmental Institute of Australia and New Zealand (**EIANZ**) (Roper-Lindsay *et al.*, 2018). The EcIA Guidelines provide a standardised matrix framework that allows ecological effects assessments to be clear, transparent, and consistent. The EcIAG framework is generally used in Ecological Impact Assessments in New Zealand as good practice, and a detailed analysis of this methodology is presented in **Appendix A**.

3.2 Assessment of District Plan matters and approach to Regional Plan matters

Designations are a form of spot zoning in a District Plan. A designation authorises a requiring authority to undertake work and activity without the need for land use consent. A designated area is still subject to Regional Plan matters in the Auckland Unitary Plan (Operative in Part) (**AUP:OP**) and the necessary resource consents will be obtained closer to construction for the Project.

As this Report relates to proposed designations, the ecological effects assessment applies to District Plan matters only. Regional Plan matters will be subject to the aforementioned future consenting phase along with a supporting EcIA. As such Regional Plan matters have not been formally assessed in this Report, however the relevant matters have been screened to inform the designation boundary and are presented in Sections 7.5, 8.2.4, 8.3.4, 8.4.4, 9.5 and 10.5.

For reference, **Appendix B** sets out the split between District and Regional matters in the AUP:OP.

4 Assessment methodology

4.1 Preparation for this Report

4.1.1 Zone of Influence

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

The ZOI of the Project on different species differs depending on how the species uses their environment. For example, mobile species such as birds and long-tailed bats have large home ranges across more diverse habitats compared to lizards and threatened plant species which may be restricted to a small area or specific habitat type. This affects how a species could be impacted by the Project and was taken into consideration during the desktop review and site investigations. To reflect the likelihood of a species occurring or its potential dispersal ability into each of the Project areas, varying search distances were used depending on the species context.

4.1.2 Desktop review

A desktop review was undertaken to determine locations and extents of protected vegetation (riparian margins, Section E15.4.1 (A18, 19) of the AUP:OP and SEA, Section E15.4.2 of the AUP:OP, and fauna habitats.

Desktop investigations also involved a review of relevant fauna databases, including:

- Department of Conservation *Amphibian and Reptile Distribution Scheme* database (accessed February 2022);
- Department of Conservation bat records (accessed June 2022);
- iNaturalist[4]records within approximately 5km radius from each NoR[5];
- New Zealand Bird Atlas eBird database[6] Bird data is recorded in 10 km^2 grid squares. Squares AC69, AD68 and AD69 were accessed as these squares are positioned over the Project area; and
- New Zealand Freshwater Fish Database records were accessed for affected stream catchments.

Information collated from these sources was used to assess which native fauna species had the potential to be present within the habitat types present within the ZOI of each of the five NoRs. Because of the highly mobile nature of most native fauna (particularly bats and birds) the desktop

[4] https://www.inaturalist.org/

[5] GPS coordinates are 'obscured' for Threatened species which may affect the accuracy of records within the study area;

[6] https://ebird.org/newzealand/home

searches for species records were not split into each NoR but rather completed once for the Project as a whole.

To assist with other aspects of reporting, the following literature was also reviewed:

- An ecological assessment of State Highway 20B Short Term Improvements (Bioresearches, 2019), which reported on the results of fauna surveys (lizards, birds, bats) undertaken over SH20B during the summer of 2018-2019;
- Auckland Council Geomaps[7];
- Department of Conservation Threat Classification Series[8]; and
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers *et al.,* 2017).

4.1.3 Site investigations

4.1.3.1 Terrestrial habitats

A 'walk-through' method was undertaken on 26 January, 4 August and 31 August 2022 to ascertain the desktop review and identify any other significant values not recorded from the review. During the site assessment, notes were recorded regarding the state and type of the vegetation and habitats present within the site, the species present, vegetation type and canopy cover identification and contextual photographs were taken.

4.1.3.2 Freshwater habitats

A site assessment was undertaken on 26 January, 4 August and 31 August 2022 by a qualified freshwater ecologist. During the site assessment, the presence and extent of wetland and associated stream features within the property were noted and the quality of any freshwater habitat was visually assessed. Overland flow paths were ground-truthed and classified under the definitions in the AUP:OP as to their permanent, intermittent or ephemeral status (Table 15).

Table 15. Stream classification criteria

Criteria	Definition
Permanent stream	
1	The continually flowing reaches of any river or stream
Intermittent or ephemeral stream*	
1	Evidence of natural pools
2	Well defined banks and bed
3	Retains surface water present more than 48 hours after a rain event
4	Rooted terrestrial vegetation not established across channel
5	Organic debris from flooding present on floodplain
6	Evidence of substrate sorting, including scour and deposition

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

[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/aboutus/science-publications/conservation-publications/nz-threat-classification-system/

*If three or more of the six assessment criteria can be met with confidence, the watercourse is considered intermittent. If at least three criteria cannot be met, the watercourse is considered ephemeral.

Ecological value of the stream was then assigned based upon factors such as:

- The intactness of the riparian zone;
- Permanency of flow and complexity of habitat present within the stream;
- Observable water quality parameters; and
- Modifications to hydrology and catchment of the stream.

To assist in recording this information and scoring, the Rapid Habitat Assessment (**RHA**) Protocol (Clapcott, 2015) was used for streams where Ecological Assessments had not been previously completed. A copy of the scoring sheet used for completing RHAs is provided in **Appendix D**.

4.1.3.3 Wetland habitats

Potential wetland areas were assessed following the Ministry for the Environment's (**MfE**) wetland delineation protocols[9], including vegetation assessments and wetland hydrology to determine whether the areas meet the definition of a 'natural wetland' under the National Policy Statement on Freshwater Management (**NPS:FM**). Assessments were carried out within the Auckland region's 'growing season'[10].

Vegetation was assessed in accordance with the relevant MfE protocol[11]; based on the dominance and prevalence of:

- Obligate wetland vegetation (**OBL**) – almost always a hydrophyte, rarely in uplands;
- Facultative wetland (**FACW**) – usually a hydrophyte but occasionally found in uplands;
- Facultative (**FAC**) – commonly occurs as either a hydrophyte or non-hydrophyte;
- Facultative upland (**FACU**) – occasionally a hydrophyte by usually occurs in uplands; and
- Upland (**UPL**) – rarely a hydrophyte, almost always in uplands.

Where the dominance and/or prevalence tests showed unclear results, hydric soils and hydrology tests were undertaken in accordance with the associated protocol[10,12].

If the area met the definition of a natural wetland, it was classified as to its habitat type as per Singers *et al.* (2017). Its ecological value was then assessed, based upon this classification and the condition of the wetland, considering factors such as damage caused by stock access and weed invasion, and modifications to natural hydrology.

4.1.3.4 Freshwater naming conventions

Streams were named either by their proper names (e.g., Taraire Creek) or, if not formally named, as a Tributary of the main watercourse they formed a part of (e.g., Pakuranga Creek Tributary). If multiple

[9] Ministry for the Environment (2020). *Wetland Delineation Protocols.* Wellington: Ministry for the Environment.

[10] Ministry for the Environment (2021). *Wetland delineation hydrology tool for Aotearoa New Zealand*. Wellington: Ministry for the Environment.

[11] Clarkson, B. (2013). *A vegetation tool for wetland delineation in New Zealand*. Prepared for Meridian Energy Limited. Hamilton: Manaaki Whenua Landcare Research.

[12] Fraser *et al*. (2018). *Hydric soils – field identification guide.* Report LC3223 prepared for Tasman District Council. Hamilton: Manaaki Whenua – Landcare Research.

tributaries of the same watercourse were identified, these were denoted with ‘A’, ‘B’, ‘C’ etc. (e.g., Waokauri Creek Tributary A; Waokauri Creek Tributary B etc.).

Wetlands and ponds were named based upon the watercourse with which they were associated and denoted with a ‘W’ for wetland and a ‘P’ for pond. Where there was more than one wetland associated with a watercourse, wetlands were also numbered sequentially (e.g., two wetlands on the banks of the Pakuranga Creek would be labelled ‘Pakuranga W.1’ and ‘Pakuranga W.2’).

If a wetland or pond was present with no connection to a watercourse, it was labelled according to a nearby geographical location or feature, e.g., for a pond and a wetland located within the Auckland University of Technology Campus, the naming convention was ‘University P.1’ for the pond, and ‘University W.1’ for the wetland.

4.1.3.5 Fauna

No specific fauna surveys were undertaken, however any opportunistic sightings of fauna (or bird calls heard) during the site visits were recorded.

Opportunistic searches for lizards were not undertaken as it was considered that the only NoR with suitable habitat for native lizard species was NoR 4a and 4b. In these areas, lizard surveys and bat surveys had already been undertaken by Bioresearches (2019), and it was considered that lizard or bat presence/ absence would not have changed greatly in the time since these surveys.

4.1.4 Other methodologies

A Specialists Workshop was attended on 8 March 2022, during which Project specialists shared initial findings and discussed potential constraints and opportunities for restoration planting.

5 Area wide ecological desktop review – All NoRs

This section presents the findings of an area wide desktop study. The study covers all the habitats and species ('ecological features') present within the ZOI of each of the NoRs.

NoR specific ecological baselines have also been set out in the 'Existing Environment' subsection for each NoR.

5.1 Historical ecological context

The Project is located within two Ecological Districts. The northern end of NoR 1, and the entirety of NoR 2 Section B and Section C, NoR 3 and NoR 4a and 4b are located within the Tāmaki Ecological District, whilst the southern end of NoR 1, and the majority of NoR 2 Section A are located within the Manukau Ecological District (Figure 2). The sections below give a brief overview of the historic ecological conditions within these districts.

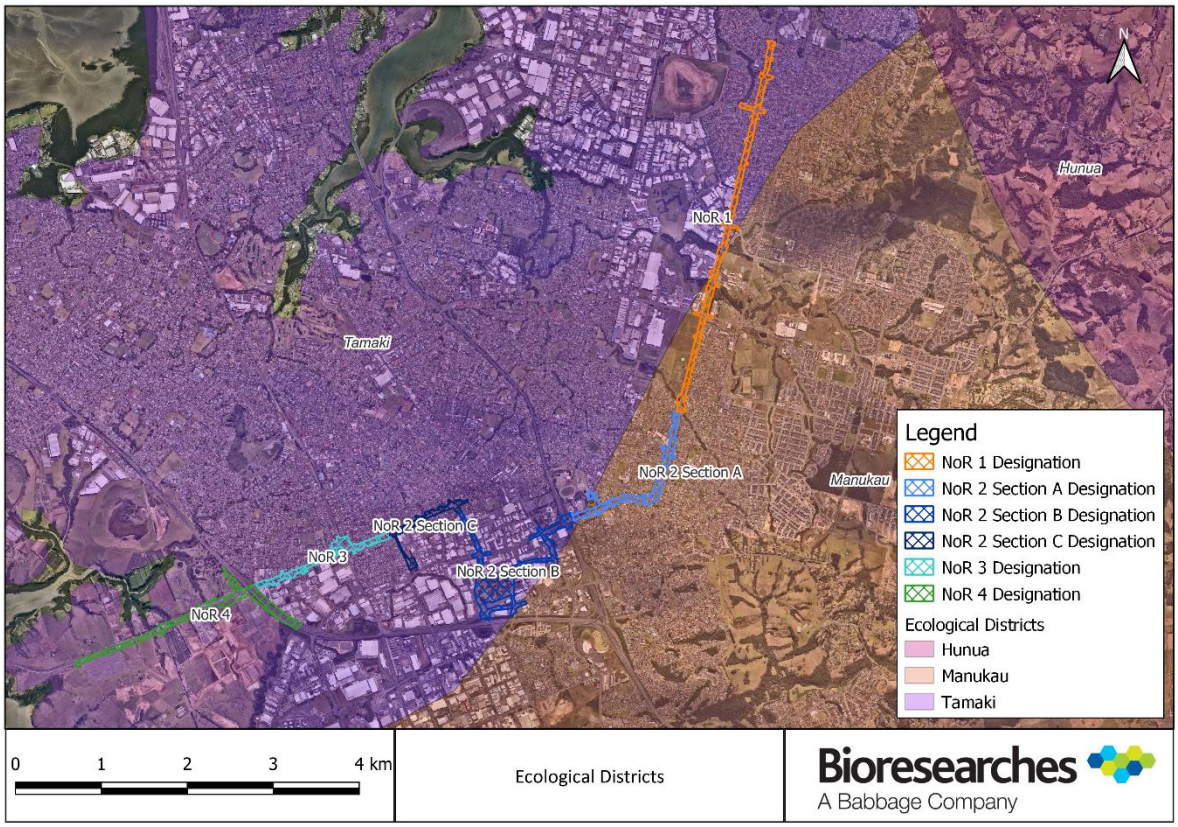


Figure 2. Ecological district boundaries in relation to the four NoRs

5.1.1 Tāmaki Ecological District

The Tāmaki Ecological District, which comprises the Auckland Isthmus, Waitematā Harbour, Takapuna and the East Coast Bays and the north-eastern edge of the Manukau Harbour. The climate of the district is warm and humid with mild winters. Soils are mainly derived from sedimentary volcanic ashes, however locally there are areas of volcanic soils on basaltic lava cones and flows (McEwan, 1987).

Much of the district was originally vegetated with taraire (*Beilschmiedia tarairi*) and pūriri (*Vitex lucens*) forest, with some kauri (*Agathis australis*) forest also present. Mangroves (*Avicennia marina* subsp. *australasica*) and saltmarsh areas were also present within the Waitematā Harbour.

As of 2009, only 6.9% of the Tamaki Ecological District remained in indigenous cover (Lindsay *et al.* 2009), with only 1% of kauri, podocarp and broadleaved forest; 2% of coastal forest; and 1% of indigenous freshwater wetland remaining. Reductions in indigenous cover below 5% are considered to be severe (Walker *et al.,* 2008). Consequently, any remaining indigenous wetland or forest vegetation; or vegetation which is regenerating into an indigenous vegetation type within the ecological district should be considered as important.

5.1.2 Manukau Ecological District

The Manukau Ecological District encompasses the Manukau Harbour and the low-lying land between it and the Waikato River. The district's climate brings warm, humid summers and mild winters. Much of the district was originally forested, with pūriri and taraire forests in upland areas and kahikatea and pukatea forests in lowland areas. Wetlands within the coastal areas were dominated by mangroves.

As of 2009, only 3% of the Manukau Ecological District remained in indigenous cover (Lindsay *et al.* 2009), with only 2% of kauri, podocarp and broadleaved forest; 4% of coastal forest; and 0.4% of indigenous freshwater wetland remaining. Reductions in indigenous cover below 5% are considered to be severe (Walker *et al*., 2008). Consequently, and like the Tāmaki District, any remaining indigenous wetland or forest vegetation; or vegetation which is regenerating into an indigenous vegetation type within the ecological district should be considered as important.

5.2 Terrestrial habitat and fauna

5.2.1 Terrestrial habitat

Where indigenous habitat remains within Auckland, it has been often been classified and mapped as a terrestrial or marine SEA in the AUP:OP. SEAs that occur within 2 km of the Project area are presented in Table 16 and shown in Figure 3. No SEAs are located directly within the Project footprint.

Table 16. SEAs located within 2 km of the Project area

Significant Ecological Area	Distance from Project area (km)	Criteria met for classification as SEA*	NoR(s) within 2 km
SEA_T_1191	1.6	1, 2, 4	NoR 1; NoR 2, Section A
SEA_T_1197	1.9	1, 2	NoR 1
SEA_T_1198	1.6	1, 2, 4	NoR 1
SEA_T_1199	1.5	2, 3	NoR 1
SEA_T_4346	1.3	2	NoR 2, Section C; NoR 3 and NoR 4
SEA_T_4347	1.5	4	NoR 1
SEA_T_4352	1.9	2	NoR 4
SEA_T_4353	1.9	2, 3, 4	NoR 4

SEA_T_5282	1.6	1, 2	NoR 1 and NoR 2, Section A
SEA_T_535	1.8	1, 2	NoR 2, Section A and Section B
SEA_T_538	1.1	1, 2	NoR 2, Section B
SEA_T_538a	0.8	1, 2, 4	NoR 1 and NoR 2, Section A and Section B
SEA_T_538b	1	1, 2, 4	NoR 1 and NoR 2, Section A and Section B
SEA_T_538c	0.8	1, 2, 4	NoR 1 and NoR 2, Section A and Section B
SEA_T_539	1.9	1, 2	NoR 2, Section B
SEA_T_5476	1.5	2, 4	NoR 4
SEA_T_607	2	4	NoR 4
SEA_T_612	0.03	2, 4	NoR 2, Section B and Section C; NoR 3 and NoR 4
SEA_T_613	0.3	2	NoR 1
SEA_T_8437	1.6	2	NoR 2, Section A, and Section B
SEA_T_8438	1.8	2	NoR 2, Section A
SEA_T_9065	1	2	NoR 3 and NoR 4
SEA-M1-27b	1.5	Artificial roost constructed which provides roosting for coastal birds. Also, a major roost for wading birds	NoR 4
SEA-M1-27c	1.9	Hight tide roost for many birds. Also has At-risk wetland bird habitat and threatened plants present.	NoR 4
SEA-M1-27w1	1.5	Wading bird habitat	NoR 4
SEA-M2-27a	0.013	An intertidal shellbank, sand flats and mangrove habitat which provides habitat for migratory birds, waders and threatened wetland birds.	NoR 3 and NoR 4
SEA-M2-45b	1.2	Best example of mangrove habitat in the Tamaki Estuary	NoR 1

* Classification codes are as follows:
1 = Representativeness
2 = Threat status and rarity
3 = Diversity
4 = Stepping-stones, migration pathways and buffers
5 = Unique or distinctiveness
Full classification criteria are provided in Appendix C

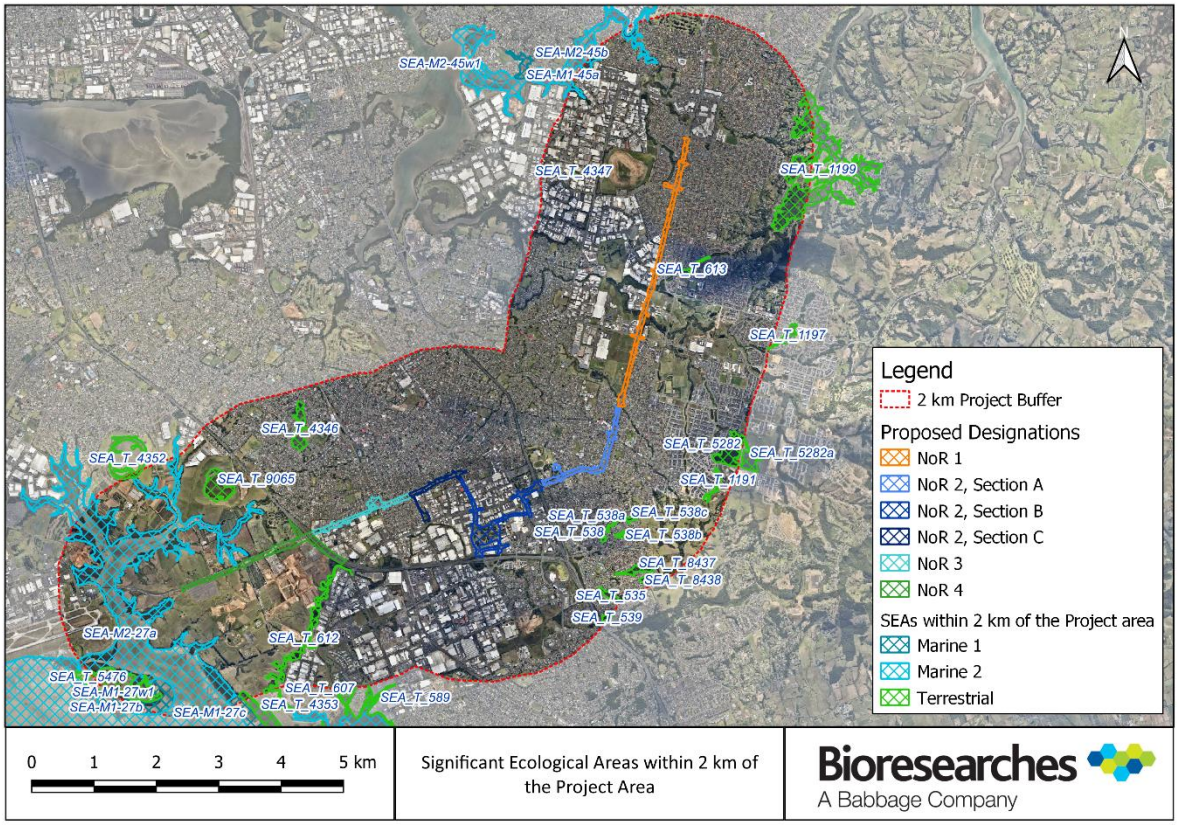


Figure 3. Significant Ecological Areas within 2 km of the Project area

5.2.2 Bats

Department of Conservation (**DOC**) records, and records from Bioresearches (2019) were accessed to complete the desktop study. This identified two bat records within 10 km of the Project (Figure 4):

- An 'unknown bat species' record located 2.1 km east of NoR 1; and
- A long-tailed bat (*Chalinolobus tuberculatus*; Threatened - Nationally Critical[13]) record 2.85 km southeast of NoR 2 Section A.

With regard to the 'unknown bat species' record, this is likely to be a long-tailed bat record. The closest records of short-tailed bats (*Mystacina tuberculata*; the other bat species present within New Zealand) are near Thames, 80 km southwest of the Project area. This species has far more specific habitat requirements than long-tailed bats (requiring mature forest with minimal introduced predators) and is far less mobile. Consequently, it is highly unlikely to be present within the Project area, and therefore this record can be considered to be a long-tailed bat.

Further than 10 km from the Project area, there are multiple long-tailed bat records in the Hunua Ranges, Waitakere Ranges and in the Pukekohe/Paerata area.

[13] Threat classification from O'Donnell *et al.* (2017).

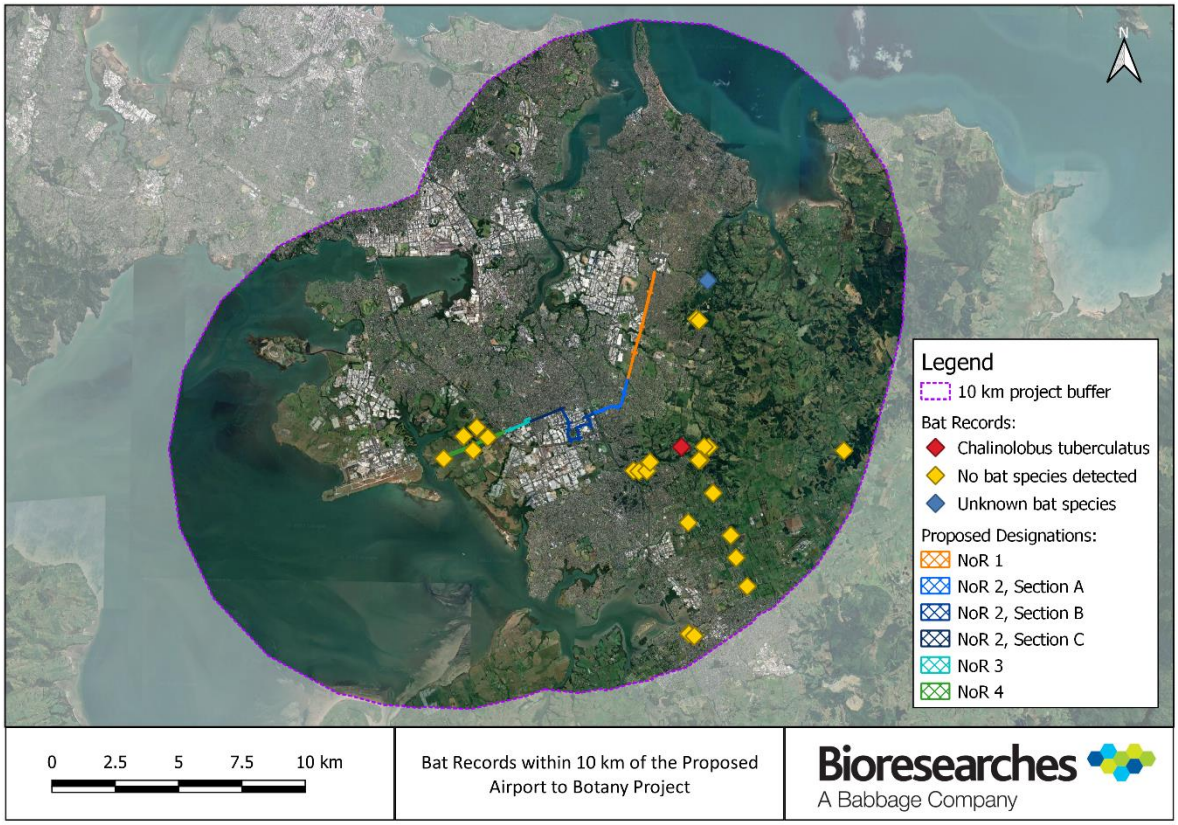


Figure 4. Bat records within 10 km of the Project area.

Analysis of potential bat habitats within the Project area both via desktop study and in the field showed that there is limited potential for bat presence due to both the urbanised nature of the Projct area within NoRs 1, 2 and 3. Despite this, the vegetation-lined stream corridors present within NoR 1 may have some potential to be used by foraging or commuting bats, however a lack of mature trees in this area removes the possibility for roosting to occur. Without a comprehensive bat survey within this area, it cannot be ruled out that bats do not use these stream corridors.

NoRs 4a and 4b have some potential for bat habitat present, in the form of vegetated stream corridors and mature trees. However, this rural environment is buffered by extensive urbanised areas which greatly reduce connectivity to other areas of known bat habitat. In addition, bat surveys conducted by Bioresearches (2019) using Automatic Bat Detectors in this area did not record bats. Consequently, the potential for bat presence within this area has been considered to be highly unlikely.

5.2.3 Birds

Records of 66 native bird species recorded within 5 km of the Project area, or within relevant grid squares of the New Zealand bird atlas data are collated in Table 87 in **Appendix B**. This included 34 Threatened or At Risk species, and exotic species were excluded. As many of these records do not include a specific location, maps were not produced.

It is accepted that common, non-threatened native species may use much of the available potential habitats present throughout the Project area, at least sporadically. However, there is limited potential habitat within the Project area which may be used by Threatened or At Risk species. Table 88 in **Appendix B** describes where suitable potential habitat may be present for these species within the

ZOI of the Project. This identified the possibility for the following birds to be present within the ZOI of the Project:

- Pāteke, banded rail, spotless crake and fernbird within NoRs 4a and 4b wetlands;
- Little black shag and pied shag to utilise larger streams within NoR 1 and 4 for foraging; and
- Pipit to use open areas within NoRs 4a and 4b.

5.2.4 Herpetofauna

A review of the DOC Bioweb database and Bioresearches (2019) found five indigenous lizard records within a 10 km radius of the NoR boundaries (Table 17). All indigenous lizard species identified in the DOC Bioweb search have a threat status of 'At Risk' (Hitchmough *et al*., 2016).

Copper skink (At Risk – Declining) is widespread and frequently recorded within highly modified habitats such as exotic scrub and rank grassland. The closest record is within the NoRs 4a and 4b. Copper skinks are also likely to be present in other NoRs if suitable vegetation is present.

Table 17. Indigenous lizard species records within a 10 km radius of the NoR boundaries

Common name	**Scientific name**	**Threat classification (Hitchmough *et al.* 2021)**
Copper skink	*Oligosoma aeneum*	At Risk – Declining
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining
Moko skink	*Oligosoma moco*	At Risk – Relict
Ornate skink	*Oligosoma ornatum*	At Risk – Declining
Shore skink	*Oligosoma smithi*	At Risk - Declining

5.3 Freshwater habitat and fauna

5.3.1 Streams

Auckland Council Geomaps' 'Rivers and Permanent Streams' layer indicates that there are 13 streams which are intersected by, or flow immediately adjacent to the Project area. These are listed in Table 18, and depicted in Figure 5 to Figure 10.

Fish surveys were not carried out during site investigations, however two 'At Risk – Declining' species, īnanga and/or longfin eel have been recorded in three of the stream catchments (Table 6).

The freshwater habitats within the NoRs were assessed for their potential to support indigenous fish during the RHA. Potential habitat, such as undercut banks, overhanging vegetation and macrophytes were observed at the time of survey.

Table 18. Streams identified within the ZOI of the Project using Auckland Council Geomaps 'Rivers and Permanent Streams' layer.

Stream[14]	**Abbreviated stream name used to identify in Figure 5 to Figure 10.**

[14] Naming conventions for each stream or waterbody are described in Section 4.1.3.4.

Pakuranga Creek Tributary A	PC A
Pakuranga Creek Tributary B Note: this stream is entirely piped beneath Te Irirangi Drive within the designation boundary and is considered to have no open sections within the ZOI. It has been included here for completeness but the small section present within the works area was consequently assessed as part of 'Pakuranga Creek Tributary A'.	PC B
Taraire Creek Tributary A	TC A
Taraire Creek	TC
Taraire Creek Tributary B	TC B
Ōtara Creek Tributary	OC
Puhinui Creek Tributary A	PC A
Puhinui Creek Tributary B	PC B
Waokauri Creek Tributary A	WC A
Waokauri Creek Tributary B	WC B
Waokauri Creek Tributary C	WC C
Waokauri Creek Tributary D	WC D
Waokauri Creek Tributary E	WC E
Waokauri Creek Tributary F	WC F

Figure 5. Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location (yellow line) and stream name codes added, within the NoR 1 section of the Project.

Figure 6. Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location (yellow line) and stream name codes added, within the NoR 2 Section A section of the Project.

Figure 7. Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location (yellow line) and stream name codes added, within the NoR 2 Section B section of the Project.

Figure 8. Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location (yellow line), within the NoR 2 Section C section of the Project.

Figure 9. Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location (yellow line), within the NoR 3 section of the Project.

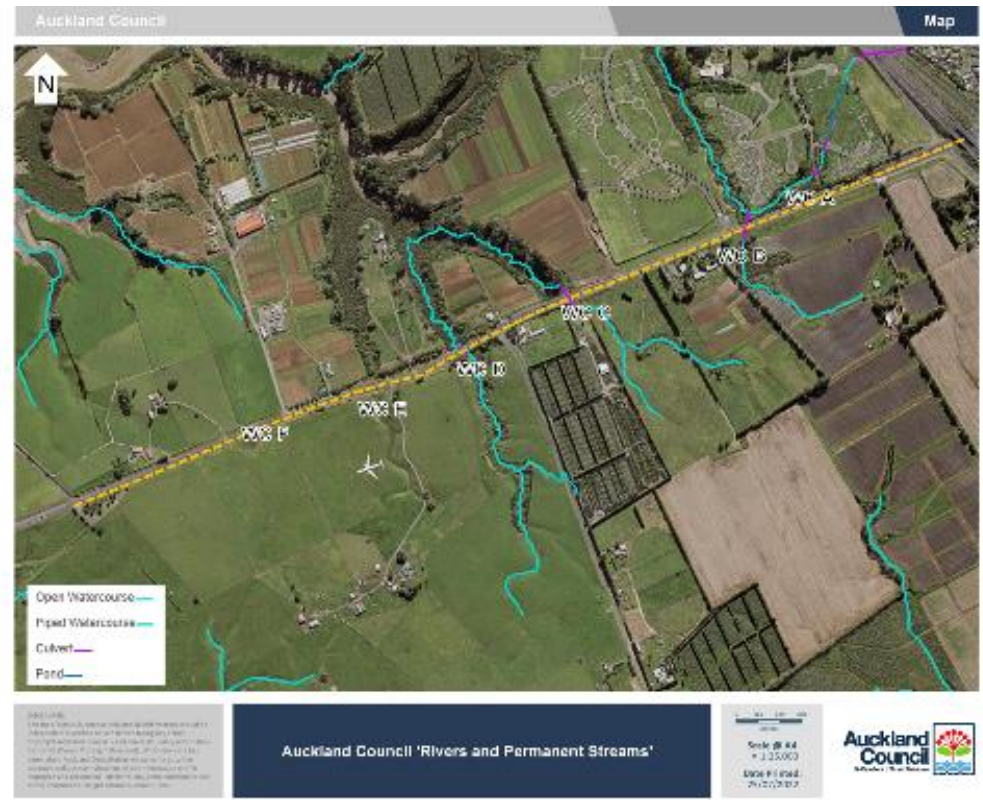


Figure 10. Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location (yellow line) and stream name codes added, within the NoR 4a and 4b section of the Project.

5.3.2 Fish

The NIWA freshwater fish database and Bioresearches (2019) were reviewed for fish records within stream catchments affected by the four NoRs. Of the fish recorded, two species – īnanga (*Galaxias maculatus*) and longfin eel (*Anguilla dieffenbachii*), are classed as At Risk – Declining (Dunn *et al.,* 2017). Also included for completeness are freshwater invertebrate results where they were included within the database. This includes records of the At Risk – Declining kākahi. The desktop review results are presented in Table 19.

Table 19. Freshwater fish recorded within streams present within the ZoI of each NoR

			Watercourse and relevant NoRs				
			1	1	1, 2	2	4
Scientific Name	**Common Name**	**Threat Classification**	Pakuranga creek	Taraire Creek	Ōtara Creek	Puhinui Stream	Pukaki and Waokauri Creek
Ameiurus nebulosus	Brown bullhead catfish	Introduced and Naturalised		x			
Anguilla australis	Shortfin eel	Not Threatened	x	x	x	x	x
Anguilla dieffenbachii	Longfin eel	At Risk - Declining		x	x	x	
Anguilla spp.	Unidentified eel	N/A	x				x
Carassius auratus	Goldfish	Introduced and Naturalised			x		
Ctenopharyngodon idella	Grass carp	Not Assessed	x	x	x	x	
Cyprinus carpio	Koi carp	Introduced and Naturalised			x		
Galaxias fasciatus	Banded kōkopu	Not Threatened		x	x	x	x
Galaxias maculatus	Īnanga	At Risk - Declining			x	x	x
Galaxias spp.	Unidentified galaxiid	N/A		x		x	
Gambusia affinis	Gambusia	Introduced and Naturalised		x	x		x
Gobiomorphus basalis	Cran's bully	Not Threatened		x		x	
Gobiomorphus cotidianus	Common bully	Not Threatened			x	x	
Hyridella menziesi	Kākahi, Freshwater mussel	At Risk - Declining		x		x	x
Paranephrops spp.	Kōura	Not Threatened		x		x	x

Paratya curvirostris	Freshwater shrimp	Not Threatened	x	x		x	x

5.4 Wetland habitat

Wetlands present within NoRs 4a and 4b had previously been assessed by Bioresearches (2019). However, as these assessments predated the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (**NES:F**), they were not undertaken using the most recent wetland delineation criteria. Wetlands within NoRs 4a and 4b were identified as either exotic freshwater wetlands, mosaics of native and non-native wetland plants, or mangrove forests.

No assessments were identified for wetlands within other NoRs.

6 Positive ecology effects of the Airport to Botany project

Positive terrestrial ecology effects could be achieved through mitigation enhancement or restoration of terrestrial and wetland habitats where ecological integrity is currently compromised through weed infestation. In addition, native restoration planting will occur on roadsides which will in time provide habitat for native fauna and assist in providing a native plant seed source in the local area which will eventually lead to the growth of native plants in other areas. Furthermore, exotic street trees to be removed often provide very little ecological function, such as the Washingtonia Palms that line Te Irirangi Drive. These will be replaced with native species that would provide indigenous resources for native fauna and contribute to local native seed sources.

Streams within the Project area are frequently affected by stormwater inputs, and the Project would allow for an increase in the number of ‘green infrastructure’ features such as stormwater wetlands, which will improve water quality of stormwater generated by the existing roadway before it enters the waterways. In addition, stream crossings where culverts are to be upgraded or lengthened will be improved so that fish passage is provided.

Opportunities within the immediate landscape of the Project include enhancing indigenous biodiversity values within the riparian margins of Waokauri Creek and at the Manukau Memorial Gardens; as well as Rongomai Park and where the Project crosses tributaries of Ōtara Creek, Taraire Creek and its tributaries, and the Pakuranga Creek Tributary (feed into the Waitematā Harbour). Of note, these opportunities have potential to strengthen and enhance wildlife corridor connectivity between the Manukau Harbour to west of the Project, and Waitematā Harbour to the north-east of the Project, as well as provide potential flood protection benefits.

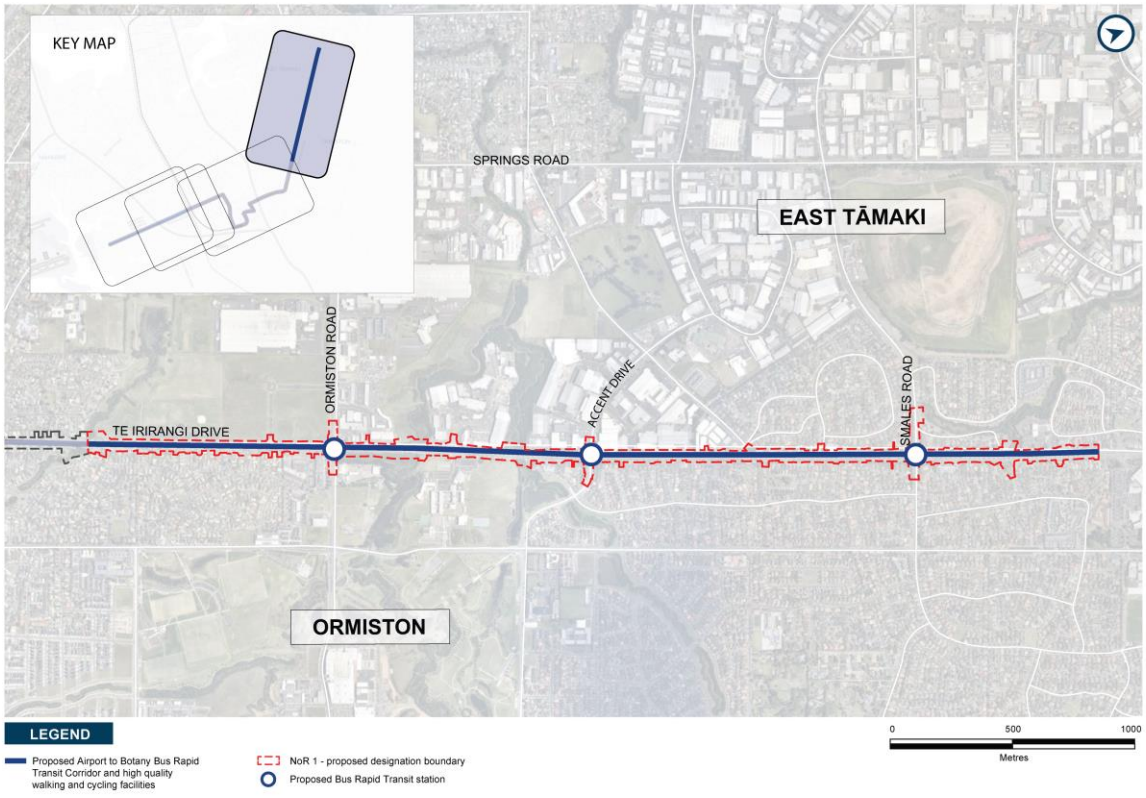
7 Airport to Botany Bus Rapid Transit – NoR 1

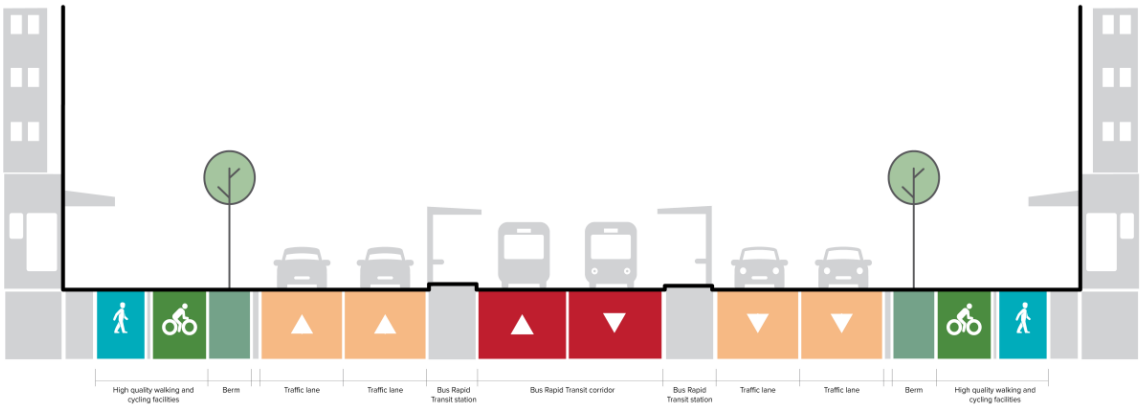
This section assesses specific ecological matters relating to NoR 1 – the Project corridor between Botany Town Centre and Rongomai Park.

