



PAPAKURA TO BOMBAY STAGE 2

ASSESSMENT OF ECOLOGICAL EFFECTS

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CONTENTS

Contents	4
1 Introduction	15
1.1 Purpose and Scope of this Report	15
1.2 Report Structure	16
2 Project Description	17
2.1 Papakura to Bombay (P2B) Project	17
2.2 Stage 2	17
2.3 Statutory context.....	20
2.3.1 Legislation	20
2.3.2 National policy statements	20
2.3.3 Regional plans and policies	21
3 Assessment methodology and statutory context	22
3.1 Preparation of this Report	22
3.1.1 EcIA Assessment - Environmental Institute of Australia and New Zealand (EIANZ).....	22
3.1.2 EcIA Assessment – NZTA.....	22
3.1.3 Tangata Whenua as Partners	22
3.1.4 Zone of Influence	22
3.1.5 Biodiversity Areas	23
3.2 Methodology	23
3.2.1 Desktop review	23
3.2.2 Site investigations	24
3.2.3 Ecological Impact Assessment methodology	27
3.3 Statutory context.....	27
3.3.1 Notice of Requirement – District Plan requirements	27
3.3.2 Future regional resource consents.....	28
3.4 Adherence of this assessment to NZTA’s organisational direction on biodiversity.....	28
3.5 Limitations of the assessment.....	30
4 AREA WIDE ECOLOGICAL DESKTOP REVIEW – ALL NOR’S	31
4.1 Historical ecological context.....	31
4.2 Terrestrial habitat and fauna	31
4.2.1 Terrestrial habitat.....	31
4.2.2 Bats (pekapeka).....	36
4.2.3 Native Birds	38
4.2.4 Herpetofauna	38
4.3 Freshwater habitat	40
4.3.1 Streams	40
4.3.2 Fish.....	45
4.4 Wetland habitat.....	46

5	Stage 2 NoR 1 (Alteration to SH1 Designations 6706) and NoR 4 (New SH1 SUP Designation)	47
5.1	Overview and description of works.....	47
5.2	Existing environment.....	48
5.2.1	Terrestrial habitats and fauna	48
5.2.2	Terrestrial ecological value	50
5.2.3	Freshwater habitats – Streams	51
5.2.4	Freshwater ecological value – Streams.....	53
5.2.5	Freshwater habitats – Wetlands.....	53
5.3	Future environment.....	53
5.4	Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects	54
5.4.1	Assessment of construction effects - terrestrial ecology.....	54
5.4.2	Operational effects – terrestrial ecology	56
5.4.3	Conclusions	57
6	Stage 2 NoR 2 (Alteration to SH1 Designations 6700) and NoR 4 (New SH1 SUP Designation)	58
6.1	Overview and description of works.....	58
6.2	Existing environment.....	59
6.2.1	Terrestrial habitats and fauna	59
6.2.2	Freshwater habitats - Streams	78
6.2.3	Freshwater habitats – Wetlands.....	100
6.3	Future environment.....	104
6.4	Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects	104
6.4.1	Assessment of construction effects - terrestrial ecology.....	104
6.4.2	Operational effects – terrestrial ecology	108
6.4.3	Conclusions	109
7	Stage 2 NoR 3 (Alteration to SH1 Designations 6701) and NoR 4 (New SH1 SUP Designation)	110
7.1	Overview and description of works.....	110
7.2	Existing environment.....	112
7.2.1	Terrestrial habitats and fauna	112
7.2.2	Freshwater habitats – Streams	119
7.2.3	Freshwater habitats – Wetlands.....	123
7.3	Future environment.....	125
7.4	Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects	125
7.4.1	Assessment of construction effects – terrestrial ecology	125
7.4.2	Operational effects – terrestrial ecology	129
7.4.3	Conclusions	130
8	Stage 2 NoR 5 (Drury South Link Road)	131
8.1	Overview and description of works.....	131
8.2	Existing environment.....	132
8.2.1	Terrestrial habitats and fauna – NoR 5.....	132

8.2.2	Terrestrial ecological value – NoR 5	134
8.2.3	Freshwater habitats – Streams of NoR 5	136
8.2.4	Freshwater ecological value – Streams of NoR 5.....	138
8.2.5	Freshwater habitats – Wetlands.....	138
8.2.6	Freshwater ecological value – Wetlands of NoR 5	139
8.3	Future environment.....	139
8.4	Assessment of ecological effects and measures to avoid, remedy or mitigate actual or potential adverse effects	139
8.4.1	Assessment of construction effects - terrestrial ecology	139
8.4.2	Operational effects – terrestrial ecology	143
8.4.3	Conclusions	144
9	Overall Stage 2 NoRS	145
9.1	Positive ecology effects	145
9.2	Assessment of construction effects.....	145
9.3	Recommended measures to avoid, remedy or mitigate construction effects	147
9.4	Assessment of operational effects	148
9.5	Recommended measures to avoid, remedy or mitigate operational effects.....	149
9.6	Cumulative effects	149
9.6.1	Cumulative impacts to native fauna	149
9.6.2	Cumulative effects to vegetation	150
10	Conclusion.....	151

Appendices

APPENDIX A – ASSESSMENT STANDARDS

APPENDIX B – REGIONAL AND DISTRICT CONSENTING MATTERS

APPENDIX C – BIRD DESKTOP STUDY RESULTS

APPENDIX D – RAPID HABITAT ASSESSMENT SCORING SHEET

APPENDIX E – SEA’S PRESENT WITHIN 2 KM OF THE PROJECT AREA

APPENDIX F – TERRESTRIAL SEA CLASSIFICATION CRITERIA

APPENDIX G – BIODIVERSITY AREAS

Figures

Figure 2-1: Indicative location plan showing Stage 2 of NZTA's P2B project Project	18
Figure 4-1 Significant Ecological Areas illustrated within 2 km of the Project area	32
Figure 4-2: Mapped ecosystem current extents within 2 km of the Project areas, as per Auckland Council...35	
Figure 4-3: Records of Bats within 10 km of the Project area.	37
Figure 4-4: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 1 and NoR 5 of the Project.	41
Figure 4-5: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 2 and 3, and NoR 5 of the Project.	42
Figure 4-6: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 2 of the Project.	42
Figure 4-7: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 2 and 3 of the Project.	43
Figure 4-8: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 3 and 4 of the Project.	43
Figure 4-9: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 4 and NoR 3 and 4 of the Project.	44
Figure 4-10: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 3 and 4 of the Project.	44
Figure 5-1: Potential terrestrial habitats associated with the proposed NoR 1 and 4.	49
Figure 5-2: Potential freshwater habitats associated with the proposed NoR 1 and 4.....	52
Figure 6-1: Potential terrestrial habitats associated with the proposed NoR 2 and 4 – Section 1.	61
Figure 6-2: Potential terrestrial habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 2.	64
Figure 6-3: Potential terrestrial habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 2.	65
Figure 6-4: Potential terrestrial habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 3.	69
Figure 6-5: Potential terrestrial habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 3.	70
Figure 6-6: Potential terrestrial habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 4.	74
Figure 6-7: Potential terrestrial habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 4.	75
Figure 6-8: Potential freshwater habitats associated with the proposed NoR 2 and 4 – Section 1.	80
Figure 6-9: Potential freshwater habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 2.	85
Figure 6-10: Potential freshwater habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 2.	86
Figure 6-11: Potential freshwater habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 3.	93
Figure 6-12: Potential freshwater habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 3.	94
Figure 6-13: Potential freshwater habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 4.	98
Figure 6-14: Potential freshwater habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 4.	99
Figure 7-1: Potential terrestrial habitats associated with the northern portion of the proposed NoR 3 and 4.	114
Figure 7-2: Potential terrestrial habitats associated with the southern portion of the proposed NoR 3 and 4.	115
Figure 7-3: Potential freshwater habitats associated with the northern portion of the proposed NoR 3 and 4.	121
Figure 7-4: Potential freshwater habitats associated with the southern portion of the proposed NoR 3 and 4.	122

Figure 8-1: Potential terrestrial habitats associated with the northern portion of the proposed NoR 5.....133
 Figure 2: Potential freshwater habitats associated with the northern portion of the proposed NoR 5.**Error!**
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Tables

Table 1-1 Report structure	16
Table 2-1: Stage 2 P2B project Notice Package Summary.....	19
Table 3-1: Summary of the various ZOI's utilised as part of this assessment.	23
Table 3-2: AUP criteria for permanent, intermittent rivers and streams and ephemeral streams	25
Table 3-3 NZTA programmes, standards, guidelines and processes relevant to ecological impact assessment, and how this assessment adheres to these directions.	28
Table 4-1: Description of the terrestrial vegetation types, as per Singers <i>et al.</i> (2017) present within the Project area.	33
Table 4-2: Terrestrial herpetofauna of the Auckland region, corresponding NZ conservation statuses and reported occurrence within 10 km of the Project area.	39
Table 4-3: Streams identified within the ZOI of the Project using Auckland Council Geomaps 'Rivers and Permanent Streams' layer.....	40
Table 4-4: Freshwater fish recorded within streams present within the surrounding area of the Project.	45
Table 4-5: Description of the wetland types present within the Project area.	46
Table 5-1: Overview of the alteration to SH1 Designation 6706	47
Table 5-2: Vegetation types present within and directly adjacent to the Project Area (NoR 1 and 4), classified according to Singers <i>et al.</i> (2017).	48
Table 5-3: Ecological values of terrestrial habitats within the ZOI of NoR 1 and 4.	50
Table 5-4: Habitat suitability values of fauna within the ZOI of NoR 1 and 4.	50
Table 5-5: Summary of streams associated with NoR 1 and 4.	51
Table 5-6: Ecological values of streams within the ZOI of NoR 1 and 4.	53
Table 5-7: Effects of vegetation removal for terrestrial habitats associated with NoR 1 and 4.	54
Table 5-8: Assessment of ecological effects encountered during construction for bats.	55
Table 5-9: Assessment of ecological effects encountered during construction for native birds.....	55
Table 5-10: Assessment of ecological effects encountered during construction for lizards.....	56
Table 5-11: Assessment of ecological effects encountered during operation for bats.	56
Table 6-1: Overview of the alteration to SH1 Designation 6700	58
Table 6-2: Vegetation types present within and directly adjacent to the Project Area (NoR 1 and 4 – Section 1), classified according to Singers <i>et al.</i> (2017).	59
Table 6-3: Ecological values of terrestrial habitats within the ZOI of NoR 2 and 4 - Section 1.....	62
Table 6-4: Ecological values of fauna within the ZOI of NoR 2 and 4 - Section 1.....	62
Table 6-5: Vegetation types present within and directly adjacent to the Project Area (NoR 2 and 4 – Section 2), classified according to Singers <i>et al.</i> (2017).	63
Table 6-6: Ecological values of terrestrial habitats within the ZOI of NoR 2 and 4 – Section 2.....	66
Table 6-7: Habitat values of fauna within the ZOI of NoR 2 and 4 – Section 2.....	67
Table 6-8: Vegetation types present within and directly adjacent to the Project Area (NoR 2 and 4 – Section 3), classified according to Singers <i>et al.</i> (2017).	67
Table 6-9: Ecological values of terrestrial habitats within the ZOI of NoR 2 and 4 – Section 3.....	71
Table 6-10: Ecological values of fauna within the ZOI of NoR 2 and 4 – Section 3.....	72
Table 6-11: Vegetation types present within and directly adjacent to the Project Area (NoR 2 and 4 – Section 4), classified according to Singers <i>et al.</i> (2017).	73
Table 6-12: Ecological values of terrestrial habitats within the ZOI of NoR 2 and 4 – Section 4.....	76
Table 6-13: Ecological values of fauna within the ZOI of NoR 2 and 4 – Section 4.....	77
Table 6-14: Summary of streams associated with NoR 2 and 4 – Section 1.....	78
Table 6-15: Ecological values of streams within the ZOI of NoR 2 and 4 - Section 1.....	81

Table 6-16: Summary of streams associated with NoR 2 and 4 – Section 2.	82
Table 6-17: Ecological values of streams within the ZOI of NoR 2 and 4 - Section 2.	87
Table 6-18: Summary of streams associated with NoR 2 and 4 – Section 3.	88
Table 6-19: Ecological values of streams within the ZOI of NoR 2 and 4- Section 3.	95
Table 6-20: Summary of streams associated with NoR 2 and 4 – Section 4.	96
Table 6-21: Ecological values of streams within the ZOI of NoR 2 and 4- Section 4.	100
Table 6-22: Wetlands associated with NoR 2 and 4 – Section 1.	100
Table 6-23: Ecological values of wetlands within the ZOI of NoR 2 and 4 - Section 1.	101
Table 6-24: Wetlands associated with NoR 2 and 4 – Section 3.	101
Table 6-25: Ecological values of wetlands within the ZOI of NoR 1 and 2- Section 3.	102
Table 6-26: Wetlands associated with NoR 2 and 4 – Section 4.	103
Table 6-27: Ecological values of wetlands within the ZOI of NoR 2 and 4 - Section 4.	104
Table 6-28: Effects of vegetation removal for terrestrial habitats associated with NoR 2 and 4.	105
Table 6-29: Assessment of ecological effects encountered during construction for bats.	105
Table 6-30: Assessment of ecological effects encountered during construction for birds.	106
Table 6-31: Assessment of ecological effects encountered during construction for lizards.	107
Table 6-32: Assessment of ecological effects encountered during operation for bats.	108
Table 7-1: Overview of the alteration to SH1 Designation 6701.	110
Table 7-2: Vegetation types present within and directly adjacent to the Project Area (NoR 3 and 4), classified according to Singers <i>et al.</i> (2017).	112
Table 7-3: Ecological values of terrestrial habitats within the ZOI of NoR 3 and 4.	116
Table 7-4: Ecological values of fauna within the ZOI of NoR 3 and 4.	118
Table 7-5: Summary of streams associated with NoR 3 and 4.	119
Table 7-6: Ecological values of streams within the ZOI of NoR 3 and 4.	123
Table 7-7: Wetlands associated with NoR 3 and 4.	124
Table 7-8: Ecological values of wetlands within the ZOI of NoR 3 and 4.	125
Table 7-9: Effects of vegetation removal for terrestrial habitats associated with NoR 3 and 4.	126
Table 7-10: Assessment of ecological effects encountered during construction for bats.	127
Table 7-11: Assessment of ecological effects encountered during construction for birds.	127
Table 7-12: Assessment of ecological effects encountered during construction for lizards.	128
Table 7-13: Assessment of ecological effects encountered during operation for bats.	129
Table 8-1: Overview of the Drury South Interchange Connections.	131
Table 9-1: Summary of ecological effects during construction prior to mitigation for district plan trees.	146
Table 9-2: Summary of ecological effects during construction prior to mitigation for bats.	146
Table 9-3: Summary of ecological effects during construction prior to mitigation for native birds.	146
Table 9-4: Summary of ecological effects during construction prior to mitigation for lizards.	147
Table 9-5: Summary of ecological effects during operation prior to mitigation for bats.	148
Table 9-6: Summary of ecological effects during operation prior to mitigation for birds.	148
Table 9-7: Summary of ecological effects during operation prior to mitigation for lizards.	149
Table 0-1: Criteria for assigning ecological value to terrestrial habitats, based on NZTA EIA guidelines and the EIANZ guidelines.	153
Table 0-2: Criteria for assigning ecological value to terrestrial habitats, based on NZTA EIA guidelines and the EIANZ guidelines.	154
Table 0-3: Factors to be considered in assigning value to species (Roper-Lindsay <i>et al.</i> 2018).	155
Table 0-4: 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 <i>et al.</i> 2018).	155
Table 0-5: Assigning ecological value (Roper-Lindsay <i>et al.</i> 2018).	156
Table 0-6: Criteria matrix for describing magnitude of effects (Roper-Lindsay <i>et al.</i> 2018).	156
Table 0-7: Criteria matrix for describing level of effects (Roper-Lindsay <i>et al.</i> 2018).	156
Table 0-8: Relevance of specific EcIA components to the environmental screen (ES), preliminary technical assessment (PTA) and detailed EcIA.	157

Table 0-9: Ecological features associated with Regional and District Plan matters. Ticks (✓) indicate provisions associated with this report. Crosses (X) indicate provisions excluded from assessment in this report.	161
Table 0-10: Native avifauna identified during the desktop study, with corresponding conservation status (Robertson et al., 2021).	164
Table 0-11: Habitat assessment for threatened or at-risk bird species. Table 0-11.....	166
Table 0-12. Rapid habitat assessment scoring sheet.....	167
Table 0-13. SEAs located within 2 km of the Project area.	168



Abbreviations

Abbreviation	Term
AEE	Assessment of Environmental Effects
ASH	Alternative State Highway
AEP	Annual Exceedance Probability
AUP	Auckland Unitary Plan (Operative in Part 2016)
BMP	Bat Management Plan
DOC	Department of Conservation
EclA	Ecological Impact Assessment
EclAG	EclA Guidelines
EIANZ	Environmental Institute of Australia and New Zealand
EPA	Expert Consenting Panel
FTA	Covid 19 Recovery (Fast Track Consenting) Act 2020
LMP	Lizard Management Plan
km	Kilometres
m	Metres
MfE	Ministry for the Environment
NoR	Notice of Requirement
NoR 1	Alteration to the SH1 Designation 6706
NoR 2	Alteration to the SH1 Designation 6700
NoR 3	Alteration to the SH1 Designation 6701
NoR 4	Shared User Path between Quarry Road and Bombay Interchange
NoR 5	Drury South Interchange Connections
NES-F	National Environmental Standards for Freshwater 2020
NPS-IB	National Policy Statement for Indigenous Biodiversity
NPS-FM	National Policy Statement for Freshwater Management 2020
NZTCS	New Zealand Threat Classification System
P2B project	SH1 Upgrades Project between Papakura to Bombay
P2DS	Papakura to Drury South project
PC	Plan Change
RMA	Resource Management Act 1991

Abbreviation	Term
RPP	Restoration Planting Plan
SEA	Significant Ecological Area
SEA-T	Significant Ecological Area – Terrestrial
SGA	Supporting Growth Alliance
SH1	State Highway 1 Motorway, the Southern Motorway
SNA	Significant Natural Area
Southern IIG	Southern Iwi Integration Group
SUP	Shared Use Path
TAR	Threatened or At-Risk
ULDF	Urban and Landscape Design Framework
WA	The Wildlife Act
ZOI	Zone of Influence

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
the Project	Stages 2 of the P2B project Project between Papakura to Bombay
Project Area	Area of land that is within the proposed designation boundary.
NZTA	NZ Transport Agency Waka Kotahi

Executive Summary

This Ecological Impact Assessment (EclA) Report (Report) has been prepared to inform the Assessment of Effects on the Environment (AEE) for five Notices of Requirement (NoR) being sought by New Zealand Transport Agency Waka Kotahi (referred herein as 'NZTA') under the Resource Management Act 1991 (RMA), for Stage 2 of the Papakura to Bombay Project (P2B project) or 'the Project'.

As the Project relates to proposed designations, this EclA focuses solely on district plan considerations. Regional matters, including compliance with the Wildlife Act (1953), will be addressed in a future consent phase along with a supporting EclA, and are not formally assessed in this report. However, relevant regional matters have been screened to inform the designation boundary and future regional resource consents.

To establish the ecological values baseline, ecological features (terrestrial, wetland, freshwater) within each Notice of Requirement (NoR) boundary were identified, mapped and assessed in terms of representativeness, rarity/distinctiveness, diversity/pattern and ecological context.

Overall, the terrestrial vegetation within the broader Project area comprises predominantly planted and exotic vegetation, with limited native vegetation present. Two vegetation areas identified as Significant Ecological Areas (SEA) are present within the Project footprint, however these areas will be avoided. Habitats comprising exotic vegetation species such as shelter belts and pine forest stands, and small clusters of native vegetation were all assessed as having low ecological value.

Native forested areas (such as the SEA's) were assessed as high ecological value. Terrestrial fauna within the Project footprint is limited to range of common native bird species, with the possible exception of New Zealand pipit, grey ducks and spotless crane. Overall, the habitat quality for the common native birds is low, due largely to the high level of edge effects that are experienced within narrow bands of vegetation, particularly alongside a high-traffic motorway. Freshwater ponds and wetlands may provide habitat for Threatened or At-Risk (TAR) wetland bird species, but these habitats are relatively small, and these species are unlikely to be present. The assessment outcome concluded that overall, habitat quality within Stage 2 of the Papakura to Bombay (P2B project) project area for native birds is very low.

The open space pasture, watercourses and wetlands present within the Project area may support commuting and foraging by bats that have been recorded in the wider landscape, particularly to the south-west of the Project area. However, there is uncertainty of bat activity taking place alongside the existing State Highway 1 (SH1). Vegetation within the Project area as potential roosting habitats is uncertain, given the proximity to disturbances (noise, light and vibrations associated with traffic on existing SH1 and the expanding urban edge of Auckland). However, if these trees are indeed used by bats for roosting, they should be considered as very high value due to the scarcity of canopy cover in the surrounding landscape.

Various streams and wetlands are present within the Project area, most of which have been affected by historical and ongoing land uses (existing transport infrastructure and agricultural developments). Due to the presence of At Risk – Declining' species of inanga and/or longfin eel in some of the streams/wetlands, these habitats were assessed as moderate ecological value, while other watercourses (such as exotic wetlands) were assessed as low ecological value. Since freshwater ecological aspects are considered under regional plan provisions, a detailed freshwater assessment of Regional Plan matters was not included as part of this report.