7.1 Overview and description of works

As set out in Table 20 below, the proposed works in NoR 1 include the widening of existing Te Irirangi Drive to accommodate a centre-running BRT corridor, two vehicle lanes in each direction and high quality walking and cycling facilities.

Table 20: Overview of NoR 1

NoR 1 – Botany Town Centre to Rongomai Park	
	
Key features	
BRT Corridor	Centre-running along Te Irirangi Drive
BRT Stations	• Smales Road Station; • Accent Drive Station; and • Ormiston Road Station.
Walking and cycling facilities	Walking and cycling facilities on both sides of the corridor
General traffic	Two lanes in each direction (existing)

Access	There is an existing central median along the majority of Te Irirangi Drive which restricts right-turn access
Speed environment	50km/h
Signalised intersections	• Te Irirangi Drive and Smales Road; • Te Irirangi Drive and Accent Drive; • Te Irirangi Drive and Bishop Dunn Avenue; and • Te Irirangi Drive and Ormiston Road.
Stormwater infrastructure	• Swales; and • Wetlands.
NoR 1 typical cross section	
	

7.2 Ecological baseline

7.2.1 Terrestrial habitats and fauna

NoR 1 (Botany to Rongomai Park) transitions through light industry, mixed use, business and residential zones (AUP:OP), as well as a few open space recreation zones, and a special purpose zone in which the full school campus of the Sancta Maria College is located. Present day habitats are therefore largely limited to amenity plantings/gardens within the ZOI, with the exception of:

- The open grassland/lawn areas of Rongomai Park, Sancta Maria College and some undeveloped land to the west of the proposed alignment between Ormiston Road and Bishop Dunn Place, classified as exotic grassland (EG) using Singers *et al*., 2017;
- Planted exotic amenity trees, classified as exotic planted vegetation (PL.2); and
- Riparian margins of a Pakuranga Creek tributary, two tributaries of the Taraire Creek and a tributary of the Ōtara Stream, classified as native planted vegetation (PL.1).

These areas are further described in Table 21, and depicted in Figure 11, Figure 12 and Figure 13.

Table 21. Vegetation types present within and directly adjacent to the Project Area (NoR 1), classified according to Singers *et al.* (2017).

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
Planted Vegetation – native	PL.1	N/A	These areas of PL.1 habitat have been divided into two types: those that line the creeks which cross or flow parallel with Te Irirangi Drive and form larger areas of continuous habitat; and the isolated stands or narrow strips of planted vegetation which have no connection with other habitats. The planting mixtures are very similar throughout these areas and given their similar height (approx. 6 m tall), they all appear to have been planted around 20 years ago. These plant mixtures comprise kānuka (*Kunzea robusta*), kowhai (*Sophora microphylla*), karo (*Pittosporum crassifolium*), māhoe (*Melicytus ramiflorus*) and tī kōuka (*Cordyline australis*). A few native seedlings are coming through an otherwise bare ground cover, including māhoe, koromiko/hebe (*Veronica stricta*) and a few tōtara (*Podocarpus totara*), as well as weeds such as moth plant (*Araujia sericifera*). These areas are classified using the Singers *et al.* (2017) classification system as PL.1 (planted native scrub and forest <20 years old or wetland <10 years old.). The peripheries of these habitats which are adjacent to the streams were often weedy and contained overgrown pasture and weed species which would provide habitat for copper skink (*Oligosoma aeneum*), and were planted along stream banks, this vegetation may provide sufficient cover to allow streams to be used as a flight path for long-tailed bats, however the isolated stands are not expected to provide habitat for these species.
Planted Vegetation – amenity plantings	PL.2	N/A	Exotic amenity trees planted within the road corridor. Most of these are Washingtonia palm (*Washingtonia robusta*) or pōhutukawa. Exotic-dominated gardens such as those within residential sections. These habitats are not likely to provide habitat for native fauna species.
Exotic grassland	EG	N/A	Grassland dominated by exotic species. This includes pasture, sport pitches, gardens and parks. These habitats are not likely to provide habitat for native fauna species.
Exotic forest	EF	N/A	Pine canopy with limited understory. The understory which is present is a mix of common, native species such as those regenerating in the PL.2 habitat, and pest plant and weed species. Groundcover is unsuitable for copper skink, but the trees may provide some nesting or roosting habitat for common native bird species.

* = Information from Singers *et al.* (2017).

Fauna identified during the desktop study which may be present within the ZOI of the NoR include:

- Long-tailed bats;
- Copper skink;
- Common, non-threatened native bird species; and

- Wetland bird species such as pāteke (At Risk – Recovering; presence confirmed during site visits) and fernbird (At Risk – Declining).

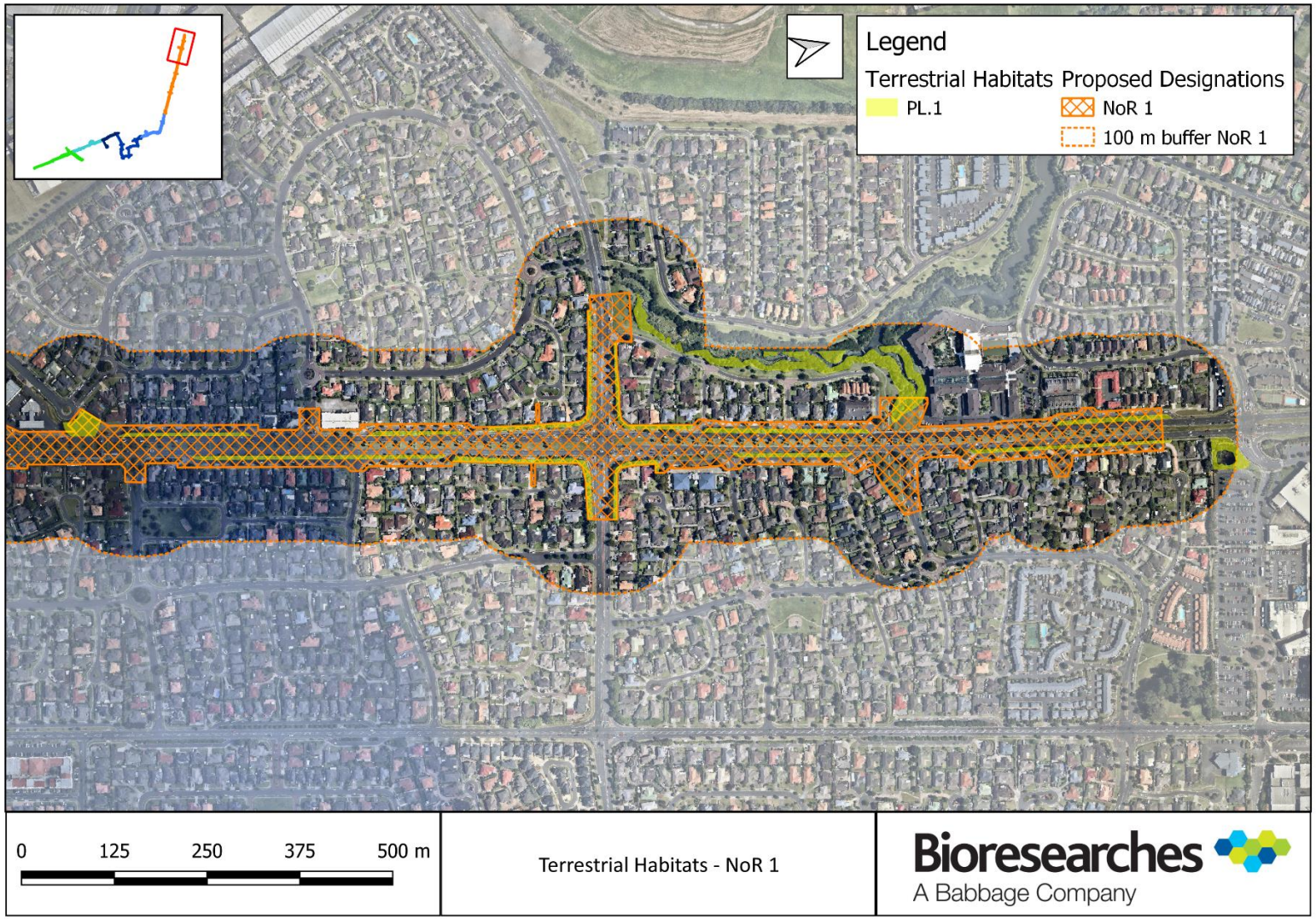


Figure 11. Terrestrial Habitats within the ZOI of the northern portion of NoR 1

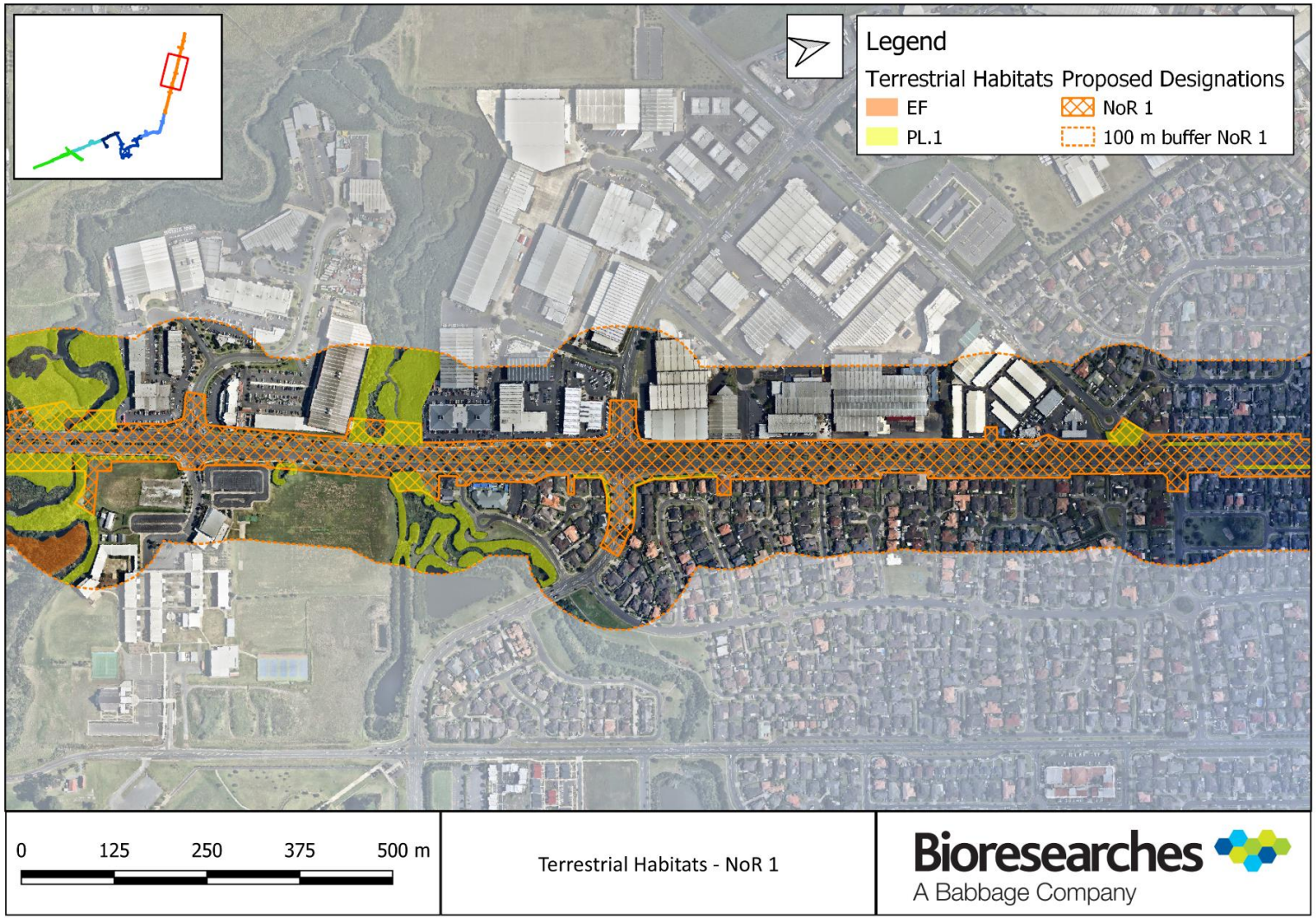


Figure 12. Terrestrial Habitats within the ZOI of the central portion of NoR 1

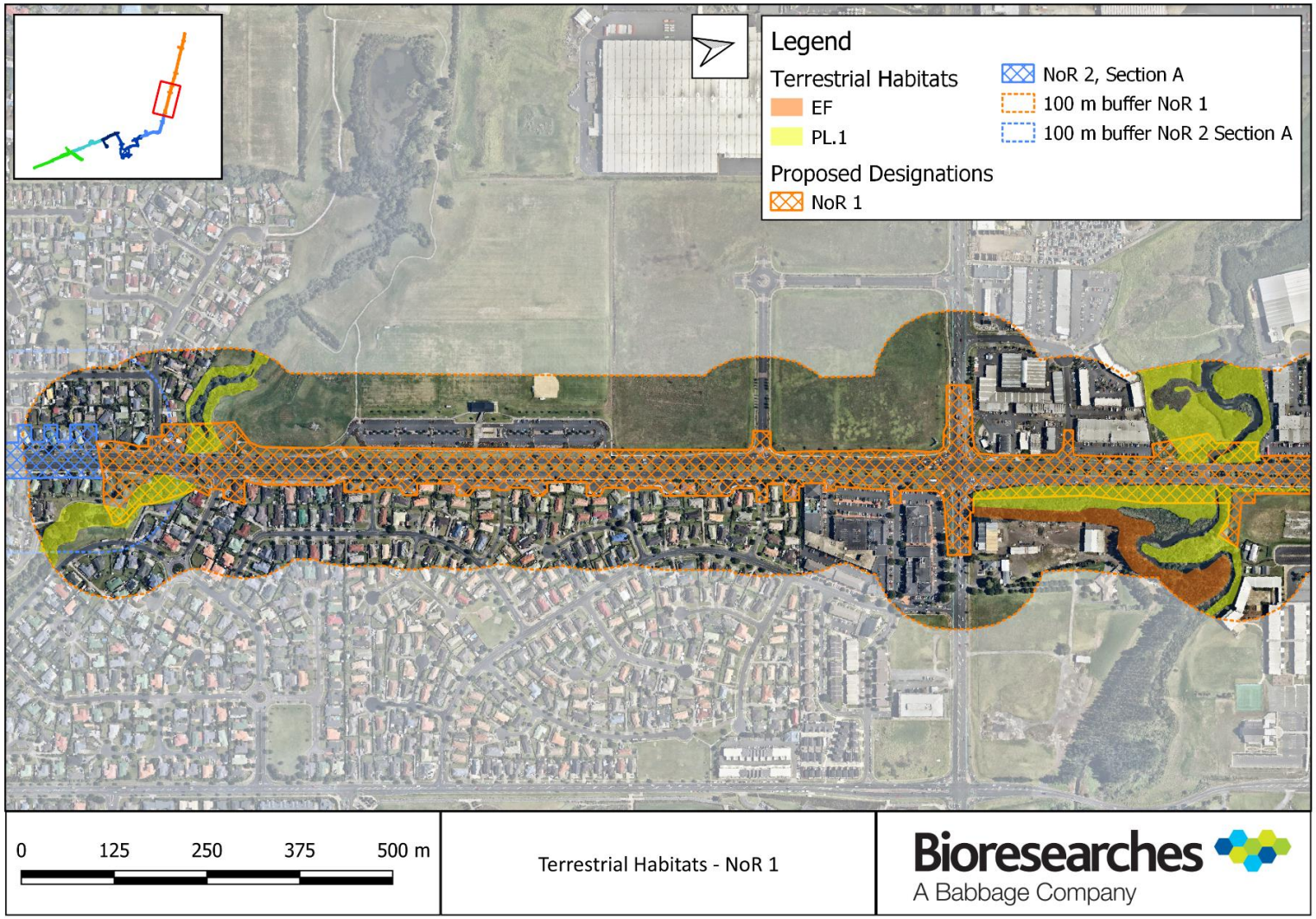


Figure 13. Terrestrial Habitats within the ZOI of the southern portion of NoR 1

7.2.2 Terrestrial ecological value

Table 22 presents the ecological value for the terrestrial habitats identified within NoR 1. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 22. Ecological values of terrestrial habitats within the ZOI of NoR 1

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
PL.1 – riparian margins	Moderate – although highly modified, there is so little natural vegetation left in the surrounding area that these areas can be considered important.	High – copper skink (At Risk - Declining) are likely present, and there is potential that the streams and riparian margins are used as long-tailed bat flight paths.	Low - while indigenous species dominate these planted compositions, they lack the diversity and structure expected of a naturally occurring ecosystem.	High - these vegetated margins provide some of the very few areas of biodiversity within a landscape that is largely devoid of indigenous vegetation and habitat.	High
PL.1 – isolated fragments	Moderate – although highly modified, there is so little natural vegetation left in the surrounding area that these areas can be considered important.	Low – not likely to support any Threatened or At Risk species.	Low – while indigenous species dominate these planted compositions, they lack the diversity and structure expected of a naturally occurring ecosystem.	Low - Whilst these areas may provide some foraging habitat for common, non-threatened bird species, due to their small, fragmented nature they are unlikely to support copper skink. Are much more susceptible to edge effects and weed incursion.	Low
PL.2	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	Low

EG	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	Negligible
EF	Low – this habitat is highly modified with low indigenous representation.	High – not likely to support any Threatened or At Risk species bird or lizard species, there is potential that the vegetation margins are used as long-tailed bat flight paths.	Low – habitat has very low diversity.	Low - Whilst these areas may provide some foraging habitat for common, non-threatened bird species, due to their small, fragmented nature they are unlikely to support copper skink. Are much more susceptible to edge effects and weed incursion.	High

Table 23 presents the ecological values for the fauna identified within the ZOI of NoR 1.

Table 23. Ecological values of fauna within the ZOI of NoR 1

Fauna	**Habitat units utilised**	**Conservation Status***	**Ecological value**
Bats – long tailed bat	PL.1 – riparian margins	Threatened - Nationally Critical	Very High
Lizards – copper skink	PL.1 – riparian margins	At Risk - Declining	High
Birds – pāteke and potentially others such as fernbird	Wetland habitats	Confirmed At Risk – Recovering and potentially At Risk – Declining species.	High
Birds – common, Not Threatened species only	Pl.1 and PL.2 habitats	Not Threatened	Low

* Retrieved from relevant New Zealand Threat Classification Series documents, available from https://www.doc.govt.nz/about-us/science-publications/series/new-zealand-threat-classification-series/

7.2.3 Freshwater habitats and fauna

Six stream branches were identified within 100 m of the designation boundary, however, only two of these were within the NoR 1 footprint. These streams are mapped in Figure 14, Figure 15 and Figure 16; and described in Table 24.

Table 24. Summary of NoR 1 streams

<table>
<tr><th>Stream</th><th>Classification</th><th>Brief description</th></tr>
<tr><td>Pakuranga Creek Tributary</td><td>Permanent</td><td>This habitat includes a larger tributary of the Pakuranga Creek which flows in a northern direction approximately 90 m west of NoR 1, and a smaller tributary stream to it which outflows from a culvert approximately 10 m west of Te Irirangi Drive and flows westward into the larger tributary. Because of their similarities and short lengths, they have been assessed as one habitat unit.
Both branches have associated wetland vegetation on their peripheries (mapped as Pakuranga W.1).
The smaller stream is entirely culverted upstream of the open extent within the Project area. The larger stream has approximately 400 m of channel upstream of the confluence of the two tributaries, above that it is entirely piped. Both streams receive all water from stormwater inflows and consequently can be expected to have highly modified hydrological regimes with flashy responses to rainfall, and likely receive contaminants from roads. Banks of both streams are lined with habitat unit PL.1 described above.
Instream habitats were observed to be degraded, with thick sediment layers and low clarity. A dam is present approximately 400 m below the confluence of the two tributaries which has artificially raised the water level within the lower reaches of the creek, forming a stormwater pond, and as such the hydraulic heterogeneity is low. The dam (and other culverts below it) likely act as at least partial barriers to fish passage.
Short fin eels (Not Threatened) were observed within the creeks. Grass carp have also been recorded in this dam, presumably introduced for control of aquatic weeds, but are likely exacerbating the poor water quality. It is likely they are still present, as the lower portions of the stream flooded by the dam were completely denuded of aquatic vegetation.
No records are held for At Risk or Threatened fish species.
Rapid habitat assessment scores were low to moderate:
<table>
<tr><th>Deposited Sediment</th><th>Invertebrate habitat diversity</th><th>Invertebrate habitat abundance</th><th>Fish cover diversity</th><th>Fish cover abundance</th><th>Hydraulic heterogeneity</th><th>Bank erosion</th><th>Bank vegetation</th><th>Riparian width</th><th>Riparian Shade</th><th>Total</th></tr>
<tr><td>1</td><td>3</td><td>1</td><td>3</td><td>4</td><td>2</td><td>5</td><td>7</td><td>8</td><td>6</td><td>40</td></tr>
</table>
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</table>

<table>
<tr>
<td>Taraire Creek Tributary A</td>
<td>Permanent</td>
<td>
Taraire Creek Tributary A is a third-order tributary stream which originates east of NoR 1. Along its peripheries are natural wetlands which generally extend approximately 2 - 3 m from the stream banks, however on the eastern side of the proposed Project there is a larger area of wetland present on the south side of the stream (mapped as Taraire A W.1).

Two stormwater ponds also flow into this wetland area; one is wholly artificial, whilst the other is a modified stream which has been dammed. Taraire Creek Tributary A outflows from the wetland approximately 20 m to the east of Te Irirangi Drive. It then flows through a culvert beneath Te Irirangi Drive. This culvert was observed to be acting as a partial barrier to fish passage, with a c. 10 cm drop in water level at its outlet. On the southern side of Tributary A, to the west of Te Irirangi Drive is an additional wetland (Taraire A W.2).

Kākahi (At Risk – Declining) have been recorded within the wider catchment, however, due to the poor habitat quality and thick sediment layer it is unlikely that they are present within the stream. Longfin eel (At Risk - Declining) have also been recorded, and likely pass through the Project to reach the upper reaches of the stream.

Sections of the stream were choked with the invasive weeds Egeria densa and hornwort (Ceratophyllum demersum), and exotic parrot’s feather (Myriophyllum aquaticum) was also present.

The stream receives a large volume of water from stormwater inflows and consequently can be expected to have a highly modified hydrological regime with flashy responses to rainfall.

Rapid habitat assessment scores were low to moderate:
<table>
<tr><th>Deposited Sediment</th><th>Invertebrate habitat diversity</th><th>Invertebrate habitat abundance</th><th>Fish cover diversity</th><th>Fish cover abundance</th><th>Hydraulic heterogeneity</th><th>Bank erosion</th><th>Bank vegetation</th><th>Riparian width</th><th>Riparian Shade</th><th>Total</th></tr>
<tr><td>1</td><td>3</td><td>3</td><td>2</td><td>7</td><td>2</td><td>4</td><td>7</td><td>10</td><td>4</td><td>43</td></tr>
</table>
</td>
</tr>
<tr>
<td>Taraire Creek</td>
<td>Permanent</td>
<td>
Taraire Creek flows in a western direction beneath a Te Irirangi Road bridge. It is a fourth-order stream with permanent flow.

The pest plant Egeria was present in thick mats within the creek, as well as large amounts of rubbish. Water clarity was too poor for the stream bed to be observed, however it is assumed that, like other nearby streams, the bed would have been smothered in fine sediment. Hydrological heterogeneity was limited to a slow run and a pool. Kākahi (At Risk – Declining) have been recorded within the wider catchment, however, due to the poor habitat quality and thick sediment layer it is unlikely that they are present within the stream. Longfin eel (At Risk - Declining) have also been recorded, and likely pass through the Project to reach the upper reaches of the stream.

The stream has wetland habitat present on both sides (Taraire W.1 and Taraire W.2, described below). Banks of the stream/wetland habitat are lined with habitat unit PL.1 described above.

Rapid habitat assessment scores were low:
<table>
<tr><th>Deposited Sediment</th><th>Invertebrate habitat diversity</th><th>Invertebrate habitat abundance</th><th>Fish cover diversity</th><th>Fish cover abundance</th><th>Hydraulic heterogeneity</th><th>Bank erosion</th><th>Bank vegetation</th><th>Riparian width</th><th>Riparian Shade</th><th>Total</th></tr>
</table>
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<tr><td></td><td></td><td>
<table>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>2</td><td>5</td><td>7</td><td>8</td><td>4</td><td>31</td></tr>
</table>
</td></tr>
<tr><td>Taraire Creek Tributary B</td><td>Permanent</td><td>
Taraire Creek Tributary B is a first order stream which flows in a northern direction on the eastern side of Te Irirangi Drive, outflowing into Taraire Creek via a wetland (Taraire.2, described below). The western stream bank is lined with habitat unit PL.1 described above, whilst the eastern bank is planted in pine.

It is approximately 200 m in length and is fed via a stormwater outlet, with no open stream above the culvert outlet. It is well shaded by overhead trees. No macrophytes were present in the stream, and substrate was clay with various sized cobbles present. Hydraulic heterogeneity was low, with the entire length being either run or riffle sections. No fish were observed within the stream. The creek outflows into a wetland which is positioned alongside the Taraire Creek.

Rapid habitat assessment scores were moderate:
<table>
<tr><th>Deposited Sediment</th><th>Invertebrate habitat diversity</th><th>Invertebrate habitat abundance</th><th>Fish cover diversity</th><th>Fish cover abundance</th><th>Hydraulic heterogeneity</th><th>Bank erosion</th><th>Bank vegetation</th><th>Riparian width</th><th>Riparian Shade</th><th>Total</th></tr>
<tr><td>6</td><td>6</td><td>4</td><td>3</td><td>4</td><td>2</td><td>4</td><td>7</td><td>8</td><td>10</td><td>54</td></tr>
</table>
</td></tr>
<tr><td>Ōtara Creek Tributary</td><td>Permanent</td><td>
The Ōtara Creek Tributary flows in a northwest direction beneath Te Irirangi Drive. At its point of crossing the road it is within the ZOI of both NoR 1 and NoR 2.

Water clarity within the stream at the time of the site visit was observed to be clear, however thick sediment coated everything in the stream including aquatic plants. The pest plant Egeria (Egeria densa) was observed within the creek, as well as large amounts of rubbish.

Banks of the stream are lined with habitat unit PL.1 described above.

Kākahi (At Risk – Declining) have been recorded within the wider catchment. However, due to the poor habitat quality and thick sediment layer it is unlikely that they are present within the stream. Both longfin eel and īnanga (At Risk – Declining) have been recorded within the wider stream catchment, and shortfin eels were observed in the creek during the site visit.

Rapid habitat assessment scores were moderate:
<table>
<tr><th>Deposited Sediment</th><th>Invertebrate habitat diversity</th><th>Invertebrate habitat abundance</th><th>Fish cover diversity</th><th>Fish cover abundance</th><th>Hydraulic heterogeneity</th><th>Bank erosion</th><th>Bank vegetation</th><th>Riparian width</th><th>Riparian Shade</th><th>Total</th></tr>
<tr><td>1</td><td>3</td><td>1</td><td>3</td><td>4</td><td>2</td><td>5</td><td>7</td><td>8</td><td>8</td><td>42</td></tr>
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</td></tr>
</table>

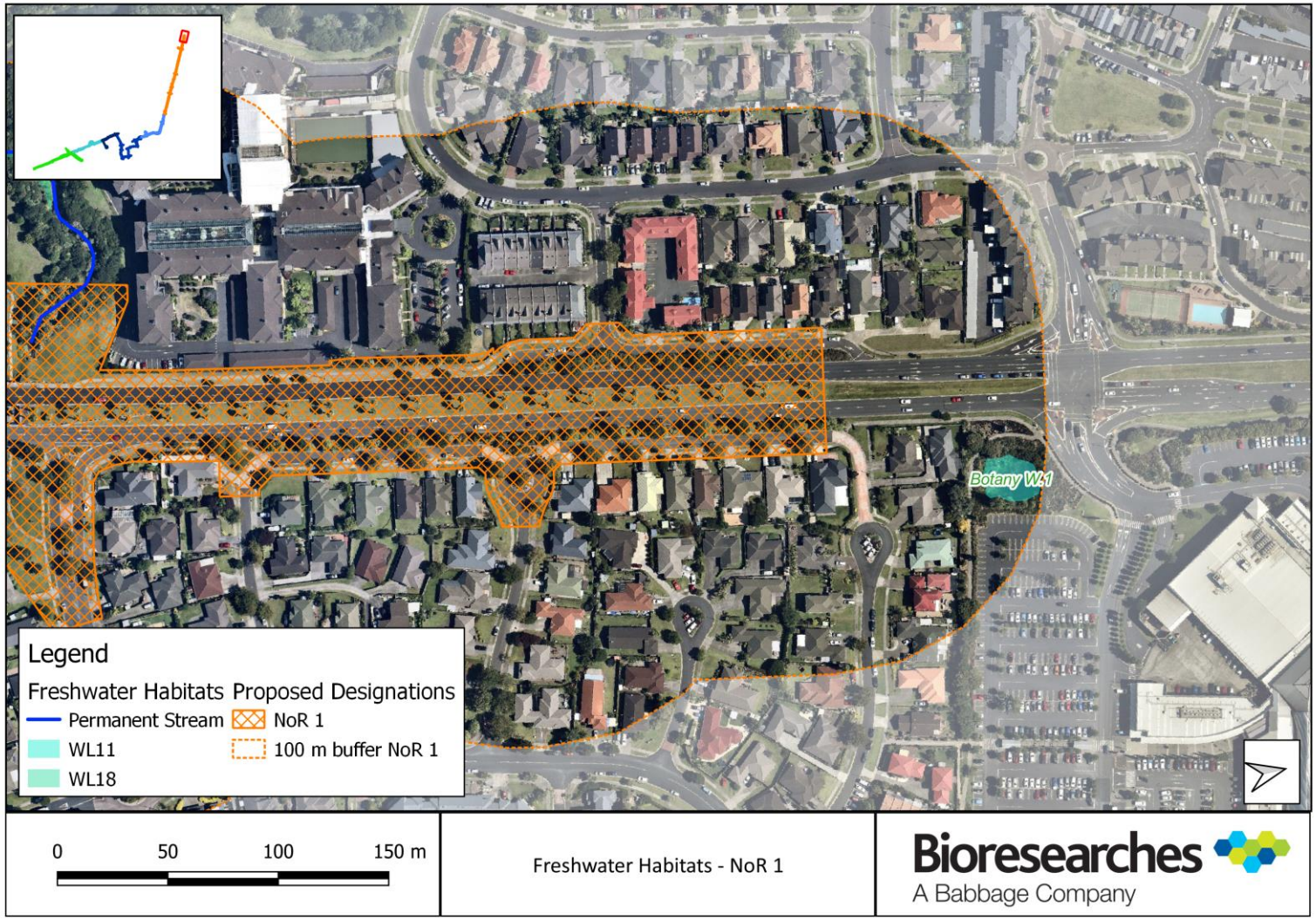


Figure 14. Freshwater habitats within the ZOI of the northern end of NoR 1

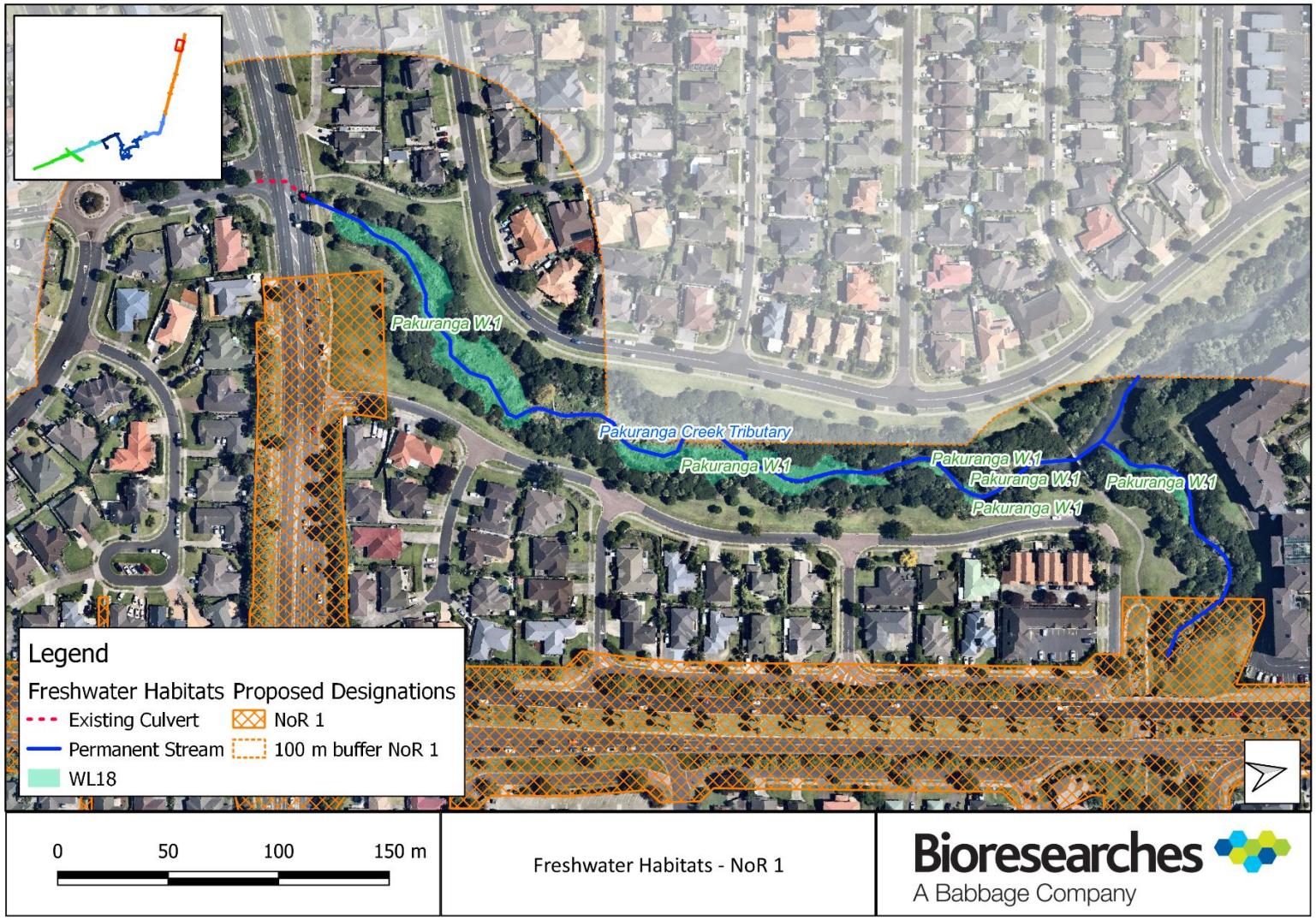


Figure 15. Freshwater habitats of the Pakuranga Creek Tributary within the ZOI of NoR 1

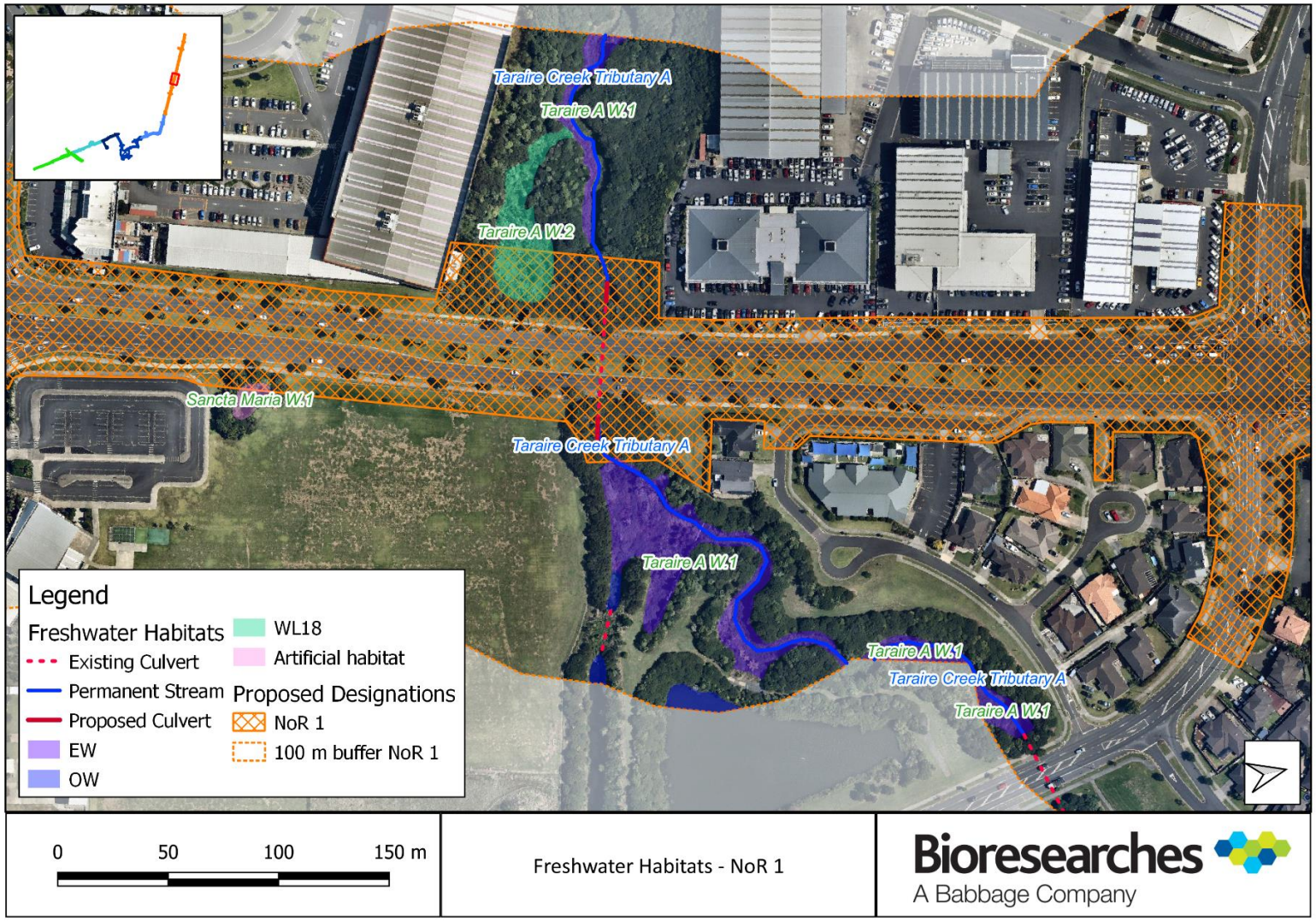


Figure 16. Freshwater habitats of Taraire Creek Tributary A, within the ZOI of the southern end of NoR 1

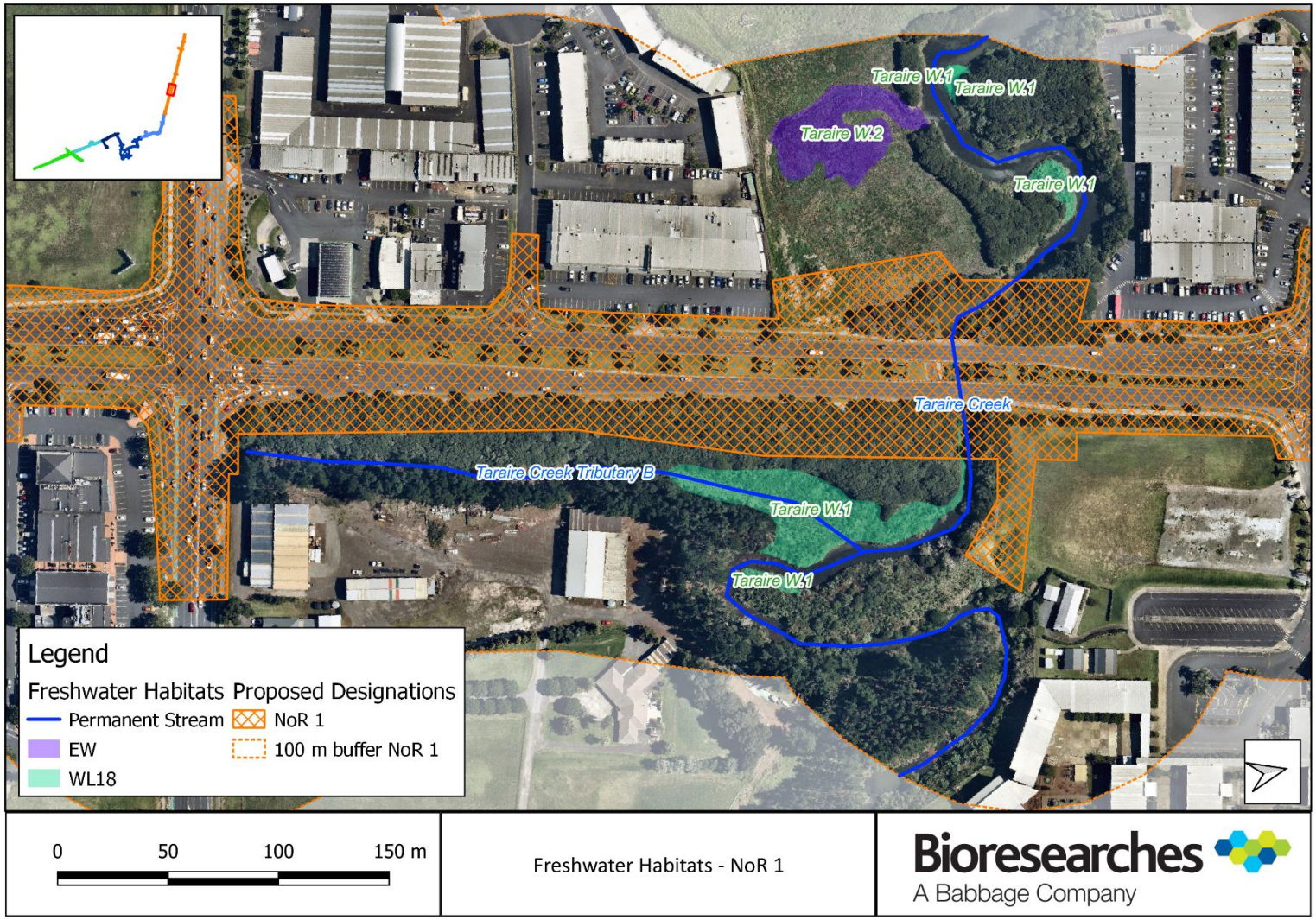


Figure 17. Freshwater habitats of Taraire Creek and Taraire Creek Tributary B, within the ZOI of the southern end of NoR 1

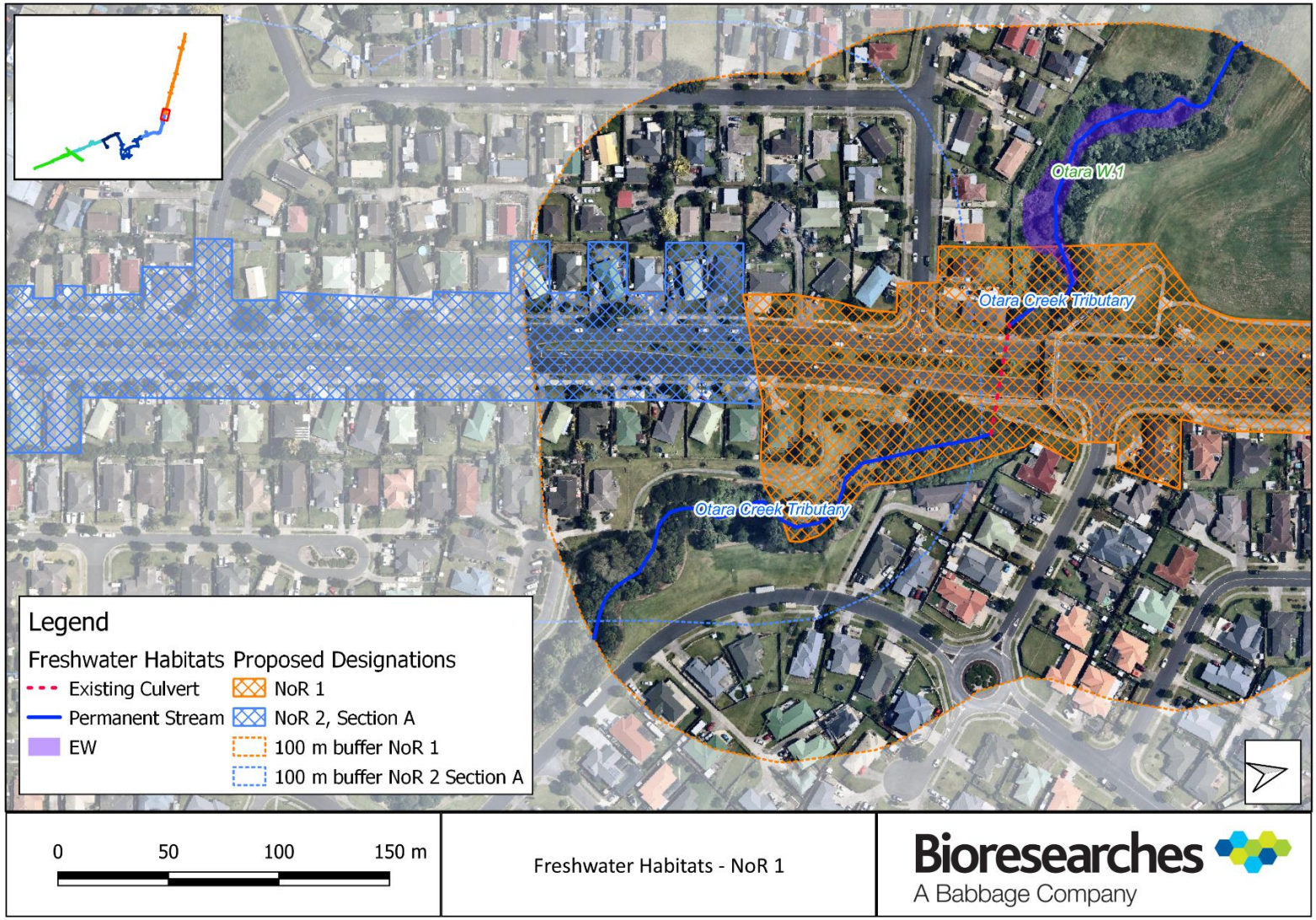


Figure 18. Freshwater Habitats of Taraire Creek Tributary A, within the ZOI of the southern end of NoR 1

7.2.4 Freshwater ecological value

Table 25 presents the ecological value for the freshwater habitats identified within NoR 1. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 25. Ecological values of streams within the ZOI of NoR 4

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Pakuranga Creek Tributary	Moderate - Riparian zone has been highly modified by human activities. However the planted margins are regenerating and recovering. The instream habitat is now degraded from nutrient and contaminant inputs, as well as the altered flow regime from stormwater inputs and the stormwater dam below.	High – At Risk Recovering Pāteke present and likely breeding.	High – the stream, associated wetland and riparian margins collectively form a habitat gradient which is uncommon within the local urban environment. The stream is modified by the presence of dams.	Moderate – permanently flowing second order stream	High
Taraire Creek Tributary A	Moderate - Riparian zone has been highly modified by human activities. However the planted margins are regenerating and recovering. The instream habitat is now degraded from nutrient and contaminant inputs, as well as the altered flow regime from stormwater inputs.	Moderate – At risk declining longfin eel present within the catchment, also pāteke are potentially present.	High – the stream, associated wetland and riparian margins collectively form a habitat gradient which is uncommon within the local urban environment.	Moderate – permanently flowing second order stream	Moderate
Taraire Creek	Moderate - Riparian zone has been highly modified by human activities. However the planted margins are regenerating and recovering. The instream habitat is now degraded from nutrient and contaminant inputs, as well as the altered flow regime from stormwater inputs.	High – At risk declining longfin eel present within the upper stream reaches, also pāteke are potentially present.	High – the stream, associated wetland and riparian margins collectively form a habitat gradient which is uncommon within the local urban environment.	High – permanently flowing third order stream	High
Taraire Creek Tributary B	Low - Riparian zone has been highly modified by human activities.However some of this is regenerating. The instream habitat is now	Low – Although longfin eel are present within the catchment, they are unlikely to be present	Low – Highly modified stream with no connectivity to upstream habitats.	Moderate – permanently flowing stream	Low

	degraded from nutrient and contaminant inputs, as well as the altered flow regime from stormwater inputs. There is also no upstream habitat as this is all culverted.	within this stream.			
Ōtara Creek Tributary	Moderate - Riparian zone has been highly modified by human activities. However the planted margins are regenerating and recovering. The instream habitat is now degraded from nutrient and contaminant inputs, as well as the altered flow regime from stormwater inputs.	Moderate – At risk declining longfin eel and īnanga are present within the catchment, also pāteke are potentially present.	High – the stream, associated wetland and riparian margins collectively form a habitat gradient which is uncommon within the local urban environment.	Moderate – permanently flowing second order stream	Moderate

7.2.5 Wetland habitat

Nine potential wetlands were identified during the desktop study and visited during the site investigations. Two of the potential wetlands are artificial swales with no wetland habitat, one wetland is artificial and the remaining wetlands were considered to be natural wetlands under the NES:F. Wetlands are described in Table 26 and depicted in Figure 35. As the artificial swales contained no wetland habitat, they have not been assessed further.

Table 26. Wetlands within 100 m of NoR 4

Wetland	NES:F Classification	Classification process	Description
Botany W.1	Artificial	N/A	Artificial stormwater pond/wetland. Vegetation included *Machaerina articulata* and raupō. Edges were planted predominantly with native species.
Pakuranga W.1	Natural Wetland	Rapid test	Riverine wetland system positioned on the floodplains of the Pakuranga Creek Tributary. Planted with harakeke, *Carex* spp., and tī kōuka, which has created a flaxland (WL18). Other vegetation included *Persicaria decipiens*, buttercup (*Ranunculus repens*), bedstraw (*Galium* sp.), and water celery (*Apium nodiflorum*). During the site visit, two pāteke (brown teal; At Risk - Recovering) were observed in the creek and adjacent wetland. One was observed to be exhibiting breeding behaviour (showing territorial behaviour and holding a wing to appear broken) and as the site visit was conducted during the breeding season, it is therefore assumed that the creek and associated wetland habitat on the peripheries are utilised by this species for breeding.

Taraire A W.1	Natural Wetland	Rapid test	Riverine wetland system positioned on the floodplains of Taraire Creek Tributary A. Patches of this have been planted with harakeke, tī kōuka and kahikatea, however these have been heavily invaded by blackberry so that they are now predominantly exotic and classed as exotic wetlands.
Taraire A W.2	Natural Wetland	Rapid test	Depression wetland which drains to Taraire Creek Tributary A. Planted with harakeke, *Carex* spp., kahikatea and tī kōuka, which has created a flaxland (WL18). Other vegetation included *Persicaria hydropiper*, buttercup, water celery, black nightshade (*Solanum nigra*), pampas (*Cortaderia selloana*) and blackberry.
Sancta Maria W.1	Artificial	N/A	Artificial swale. Grassed in the centre, with native plantings on margins.
Taraire W.1	Natural wetland	Rapid test	Riverine wetland system positioned on the floodplains of the Taraire Creek. Planted with harakeke, *Carex* spp., and tī kōuka, which has created a flaxland (WL18). Some incursion of exotic weeds is occurring.
Taraire W.2	Natural wetland	Rapid test	Floodplain wetland system adjacent to the Taraire Creek. Recently has been planted with native species including *Carex* spp., harakeke, wīwī (*Juncus edgariae*) and tī kōuka. However these specimens are still small and do not dominate the wetland, which is still predominantly exotic, with species such as mercer grass (*Paspalum distichum*) and buttercup present.
Ōtara W.1	Natural wetland	Rapid test	Riverine wetland system positioned on the floodplains of the Ōtara Creek Tributary. Planted with harakeke, *Carex* spp., and tī kōuka, which has created a flaxland (WL18). Some incursion of exotic weeds is occurring, such as willow (*Salix* spp.) and arum lily (*Zantedeschia aethiopica*).

7.2.6 Wetland ecological value

Table 27 presents the ecological value for the wetland habitats identified within NoR 1. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 27. Ecological values of wetlands within the ZOI of NoR 1

Wetland	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Botany W.1	Low – highly modified catchment and likely to support only common, non-native biota.	Low - not suitable habitat for any species of conservation significance. Is present in an environment where wetland habitats are uncommon but its lack of connectivity to other ecologically functional	Low - low diversity in habitat type.	Moderate – does provide some filtering of nutrients and flow regulation.	Low

		habitats greatly reduces the value.			
Pakuranga W.1	High – the wetland retains most of its hydrological functioning and composition of flora and fauna.	High – wetlands of this size are very uncommon in the ecological district. Although achieved via planting, is a rare habitat type. Also is a known habitat for At Risk bird species.	High – forms a continuum in habitats from terrestrial to freshwater.	Moderate – slightly reduced due to highly modified catchment.	High
Taraire A W.1	Moderate – the wetland retains most of its hydrological functioning, but the composition of flora and fauna is greatly modified.	High – wetland habitat is uncommon in the ecological district, although exotic wetlands are the most common type. Also is a potential habitat for At Risk bird species.	High – forms a continuum in habitats from terrestrial to freshwater.	Moderate – slightly reduced due to highly modified catchment.	High
Taraire A W.2	High – the wetland retains most of its hydrological functioning and composition of flora and fauna.	High – wetlands of this size are very uncommon in the ecological district. Although achieved via planting, is a rare habitat type. Also is a potential habitat for At Risk bird species.	High – forms a continuum in habitats from terrestrial to freshwater.	Moderate – slightly reduced due to highly modified catchment.	High
Taraire W.1	High – the wetland retains most of its hydrological functioning and composition of flora and fauna.	High – wetlands of this size are very uncommon in the ecological district. Although achieved via planting, is a rare habitat type. Also is a potential habitat for At Risk bird species.	High – forms a continuum in habitats from terrestrial to freshwater.	Moderate – slightly reduced due to highly modified catchment.	High
Taraire W.2	Low - the wetland retains little of its hydrological functioning and composition of flora and fauna.	Moderate – wetland habitat is uncommon in the ecological district, although exotic wetlands are the most common type.	Moderate – is connected to a functional freshwater ecosystem	Moderate – slightly reduced due to highly modified catchment.	Moderate
Ōtara W.1	High – the wetland retains most of its hydrological functioning and composition of flora and fauna.	High – wetlands of this size are very uncommon in the ecological district. Although achieved via planting, is a rare habitat type. Also is a potential habitat for At Risk bird species.	High – forms a continuum in habitats from terrestrial to freshwater.	Moderate – slightly reduced due to highly modified catchment.	High

7.3 Future environment

Over the next 15 years, existing moderate ecological value vegetation and habitats will mature and diversify within their current extents. These areas are constrained in extent by the surrounding land uses and are unlikely to increase in area. While fauna habitats are likely to support greater capacity for resource provision (nesting habitat, food resources), with maturity, fauna diversity is likely to remain stable and reflective of the surrounding urban environment.

The NoR 1 Project area is almost entirely developed to its limit under the current zoning, with the exception of land north of Rongomai Park which is currently under development. Intensification of the immediate urban area may occur, (e.g., in accordance with the Medium Density Residential Standards and the National Policy Statement on Urban Development), however this is not expected to impact the existing extents of this vegetation, and is unlikely to significantly increase pressure on these habitats, which are already subject to intensive edge effects.

Ecological values are likely to remain consistent. Low value vegetation and habitats beyond protected riparian margins have similar capacity to mature, as well as to expand or contract, given that they are unprotected. These areas area likely to remain low in ecological value. Higher value habitats may mature further but will be limited by impacts from edge effects, pests and a lack of seed sources to diversify vegetation without supplementary planting.

7.4 Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects

This section assesses the ecological effects of activities which relate to District Plan matters under the AUP:OP. Refer to the 'Future Environment' Section for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

As per the matrix presented in **Appendix A**, Table 86, ecological features with a 'negligible' ecological value, even if combined with a 'very high' magnitude of effect, will not have a level of effect greater than 'low' and consequently would not typically require effects management. Therefore, ecological features with a negligible ecological value are not assessed within this section, unless there is the potential to contravene the Wildlife Act 1953.

7.4.1 Construction effects – terrestrial ecology

The potential ecological effects to terrestrial habitats and fauna, which may be encountered during the construction phase of the Project (as they relate to District Plan matters) have been identified:

- Removal of vegetation which is subject to District Plan controls (refer to **Appendix B** for a breakdown of Regional Plan versus District Plan vegetation); and
- Disturbance and displacement of birds, bats and lizards due to construction-related activities.

The following sections detail the magnitude of effect and level of effect of construction effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

7.4.1.1 Terrestrial vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors (in this case, the PL.2 habitat, with low ecological value) and grassland (EG, negligible ecological value).

The effects of the removal of this vegetation are assessed below in Table 28.

Table 28. Assessment of ecological effects of the removal of terrestrial District Plan vegetation

Effect	**Permanent removal of vegetation/habitat and introduction of edge effects to remaining habitat.**	
Habitat	PL.2	
Time scale	Baseline	Future environment
Magnitude of effect	The permanent removal of this vegetation, which is already highly fragmented will not introduce additional edge effects. Consequently, the magnitude is assessed as Low.	This habitat is not expected to change by the time of development, consequently the magnitude of effect remains the same.
Level of effect prior to impact management	Very low	Very low
Impact management and residual level of effect	Not required	Not required
Management of residual effects	N/A	N/A

7.4.1.2 Bats

Long-tailed bats (very high ecological value) may utilise the stream corridors for foraging or as flight paths, which means they may fly over the NoR at the stream crossing locations at night (although bats have not been recorded from survey and are considered unlikely to be present). Vegetation within the road corridor is not considered likely to provide roosting or foraging habitat.

During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging or moving along the stream corridors. There are no trees suitable for bats to roost in within the ZOI of the Project and consequently noise and vibration is not considered to be an issue, and mortality or injury to bats or loss of foraging habitat has not been considered.

The effects of the works upon bats are described below in Table 29.

Table 29. Assessment of ecological effects encountered during construction for bats

Effect	**Disturbance and displacement of bats crossing the NoR as they use streams as a flight corridor**	
Time scale	Baseline	Future environment
Magnitude of effect	As the Project is situated in a residential area, night-time work and subsequent	As urbanisation intensifies east of the alignment on the current outskirts of Flat

	noise generated by the Project is likely to occur infrequently. As the Project area is already lit with street lighting and lighting from nearby commercial buildings, and the area is subject to residential noise, the night-time noises and lighting generated from the Project area are not expected to have more than a Low magnitude of effect on bats; if present.	Bush and Chapel Heights, the likelihood of bats utilising the Project area will likely reduce as their range contracts, however as the habitat they are utilising will remain, conservatively it is considered that effects will remain the same as baseline.
Level of effect prior to impact management	**Moderate**	
Impact management and residual level of effect	Surveys should be completed prior to construction commencing to confirm bat presence. If bats are identified to be present, then a Bat Management Plan should be implemented. This plan incorporates mitigation measures such as reduction of light spill and works at night near bat habitats, and siting of compounds and laydown areas away from bat habitats. The post mitigation level of effect can be reduced to **Negligible**.	
Management of residual effects	Not required	

7.4.1.3 Birds

Indigenous birds including both the Not Threatened bird species and the At Risk wetland bird species may be displaced from nearby habitats due to construction activities. In addition, Not Threatened birds may lose roosting/foraging habitat, abandon or lose nests and also be at risk of mortality or injury during tree felling when the District Plan vegetation is removed.

The effects of the works upon birds are described below in Table 30.

Table 30. Assessment of ecological effects encountered during construction for birds

Effect	**Disturbance and displacement of birds due to construction activities (pāteke/ At Risk wetland birds; and Not Threatened birds)**		**Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill birds (Not threatened birds only)**	
Time scale	Baseline	Future environment	Baseline	Future environment
Magnitude of effect	Adjacent habitats are definitely periodically used by birds. Although the pāteke, and any other birds present are likely habituated to a level of disturbance already due to the urban environment in which they are found, the	These trees are expected to still be present and utilised by birds in the same manner as they are currently. Consequently, the magnitude of effect is expected to be the same.	There is a reasonable probability that native birds utilise these trees for nesting. The magnitude of effect is expected to be **Moderate**.	This effect is expected to be the same as baseline.

	magnitude of effect is expected to be **High**, especially as nest abandonment could result in the death of birds.			
Level of effect prior to impact management	**High** for pāteke and other wetland birds, **Low** for other Not Threatened bird species.		**Low**	
Impact management and residual level of effect	Pre-construction bird surveys should be undertaken to determine if pāteke and other wetland bird species are present. If At risk or Threatened wetland birds are present, a Wetland Bird Management Plan should be developed which could include the following management controls: Where practicable, construction works should commence prior to the breeding season/s of the wetland birds identified as present; in order to discourage bird nesting. Prior to any works beginning a nesting bird survey should be undertaken of wetland areas within a 50 m radius of the works footprint. If nesting birds are detected, then a 20 m buffer surrounding the nest should be clearly demarcated and works should not be completed within this buffer until birds have fledged. Where practicable, works should be set back from wetland edges by at least a 10 m buffer. Light spillage from construction areas should be minimised as far as practicable.		Under the Wildlife Act 1953, impact management measures will be required to prevent killing or injuring native birds during tree felling. This should include scheduling tree felling and vegetation removal activities outside of the bird nesting season (which is September to February, inclusive), or undertaking pre-clearance inspections to ensure nesting birds are not present.	
Management of residual effects	Not required		Not required	

7.4.1.4 Lizards

Lizards are not expected to be present within any of the District Plan vegetation to be removed. Consequently, effects are limited to the potential displacement of lizards from adjacent habitats.

The effects of the works upon lizards is described below in Table 31.

Table 31. Assessment of ecological effects encountered during construction for lizards

Effect	**Disturbance and displacement of lizards due to construction activities**	
Time scale	Baseline	Future environment

Magnitude of effect	The magnitude of effect is assessed as **Negligible** due to unlikelihood of lizard disturbance due to construction related noise and vibration.	This effect is expected to be the same as baseline.
Level of effect prior to impact management	Very low	
Impact management and residual level of effect	Not required	
Management of residual effects	Not required	

7.4.2 Operational effects – terrestrial ecology

The Project involves the addition of bus lanes to an existing road in an urban landscape. The future environment is also urban, however the few remaining undeveloped properties along the NoR will likely have been developed into mixed use or light industry. The stream corridors and existing habitats associated with these will remain.

Many of the potential operational effects of the Project such as habitat fragmentation, noise and light pollution are pre-existing. Potential operational effects include reductions in habitat connectivity and impacts from noise, light and vibration upon indigenous fauna, as well as potential mortality from vehicle strike.

The following sections detail the magnitude of effect and level of effect of operational effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

7.4.2.1 Bats

Potential operational impacts to bats include:

- Loss of habitat connectivity through the presence of the upgraded roadway, and impacts of lighting spillage which may impact behaviour of both bats and insects (their prey). This is considered to have a moderate magnitude of effect and consequently a high level of effect and therefore is discussed further in Table 32; and
- Vehicle strike causing injury or mortality. This is considered to have a very low likelihood of occurring, as bats are not considered likely to be using potential habitats within the NoR. Consequently, the magnitude of effect is considered to be negligible, and therefore has a low level of effect. Effects management is not required.

As the habitats adjacent to the Project area do not provide roosting habitat for bats and are not expected to develop to provide this within 15 years (when the Project is expected to begin), impacts on roosting bats have not been considered.

Table 32. Assessment of ecological effects encountered during operation for bats

Effect	**Loss in habitat connectivity due to presence of the upgraded roadway and associated noise and lighting**

Time scale	Baseline	Future environment
Magnitude of effect	The habitat is already fragmented by the presence of the existing road, which is lit at night, and already generates vehicle noise. In addition, bats are unlikely to frequently visit the Project area. Consequently, the magnitude of effects is considered to be **Low**, and therefore the level of effect is **Moderate**.	As urbanisation intensifies east of the alignment on the current outskirts of Flat Bush and Chapel Heights, the likelihood of bats utilising the Project area will likely reduce as their range contracts, however as the habitat they are utilising will remain, conservatively it is considered that effects will remain the same as baseline.
Level of effect prior to impact management	**Moderate**	
Impact management and residual level of effect	If bats are identified to be present during pre-construction surveys, then a Bat Management Plan should be implemented. This plan incorporate mitigation measures such as reduction of light spill near bat habitats, and planting of supplementary trees within the riparian corridors which will in time increase the canopy height of the plantings and aim to retain connectivity as the local area intensifies further. The post mitigation level of effect can be reduced to **Negligible**.	
Management of residual effects	Not required	

7.4.2.2 Birds

Indigenous birds may be displaced from nearby habitats due to noise, lighting and vibration generated from the Project. However as the birds present within the Project area are likely already habituated to these effects, the magnitude of this effect is considered to be **Low** for both the baseline and future environment, and consequently the level of effect is considered to be **Very Low** for Not Threatened birds and **Low** for pāteke.

Birds may also be affected by vehicle strike; however, this is only likely to occur infrequently. Consequently, the magnitude of effect of this is considered to be **Low**, and the level of effect is considered to be **Very Low** for Not Threatened birds and **Low** for pāteke.

Impact management is therefore not required for operational effects to birds.

7.4.2.3 Lizards

The Project works are not expected to increase limitations on lizard dispersal or increase disturbance to lizards. Consequently, the magnitude of this effect is considered to be **low** for both the baseline and future environment, and the level of effect is considered to be **Low**.

Lizards may also be affected by vehicle strike, however there is a very low probability of this occurring, and it would likely only occur at a very low frequency. Consequently, the magnitude of effect of this is considered to be **Negligible**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to lizards.

7.4.3 Conclusions

Ecological effects assessed as moderate or greater include:

- Moderate level of effect to bats during construction for both the ecological baseline and future ecological environment may occur due to disturbance to bats utilising the streams which the NoR crosses as flight corridors;
- Moderate level of effect to pāteke during construction for both the ecological baseline and future ecological environment may occur due to disturbance to birds nesting in adjacent habitats; and
- Moderate level of effect to bats during operation for both the ecological baseline and future ecological environment may occur due to fragmentation of habitat and impacts of lighting and noise.

Effects management (implementation of a Bat Management Plan and a Bird Management Plan) reduces these effects to **Negligible** for disturbance to bats, and **Low** for disturbance to pāteke and habitat fragmentation for bats.

7.5 Design and future Regional Resource Consent considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the following sections to inform design and alignment options for the NoR.

7.5.1 Terrestrial ecology

Construction of the Project will result in both temporary and permanent losses in terrestrial habitat within the NoR, including habitat which is being used by native fauna.

Table 33 details the types and area (m^2) of terrestrial habitats which will be lost during construction, as well as the total area of each habitat present within the designation boundary. This includes vegetation which is subject to District Plan and Regional Plan controls as well as vegetation not subject to plan controls. As the PL.2 habitat is comprised of specimen trees planted in the roadway, this has not been mapped by area and is instead recorded as the number of trees to be removed (692 trees).

Terrestrial habitats which will be lost are currently of **High** or **Low** ecological value and may provide habitat for native fauna. Exotic grassland habitat is of **Negligible** ecological value and therefore is not considered here.

Table 33. Terrestrial habitat types and the areas of these both within the Project footprint (which will be permanently lost) and within the designation boundary.

Habitat type	Classification (Singers *et al.* 2017)	Area within Footprint (m^2)	Area within Designation (m^2)
Planted Vegetation – native	PL.1	TBC	32,489
Exotic forest	EF	0	0

7.5.2 Bats

The stream corridors and associated PL.1 vegetation may act as flight corridors for commuting and foraging bats. The presence of bats should be assessed prior to obtaining any regional consents for removal of vegetation within 10 m of riparian zones, or any of the PL.1 vegetation lining the creek edges.

7.5.3 Birds

Non-threatened indigenous birds are present within the designation boundary and will be impacted by vegetation removal. This should therefore occur outside of the bird nesting season to reduce impacts to these birds.

At Risk bird species (pāteke) are present within at least one of the wetlands located within the designation. These birds could be impacted by construction activities and therefore a Wetland Bird Management Plan is recommended to reduce the magnitude of effect of these works.

7.5.4 Lizards

Copper skinks are potentially present within the vegetation to be cleared, and there is potential that during this clearance they could be injured or killed. Consequently, the works should be completed in accordance with the Wildlife Act 1953, and a Lizard Management Plan should be implemented.

7.5.5 Freshwater ecology

The proposed designation crosses two streams. One crossing will involve culvert extensions (Taraire Creek Tributary A), and one crossing no stream works will occur because the Project crosses an existing bridge (Taraire Creek Tributary B). As the crossing for the Ōtara Creek Tributary is located within NoR 2, Section A, the impacts of this crossing have not been assessed in this section.

The culvert extensions will result in stream loss, for which mitigation will be required. Erosion and sediment control plan/s will likely also be required to prevent sediment entering streams during the works, and a Fish Management Plan should be implemented to reduce the likelihood of injury or killing of native freshwater fish during the works.

All new culverts and culvert extensions should be installed in accordance with fish passage guidance and where practicable, fish passage structures should be implemented in the existing culvert sections where culverts are being lengthened.

Much of the riparian zones within the designation are already planted in native restoration plantings, and consequently stream length available for restoration via replanting is limited to the Taraire Creek Tributary B (190 m), which is planted in exotic forest and could be replaced or underplanted with native forest.

Table 34 details the stream loss expected to be incurred within the designation.

Table 34. Potential stream loss within the NoR 1 designation boundary.

Stream	Hydroperiod	Approximate active channel width (m)	Approximate length to be lost (m)	Loss (m^2)

Taraire Creek Tributary A	Permanent	2	19.3 m (8.4 m on the western side of the Project area, and 10.9 m on the eastern side).	38.6

Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

7.5.6 Wetland ecology

Construction of the NoR will not result in the loss of extent of any wetland, however as works are to be carried out within 100 m of wetlands associated with the Ōtara Creek, Taraire Creek tributaries and the Pakuranga Creek Tributary, consent for the works under the NES:F will be required. This will require mitigation in the form of erosion and sediment control plans.

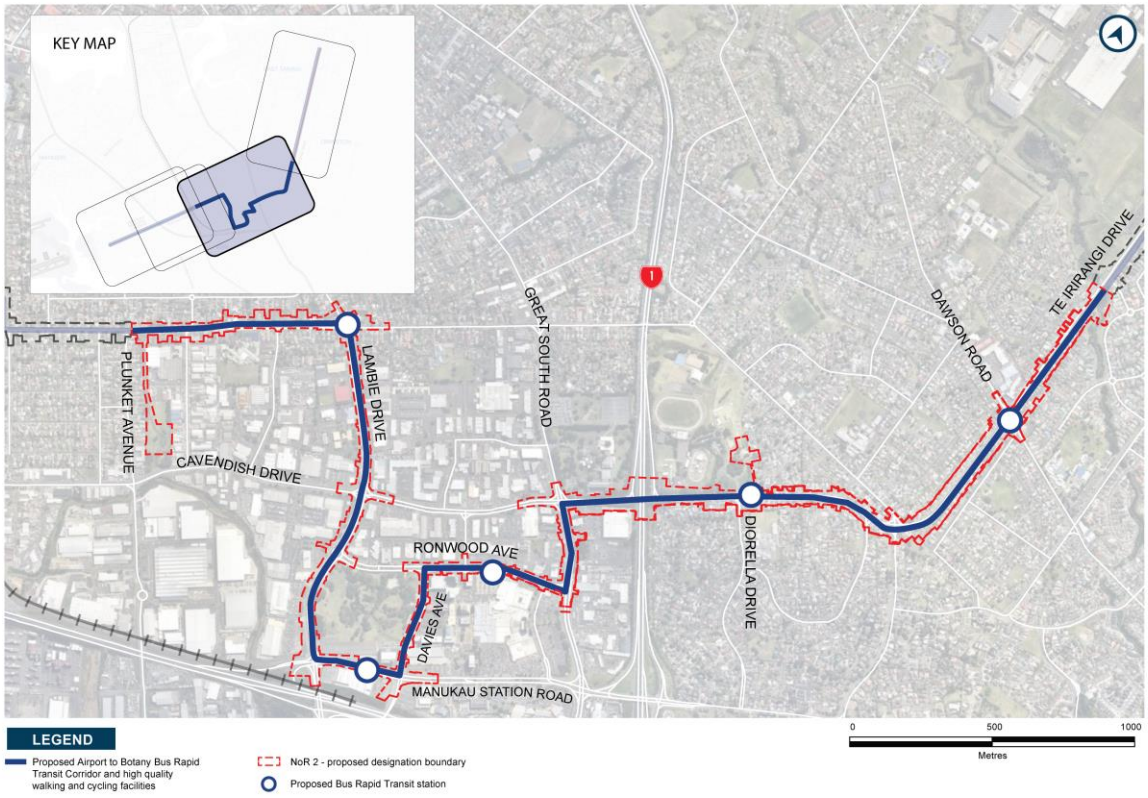
8 Airport to Botany Bus Rapid Transit – NoR 2

This section assesses specific ecology matters relating to NoR 2 – the Project corridor between Rongomai Park and Puhinui Station, in the vicinity of Plunket Avenue and Rongomai Park.

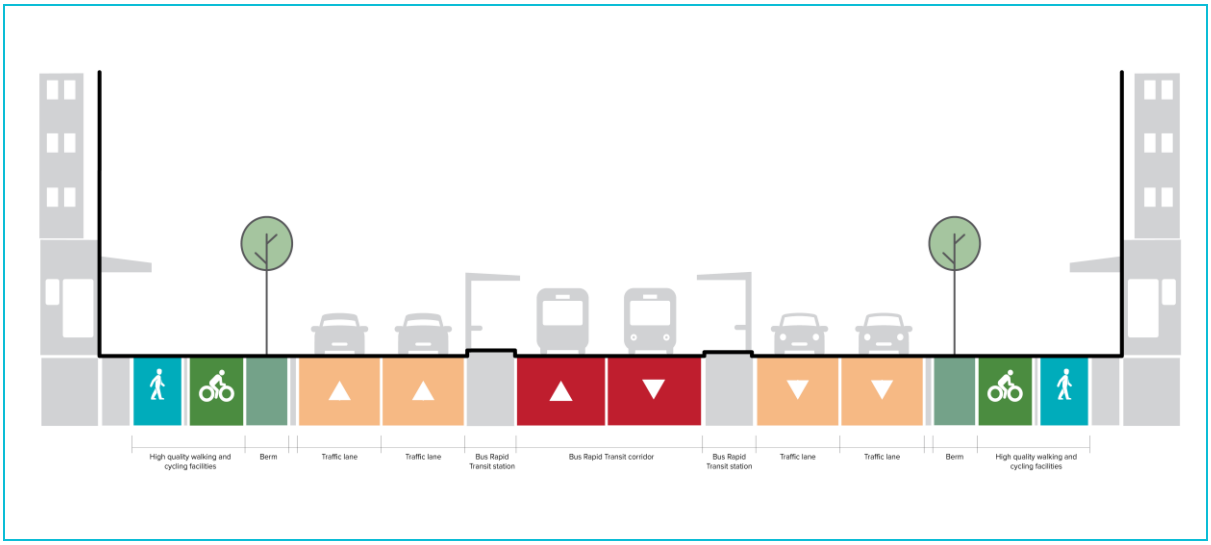
8.1 Overview and description of works

As set out in Table 35 below, the proposed works in NoR 2 include the widening of several existing roads to accommodate a centre-running BRT corridor, vehicle lanes and high quality walking and cycling facilities.

Table 35: Overview of NoR 2

NoR 2 – Rongomai Park to Puhinui Station, in the vicinity of Plunket Avenue	
	
Key features	
BRT Corridor	Centre-running for the majority of the corridor along Te Irirangi Drive, Great South Road, Ronwood Avenue, Manukau Station Road, Lambie Drive, and Puhinui Road West-running on Davies Avenue along the edge of Hayman Park
BRT stations	• Dawson Road Station; • Diorella Drive Station; • Ronwood Avenue Station; • Manukau Station; and

	• Corner of Lambie Drive and Puhinui Road Station.
Walking and cycling facilities	Walking and cycling facilities on both sides of the corridor
General traffic	• Two lanes in each direction along Te Irirangi Drive, Great South Road, Ronwood Avenue, Manukau Station Road, and Lambie Drive; • One-way single lane along Davies Avenue; and • One lane in each direction along Puhinui Road.
Access	Existing central medians limit right turn access on Te Irirangi Drive, Great South Road, Ronwood Avenue, and Lambie Drive. New signalised intersection at Mitre 10 and Bunnings Warehouse on Lambie Drive. Priority access for fire engine movements across the BRT corridor at Papatoetoe Fire Station.
Speed environment	• 30 km/h on Ronwood Avenue and Davies Avenue; and • 50 km/h on Te Irirangi Drive, Great South Road, Manukau Station Road, Lambie Drive and Puhinui Road.
Signalised intersections (**new intersections in bold**)	• Te Irirangi Drive and Dawson Road; • Te Irirangi Drive, Boundary Road and Hollyford Drive; • Te Irirangi Drive and Diorella Drive; • Te Irirangi Drive, Great South Road and Cavendish Drive; • Great South Road and Ronwood Avenue; • Ronwood Avenue and Davies Avenue; • Davies Avenue, Wiri Station Road and Manukau Station Road; • Manukau Station Road and Lambie Drive; • **Mitre 10 and Bunnings Warehouse;** • **Lambie Drive and Ronwood Avenue;** • Lambie Drive and Cavendish Drive; • Lambie Drive and Puhinui Road; and • **Puhinui Road and Plunket Avenue.**
Stormwater infrastructure	• Swales; and • Wetlands.
NoR 2 typical cross section	



For assessment purposes, NoR 2 has been split into three sections as shown in Figure 19 below:

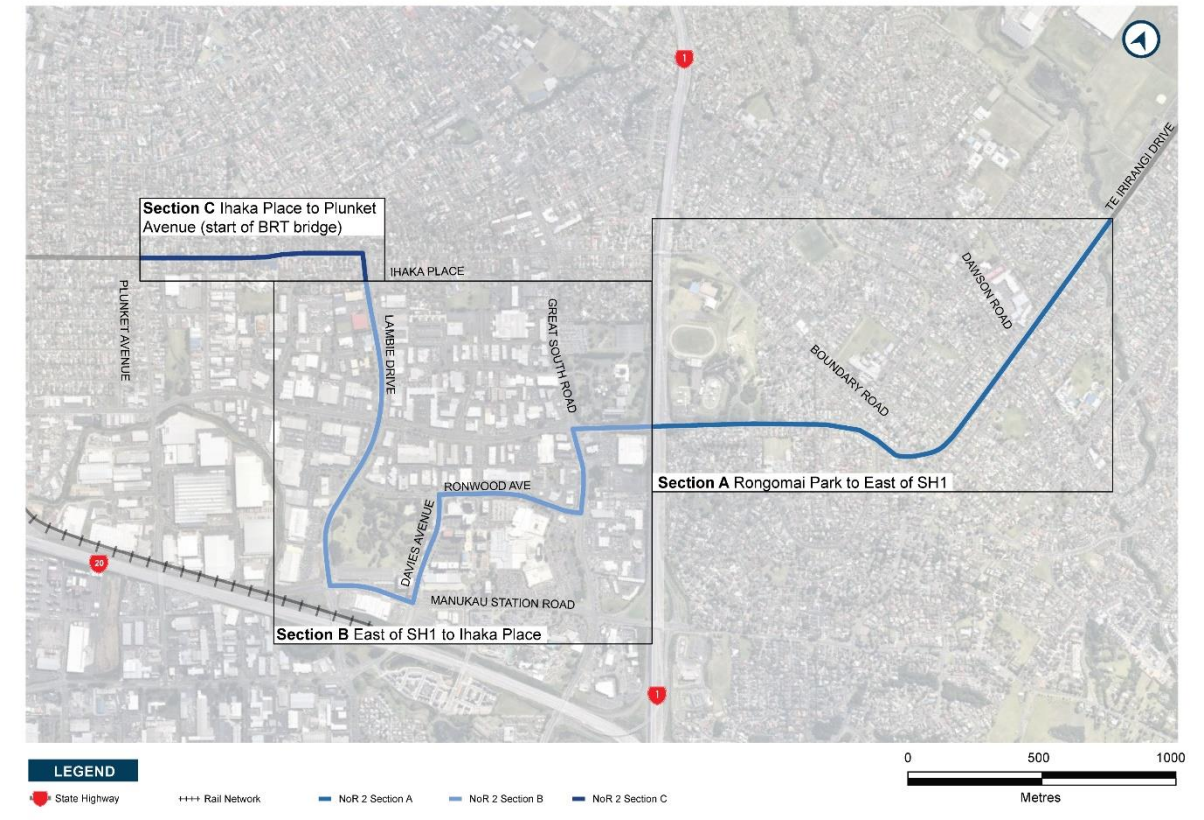


Figure 19 Sections of NoR 2

8.2 Section A: Rongomai Park to East of SH1

8.2.1 Ecological baseline

8.2.1.1 Terrestrial habitats and fauna

Desktop Review

NoR 2 Section A transitions through light industry, business, metropolitan centre and residential zones in the AUP:OP, as well as a few open space recreation zones.