The overall construction ecological effects on a district level were assessed as very low (terrestrial vegetation), to moderate and high (birds and bats) without any mitigation measures. In cases where the assessed effect level is moderate or higher, then mitigation has been developed. The measures for mitigating effects will include:

- A Lizard Management Plan (LMP). Details of the LMP will be dependent on the lizard habitat present during the construction phase. The LMP is expected to include activities such as reassessment or surveys of lizard habitats prior to construction, the placement of compounds and laydown areas, identification of relocation sites and the determination of timing and methods for capturing and relocating lizards.

- A Bat Management Plan (BMP). Details of the BMP will be dependent on the bat habitat present during the construction phase. The BMP activities will involve conducting surveys of bat habitat before construction is commenced, positioning compounds and laydown areas to be clear of bat habitat, designing lighting systems to minimise light levels and prevent light spill from construction areas, and enforcing restrictions on night works in proximity to bat habitats.
- Bird management: Considerations for bird management will include conducting a pre-construction bird survey to confirm the absence of Threatened or At Risk (TAR) species and to provide guidance in case such species are found. This guidance may involve avoiding construction activities during the bird breeding seasons, which typically spans from September to February; or effects management measures to ensure breeding native birds are not disturbed or minimally disturbed.
- A Restoration Planting Plan (RPP): Details of the RPP will depend on vegetation and fauna habitat present at the time of construction, and is likely to include identification of strategic revegetation to buffer and restore habitats, and potentially offset or compensate for high vegetation and / or fauna habitat values.

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

The overall operational effects related to district plan matters caused by the road, which may result in disturbance or loss in connectivity for bats, birds and lizards was assessed as **Low to Very Low**.

1 INTRODUCTION

This Ecological Impact Assessment (EclA) Report (Report) has been prepared to inform the Assessment of Effects on the Environment (AEE) for five Notices of Requirement (NoR) being sought by New Zealand Transport Agency Waka Kotahi (referred herein as 'NZTA') under the Resource Management Act 1991 (RMA), for Stage 2 of the Papakura to Bombay Project (P2B project) or 'the Project'.

1.1 Purpose and Scope of this Report

This Report considers the actual and potential ecological effects associated with the construction and operation of the Project on the existing and likely future environment. Recommendations have been made on appropriate measures that can be adopted to avoid, remedy, and/or mitigate these effects.

This EclA Report should be read alongside the AEE (**Appendix A**), 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 of the five NoRs, and the typical construction methodologies that will be used to implement this work. The authors of this EclA have reviewed these recommendations and incorporated them into the assessment. Consequently, they are not restated in this document. In instances where a description of an activity is necessary to understand the potential effects, it has been included in this Report for the sake of clarity.

NZTA provides ecological impact assessment guidelines to inform the EclA process specific to land transport projects (released in August 2023). The NZTA ecological impact assessment guidelines (2023) were used in conjunction with the Ecological Impact Assessment guidelines for use in New Zealand for terrestrial and freshwater ecosystems, in the framework laid out by the Environment Institute of Australia and New Zealand (EIANZ, 2018). The NZTA ecological impact assessment guidelines, although broader in scope, share a foundation with the EIANZ guidelines. As such, this report incorporates the scope of both guidelines, where applicable, as part of authorizing the District Plan land use components of the Project. Section 2.3 provides more details regarding the statutory context of this assessment and Sections 3.1.1 and 3.1.2 detail the methodologies of the abovementioned guidelines.

Due to the constraints outlined (refer to Section 3.5), the data collected for this report detail ecological baseline conditions for some ecological components only. However, a follow-up ecological baseline assessments of pre-work conditions will be necessary, and specific instances where this is required (i.e. bat and lizard management, freshwater ecological assessment) have been detailed throughout the report.

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.

Table 1-1 below describes the extent of each section, and where the description of effects can be found in this Report.

Table 1-1 Report structure

Sections	Section number
Description of the Project	Section 2
Identification and description of the existing and likely receiving environment	Section 4
Transport: Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines	Section 3
Assessment of specific transport matters for Stage 2 NoR 1 - 3: Alteration to SH1 Designations, and NoR 4: SUP between Quarry Road and Bombay Interchange	Section 5 to 7
Assessment of specific transport matters for Stage 2 NoR 5: Drury South Interchange Connections	Section 8
Overall conclusion of the level of potential adverse effects of the Stage 2 P2B project Project.	Section 9

2 PROJECT DESCRIPTION

2.1 Papakura to Bombay (P2B) Project

The P2B project is a NZTA led project to improve the transport capacity and functionality of the State Highway network and provide for long term growth South of Auckland. An indicative location plan of the P2B project area is illustrated in Figure 2-1 (below).

Further discussion of the different stages of the P2B project is contained in the AEE (**Appendix A**) and Design Construction Report (**Appendix C**), which support this application.

For clarity and by way of summary we note that:

- The previous stages of the P2B project, were approved under the Covid 19 Recovery (Fast Track Consenting) Act 2020 (FTA), as part of the Papakura to Drury South project (P2DS), this includes: Stage 1B1 and Stage 1B2; and,
- Stage 1B1 of the P2DS was approved by the Expert Consenting Panel (EPA) in November 2022 and Stage 1B2 was approved by the EPA in July 2023. Both these applications altered the existing SH1 Designation 6706 (Takanini to Drury Interchange), which is the subject of NoR 1.

2.2 Stage 2

NZTA is seeking five NoRs for Stage 2 of P2B project, which are summarised in Table 2-1(below).

For clarity and by way of summary we note that:

- The Project area, which was formally known as Stages 2 and 3 under the P2B project, is now to be referred to as a single stage for route protection only, this is referred herein as 'Stage 2' or 'the Project',
- Stage 2 incorporates the remaining portion of the P2B project area south of Quarry Road to the existing Bombay/Mill Road Interchange,
- Stage 2 will protect land required for the future upgrades of the SH1 corridor.

NZTA is seeking to protect adequate land to accommodate the following planned works:

- New interchange constructed at Drury South (including one additional motorway lane in both direction of the proposed interchange),
- Upgrades to existing Bombay Interchange (one additional lane in both directions),
- Upgrades to Ramarama Interchange,
- Continuation of a Shared User Path (SUP) from Quarry Road to Bombay Interchange; and
- Stormwater management devices.

SH1 Papakura to Bombay project

October 2023



Figure 2-1: Indicative location plan showing Stage 2 of NZTA's P2B project Project

Table 2-1: Stage 2 P2B project Notice Package Summary

Notice	Requiring Authority	Project	Purpose	Extent	Lapse Period
NoR 1	NZTA	Alteration to SH1 Designation 6706	Motorway between Takanini and Hamilton	SH1 CH 15160 to CH 15500 State Highway 1 from north of Takanini Interchange to south of Quarry Road, Drury	Given effect (ie. no lapse date)
NoR 2		Alteration to SH1 Designation 6700	Motorway	SH1 CH 15500 to CH 22740 State Highway 1 from south of Quarry Road, Drury to Bombay Road, Bombay	
NoR 3		Alteration to SH1 Designation 6701	Motorway	SH1 CH 22740 to CH 24600 State Highway 1 from Bombay Road to Mill Road, Bombay	
NoR 4		Shared User Path	Designation for the construction, operation and maintenance of a shared path and associated infrastructure.	SH1 CH 15160 to CH 24580 State Highway 1 from Quarry Road, Drury to Bombay Interchange/Mill Road.	20 years
NoR 5		Drury South Interchange Connections	Designation for the construction, operation and maintenance of a new link road and associated infrastructure.	CH 300 to CH 1750 Adjacent State Highway 1 at Drury South Interchange, linking to Quarry Road to the east, and Great South Road to the west.	20 years

2.3 Statutory context

This assessment has been prepared to support the AEE and NoR process. If confirmed, the designations will authorise the District Plan land use components of the Project. Accordingly, when assessing the actual or potential effects on the environment for allowing the requirement in terms of Section 171 of the RMA, this assessment has been limited to matters that would trigger a District Plan consent requirement.

It must be noted that there are ecological values present within the designation which relate to Regional Plan matters. Regional resource consents will be separately sought for any project works, if required.

2.3.1 Legislation

2.3.1.1 Resource Management Act 1991 (RMA)

The purpose of the RMA is to achieve sustainable management. Important elements of this are the maintenance of indigenous biodiversity and protection of significant indigenous vegetation and habitats. The RMA requires that any adverse effects of development be avoided in the first instance, and where avoidance is not reasonably practicable, impacts should be minimised, remedied, or mitigated. These elements are given effect in Sections 5, 6 and 7, and Schedule 4 sets out the requirements for effects assessments.

2.3.1.2 Wildlife Act 1953

The Wildlife Act (WA, 1953) provides legal protection to listed species classed as wildlife. It controls how people interact with Wildlife, including all native birds, bats, frogs and lizards and some invertebrates. Note, this Act does not cover plants or freshwater fish.

2.3.1.3 National Environmental Standards for Freshwater 2020 (NES-F)

The National Environmental Standards for Freshwater 2020 (NES-F) set requirements for carrying out certain activities that pose risks to freshwater and freshwater ecosystems.

2.3.2 National policy statements

2.3.2.1 Freshwater Management

The National Policy Statement for Freshwater Management 2020 (NPS-FM) provides direction under the RMA, to local authorities on managing activities that affect the health of freshwater, and provides protections to freshwater bodies, including natural inland wetlands, includes provisions for monitoring and reporting on freshwater quality and quantity, and for addressing the impacts of land use activities on freshwater resources.

2.3.2.2 Indigenous Biodiversity

The National Policy Statement for Indigenous Biodiversity (NPS-IB) provides direction to councils to protect, maintain and restore indigenous biodiversity in the terrestrial environment, requiring at least no further reduction nationally. It is relevant to the Project area as it is within the terrestrial environment, and it contains indigenous biodiversity as defined in Section 1.6 (Interpretation) of the NPS-IB.

The indigenous biodiversity within the Project area includes that which is subject to a notified Significant Natural Area (SNA, or Significant Ecological Area (SEA) as per the AUP, NPS-IB), as well as indigenous biodiversity that is not subject to a SNA overlay.

The NPS-IB requires that indigenous biodiversity that is not protected by an SNA:

- a. Is managed by applying the effects management hierarchy (avoid, minimise, remedy, offset, compensate), where those effects are significant.
- b. is managed to give effect to its Objective and Policies, where those effects are not significant (Section 3.16 (2)).

2.3.3 Regional plans and policies

The Auckland Unitary Plan (AUP) is the principal statutory planning document for Auckland. It was prepared by Auckland Council for the purpose of giving effect to the RMA as a regional council and as a territorial authority. There are several AUP overlays within the Project area which pertain to ecology (e.g., Significant Ecological Areas (SEAs)).

3 ASSESSMENT METHODOLOGY AND STATUTORY CONTEXT

3.1 Preparation of this Report

3.1.1 EclA Assessment - Environmental Institute of Australia and New Zealand (EIANZ)

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

3.1.2 EclA Assessment – NZTA

In addition to the EIANZ EclA guidelines, NZTA has formulated its own ecological impact assessment guidelines (August 2023). These guidelines have a broader scope than the EIANZ guidelines, as ecological impact assessments for NZTA projects frequently commence before seeking statutory approvals. For NZTA projects, the EclA is primarily conducted during a project's development and delivery stages. Project development is guided by the NZTA Business Case Approach (BCA), and the EclA process aligns with the steps in the BCA, involving three levels of assessment:

- Step 1: An environmental screen (ES);
- Step 2: A preliminary technical assessment (PTA), and
- Step 3: A detailed EclA.

Appendix A provides a detailed overview of NZTA's ecological impact assessment guidelines, outlining the required assessment steps. Bioreserches was engaged to provide ecological input only after a development layout had already been established. Therefore, this assessment is predominantly in line with Steps 1 and 2, albeit some desired outcomes thereof have not been achieved (i.e. engagement with DOC, iwi, NZTA technical specialists, site investigations programmed with realistic timeframes, etc.). Considering this, this Report makes use of NZTA guidelines, in conjunction to that of the EIANZ guidelines (where applicable).

3.1.3 Tangata Whenua as Partners

The NPS-IB recognises tangata whenua as kaitiaki of, and partners, in the management of indigenous biodiversity (NPS-IB, Policy 2). At the time of preparation of this report, no acknowledged taonga species have been identified with respect to this Project or are currently listed in the public domain.

3.1.4 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 vary 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 SEAs within 2 km of the Project area have been included in the desktop review, along with their connectivity to the Project area. This is to ensure that consideration has been given to significant habitats present within the wider landscape and can be used to inform the presence of potential flora and fauna within each of the Project areas, and also whether the Project ZOI extends out to these SEAs. This was repeated for several other ecological aspects, as summarised in Table 3-1.

The ZOI of the Project on various species differs depending on how those species uses their environment. For example, mobile species such as native 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.

Table 3-1: Summary of the various ZOI's utilised as part of this assessment.

Zoi	Extent	Description	Applicable Section
Significant Ecological Areas (SEA)	2 km	Identify remaining indigenous habitat (classified and mapped as SEA) within relatively close proximity to the site, as native fauna may utilise these habitats	4.2.1
Current Ecosystem Extent	2 km	Identify other mapped and described terrestrial vegetation types within relatively close proximity to the site, as native fauna may utilise these habitats	4.2.1
Department of Conservation (DOC) bat records	10 km	This extent is indicative of typical movement patterns of bats	4.2.2
Birds (various desktop datasets)	5 km	This extent is indicative of typical movement patterns of native birds utilising various habitat units.	4.2.3
Herpetofauna of the Auckland Region	10 km	This extent is indicative of typical movement patterns of native fauna utilising various habitat units.	4.2.3

3.1.5 Biodiversity Areas

Considering that the Project construction timeframe is between 15 to 20 years, updated assessments will be required for a Stage of Work. As such, specific ecological values, referred to as Biodiversity Area, should be revisited/reassessed in the future to determine whether species of value or if habitat of moderate or high value is still present.

A Biodiversity Area refers to an area or areas of ecological value where the Project ecologist has identified that the Project will potentially support moderate or higher values, or have a moderate or greater level of ecological effect, prior to implementation of impact management measures, as determined in accordance with the EIANZ guidelines. The maps presented in Appendix G details the Biodiversity Areas associated with the Project.

The Biodiversity Areas as mapped in Appendix G, was assigned on a precautionary basis, considering their potential future value (specifically to recently planted native habitats, which will mature in 15 years time) and/or their still remaining presence in the Project footprint in 20 years' time. Reassessment of the Biodiversity Area will be undertaken under the discretion of the Project ecologist.

3.2 Methodology

3.2.1 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 and SEAs, Section E15.4.2 of the AUP), and fauna habitats.

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

- Department of Conservation Bioweb records for herpetofauna and bats¹;
- Auckland Council herpetofauna records;
- iNaturalist records for herpetofauna and birds within approximately a 5 km radius from each NoR²;
- New Zealand Bird Atlas eBird database.³ Bird data is recorded in 10 km² grid squares. Squares AE69 and AF69 were accessed as these squares are positioned over the Project area; and
- NIWA's New Zealand Freshwater Fish Database⁴ 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 NoRs. Because of the highly mobile nature of most native fauna (particularly bats and birds) the desktop 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:

- Auckland Council Geomaps⁵;
- Department of Conservation Threat Classification Series⁶;
- Auckland Council conservation status reports for vascular plants (Simpkins *et al.*, 2022)⁷, bats (Woolly *et al.*, 2023)⁸, and reptiles (Melzer *et al.*, 2022)⁹;
- Retrolens historic aerial imagery¹⁰; and
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers *et al.*, 2017)¹¹.

Use was also made of reports (and associated collected data) Bioresearches has composed for previously assessed ecological values within the Project area (Bioresearches, 2022 and Bioresearches, 2023). The Stream Environmental Compensation Plan (Boffa Miskell, 2018) for the proposed Drury South Residential and Industrial Precincts were reviewed, as this references the future consented baseline ecological environment associated with that development.

3.2.2 Site investigations

3.2.2.1 Terrestrial habitats

A 'walk-through' method was undertaken on 17 October, 3 and 27 November 2023 to select private properties (where site access was granted) and publicly accessible areas, to verify and inform the desktop review and identify any other potentially significant values not identified from the review. Limited and delayed access reduced capacity to undertake full fauna surveys.

During site assessments, the state and type of the vegetation and habitats present within the NoR, and any notable species present were recorded. Contextual photographs were taken to inform analysis. Potential fauna habitats for indigenous lizards, bats and birds were assessed qualitatively.

¹ <https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/>

² GPS coordinates are 'obscured' for Threatened species which may affect the accuracy of records within the study area;

³ <https://ebird.org/newzealand/home>

⁴ <https://nzffdms.niwa.co.nz/>

⁵ <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>

⁶ All Department of Conservation Threat Classification Documents are listed in the below webpage. When individual reports are referenced hereafter, they are referenced in-text.

<https://www.doc.govt.nz/aboutus/science-publications/conservation-publications/nz-threat-classification-system/>

⁷ <https://knowledgeauckland.org.nz/media/egzhyd1g/tr2022-19-conservation-status-of-vascular-plant-species-in-auckland.pdf>

⁸ <https://knowledgeauckland.org.nz/media/2592/tr2023-04-conservation-status-of-bat-species-in-auckland.pdf>

⁹ <https://knowledgeauckland.org.nz/media/2324/tr2022-03-conservation-status-reptile-species-auckland.pdf>

¹⁰ <https://retrolens.co.nz/>

¹¹ <https://knowledgeauckland.org.nz/media/1399/indigenous-terrestrial-and-wetland-ecosystems-of-auckland-web-print-mar-2017.pdf>

3.2.2.2 Ecological value of an area, based on the Ecological Impact Assessment Guidelines from NZTA.

The ecological value of an area is determined by the value of species, communities and habitats found there and the area's contribution to the maintenance of indigenous biodiversity. The professional judgement of the ecologist is to be used when applying the EIANZ criteria (Appendix A) and assigning the final overall ecological value. Justification of how ecological value is assigned is provided in each section (throughout various subsections in Sections 5 to 8).

Table 0-1 in Appendix A1 details the justification of how ecological value was assigned, utilising the EIANZ guidelines but also includes recommendations from the Waka Kotahi Ecological Impact Assessment Guidelines.

3.2.2.3 Ecological value of a species, based on the Ecological Impact Assessment Guidelines from NZTA.

Where species are being considered in isolation, an accepted method for assessing and assigning ecological value is by considering their threat classification. The New Zealand Threat Classification System (NZTCS) is a key tool for identifying threatened species and for use in assigning a rating to indicate ecological value. While EIANZ provides guidance on assigning value depending on threat status, this is not rigid and EclA requires the ecologist to apply their experience and knowledge of the specific circumstances before assigning value to a species. Table 0-2 in Appendix A1 details the justification of how ecological values were assigned, utilising the EIANZ guidelines but also including recommendations from the Waka Kotahi Ecological Impact Assessment Guidelines

3.2.2.4 Freshwater habitats

Although freshwater habitats are considered a Regional Plan matter, baseline freshwater conditions (with limited field verification) are presented in this report. Should regional resource consents be required, these will be separately sought, and at this time, more detailed surveys will likely be required.

Site assessments were undertaken on 17 October 2023, 3 and 27 November 2023 by qualified freshwater ecologists. During the site visits to accessible properties, the presence and extent of wetlands, streams and other freshwater habitats within public accessible areas and permitted access private properties within the Project area were noted and the quality of any freshwater habitat was visually assessed as described below.

3.2.2.4.1 Streams

Overland flow paths were ground-truthed and classified under the definitions in the AUP as to their permanent, intermittent or ephemeral status (Table 3-2). In addition, these watercourses were assessed as to whether they were natural or artificial, in accordance with AUP definitions, using information from both the desktop review and site visit.

Stream Ecological Valuation (SEV) assessments were not undertaken but are expected to be included during the regional resource consenting phase. Macroinvertebrate and fish surveys were not undertaken as part of this assessment, however, NZ Freshwater Fish Database records were used to inform the potential ecological value of streams. Where access was restricted, stream assessments were based solely on desktop information.

Table 3-2: AUP criteria for permanent, intermittent rivers and streams and ephemeral streams¹²

Criteria	Definition
Permanent Stream	
1	The continually flowing reaches of any river or stream, but excludes ephemeral reaches
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

¹² Table reproduced from: <https://content.aucklanddesignmanual.co.nz/regulations/practice-notes/Documents/RC%203.3.17%20Stream%20Classification.pdf>

Criteria	Definition
5	Organic debris from flooding present on floodplain
6	Evidence of substrate sorting, including scour and deposition
*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.	

The 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)¹³ was used for streams. A copy of the scoring sheet used for completing RHAs is provided in Appendix D.

3.2.2.4.2 Wetland habitats

Potential wetland areas were assessed following the Ministry for the Environment's (MfE) wetland delineation protocols¹⁴, including vegetation assessments and wetland hydrology to determine whether the areas meet the definition of a 'natural inland wetland' under the NPS-FM. Assessments were carried out within the Auckland region's 'growing season'¹⁵.

Vegetation was assessed in accordance with the relevant MfE protocol¹⁶; 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 but usually occurs in uplands; and
- Upland (UPL) – rarely a hydrophyte, almost always in uplands.

Where the dominance and/or prevalence tests showed unclear results the 'FAC neutral' test was used, and if necessary, hydric soils and hydrology tests were undertaken in accordance with the associated protocols (Fraser *et al.* (2018) and MfE (2021))¹⁷

If the area met the definition of a natural inland 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.

¹³ Clapcott J 2015. National rapid habitat assessment protocol development for streams and rivers. Prepared for Northland Regional Council. Cawthron Report No. 2649.

¹⁴ Ministry for the Environment (2020). *Wetland Delineation Protocols*. Wellington: Ministry for the Environment.

¹⁵ Ministry for the Environment (2021). *Wetland delineation hydrology tool for Aotearoa New Zealand*. Wellington: Ministry for the Environment.