Present day habitats are therefore largely limited to:

- Mown lawns, classified using Singers *et al.* (2017) as Exotic Grassland (**EG**);
- Amenity plantings/gardens such as street trees within the road corridor and in residential sections, classified as amenity planted vegetation (PL.2);
- Two areas of native restoration planting; one adjacent to the Ōtara Creek tributary at the northern end of the NoR Section, and one adjacent to the SH1 bridge crossing at the western end, classified as native Planted Vegetation (PL.1); and
- A row of mixed native and exotic trees adjacent to the Manukau velodrome, classified as mixed exotic and native treeland (TL.2).

These areas are further described in Table 36, and depicted in Figure 20.

Table 36. Vegetation types present within and directly adjacent to the Project Area (NoR 2, Section A), classified according to Singers *et al.* (2017).

Vegetation type	Alphanumeric code*	Regional IUCN Conservation Status*	Description of habitat
Planted Vegetation – native	PL.1	N/A	This habitat is located adjacent to the Ōtara Creek, and at the SH1 bridge crossing. These plant mixtures comprise kānuka, kowhai, karo, māhoe and tī kōuka. A few native seedlings are coming through an otherwise bare ground cover, including māhoe, koromiko/hebe and a few tōtara, as well as weeds such as moth plant. These areas are classified using the Singers *et al.* (2017) classification system as PL.1 (planted native scrub and forest <20 years old or wetland <10 years old.). The peripheries of these habitats were often weedy and contained overgrown pasture and weed species which would provide habitat for copper skink.
Planted Vegetation – amenity plantings	PL.2	N/A	Exotic amenity trees planted within the road corridor. Many of these are Washingtonia palm, but also included are pūriri, pōhutukawa, titoki and oak. Exotic-dominated gardens such as those within residential sections.
Exotic grassland	EG	N/A	Grassland dominated by exotic species. This includes gardens, road verges and parks.

Treeland – mixed exotic and native	TL.2	N/A	Mixed, semi-mature stands of native and exotic trees planted adjacent to the Manukau Velodrome.

* = Information from Singers *et al.* (2017).

Fauna identified during the desktop study which may be present within the ZOI of the NoR include:

- Long-tailed bats;
- Copper skink; and
- Common, non-threatened native bird species.

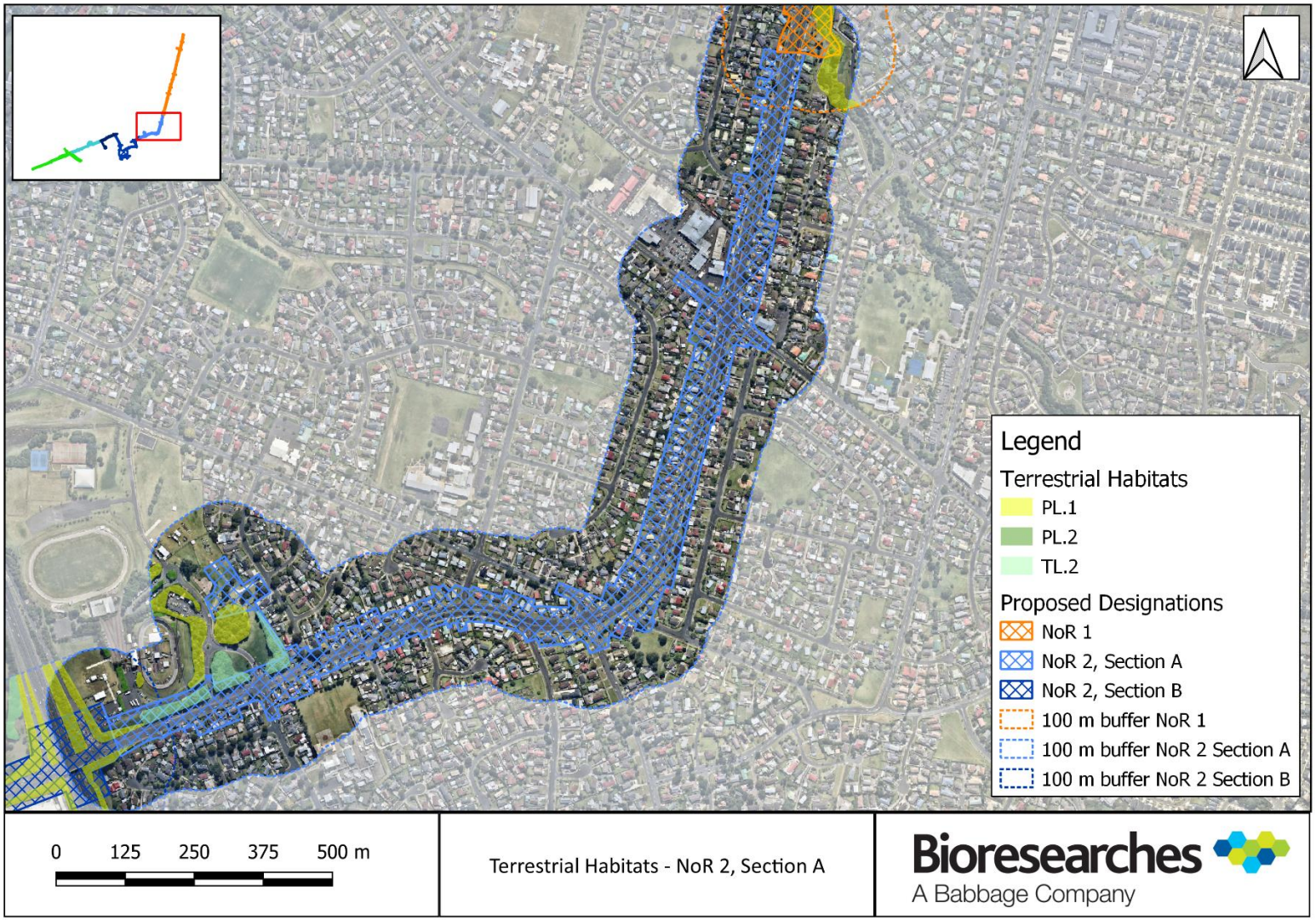


Figure 20. Terrestrial Habitats within the ZOI of NoR 2, Section A

8.2.1.2 Terrestrial Ecological Value

Table 22 presents the ecological value for the terrestrial habitats and fauna identified within NoR 2, Section A. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 37. Ecological values of terrestrial habitats within the ZOI of NoR 2, Section A

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
PL.1 – riparian margin of Ōtara Creek and adjacent to the SH1 bridge crossing.	Moderate – although highly modified, there is so little natural vegetation left in the surrounding are that these areas can be considered important.	High – copper skink (At Risk - Declining) are likely present, and there is potential that the streams and riparian margins are used as long-tailed bat flight paths.	Low - while indigenous species dominate these planted compositions, they lack the diversity and structure expected of a naturally occurring ecosystem.	High - these vegetated margins provide some of the very few areas of biodiversity within a landscape that is largely devoid of indigenous vegetation and habitat.	**High**
PL.2	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
TL.2	Moderate – this habitat is planted and semi mature, but within the local area native plantings of this size are less common.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat is not connected to any other habitats, provides no buffering, no sensitive receptors remain and does not provide a linkage.	**Low**
EG	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors	**Negligible**

				remain and does not provide a linkage.	

Table 38 presents the ecological values for the fauna identified within the ZOI of NoR 2, Section A.

Table 38. Ecological values of fauna within the ZOI of NoR 2, Section A

Fauna	Habitat units utilised	Conservation Status*	Ecological value
Bats – long tailed bat	PL.1 – riparian margins	Threatened - Nationally Critical	Very High
Lizards – copper skink	PL.1 – riparian margins	At Risk - Declining	High
Birds – common, Not Threatened species only	Pl.1 and PL.2 habitats	Not Threatened	Low

* Retrieved from relevant New Zealand Threat Classification Series documents, available from https://www.doc.govt.nz/about-us/science-publications/series/new-zealand-threat-classification-series/

8.2.1.3 Freshwater habitats and fauna

One stream was identified within 100 m of the proposed designation boundary, the Ōtara Creek Tributary. As this stream was also assessed within the NoR 1 section (as the stream is located adjacent to the boundary of the two NoRs) the assessment is not repeated here (see NoR 1 Freshwater Habitats Section). No other streams were identified within 100 m of the proposed designation boundary.

8.2.1.4 Freshwater ecological value

Ōtara Creek Tributary was assessed to have **High** ecological value (see NoR 1 Freshwater Ecological Value Section). No other streams or non-wetland freshwater habitats were identified within 100 m of the designation boundary.

8.2.1.5 Wetland habitat

One wetland (Ōtara W.1) was identified within 100 m of the designation boundary. As the wetland is also within 100 m of the NoR 1 designation boundary, it was assessed within the NoR 1 Wetland Habitats Section.

8.2.1.6 Wetland ecological value

Wetland Ōtara W.1 was assessed to have ecological **High** value (see NoR 1 Wetland Ecological Value Section).

8.2.2 Future environment

Over the next 15 years, existing vegetation and habitats will mature and diversify within their current extents. These areas are constrained in extent by the surrounding land uses and are unlikely to increase in area. While fauna habitats are likely to support greater capacity for resource provision (nesting habitat, food resources), with maturity, fauna diversity is likely to remain stable and reflective of the surrounding urban environment.

The area is largely developed, although intensification of the immediate urban area may occur as a result of recent changes in national policy direction and changes to the RMA.

Ecological values are likely to remain stable in value. **Low** value vegetation and habitats beyond protected riparian margins have capacity to mature, as well as to expand or contract, given that they are unprotected. These areas area likely to remain low in value.

8.2.3 Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects

This section assesses the ecological effects of activities which relate to District Plan matters under the AUP:OP. Refer to the 'Future Environment' Section for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

As per the matrix presented in **Appendix A**, Table 86, ecological features with a 'negligible' ecological value, even if combined with a 'very high' magnitude of effect, will never have a level of effect greater than 'low' and consequently will never require effects management. Therefore, ecological features with a negligible ecological value are not assessed within this section, unless there is the potential to contravene the Wildlife Act 1953.

8.2.3.1 Construction effects – terrestrial ecology

The potential ecological effects to terrestrial habitats and fauna, which may be encountered during the construction phase of the Project (as they relate to District Plan matters) have been identified:

- Removal of vegetation which is subject to District Plan controls (refer to **Appendix B** for a breakdown of Regional Plan versus District Plan vegetation); and
- Disturbance and displacement of bats, birds and lizards due to construction-related activities.

The following sections detail the magnitude of effect and level of effect of construction effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

Terrestrial vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors (in this case, the PL.2 habitat, with low ecological value) and grassland (EG, negligible ecological value).

The effects of the removal of this vegetation are the same as for NoR 1 and are assessed in Table 28. This identified a **Very Low** level of effect associated with the removal of PL.2 vegetation, and consequently no impact management measures are required.

Bats

Long-tailed bats may utilise the Ōtara Creek corridor for foraging or as flight paths, which means they may fly over the NoR at the stream crossing locations at night. Vegetation within the road corridor is not considered to provide roosting or foraging habitat.

During construction of the Project, night works may be required, and site compounds are likely to be lit overnight. Lighting at night has the potential to modify the behaviour of bats if foraging or moving along the stream corridors. There are no trees suitable for bats to roost in within the ZOI of the Project and consequently noise and vibration is not considered to be an issue, and mortality or injury to bats or loss of foraging habitat has not been considered.

The effects of the works upon bats are the same as for NoR 1 and are described Table 29. In summary, disturbance and displacement of bats crossing the NoR as they use streams as a flight corridor is determined to have a **Moderate** magnitude of effect and consequently a **Moderate** level of effect. Effects management in the form of a Bat Management Plan is recommended, which would reduce the level of effect to **Negligible.**

Birds

Indigenous birds may be displaced from nearby habitats due to construction activities. In addition, birds may lose roosting/foraging habitat, abandon or lose nests and also be at risk of mortality or injury during tree felling when the District Plan vegetation is removed.

The effects of the works upon birds are the same as for NoR 1 and are described in Table 30. No level of effect greater than **Low** was identified and consequently no impact management for birds is required.

Lizards

Lizards are not expected to be present within any of the District Plan vegetation to be removed but may be present within the vegetation which lines the Ōtara Creek, adjacent to the Project area. Consequently, effects are limited to the potential displacement of lizards from adjacent habitats.

The effects of the works upon lizards are the same for NoR 1 and are described in Table 31. No level of effect greater than **Very Low** was identified and consequently no impact management for lizards is required.

8.2.3.2 Operational effects – terrestrial ecology

The Project involves the addition of bus lanes to an existing road in an urban landscape. The future environment is also urban, and consequently limited change is expected within the surrounding landscape. The Ōtara Creek corridor and existing habitats associated with this waterway will remain.

Many of the potential operational effects of the Project such as habitat fragmentation, noise and light pollution are pre-existing. Potential operational effects include reductions in habitat connectivity and impacts from noise, light and vibration upon indigenous fauna, as well as potential mortality from vehicle strike.

The following sections detail the magnitude of effect and level of effect of operational effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact

management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

Bats

Potential operational impacts to bats are the same as for NoR 1. They include:

- Loss of habitat connectivity through the presence of the upgraded roadway, and impacts of lighting spillage which may impact behaviour of both bats and insects (their prey). This is considered to have a Moderate magnitude of effect and consequently a High level of effect and therefore is discussed in Table 29.
- As discussed for NoR 1, if bats are identified to be present during pre-construction surveys, then a Bat Management Plan should be implemented. This plan will incorporate mitigation measures such as reduction of light spill near bat habitats, and planting of supplementary trees within the riparian corridors which will in time increase the canopy height of the plantings and aim to retain connectivity. This would reduce the level of effect to Negligible.
- Vehicle strike causing injury or mortality. This is considered to have a very low likelihood of occurring. Consequently, the magnitude of effect is considered to be **Negligible**, and therefore has a **Low** level of effect. Effects management is not required.

As the habitats adjacent to the Project area do not provide roosting habitat for bats and are not expected to develop to provide this within 15 years (when the Project is expected to begin), impacts on roosting bats have not been considered.

Birds

Indigenous birds may be displaced from nearby habitats due to noise, lighting and vibration generated from the Project works. However as the birds present within the Project area are likely already habituated to these effects, the magnitude of this effect is considered to be **Low** for both the baseline and future environment, and consequently the level of effect is considered to be **Very Low**.

Birds may also be affected by vehicle strike; however, this is only likely to occur infrequently. Consequently, the magnitude of effect of this is considered to be **Low**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to birds.

Lizards

The Project works is not expected to increase limitations on lizard dispersal or increase disturbance to lizards. Consequently, the magnitude of this effect is considered to be **low** for both the baseline and future environment, and the level of effect is considered to be **Low**.

Lizards may also be affected by vehicle strike, however there is a very low probability of this occurring, and it would likely only occur at a very low frequency. Consequently, the magnitude of effect of this is considered to be **Negligible**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to lizards.

8.2.3.3 Conclusions

Ecological effects assessed as moderate or greater include:

- Moderate level of effect to bats during construction for both the ecological baseline and future ecological environment may occur due to disturbance to bats utilising the streams which the NoR crosses as flight corridors; and
- Moderate level of effect to bats during operation for both the ecological baseline and future ecological environment may occur due to fragmentation of habitat and impacts of lighting and noise.

Effects management (implementation of a Bat Management Plan) reduces these effects to **Negligible** and **Low**, respectively.

8.2.4 Design and future Regional Resource Consent considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the following sections to inform design and alignment options for the NoR.

8.2.4.1 Terrestrial ecology

Construction of the Project will result in both temporary and permanent losses in terrestrial habitat within the NoR, including habitat which is being used by native fauna.

Table 39 details the types and area (m^2) of terrestrial habitats which will be lost during construction, as well as the total area of each habitat present within the proposed designation boundary. This includes vegetation which is subject to District Plan and Regional Plan controls as well as vegetation not subject to plan controls. As the PL.2 habitat is comprised of specimen trees planted in the roadway, this has not been mapped by area and is instead recorded as the number of trees to be removed (160 trees).

Terrestrial habitats which will be lost are currently of high or low ecological value and may provide habitat for native fauna. Exotic grassland habitat is of **Negligible** ecological value and therefore is not considered here.

Table 39. Terrestrial habitat types and the areas of these both within the Project footprint (which will be permanently lost) and within the designation boundary.

Habitat type	Classification (Singers *et al.* 2017)	Area within Footprint (m^2)	Area within Designation (m^2)
Planted Vegetation – native	PL.1	TBC	1623
Treeland – mixed exotic and native	TL.2	TBC	5,333

8.2.4.2 Birds

Non-threatened indigenous birds are present within the proposed designation boundary and will be impacted by vegetation removal. This should therefore occur outside of the bird nesting season to reduce impacts to these birds.

At Risk bird species (pāteke) may be present within the wetland Ōtara W.1 located adjacent to the proposed designation. These birds could be impacted by construction activities and therefore a Bird Management Plan is recommended to reduce the magnitude of effect of these works.

8.2.4.3 Lizards

Copper skinks are potentially present within the vegetation to be cleared, and there is potential that during this clearance they could be injured or killed. Consequently, the works should be completed in accordance with the Wildlife Act 1953, and a Lizard Management Plan should be implemented.

8.2.4.4 Freshwater ecology

The proposed designation crosses one stream, however no stream loss is expected as the existing culvert will be unchanged.

Erosion and sediment control plan/s will likely also be required to prevent sediment entering streams during the works. Fish passage structures should be implemented in existing culvert sections if fish passage is not already available.

8.2.4.5 Wetland ecology

Construction of the NoR will result not result in the loss of extent of any wetland. However as works are to be carried out within 100 m of wetlands associated with the Ōtara Creek, consent for the works under the NES:F will be required. This will require mitigation in the form of erosion and sediment control plans.

8.3 Section B: East of SH1 to Ihaka Place

8.3.1 Ecological baseline

8.3.1.1 Terrestrial habitats and fauna

Desktop review

NoR 2 Section B transitions through light industry, business, metropolitan centre and residential zones in the AUP:OP, as well as a few open space recreation zones.

Present day habitats are therefore largely limited to:

- Mown lawns classified using Singers *et al.* (2017) as Exotic Grassland (EG);
- Amenity plantings/gardens such as street trees within the road corridor (e.g., along Manukau Station Road and Lambie Drive) and in residential sections, classified as planted amenity trees and gardens (PL.2);
- Areas of native restoration planting; one on the north and south side of Te Irirangi Drive where it passes the Auckland University of Technology grounds, and one bordering the Wiri Substation, classified as planted native vegetation (PL.1); and
- Planted treeland vegetation, comprised of a mix of exotic and native trees is present within Hayman Park (TL.2).

These areas are further described in Table 40, and depicted in Figure 21.

Table 40. Vegetation types present within and directly adjacent to the Project Area (NoR 2, Section B), classified according to Singers *et al.* (2017).

Vegetation type	Alphanumeric code*	Regional IUCN Conservation Status*	Description of habitat
Planted Vegetation – native	PL.1	N/A	This habitat is located on either side of Te Irirangi Drive immediately west of the SH1 bridge crossing, and outside the Wiri Substation. The plant mixtures comprise karo, taupata (*Coprosma repens*), mānuka (*Leptospermum scoparium*), kānuka, pōhutukawa (*Metrosideros excelsum*), harakeke (*Phormium tenax*), māhoe and tī kōuka and occasional exotic trees such as magnolia (*Magnolia grandiflora*). A few native seedlings are coming through an otherwise bare ground cover, including māhoe and tōtara, as well as weeds such as moth plant (*Araujia sericifera*). These areas are classified using the Singers *et al.* (2017) classification system as PL.1 (planted native scrub and forest <20 years old or wetland <10 years old.). The peripheries of these habitats were often weedy and contained overgrown pasture and weed species which would provide habitat for copper skink (*Oligosoma aeneum*).
Planted Vegetation – amenity plantings	PL.2	N/A	Amenity trees planted within the road corridor. Species include oaks (*Quercus* sp.), Norfolk pine (*Araucaria heterophylla*), magnolia, pōhutukawa and *Eucalyptus* spp. Exotic-dominated gardens such as those outside 22 Manukau Station Road and within residential sections.
Exotic grassland	EG	N/A	Grassland dominated by exotic species. This includes gardens, road verges and parks.
Treeland – mixed exotic and native	TL.2	N/A	Mixed, semi-mature stands of native and exotic trees planted within Hayman Park.

* = Information from Singers *et al.* (2017).

Fauna identified during the desktop study which may be present within the ZOI of the NoR include:

- Copper skink; and
- Common, non-threatened native and exotic bird species.

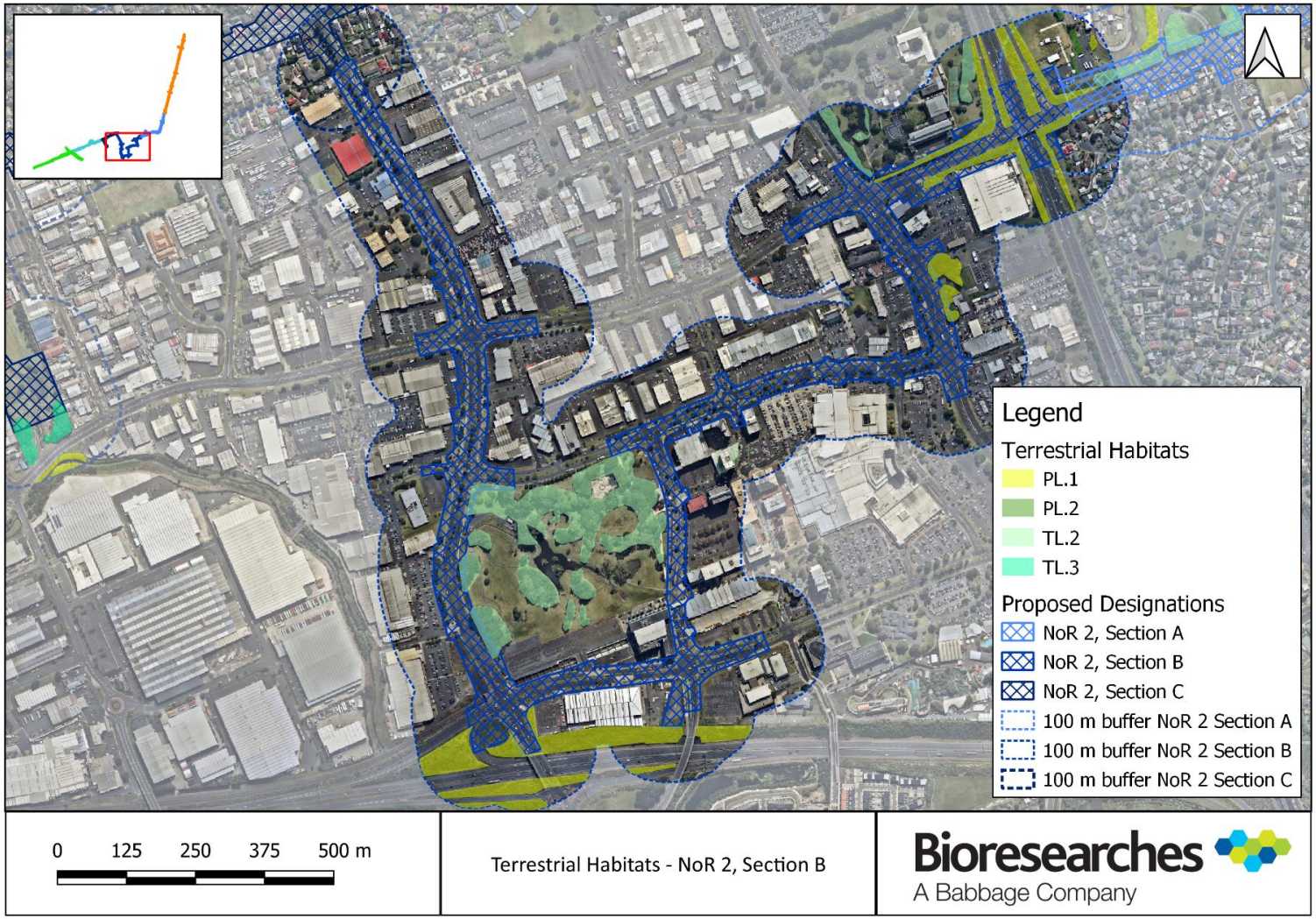


Figure 21. Terrestrial habitats within the ZOI of NoR 2, Section B

8.3.1.2 Terrestrial ecological value

Table 41 presents the ecological value for the terrestrial habitats and fauna identified within NoR 2, Section B. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 41. Ecological values of terrestrial habitats within the ZOI of NoR 2, Section B

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
PL.1	Moderate – this habitat is planted and semi mature, but within the local area native plantings of this size are less common.	High – copper skink (At Risk - Declining) are potentially present	Low - while indigenous species dominate these planted compositions, they lack the diversity and structure expected of a naturally occurring ecosystem.	Low – habitat is not connected to any other habitats, provides no buffering, no sensitive receptors remain and does not provide a linkage.	High
PL.2	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	Low
TL.2	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	Low
EG	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	Negligible

Table 42 presents the ecological values for the fauna identified within the ZOI of NoR 2, Section B.

Table 42. Ecological values of fauna within the ZOI of NoR 2, Section B

Fauna	Habitat units utilised	Conservation Status*	Ecological value
Lizards – copper skink	PL.1	At Risk - Declining	High
Birds – common, Not Threatened species only	Pl.1, TL.2 and PL.2 habitats	Not Threatened	Low

* Retrieved from relevant New Zealand Threat Classification Series documents, available from https://www.doc.govt.nz/about-us/science-publications/series/new-zealand-threat-classification-series/

8.3.1.3 Freshwater habitats and fauna

One stream branch was identified within NoR 2, Section B. Three stormwater/amenity ponds were also identified. The stream and ponds are mapped in Figure 24 and Figure 25; and described in Table 43.

Table 43. Summary of NoR 2 Section B streams

Stream/habitat	Classification	Description
Puhinui Creek Tributary A	Intermittent	The headwaters of Puhinui Creek Tributary A originate from a culvert outlet in the Hayman Park's south-east corner. This outlet immediately forms an intermittent stream, which flows in a north-west direction into a large stormwater pond (Puhinui A.3). An additional, smaller stormwater pond (Puhinui A.2) is present to the east of the larger pond, this also discharges into the larger pond via a culvert. The pond outflows via a culvert into a second reach of Puhinui Creek Tributary A, which flows in a north-west direction for 80 m where it meets a second channel (c. 20 m in length) dug to convey surface water from the north-eastern corner of Hayman Park. After the confluence of these two watercourses, the stream flows in a south-west direction into a culvert which flows beneath Lambie Drive and Bunnings warehouse and discharges into the Puhinui Creek. It is not known if the stream is natural in origin or not. The earliest historic aerial imagery available (Figure 22) shows that a watercourse in the rough location of the existing tributary has been present since at least the 1930's. However in the historic imagery the stream has an unnaturally straight and uniform channel, suggesting that if it was a natural stream, it had already been realigned by this point.

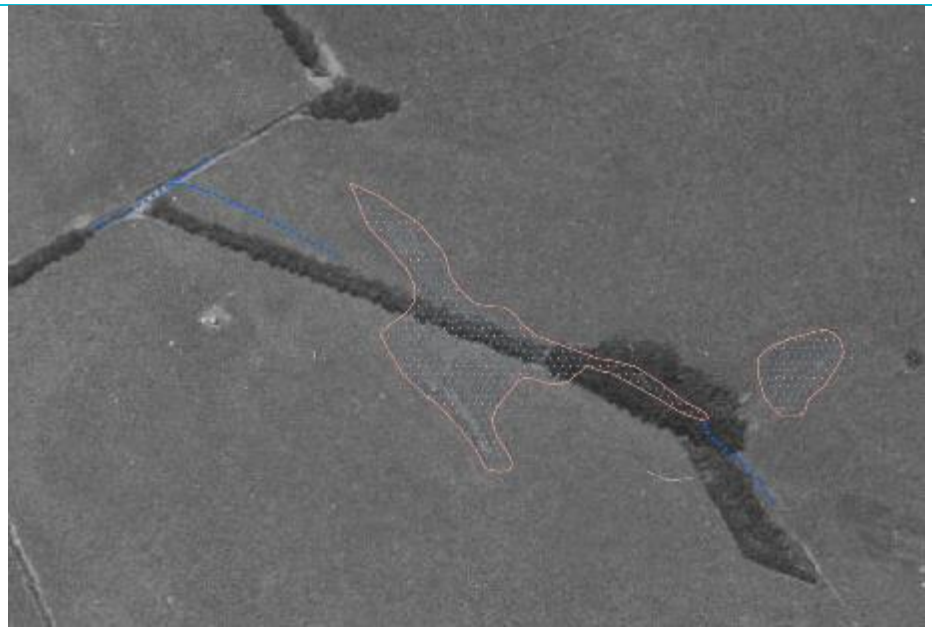


Figure 22. 1930's aerial imagery of the current location of Tributary B. Blue dashed lines indicate present-day stream sections and peach polygons indicate the stormwater ponds. Imagery from Retrolens.

Both the upper and lower reaches of stream have very low hydrological heterogeneity and fish and invertebrate habitat is limited to sparse macrophytes.

The outlet of the Lambie Drive culvert was not able to be viewed, so it is not known if it prohibits fish passage. However its length would prevent īnanga from reaching the stream reach, and long-fin eel would not find the habitats suitable, so it is likely that any fish species present would be limited to common, non-threatened species, and gambusia which were observed during the site visits.

The stream reaches have limited shading and riparian cover is mostly closely mown lawn.

Rapid habitat assessment results were indicative of low-quality habitat:

Deposited Sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width	Riparian Shade	Total
6	1	9	1	9	1	5	1	1	1	35

Puhinui A P.2	Artificial pond	Artificially constructed pond. This pond contained no vegetation and water quality appeared poor, with algae present in large quantities and very poor clarity. It lacks any connection to a natural watercourse other than the culvert connecting it to Puhinui A.3 and very limited habitat for native fauna. No macrophytes or hydrophytic vegetation was present in or around the pond and it is not considered to meet the definition of a Wetland under the NES:F.
Puhinui A P.3	Artificial pond	Artificially constructed pond. This pond contained no vegetation and water quality appeared poor, with algae present in large quantities. Large numbers of the pest fish Gambusia were observed. The pond is poorly connected to other watercourses, and very limited habitat for native fauna. In Figure 22, there is no evidence of wetland habitat in the vicinity of either pond and therefore this pond (and also pond Puhinui A.2) can be considered wholly artificial and not modified natural wetlands. Small patches of emergent macrophytes were present on the pond edges, however these are not considered to meet the definition of 'natural wetlands' under the NES:F as they have formed incidentally around this artificial waterbody.
University.1	Artificial pond	Artificially constructed pond. Partially shaded with mixed exotic and native trees on edges. Edges are lined with rock walls, and the base is concrete lined. Some plants (*Machaerina articulata* and papyrus (*Cyperus papyrus*)) were present within the pond, however these were potted and not rooted in sediment. Two shortfin eels were observed within the pond. This pond is very disconnected from surrounding natural habitats and only connected to other waterbodies via the stormwater system. As such it is considered highly unlikely to provide habitat for At Risk or Threatened native species.

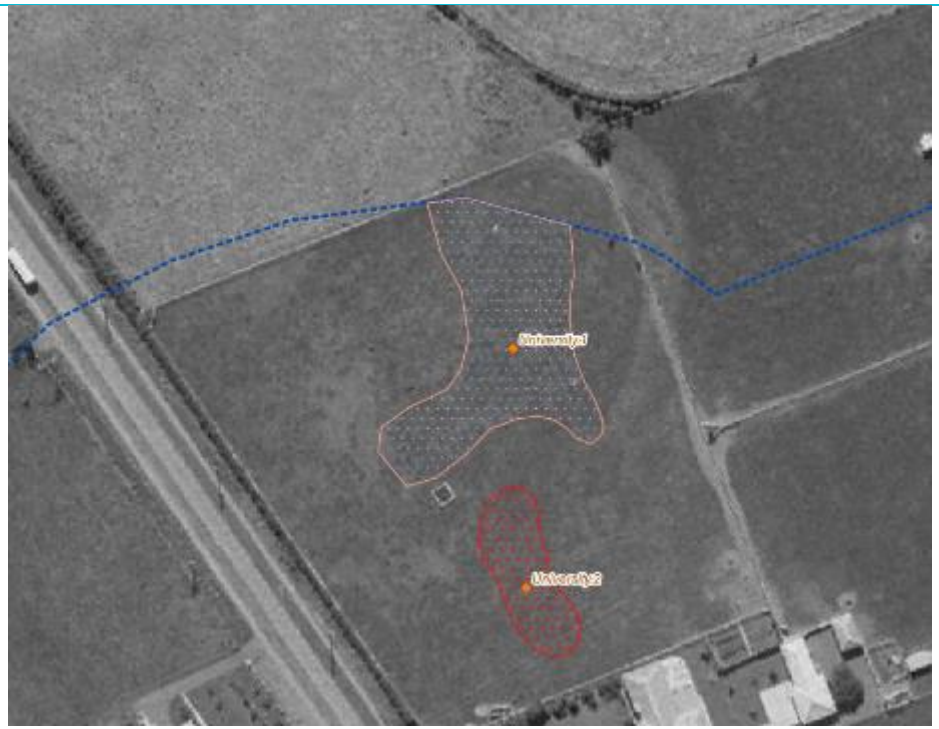


Figure 23: 1930's aerial imagery of the current location of University.

1 artificial pond (pink) and University.
2 constructed wetland (red; assessed below).
Blue dashed line indicates a 100 m buffer from the designation boundary, note the artificial pond is not mapped beyond (north of) this point. Imagery from Retrolens.

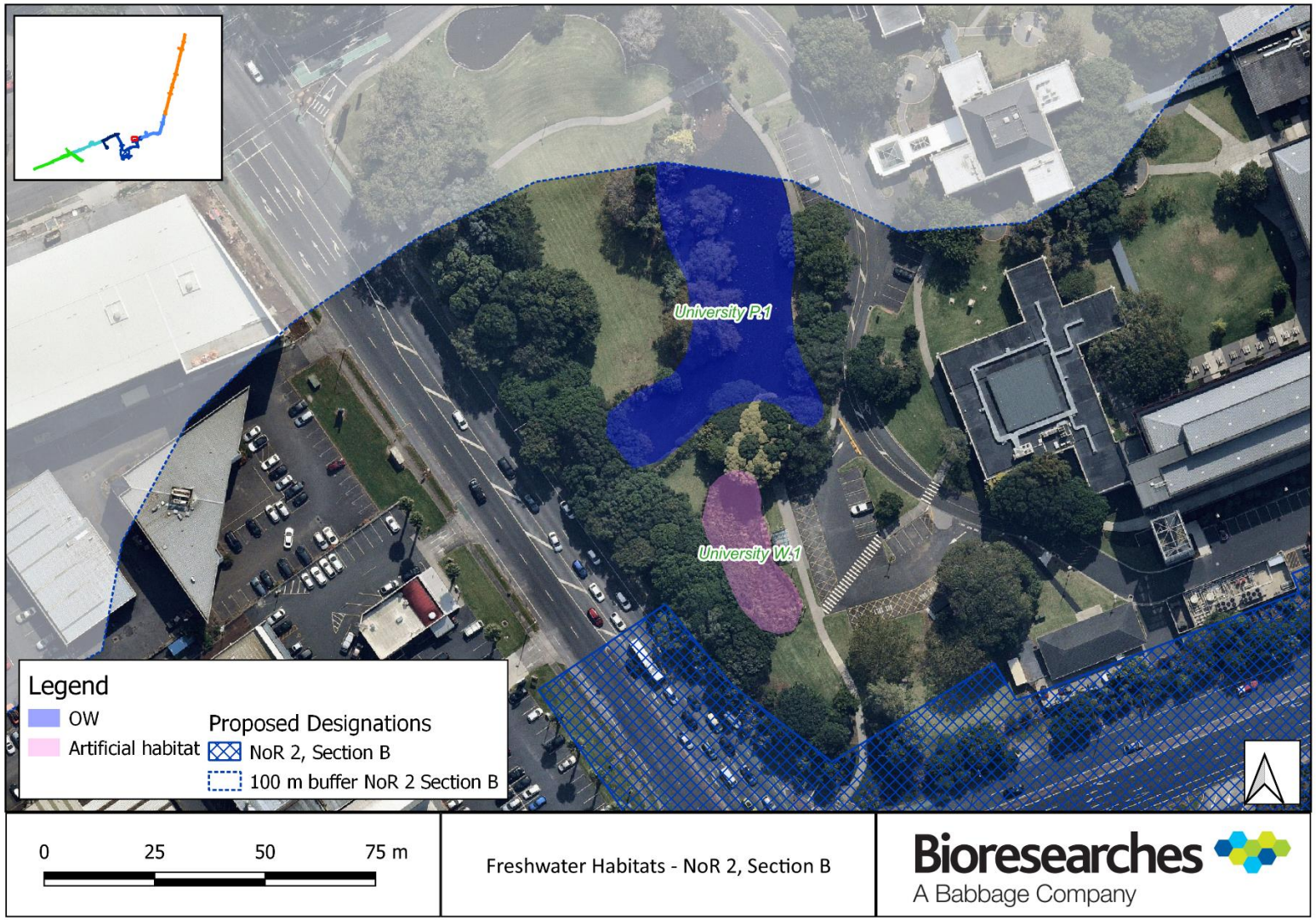


Figure 24. Freshwater Habitats within the northern portion of the ZOI of NoR 2, Section B.

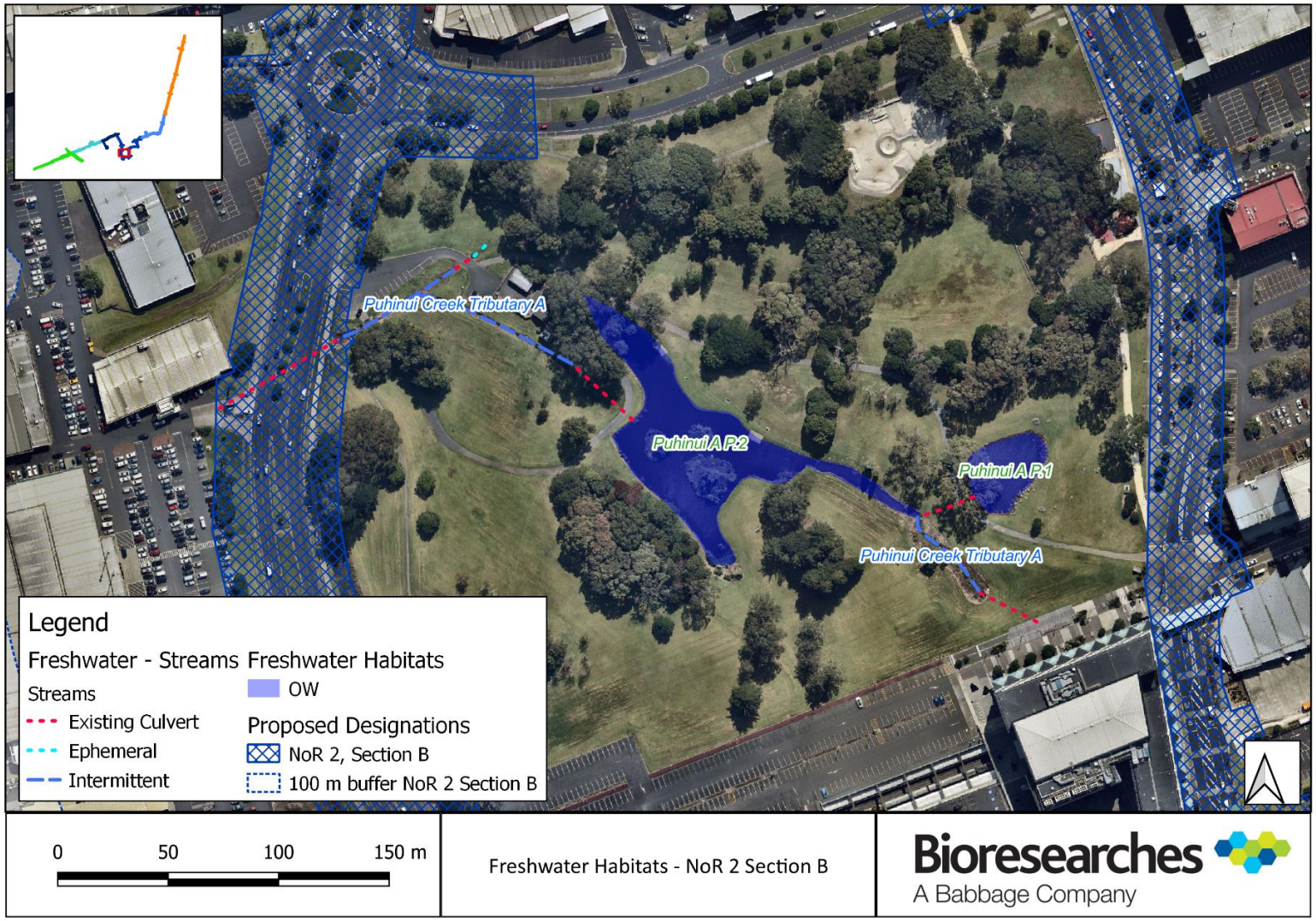


Figure 25. Freshwater Habitats within the southern portion of the ZOI of NoR 2, Section B

8.3.1.4 Freshwater ecological value

Table 44 presents the ecological value for the freshwater habitats identified within NoR 2 Section B. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 44. Ecological values of streams and ponds within the ZOI of NoR 2, Section B

Stream/pond	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Puhinui Creek Tributary A	Low – highly modified instream habitat and riparian zone	Low – no 'At Risk' or 'Threatened' species present	Low – highly modified	Low – First order stream	**Low**
Puhinui A P.2	Low – wholly artificial habitat which almost no natural habitat has developed within.	Low – no 'At Risk' or 'Threatened' species present	Very low – only one hydrological unit	Very low – highly modified artificial environment within a highly modified catchment.	**Negligible**
Puhinui A P.3	Low – wholly artificial habitat which almost no natural habitat has developed within.	Low – no 'At Risk' or 'Threatened' species present	Very low – only one hydrological unit	Very low – highly modified artificial environment within a highly modified catchment.	**Negligible**
University P.1	Low – wholly artificial habitat which almost no natural habitat has developed within.	Low – no 'At Risk' or 'Threatened' species present	Very low – only one hydrological unit	Very low – highly modified artificial environment within a highly modified catchment.	**Negligible**

8.3.1.5 Wetland habitat

One wetland was identified within 100m of NoR 2, a constructed wetland within the Auckland University of Technology grounds. It is described in Table 45, and depicted in Figure 24.

Table 45. Wetlands within 100 m of NoR 2

Wetland	NES:F Classification	Classification process	Description
University W.1	Constructed wetland	Rapid test	Wetland constructed in 2017 (Figure 26), and planted with oioi and *Carex* sp. This wetland is only connected to other natural freshwater habitats via stormwater culverts which eventually link it to the Ōtara Creek. As such it is considered highly unlikely to provide habitat for At Risk or Threatened native species. During the site visit the wetland held no standing water so it is considered highly unlikely to provide fish habitat, and unlikely to provide habitat for wetland birds because of its small size.  **Figure 26. 2015/16 aerial imagery on left showing the university grounds pre-construction of 'University.2' wetland, and in 2017 on right during construction. Imagery from Auckland Council Geomaps.**

8.3.1.6 Wetland ecological value

Table 46 presents the ecological value for the wetland habitat identified within NoR 2 Section B. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 46. Ecological value of wetlands within the ZOI of NoR 2 Section B.

Wetland	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
University.2	Low – highly modified catchment and likely to support only common, non-native biota.	Low - not suitable habitat for any species of conservation significance. Is present in an environment where wetland habitats are uncommon but it's lack of connectivity to other ecologically functional habitats greatly reduces the value.	Low - low diversity in habitat type.	Moderate – does provide some filtering of nutrients and flow regulation.	**Low**

8.3.2 Future environment

Over the next 15 years, existing vegetation and habitats will mature and diversify within their current extents. These areas are constrained in extent by the surrounding land uses and are unlikely to increase in area. While fauna habitats are likely to support greater capacity for resource provision (nesting habitat, food resources), with maturity, fauna diversity is likely to remain stable and reflective of the surrounding urban environment.

The area is almost entirely developed, although some intensification of the immediate urban area may occur. Ecological values are likely to remain consistent in value.

8.3.3 Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects

8.3.3.1 Construction effects – terrestrial ecology

The potential ecological effects to terrestrial habitats and fauna, which may be encountered during the construction phase of the Project (as they relate to district matters) have been identified:

- Removal of vegetation which is subject to District Plan controls (refer to **Appendix B** for a breakdown of Regional versus District Plan vegetation); and
- Disturbance and displacement of birds and lizards due to construction-related activities.

The following sections detail the magnitude of effect and level of effect of construction effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

Terrestrial vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors (in this case, the PL.2 habitat, with low ecological value) and grassland (EG, negligible ecological value).

The effects of the removal of this vegetation are the same as for NoR 1 and are assessed in Table 28. This identified a **Very Low** level of effect associated with the removal of PL.2 vegetation, and consequently no impact management measures are required.

Birds

Indigenous birds may be displaced from nearby habitats due to construction activities. In addition, birds may lose roosting/foraging habitat, abandon or lose nests and also be at risk of mortality or injury during tree felling when the District Plan vegetation is removed.

The effects of the works upon birds are described below in Table 47.

Table 47. Assessment of ecological effects encountered during construction for birds

Effect	**Disturbance and displacement of birds due to construction activities**	**Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill birds**

Time scale	Baseline	Future environment	Baseline	Future environment
Magnitude of effect	Adjacent habitats are definitely periodically used by birds. The magnitude of effect is expected to be **Moderate**.	These trees are expected to still be present and utilised by birds in the same manner as they are currently. Consequently, the magnitude of effect is expected to be the same.	There is a reasonable probability that native birds utilise these trees for nesting. The magnitude of effect is expected to be **Moderate**.	This effect is expected to be the same as baseline.
Level of effect prior to impact management	**Low** for other bird species.		**Low**	
Impact management and residual level of effect	Not required		Under the Wildlife Act 1953, impact management measures will be required to prevent killing or injuring native birds during tree felling. This should include scheduling tree felling and vegetation removal activities outside of the bird nesting season (which is September to February, inclusive), or undertaking pre-clearance inspections to ensure nesting birds are not present.	
Management of residual effects	Not required		Not required	

Lizards

Lizards are not expected to be present within any of the District Plan vegetation to be removed but may be present within the vegetation which lines the Ōtara Creek, adjacent to the Project area. Consequently, effects are limited to the potential displacement of lizards from adjacent habitats.

The effects of the works upon lizards are the same for NoR 1 and are described in Table 31. No level of effect greater than **Very Low** was identified and consequently no impact management for lizards is required.

8.3.3.2 Operational effects – terrestrial ecology

The Project involves the addition of dedicated BRT lanes and high quality walking and cycling facilities to an existing road in an urban landscape. The future environment is also urban, and consequently limited change is expected within the surrounding landscape. The Ōtara Creek corridor and existing habitats associated with this waterway will remain.

Many of the potential operational effects of the project such as habitat fragmentation, noise and light pollution are pre-existing. Potential operational effects include reductions in habitat connectivity and impacts from noise, light and vibration upon indigenous fauna, as well as potential mortality from vehicle strike.

The following sections detail the magnitude of effect and level of effect of operational effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

Birds

Indigenous birds may be displaced from nearby habitats due to noise, lighting and vibration generated from the Project Works. However as the birds present within the Project area are likely already habituated to these effects, the magnitude of this effect is considered to be **Low** for both the baseline and future environment, and consequently the level of effect is considered to be **Very Low**.

Birds may also be affected by vehicle strike. However, this is only likely to occur infrequently. Consequently, the magnitude of effect of this is considered to be **Low**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to birds.

Lizards

The Project is not expected to increase limitations on lizard dispersal or increase disturbance to lizards. Consequently, the magnitude of this effect is considered to be **Low** for both the baseline and future environment, and the level of effect is considered to be **Low**.

Lizards may also be affected by vehicle strike, however there is a very low probability of this occurring, and it would likely only occur at a very low frequency. Consequently, the magnitude of effect of this is considered to be **Negligible**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to lizards.

8.3.3.3 Conclusions

No effects with a level of effect greater than **Low** were identified. Consequently, no effects management is required.

8.3.4 Design and future Regional Resource Consent considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the following sections to inform design and alignment options for the NoR.

8.3.4.1 Terrestrial ecology

Construction of the Project will result in both temporary and permanent losses in terrestrial habitat within the NoR, including habitat which is being used by native fauna.

Table 48 details the types and area (m^2) of terrestrial habitats which will be lost during construction, as well as the total area of each habitat present within the designation boundary. This includes vegetation which is subject to District Plan and Regional Plan controls as well as vegetation not subject to plan controls. As the PL.2 habitat is comprised of specimen trees planted in the roadway, this has not been mapped by area and is instead recorded as the number of trees to be removed (180 trees).

Terrestrial habitats which will be lost are currently of **Moderate** or **Low** ecological value and may provide habitat for native fauna. Exotic grassland habitat is of **Negligible** ecological value and therefore is not considered here.

Table 48. Terrestrial habitat types and the areas of these both within the Project footprint (which will be permanently lost) and within the designation boundary.

Habitat type	Classification (Singers *et al.* 2017)	Area within Footprint (m^2)	Area within Designation (m^2)
Planted Vegetation – native	PL.1	TBC	13,475
Treeland – mixed exotic and native	TL.2	TBC	45,668

8.3.4.2 Birds

Non-threatened indigenous birds are present within the designation boundary and will be impacted by vegetation removal. This should therefore occur outside of the bird nesting season to reduce impacts to these birds.

8.3.4.3 Lizards

Copper skinks are potentially present within the vegetation to be cleared, and there is potential that during this clearance they could be injured or killed. Consequently, the works should be completed in accordance with the Wildlife Act 1953, and a Lizard Management Plan should be implemented.

8.3.4.4 Freshwater ecology

One stream, Puhinui Stream Tributary A (and two stormwater ponds) are positioned directly adjacent to two additional stormwater ponds proposed to be constructed. Whilst there are no instream works proposed, and no stream loss, under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for sediment control and management of the riparian condition.

8.3.4.5 Wetland ecology

Construction of the NoR will occur within 100 m of one wetland. No direct loss wetland loss will occur, but assessment of the effects of these works will be required under the NES:F. Effects management likely be limited to implementation of erosion and sediment control measures.

8.4 Section C: Ihaka Place to Puhinui Station

8.4.1 Ecological baseline

8.4.1.1 Terrestrial habitats and fauna

NoR 2 Section C is placed within residential zones.

Present day habitats are therefore largely limited to amenity plantings/gardens in residential sections and on roadsides, classified using Singers *et al.* (2017) as amenity planted vegetation (PL.2), exotic-dominated treeland (TL.3) and mown lawns, classified as Exotic Grassland (EG).

These areas are further described in Table 49, and depicted in Figure 27.

Table 49. Vegetation types present within and directly adjacent to the Project Area (NoR 2, Section C), classified according to Singers *et al.* (2017).

Vegetation type	Alphanumeric code*	Regional IUCN Conservation Status*	Description of habitat
Planted Vegetation – amenity plantings	PL.2	N/A	Amenity trees planted within the road corridor. Species include bottlebrush (*Callistemon* sp.), pōhutukawa and titoki (*Alectryon excelsum*). Exotic-dominated gardens such as those outside 22 Manukau Station Road and within residential sections.
Treeland – Exotic dominated	TL.3	N/A	*Eucalyptus* spp. planted within Puhinui Domain
Exotic grassland	EG	N/A	Grassland dominated by exotic species. This includes gardens and road verges.

* = Information from Singers *et al.* (2017).

Fauna identified during the desktop study which may be present within the ZOI of the NoR include:

- Common, non-threatened native bird species.

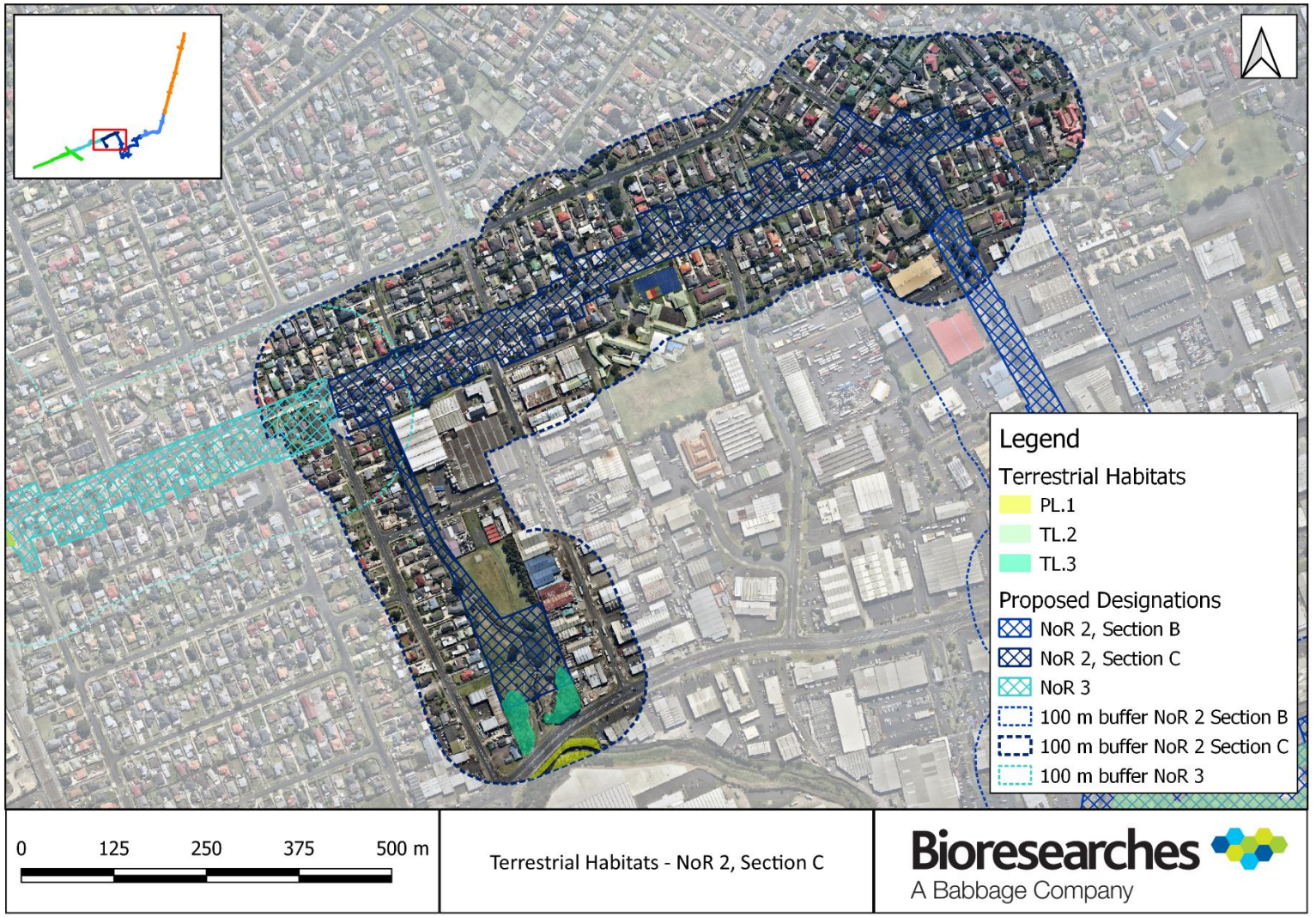


Figure 27. Terrestrial Habitats within the ZOI of NoR 2, Section C.

8.4.1.2 Terrestrial ecological value

Table 50 presents the ecological value for the terrestrial habitats and fauna identified within NoR 2, Section C. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 50. Ecological values of terrestrial habitats within the ZOI of NoR 2, Section C

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
PL.2	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too manicured or isolated to offer much variation in habitat or to be used for completion of lifecycles. Species are of a highly modified assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
TL.3	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has low diversity and other than copper skink does not provide habitat for other sensitive species.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
EG	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Negligible**

Table 51 presents the ecological values for the fauna identified within the ZOI of NoR 2, Section C.

Table 51. Ecological values of fauna within the ZOI of NoR 2, Section C

Fauna	Habitat units utilised	Conservation Status*	Ecological value
Birds – common, Not Threatened species only	Pl.1 and PL.2 habitats	Not Threatened	**Low**

* Retrieved from relevant New Zealand Threat Classification Series documents, available from https://www.doc.govt.nz/about-us/science-publications/series/new-zealand-threat-classification-series/

8.4.1.3 Freshwater habitats and fauna

One stream was identified within the NoR, Puhinui Creek Tributary B. It is mapped in Figure 28 and described in Table 52.

Table 52. Summary of NoR 2 Section C streams

<table>
<tr><th>Stream</th><th>Classification</th><th>Brief Description</th></tr>
<tr><td>Puhinui Creek Tributary B</td><td>Permanent</td><td>Puhinui Creek Tributary B is fed via stormwater discharges. Its headwaters are located approximately 40 m south of Puhinui Road, at a culvert outflow. It flows for approximately 370 m before discharging into a stormwater pond. It then discharges from the pond, flows beneath Cavendish Drive via a culvert and discharges into Puhinui Creek. As the stream receives all water from stormwater inflows, consequently it can be expected to have a highly modified hydrological regime, with flashy responses to rainfall, and likely receives contaminants via these pathways.

Historic aerial imagery shows that a watercourse has been present since at least the 1930’s in that location. owever the stream has an unnaturally straight and uniform channel, much of which is concrete lined. It has no riparian cover and the vegetation within the riparian zone consists of short mown grass.

Shortfin eels (seven in total) were observed within the stream during the site visit. Macrophytes were present in low numbers within the stream and included starwort (Callitriche stagnalis), swamp lily (Ottelia ovalifolia), Persicaria hydropiper and curly pondweed (Potamogeton crispus).

Despite the presence of freshwater fish records for longfin eel and īnanga within the wider catchment, the habitat quality is considered too poor to support these species and the lack of upstream habitat means they are highly unlikely to pass through the site.

Rapid habitat assessment scores were low:
<table>
<tr><th>Deposited Sediment</th><th>Invertebrate habitat diversity</th><th>Invertebrate habitat abundance</th><th>Fish cover diversity</th><th>Fish cover abundance</th><th>Hydraulic heterogeneity</th><th>Bank erosion</th><th>Bank vegetation</th><th>Riparian width</th><th>Riparian Shade</th><th>Total</th></tr>
<tr><td>4</td><td>2</td><td>1</td><td>2</td><td>1</td><td>1</td><td>7</td><td>1</td><td>1</td><td>1</td><td>22</td></tr>
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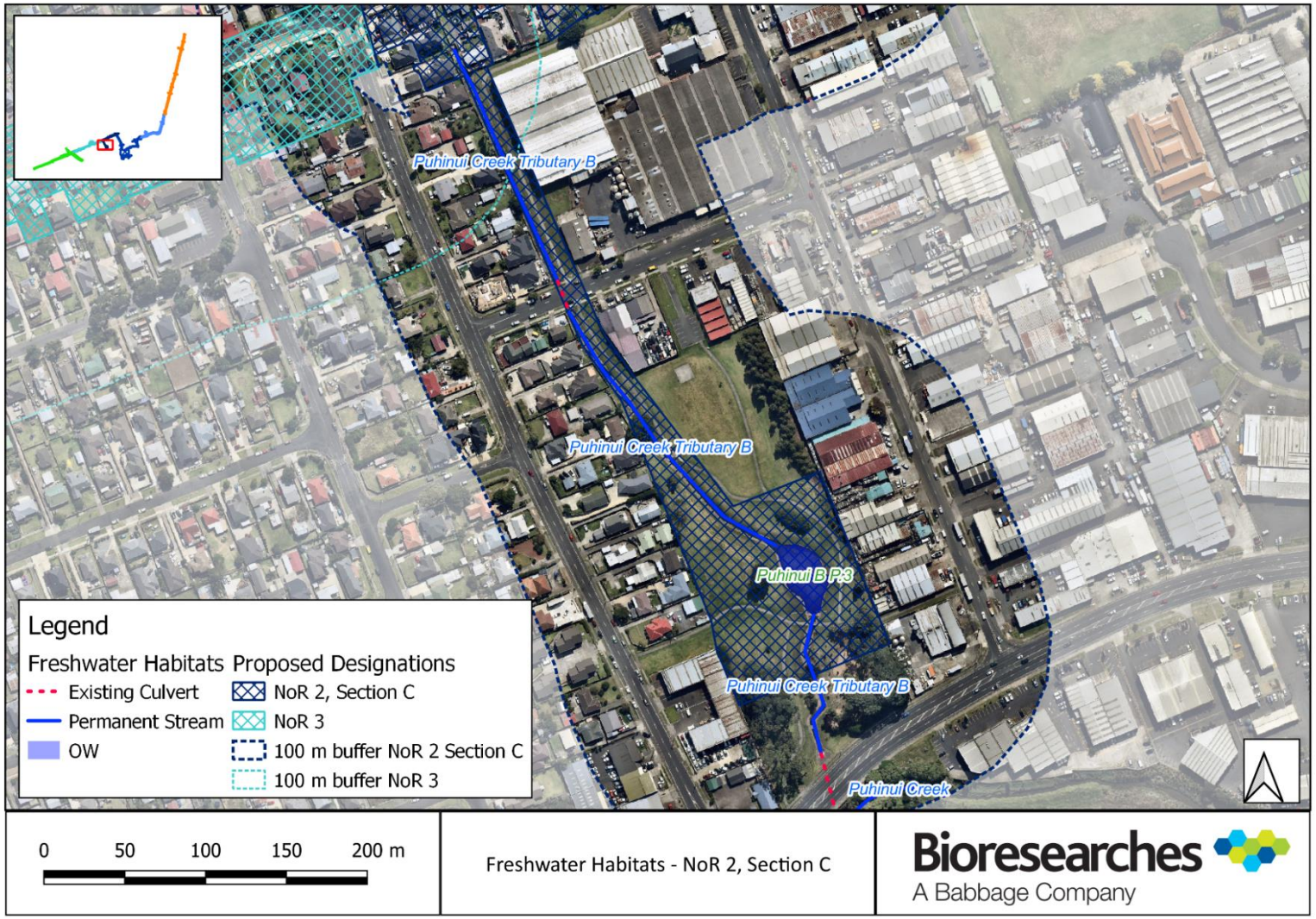


Figure 28. Freshwater Habitats within the ZOI of NoR 2 Section C.

8.4.1.4 Freshwater ecological value

Table 53 presents the ecological value for the freshwater habitats identified within NoR 2 Section C. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 53. Ecological values of streams within the ZOI of NoR 2

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Puhinui Tributary B	Low - highly modified instream habitat and riparian zone	Low – no 'At Risk' or 'Threatened' species present	Low – highly modified, near-uniform habitat	Low – first order stream	**Low**

8.4.1.5 Wetland habitat

No wetland habitat was identified within NoR 2, Section C.

8.4.2 Future environment

Over the next 15 years, existing vegetation and habitats will mature and diversify within their current extents. These areas are constrained in extent by the surrounding land uses and are unlikely to increase in area. While fauna habitats are likely to support greater capacity for resource provision (nesting habitat, food resources), with maturity, fauna diversity is likely to remain stable and reflective of the surrounding urban environment.

The area is almost entirely developed, although some intensification of the immediate urban area may occur as a result of changes to national policy direction and the RMA. Ecological values are likely to remain consistent in value.

8.4.3 Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects

8.4.3.1 Construction effects – terrestrial ecology

The potential ecological effects to terrestrial habitats and fauna, which may be encountered during the construction phase of the Project (as they relate to district matters) have been identified:

- Removal of vegetation which is subject to District Plan controls (refer to **Appendix B** for a breakdown of Regional versus District Plan vegetation); and
- Disturbance and displacement of birds due to construction-related activities.

The following sections detail the magnitude of effect and level of effect of construction effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

Terrestrial vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors (in this case, the PL.2 habitat, with low ecological value) and grassland (EG, negligible ecological value).

The effects of the removal of this vegetation are the same as for NoR 1 and are assessed in Table 28. This identified a **Very Low** level of effect associated with the removal of PL.2 vegetation, and consequently no impact management measures are required.

Birds

Indigenous birds may be displaced from nearby habitats due to construction activities. In addition, birds may lose roosting/foraging habitat, abandon or lose nests and also be at risk of mortality or injury during tree felling when the District Plan vegetation is removed.

The effects of the works upon birds are the same as for NoR 2, Section B and are described in Table 47. No level of effect greater than **Low** was identified and consequently no impact management for birds is required.

8.4.3.2 Operational effects – terrestrial ecology

The Project involves the addition of BRT lanes and high quality walking and cycling facilities to an existing road in an urban landscape. The future environment is also urban, and consequently limited change is expected within the surrounding landscape. The Ōtara Creek corridor and existing habitats associated with this waterway will remain.

Many of the potential operational effects of the Project such as habitat fragmentation, noise and light pollution are pre-existing. Potential operational effects include reductions in habitat connectivity and impacts from noise, light and vibration upon indigenous fauna, as well as potential mortality from vehicle strike.

The following sections detail the magnitude of effect and level of effect of operational effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

Birds

Indigenous birds may be displaced from nearby habitats due to noise, lighting and vibration generated from the Project works. However as the birds present within the Project area are likely already habituated to these effects, the magnitude of this effect is considered to be **Low** for both the baseline and future environment, and consequently the level of effect is considered to be **Very Low**.

Birds may also be affected by vehicle strike. However, this is only likely to occur infrequently. Consequently, the magnitude of effect of this is considered to be **Low**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to birds.

8.4.3.3 Conclusions

No effects with a level of effect greater than '**Low**' were identified. Consequently, no effects management is required.

8.4.4 Design and future Regional Resource Consent considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the following sections to inform design and alignment options for the NoR.

8.4.4.1 Terrestrial ecology

Construction of the Project will result in both temporary and permanent losses in terrestrial habitat within the NoR, including habitat which is being used by native fauna.

Table 54 details the types and area (m^2) of terrestrial habitats which will be lost during construction, as well as the total area of each habitat present within the designation boundary. This includes vegetation which is subject to District Plan and Regional Plan controls as well as vegetation not subject to plan controls. As the PL.2 habitat is comprised of specimen trees planted in the roadway, this has not been mapped by area and is instead recorded as the number of trees to be removed.

Terrestrial habitats which will be lost are currently of low or negligible ecological value and may provide habitat for native fauna. Exotic grassland habitat is of **Negligible** ecological value and therefore is not considered here.

Table 54. Terrestrial habitat types and the areas of these both within the Project footprint (which will be permanently lost) and within the designation boundary.

Habitat type	Classification (Singers *et al.* 2017)	Area within Footprint (m^2)	Area within Designation (m^2)
Planted Vegetation – amenity plantings	PL.2		

8.4.4.2 Birds

Non-threatened indigenous birds are present within the designation boundary and will be impacted by vegetation removal. This should therefore occur outside of the bird nesting season to reduce impacts to these birds.

8.4.4.3 Freshwater ecology

The designation includes one stream. No stream loss is expected, as the stream is culverted within the works footprint.

The total stream length available for restoration within the designation boundary is 391, and restoration is already proposed for the entirety of this section of stream.

Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for sediment control and management of the riparian condition.

9 Airport to Botany Bus Rapid Transit – NoR 3

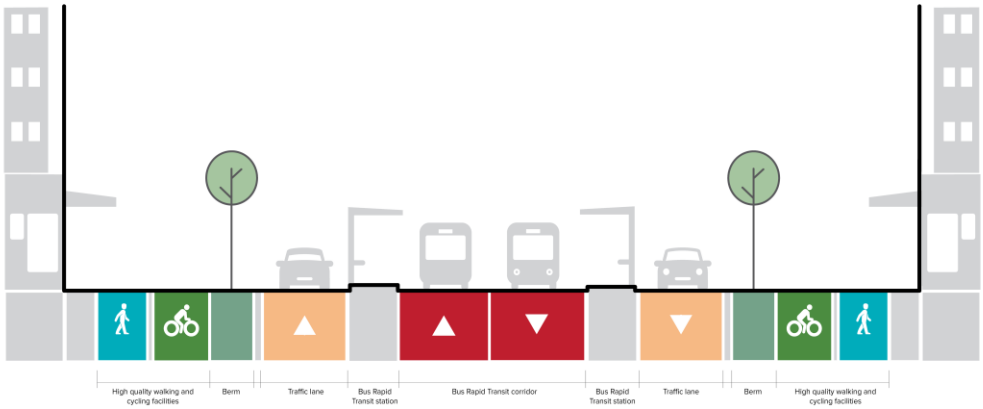
This section assesses specific ecological matters relating to NoR 3 – the Project corridor between Puhinui Station (in the vicinity of Plunket Avenue) to the SH20/20B Interchange.

9.1 Overview and description of works

As set out in Table 55 below, the proposed works in NoR 3 include the widening of the existing Puhinui Road to accommodate a centre-running BRT corridor, vehicle lanes and high quality walking and cycling facilities. As part of the proposed works, a BRT bridge over the NIMT is proposed to connect to the Puhinui Station.

Table 55: Overview of NoR 3

NoR 3 – Puhinui Station, in the vicinity of Plunket Avenue to SH20/20B Interchange	
	
Key features	
BRT Corridor	Centre-running along Puhinui Road connecting to the Puhinui Station concourse via a new BRT bridge structure
BRT Stations	Puhinui Station
Walking and cycling facilities	• Walking and cycling facilities on both sides of the corridor; and • Walking and cycling facilities will be provided along Cambridge Terrace, Bridge Street and Kenderdine Road.

General traffic	One lane in each direction on Puhinui Road
Access	Limited right turn access
Speed environment	50 km/h
Signalised intersections	• Puhinui Road and Noel Burnside Road; and • Puhinui Road and Wyllie Road.
Stormwater infrastructure	Wetland
NoR 3 typical cross section	
	

9.2 Ecological baseline

9.2.1 Terrestrial habitats and fauna

NoR 3 (Plunket Avenue to the SH20B/20 Interchange passes through a predominantly residential environment. Present day habitats are therefore largely limited to:

- Planted native vegetation associated with the SH20 underpass and Puhinui Station, classified using Singers *et al.* (2017) as planted amenity vegetation (PL.1);
- Amenity plantings/gardens in residential sections and on roadsides, classified using Singers *et al.* (2017) as planted amenity vegetation (PL.2); and
- Mown lawns classified as exotic grassland (EG).

These areas are further described in Table 56, and depicted in Figure 29.

Table 56. Vegetation types present within and directly adjacent to the Project Area (NoR 3), classified according to Singers *et al.* (2017).

Vegetation type	Alphanumeric code*	Regional IUCN Conservation Status*	Description of habitat

Planted Vegetation – amenity plantings	PL.2	N/A	This habitat can be split into three subtypes within the NoR: Standalone trees planted for their amenity value within the road corridor. Whilst predominantly exotic, pōhutukawa and tītoki are also included, although these trees are relatively immature (<5 m in height). Private exotic-dominated gardens (excluding 22 Cambridge Terrace and 252 Puhinui Road) may provide some foraging habitat for common, non-threatened and disturbance-tolerant native bird species, but due to their lack of connectivity with other, more established habitats, they are not expected to provide habitat for species such as copper skink. 22 Cambridge Terrace, and 252 Puhinui Road which contain semi-mature native and exotic tree species. This area has potential to provide habitat for copper skink and common, non-threatened native bird species.
Planted vegetation – native plantings	PL.1	N/A	Plantings adjacent to the SH20 underpass and Puhinui Station, which are less than 15 years old and comprised of *Coprosma* spp., harakeke, tī kōuka, small-leaved pōhuehue (*Muehlenbeckia complexa* var. *complexa*), karo, and *Carex* spp., as well as other common native species. Overall, while indigenous species dominate these planted compositions, they lack the diversity and structure expected of a naturally occurring ecosystem.
Exotic grassland	EG	N/A	Grassland dominated by exotic species. This includes gardens and road verges.

* = Information from Singers *et al.* (2017).

Fauna identified during the desktop study which may be present within the ZOI of the NoR include:

- Copper skink; and
- Common, non-threatened native bird species.

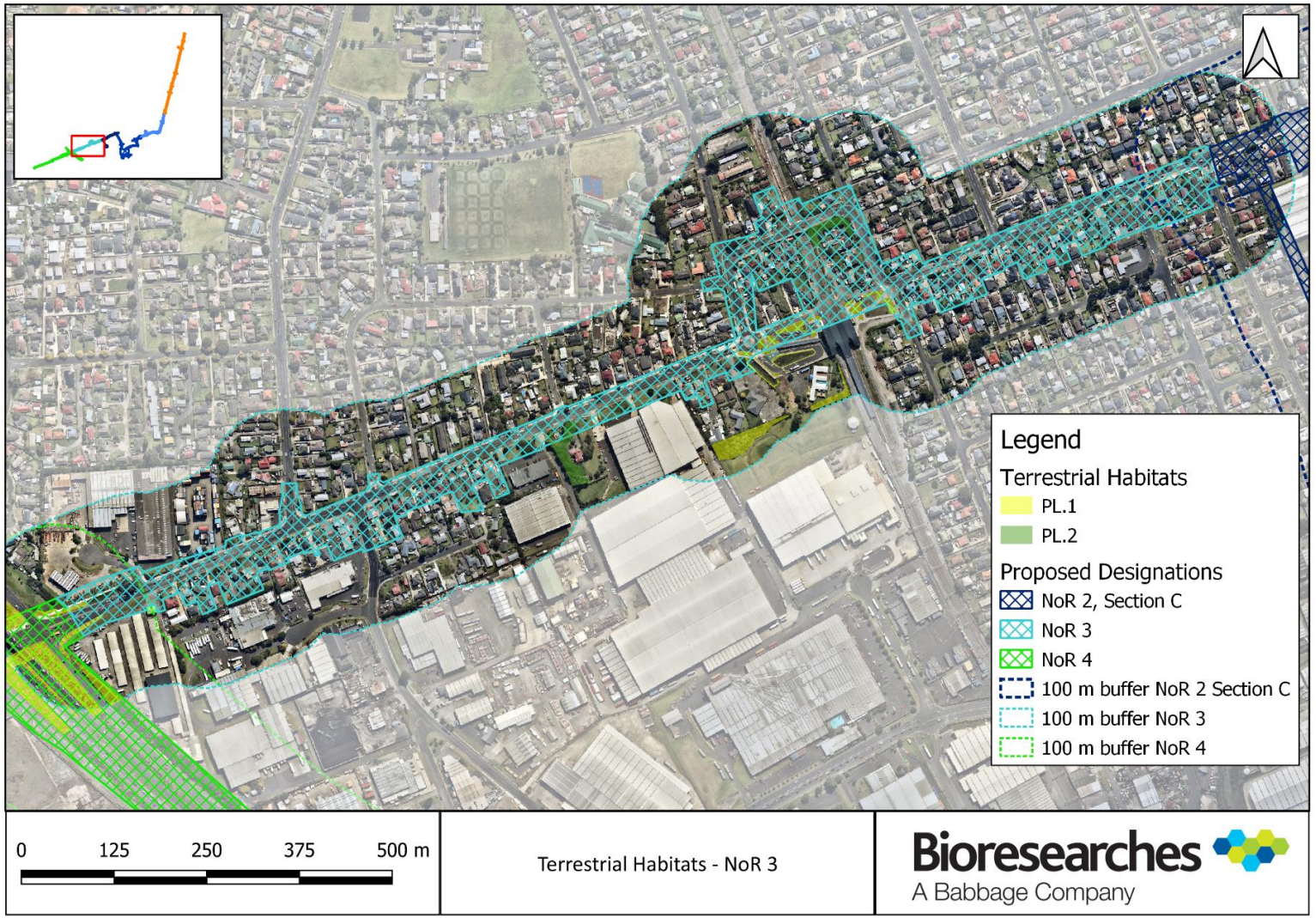


Figure 29. Terrestrial Habitats within the ZOI of NoR 3

9.2.2 Terrestrial ecological value

Table 57 presents the ecological value for the terrestrial habitats and fauna identified within NoR 3. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 57. Ecological values of terrestrial habitats within the ZOI of NoR 3

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
PL.2 – Amenity trees and private gardens	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too young to offer much variation in habitat or to be used for completion of lifecycles. Species are of a common assemblage.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
PL.2 – 22 Cambridge Terrace and 252 Puhinui Road	Low – this habitat is highly modified with low indigenous representation.	High – precautionary rating unless copper skink (At Risk - Declining) are found not to be present.	Moderate – some diversity in species, however habitat is reasonably homogenous and other than copper skink does not provide habitat for other sensitive species.	Low – habitat has no linkages to any other habitats.	**High**
PL.1 – Planted native vegetation	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too young to offer much variation in habitat or to be used for completion of lifecycles. Species are of a common assemblage.	Low – habitat is too immature to provide significant buffering and does not yet provide a linkage.	**Low**
EG	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Negligible**

Table 58 presents the ecological values for the fauna identified within the ZOI of NoR 3.

Table 58. Ecological values of fauna within the ZOI of NoR 3

Fauna	Habitat units utilised	Conservation Status*	Ecological value
Lizards – copper skink	PL.2 – 22 Cambridge Terrace	At Risk - Declining	High
Birds – common, Not Threatened species only	PL.1 and PL.3 habitats	Not Threatened	Low

* Retrieved from relevant New Zealand Threat Classification Series documents, available from https://www.doc.govt.nz/about-us/science-publications/series/new-zealand-threat-classification-series/

9.2.3 Freshwater habitat

No streams were identified within the ZOI of the NoR 3 alignment during the desktop study or site investigations.

9.2.4 Wetland habitat

Two constructed wetlands were identified within 100 m of NoR 3, both adjacent to the Puhinui Station. The wetlands are described in Table 59, and depicted in Figure 31.

Table 59. Wetlands within 100 m of NoR 3

Wetland	NES:F Classification	Classification process	Description
Puhinui Station W.1	Constructed wetland	Rapid test	Wetland constructed between 2017 and 2022 (Figure 30), and planted with oioi, *Juncus* sp. and *Carex* sp. This wetland is only connected to other natural freshwater habitats via stormwater culverts which eventually link it to the Puhinui Creek. As such it is considered highly unlikely to provide habitat for At Risk or Threatened native species. During the site visit the wetland held no standing water so it is considered highly unlikely to provide fish habitat, and unlikely to provide habitat for wetland birds because of its small size.

			 Figure 30. 2017 aerial imagery on left showing the Puhinui Station pre-construction of 'Puhinui Station W.1' and 'Puhinui Station W.2' wetlands, and in 2022 on right post-construction. Imagery on left from Auckland Council Geomaps, and on right from Nearmap.
Puhinui Station W.2	Constructed wetland	Rapid test	Wetland constructed between 2017 and 2022 (Figure 30), and planted with oioi, *Juncus* sp. and *Carex* sp. This wetland is only connected to other natural freshwater habitats via stormwater culverts which eventually link it to the Puhinui Creek. As such it is considered highly unlikely to provide habitat for At Risk or Threatened native species.

			During the site visit the wetland held no standing water so it is considered highly unlikely to provide fish habitat, and unlikely to provide habitat for wetland birds because of its small size.