¹⁶ Clarkson, B. (2013). *A vegetation tool for wetland delineation in New Zealand*. Prepared for Meridian Energy Limited. Hamilton: Manaaki Whenua Landcare Research.

¹⁷ Fraser S, Singleton P, Clarkson B. (2018). Hydric soils – field identification guide. Manaaki Whenua – Landcare Research Contract Report LC3233 for Tasman District Council.

3.2.2.4.3 Freshwater naming conventions

Streams were named either by their proper names (e.g. Hingaia Stream or Ngaakooroa Stream) or, if not formally named, as a Tributary of the main watercourse they formed a part of (e.g., Hingaia Stream Tributary). If multiple tributaries of the same watercourse were identified, these were denoted with 'A', 'B', 'C' etc. (e.g., Hingaia Stream Tributary A; Hingaia Stream Tributary B etc.).

3.2.2.5 Fauna

The assessments generally relied on desktop reviews (Section 3.2.1 above) and qualitative habitat assessments from walk throughs of the Project area. Due to limited and delayed site access, no specific fauna surveys were undertaken, however a bat recorder was set on the edge of a Significant Ecological Area at NoR 2 and 4, over a three week period. Incidental bird sightings were noted during the site visits.

3.2.3 Ecological Impact Assessment methodology

Details of the ecological impact assessment methodology, are in Appendix A, Tables Table 0-6 and Table 0-7 for the EIANZ EclA guidelines, and Appendix A3 for the NZTA's ecological impact assessment guidelines. Both sets of guidelines were consulted for the ecological effects assessments.

3.3 Statutory context

3.3.1 Notice of Requirement – District Plan requirements

This assessment has been prepared to support the AEE and NoR process. If confirmed, the designations will authorise the District Plan land use components of the Project. Accordingly, when assessing the actual or potential effects on the environment of allowing the requirement in terms of Section 171 of the RMA, this assessment has been limited to matters that would trigger a District Plan consent requirement. Where regional consenting requirements are triggered, these will not be authorised by the designation, and will require further regional consents.

In order to demonstrate the split between Regional and District Plan matters (under either the Regional or District provisions of the AUP) they have been listed in tables and plotted on site plans in **Appendix B** of this Report. The tables and site plans assist to identify the potential effects of the construction of the Project, and whether these are Regional Plan or District Plan matters under the AUP.

3.3.2 Future regional resource consents

No regional resource consents are currently being sought for the Project. These will be sought at a later date, before construction commences, which is expected to take place within 15-20 years. Although regional consents are not being sought at this time, ecological effects arising in respect of activities that require regional consents have been considered as part of this assessment to inform design, and the proposed designation footprint. While ecological effects in respect of regional consent matters have been considered for these limited purposes, a detailed assessment of Regional Plan matters is not proposed to be undertaken at this NoR phase.

3.4 Adherence of this assessment to NZTA’s organisational direction on biodiversity

NZTA policy directs the responsible management of the land transport system’s interaction with people, places and the environment. For biodiversity, this is communicated through various means as shown in Table 3-3. The EclA is a key tool to enable projects to adhere to NZTA organisational direction on biodiversity.

Table 3-3 NZTA programmes, standards, guidelines and processes relevant to ecological impact assessment, and how this assessment adheres to these directions.

NZTA direction	Description	Adherence of this assessment
Environmental and social responsibility policy	<p>The Environmental and social responsibility policy (ESR) helps set out how NZTA will operate in ways that reflect the statutory operating principles of the Land Transport Management Act of social and environmental responsibility.</p> <p>NZTA commits to protecting and enhancing the natural environment, including health, integrity and connectivity of biodiversity, inclusive of ecosystems, indigenous species and their habitats.</p>	<p>As detailed in Section 9.1, NZTA projects can potentially offer opportunities or undertake works to support national indigenous biodiversity strategic outcomes and contribute to national targets. Degraded areas and/or depauperate biodiversity areas especially provide opportunities for NZTA to enhance biodiversity and align with regional and local priorities.</p> <p>Positive terrestrial ecology effects could be achieved through mitigation of effects, enhancement or restoration (by means of native vegetation planting) of terrestrial and wetland habitats where ecological integrity is currently compromised through weed infestation and / or limited connectivity. This will provide suitable habitat and foraging for native faunal species.</p> <p>Avoidance of high values terrestrial habitats (such as SEA’s – refer to Section 4.2.1).</p>
Toitū te Taiao – Our Sustainability Action Plan	<p>Toitū te Taiao supports Arataki, the NZTA long-term plan for the land transport system. Toitū te Taiao responds to four big challenges, one of which is to reduce adverse effects of land transport on biodiversity (and water quality). The long-term outcomes (to 2050) include managing the transport network to support and enhance indigenous biodiversity.</p>	<p>Adverse effects to terrestrial habitats are avoided through the specific avoidance of an SEA within the Project area. Additionally, with the implementation of the recommended mitigation and maintenance measures (specifically those listed in Section 9.3) long-term residual effects will also be mitigated.</p> <p>Revegetation of roadside areas with suitable native vegetation species (Section 9.1) will support and enhance indigenous biodiversity within the Project area.</p>

NZTA direction	Description	Adherence of this assessment
State highway environmental plan: improving environmental sustainability and public health in New Zealand	<p>The Environmental Plan (2008) sets out the strategic environmental vision for state highways. While it was prepared prior to some key statutory changes; the plan still provides strong direction on biodiversity. Its three objectives for ecological resources are:</p> <ul style="list-style-type: none"> • Objective E1: Promote biodiversity on the state highway network. • Objective E2: No net loss of native vegetation, wetlands, critical habitat for endangered species. • Objective E3: Limit spread of pest plants. 	<p>Revegetation of roadside areas with suitable native vegetation species (Section 9.1) will support and enhance indigenous biodiversity within the Project area.</p> <p>No loss of high value indigenous vegetation (avoidance of an SEA within the Project area). In the event of native vegetation removal, suitable replacement planting within the Project area is recommended. Note that this report does not address any effects to freshwater ecosystems (such as wetlands).</p>
Z/19 Taumata Taiao – Environmental and Sustainability Standard	<p>The purpose of Taumata Taiao is to give effect to the legal obligations of NZTA and our Environmental and Social Responsibility Policy by ensuring that environmental matters (including biodiversity) are considered early and consistently throughout the lifecycle of a project. Taumata Taiao explains how and where to implement the NZTA environmental and sustainability requirements.</p>	<p>Not applicable - Not within the scope of this ecological assessment.</p>
Land Transport Benefits Framework	<p>When considering suitable benefits and measures for an investment (section 1.4.1), how the project can support NZTA biodiversity objectives and national strategic outcomes need to be considered, particularly where there could be co benefits for biodiversity, climate change and human wellbeing (section 3.3).</p>	<p>As listed above.</p>
Sustainability Rating Scheme Policy	<p>NZTA requires new projects over \$15 million to consider the merits of undertaking an Infrastructure Sustainability Council (ISC) rating and those over \$100 million are required to undertake an ISC rating. Infrastructure sustainability rating schemes provide a consistent method of driving, measuring, and recognising sustainability performance and outcomes across a range of sustainability areas (environmental, social, governance, economic). The ISC rating scheme includes credits to drive improved ecological and biodiversity outcomes.</p>	<p>Not applicable - Not within the scope of this ecological assessment.</p>

3.5 Limitations of the assessment

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

- Site investigations on private property required obtaining permission from the landowners beforehand, as a result access was not available for all locations, and where available, access was achieved relatively late within the study timeframe. This was a limitation for the infield assessment and verification component of this study. As a result, limited ecological features were assessed infield. Features assessed at a desktop level, or from the roadside or other vantage points are identified throughout the report.
- Formal fauna surveys (herpetofauna, avifauna, bats) were not undertaken due to restricted and delayed access to largely private land, however one bat recorder was installed over a three-week period near the SEA at NoR 2 & 4, Section 4 (SEA_T_4513). Potential fauna habitat assessments relied largely on desktop records, vegetation cover and inferences from habitat types identified.
- Stream Ecological Valuation (SEV) assessments were not undertaken but are expected to be included during the regional resource consenting phase. Macroinvertebrate and fish surveys will also need to be included during the regional consenting phase.
- Detailed wetland delineations according to the wetland delineation protocols (MfE, 2022) were not undertaken. The assessment focused on identifying the presence of wetlands within and adjacent to the designation. This was undertaken primarily at a desktop level (note - access restrictions prevent infield investigations of most of the wetlands likely to occur within the Project area), and through the use of the MfE rapid assessment. A detailed wetland assessment will need to be undertaken during the regional resource consenting phase.
- The desktop and infield mapped features compiled during the project were digitized as an individual polygon, point, or line feature. These features were used to guide the identification of likely ecological effects. Most of these mapped features were identified at a desktop level and therefore still need to be ground-truthed to confirm both the feature and the extent. Detailed mapping of ecological features will need to be undertaken during the regional resource consenting phase.
- Contributing to the development of a detailed design for each NoR, which included updating the required designation and the realignment or redesign of associated features, was a fluid process. Changes and improvements to accommodate findings from not only an ecological perspective, but a range of specialist assessments, were undertaken in collaboration with the project team. As such, changes to limit impacts on ecological features in the landscape were made prior to this report being finalised. These measures to avoid or reduce ecological effects were documented. However, some of the more subtle changes may have been omitted.

4 AREA WIDE ECOLOGICAL DESKTOP REVIEW – ALL NOR’S

This section presents the results of a comprehensive desktop study conducted across the entire area. The study includes habitats and species, referred to as "ecological features," found within the Zone of Influence (ZOI) of each NoR. Specific ecological baseline for each NOR have been stipulated in the 'Existing Environment' subsection for each NoR.

4.1 Historical ecological context

The Project is located within the Manukau Ecological District, which includes the Manukau Harbour and the low-lying land that lies between the harbour 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, 3% of the Manukau Ecological District remained in indigenous cover (Lindsay *et al.* 2009), with only 2% kauri, podocarp and broadleaved forest; 4% of coastal forest; and 0.4% of indigenous freshwater wetland remaining. Such a reduction in indigenous canopy cover is considered severe (Walker *et al.*, 2008). Most of the remaining native vegetation in the Project area is now limited to isolated SEAs, relatively small exotic plantations, and occasional hedgerows or other non-native growth along road corridors or riparian margins (with limited native vegetation).

4.2 Terrestrial habitat and fauna

4.2.1 Terrestrial habitat

The remaining high value indigenous habitat within Auckland has mostly been classified and mapped as a terrestrial or marine SEAs under the AUP. There are forty terrestrial SEAs present within 2 km of the Project area, as presented in Table 0-13 (**Appendix E**) and shown in Figure 4-1 below; with two SEAs present within the Project footprint, (SEA_T_5280 at NoR 5 and SEA_T_4513 at NoR 2 & 4, Section 4). Both SEAs are expected be avoided by the designation through design and construction.

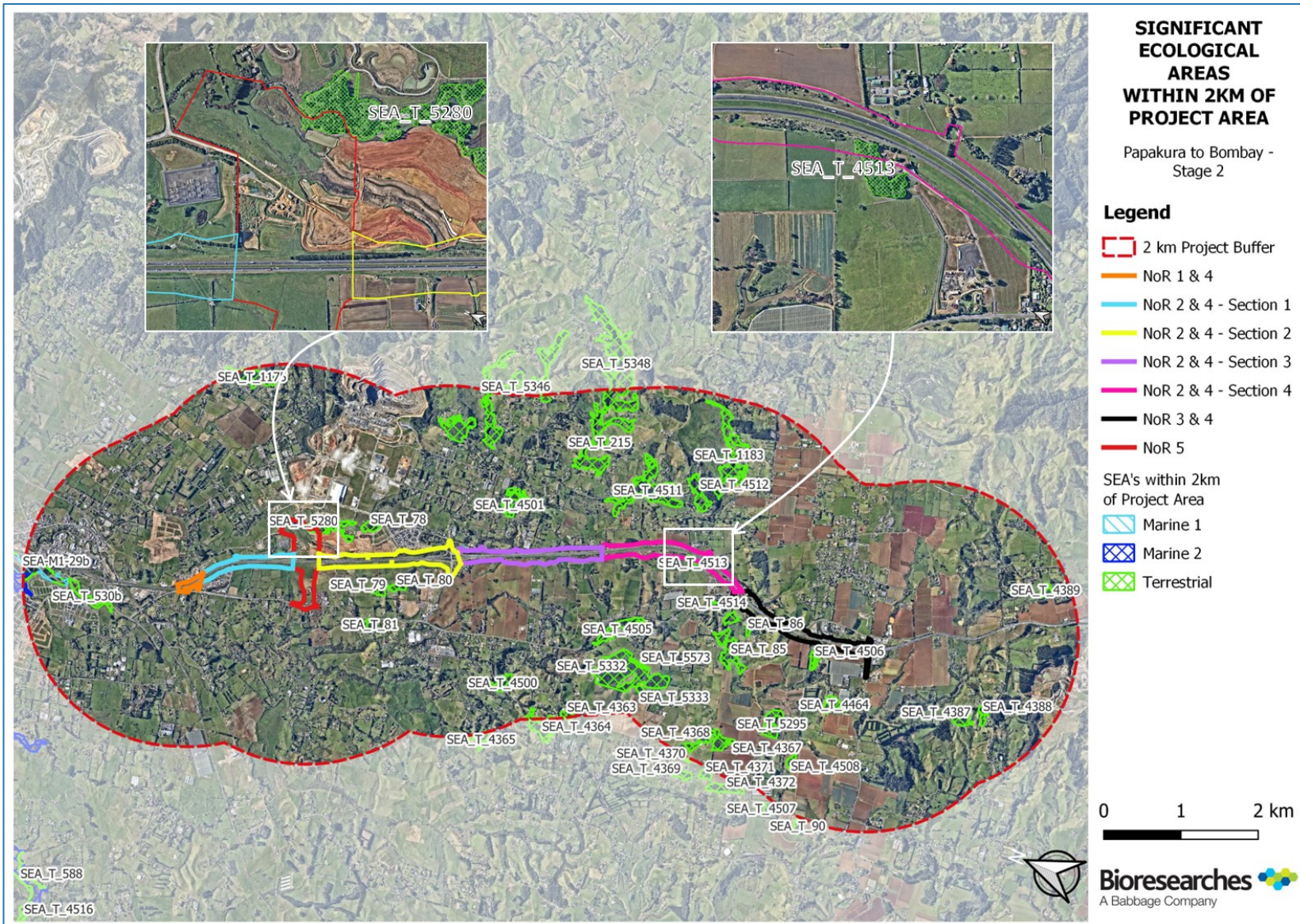


Figure 4-1 Significant Ecological Areas illustrated within 2 km of the Project area.

Additional to the identified SEAs, the AUP has mapped and described other terrestrial vegetation types as shown in

Table 4-1. This provides a description of the terrestrial vegetation varieties within the Project area, based on the 'Current Ecosystem Extent' layer of AUP. It also indicates which of these ecosystems intersect with the Project area footprint. The mapping of these ecosystem extents can be found in Figure 4-2.

Exotic grassland habitat (as defined in the table below) encountered as part of this Project is of Negligible ecological value. Since these areas are grazed or mown frequently enough that they are not expected to provide habitat for copper skink or as foraging habitat by pipit (At Risk – Declining), and therefore is not assessed or considered further in this report.

Table 4-1: Description of the terrestrial vegetation types, as per Singers *et al.* (2017) present within the Project area.

Habitat	Classification	Description of Habitat	NoR intersected
Exotic grassland	EG	Grassland dominated by exotic species. This includes pasture, garden lawns and sport pitches	-
Exotic Forest	EF.1	>50% native understorey and/or groundcover biomass, with dominant exotic canopy.	-
	EF.2	<50% native understorey and/or groundcover biomass, with dominant exotic canopy.	-
Exotic scrub	ES	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species.	-
Planted vegetation	P.1	Planted native scrub and forest <20 years old or wetland <10 years old.	-
	P.2	Planted native scrub and forest >20 years old or wetland >10 years old.	-
	P.3	Native and/or amenity plantings.	-
Open water	OW	-	NoR 5
Treeland	TL.1	Native-dominated: >75% native tree cover. For the purposes of mapping, this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopies of mature trees within gardens, farms and amenity areas.	-
	TL.2	Mixed native/exotic: with 25-75% native tree cover For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms, and amenity areas.	-
	TL.3	Exotic-dominated: <25% native with exotic tree cover Dominant For the purposes of mapping this includes planted and wilding exotic vegetation and mature shelterbelts. This includes mature riparian vegetation and scattered or discontinuous canopy of mature trees within gardens, farms, and amenity areas.	-
Unclassified	UC	-	NoR 2 and 4 – Section 4, NoR 3
Kahikatea forest	MF4	Mostly remnant Kahikatea swamp forest constrained to SEA_T_5280.	NoR 5
Kānuka scrub/forest	VS2	Kānuka-dominated forest with insufficient emergent secondary species to determine trajectory to mature forest type. Occurs on hillslopes, ridges, terraces, and plains especially on free-draining soils. Species include kānuka (<i>Kunzea robusta</i>), <i>Coprosma</i> spp. and <i>Pittosporum</i> spp	-
Pūriri forest	WF7	Remnant/regenerating pūriri, tōtara forest. Occurs on recent alluvial terraces and floodplain/river valleys. Secondary successions dominated by podocarp trees, notably totara.	NoR 2 and 4 – Section 4

Habitat	Classification	Description of Habitat	NoR intersected
Kahikatea, pukatea forest	WF8	Dominated by podocarp–broadleaved forest, with emergent trees or a canopy of kahikatea and pukatea, and locally, rimu.	NoR 5
Taraire, tawa, podocarp forest	WF9	Characterised by large emergent rimu and northern rātā, with kahikatea in gullies emerging over a broadleaved canopy of abundant taraire and kohekohe. Occurs over a variety of topographies, with shallow to steep hill-slopes interspersed with ridges.	-
Kauri, podocarp, broadleaved forest	WF11	Mostly constrained to specific SEAs, but some remnant patches present outside of SEAs. Exotic species present on canopy margins and understory. Absence or few kauri is present in remnant patches. Broadleaved species and kahikatea common in the gullies. Generally, only the gully component of this ecosystem type remains, with few kauri.	-

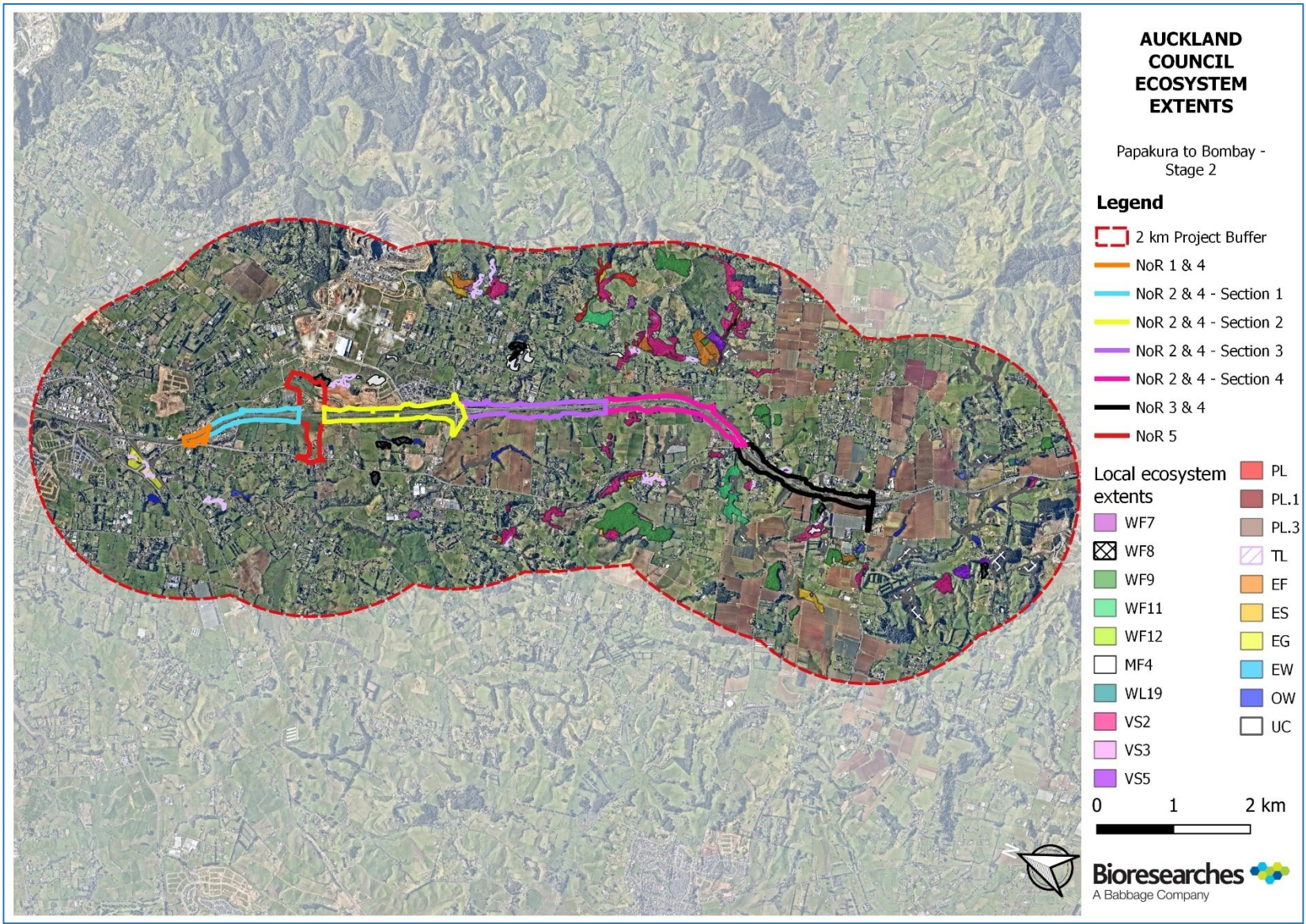


Figure 4-2: Mapped ecosystem current extents within 2 km of the Project areas, as per Auckland Council.