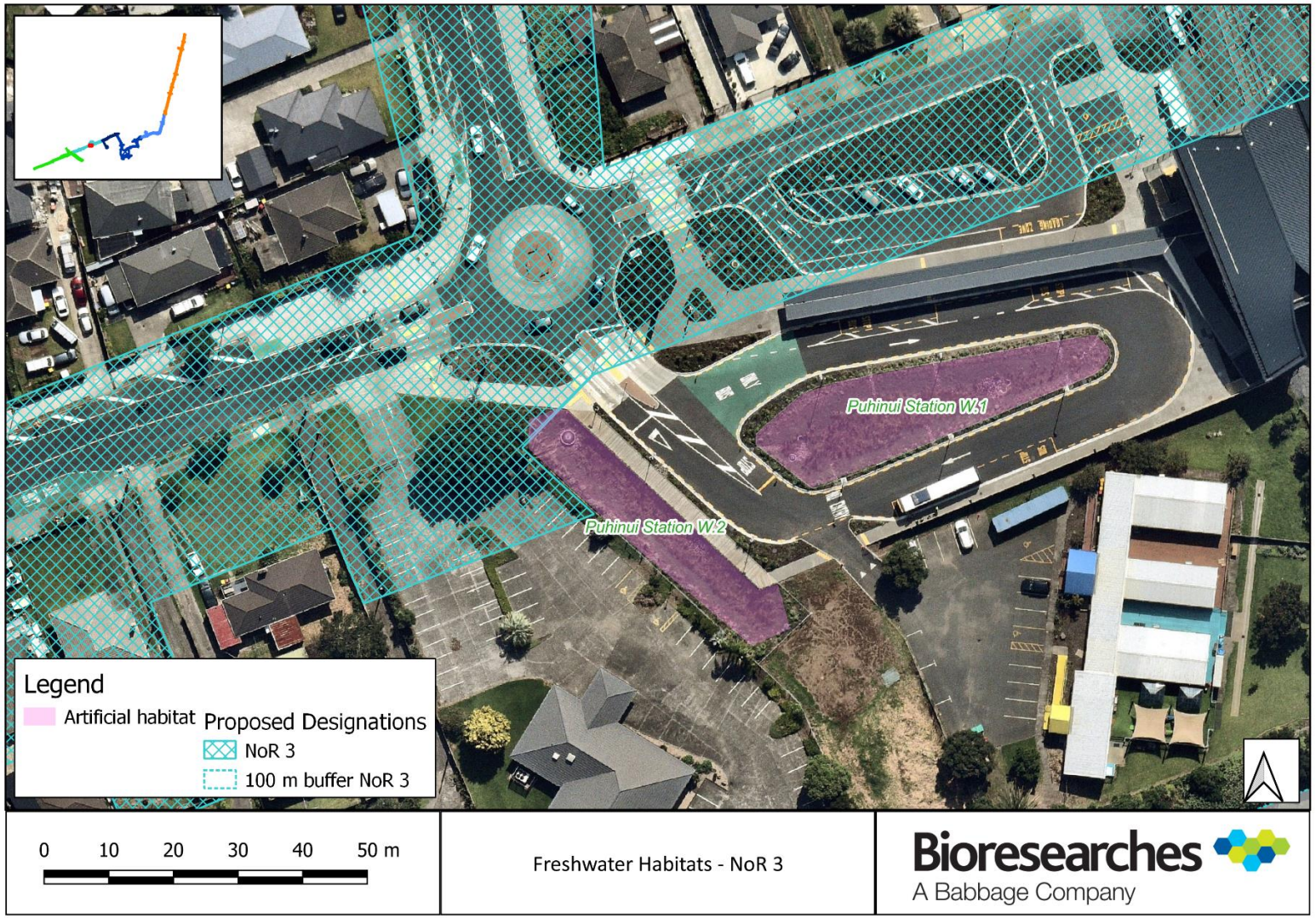


Figure 31. Freshwater habitats within the ZOI of NoR 3.

9.2.4.1 Wetland ecological value

Table 60 presents the ecological value for the wetland habitat identified within NoR 3. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 60. Ecological value of wetlands within the ZOI of NoR 2 Section B.

Wetland	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Puhinui Station W.1	Low – highly modified catchment and likely to support only common, non-native biota.	Low - not suitable habitat for any species of conservation significance. Is present in an environment where wetland habitats are uncommon but it's lack of connectivity to other ecologically functional habitats greatly reduces the value.	Low - low diversity in habitat type.	Moderate – does provide some filtering of nutrients and flow regulation.	Low
Puhinui Station W.2	Low – highly modified catchment and likely to support only common, non-native biota.	Low - not suitable habitat for any species of conservation significance. Is present in an environment where wetland habitats are uncommon but it's lack of connectivity to other ecologically functional habitats greatly reduces the value.	Low - low diversity in habitat type.	Moderate – does provide some filtering of nutrients and flow regulation.	Low

9.3 Future environment

The area is almost entirely developed, although some intensification of the immediate urban area may occur. Over the next 15 years, ecological values are likely to remain consistent in their ecological values, given the limited current extents within an urban environment.

9.4 Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects

This section assesses the ecological effects of activities which relate to District Plan matters under the AUP:OP. Refer to the 'Future Environment' Section for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

9.4.1 Construction effects – terrestrial ecology

The potential ecological effects to terrestrial habitats and fauna, which may be encountered during the construction phase of the Project (as they relate to district matters) have been identified:

- Removal of vegetation which is subject to District Plan controls (refer to **Appendix B** for a breakdown of Regional versus District Plan vegetation); and
- Disturbance and displacement of birds and lizards due to construction-related activities.

The following sections detail the magnitude of effect and level of effect of construction effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

9.4.1.1 Terrestrial vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors (in this case, the PL.2 habitat within the road corridor (excluding that within private property), with low ecological value) and grassland (EG, negligible ecological value).

The effects of the removal of this vegetation are the same as for NoR 1 and are assessed in Table 28. This identified a **Very Low** level of effect associated with the removal of PL.2 vegetation, and consequently, no impact management measures are required.

9.4.1.2 Birds

Indigenous birds may be displaced from nearby habitats due to construction activities. In addition, birds may lose roosting/foraging habitat, abandon or lose nests and also be at risk of mortality or injury during tree felling when the District Plan vegetation is removed.

The effects of the works upon birds are the same as for NoR 2, Section B and are described in Table 47. No level of effect greater than **Low** was identified and consequently no impact management for birds is required.

9.4.1.3 Lizards

Lizards are not expected to be present within any of the District Plan vegetation to be removed but may be present within the vegetation at 22 Cambridge Terrace, adjacent to the Project area. Consequently, effects are limited to the potential displacement of lizards from adjacent habitats. As the vegetation is unprotected and on private property, there is some chance it may be removed prior to works commencing however it is conservatively assumed for the likely future environment that the vegetation would still be present.

The effects of the works upon lizards are the same for NoR 1 and are described in Table 31. No level of effect greater than **Very Low** was identified and consequently no impact management for lizards is required.

9.4.2 Operational effects – terrestrial ecology

The Project involves the addition of BRT lanes and high quality walking and cycling facilities to an existing road in an urban landscape. The future environment is also urban, and consequently limited change is expected within the surrounding landscape. The Ōtara Creek corridor and existing habitats associated with this waterway will remain.

Many of the potential operational effects of the Project such as habitat fragmentation, noise and light pollution are pre-existing. Potential operational effects include reductions in habitat connectivity and impacts from noise, light and vibration upon indigenous fauna, as well as potential mortality from vehicle strike.

The following sections detail the magnitude of effect and level of effect of operational effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

9.4.2.1 Birds

Indigenous birds may be displaced from nearby habitats due to noise, lighting and vibration generated from the upgraded roadway. However as the birds present within the Project area are likely already habituated to these effects, the magnitude of this effect is considered to be **Low** for both the baseline and future environment, and consequently the level of effect is considered to be **Very Low**.

Birds may also be affected by vehicle strike. However, this is only likely to occur infrequently. Consequently, the magnitude of effect of this is considered to be **Low**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to birds.

9.4.2.2 Lizards

The upgraded roadway is not expected to increase limitations on lizard dispersal or increase disturbance to lizards. Consequently, the magnitude of this effect is considered to be **Low** for both the baseline and future environment, and the level of effect is considered to be **Low**.

Lizards may also be affected by vehicle strike, however there is a very low probability of this occurring, and it would likely only occur at a very low frequency. Consequently, the magnitude of effect of this is considered to be **Negligible**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to lizards.

9.4.3 Conclusions

No effects with a level of effect greater than **Low** were identified. Consequently, no effects management is required.

9.5 Design and future Regional Resource Consent considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the following sections to inform design and alignment options for the NoR.

9.5.1 Terrestrial ecology

Construction of the Project will result in both temporary and permanent losses in terrestrial habitat within the NoR, including habitat which is being used by native fauna.

Table 61 details the types and area (m^2) of terrestrial habitats which will be lost during construction, as well as the total area of each habitat present within the designation boundary. This includes vegetation which is subject to District Plan and Regional Plan controls as well as vegetation not subject to plan controls. The PL.2 habitat type which is comprised of specimen trees planted in the roadway has not been mapped by area and is instead recorded as the number of trees to be removed (21 trees).

Terrestrial habitats which will be lost are currently of **Low** or **Negligible** ecological value and may provide habitat for native fauna. Exotic grassland habitat is of **Negligible** ecological value and therefore is not considered here.

Table 61. Terrestrial habitat types and the areas of these both within the Project footprint (which will be permanently lost) and within the designation boundary.

Habitat type	Classification (Singers *et al.* 2017)	Area within Footprint (m^2)	Area within Designation (m^2)
Planted Vegetation – amenity plantings in 22 Cambridge Terrace and 252 Puhinui Road	PL.2	TBC	1,271
Planted Vegetation – native plantings	PL.1	TBC	1,708

9.5.2 Birds

Non-threatened indigenous birds are present within the proposed designation boundary and will be impacted by vegetation removal. This should therefore occur outside of the bird nesting season to reduce impacts to these birds.

9.5.3 Lizards

Copper skinks are potentially present within the vegetation to be cleared, and there is potential that during this clearance they could be injured or killed. Consequently, the works should be completed in accordance with the Wildlife Act 1953, and a Lizard Management Plan should be implemented.

9.5.4 Wetland ecology

Construction of the NoR will occur within 100 m of two wetlands. No direct loss wetland loss will occur, but assessment of the effects of these works will be required under the NES:F. Effects management likely be limited to implementation of erosion and sediment control measures.

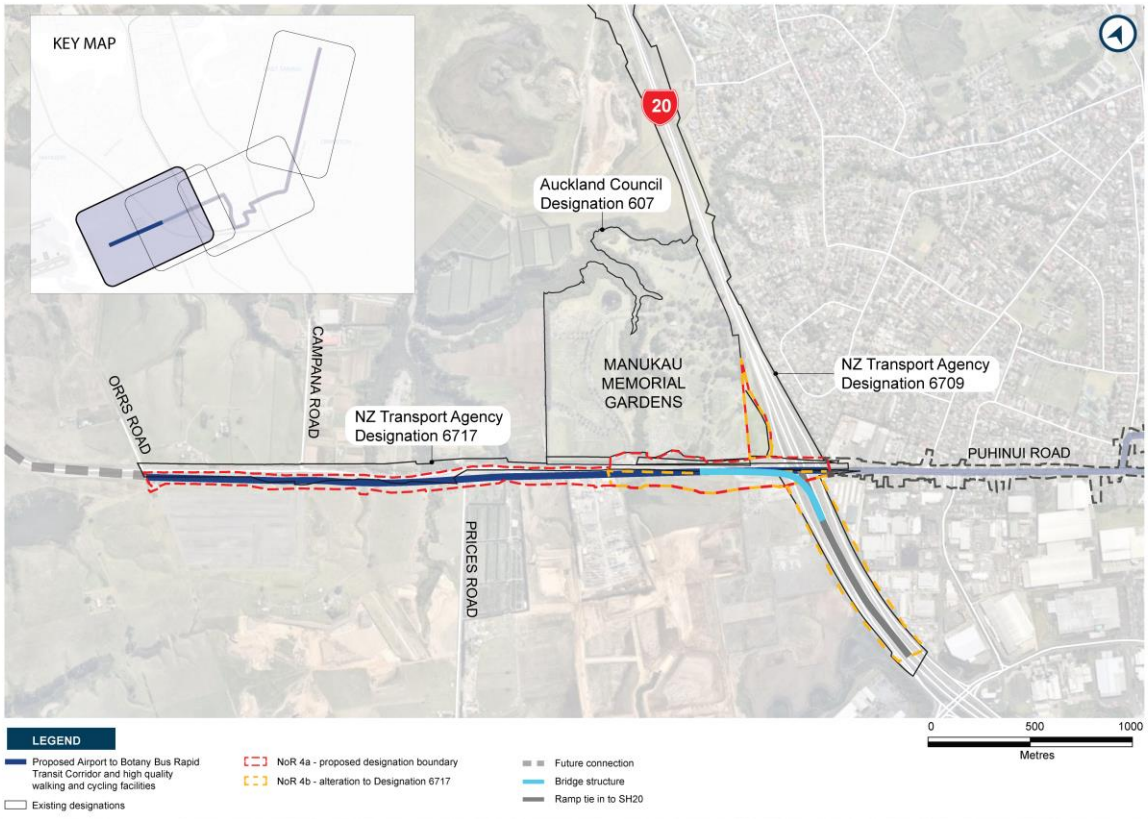
10 Airport to Botany Bus Rapid Transit NoRs 4a and 4b

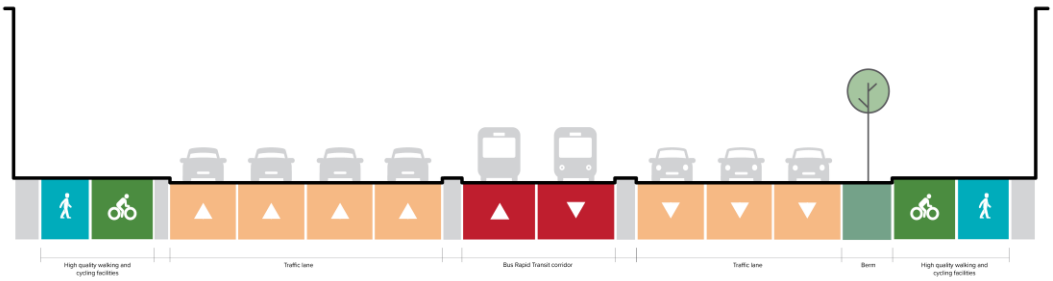
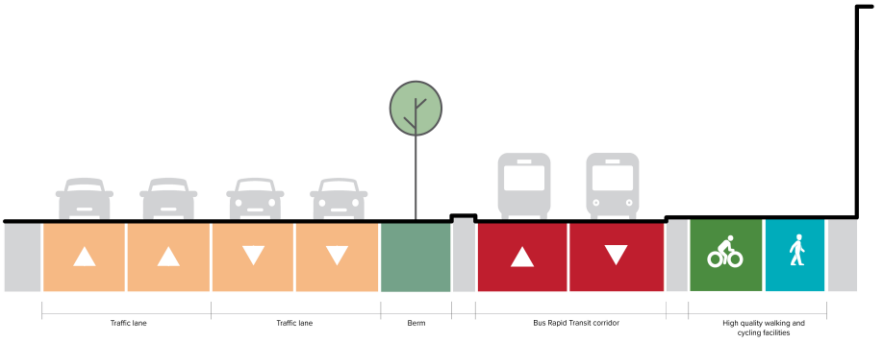
This section assesses specific terrestrial ecology matters relating to NoR 4a and NoR 4b – the Project corridor between the SH20/20B Interchange and Orrs Road.

10.1 Overview and description of works

As set out in Table 62 below, the proposed works in NoRs 4a and 4b include the widening of SH20B to accommodate a centre-running BRT corridor until the Manukau Memorial Gardens. From this point, the BRT corridor shifts south of SH20B until Orrs Road. Proposed works also include high quality walking and cycling facilities, eastbound lanes to Auckland Airport and a ramp from SH20B onto SH20 for southbound traffic.

Table 62: Overview of NoR 4a and 4b

NoRs 4a and 4b – SH20/20B Interchange to Orrs Road	
	
Key features	
BRT corridor	• Centre-running on Puhinui Road through to the Manukau Memorial Gardens intersection (approx. 600 m west of SH20/20B Interchange); and • South running to Orrs Road.

Walking and cycling facilities	Walking and cycling facilities on southern side of the corridor
General traffic	• Two lanes in each direction; and • New southbound ramp from SH20B onto SH20.
Access	• Limited access; and • Access maintained via signals at Manukau Memorial Gardens and Campana Road.
Speed environment	60 km/h
Signalised intersections	• SH20/SH20B Interchange; • Puhinui Road and Manukau Memorial Gardens; and • Puhinui Road and Campana Road.
Stormwater infrastructure	Swales
NoR 4b typical cross section	
	
NoR 4a typical cross section	
	

10.2 Ecological baseline

Ecological features within NoRs 4a and 4bb include riparian vegetation associated with the Waokauri Creek tributaries, and riparian vegetation associated with these tributaries. This vegetation is protected (E15.4.1(A19), AUP:OP).

10.2.1 Terrestrial habitats and fauna

Zoning within the ZOI of NoRs 4a and 4b is predominantly Light Industry Zone and Future Urban Zone, however the majority of the area is currently utilised for agricultural and horticultural purposes.

Much of the vegetation which was present on the northern side of NoR 4a and NoR 4b in 2018 has been removed for consented SH20B Improvements works (e.g., Figure 32), and these areas are now bare, or have been replanted with native vegetation. Remaining vegetation consists of predominantly isolated, **Low** botanical value pockets of planted and regenerating native and exotic species. Some plantings have been undertaken for remediation of SH20B upgrade works.

Figure 32. Large parts of the northern side of SH20B within NoR1a and NoR1b have been earth-worked and do not currently support indigenous vegetation or associated habitats.

Present day habitats include:

- Mixed exotic and native vegetation growing along the road frontage of the Manukau Memorial Gardens for approximately 200 m east of the entrance to the gardens and on either side of the Waokauri Creek tributary streams labelled WC A and WC B within the 'Freshwater and Wetland Habitats' section below. This is recorded on the Auckland Council Geomaps 'Ecosystems Current Extent' layer as VS5 (Broadleaved species scrub/forest). Vegetation growing along tributary streams. Riparian margins of the tributaries of Waokauri Creek marked as WC C, WC D and WC E within the 'Freshwater and Wetland Habitats' section below are also classified as VS5.
- Planted vegetation classified as native Planted Vegetation (PL.1), including:
  - Recently planted native vegetation adjacent to Puhinui Road, which has been planted since 2019; and

  - Older planted native vegetation adjacent to SH20 and on the northern side of Puhinui Road extending toward the Manukau Memorial Gardens, which appears to have been planted between 2003 and 2006.
- Treeland habitat comprised of poplar (*Populus* sp.) and London plane (*Platanus x acerifolia*) trees alongside Puhinui Road, classified as Exotic Treeland (TL.3).
- Exotic Scrub (ES), comprised of weedy exotic species.
- Grassland used for pasture and lawns, classified using Singers *et al.* (2017) as Exotic Grassland (EG).
- Wetland vegetation which is recorded on the Auckland Council Geomaps 'Ecosystems Current Extent' layer as SA1.2 (Mangrove forest and scrub) vegetation; and other areas of wetland habitat including exotic wetlands (EW) and raupō reedland (WL17). This habitat is assessed in the 'Wetland Habitats' section below.

These areas are further described in Table 63, and depicted in Figure 33 and Figure 34.

Table 63. Vegetation types present within and directly adjacent to the Project Area (NoR 4), classified according to Singers et al. (2017).

Vegetation type	Alphanumeric code*	Regional IUCN Conservation Status*	Description of habitat
Broadleaved scrub/forest	VS5	Least Concern	Vegetation along the road frontage of the Manukau Memorial gardens which is classified as VS5 by Auckland Council has a species assemblage which includes mature ngaio (*Myoporum laetum*) in parts, and mamaku (*Cyathea medullaris*) with other species such as planted pōhutukawa, māhoe and karaka (*Corynocarpus laevigatus*) present in the sub-canopy (Photo 19). A number of ground ferns including rosy maidenhair (*Adiantum hispidulum*), shining spleenwort (*Asplenium oblongifolium*) and hound's tongue (*Microsorum pustulatum* subsp. *pustulatum*) are present on the forest floor. There is also incursion of weed species, particularly tree privet and crack willow (*Salix* X*fragilis*). With distance north, away from the designation boundary, this vegetation grades into a tangle of Chinese privet, *Muehlenbeckia complexa* var. *grandifolia* and karamu (*Coprosma robusta*). This habitat unit also includes vegetation on three other Waokauri Creek tributaries which is comprised of a similar mix of native and exotic species. This vegetation type is known to support copper skink (Bioresearches, 2019).
Planted vegetation – Native	PL.1	N/A	Overall, while indigenous species dominate these planted compositions, they lack the diversity and structure expected of a naturally occurring ecosystem. These areas of PL.1 habitat have been divided into two types: Those adjacent to the SH20 underpass, which are approximately 15 years old and comprised of *Coprosma* spp., harakeke, tī kōuka, small-leaved

			pōhuehue (*Muehlenbeckia complexa* var. *complexa*), karo, and *Carex* spp. Those which have been planted more recently with the SH20B upgrades. These are of a similar species assemblage but are smaller with less continuous cover. There are also some areas which are vegetated with swards of native sedges and rushes-like' species – e.g., *Carex* spp. and oioi (*Apodasmia similis*).
Treeland – Exotic dominated	TL.3	N/A	London plane and poplar trees planted in a shelterbelt. These have no sub-canopy, but the groundcover is comprised of rough grasses.
Exotic Forest	EF	N/A	Vegetation growing alongside Waokauri Tributary C, Waokauri Tributary D and Waokauri Tributary E, within the riparian zones. This vegetation is heavily dominated by tree privet, with Chinese privet, gorse, woolly nightshade and moth plant also present in high numbers. Sporadic common native trees and shrubs such as māhoe and karamū are also present.
Exotic Scrub	ES	N/A	This habitat comprises an area south of the NoR which is comprised almost entirely of gorse, and also the edges of one of the Waokauri tributary streams on the South Side of Puhinui Road which is comprised of gorse, tobacco weed, pampas, and occasional exotic trees.
Exotic grassland	EG	N/A	Grassland dominated by exotic species. This includes lawn areas (e.g., within the ManukauMemorial Gardens) which not likely to be utilised by any native species. This also includes open areas of pasture. These are grazed or mown frequently enough that they are not expected to provide habitat for copper skink but may be used as foraging habitat by pipit (At Risk – Declining).
Croplands	None applied	N/A	Horticultural cropping areas

* = Information from Singers *et al.* (2017).

Fauna identified during the desktop study which may be present within the ZOI of the NoR include:

- Copper skink;
- Common, non-threatened native bird species; and
- High value New Zealand pipit (At Risk- declining).

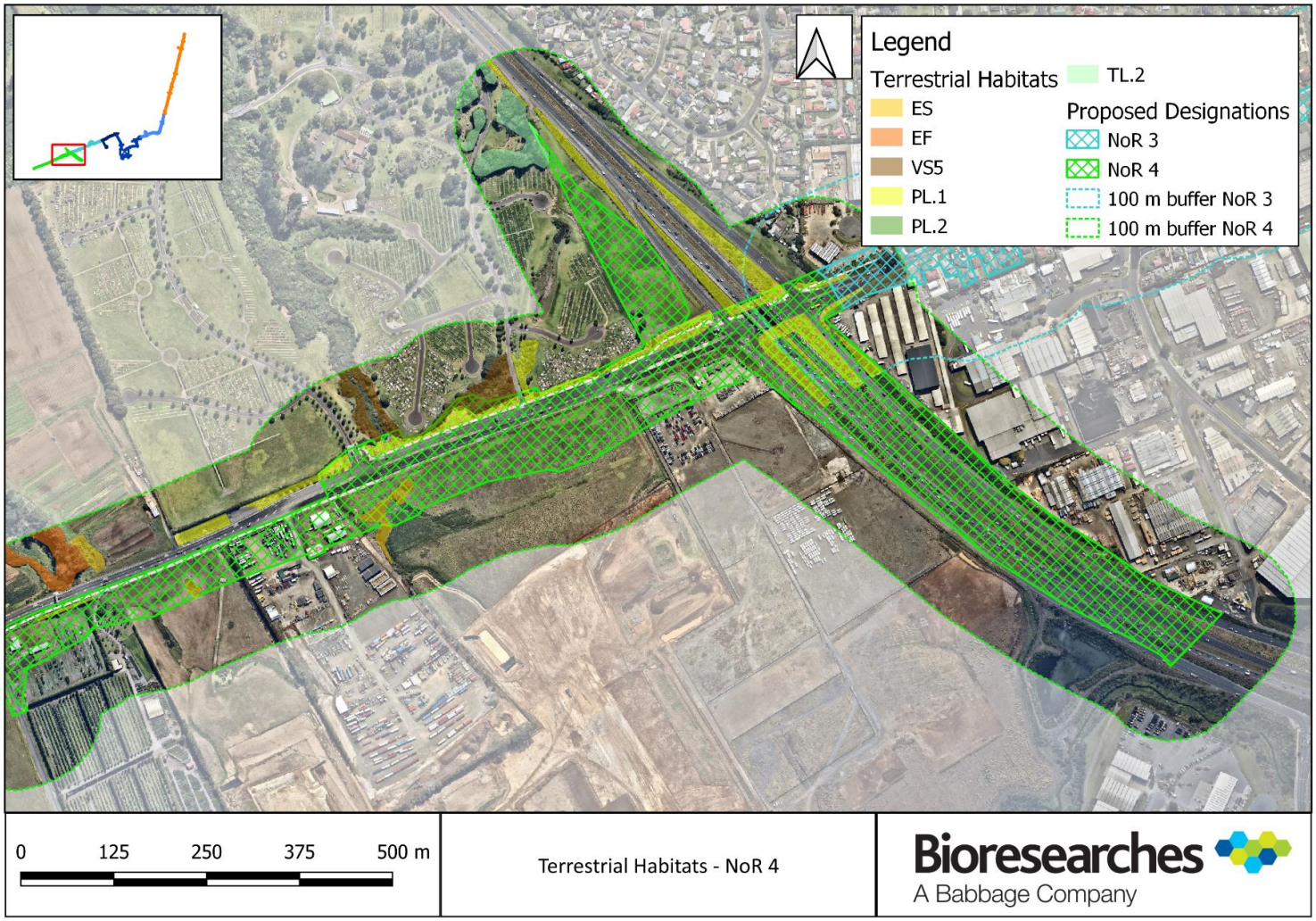


Figure 33. Terrestrial Habitats within the ZOI of the eastern end of NoR 4

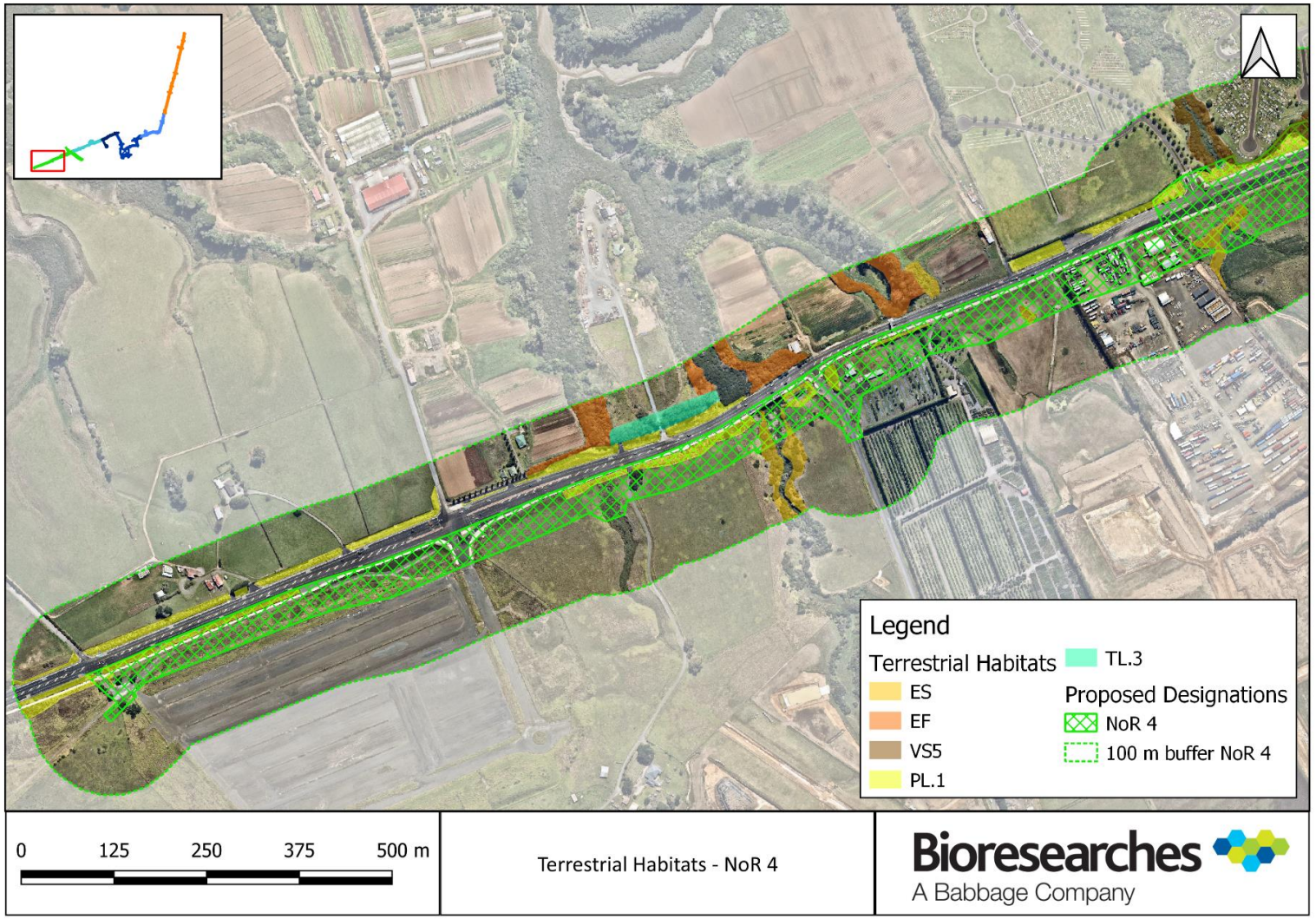


Figure 34. Terrestrial Habitats within the ZOI of the western end of NoR 4.

10.2.2 Terrestrial ecological value

Table 64 presents the ecological value for the terrestrial habitats and fauna identified within NoRs 4a and 4b. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 64. Ecological values of terrestrial habitats within the ZOI of NoRs 4a and 4b

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
VS.5	Moderate – 'True' VS5 habitat is rare within the ecological district. However this habitat is highly impacted by weeds.	High – copper skink (At Risk - Declining) are present.	Moderate – some diversity in species, however habitat is reasonably homogenous and other than copper skink does not provide habitat for other sensitive species.	High – provides the Waokauri tributaries with a level of buffering which is uncommon in the ecological district. They also provide a network between the terrestrial and freshwater/wetland habitats.	**High**
PL.1	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – plantings are too young to offer much variation in habitat or to be used for completion of lifecycles. Species are of a common assemblage.	Low – habitat is too immature to provide significant buffering and does not yet provide a linkage.	**Low**
TL.3	Low – this habitat is highly modified with low indigenous representation.	High – copper skink is potentially present beneath.	Low – habitat has low diversity and other than copper skink does not provide habitat for other sensitive species.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**High**
EF	Low – this habitat is highly modified with low indigenous representation.	High – copper skink is potentially present beneath.	Low – habitat has low diversity and other than copper skink does not provide habitat for other	Moderate – provides the Waokauri tributaries with a level of buffering which is uncommon in the ecological district. They also provide a network between the	**High**

			sensitive species.	terrestrial and freshwater/wetland habitats.	
ES	Low – this habitat is highly modified with low indigenous representation.	Low – not likely to support any Threatened or At Risk species.	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**
EG	Low – this habitat is highly modified with low indigenous representation.	High – may support pipit (At Risk - Declining)	Low – habitat has very low diversity.	Low – habitat provides no buffering; no sensitive receptors remain and does not provide a linkage.	**Low**

Table 65 presents the ecological values for the fauna identified within the ZOI of NoR 4.

Table 65. Ecological values of fauna within the ZOI of NoRs 4a and 4b

Fauna	**Habitat units utilised**	**Conservation Status***	**Ecological value**
Lizards – copper skink	VS5, and TL.3 understory	At Risk – Declining	**High**
Birds – common, Not Threatened species only	VS5, PL.1 and TL.3	Not Threatened	**Low**
Birds – pipit	EG – pastoral areas	At Risk – Declining	**High**
Wetland birds – banded rail, spotless crake, fernbird, little black shag, pied shag	Wetland habitats (described below in 'Wetland Habitat' Section).	At Risk – Declining – Fernbird, banded rail, spotless crake, At Risk – Naturally Uncommon – little black shag. At Risk – Recovering – Pied shag	**High**

* Retrieved from relevant New Zealand Threat Classification Series documents, available from https://www.doc.govt.nz/about-us/science-publications/series/new-zealand-threat-classification-series/

10.2.3 Freshwater habitats and fauna

Seven stream branches were identified within 100 m of the designation boundary, however, only 5 of these were within the NoR. These streams are mapped in Figure 35 to Figure 40; and described in Table 66. As these streams had already been recently extensively assessed by Bioresearches (2019), rapid habitat assessments were not completed for these streams.

Table 66. Summary of NoRs 4a and 4b streams

Stream	**Classification**	**Brief Description**

Waokauri Creek Tributary A	Permanent	The upstream end of Tributary A originates to the north of SH20B and flows in a southwest direction. It then flows into a culvert which travels under SH20B, with the outlet of the culvert also on the northern side of SH20B. Waokauri Creek Tributary B, which originates south of SH20B, is culverted underneath SH20B converges with Tributary A at the outlet of the Tributary A culvert. From the outlet of these culverts, the stream then flows north ward and eventually into the Waokauri Creek. The transition to the marine environment is located approximately 500 m downstream of the designation boundary. This also marks the edge of the marine SEA 'SEA-M2-27a'. Within the upstream end of Tributary A, adjacent to the culvert inlet, the shading over the stream was high and the woody debris provided habitat to a moderate population of shortfin eel. Six eels were observed ranging between 800mm and 450mm, the majority being large juveniles 500 mm or less (Bioresearches, 2019). Both the upstream reach and the downstream reach of the stream contain macrophytes and riparian vegetation which meets the definition of a Natural Wetland under the NES:F (wetlands Waokauri A.2 and Waokauri A.1, respectively). Water quality measurements showed very poor habitat quality, with adequate temperature control because of the high shading, but critically low dissolved oxygen levels, 10% saturation in the upstream region, and poor levels within the downstream region (66%). Hydrocarbon sheens were present within the area which would have contributed to the poor water quality (Bioresearches, 2019). In both the upstream and downstream portions of the stream, MCI scores were indicative of 'poor' quality habitat (Bioresearches, 2019).
Waokauri Creek Tributary B	Intermittent	This stream originates on the south side of SH20B, and flows north under SH20B though a culvert, discharging into Waokauri Creek Tributary A. The stream is in poor ecological condition; it is largely unshaded, and was observed to have poor water quality, with an abundance of iron-oxidising bacteria and floc present. Water clarity was poor, due to this and high levels of suspended sediment in the water. Two sediment retention ponds discharge into the stream, and the outlet of a culvert which presumably conveys stormwater also is present and discharging to the stream. Due to the low level of flow within the stream at the time of survey (August 2022), the stream is presumed to have intermittent flow.
Waokauri Creek Tributary C	Intermittent	Tributary C flows (generally) in a northern direction from south to north. The upstream section, south of the NoR, contains a stream with some wetland habitat (see information below on Wetland 'Waokauri C.2'). The stream discharges into a culvert which flows beneath SH20B. . The inlet to the culvert is via a manhole, which acts as at-least a partial barrier to fish passage. Also flowing into the manhole is the discharge from an artificial amenity pond (Waokauri C P.1). The stream upstream of the culvert is almost entirely clogged with macrophytes (mercer grass (*Paspalum distichum*) and willow weed (*Persicaria* sp.)) which meant it also met the definition of a natural wetland (Waokauri C.2). The manhole is at least a partial barrier to fish passage and the stream upstream of the pond was of low quality ecologically, with no effective shading, no hydrological variation and no suitable substrate for sensitive macroinvertebrate taxa which contributed to the stream's low ecological value. The pond which discharges into the stream is located at the bottom of the driveway for the tree nursery at 436 Puhinui Road south of SH20B. The small open-water area is bordered on the road and driveway edges with a mix of native and non-native species. The pond itself has a small established

		population of common water lily (*Nymphaea alba)*. These plants may be providing some filtration for the open water. South of SH20B, water quality in August 2022 was observed to be poor, with a high volume of iron flocculants and low water quality. Flow rates were low, and consequently it is assumed that the stream does not flow in dry periods and consequently has intermittent flow. North of SH20B, Bioresearches (2019) described the water quality of the stream as low, with a high volume of iron flocculants, bacterial and hydrocarbon films and low water clarity throughout. Wetland vegetation was present on the stream margins and on the floodplain. The outflow of the culvert under SH20B contained deep, stagnant water. The stream and floodplain appeared degraded. The channel varied in size; nearer the culvert it was well-defined and narrower with steeper banks, while toward the CMA the banks flattened, the channel widened and the stream become less defined, with multiple backwaters. At this point it was considered more of a wetland habitat than a stream habitat and is assessed as such (see wetland assessment for Waokauri C.1).
Waokauri Creek Tributary D	Permanent	The watercourse with which Tributary D is associated is a complex of stream and wetland habitats (for a description of wetland portions see Waokauri D.1), which flows in a northern direction from south to north and flows beneath a SH20B bridge. The majority of the portion of the watercourse within the ZOI of the NoR is wetland, however the upstream extent also includes stream habitat, which is flanked on either side with a mosaic of raupō reedland and exotic wetland habitat. The banks of the stream are vegetated with exotic scrub, predominantly gorse and woolly nightshade, which provide some shade to the stream. The watercourse is unfenced, and stock access is evident. Bioresearches (2019) observed short fin eels (not threatened), īnanga (At Risk – Declining) and the pest fish *Gambusia affinis* within the stream; and noted that stream and wetland area provide good-quality īnanga spawning habitat, with overhanging vegetation and shading from riparian vegetation and wetland plants. Bioresearches (2019) also undertook macroinvertebrate sampling, which resulted in a Macroinvertebrate Community Index (MCI) score of 93.8, showed low diversity in taxa and did not detect any sensitive (EPT) taxa. They concluded that this, along with the presence of īnanga, suitable native fish spawning habitat and good connectivity to the ocean indicates the site is of moderate freshwater ecological quality. The CMA transitions to freshwater in the vicinity of the southern abutment of the SH20B bridge. In this location, vegetation transitions from marine (mangroves, bachelor's buttons (*Cotula coronopfoila*) to freshwater wetland (dominated by raupō (*Typha orientalis*), mercer grass and sharp spike sedge (*Eleocharis acuta*)). East of Tributary D and immediately south of SH20B is a stormwater device which collects water from the road. This is entirely artificial and is lined with coarse gravel. Presently, it contains no plants or ecological habitat for fish or invertebrates.
Waokauri Creek Tributary E	Permanent	Tributary E flows in a northern direction from south to north and flows beneath SH20B via a culvert. The upstream section, south of the NoR, is predominantly a wetland habitat (see information below on wetland 'Waokauri E.2') and consequently has not been assessed as stream. The downstream section of Tributary E, north of the NoR, contains both stream and wetland features and consequently has been assessed as both (see information below for wetland 'Waokauri E.1').

		At the outlet of the SH20B culvert water was stagnant, with high iron floc and a hydrocarbon film on the surface. Riparian vegetation was dense and often overhanging into the stream. The quality of the aquatic habitat was low, with silt substrate dominant, no flow and anaerobic processes apparent. Shortfin eels may be found utilising the stream (Bioresearches, 2019). Approximately 100 m downstream of the designation boundary, the watercourse transitions into a coastal SA1.2 ecosystem, which is dominated by mangrove forest. This also marks the edge of the marine SEA 'SEA-M2-27a'.
Waokauri Creek Tributary F	Ephemeral	This watercourse flows in a southern direction through pasture. South of SH20B is a swale designed to collect stormwater, which is culverted under SH20B and forms the headwaters of this flow path. This watercourse is contained within a tile drain, which was installed in the early 1900's (personal communication with landowner). The tile drain is functional and flows ephemerally, however if it were to block, it is possible that this area may develop into a wetland habitat, as the topography of the area is a relatively flat-bottomed small gully. The vegetation within the vicinity of the tile drain in August 2022 however was maintained as high-quality, weed free pasture (heavily dominated by rye grass (*Lolium perenne*; FACU) and white clover (*Trifolium repens*; FACU)) and consequently would not have met the definition of a wetland and vegetation tests were not performed.
Waokauri C P.1	Artificial Pond	Artificial pond which drains into Waokauri Creek Tributary C. This pond has sparse amounts of macrophytes present on the periphery (*Persicaria* sp.) and dries out in drier months.
SH20 B Swales 1 to 4	Artificial swales	Artificial swales constructed to slow the flow of stormwater collected by SH20B. These habitats are currently lined with rip-rap, and are devoid of vegetation, however this may change with time.