4.2.2 Bats (pekapeka)

NZTA's bat framework (Smith *et al.*, 2017) recommends that bats should be surveyed where they have been detected within several home range spans of a project. Site access limitations (Section 3.4) limited the scope of this study, however one bat recorder was set for three weeks within NoR 2 & 4, Section 4, however this survey¹⁸ did not detect any bats.

The Department of Conservation (DOC) records for native bats were reviewed, as well as previous studies of the SH1 southern Corridor. A total of 106 survey datapoints within a 10 km radius of the Project, were identified (Figure 4-3). The findings indicate:

- A total of 24 records of long-tailed bat (*Chalinolobus tuberculatus*; Threatened - Nationally Critical¹⁹) present within 10 km of the Project area (DOC bat database), of which two records were identified within 5 km of the Project area (3.2 km north of NoR 2 and 4 – Section 1; and 4.3 km east of NoR 5); and
- No bat species were detected in the remaining 82 records.

A bat survey (20 nights, November-December, two recorders) for the Papakura to Drury South Stage 1B2 Project was undertaken in 2019, focusing on Otūwairoa Creek and Ngaakooroa Stream crossings, approximately 1.5 km north of the current Project area. That survey did not detect bats.

The closest records of short-tailed bats (*Mystacina tuberculata*), which are another bat species found in New Zealand, are located in Thames, approximately 60 km southeast of the project area. Unlike long-tailed bats, short-tailed bats have more specialized habitat requirements, necessitating mature forests with minimal introduced predators. They are also less mobile. Therefore, it is unlikely that short-tailed bats are present within the Project area.

The existing environment within the Project area is predominantly associated with open pasture or other agricultural land, with scattered areas of weedy scrub, hedgerows and fragments of exotic and native vegetation. The open space pasture, watercourses and wetlands may support commuting and foraging by bats that have been recorded in the wider landscape, particularly to the south-west of the Project area. However, there is uncertainty of bat activity taking place alongside the existing SH1 associated with the Project area. Potential bat roosting habitats are linked to larger trees and forest fragments, especially where they maintain some linear connectivity, such as along watercourses, wetlands or edges of contiguous vegetation beyond the NoR. The significance of such vegetation as potential roosting habitats is uncertain, given their proximity to existing disturbances such as noise, light and vibrations associated with traffic on SH1 and the expanding urban edge of Auckland. However, if these trees are indeed used by bats for roosting, they should be considered as very high value due to the scarcity of canopy cover in the surrounding landscape.

As such, it is recommended that additional bat surveys be undertaken to enhance the understanding of potential bat habitat within the Project Area and potential effects to these habitats, for which a Bat Management Plan (BMP) must be compiled. Use should be made of NZTA's bat framework developed by Smith *et al.* (2017) to inform the BMP.

Likely activities recommended by the BMP will involve conducting targeted surveys of bat habitat along the Project Area before construction is commenced, positioning compounds and laydown areas to steer clear of bat habitat, designing lighting systems to minimise light levels and minimise light spill from construction areas, and enforcing restrictions on night works in proximity to bat habitats. Considering that there may be a time lag between when the construction occurs and when its full ecological effects are detectable on bat communities, ongoing monitoring may also be recommended.

¹⁸ Bat survey from 3 November to 26 November 2023, with 10 valid survey nights (others had to be excluded due to temperatures below 10°C, and a single night needed to be excluded due to a full moon).

¹⁹ Threat classification from O'Donnell *et al.* (2017).

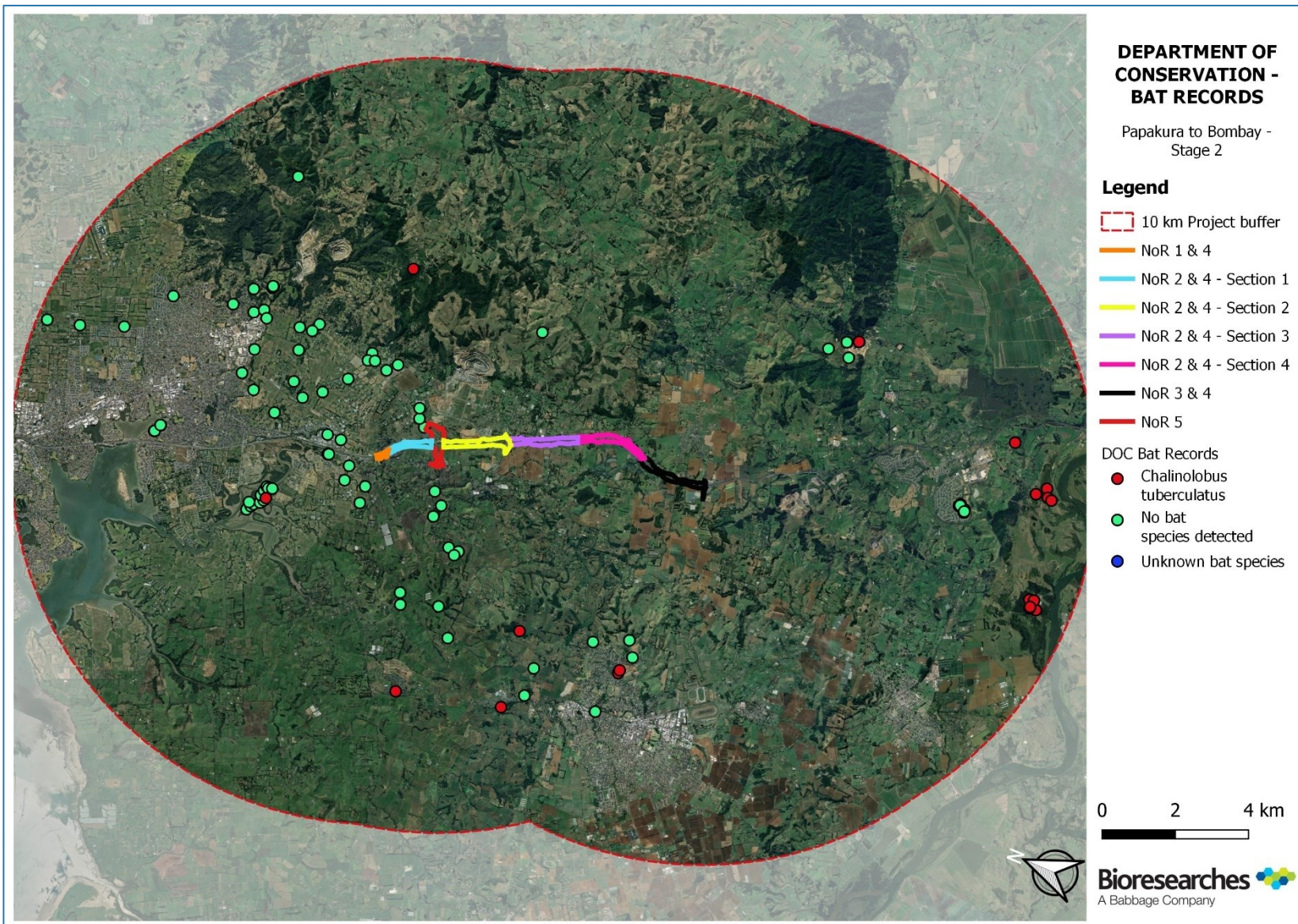


Figure 4-3: Records of Bats within 10 km of the Project area.

4.2.3 Native Birds

The desktop review of records from iNaturalist and eBird indicate that 39 native bird species are present within 5 km of the Project area, or within relevant grid squares of the New Zealand bird atlas. These desktop data have been collated in Table 0-10 (**Appendix C**). This includes 19 Threatened or At-Risk (TAR) species, of which the majority are coastal species. Numerous records of common or widespread native species lack precise location information, and therefore no maps were generated from these data.

The Project area supports nesting, roosting and foraging habitat that would be expected to be used by a range of common native bird species (including passerines, herons, waterfowl) in the form of native and exotic trees, shelterbelts, regenerating scrub rough grasses, waterbodies and open pasture. These species may either establish permanent residence in these potential habitats, like fantails and grey warblers, or use them intermittently, as is the case with kererū and tūī, which have larger home ranges. Being in close proximity to the existing motorway, the Project area generally lacks high value habitat for TAR bird species as identified in Table 0-11 of **Appendix C**, which are largely coastal or require well vegetated aquatic (ponds and lakes) or wetland features for foraging, roosting and nesting. Potential exceptions to this include the following species:

New Zealand pipit (*Anthus novaeseelandiae*, At Risk), is commonly found in rugged, open environments like rough pastures, akin to certain areas within the Project area. Pipits are considered to have likely benefitted from the forest clearance and have been recorded throughout the Auckland Region where similar, highly modified (rough, open pastures) are common. Nesting habitat is ground based, typically under grass or tussock clumps, within ferns where they are fully covered by vegetation. Such environments have the potential to be found throughout the Project area.

Grey Ducks (*Anas superciliosa*) and **New Zealand dabchicks** (*Poliocephalus rufopectus*), both of which are Threatened species, may use ponds for foraging, roosting or breeding. Small freshwater ponds are present within the Project area and have some potential to be used by these species, although but most are of degraded quality (e.g., small size, lack of vegetative cover).

Spotless crane (*Zapornia tabuensis*, At Risk) inhabit wetland areas dominated by dense emergent vegetation, particularly raupō. Most of the wetland sites within the Project area are degraded and would not support suitable, stable habitat for this species. However, one Raupō Wetland (WL19), within NoR 3 & 4 supports such characteristics (Table 7-7), although it occurs within a highly modified landscape at close proximity to the existing motorway and is therefore unlikely to support this species on any regular basis, if at all.

Overall, the habitat quality for the common native birds is low, due largely to the high level of edge effects that are likely experienced within narrow bands of vegetation, particularly alongside a high-traffic motorway, such as SH1. Some nesting or roosting may occur where planted trees are also protected on one side by solid fences that mark property boundaries. Freshwater ponds and wetlands may provide habitat for TAR wetland bird species, but these habitats are relatively small, and these species are unlikely to be present. The assessment outcome concluded that overall, habitat quality within the Stage 2 of the P2B project area for native birds is **very low**.

4.2.4 Herpetofauna

The indigenous herpetofauna of the Auckland Region includes 18 terrestrial taxa, of which 12 occur on the region's mainland (c.f. islands). A further four introduced species are also known to occur in the region (van Winkel *et al.*, 2018). These species are listed in Table 4-2, which also lists the species recorded within 10 km of the Project during the DOC Bioweb database review. This includes three native skink species.

Survey effort of the SH1 southern corridor (2016-2019), immediately north of the Project area, has not recorded copper skinks. This includes extensive pre-clearance surveys and destructive searches along similar adjacent areas for the Southern Corridor Improvements Project, including planted bunds and below hedge rows (Bioresarches 2016 a, b, c). Similarly, no native lizards were recorded from a skink survey (32 artificial retreat locations) to inform the Papakura to Drury South Stage 1B2 Project.

Copper skink (At Risk – Declining) is widespread throughout the Auckland Region and is frequently recorded within highly modified habitats such as exotic scrub and rank grassland, including urban environments. No records for native species occur within the Project area, however, plague skink was recorded approximately 230 m east of NoR 2 and 4 – Section 1 and 2, and NoR 5, and copper skink within 910 m of NoR 2 and 4 – Section 2. Copper skinks may be present in other NoRs if suitable vegetation is present.

In accordance with EIANZ guidelines, any species with a threat status of At Risk – Declining or threatened is considered to have high ecological value.

Table 4-2: Terrestrial herpetofauna of the Auckland region, corresponding NZ conservation statuses and reported occurrence within 10 km of the Project area.

	Common name	Species name	NZ threat status*	Habitat potentially present**	Reported within 10 km of Project
Indigenous	<i>Woodworthia korowai</i>	Korowai gecko	Nationally Critical		
	<i>Mokopirirakau granulatus</i>	Forest gecko	At Risk – Declining	✓	
	<i>Naultinus elegans</i>	Elegant gecko	At Risk – Declining	✓	✓
	<i>Dactylocnemis pacificus</i>	Pacific gecko	At Risk – Relict	✓	
	<i>Woodworthia maculata</i>	Raukawa gecko	Not Threatened		
	<i>Oligosoma ornatum</i>	Ornate skink	At Risk – Declining	✓	✓
	<i>Oligosoma striatum</i>	Striped skink	At Risk – Declining		
	<i>Oligosoma moco</i>	Moko skink	At Risk – Relict		
	<i>Oligosoma smithi</i>	Shore skink	At Risk – Naturally Uncommon		
	<i>Oligosoma aff. smithi</i>	Tatahi skink	At Risk – Naturally Uncommon		
	<i>Oligosoma aeneum</i>	Copper skink	At Risk – Declining	✓	✓
	<i>Leiopelma hochstetteri</i>	Hochstetter's frog	At Risk – Declining		
	Introduced	<i>Lampropholis delicata</i>	Plague skink	Introduced & Naturalised	✓
<i>Ranoidea aurea</i>		Green and golden bell frog	Introduced & Naturalised	✓	✓
<i>Ranoidea raniformis</i>		Southern bell frog	Introduced & Naturalised	✓	✓
<i>Litoria ewingii</i>		Whistling tree frog	Introduced & Naturalised		

* Hitchmough *et al.*, 2021; Burns *et al.*, 2018

**To be confirmed for each NoR following site visits prior to construction.

4.3 Freshwater habitat

4.3.1 Streams

Auckland Council Geomaps 'Rivers and Permanent Streams' layer indicates that there are several streams which are intersected by, or flow immediately adjacent to the Project area. These are listed in Table 4-3, and illustrated in Figure 4-4 to Figure 4-10. Limited verification of the streams within the Project area were undertaken.

It must be noted that freshwater habitats, including streams, are recognized as a regional plan matter. While there was some field verification of streams associated with the Project Area, a significant portion of the baseline assessments in this report is based on desktop analysis. It is strongly recommended that a comprehensive site verification of streams be conducted as an integral component of the regional resource consent process. This will ultimately inform the layout and design considerations for the proposed development.

Fish surveys were not carried out during site investigations, however two 'At Risk – Declining' species, īnanga and/or longfin eel have been recorded in the catchments of the streams associated with the Project area (Table 4-4).

The freshwater habitats within the NoRs were assessed²⁰ for their potential to support indigenous fish during the RHA. Potential habitats such as undercut banks, overhanging vegetation and macrophytes were noted at the time of survey.

Table 4-3: Streams identified within the ZOI of the Project using Auckland Council Geomaps 'Rivers and Permanent Streams' layer.

Stream ²¹	Abbreviated stream name used to identify in Figure 4-4 to Figure 4-10	Applicable NoR
Hingaia Stream	HS	ZOI of NoR 1 and 4 NoR 5
Hingaia Stream Tributary A (also referred to as the 'Transpower Stream' (Boffa Miskell, 2018))	HS A	NoR 2 and 4 – Section 1
Hingaia Stream Tributary B	HS B	NoR 2 and 4 – Section 1
Hingaia Stream Tributary C	HS C	NoR 2 and 4 – Section 1, NoR 5
Hingaia Stream Tributary D (also referred to as the 'Harrison Stream' (Boffa Miskell, 2018))	HS D	NoR 5 NoR 2 and 4 – Section 2
Hingaia Stream Tributary E (also referred to as the 'Roslyn Stream' (Boffa Miskell, 2018))	HS E	NoR 5 NoR 2 and 4 – Section 2
Hingaia Stream Tributary F	HS F	ZOI of NoR 2 and 4 – Section 2
Hingaia Stream Tributary G	HS G	NoR 2 and 4 – Section 2
Hingaia Stream Tributary H	HS H	ZOI of NoR 2 and 4 – Section 3
Hingaia Stream Tributary I	HS I	NoR 2 and 4 – Section 3
Hingaia Stream Tributary J	HS J	NoR 2 and 4 – Section 3

²⁰ Based on those freshwater watercourses that could be accessed during October/November 2023.

²¹ Naming conventions for each stream or waterbody are described in Section 3.2.2.5.

Stream ²¹	Abbreviated stream name used to identify in Figure 4-4 to Figure 4-10	Applicable NoR
Hingaia Stream Tributary K	HS K	NoR 2 and 4 – Section 3
Hingaia Stream Tributary L	HS L	ZOI of NoR 2 and 4 – Section 3
Hingaia Stream Tributary M	HS M	NoR 2 and 4 – Section 4
Hingaia Stream Tributary N	HS N	NoR 2 and 4 – Section 4
Ngaakooroa Stream Tributary A	NS A	ZOI of NoR1 and 4 ZOI of NoR 2 and 4 – Section 1
Ngaakooroa Stream Tributary B	NS B	NoR 2 and 4 – Section 3
Ngaakooroa Stream Tributary C	NS C	NoR 3
Ngaakooroa Stream Tributary D	NS D	NoR 3
Ngaakooroa Stream Tributary E	NS E	ZOI of NoR 3
Ngaakooroa Stream Tributary F	NS F	NoR 3
Ngaakooroa Stream Tributary G	NS G	NoR 3
Ngaakooroa Stream Tributary H	NS H	ZOI of NoR 3

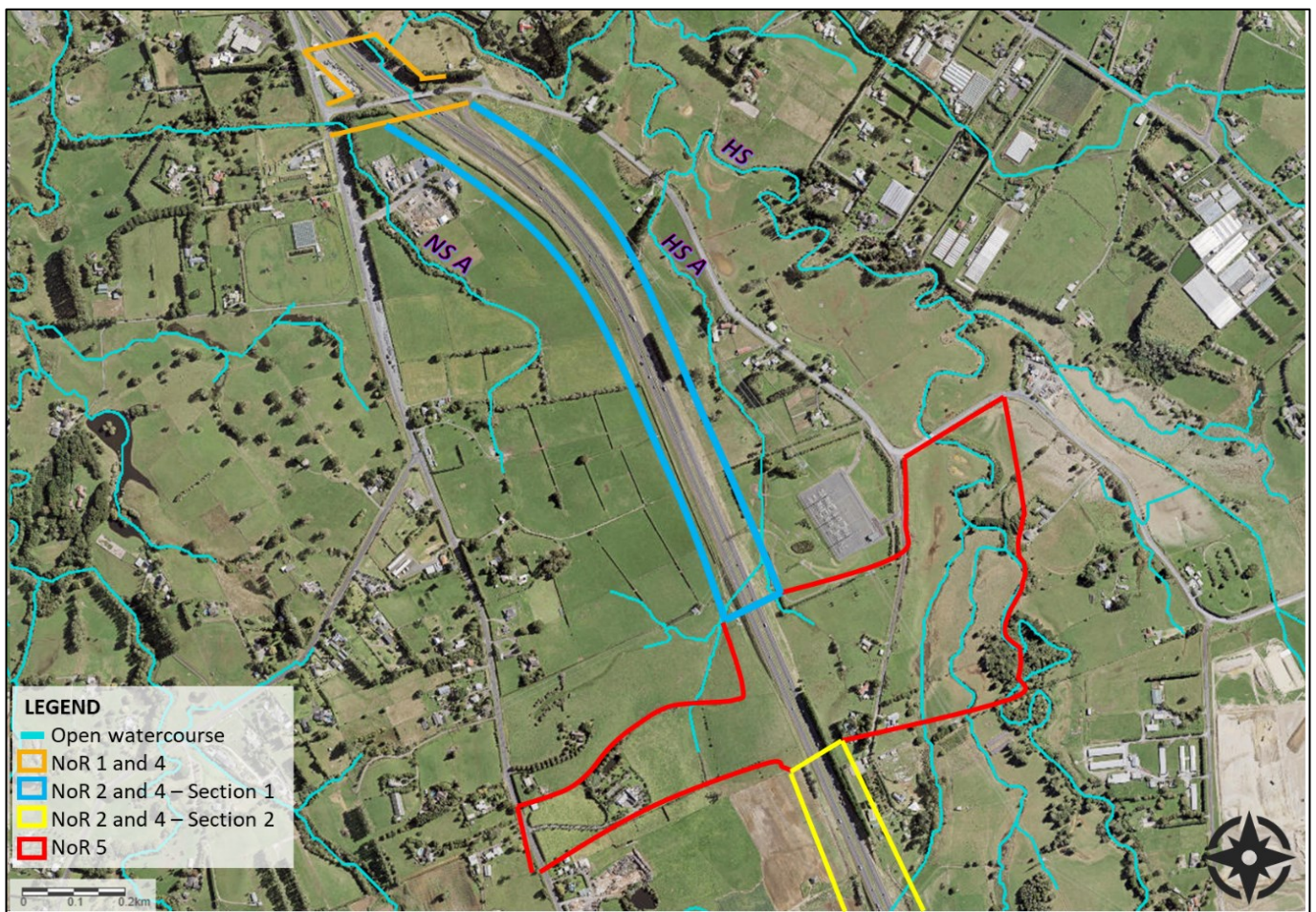


Figure 4-4: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 1 and NoR 5 of the Project.