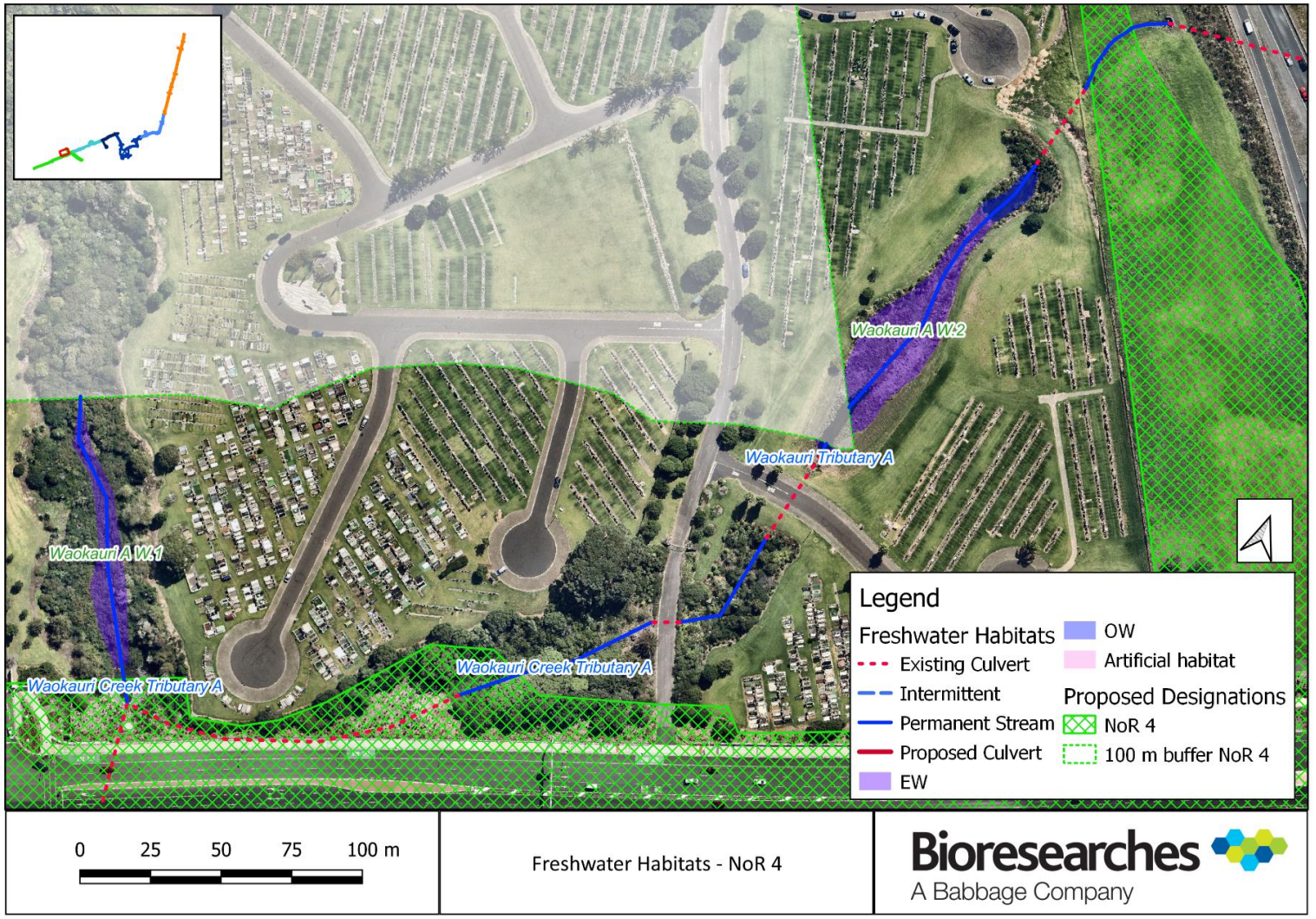


Figure 35. Freshwater Habitats vicinity of Waokauri Creek Tributary A, within the ZOI of NoR 4.

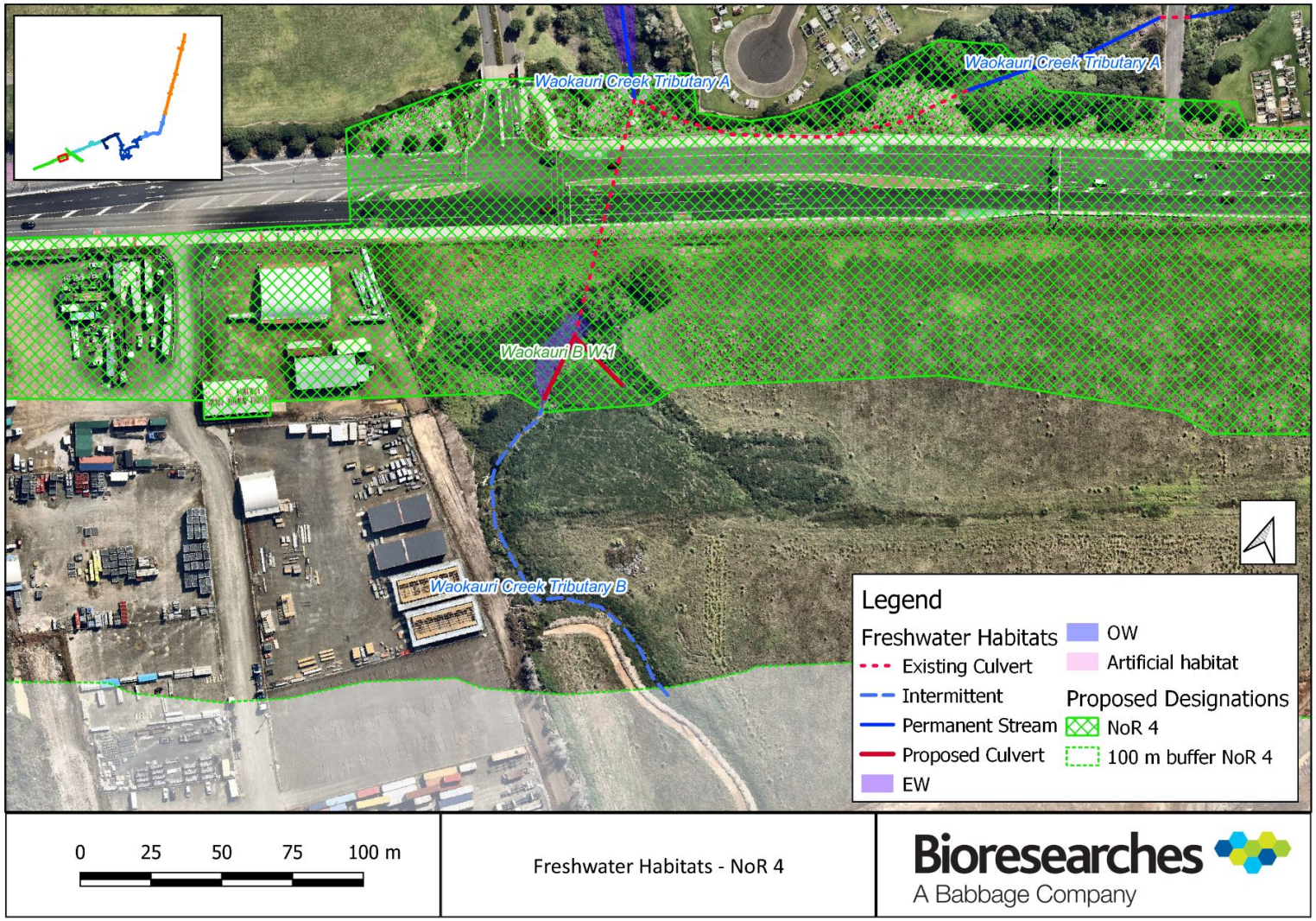


Figure 36. Freshwater Habitats vicinity of Waokauri Creek Tributary B, within the ZOI of NoR 4.

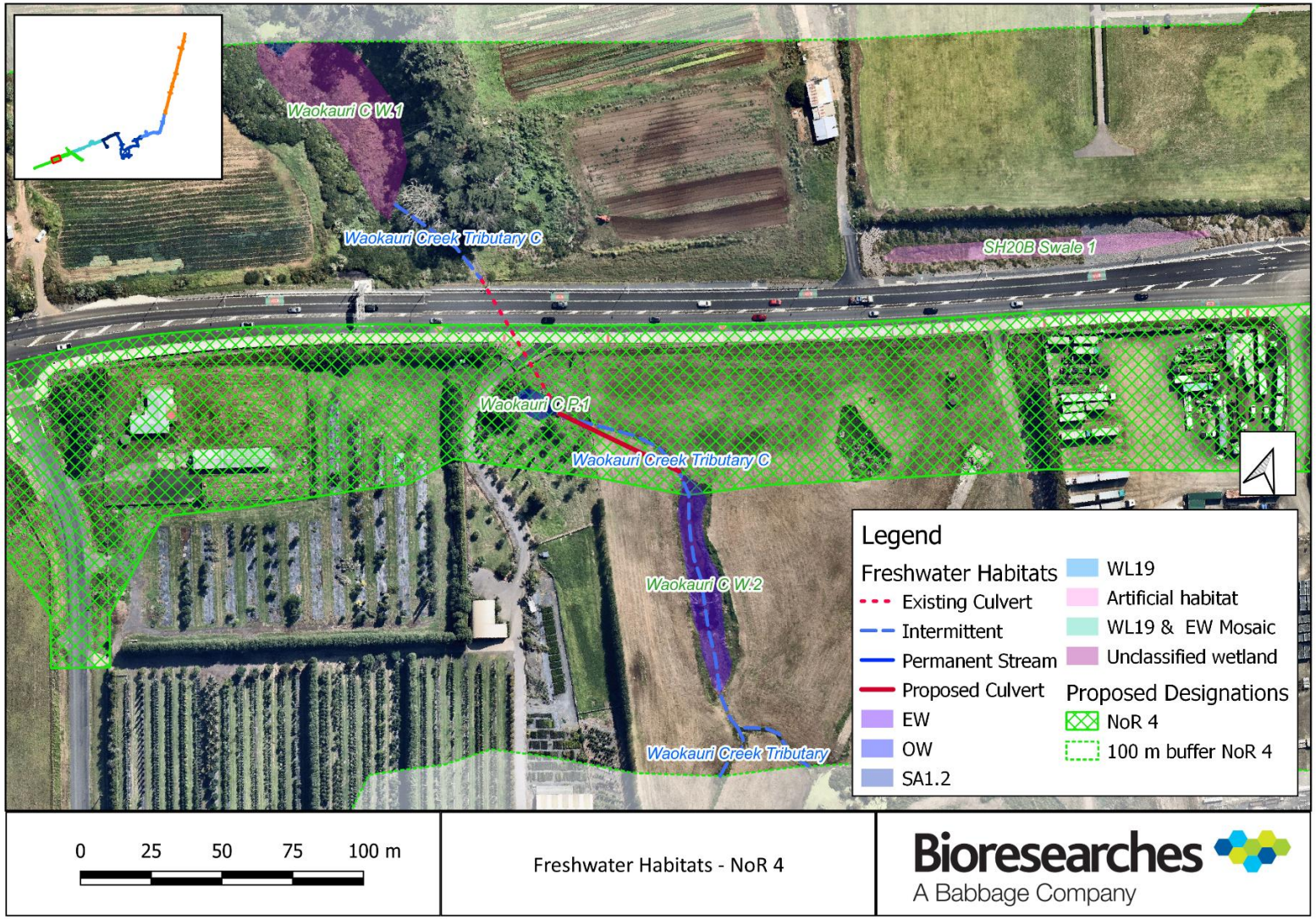


Figure 37. Freshwater Habitats vicinity of Waokauri Creek Tributary C, within the ZOI of NoR 4.

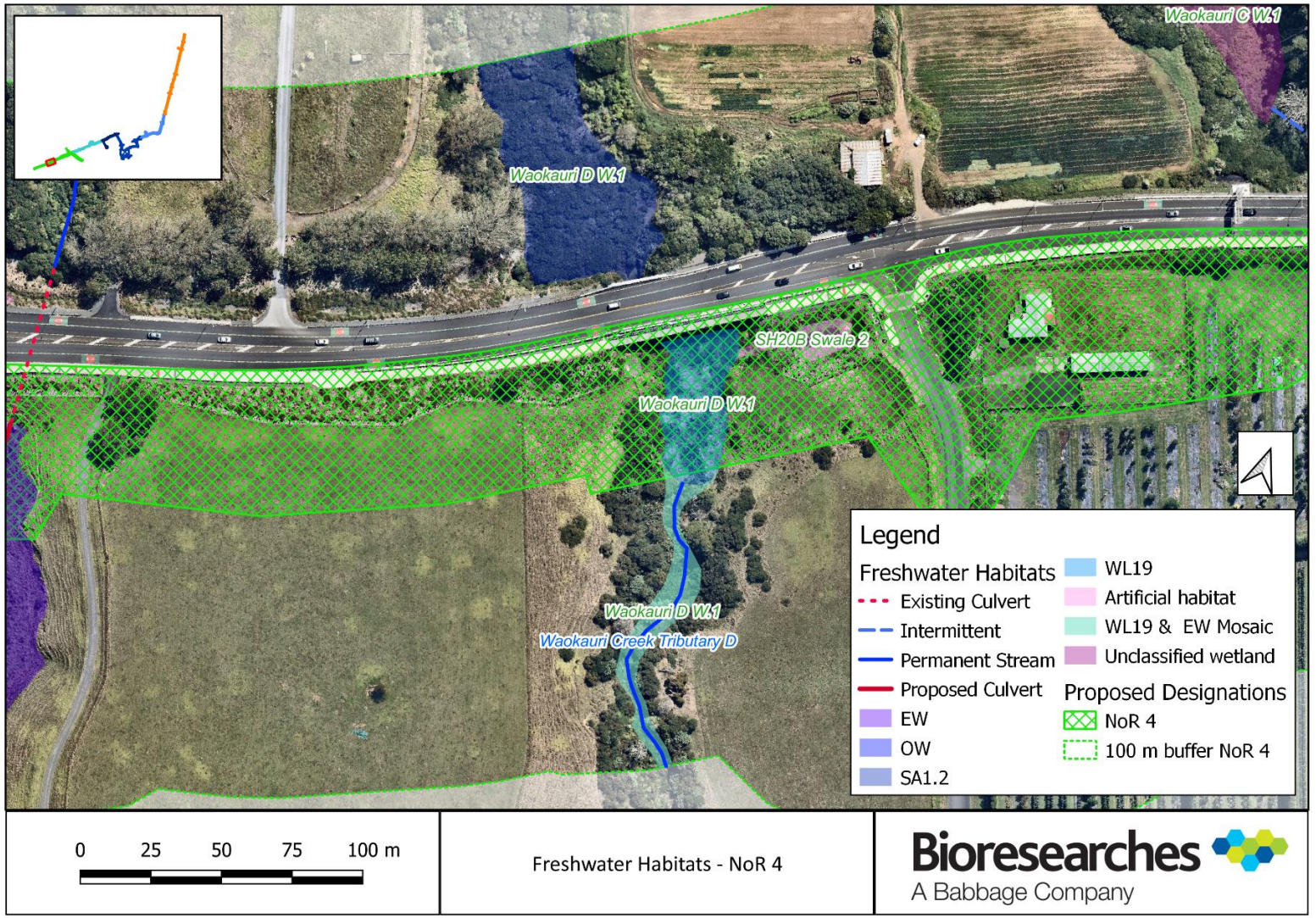


Figure 38. Freshwater Habitats vicinity of Waokauri Creek Tributary D, within the ZOI of NoR 4.

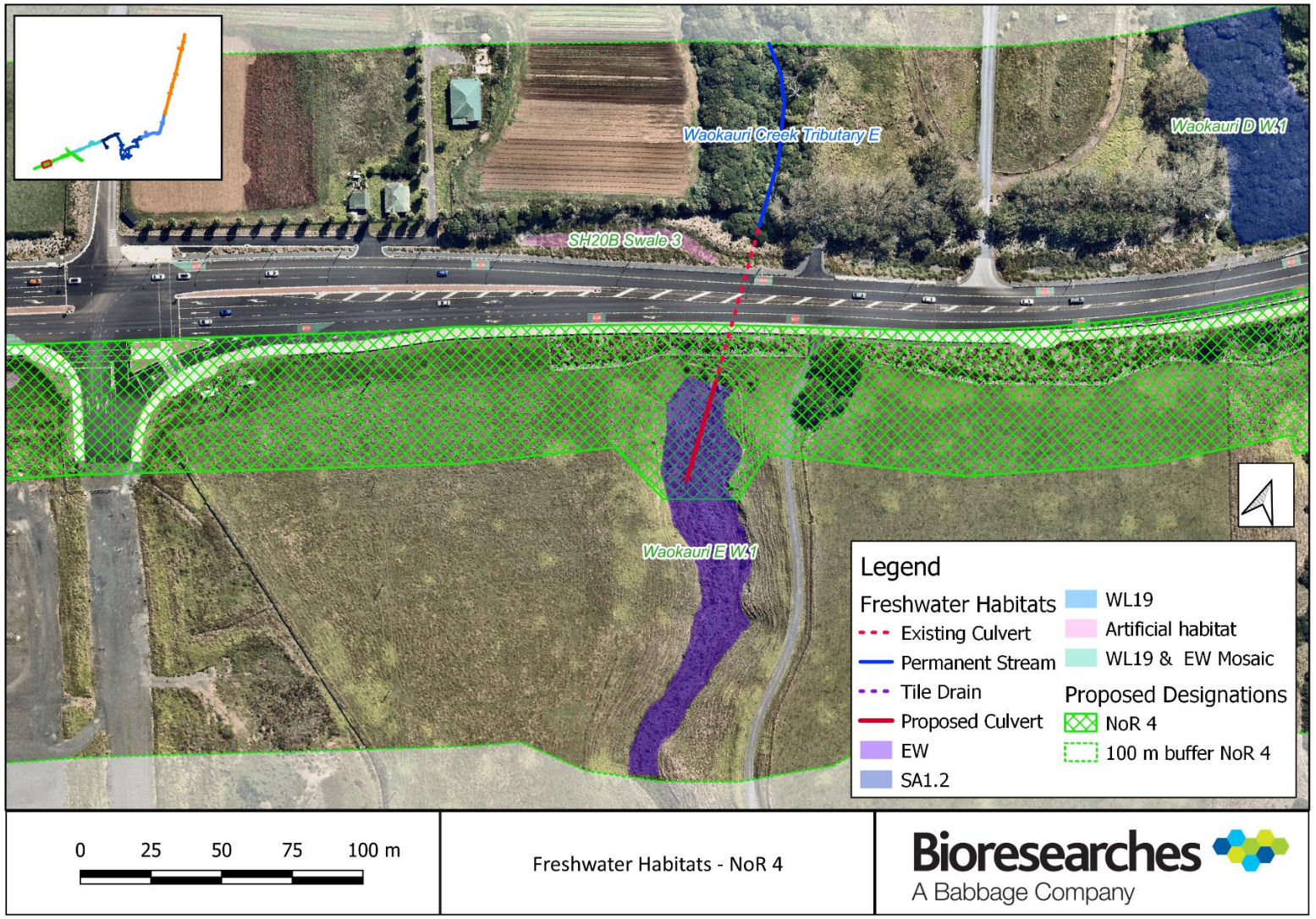


Figure 39. Freshwater Habitats vicinity of Waokauri Creek Tributary E, within the ZOI of NoR 4.

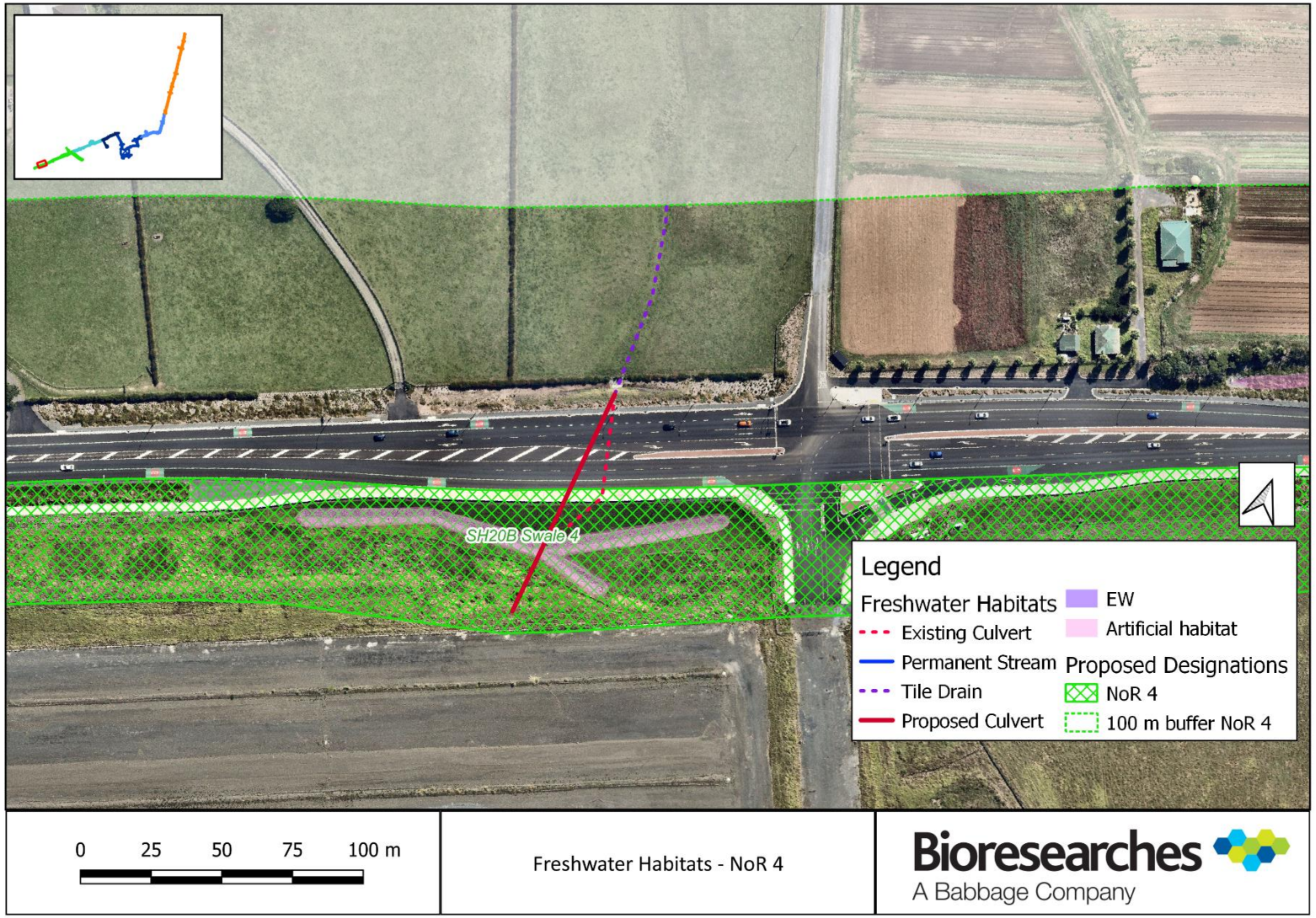


Figure 40. Freshwater Habitats vicinity of Waokauri Creek Tributary F, within the ZOI of NoR 4.

10.2.4 Freshwater ecological value

Table 67 presents the ecological value for the freshwater habitats identified within NoRs 4a and 4b. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 67. Ecological values of streams within the ZOI of NoRs 4a and 4b

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Waokauri Creek Tributary A	Moderate -instream habitat highly modified, with moderately modified riparian zone.	Low – no 'At Risk' or 'Threatened' species present.	Moderate – some hydrological variation.	Moderate – second order stream, with permanent flow.	**Moderate**
Waokauri Creek Tributary B	Low – highly modified instream habitat and riparian zone	Low – no 'At Risk' or 'Threatened' species present	Low – highly modified	Low – First order stream	**Low**
Waokauri Creek Tributary C	Moderate -instream habitat highly modified, with moderately modified riparian zone.	Low – no 'At Risk' or 'Threatened' species present	Moderate – some hydrological variation.	Moderate - second order stream, with permanent flow.	**Moderate**
Waokauri Creek Tributary D	Moderate -instream habitat highly modified, with moderately modified riparian zone.	High – īnanga present.	Moderate – some hydrological variation.	Moderate - first order stream, with permanent flow.	**High**
Waokauri Creek Tributary E	Moderate -instream habitat highly modified, with moderately modified riparian zone.	Low – no 'At Risk' or 'Threatened' species present	Moderate – some hydrological variation.	Moderate - first order stream, with permanent flow.	**Moderate**
Waokauri C P.1	Low – artificial habitat which is unnatural and not representative of a natural habitat.	Low – no 'At Risk' or 'Threatened' species present	Very low – highly modified	Very low – only seasonally wet, very limited connectivity to any other habitat.	**Negligible**
SH20 B Swales 1 to 4	Low – artificial habitat which is unnatural and not representative of a natural habitat.	Low – no 'At Risk' or 'Threatened' species present	Very low – highly modified	Very low – only seasonally wet, very limited connectivity to any other habitat.	**Negligible**

10.2.5 Wetland habitat

Seventeen potential wetlands were identified during the desktop study. Of these, two were not surveyed as although they are within 100 m of the proposed designation, they were not within 100 m

of any proposed works[15], and two were only able to be assessed via a desktop assessment. In total, seven natural wetlands, four artificially constructed swales and one artificial pond were identified.

Wetlands are depicted in Figure 35and described in Table 68.

Table 68. Wetlands within 100 m of NoRs 4a and 4b

Wetland	NES:F Classification	Classification process	Description
Waokauri A.1	Natural Wetland	Rapid test	Exotic wetland. A willow canopy is present, under which are patches of water purslane (*Ludwigia palustris*) and sporadic *Carex* sp. The water table was high, and ground was very boggy. Due to the steep sides of the small gully in which the stream and wetland are present, it was not able to be fully delineated on site and delineations were undertaken predominantly via desktop. In areas where the wetland was able to be viewed, water quality was observed to be poor; there was low clarity, high levels of iron oxidising bacteria and large amounts of rubbish within the water.
Waokauri A.2	Induced Wetland	Rapid test	Exotic wetland. Vegetation present includes mercer grass, water pepper, water purslane, *Juncus* spp., and planted natives such as flax, oioi, and multiple *Carex* species. The wetland is unshaded, and water quality within it was observed to be poor, with large volumes of filamentous algae (indicative of high nutrient loading) and iron oxidising bacteria present. Upstream of the wetland is a culvert which the Waokauri Creek Tributary A stream flows through and then discharges into an open water area. This open water area then grades into wetland habitat. At the downstream end of the wetland is another open water area, which drains into a second culvert. Historic aerial imagery from 1983 does not show this wetland as being present, and consequently it is presumed that it is an induced wetland created from the addition of culverts and possible deepening of the original Waokauri Creek Tributary A streambed (Figure 41).
Waokauri B.1	Natural Wetland	Rapid test	Exotic wetland, which was entirely vegetated with mercer grass. The stream Waokauri Tributary B discharges into the wetland. The water quality of the stream is poor (see Table 66) and consequently, the water quality within the wetland was also poor.
Waokauri C.1*	Natural wetland	Rapid test	This wetland was assessed via desktop assessment only. Waokauri Creek Tributary C inflows into the wetland at its southern end, and the wetland drains to the north, grading into a mangrove forest (SA1.2) habitat approximately 100 m north of the designation boundary. The vegetation composition of the southern end of the wetland nearest to the Project area is unknown consequently and this portion of the wetland is not

[15] This was two stormwater ponds located south and east of the portion of the designation which extends south along SH20.

			able to be classified. Water quality within the wetland was not able to be assessed.
Waokauri C.2*	Natural wetland	Rapid test	Wetland was assessed from desktop and from the roadside. The portion able to be viewed from the roadside consisted of exotic wetland which appeared to be dominated by mercer grass. This has been mapped as such. Water quality within the wetland is not known, however it is presumed to be low and impacted by stock access, as the wetland is unfenced. When viewed on aerial imagery during different times of year, a section of open water present within the wetland dries out in periods of low rainfall, and is subject to periodic algal blooms, suggesting the wetland is subject to high nutrient loads.
Waokauri D.1	Natural wetland	Rapid test	Whilst other wetlands within this NoR are split into northern and southern halves by the presence of culverts beneath SH20B, this watercourse is bridged and consequently the associated wetland habitats have been described as one unit. The southern portion of the wetland has been observed in the field. This, combined with information from Bioresearches (2019) has been used to form the following wetland description. The northern end of the wetland is saline, and forms part of the CMA. It is also mapped as SEA-M2-27A. The transition between the marine and freshwater environments occurs in the vicinity of the southern abutment of the SH20B bridge. In this location, vegetation transitions from marine (mangroves, bachelor's buttons (*Cotula coronopfoila*) to freshwater wetland, forming a transition zone which also acts as a pathway for migratory fish, i.e., eels and whitebait. North of the bridge, vegetation is typical of SA1.2 mangrove forest and was dominated by mangroves. Within the transitional environment, the estuarine mud crab was common under the bridge abutments and bachelor's button formed extensive mats below and under the bridge abutments. Vegetation then transitioned to a band of mercer grass with small patches of the sea rush *(Juncus kraussii* subsp*. australiensis)* near the edges, and occasional specimens of salt marsh ribbon wood (*Plagianthus divaricatus*), before transitioning into the freshwater raupō wetland habitat, which contained species such as raupō, harakeke, swamp sedge (*Carex virgata*), *Deparia petersenii* subsp. *congrua*, and watercress (*Nasturtium officinale*), baumea (*Machaerina rubiginosa*), Mercer grass and sharp spike sedge. Crack willow was also present. Further upstream, the freshwater system narrowed and formed a channel which was also assessed as a stream (Waokauri Creek Tributary D). Within this area, wetland vegetation was found to be patchy, and where present, was a mosaic of raupō reedland and exotic wetland areas. Due to access limitations (dense gorse) these vegetation units were not able to be mapped separately, and consequently this portion of the wetland was mapped as a 'mosaic' habitat. Bioresearches (2019) identified banded rail (At risk - Declining) footprints within the wetland, and also considered the

			freshwater portion of the wetland to provide īnanga spawning habitat.
Waokauri E.1	Natural Wetland	Rapid test	The wetland has been observed from aerial imagery and from the roadside of SH20B. This, combined with information from Bioresearches (2019) has been used to form the following wetland description. The wetland has been mapped from desktop observations. Wetland E.2 is best classified as a mosaic habitat, containing both raupō reedland (WL19) and exotic wetland (EW). It is bordered by pasture on three sides and Puhinui Road at its northern boundary. This wetland is dominated by raupō, native Persicaria (*Persicaria decipiens*), and exotic Mercer grass. Also present are gorse and soft rush, Yorkshire fog, buttercup and lotus. The high proportion of native vegetation gives this site a moderate botanical value. In localised areas, standing water was contained within a small channel and provided low quality aquatic habitat.

* = wetland not able to be accessed for assessment, and therefore was only assessed via a desktop study.

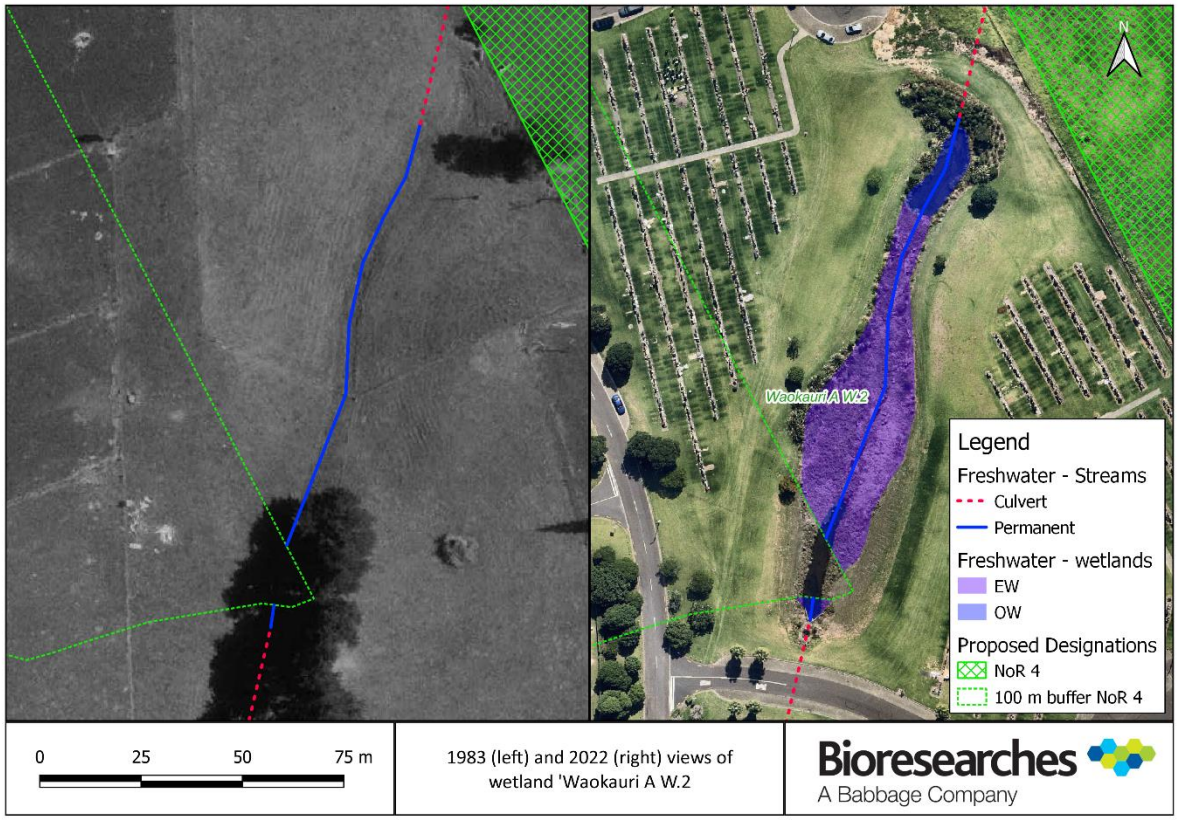


Figure 41. 1983 and 2022 views of Waokauri Creek Tributary A and wetland Waokauri A W.2. 1983 imagery from Retrolens.

10.2.6 Wetland ecological value

Table 69 presents the ecological value for the wetland habitats identified within NoRs 4a and 4b. Information obtained for the ecological baseline (refer Section 6.1) was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 69. Ecological values of wetlands within the ZOI of NoRs 4a and 4b

Wetland	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Waokauri A.1	Moderate – the wetland retains most of its hydrological functioning but does not retain much of its natural composition of flora and fauna.	Moderate – At-risk species identified (īnanga and banded rail), but habitat is not distinct or rare.	High – forms the upper portion of a wetland where there is a variety in habitat types from freshwater to saline.	Moderate – slightly reduced due to highly modified catchment.	**Moderate**
Waokauri A.2	Moderate – the wetland retains most of its hydrological functioning but does not retain much of its natural composition of flora and fauna.	Low - Unlikely to contain habitat for anything other than common, non-threatened species.	Moderate – this wetland contains both shallow and open water areas.	Low – induced (non-natural) wetland in a highly modified catchment.	**Moderate**
Waokauri B.1	Low - the watercourse/wetland is highly modified, and consequently the wetland flora is too. The wetland also is choked with sediment and consequently has limited hydrological functionality.	Low - Unlikely to contain habitat for anything other than common, non-threatened species.	Low – largely uniform habitat	Low – highly modified wetland in a local environment with multiple wetlands which have retained their features.	**Low**
Waokauri C.1	High – conservatively assessed via desktop as though it contains native vegetation and retains a high degree of hydrological function.	High – is a transitional wetland which includes both freshwater and marine components. Has potential to contain At-risk fauna species.	High – there is a variety in habitat types from freshwater to saline.	Moderate – slightly reduced due to highly modified catchment.	**High**
Waokauri C.2	Low – appears from desktop to be a wetland formed in a highly modified watercourse.	Low - Unlikely to contain habitat for anything other than common, non-threatened species.	Low – largely uniform habitat	Low – highly modified wetland in a local environment with multiple wetlands which have retained their features.	**Low**
Waokauri D.1	High – the wetland retains most of its hydrological functioning and composition of flora and fauna.	High – a transitional wetland such is this is uncommon within the ecological district. At-risk species identified (īnanga and	High – there is a variety in habitat types from	Moderate – slightly reduced due to highly modified catchment.	**High**

		banded rail). Also contains endangered raupō reedland habitat.	freshwater to saline.		
Waokauri E.1	Moderate – whilst the wetland retains most of its hydrological functioning, its flora has been modified.	Moderate – the raupō reedland is an endangered habitat, however this is interspersed with large pockets of exotic wetland.	Moderate – the wetland retains some of its original diversity.	Moderate – reduced due to the highly modified catchment.	**Moderate**

10.3 Future environment

Zoning within the ZOI of NoRs 4a and 4b is predominantly Light Industry Zone. The largest areas of the Light Industry zoning include the areas south of Puhinui Road, and areas north of Puhinui Road but west of Orrs Road. Most of this land is largely undeveloped, and therefore it is expected that these areas will be developed into light industry over the next 15 years. North of Puhinui Road, between Orrs Road and Prices Road is an area of Future Urban Zone which will likely be developed into an industrial land use. The final zoning is a Special Purpose Zone, used for the Manukau Memorial Gardens. This landuse is not expected to change.

The future urban and light industry land will largely undergo a significant change from rural to urban over the next few decades. However, it is assumed that in a future urbanised scenario, permanent stream corridors and areas of indigenous vegetation will generally be retained. It is likely that ecological features of value such as the vegetated stream corridors will remain and also may be enhanced, particularly along the edges of the streams, where in places the existing vegetation does not form a 10 m buffer. Within these corridors, over the next 15 years, indigenous vegetation will mature and diversify. Moderate value fauna habitats are likely to increase in habitat value in terms of resource provision (nesting habitat, food resources). However fauna diversity is likely to remain stable and reflective of the surrounding and expanding urban environment. Ecological values are likely to remain **Moderate** in value.

Low value vegetation and habitats beyond protected riparian margins have similar capacity to mature, as well as to expand or contract, given that they are unprotected. These areas area likely to remain low in value. Wetlands located within the ZOI of the corridor will be protected from reclamation and will likely benefit from stock exclusion and grazing as the landuse of the area changes. If these are also provided riparian planting on the margins as development occurs, which is reasonably likely, the ecological value of these habitats will likely increase.

10.4 Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects

This section assesses the ecological effects of activities which relate to District Plan matters under the AUP:OP. Refer to the 'Future Environment' Section for a discussion regarding the assumptions made for the effects assessment as it relates to permitted activities and likely future environment.

10.4.1 Construction effects – terrestrial ecology

The potential ecological effects to terrestrial habitats and fauna, which may be encountered during the construction phase of the Project (as they relate to district matters) have been identified:

- Removal of vegetation which is subject to District Plan controls (refer to **Appendix B** for a breakdown of Regional versus District Plan vegetation); and
- Disturbance and displacement of birds and lizards due to construction-related activities.

The following sections detail the magnitude of effect and level of effect of construction effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

10.4.1.1 Terrestrial vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors (in this case, the PL.1 habitat within the road corridor (excluding that within private property), with low ecological value and grassland (EG, negligible ecological value).

Although the habitat type is different (PL.1 instead of PL.2), the effects of the removal of this vegetation are the same as for NoR 1 and are assessed in Table 28. This identified a **Very Low** level of effect associated with the removal of PL.1 vegetation, and consequently, no impact management measures are required.

10.4.1.2 Birds

Indigenous birds may be displaced from nearby habitats due to construction activities. This would affect both At Risk – Declining wetland bird species (high ecological value) and Not Threatened birds (low ecological value).

In addition, birds may lose roosting/foraging habitat, abandon or lose nests and also be at risk of mortality or injury during tree felling when the District Plan vegetation is removed. This effect is limited to Not Threatened birds only, as the At – Risk wetland bird species do not utilise the District Plan vegetation which is scheduled to be removed.

The effects of the works upon birds are described below in Table 30.