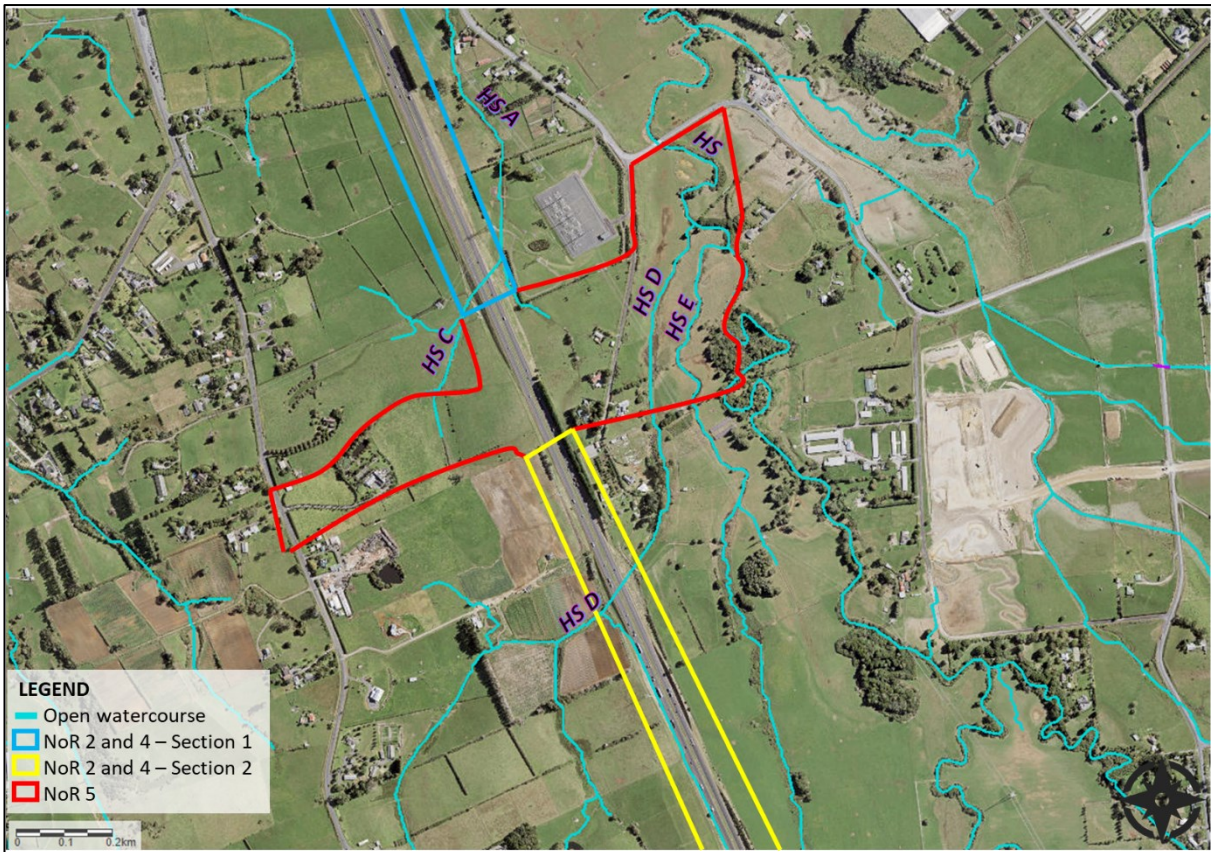


Figure 4-5: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 2 and 3, and NoR 5 of the Project.



Figure 4-6: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 2 of the Project.



Figure 4-7: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 2 and 3 of the Project.

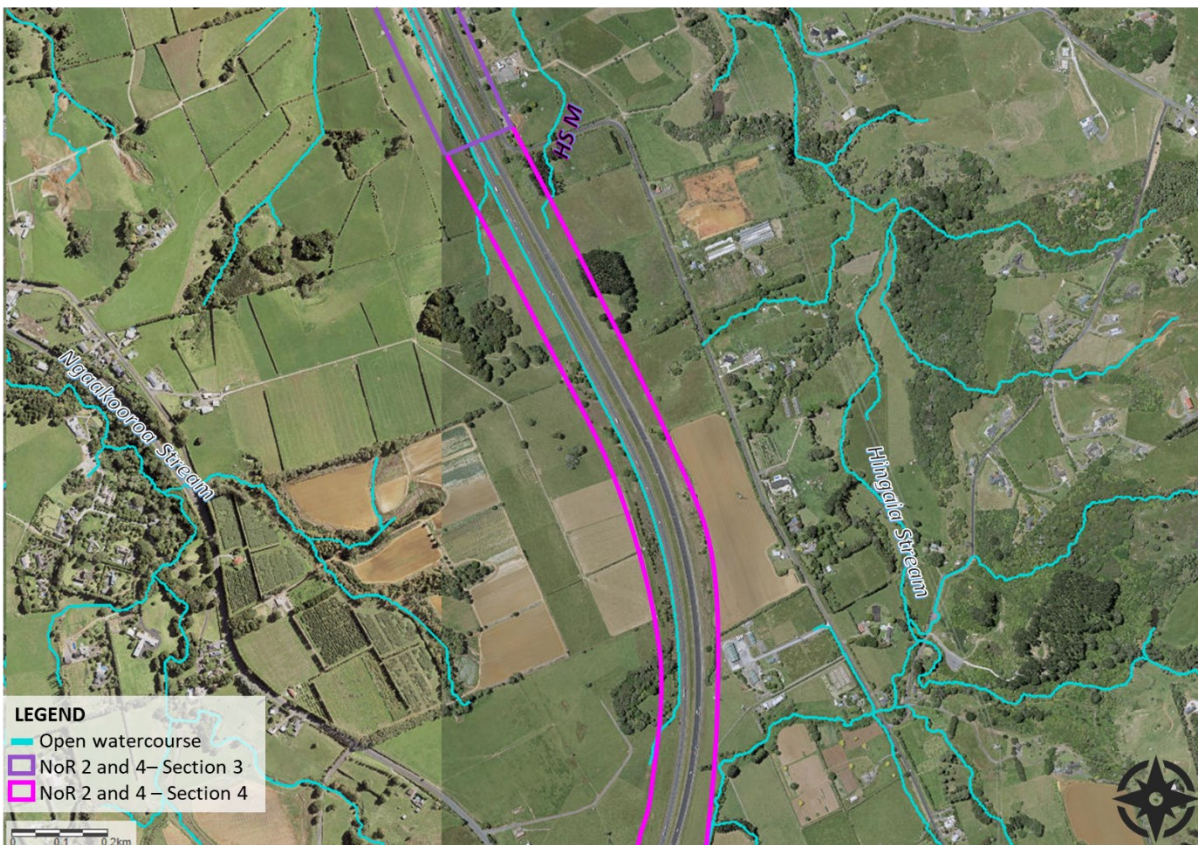


Figure 4-8: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 3 and 4 of the Project.



Figure 4-9: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 2 and 4 – Section 4 and NoR 3 and 4 of the Project.



Figure 4-10: Auckland Council Geomaps 'Rivers and Permanent Streams' layer, with approximate alignment location within the NoR 3 and 4 of the Project.

4.3.2 Fish

The NIWA freshwater fish database were reviewed for fish records within stream catchments affected by the Project area. Of the fish recorded, two species – īnanga (*Galaxias maculatus*) and longfin eel (*Anguilla dieffenbachii*), are classed as At Risk – Declining (Dunn *et al.*, 2017). The desktop review results are presented in Table 4-4.

Table 4-4: Freshwater fish recorded within streams present within the surrounding area of the Project.

Scientific Name	Common Name	Threat Classification	Applicable NoR and stream				
			Hingaia Stream, downstream/north of NoR 2 and 4 – Section 1	Tributary of Hingaia Stream, directly east of NoR 2 and 4 – Section 2	Hingaia Stream, directly east of NoR 2 and 4 – Section 4	Ngaakoeroa Stream west of NoR 2 and 4 – Section 4	Ngaakoeroa Stream west of NoR 3
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	x	x	x		x
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	x		x		
<i>Gobiomorphus basalis</i>	Cran's bully	Not Threatened	x				x
#* <i>Gambusia affinis</i>	mosquitofish	Introduced and Naturalised	x	x			
<i>Gobiomorphus cotidianus</i>	Common bully	Not Threatened	x				x
<i>Galaxias maculatus</i>	Īnanga	At Risk - Declining	x				x
<i>Galaxias fasciatus</i>	Banded kōkopu	Not Threatened					x
<i>Retropinna retropinna</i>	Common smelt	Not Threatened					x
#* <i>Ameiurus nebulosus</i>	Catfish	Introduced and Naturalised	x				
# <i>Ctenopharyngodon idella</i>	Grass carp	Not Assessed				x	
# <i>Hypophthalmichthys molitrix</i>	Silver carp	Not Assessed				x	
* <i>Cyprinus carpio</i>	Koi carp	Introduced and Naturalised					x

#exotic fish species, *pest fish species

4.4 Wetland habitat

There have been limited studies of wetland ecosystems within the general vicinity of the Project area. This is probably a consequence of extensive landscape modifications, notably historical drainage and reclamation efforts. The Auckland Council floodplain mapping and 'ecosystem potential extent' data set would suggest that the Hingaia Stream floodplains were once a swamp / floodplain vegetated with kahikatea, pukatea forest and taraire, tawa, podocarp forest (WF8 and WF9), and the floodplains of the Ngaakooroa Stream were Pūriri forest (WF7).

The scarcity of these habitat types suggests a significant conversion of wetlands into agricultural, horticulture and urban areas. Nonetheless, extensively modified wetlands persist throughout the landscape.

It must be noted that freshwater habitats, such as wetlands, are recognized as a regional plan matter. While there was some field verification of wetlands associated with the Project Area, a significant portion of the baseline assessments in this report is based on desktop analysis. It is strongly recommended that a comprehensive site verification of wetlands be conducted as an integral component of the regional resource consent process. This will ultimately inform the layout and design considerations for the proposed development. Table 4-5 lists the wetland habitat types identified (via desktop and limited field verification) within the Project area and its vicinity.

Table 4-5: Description of the wetland types present within the Project area.

Habitat	Classification	Description of Habita	Applicable NoR
Exotic wetland	EW	Wetland ecosystems with >50% exotic plant biomass. Wetlands with exotic-dominated canopy (e.g. crack willow) but >75% native understorey/groundcover should be categorised as appropriate native wetland ecosystem type.	NoR 2 and 4 – Section 1 ZOI of NoR 5 ZOI 2 and 4 – Section 3 and 4
Planted Wetland - Native (recent)	P.1	Native restoration plantings with planted native scrub and forest <20 years old or wetland <10 years old.	NoR 3
Raupō reedland	WL19	Raupō-dominated freshwater wetland. Includes modified wetland examples where <i>Carex</i> spp, <i>Juncus</i> spp. and swamp millet are common.	ZOI of NoR 3

Considering the widespread modification of wetlands in the region, numerous wetlands were identified within the Project area and its environs. The identification and evaluation of these wetlands were predominately conducted through desktop assessments, with on-site investigations undertaken at locations where property access was granted. None of the wetlands were found to be native wetlands. Specific details of the identified wetlands and their geographical locality relative to the NoR's are presented in Sections 5 to 8.

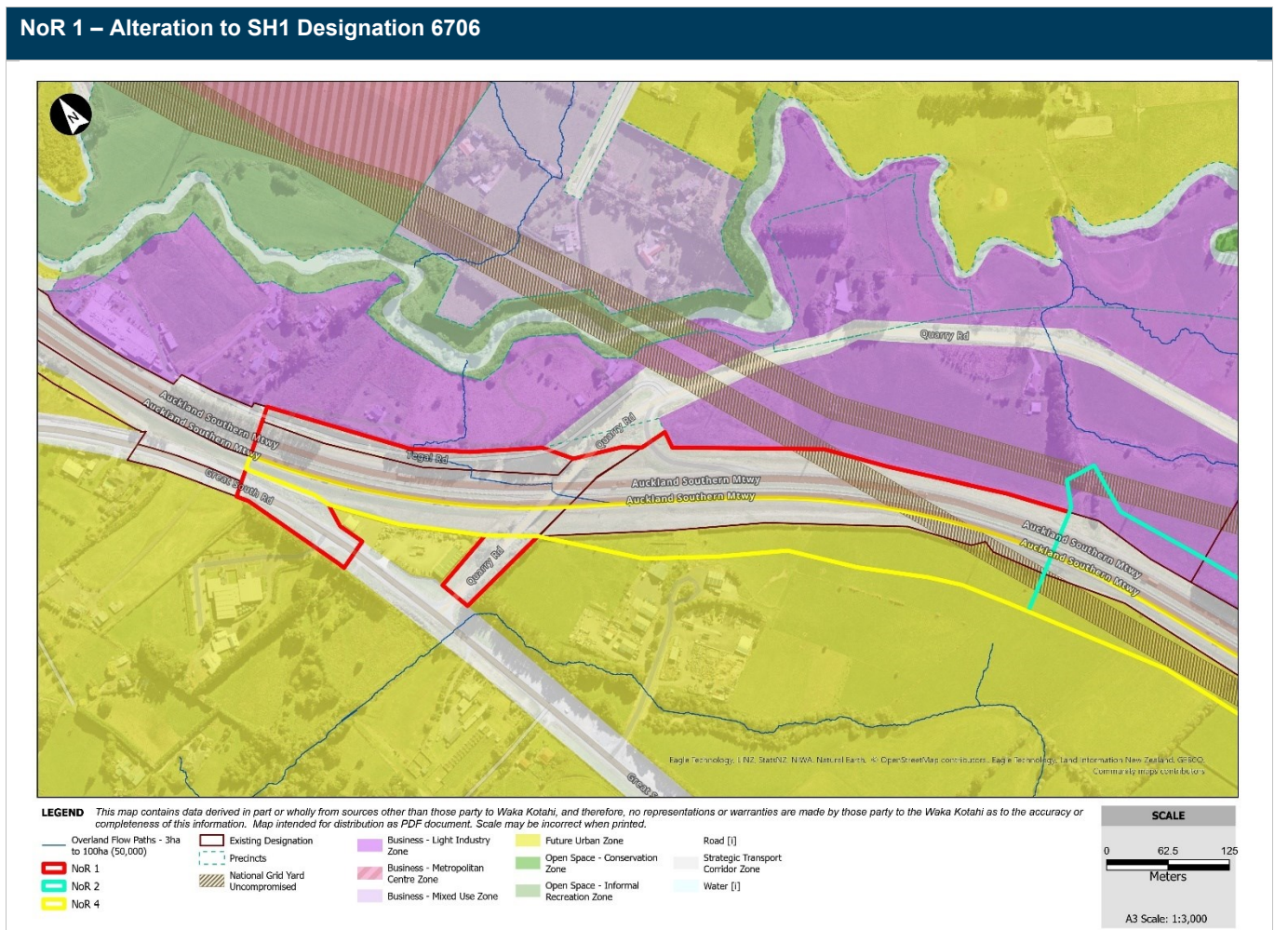
5 STAGE 2 NOR 1 (ALTERATION TO SH1 DESIGNATIONS 6706) AND NOR 4 (NEW SH1 SUP DESIGNATION)

This section assesses the specific freshwater and indigenous biodiversity matters relation to NoR 1: Alteration to the existing SH1 Designations 6706, and NoR 4: Shared User Path Quarry Road to Bombay Interchange.

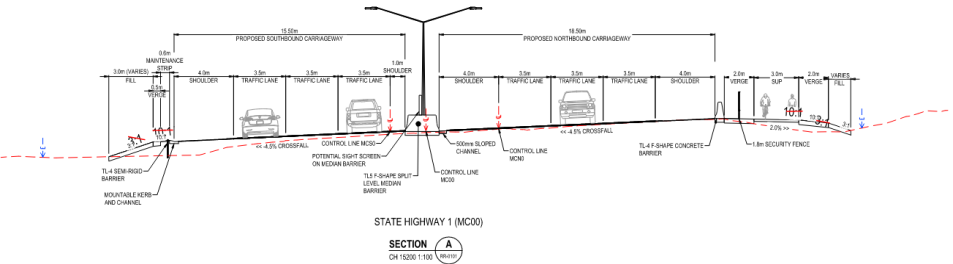
5.1 Overview and description of works

As set out in Table 5-1 below, the proposed alterations to the existing SH1 Designation 6706 to provide widening of the existing SH1 corridor and accommodate the future upgrades to the SH1 network.

Table 5-1: Overview of the alteration to SH1 Designation 6706



Key features	
Overview	<ul style="list-style-type: none"> Six general traffic lanes (4.3m shoulders) on State Highway 1. Safety improvements include upgrading interchanges, wider shoulders, new barriers, and improved lighting along the full extent of the Project.
Structures	<ul style="list-style-type: none"> Upgrades to existing Quarry Road over-bridge
Speed Environment	<ul style="list-style-type: none"> Design to accommodate 110km/h on State Highway 1
Access Lanes	<ul style="list-style-type: none"> Designed to accommodate special vehicle lane within the 4m shoulder
Intersections	<ul style="list-style-type: none"> N/A

Stormwater Infrastructure	<ul style="list-style-type: none"> • Swales and wetland treatment train (100% treatment of impervious surfaces and full scale wetland)
Typical sections	<p style="text-align: center;">cross</p>  <p style="text-align: center;">STATE HIGHWAY 1 (MCOO) SECTION A CH 15200 1:100</p>

5.2 Existing environment

5.2.1 Terrestrial habitats and fauna

NoR 1 and 4 transitions through light industry and rural-mixed rural zones, with land located to the west of SH1 zoned Future Urban Zone or 'FUZ' (AUP). Present day potential habitats are limited to amenity plantings/gardens, shelterbelts and exotic grasslands. The identified terrestrial habitats were classified according to Singers *et al.* (2017) and summarised in Table 5-2. These habitats are mapped in Figure 5-1.

Table 5-2: Vegetation types present within and directly adjacent to the Project Area (NoR 1 and 4), classified according to Singers *et al.* (2017).

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
Exotic scrub	ES	N/A	This habitat is scattered throughout the ZOI (shelterbelts and roadside vegetation) and is comprised almost entirely of gorse (<i>Ulex europaeus</i>), woolly nightshade (<i>Solanum mauritanum</i>), pampas (<i>Cortaderia selloana</i>), and occasional exotic trees.
Exotic dominated treeland	TL.3	N/A	Planted <i>Eucalyptus</i> spp. and <i>Pinus</i> spp., partially extending into the NoR footprint. No understory present.

Potentially present fauna identified during the desktop study which are considered within the ZOI of the NoR include:

- Threatened long-tailed bats;
- At-Risk lizards, including copper skink; and
- Common, non-threatened native bird species.

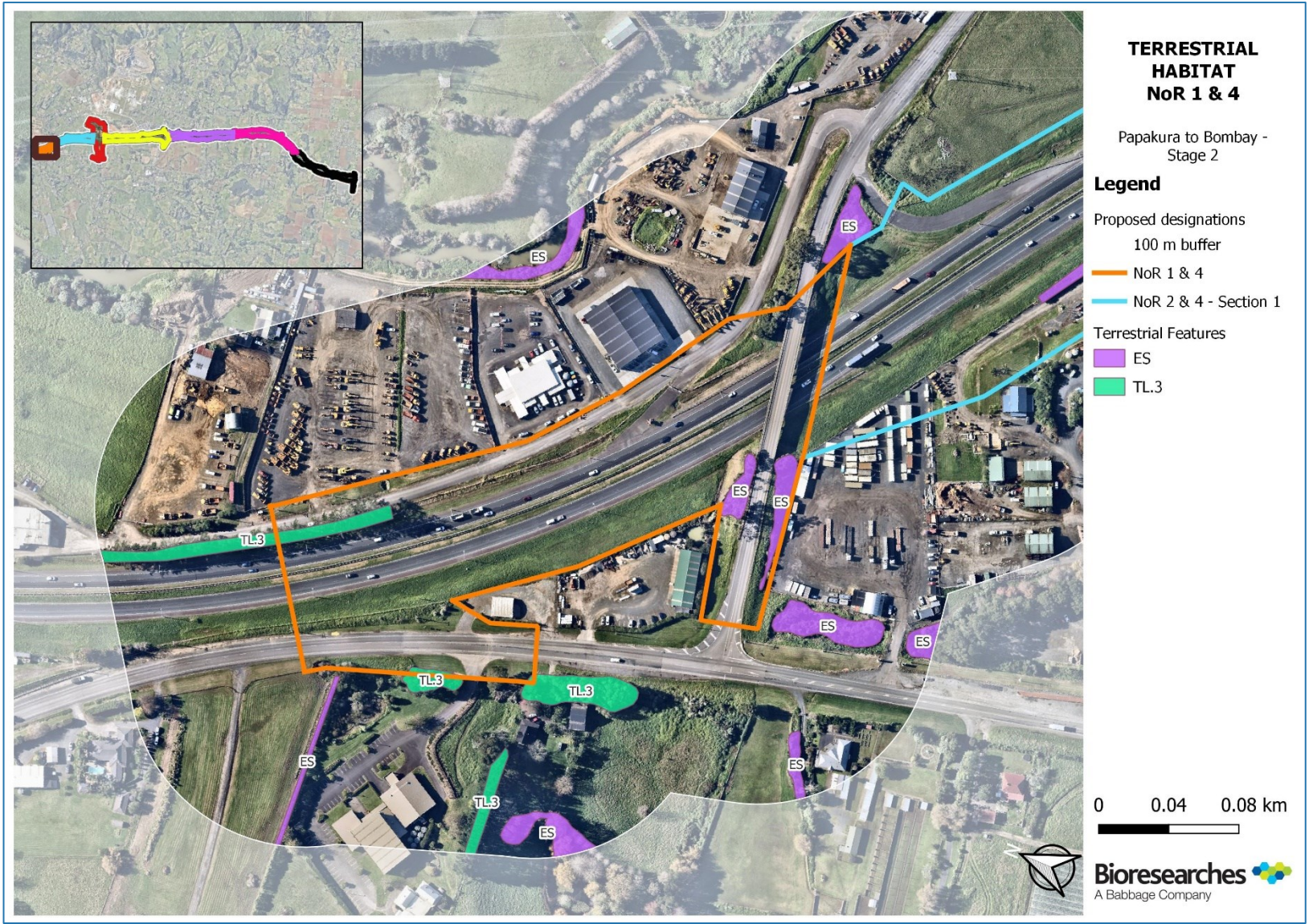


Figure 5-1: Potential terrestrial habitats associated with the proposed NoR 1 and 4.

5.2.2 Terrestrial ecological value

Table 5-3 presents the ecological value for the potential terrestrial habitats identified within NoR 1 and 4. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 5-3: Ecological values of terrestrial habitats within the ZOI of NoR 1 and 4.

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
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
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

Table 5-4 presents the ecological values for the potential fauna identified within the ZOI of NoR 1 and 4,

Table 5-4: Habitat suitability values of fauna within the ZOI of NoR 1 and 4.

Fauna	Habitat units potentially utilised	Conservation Status*	Potential habitat value should it be utilized by specified native fauna
Native Bats – long tailed bat	TL.3	Threatened - Nationally Critical	Low
Native Lizards – copper skink	ES and riparian vegetation	At Risk - Declining	Moderate
Native Birds – common, Not Threatened species only	ES and TL.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>

5.2.3 Freshwater habitats – Streams

Two stream branches were identified within 100 m of the designation boundary, however, none of these are within the NoR 1 and 4 footprint. These streams are mapped in Figure 5-2; and described in Table 5-5.

Table 5-5: Summary of streams associated with NoR 1 and 4.


Stream	Classification	Site verified?	Brief description																							
Hingaia Stream	Permanent	No	The Hingaia Stream is located outside the NoR 2 and 4 – Section 1 footprint. The stream is separated from the Project area by existing light industrial developments.																							
Ngaakooroa Stream Tributary A	Permanent	Yes	<p>This stream is situated outside the NoR footprint, to the west thereof. It extends for approximately 198 m within the ZOI. However, it's important to note that the proposed designation comes in very close proximity to this stream, specifically at the corner of Quarry Road and Great South Road.</p> <p>A number of roads intersect this stream through culvert crossings. Notably, mature exotic pine trees were removed from the stream (c. 2020). While some pest plant species like tree privet (<i>Ligustrum lucidum</i>) and other exotic species, including pine saplings and rank grasses, are present amidst the planted native species such as mānuka, kānuka, and cabbage trees. This habitat unit was defined as Exotic Scrub.</p> <p>Instream habitats were observed to be degraded, with thick sediment layers and low clarity, with the base of the channel being incised. No records are held for At Risk or Threatened fish species, within this stream.</p> <p>Rapid habitat assessment score was low:</p>																							
			<table border="1"> <thead> <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> </thead> <tbody> <tr> <td>5</td> <td>2</td> <td>2</td> <td>2</td> <td>6</td> <td>1</td> <td>6</td> <td>3</td> <td>5</td> <td>3</td> <td>35</td> </tr> </tbody> </table>		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	5	2	2	2	6	1	6	3	5	3	35
			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													
5	2	2	2	6	1	6	3	5	3	35																
																										



Figure 5-2: Potential freshwater habitats associated with the proposed NoR 1 and 4.

5.2.4 Freshwater ecological value – Streams

Table 5-6 presents the ecological value for the freshwater habitats identified within NoR 1 and 4. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 5-6: Ecological values of streams within the ZOI of NoR 1 and 4.

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Hingaia Stream	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 the loss of the riparian vegetation, nutrient and contaminant inputs, as well as a altered flow regime from stormwater inputs.	Moderate – At risk declining longfin eel present within the catchment.	High – the stream and riparian margins collectively form a habitat gradient which is uncommon within the local agricultural environment.	High – permanently flowing stream with high water volume.	High
Ngaakooroa Stream Tributary A	Moderate - instream habitat highly modified, with moderately modified riparian zone.	Low – no ‘At Risk’ or ‘Threatened’ species present.	Low – highly modified	Moderate permanently flowing stream.	Moderate

5.2.5 Freshwater habitats – Wetlands

Based on the desktop review and brief site assessment to selected areas within this NoR, no natural inland wetlands are associated with NoR 1 and 4.

5.3 Future environment

Zoning within the ZOI of Stage 2 NoR 1 and NoR 4 is a combination of Future Urban Zone (FUZ) in the west and Business – light industry zone to the east. The eastern ZOI is largely developed, and it is expected that these areas will continue to be utilised for light industry purposes over the next 10 years. The western portions are currently hosting residential dwellings but is likely to be developed over the next 10 years (Future Urban Zone). Given the Project is not expected to be constructed for 10-20 years it is reasonable to expect that these areas of FUZ will be live zoned by the time of construction. Potential terrestrial habitats within NoR 1 are therefore relatively unstable. Gradual development of the surrounding area has some potential to increase habitat suitability for native fauna, however it is considered more likely that the habitats will be degraded as a result of development.

5.4 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. 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.

Freshwater habitats are considered a Regional Plan matter, no effects assessment thereof is provided in this report. Should regional resource consent be required, this will be separately sought.

5.4.1 Assessment of 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 rules); and
- Disturbance and displacement of native 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.

5.4.1.1 Terrestrial Vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors.

The effects of the removal of this vegetation are assessed below in Table 5-7.

Table 5-7: Effects of vegetation removal for terrestrial habitats associated with NoR 1 and 4.

Vegetation type	Alpha-numeric code*	Ecological Value	Magnitude of effect	Level of effect prior to impact management	Impact management and residual level of effect	Management of residual effects
Exotic scrub	ES	Negligible	Very Low	Negligible	Not required	N/A
Treeland	TL.3	Negligible	Very Low	Negligible	Not required	N/A

5.4.1.2 Bats

Long-tailed bats (very high ecological value) may utilise large trees for roosting, as well as stream corridors, wetlands and ponds for foraging or as flight paths. Such features occur within the Project area, and may be used by bats, at least intermittently. However, the existing environment, at the northern end of the Project is highly fragmented and is subject to existing light, noise and vibrations associated with the existing, high traffic-load motorway. Bats are therefore not considered likely to be using roosting or foraging habitat within the NoR, and this low-value potential habitat quality is likely to further decrease as surrounding development increases.

The effects of the works upon bats are described below in Table 5-8.

Table 5-8: Assessment of ecological effects encountered during construction for bats.

Effect	Disturbance and displacement of bats within the NoR
Magnitude of effect	The Project area is already lit with street lighting and supports the main southern connection to and from Auckland with continuous traffic, including heavy trucks. Bats are not expected to be present currently, or at the time of construction, therefore the magnitude of potential effect is assessed as Negligible .
Level of effect prior to impact management	Low
Impact management and residual level of effect	Not required
Management of residual effects	Not required

5.4.1.3 Native Birds

Indigenous bird species may be displaced from nearby habitats (beyond the NoR) due to construction activities, including loss of roosting/foraging habitat. Abandonment or destruction of nests, eggs, chicks or injury during tree and scrub removal may also result from unmanaged vegetation removal. TAR bird species are not considered present within NoR 1&4.

The effects of the works upon native birds are described below in Table 5-9.

Table 5-9: Assessment of ecological effects encountered during construction for native birds.

Effect	Disturbance and displacement of native birds due to construction activities	Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill native birds (Not threatened native birds only)
Magnitude of effect	Adjacent habitats are periodically used by birds. Although birds present are likely to be habituated to a level of disturbance due to existing proximity to the motorway and urban environments in which they are found, the magnitude of effect is expected to be Low, as habitat availability is poor quality and very limited relative to the surrounding environment.	There is a reasonable probability that native birds utilise these trees for nesting, however habitat quality is poor, being predominantly exotic, narrow, isolated strips of vegetation. The magnitude of effect is expected to be Low .
Level of effect prior to impact management	Very Low for Not Threatened bird species.	Low
Impact management and residual level of effect	Where practicable, construction works should commence prior to the primary bird breeding season to avoid disturbance to native birds nesting. Prior to any works beginning a nesting bird survey should be undertaken within a 50 m radius of the works footprint. If nesting native 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. 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

5.4.1.4 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 are described below in Table 5-10.

Table 5-10: Assessment of ecological effects encountered during construction for lizards.

Effect	Disturbance and displacement of lizards due to construction activities
Magnitude of effect	Low. Potential habitats in the surrounding landscape are less disturbed and have greater connectivity, hence provide greater habitat value and potential for native lizard presence.
Level of effect prior to impact management	Low
Impact management and residual level of effect	Precautionary management of lizards under the Wildlife Act
Management of residual effects	Not required

5.4.2 Operational effects – terrestrial ecology

The Project involves the widening of the SH1 and construction of a shared use path. The future environment is a mix of urban and light industrial. The stream corridors and existing habitats associated with these are highly likely to remain as they have significant protections under current legislation.

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 A2** 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.

5.4.2.1 Bats

The potential habitats within NoR 1 & 4 are not considered to provide habitat for bats at present, and this low likelihood is expected to decrease over time, as land uses within the surrounding environment intensify. Bats are not expected to be present within this area within 10 years (when the Project is expected to begin), therefore no adverse effects on bats are expected.

Table 5-11: 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
Magnitude of effect	The potential habitat within NoR 1 & 4 is within a highly modified and disturbed light industry and future urban zoned environment, abutting the existing motorway. It is fragmented by the presence of the existing motorway, which is lit at night with high traffic movement, 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 negligible .
Level of effect prior to impact management	Very Low

Effect	Loss in habitat connectivity due to presence of the upgraded roadway and associated noise and lighting
Impact management and residual level of effect	Not required
Management of residual effects	Not required

5.4.2.2 Native 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**, and consequently the level of effect is considered to be **Very Low** for Not Threatened birds and **Low** for At Risk birds.

Birds may also be affected by vehicle strike; however, this is only likely to occur infrequently and is unlikely to occur with greater frequency than current conditions. 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 At Risk birds.

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

5.4.2.3 Lizards

Native lizards, particularly copper skink, are commonly encountered in rough, regenerating environments such as rough grass and exotic scrub alongside high-traffic volume motorways. Therefore, if native lizards are present within potential habitats at the time of operation, no more than **Low** level effects are expected.

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

5.4.3 Conclusions

Ecological effects are assessed as follows:

- Low level of effect to bats during construction may occur, however bats are not considered to be using NoR 1 & 4;
- Low level of effect to common native birds may occur during construction and operation due to disturbance to birds nesting in adjacent habitats; and
- Low level of effect to lizards during construction and operation 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, **Low** for disturbance to native lizards, and **Low** for disturbance to At Risk birds and habitat fragmentation for bats.

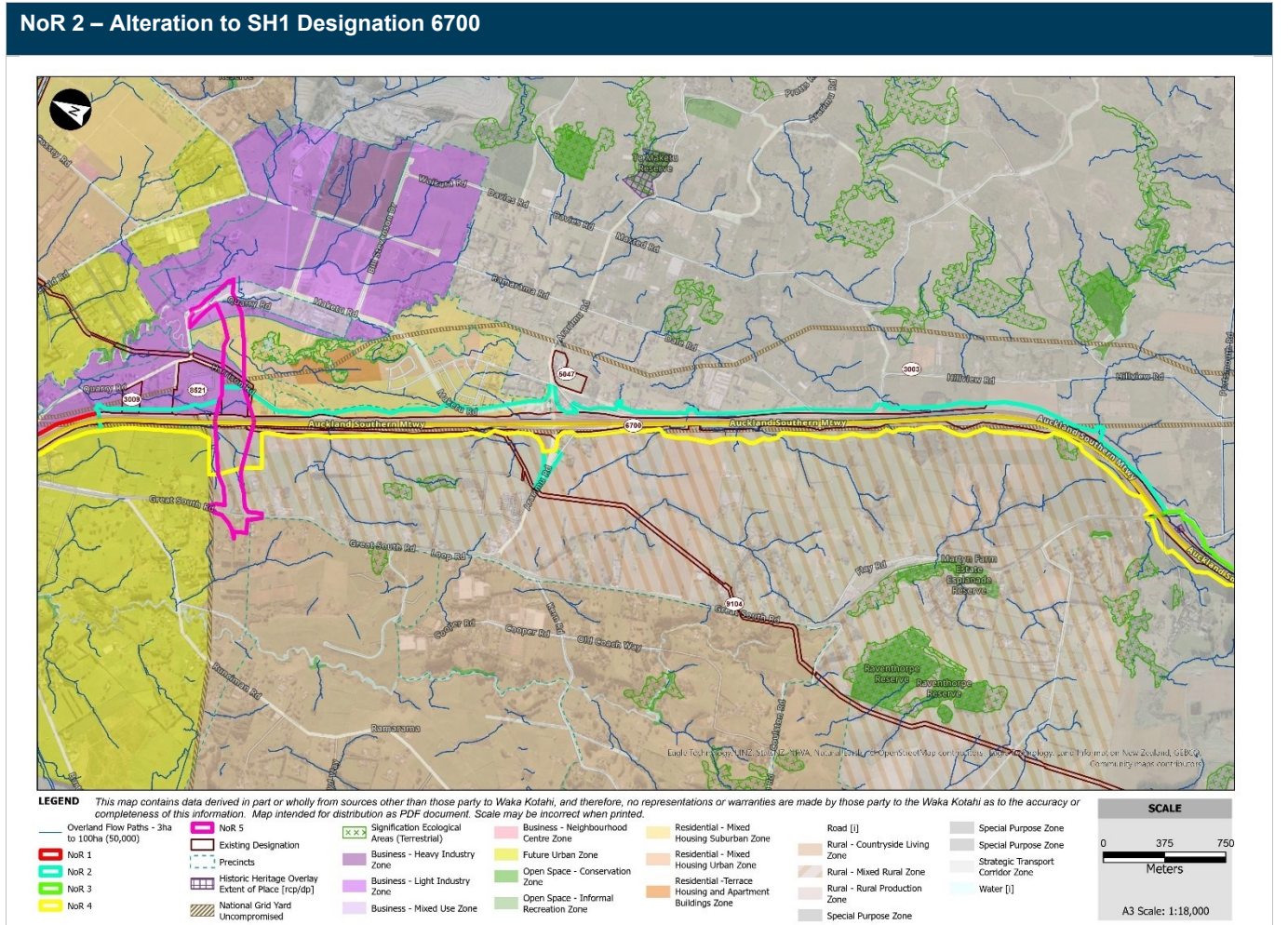
6 STAGE 2 NOR 2 (ALTERATION TO SH1 DESIGNATIONS 6700) AND NOR 4 (NEW SH1 SUP DESIGNATION)

This section assesses the specific freshwater and indigenous biodiversity matters relation to NoR 2: Alterations to the existing SH1 Designations 6700, and NoR 4: Shared User Path Quarry Road to Bombay Interchange.

6.1 Overview and description of works

As set out in Table 6-1 below, the proposed alterations to the existing SH1 Designation 6700 to provide widening of the existing SH1 corridor and accommodate the future upgrades to the SH1 network.

Table 6-1: Overview of the alteration to SH1 Designation 6700



Key features	
Overview	<ul style="list-style-type: none"> Six general traffic lanes (4.3m shoulders) on State Highway 1. Safety improvements include upgrading interchanges, wider shoulders, new barriers, and improved lighting along the full extent of the Project.
Structures	<ul style="list-style-type: none"> Drury South Interchange Ramarama Interchange
Speed Environment	<ul style="list-style-type: none"> Design to accommodate 110km/h on State Highway 1

Access Lanes	<ul style="list-style-type: none"> Designed to accommodate special vehicle lane within the 4m shoulder
Intersections	<ul style="list-style-type: none"> Drury South Interchange – new over-pass with roundabouts Ramarama Interchange – modified Stevensons roundabout with ramp signals and off-line bridge
Stormwater Infrastructure	<ul style="list-style-type: none"> Swales and wetland treatment train (100% treatment of impervious surfaces and full scale wetland)
Typical sections	<p>cross</p> <p>STATE HIGHWAY 1 (MC00) SECTION A CH 15200 T.100</p>

6.2 Existing environment

6.2.1 Terrestrial habitats and fauna

6.2.1.1 Terrestrial habitats and fauna: NoR 2 and 4 - Section 1

NoR 2 and 4 - Section 1 transitions through light industry and rural-mixed rural zones (AUP). Present day habitats are therefore largely limited to amenity plantings/gardens, shelterbelts and exotic grasslands. The identified terrestrial habitats were classified according to Singers *et al.* (2017) and summarised in Table 6-2. These habitats are mapped in Figure 6-1.

Table 6-2: Vegetation types present within and directly adjacent to the Project Area (NoR 1 and 4 – Section 1), classified according to Singers *et al.* (2017).

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
Exotic scrub	ES	N/A	This habitat is scattered throughout the ZOI (shelterbelts and roadside vegetation), and comprised almost entirely of gorse, tobacco weed, pampas, and occasional exotic trees.
Exotic dominated treeland	TL.3	N/A	Planted <i>Eucalyptus</i> spp. and <i>Pinus</i> spp., located within the eastern portion of the ZOI, outside the NoR footprint.
Planted vegetation	P.3	N/A	Shrub vegetation is present within the central eastern portion of the NoR footprint.

Potentially present fauna identified during the desktop study which are considered within the ZOI of the NoR include:

- Threatened long-tailed bats;
- At-Risk lizards, including copper skink; and
- Common, non-threatened native bird species.



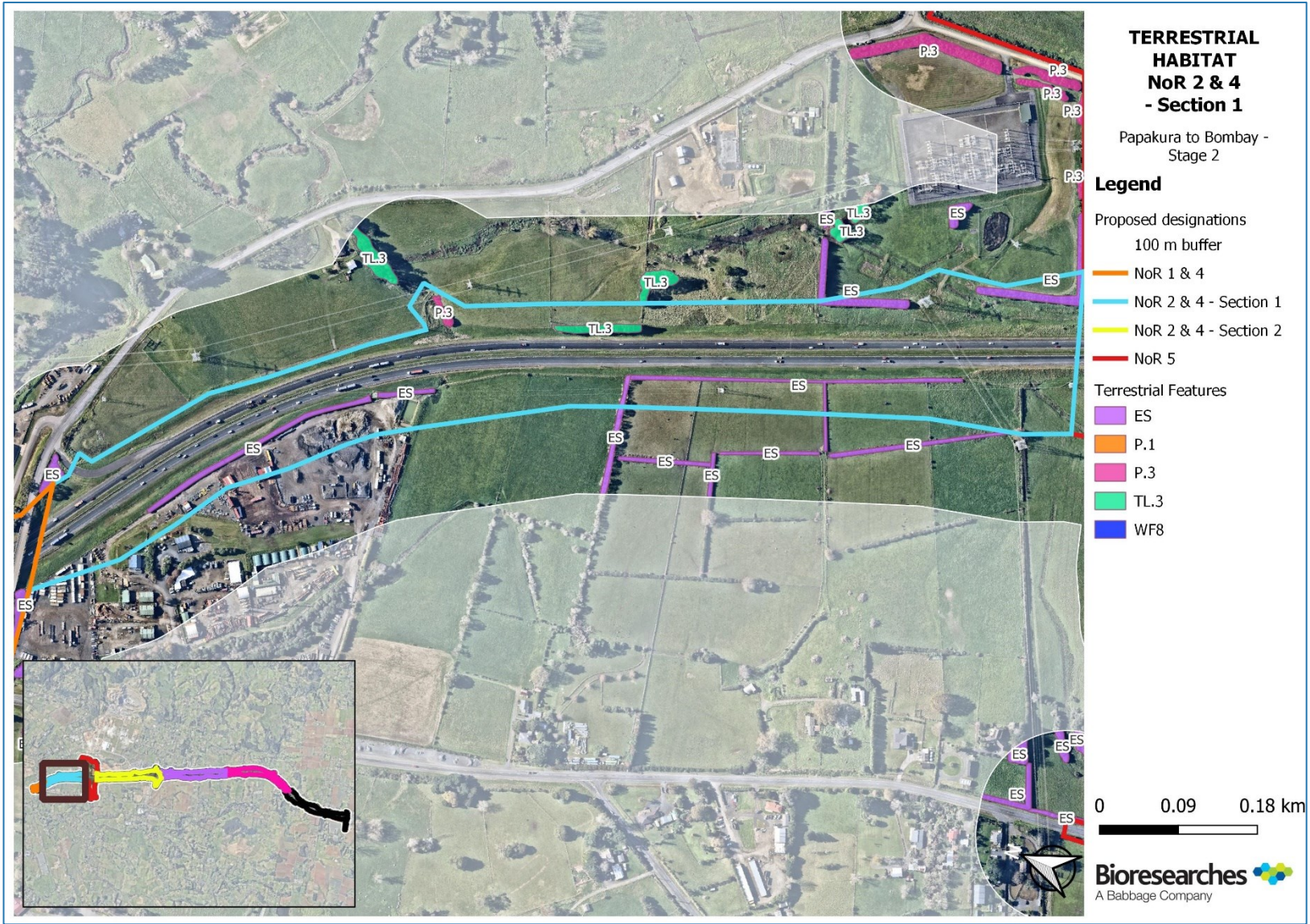


Figure 6-1: Potential terrestrial habitats associated with the proposed NoR 2 and 4 – Section 1.

6.2.1.1.1 Terrestrial ecological value - NoR 2 and 4 - Section 1

Table 6-3 presents the ecological value for the terrestrial habitats identified within NoR 2 and 4 - Section 1. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 6-3: Ecological values of terrestrial habitats within the ZOI of NoR 2 and 4 - Section 1.

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
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
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
PL.3	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

Table 6-4 presents the ecological values for the fauna identified within the ZOI of NoR 2 and 4 - Section 1.

Table 6-4: Ecological values of fauna within the ZOI of NoR 2 and 4 - Section 1.