Table 70. Assessment of ecological effects encountered during construction for birds

Effect	**Disturbance and displacement of birds due to construction activities**		**Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill birds**	
Affected birds	At Risk – Declining wetland bird species and pipit (High ecological value), , and Not Threatened birds (Low ecological value).		Non-threatened birds only (Low ecological value).	
Time scale	Baseline	Future environment	Baseline	Future environment
Magnitude of effect	Adjacent habitats are definitely periodically used by birds. The magnitude of effect is expected to be Moderate.	The habitats are expected to still be present and utilised by birds in a similar manner as they are currently. There is a chance that development of the area may result in these birds no longer being present at the time of construction, however conservatively it is considered they will be. Consequently, the magnitude of	There is a reasonable probability that native birds utilise these trees for nesting. The magnitude of effect is expected to be Moderate.	This effect is expected to be the same as baseline.

		effect is expected to be the same.		
Level of effect prior to impact management	High for At Risk wetland birds and Pipit, Low for Not Threatened species.		Low	
Impact management and residual level of effect	Pre-construction bird surveys should be undertaken to determine which Threatened or At Risk bird species are present. If wetland birds are present, a Wetland Bird Management Plan should be developed which could include the following management controls: • Where practicable, construction works should commence prior to the breeding season/s of the wetland birds identified as present; in order to discourage bird nesting. • Prior to any works beginning a nesting bird survey should be undertaken of wetland areas within a 50 m radius of the works footprint. If nesting birds are detected, then a 20 m buffer surrounding the nest should be clearly demarcated and works should not be completed within this buffer until birds have fledged. • Where practicable, works should be set back from wetland edges by at least a 10 m buffer. • Light spillage from construction areas should be minimised as far as practicable. If these measures are undertaken, it is considered that the impacts to wetland birds could be reduced to Low. If pipit are present within the nearby grassland habitats, these should be mown outside of the pipit breeding season (August to February inclusive (Beauchamp, 2022)) and managed as short grass thereafter to prevent pipits nesting adjacent to the Project area. If this measure is undertaken, it is considered that the impacts to pipit would be reduced to Low.		Under the Wildlife Act 1953, impact management measures will be required to prevent killing or injuring native birds during tree felling. This should include scheduling tree felling and vegetation removal activities outside of the bird nesting season (which is September to February, inclusive), or undertaking pre-clearance inspections to ensure nesting birds are not present.	
Management of residual effects	Not required		Not required	

10.4.1.3 Lizards

Under the current ecological baseline, lizards are not expected to be present within any of the District Plan vegetation to be removed. However, in the likely future environment, as the PL.1 habitat within the NoR develops, it will likely become suitable for copper skink to utilise. As copper skink are present in adjacent habitats (VS5 vegetation), it is likely that they would move into the PL.1 habitats, which are District Plan vegetation.

The effects of the works upon lizards are described below in Table 71.

Table 71. Assessment of ecological effects encountered during construction for lizards

Effect	**Disturbance and displacement of lizards due to construction activities**		**Loss of District Plan vegetation which may injure or kill native lizards**	
Time scale	Baseline	Future environment	Baseline	Future environment
Magnitude of effect	The magnitude of effect is assessed as Negligible due to unlikely probability of lizard disturbance due to construction related noise and vibration.	This effect is expected to be the same as baseline.	Lizards are not currently expected to occupy these habitats. The magnitude of effect is **Negligible**.	There is a reasonable probability that lizards will utilise these PL.1 habitats in the future. The magnitude of effect is expected to be **High**.
Level of effect prior to impact management	**Very Low**		**Very Low**	**Very High**
Impact management and residual level of effect	Not required		Not required	As part of future regional consenting processes, a survey should be undertaken to ascertain if native lizards are present within this vegetation. If confirmed, a Lizard Management Plan should be prepared in accordance with the Wildlife Act 1953. which should include: • Appointment of a herpetologist with who holds or can obtain appropriate Wildlife Authorisations. • Identification of lizard habitat which needs to be cleared.

			• Lizard salvage procedures to be completed prior to and/or during clearance works to reduce likelihood of injury or killing of lizards. • Offset planting for habitat loss and enhancement measures for the lizard release site. If such a plan is implemented, it is considered that the level of effect would be reduced to **Low.**
Management of residual effects	Not required	Not required	Not required

10.4.2 Operational effects – terrestrial ecology

The Project involves the addition of BRT lanes and high quality walking and cycling facilities south of SH20B. The future environment will be urban, and consequently there will be a transition from a rural landscape to an urban environment. The Ōtara Creek corridor and existing habitats associated with this waterway will remain.

Many of the potential operational effects of the Project such as habitat fragmentation, noise and light pollution are pre-existing. Potential operational effects include reductions in habitat connectivity and impacts from noise, light and vibration upon indigenous fauna, as well as potential mortality from vehicle strike.

The following sections detail the magnitude of effect and level of effect of operational effects on these ecological features. **Appendix A** provides additional detail on how these were calculated. Impact management measures and residual effects are also described where the level of effect is expected to be moderate or greater.

10.4.2.1 Birds

Indigenous birds may be displaced from nearby habitats due to noise, lighting and vibration generated from the upgraded roadway, however as the birds present within the Project area are likely already habituated to these effects, the magnitude of this effect is considered to be **Low** for both the baseline and future environment, and consequently the level of effect is considered to be **Very Low**.

Birds may also be affected by vehicle strike; however, this is only likely to occur infrequently. Consequently, the magnitude of effect of this is considered to be **Low**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to birds.

10.4.2.2 Lizards

The Project works are not expected to increase limitations on lizard dispersal or increase disturbance to lizards. Consequently, the magnitude of this effect is considered to be **low** for both the baseline and future environment, and the level of effect is considered to be **Low**.

Lizards may also be affected by vehicle strike, however there is a very low probability of this occurring, and it would likely only occur at a very low frequency. Consequently, the magnitude of effect of this is considered to be **Negligible**, and the level of effect is considered to be **Very Low**.

Impact management is therefore not required for operational effects to lizards.

10.4.3 Conclusions

Ecological effects assessed as moderate or greater include:

- High level of effect to wetland birds during construction for both the ecological baseline and future ecological environment may occur due to disturbance to birds within wetlands adjacent to the project area; and
- Very high level of effect to lizards during construction in the likely future ecological environment may occur due to the potential for injury or killing of lizards.

Effects management (implementation of a Wetland Bird Management Plan and a Lizard Management Plan) reduces these effects to **Low**.

10.5 Design and future Regional Resource Consent considerations

Ecological effects associated with activities that require regional consents and Wildlife Act Authority permits are briefly discussed in the following sections to inform design and alignment options for the NoR.

10.5.1 Terrestrial ecology

Construction of the Project will result in both temporary and permanent losses in terrestrial habitat within the NoR, including habitat which is being used by native fauna.

Table 72 details the types and area (m^2) of terrestrial habitats which will be lost during construction, as well as the total area of each habitat present within the designation boundary. This includes vegetation which is subject to District Plan and Regional Plan controls as well as vegetation not subject to plan controls.

Terrestrial habitats which will be lost are currently of **High** or **Low** ecological value and may provide habitat for native fauna. Exotic grassland habitat is of **Negligible** ecological value and therefore is not considered here.

Table 72. Terrestrial habitat types and the areas of these both within the Project footprint (which will be permanently lost) and within the designation boundary.

Habitat type	Classification (Singers *et al.* 2017)	Area within Footprint (m^2)	Area within Designation (m^2)
Broadleaf forest and scrub	VS.5	TBC	1495
Native planted vegetation	PL.1	TBC	19,789
Treeland	TL.3	TBC	119
Exotic scrub	ES	TBC	2,663

10.5.2 Birds

Non-threatened indigenous birds are present within the proposed designation boundary and will be impacted by vegetation removal. This should therefore occur outside of the bird nesting season to reduce impacts to these birds.

At Risk wetland bird species are present within at least one of the wetlands present within the designation. Wetland loss will occur, and bridges will be constructed over wetlands which will impact these species. A Wetland Bird Management Plan is recommended to reduce the magnitude of effect of these works.

10.5.3 Lizards

Copper skinks are potentially present within the vegetation to be cleared, and there is potential that during this clearance they could be injured or killed. Consequently, the works should be completed in accordance with the Wildlife Act 1953, and a Lizard Management Plan should be implemented.

10.5.4 Freshwater ecology

The proposed designation crosses two intermittent and two permanent streams. Three of these crossings will involve culvert extensions or replacements, and one crossing will involve the construction of a new bridge. One of the culvert extensions will result in stream loss, and the remaining two will result in wetland loss, both of which mitigation will be required. Erosion and sediment control plan/s will likely also be required to prevent sediment entering streams during the works, and a Fish Management Plan should be implemented to reduce the likelihood of injury or killing of native freshwater fish during the works.

All new culverts and culvert extensions should be installed in accordance with fish passage guidance and where practicable, fish passage structures should be implemented in existing culvert sections where culverts are being lengthened.

The total stream length available for restoration within the designation boundary is 24 m.

Table 73 details the stream loss expected to be incurred within the designation.

Table 73. Potential stream loss within the NoR 4 designation boundary.

Stream	Hydroperiod	Approximate active channel width (m)	Approximate length to be lost (m)	Loss (m^2)
Waokauri Creek Tributary C	Intermittent	1.2	48.5	58.2

Under a future regional consent for instream works, earthworks and vegetation removal, impact management would also be required for fish salvage and relocation, sediment control and management of the riparian condition.

10.5.5 Wetland ecology

Construction of the NoR will result in loss of extent for one wetland. The area of loss for each wetland is detailed in Table 74. This loss has been largely unavoidable as the wetland locations and orientations relative to the existing road mean they must be crossed. However, it could be reduced with the use of bridges rather than culverts.

In addition to the direct loss in area, wetlands can also be impacted by construction and operational activities such as nearby earthworks, stormwater diversions, increases in impermeable area in their catchments and introduction of contaminants from roads.

It is expected that details regarding the offset/ compensation requirements will be addressed during the future regional resource consent application. The total extent of wetland within thev NoRs 4a and 4b designation boundary available for restoration is approximately 248 m^2.

Table 74 details the wetland loss expected to be incurred within the designation.

Table 74. Potential wetland loss within the NoR 4 designation boundary.

Wetland	NES:F Classification	Total size (m^2)	Area lost (m^2)
Waokauri B W.1	Natural wetland	262	256
Waokauri E W.1	Natural wetland	3100	739

11 Conclusions

Table 75 to Table 78 provide a summary of district matter ecological effects during construction prior to any mitigation. The summary represents the level of effect for the baseline and likely future ecological environment activities as one where they are the same[16]. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed. Construction effect mitigation measures will include:

- A BMP for NoR 1 and NoR 2 Section A. Details of the BMP will depend on bat habitat present at the time of construction and is likely to include bat habitat surveys prior to construction, siting of compounds and laydown areas to avoid bat habitat, lighting design to reduce light levels and spill from construction areas and restriction of nightworks around bat habitat.
- Bird management will be required for NoR 1, NoR 2 Section A and NoR. Considerations for bird management will include a bird survey prior to construction to confirm TAR species are not present and to provide guidance if TAR species are present, including the avoidance of the bird breeding season (September to February) during construction.
- The residual (post-mitigation) level of effect for all construction effects are considered **Negligible** or **Low**.

Table 75. Summary of ecological effects during construction prior to mitigation for District Plan trees

Construction - Terrestrial vegetation (district plan)	
	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal (district plan trees
NoR 1	Very Low
NoR 2, Section A	Very Low
NoR 2, Section B	Very Low
NoR 2, Section C	Very Low
NoR 3	Very Low
NoR 4	-

Table 76. Summary of ecological effects during construction prior to mitigation for bats

Construction - Bats			
NoR	Disturbance and displacement to roosts and individuals (existing) due to construction activities (noise, light, dust etc.)	Loss of foraging habitat due to vegetation removal - District plan only	Kill or injure individual bats due to vegetation removal - District plan only
NoR 1	Moderate	N/A	N/A
NoR 2, Section A	Moderate	N/A	N/A
NoR 2, Section B	-	-	-

[16] The effects assessment considered the baseline and the likely future environment as the construction of the road will only occur more than 10 years in the future.

NoR 2, Section C	-	-	-
NoR 3	-	-	-
NoR 4	-	-	-

Table 77. Summary of ecological effects during construction prior to mitigation for birds

Construction - Birds		
NoR	Disturbance and displacement to nests and individuals (existing) due to construction activities (noise, light, dust etc.) - Non-TAR	Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill birds
NoR 1	High	Low
NoR 2, Section A	High	Low
NoR 2, Section B	Low	Low
NoR 2, Section C	Low	Low
NoR 3	Low	Low
NoR 4	High	N/A

Table 78. Summary of ecological effects during construction prior to mitigation for lizards

Construction – Lizards	
NoR	Disturbance and displacement of individuals (existing) adjacent to construction activities (noise, dust etc.)
NoR 1	Very Low
NoR 2, Section A	Very Low
NoR 2, Section B	Very Low
NoR 2, Section C	N/A
NoR 3	Very Low
NoR 4	Very Low

Table 79 to Table 81 provide summaries of district plan matter operational effects due to the presence of the road resulting in disturbance or loss in connectivity to bats, birds and lizards. Where the level of effect was assessed to be **Moderate** or higher, then mitigation has been developed.

Operational effects mitigation measures will include a BMP. The BMP will include buffer planting along road corridors associated with stream crossings[17], lighting design along strategic location of the road (stream crossings) and retention of large, mature trees (specifically TL.3 stands) where practicable.

The residual level of effect for operational effects are considered **Low** or **Very Low**.

[17] The extent of buffer planting is not specifically defined in this report as the requirements may change in the future. For example, stream corridors may have no or immature buffer planting under present conditions that may change in the future. The requirement to provide buffer planting and/or retain trees (that already meet the function of buffer planting) is likely to include the area between the road embankment and the designation boundary to a minimum distance of 10 m on either side of stream crossings (noting that buffer planting can occur on the road embankments).

Table 79. Summary of ecological effects during operation prior to mitigation for bats

Bats - Operation		
NoR	Loss in habitat connectivity due to presence of the upgraded roadway and associated noise and lighting	Kill or injuring - vehicle strike
NoR 1	Moderate	Low
NoR 2, Section A	Moderate	Low
NoR 2, Section B	N/A	N/A
NoR 2, Section C	N/A	N/A
NoR 3	N/A	N/A
NoR 4	N/A	N/A

Table 80. Summary of ecological effects during operation prior to mitigation for birds

Operation - Birds			
NoR	Disturbance - presence of the road	Loss in connectivity - presence of the road	Kill or injuring - vehicle strike
NoR 1	Low		Very Low
NoR 2, Section A	Very Low		Very Low
NoR 2, Section B	Very Low		Very Low
NoR 2, Section C	Very Low		Very Low
NoR 3	Very Low		Very Low
NoR 4	Low		Very Low

Table 81. Summary of ecological effects during operation prior to mitigation for lizards

Operation - Lizards			
NoR	Disturbance - presence of the road	Loss in connectivity - presence of the road	Kill or injuring - vehicle strike
NoR 1	Low		Very Low
NoR 2, Section A	Low		Very Low
NoR 2, Section B	Low		Very Low
NoR 2, Section C	N/A		N/A
NoR 3	Low		Very Low
NoR 4	Low		Very Low

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Appendix A

Assessment standards

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Appendix A – Assessment standards

The ecological assessments undertaken for the Airport to Botany Notices of Requirement generally follow Ecological Impact Assessment guidelines for use in New Zealand (**EcIAG**) published by EIANZ[18] (Roper-Lindsay et al. 2018[19]). The EcIAGs provide a standardised matrix framework that allows ecological effects assessments to be clear, transparent and consistent. The EcIAG framework is generally used in impact assessments in New Zealand as good practice.

The EcIAGs provide a three-step process for undertaking terrestrial assessments as follows:

Step 1: Assess the **value** of the area, taking into consideration species (Table 66) and other attributes of importance for vegetation or habitats to assign an overall ecological value (Table 83).

Step 2: Determine the **magnitude** of effect (). This step also includes consideration of the timescale and permanence of the effect, whereby temporary (< 25 years) and long-term (substantial improvement after 25 years) effects are distinguished from permanent (beyond the span of a human generation) effects.

Step 3: Evaluate the overall severity or **level of effect** using a matrix (Table 84) of the ecological value and magnitude of effect.

That analysis then leads to an effects management regime comparable to the level of adverse ecological effect using the mitigation hierarchy to end with an overall outcome for ecological values that demonstrably results in no greater than minor, or preferably, a net improvement (Net Environmental Gain).

Fauna considered in this report include all those that are protected by the Wildlife Act (1953), including lizards, birds and long-tailed bats. Particular consideration was given where species with a conservation status of nationally 'At Risk' or higher have the potential to be present.

Table 82. Factors to be considered in assigning value to species (Roper-Lindsay et al. 2018)

Determining factors	Value
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 (Zone of Interest) 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

[18] Environmental Institute of Australia and New Zealand
[19] Roper-Lindsay, J.; Fuller, SA.; Hooson, S.; Sanders, MD.; Ussher, GT. 2018. Ecological Impact Assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.

Table 83. Attributes to be considered when assigning ecological value or importance to a site or area of vegetation / habitat / community (as per Table 4 of Roper-Lindsay et al. 2018).

Matters	Attributes to be considered
Representativeness	*Criteria for representative vegetation:* • Typical structure and composition; • Indigenous species dominate; and • Expected species and tiers are present. *Criteria for representative vegetation:* • Species assemblages that are typical of the habitat; and • Indigenous species that occur in most of the guilds expected for the habitat type.
Rarity/ distinctiveness	*Criteria for rare/distinctive vegetation and habitats:* • Naturally uncommon or induced scarcity; • Amount of habitat or vegetation remaining; • Distinctive ecological features; and • National Priority for Protection. *Criteria for rare/distinctive species of species assemblages:* • Habitat supporting nationally threatened or At-Risk species, or locally uncommon species; • Regional or national distribution limits of species or communities; • Unusual species or assemblages; and • Endemism.
Diversity and Pattern	• Level of natural diversity, abundance and distribution • Biodiversity reflecting underlying diversity; • Biogeographical considerations- pattern, complexity; and • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation.
Ecological context	• Site history and local environment conditions which have influenced the development of habitats and communities; • The essential characteristics that determine an ecosystems integrity, form, functioning and resilience (from 'intrinsic value' as defined in RMA); • Size, shape and buffering; • Condition and sensitivity to change; • Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material; and • Species role in ecosystem functioning - high level, key species identification, habitat as proxy.

Table 84. Assigning ecological value (Roper-Lindsay et al. 2018)

Value	Description
Very High	Area rates High for three or all of the four assessment matters. Likely to be nationally important 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 one of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter. Moderate and Low for the remainder, or area rates Moderate for two 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 majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for three matters and Moderate, Low or Very Low for remainder.

Table 85. Criteria matrix for describing magnitude of effects (Roper-Lindsay et al. 2018)

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

Table 86. Criteria matrix for describing level of effects (Roper-Lindsay et al. 2018)

Ecological Value → **Magnitude ↓**	**Very High**	**High**	**Moderate**	**Low**	**Negligible**
Very High	*Very High*	*Very High*	*High*	*Moderate*	Low
High	*Very High*	*Very High*	*Moderate*	Low	Very Low
Moderate	*High*	*High*	*Moderate*	Low	Very Low
Low	*Moderate*	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

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Appendix B

Regional and District consenting matters

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Appendix B – Regional and District consenting matters

Ecological feature	Activity	Ecological Effect	AUP:OP district plan provisions	AUP:OP Regional Plan provisions	Wildlife Act (1953)
Construction					
Terrestrial habitat	Vegetation removal (including trees) outside of roads and public spaces in: a) a rural zone b) riparian margins c) coastal areas d) SEAs This also includes other terrestrial habitat of value identified in the EcIA.	Permanent loss of habitat/ecosystem, fragmentation and edge effects		X	
	Vegetation removal (including trees) in: a) Roads b) Public spaces c) ONFs d) ONLs e) HNCs f) 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		X	
Bats	Vegetation removal	Roost loss		X	X
	Vegetation removal	Kill or injure individual			X
	Vegetation removal	Loss of foraging habitat		X	
	Construction activities (Noise, light, dust etc.)	Disturbance and displacement to roosts and to individuals (existing)	✓		X
Birds (native)	Vegetation removal	Nest loss		X	X
	Vegetation removal	Kill or injure individual			X
	Vegetation removal	Loss of foraging habitat		X	
	Construction activities (Noise, light, dust etc.)	Disturbance and displacement of roosts and individuals (existing)	✓		X
Herpetofauna (native)	Vegetation removal	Lizard habitat loss		X	
	Vegetation removal	Kill or injure individual			X

	Construction activities (Noise, light, dust etc.)	Disturbance and displacement of individuals (existing)	✓		X
	Reclamation/ culverting/other structures e.g., bank armouring	Permanent loss/modification of habitat/ecosystem		X	
Freshwater habitat – wetland or stream (including riparian margins)	Vegetation removal	Permanent loss of habitat/ecosystem, fragmentation and edge effects		X	
	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		X	
	Diversion, abstraction or bunding of watercourses and water level/ flow/ periodicity changes.	Detrimental effects on habitats including plant composition and fauna		X	
Fish (native)	Reclamation/diversion/other structures e.g., bank armouring	Loss of aquatic habitat		X	
	Reclamation/diversion/ culverting/other structures e.g., bank armouring	Kill or injure individual			X
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		X	
	Road maintenance – Increased use of herbicides	Increased weed incursion, unintentional spray of indigenous vegetation		X	
Bats	Vehicle movement	Kill or injure individual			X
	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	✓		X
	Lighting and noise/vibration	Disturbance and displacement of (new and existing) roosts and individuals	✓		X

Birds (native)	Vehicle movement	Kill or injure individual			X
	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.	✓		X
	Lighting and noise/vibration	Disturbance and displacement of (new and existing) nests and individuals	✓		X
Herpetofauna (native)	Vehicle movement	Kill or injure individual			X
	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	✓		X
	Lighting	Disturbance of nocturnal lizard behaviour	✓		X
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		X	
	Presence of bridge	Shading leading to change in ecosystem structure		X	
	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)		X	
	Stormwater discharges – pollutants (such as heavy metals and herbicides).	Permanent degradation of wetland or instream habitat and water quality		X	
Fish (native)	Presence of culvert	Loss of connectivity due to culvert preventing fish passage up and downstream		X	

TE TUPU NGĀTAHI
SUPPORTING GROWTH

Appendix C

Bird desktop study results

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NZ TRANSPORT AGENCY

New Zealand Government

Appendix C – Bird desktop study results

Table 87. Desktop records of native bird species for which there is suitable habitat types within the Project area.

Common name	Scientific name	Threat classification (Robertson *et al.*, 2021)	Observation source
kōtuku / white heron	*Ardea modesta*	Threatened - Nationally Critical	New Zealand Bird Atlas, iNaturalist
shore plover	*Thinornis novaeseelandiae*	Threatened - Nationally Critical	New Zealand Bird Atlas
reef heron	*Egretta sacra sacra*	Threatened - Nationally Endangered	New Zealand Bird Atlas
Caspian tern	*Hydroprogne caspia*	Threatened - Nationally Vulnerable	New Zealand Bird Atlas, iNaturalist
long-tailed cuckoo	*Eudynamys taitensis*	Threatened - Nationally Vulnerable	iNaturalist
pārera / grey duck	*Anas superciliosa*	Threatened - Nationally Vulnerable	New Zealand Bird Atlas
New Zealand dabchick	*Poliocephalus rufopectus*	Threatened - Nationally Increasing	New Zealand Bird Atlas, iNaturalist
northern New Zealand dotterel	*Charadrius obscurus aquilonius*	Threatened - Nationally Increasing	New Zealand Bird Atlas, iNaturalist
pāteke / brown teal	*Anas chlorotis*	Threatened - Nationally Increasing	New Zealand Bird Atlas, iNaturalist
wrybill	*Anarhynchus frontalis*	Threatened - Nationally Increasing	New Zealand Bird Atlas, iNaturalist
banded dotterel	*Charadrius bicinctus bicinctus*	At Risk - Declining	New Zealand Bird Atlas, iNaturalist
banded rail	*Gallirallus philippensis assimilis*	At Risk - Declining	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
black-billed gull	*Larus bulleri*	At Risk - Declining	New Zealand Bird Atlas, iNaturalist
eastern bar-tailed godwit	*Limosa lapponica baueri*	At Risk - Declining	New Zealand Bird Atlas, iNaturalist
lesser knot	*Calidris canutus rogersi*	At Risk - Declining	New Zealand Bird Atlas
New Zealand pipit	*Anthus novaeseelandiae novaeseelandiae*	At Risk - Declining	New Zealand Bird Atlas
North Island fernbird	*Bowdleria punctata vealeae*	At Risk - Declining	New Zealand Bird Atlas
northern blue penguin	*Eudyptula minor iredalei*	At Risk - Declining	New Zealand Bird Atlas, iNaturalist
red-billed gull	*Larus novaehollandiae scopulinus*	At Risk - Declining	New Zealand Bird Atlas, iNaturalist

South Island pied oystercatcher	*Haematopus finschi*	At Risk - Declining	New Zealand Bird Atlas, iNaturalist
spotless crake	*Porzana tabuensis tabuensis*	At Risk - Declining	New Zealand Bird Atlas
white-fronted tern	*Sterna striata striata*	At Risk - Declining	New Zealand Bird Atlas, iNaturalist
black shag	*Phalacrocorax carbo novaehollandiae*	At Risk - Relict	New Zealand Bird Atlas, iNaturalist
Cook's petrel	*Pterodroma cookii*	At Risk - Relict	iNaturalist
fairy prion	*Pachyptila turtur*	At Risk - Relict	iNaturalist
fluttering shearwater	*Puffinus gavia*	At Risk - Relict	iNaturalist
Australian coot	*Fulica atra australis*	At Risk - Naturally Uncommon	New Zealand Bird Atlas
black-fronted dotterel	*Elseyornis melanops*	At Risk - Naturally Uncommon	New Zealand Bird Atlas, iNaturalist
little black shag	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	New Zealand Bird Atlas, iNaturalist
royal spoonbill	*Platalea regia*	At Risk - Naturally Uncommon	New Zealand Bird Atlas, iNaturalist
kākā / North Island kākā	*Nestor meridionalis septentrionalis*	At Risk - Recovering	New Zealand Bird Atlas, iNaturalist
northern giant petrel	*Macronectes halli*	At Risk - Recovering	iNaturalist
pied shag	*Phalacrocorax varius varius*	At Risk - Recovering	New Zealand Bird Atlas, iNaturalist
variable oystercatcher	*Haematopus unicolor*	At Risk - Recovering	New Zealand Bird Atlas, iNaturalist
Australasian shoveler	*Anas rhynchotis*	Not Threatened	New Zealand Bird Atlas, iNaturalist
black swan	*Cygnus atratus*	Not Threatened	New Zealand Bird Atlas, iNaturalist
grey teal	*Anas gracilis*	Not Threatened	New Zealand Bird Atlas, iNaturalist
kāhu / Australasian harrier	*Circus approximans*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
karoro / southern black-backed gull	*Larus dominicanus dominicanus*	Not Threatened	New Zealand Bird Atlas, iNaturalist
kererū / New Zealand pigeon	*Hemiphaga novaeseelandiae*	Not Threatened	New Zealand Bird Atlas, iNaturalist
kōtare / New Zealand kingfisher	*Todiramphus sanctus vagans*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
North Island fantail	*Rhipidura fuliginosa placabilis*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)

pāpango / New Zealand scaup	*Aythya novaeseelandiae*	Not Threatened	New Zealand Bird Atlas, iNaturalist
pīpīwharauroa / shining cuckoo	*Chrysococcyx lucidus lucidus*	Not Threatened	New Zealand Bird Atlas, iNaturalist
poaka / pied stilt	*Himantopus himantopus leucocephalus*	Not Threatened	New Zealand Bird Atlas, iNaturalist
pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
pūtangitangi / paradise shelduck	*Tadorna variegata*	Not Threatened	New Zealand Bird Atlas, iNaturalist
riroriro / grey warbler	*Gerygone igata*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
ruru / morepork	*Ninox novaeseelandiae novaeseelandiae*	Not Threatened	New Zealand Bird Atlas
spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
tākapu / Australasian gannet	*Morus serrator*	Not Threatened	New Zealand Bird Atlas
tauhou / silvereye	*Zosterops lateralis lateralis*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
welcome swallow	*Hirundo neoxena neoxena*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
white-faced heron	*Egretta novaehollandiae*	Not Threatened	New Zealand Bird Atlas, iNaturalist, Bioresearches (2019)
Arctic skua	*Stercorarius parasiticus*	Non-resident Native - Migrant	iNaturalist
ruddy turnstone	*Arenaria interpres*	Non-resident Native - Migrant	New Zealand Bird Atlas
Asiatic black-tailed godwit	*Limosa limosa melanuroides*	Non-resident Native - Vagrant	New Zealand Bird Atlas
chestnut-breasted shelduck	*Tadorna tadornoides*	Non-resident Native - Vagrant	iNaturalist
eastern curlew	*Numenius madagascariensis*	Non-resident Native - Vagrant	iNaturalist
little egret	*Egretta garzetta immaculata*	Non-resident Native - Vagrant	New Zealand Bird Atlas, iNaturalist

little pied shag	*Phalacrocorax melanoleucos melanoleucos*	Non-resident Native - Vagrant	New Zealand Bird Atlas, iNaturalist
pectoral sandpiper	*Calidris melanotos*	Non-resident Native - Vagrant	iNaturalist
western sandpiper	*Calidris mauri*	Non-resident Native - Vagrant	New Zealand Bird Atlas, iNaturalist
whiskered tern	*Chlidonias hybridus javanicus*	Non-resident Native - Vagrant	iNaturalist

Table 88. Habitat assessment for threatened or at-risk bird species.

Common name	**Threat classification (Robertson *et al.*, 2021)**	**Potential habitat**
kōtuku / white heron	Threatened - Nationally Critical	Kōtuku occasionally visit freshwater wetlands (Adams, 2013), however they are rare visitors to the Manukau Harbour and highly unlikely to utilis the wetlands within the project area due to their small size. Consequently, they have not been considered further.
long-tailed cuckoo	Threatened - Nationally Vulnerable	Long-tailed cuckoo require extensive forest habitat, which is not present within the project area. Birds are occasionally seen in rural or urban areas whilst on passage and therefore are highly unlikely to be present within the project area and have not been considered further.
pārera / grey duck	Threatened - Nationally Vulnerable	Individuals of this species within urban environments are almost always hybrids with introduced mallard ducks (*Anas superciliosa*), which are not a threatened species (Williams, 2013) Consequently, pārera are highly unlikely to be present within the project area and have not been considered further.
New Zealand dabchick	Threatened - Nationally Increasing	Dabchick generally require areas of open water with wetland habitats on the periphery (Szabo, 2022). This habitat is not considered to be present within the ZOI of the Project and consequently dabchick have not been considered further.
pāteke / brown teal	Threatened - Nationally Increasing	Pāteke utilise estuaries and wetlands, including forested wetlands. They are greatly impacted by introduced pests however (Williams, 2013). There is a small chance that they could utilise streams and wetlands within NoR 4 as cover.
banded rail	At Risk - Declining	Banded rail footprints were recorded within NoR 4 wetlands by Bioresearches (2019). It is highly unlikely they are present in other NoRs due to unsuitability of the habitat.
black-billed gull	At Risk - Declining	Black-billed gull are highly mobile and do occasionally spend time foraging in more urbanised areas, however this is likely to occur very sporadically at best within the Project area. Records of them have been uncommon and generally in the Manukau Harbour. Consequently, their potential for presence is very low.
New Zealand pipit	At Risk - Declining	Pipit often are present within rural areas, such as the environment where NoR 4 is located. It is possible therefore that they are present within the ZOI of NoR 4.
North Island fernbird	At Risk - Declining	Occur and breed in dense freshwater and coastal wetland vegetation throughout New Zealand (Miskelly, 2013). It is possible that fernbird may

		utilise wetland habitat in NoR 4. It is unlikely that they would utilise habitat within other NoRs as the wetland habitats are generally smaller and less connected to other areas of wetland habitat.
red-billed gull	At Risk - Declining	Red-billed gull are highly mobile and do occasionally spend time foraging in more urbanised areas, either for food scraps, or in large open areas such as sports pitches (Mills, 2013). They may be sporadically present within any NoR but are highly mobile and disturbance tolerant and consequently are not assessed further.
spotless crake	At Risk - Declining	Spotless crakes occur and breed in freshwater wetland dominated by dense emergent vegetation (particularly raupō) throughout the North Island (Fitzgerald, 2013). It is possible they may utilise the wetlands/streams within NoR 4.
Australian coot	At Risk - Naturally Uncommon	Australian coots prefer large areas of open water with reedy or grassy edges (Mason, 2013). Such habitats are not present within the ZOI of the Project Area.
little black shag	At Risk - Naturally Uncommon	May frequent streams and wetlands for foraging, such as those in NoR 1 and 4.
kākā / North Island kākā	At Risk - Recovering	Kākā are rare to uncommon in native forest on the mainland, with strongholds on pest free offshore island. Kākā however disperse widely during winter and regularly visit forest fragments and pine plantations in the Auckland area (Moorhouse, 2013). At best they may use the project area as a movement corridor but due to a lack of foraging habitat are unlikely to utilise the project area for more.
pied shag	At Risk - Recovering	May frequent streams and wetlands for foraging, such as those in NoR 1 and 4.

Appendix D – Rapid habitat assessment scoring sheet

Habitat parameter	Condition category										SCORE
1. Deposited sediment	*The percentage of the stream bed covered by fine sediment.*										
	0	*5*	*10*	*15*	*20*	*30*	*40*	*50*	*60*	*≥ 75*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
2. Invertebrate habitat diversity	*The number of different substrate types such as boulders, cobbles, gravel, sand, wood, leaves, root mats, macrophytes, periphyton. Presence of interstitial space score higher.*										
	≥ 5	*5*	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
3. Invertebrate habitat abundance	*The percentage of substrate favourable for EPT colonisation, for example flowing water over gravel-cobbles clear of filamentous algae/macrophytes.*										
	95	*75*	*70*	*60*	*50*	*40*	*30*	*25*	*15*	*5*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
4. Fish cover diversity	*The number of different substrate types such as woody debris, root mats, undercut banks, overhanging/encroaching vegetation, macrophytes, boulders, cobbles. Presence of substrates providing spatial complexity score higher.*										
	≥ 5	*5*	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
5. Fish cover abundance	*The percentage of fish cover available.*										
	95	*75*	*60*	*50*	*40*	*30*	*20*	*10*	*5*	*0*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
6. Hydraulic heterogeneity	*The number of of hydraulic components such as pool, riffle, fast run, slow run, rapid, cascade/waterfall, turbulance, backwater. Presence of deep pools score higher.*										
	≥ 5	*5*	*4*	*4*	*3*	*3*	*2*	*2*	*2*	*1*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
7. Bank erosion	*The percentage of the stream bank recently/actively eroding due to scouring at the water line, slumping of the bank or stock pugging.*										
Left bank	*0*	*≤ 5*	*5*	*15*	*25*	*35*	*50*	*65*	*75*	*> 75*	
Right bank	*0*	*≤ 5*	*5*	*15*	*25*	*35*	*50*	*65*	*75*	*> 75*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
8. Bank vegetation	*The maturity, diversity and naturalness of bank vegetation.*										
Left bank AND Right bank	*Mature native trees with diverse and intact understorey*		*Regenerating native or flaxes/sedges/tussock > dense exotic*			*Mature shrubs, sparse tree cover > young exotic, long grass*			*Heavily grazed or mown grass > bare/impervious ground.*		
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
9. Riparian width	*The width (m) of the riparian buffer constrained by vegetation, fence or other structure(s).*										
Left bank	*≥ 30*	*15*	*10*	*7*	*5*	*4*	*3*	*2*	*1*	*0*	
Right bank	*≥ 30*	*15*	*10*	*7*	*5*	*4*	*3*	*2*	*1*	*0*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
10. Riparian shade	*The percentage of shading of the stream bed throughout the day due to vegetation, banks or other structure(s).*										
	≥ 90	*80*	*70*	*60*	*50*	*40*	*25*	*15*	*10*	*≤ 5*	
SCORE	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	
TOTAL	(Sum of parameters 1-10)										

Appendix E – Terrestrial SEA classification criteria

Below are the four factors used when assessing if terrestrial vegetation meets the criteria for classification as an SEA. These criteria are from Schedule 3 of the AUP OP.

Factors:

1) REPRESENTATIVENESS
   Sub-factor:
   (a) It is an example of an indigenous ecosystem (including both mature and successional stages), that contributes to the inclusion of at least 10% of the natural extent[20] of each of Auckland's original ecosystem types[21] in each ecological district of Auckland (starting with the largest, most natural and intact, most geographically spread) and reflecting the environmental gradients of the region, and is characteristic or typical of the natural ecosystem diversity of the ecological district and/or Auckland.
2) THREAT STATUS AND RARITY
   Sub-factors:
   (a) It is an indigenous habitat, community or ecosystem that occurs naturally in Auckland and has been assessed (using the IUCN threat classification system) to be threatened, based on evidence and expert advice (including Holdaway *et al*. Status assessment of NZ naturally uncommon ecosystems[22]).
   (b) It is a habitat that supports occurrences of a plant, animal or fungi that has been assessed by the Department of Conservation and determined to have a national conservation status of threatened or at risk;
      i. or it is assessed as having a regional threatened conservation status including Regionally Critical, Endangered and Vulnerable and Serious and Gradual Decline.
   (c) It is indigenous vegetation that occurs in Land Environments New Zealand Category IV where less than 20% remains.
   (d) It is any indigenous vegetation or habitat of indigenous fauna that occurs within an indigenous wetland or dune ecosystem.
   (e) It is a habitat that supports an occurrence of a plant, animal or fungi that is locally rare; or
      i. it has been assessed by the Department of Conservation and determined to have a national conservation status of Naturally Uncommon, Range Restricted or Relict.
3) DIVERSITY
   Sub-factors:
   (a) It is any indigenous vegetation that extends across at least one environmental gradient resulting in a sequence that supports more than one indigenous habitat, community or ecosystem type e.g., an indigenous estuary to an indigenous freshwater wetland.
   (b) It supports the expected indigenous ecosystem diversity for the habitat(s).
   (c) It is an indigenous habitat type that supports a typical species richness or species assemblage for its type.
4) STEPPING-STONES, MIGRATION PATHWAYS AND BUFFERS
   Sub-factors:

[20] "Natural extent" is intended to mean a combination of our understanding of the historic pre-human diversity, distribution and extent of ecosystems in Auckland and what we would expect this to be given past and current environmental drivers.

[21] The Department of Conservation's ecosystem classification system described over 135 ecosystems in New Zealand (Singers and Rogers in press). Of these 35 ecosystems are known to have occurred in Auckland and these are what is meant by original ecosystems. They include the more recent indigenous dominated shrub and scrublands that have evolved as a result of human modification of the landscape.

[22] Status Assessment of New Zealand's Naturally Uncommon Ecosystems, ROBERT J. HOLDAWAY, SUSAN K. WISER and PETER A. WILLIAMS. Conservation Biology. Volume 26, Issue 4, pages 619–629, August 2012

(a) It is an example of an indigenous ecosystem, or habitat of indigenous fauna that is used by any native species permanently or intermittently for an essential part of their life cycle (e.g., known to facilitate the movement of indigenous species across the landscape, haul-out site for marine mammals) and therefore makes an important contribution to the resilience and ecological integrity of surrounding areas.

(b) It is an example of an ecosystem, indigenous vegetation or habitat of indigenous fauna, that is immediately adjacent to, and provides protection for, indigenous biodiversity in an existing protected natural area (established for the purposes of biodiversity protection); or

   i. it is an area identified as significant under the 'threat status and rarity' or 'uniqueness' factor. This includes areas of vegetation (that may be native or exotic) that buffer a known significant site. It does not include buffers to the buffers.

c) It is part of a network of sites that cumulatively provide important habitat for indigenous fauna or when aggregated make an important contribution to the provision of a particular ecosystem in the landscape.

d) It is a site which makes an important contribution to the resilience and ecological integrity of surrounding areas.

5) UNIQUENESS OR DISTINCTIVENESS

Sub-factors:

(a) It is habitat for a plant, animal or fungi that is endemic to the Auckland region (i.e., not found anywhere else).

(b) It is an indigenous ecosystem that is endemic to the Auckland region or supports ecological assemblages, structural forms or unusual combinations of species that are endemic to the Auckland region.

(c) It is an indigenous ecosystem or a habitat that supports occurrences of a plant, animal or fungi that are near-endemic (i.e., where the only other occurrence(s) is within 100 km of the council boundary).

(d) It is a habitat that supports occurrences of a plant, animal or fungi that is the type locality for that taxon.

(e) It is important as an intact sequence or outstanding condition in the region.

(f) It is a habitat that supports occurrences of a plant, animal or fungi that is the largest specimen or largest population of the indigenous species in Auckland or New Zealand.

(g) It is a habitat that supports occurrences of a plant, animal or fungi that are at (or near) their national distributional limit.