Fauna	Habitat units potentially utilised	Conservation Status*	Potential habitat value should it be utilized by specified native fauna
Native Bats – long tailed bat	PL.1 – riparian margins	Threatened - Nationally Critical	Low
Native Lizards – copper skink	PL.1 – riparian margins	At Risk - Declining	Low
Native Birds – Spotless crane	Wetland habitats	At Risk – Declining	Low
Native Birds – Grey duck and New Zealand dabchick	Pond habitats	Threatened - Nationally Vulnerable and Threatened - Nationally Increasing species.	Low
Native Birds – common, Not Threatened species only	ES, TL.3 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>

6.2.1.2 Terrestrial habitats and fauna: NoR 2 and 4 - Section 2

NoR 2 and 4 – Section 2 transitions through residential – mixed housing suburban (east) and rural – mixed rural (west) zones (AUP: OP). Present day habitats are therefore largely limited to amenity plantings/gardens, shelterbelts and exotic grasslands. The identified terrestrial habitats were classified according to Singers *et al.* (2017) and summarised in Table 6-5. These habitats are mapped in Figure 6-2 and Figure 6-3.

Table 6-5: Vegetation types present within and directly adjacent to the Project Area (NoR 2 and 4 – Section 2), classified according to Singers *et al.* (2017).

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
Exotic scrub	ES	N/A	Exotic scrub is associated with an intermittent stream located along the western boundary of the ZOI. This habitat unit is also present outside the southern end of the NoR footprint, along the verges of Ararimu and Hillview Road crossing.
Planted vegetation	PL.1	N/A	Restoration planting (native vegetation species) along SH 1 and the Ararimu Road interchange. Includes future native restoration planting (10 m riparian yards) along the Hingaia Stream Tributary D (also referred to as the 'Harrison Stream' (Boffa Miskell, 2018)) and newly diverted Hingaia Stream Tributary E (also referred to as the 'Roslyn Stream' (Boffa Miskell, 2018)).
	PL.3	N/A	Recent amenity planting (native vegetation species) surrounding intermittent streams (Hingaia Stream Tributary G) and a pond. Mature trees are present along the Ararimu Road.
Anthropogenic tōtara forest	AVS1	N/A	Mature anthropogenically induced tōtara forest within a pastoral landscape, outside the Section 2 footprint.

Potentially present fauna identified during the desktop study which are considered within the ZOI of the NoR include:

- Threatened long-tailed bats;
- At-Risk lizards, including copper skink; and
- Threatened pārerā / grey duck, New Zealand dabchick potentially within pond habitats, and At-Risk pipit, potentially within rough grassland. Common, non-threatened native bird species likely in other terrestrial habitats.

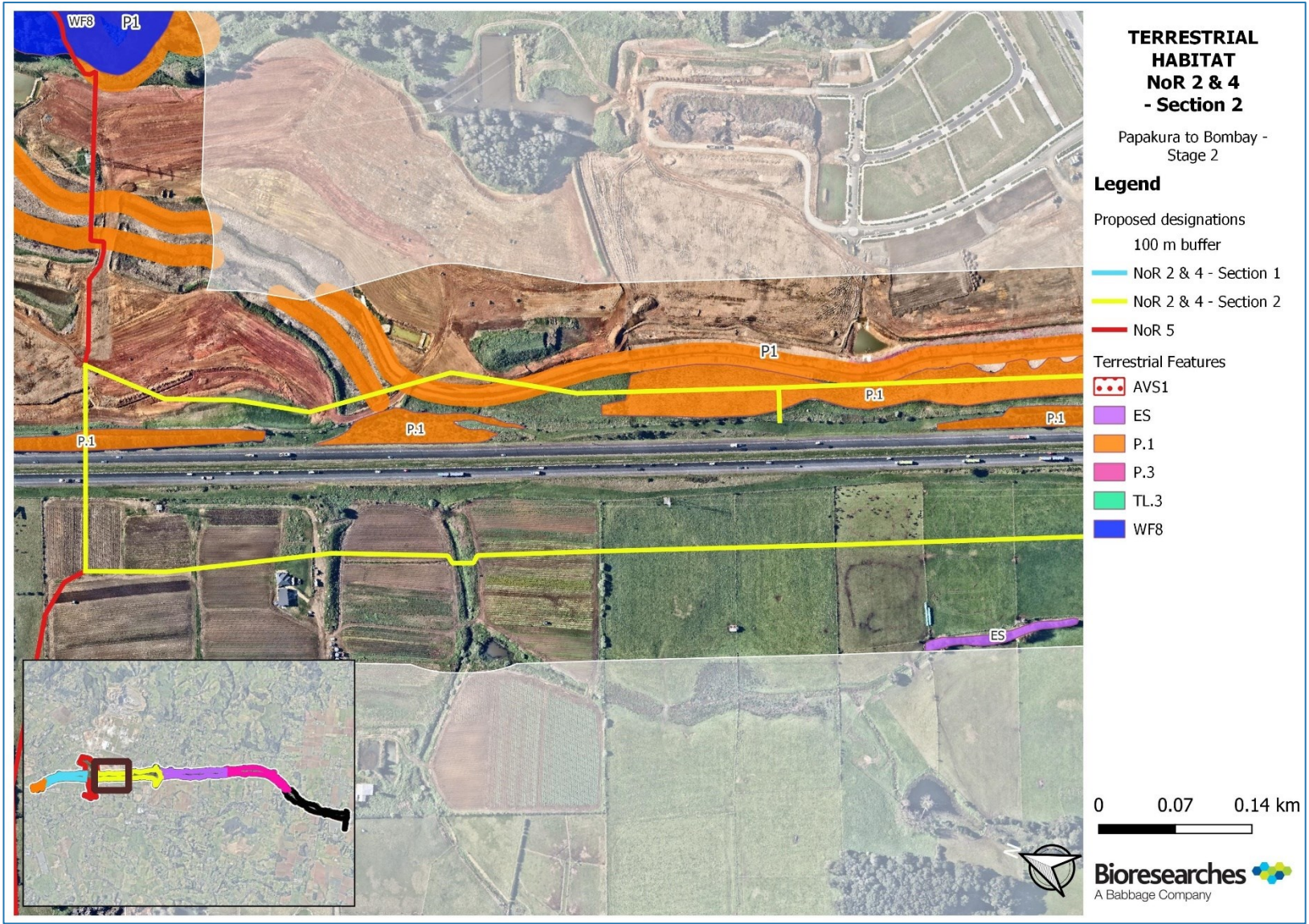


Figure 6-2: Potential terrestrial habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 2.

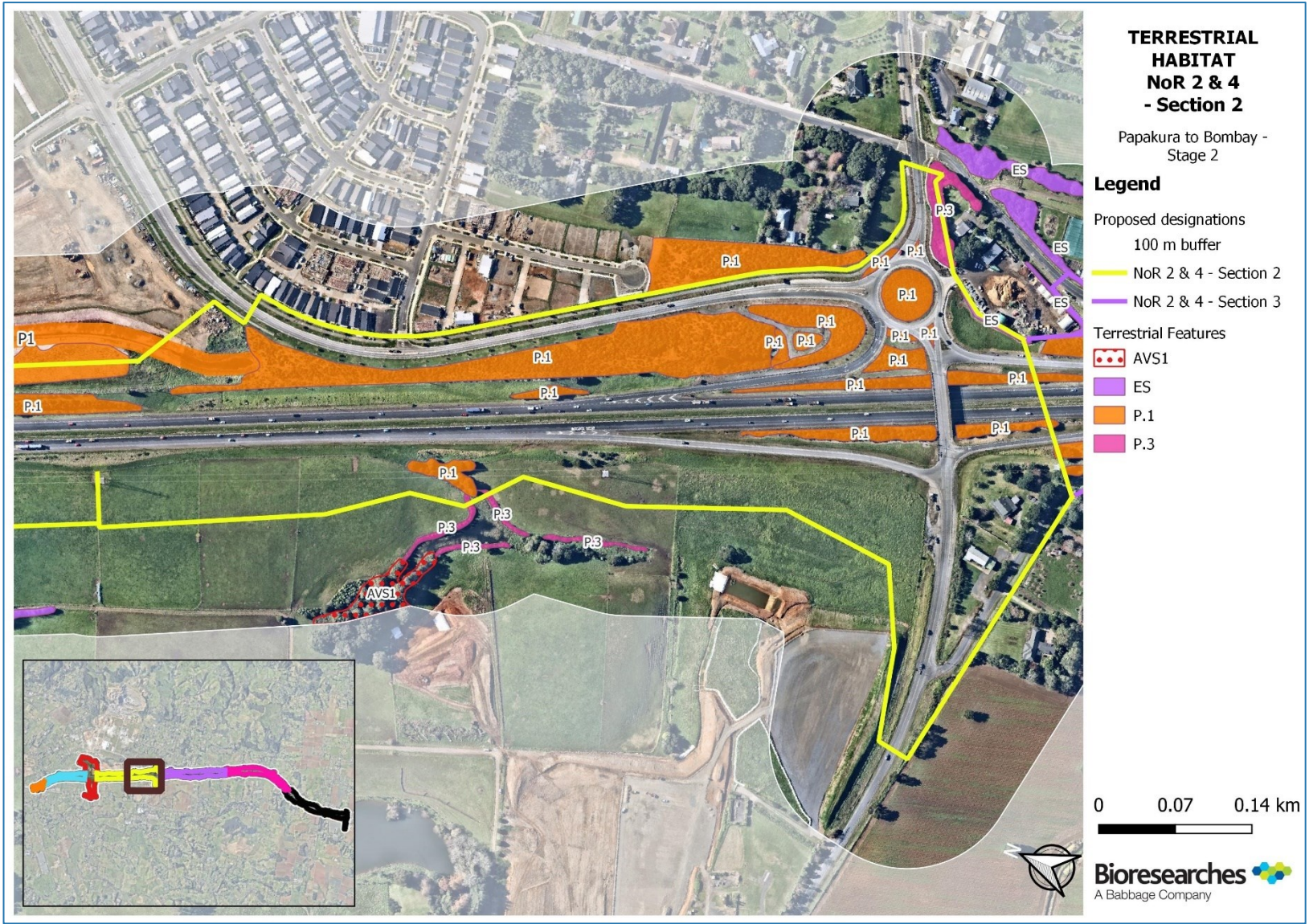


Figure 6-3: Potential terrestrial habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 2.

6.2.1.2.1 Terrestrial ecological value - NoR 2 and 2- Section 2

Table 6-6 presents the ecological value for the terrestrial habitats identified within NoR 2 and 4 – Section 2. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

The riparian margins of the streams associated with this Section (Hingaia Stream Tributary D/Harrison Stream and Hingaia Stream Tributary E/Roslyn Stream' (Boffa Miskell, 2018)) will be vegetated with native vegetation as part of an offset as part of the precinct development. The stream corridors will be revegetated to a width of 20 m (10 m to either side of the stream). Due to the lack of current vegetation, the current ecological value of the habitats are negligible. Nonetheless, when the vegetation matures over the next 15 to 20 years, it is expected that the ecological value will increase. As such, these areas are considered Biodiversity Areas, to be reassessed in the future.

Table 6-6: Ecological values of terrestrial habitats within the ZOI of NoR 2 and 4 – Section 2.

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
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
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 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
PL.3	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
AVS1	Moderate – although highly modified, there is so little natural vegetation left in the surrounding area that these areas can be considered important.	High – not likely to support any Threatened or At Risk bird or lizard species, but there is (low) potential that the vegetation margins are used as long-tailed bat flight paths.	Low - while indigenous species dominate, they lack the diversity and structure expected of a naturally occurring ecosystem.	High – the forest provides some of the very few areas of biodiversity within a landscape that is largely devoid of indigenous vegetation and habitat.	Moderate

Table 6-7 presents the potential habitat suitability values for the fauna identified within the ZOI of NoR 2 and 4 – Section 2.

Table 6-7: Habitat values of fauna within the ZOI of NoR 2 and 4 – Section 2.

Fauna	Habitat units potentially utilised	Conservation Status*	Potential habitat value should it be utilized by specified native fauna
Native Bats – long tailed bat	PL.1 – riparian margins	Threatened - Nationally Critical	Low
Native Lizards – copper skink	PL.1 – riparian margins	At Risk - Declining	Moderate
Native Birds – TAR wetland birds and Pipit	Pond habitats Open rough grassland	Grey duck: Threatened - Nationally Vulnerable and Dabchick: Threatened - Nationally Increasing. Pipit: At Risk	Low
Native Birds – common, Not Threatened species only	ES, PL.1, PL.3, and AVS1 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>

6.2.1.3 Terrestrial habitats and fauna: NoR 2 and 4 - Section 3

NoR 2 and 4 – Section 3 transitions through a mixed rural zone (west) and a rural – rural production zone to the east (AUP). Present day habitats are therefore largely limited to amenity plantings/gardens, shelterbelts and exotic grasslands. The identified terrestrial habitats were classified according to Singers *et al.* (2017) and summarised in Table 6-8. These habitats are mapped in Figure 6-4 and Figure 6-5.

Table 6-8: Vegetation types present within and directly adjacent to the Project Area (NoR 2 and 4 – Section 3), classified according to Singers *et al.* (2017).

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
Exotic scrub	ES	N/A	Scattered exotic scrub are present within the footprint and wider ZOI, comprising shelterbelts, roadside vegetation and disturbed riparian areas (associated with permanent and intermittent streams).
Planted vegetation	PL.1	N/A	Native vegetation restoration planting along SH 1
Treeland	TL.3	N/A	Planted <i>Pinus</i> spp., to the west of SH1, within the central NoR footprint.
TBC – Native/exotic scrubs	TBC - N/ES	TBC	Shrub vegetation identified outside the Section 3 footprint. This ecosystem will be classified pending the outcome of site verification.
TBC – Native/exotic trees	TBC - N/ET	TBC	Mature trees along Ngaakooroa Stream Tributary A within the western portion of the ZOI associated with Section 3. This ecosystem will be classified pending the outcome of site verification.

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
TBC – Native trees	TBC - NT	TBC	Mature trees (likely native trees) within the western Section 3 footprint. This ecosystem will be classified pending the outcome of site verification.

Potentially present fauna identified during the desktop study which are considered within the ZOI of the NoR include:

- Threatened long-tailed bats;
- At-Risk lizards, including copper skink; and
- Threatened pārerā / grey duck, New Zealand dabchick potentially within pond habitats and pipit in open grassland. Common, non-threatened native bird species in other habitats.

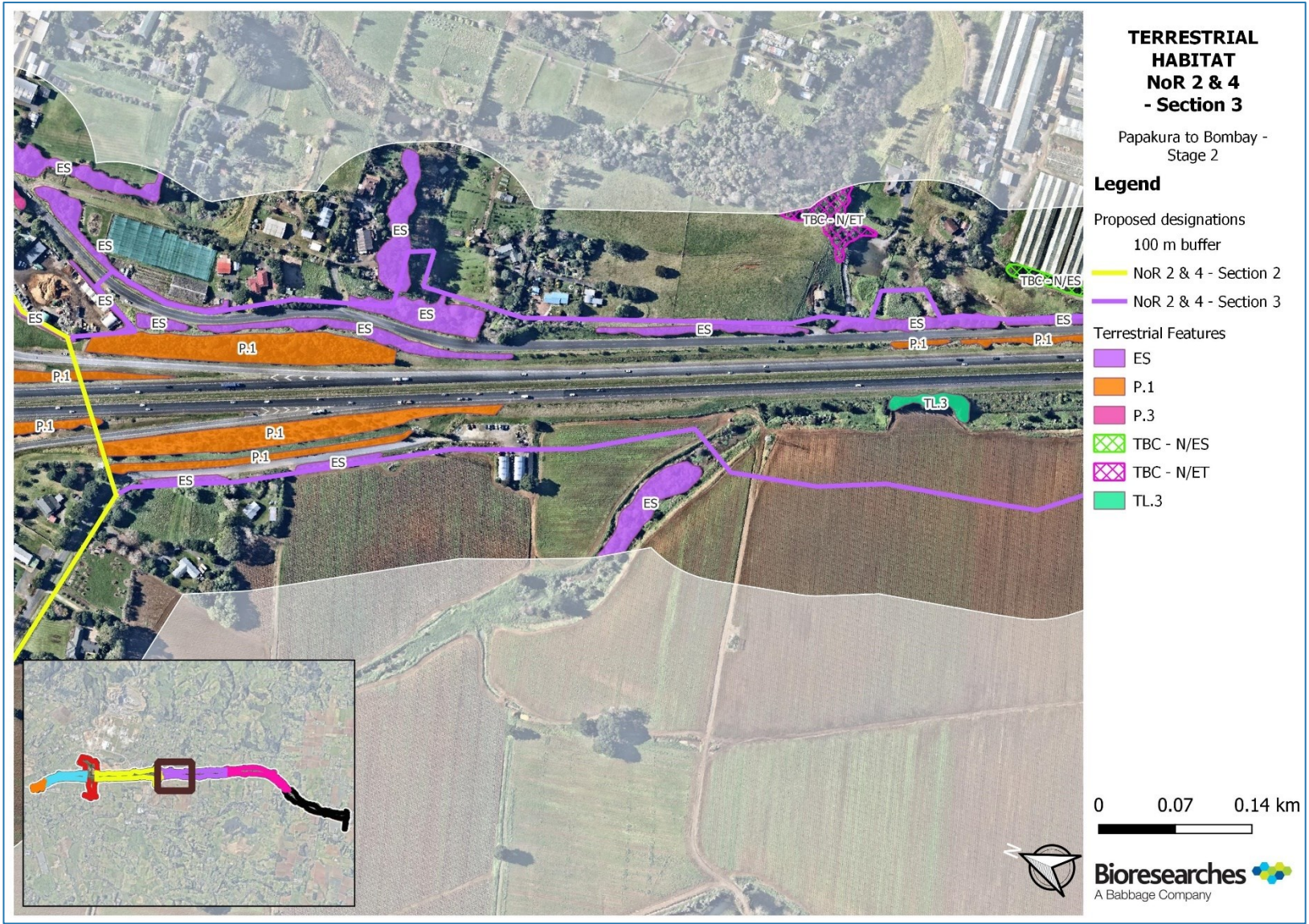


Figure 6-4: Potential terrestrial habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 3.

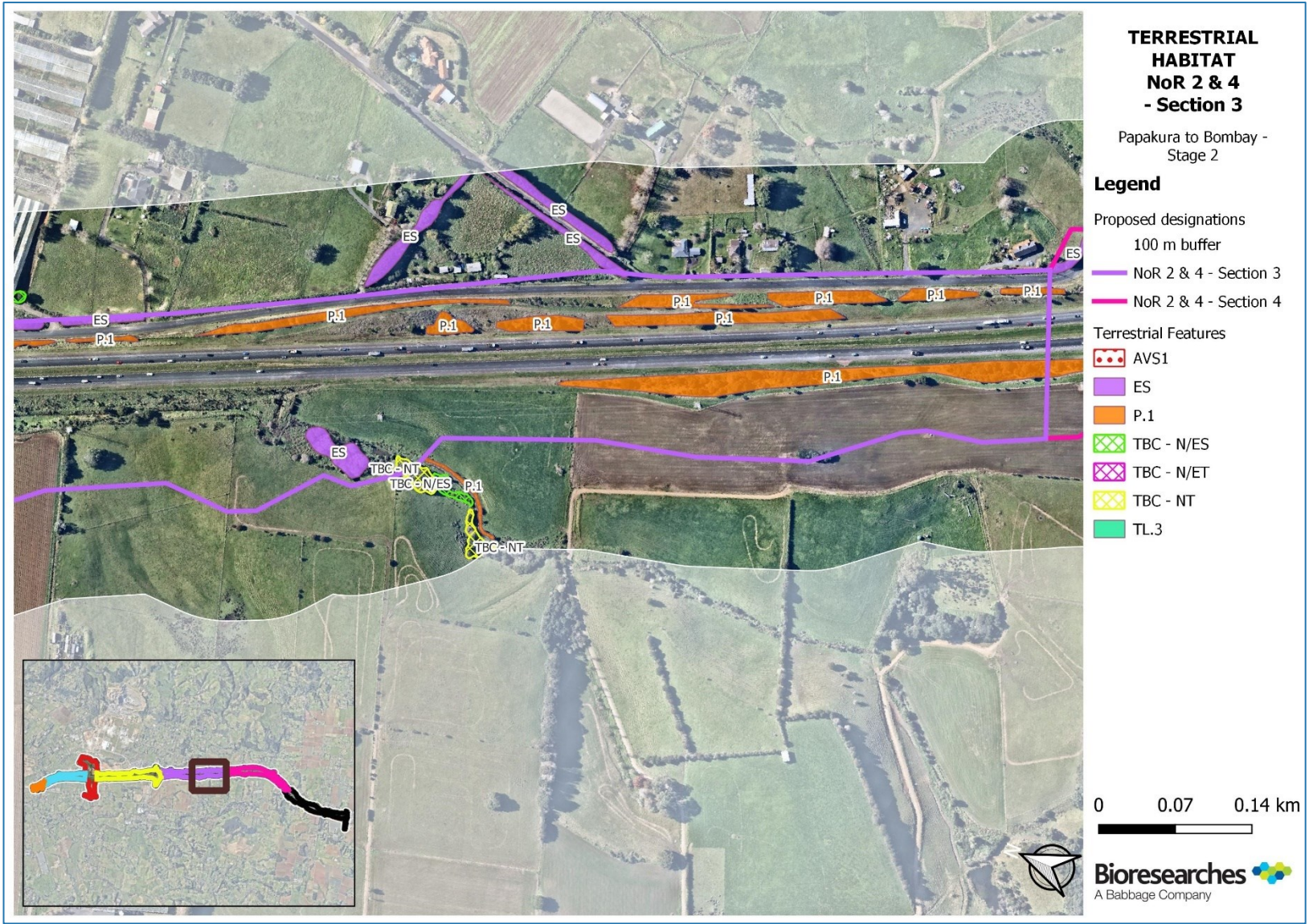


Figure 6-5: Potential terrestrial habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 3.

6.2.1.3.1 Terrestrial ecological value - NoR 2 and 4 - Section 3

Table 6-9 presents the ecological value for the terrestrial habitats identified within NoR 2 and 4 – Section 3. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 6-9: Ecological values of terrestrial habitats within the ZOI of NoR 2 and 4 – Section 3.

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
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
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 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
TBC - N/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
TBC - N/ET	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 <i>incursion</i> .	Low

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
TBC - NT	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.	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.	Moderate

Table 6-10 presents the potential ecological values for the fauna identified within the ZOI of NoR 2 and 4 – Section 3.

Table 6-10: Ecological values of fauna within the ZOI of NoR 2 and 4 – Section 3.

Fauna	Habitat units potentially utilised	Conservation Status*	Potential habitat value should it be utilized by specified native fauna
Native Bats – long tailed bat	PL.1 – riparian margins	Threatened - Nationally Critical	Low
Native Lizards – copper skink	PL.1 – riparian margins	At Risk - Declining	Moderate
Native Birds – Spotless crane	Wetland habitats	At Risk – Declining species.	Low
Native Birds – Grey duck and New Zealand dabchick	Pond habitats	Confirmed Threatened - Nationally Vulnerable and Threatened - Nationally Increasing species.	Low
Native Birds – common, Not Threatened species only	All habitats identified within this NoR section.	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>

6.2.1.4 Terrestrial habitats and fauna: NoR 2 and 2- Section 4

NoR 2 and 4 – Section 4 transitions through a mixed rural zone (west) and a rural – rural production zone to the east (AUP). Present day habitats are therefore largely limited to amenity plantings/gardens, shelterbelts and exotic grasslands. The identified terrestrial habitats were classified according to Singers *et al.* (2017) and summarised in Table 6-11. These habitats are mapped in Figure 6-6 and Figure 6-7.

Table 6-11: Vegetation types present within and directly adjacent to the Project Area (NoR 2 and 4 – Section 4), classified according to Singers *et al.* (2017).

Vegetation type	Alpha-numeric code*	Regional IUCN Conservation Status*	Description of habitat
Exotic scrub	ES	N/A	Comprising shelterbelts, roadside vegetation and disturbed riparian areas.
Planted vegetation	PL.1	N/A	Native vegetation restoration planting along SH 1, within the Section 4 footprint
Treeland	TL.3	N/A	Planted <i>Eucalyptus</i> spp. and <i>Pinus</i> spp. within and outside the Section 4 footprint.
Pūriri forest	WF7	Critically Endangered	<p>Partially extends into the western NoR footprint (located to the west of SH1).</p> <p>This is a fenced broadleaved forest remnant that appears to be reviving after a history of grazing and fragmentation that has significantly thinned out the canopy.</p> <p>Typical species include pūriri (<i>Vitex lucens</i>), taraire (<i>Beilschmiedia tarairi</i>), kohekohe (<i>Didymocheton spectabilis</i>), karaka (<i>Corynocarpus laevigatus</i>) and kawakawa (<i>Piper excelsum</i>). Mature planted pine and eucalyptus trees are also present. The canopy tier of the forest is mostly intact, however past grazing is evident in the reduced subcanopy and low coverage and diversity of shrub and ground covers. One Threatened species was identified: Akatea (<i>Metrosideros perforata</i>) with the threat listing of Threatened – Nationally Vulnerable.</p> <p>This forest remnant is primarily composed of indigenous species, however some weedy exotic species are also present.</p>
Anthropogenic tōtara forest	AVS1	N/A	Mature anthropogenically induced tōtara forest within a pastoral landscape, outside the NoR footprint.
TBC – Native/exotic trees	TBC - N/ET	TBC	Mature native trees within the eastern portion of the ZOI associated with the NoR. This ecosystem will be classified pending the outcome of site verification.

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

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

- Threatened long-tailed bats;
- At-Risk lizards, including copper skink; and
- Threatened pārerā / grey duck, New Zealand dabchick, potentially within pond habitats; and At Risk spotless crane, potentially within wetland habitats; and New Zealand Pipit potentially within rough grassland. Common, non-threatened native bird species are likely in other terrestrial habitats.

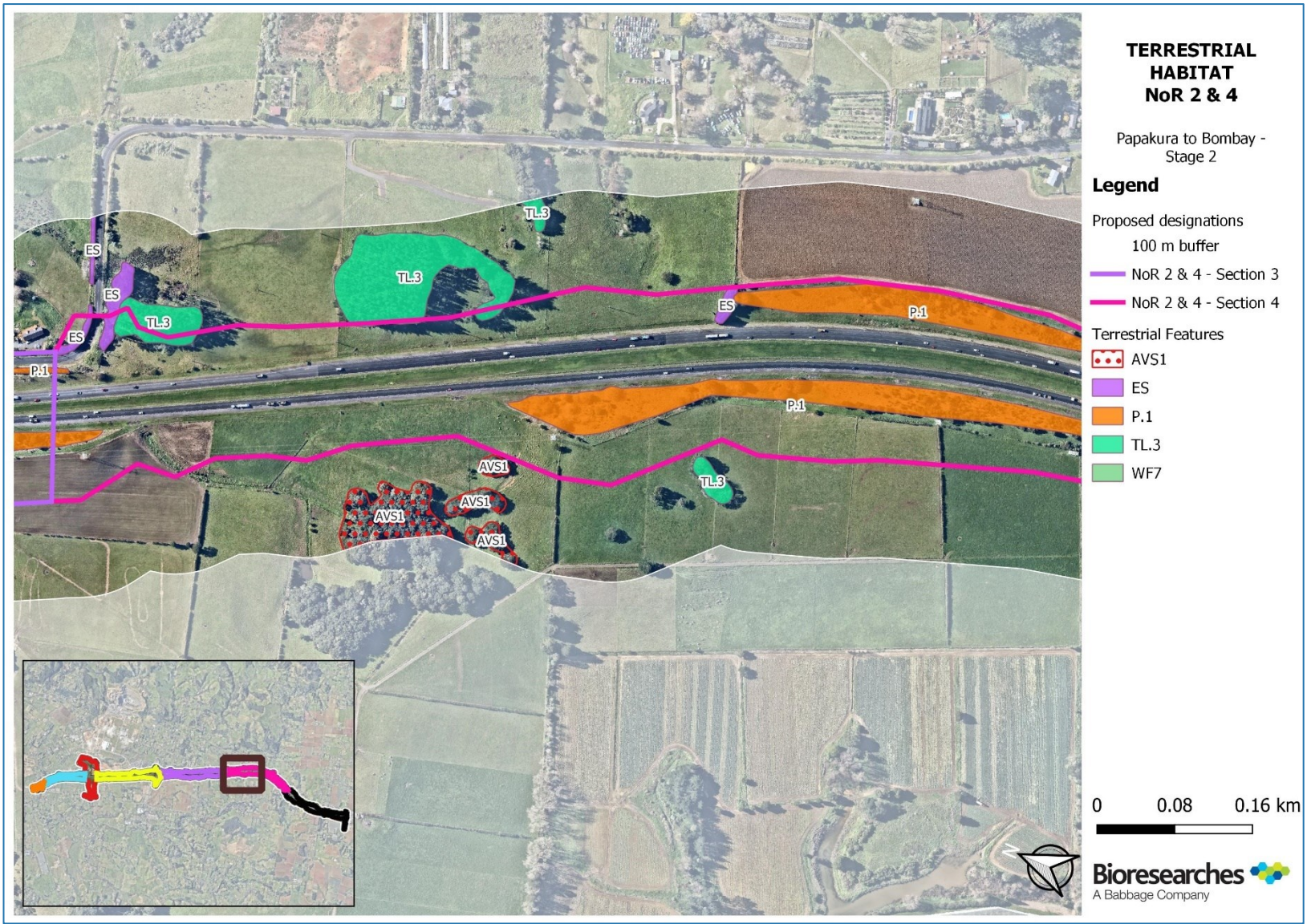


Figure 6-6: Potential terrestrial habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 4.

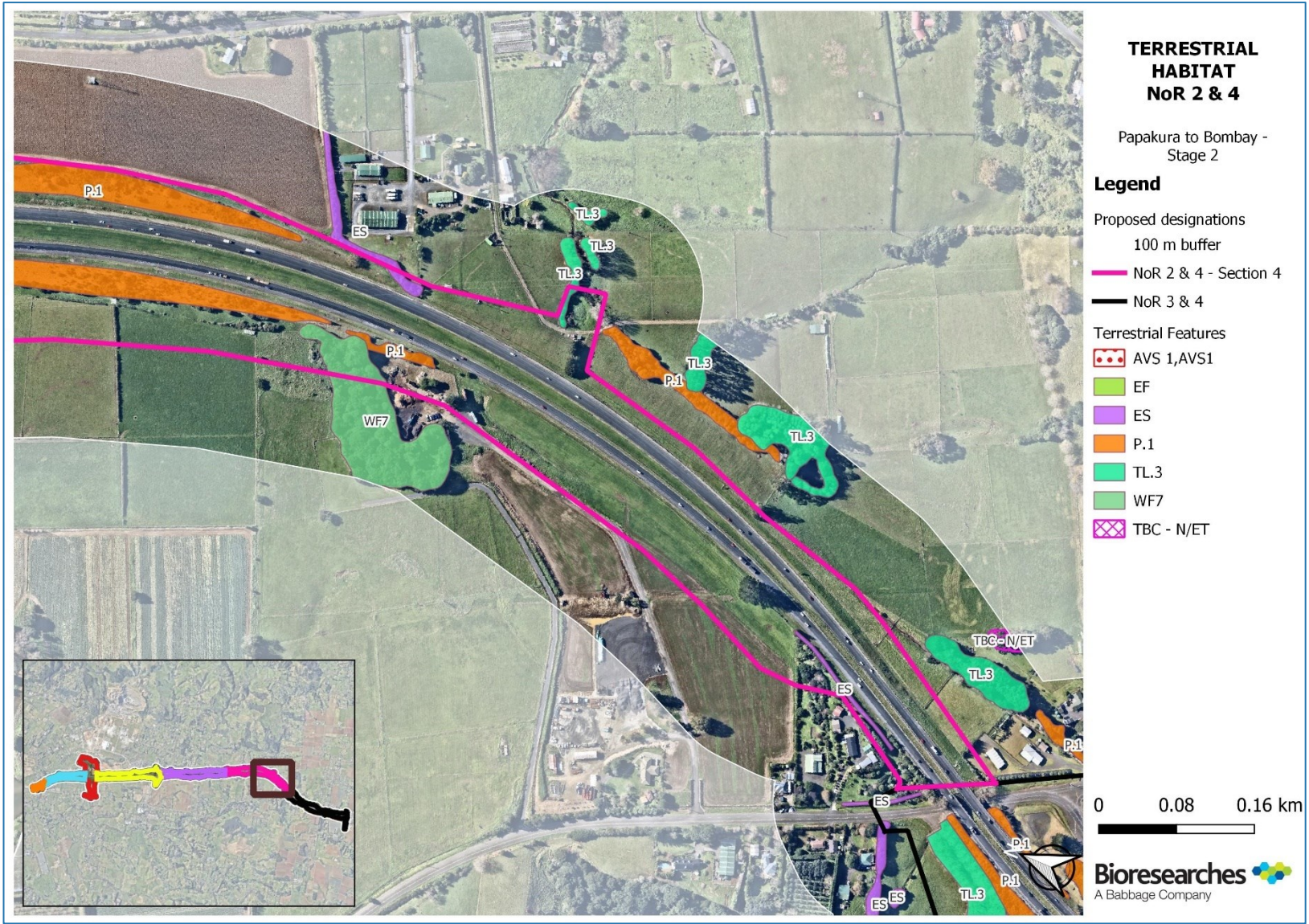


Figure 6-7: Potential terrestrial habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 4.

6.2.1.4.1 Terrestrial ecological value - NoR 1 and 2- Section 4

Table 6-12 presents the ecological value for the terrestrial habitats identified within NoR 2 and 4 – Section 4. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 6-12: Ecological values of terrestrial habitats within the ZOI of NoR 2 and 4 – Section 4.

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
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
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 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
WF7	Moderate – although highly modified, there is so little natural vegetation left in the surrounding area that these areas should be considered important.	High – copper skink (At Risk - Declining) are likely present, and there is potential that the forest is used as long-tailed bat flight paths. This forest ecosystem type is listed as Critically Endangered.	Moderate – some diversity in species, however habitat is reasonably homogenous.	High – the forest some of the very few areas of biodiversity within a landscape that is largely devoid of indigenous vegetation and habitat.	High

Habitat unit	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
AVS1	Moderate – although highly modified, there is so little natural vegetation left in the surrounding area that these areas can be considered important.	High – not likely to support any Threatened or At Risk bird or lizard species, but there is potential that the vegetation margins are used as long-tailed bat flight paths.	Low - while indigenous species dominate, they lack the diversity and structure expected of a naturally occurring ecosystem.	High – the forest provides some of the very few areas of biodiversity within a landscape that is largely devoid of indigenous vegetation and habitat.	Moderate
TBC - N/ET	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.	Low

Table 6-13 presents the ecological values for the fauna identified within the ZOI of NoR 2 and 4 – Section 4.

Table 6-13: Ecological values of fauna within the ZOI of NoR 2 and 4 – Section 4.

Fauna	Habitat units potentially utilised	Conservation Status*	Potential habitat value should it be utilized by specified native fauna
Native Bats – long tailed bat	PL.1 – riparian margins WF7- native forest	Threatened - Nationally Critical	High
Native Lizards – copper skink, ornate skink, forest geckos, pacific gecko	PL.1 – riparian margins WF7- native forest	All spp. At Risk - Declining	High
Native Birds – common, Not Threatened species only	ES, PI.1, TL.1, WF7, AVS and N/ET 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>


6.2.2 Freshwater habitats - Streams

6.2.2.1 Freshwater habitats – Streams of NoR 2 and 4 - Section 1

Four stream branches were identified within 100 m of the designation boundary, however, only two of these were within the NoR 2 and 4 – Section 1 footprint. These streams are mapped in Figure 6-8; and described in Table 6-14.

Table 6-14: Summary of streams associated with NoR 2 and 4 – Section 1.

Stream	Classification	Site verified?	Brief description																			
Hingaia Stream Tributary A (also referred to as the 'Transpower Stream' (Boffa Miskell, 2018))	Permanent	No (Observed from public access road)	<p>The stream flows from south to north, primarily outside the Section 1 footprint, but it passes through the southern part of the Section 1 area. The length of stream draining through the ZOI is approximately 660 m.</p> <p>A culvert, located underneath SH1, discharges water from Hingaia Stream Tributary C (west of SH1) into this stream. Some sections of the stream appear to have been historically straightened. Additionally, several culverts are present along its course.</p> <p>Notably the stream is dominated by exotic species such as canna lily (<i>Canna xgeneralis</i>) and water celery (<i>Helosciadium nodiflorum</i>). Very few shrubs or trees are present on the embankments of this stream, providing negligible effective shading to the stream.</p> <p>Longfin eel (At Risk - Declining) have been recorded in the stream catchment, and likely pass through this stream reach. However, there are several culvert crossings within this stream reach which may pose as fish barriers.</p> <p>Rapid habitat assessment score was very low (calculated from observations of the stream from public access road):</p>																			
																						
			<table border="1"> <thead> <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> </thead> <tbody> <tr> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>1</td> <td>8</td> <td>2</td> <td>2</td> <td>1</td> <td>25</td> </tr> </tbody> </table>	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	3	2	2	2	2	1	8	2
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												
3	2	2	2	2	1	8	2	2	1	25												

Stream	Classification	Site verified?	Brief description																			
Hingaia Stream Tributary B	Intermittent	No	<p>Based on desktop analysis and considering the catchment of this stream, it is likely intermittent in nature, and is associated with a small exotic wetland. This intermittent stream is located within the Section 1 footprint, and has an approximate length of 78 m.</p> <p>It is probable that stormwater runoff from SH1, located upgradient of this stream, contributes to the hydrology of this stream. Its yet to be confirmed if a culvert underneath SH1 discharges water into this stream.</p>																			
Hingaia Stream Tributary C	Intermittent	Yes	<p>The stream, situated to the west of SH1, flows in a northeasterly direction and passes under SH1 through a culvert before discharging into Hingaia Stream Tributary A. It has an approximate total length of 370 m within the ZOI, of which approximately 88 m are within the Project footprint.</p> <p>The stream reach located within the Section 1 footprint appears to have undergone historical straightening. Given the surrounding agricultural land uses, this stream is dominated by exotic aquatic species (water celery and willow weed) and features typical pasture grasses along its banks. The stream banks lack any shrub or tree vegetation.</p> <p>Longfin eel (At Risk - Declining) have been recorded in the stream catchment, and likely pass through this stream reach. However, there are several culvert crossings within this stream reach which may pose as fish barriers.</p> <p>Rapid habitat assessment score was very low:</p>																			
																						
			<table border="1"> <thead> <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> </thead> <tbody> <tr> <td>4</td> <td>2</td> <td>2</td> <td>1</td> <td>1</td> <td>1</td> <td>8</td> <td>2</td> <td>2</td> <td>1</td> <td>24</td> </tr> </tbody> </table>	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	4	2	2	1	1	1	8	2
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												
4	2	2	1	1	1	8	2	2	1	24												

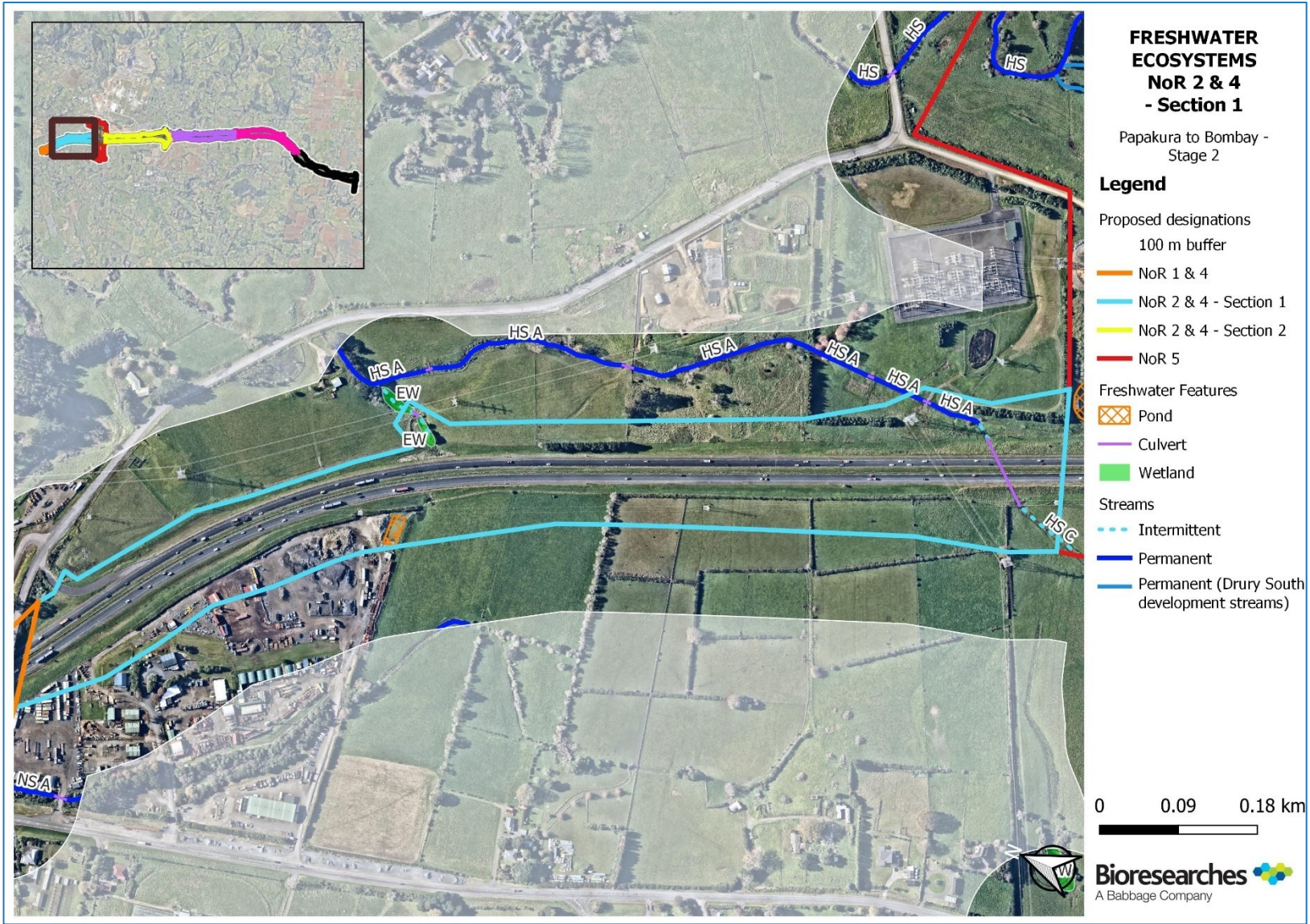


Figure 6-8: Potential freshwater habitats associated with the proposed NoR 2 and 4 – Section 1.

6.2.2.1.1 Freshwater ecological value – Streams of NoR 2 and 4 - Section 1

Table 6-15 presents the ecological value for the freshwater habitats identified within NoR 2 and 4 - Section 1. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 6-15: Ecological values of streams within the ZOI of NoR 2 and 4 - Section 1.

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Ngaakooroa Stream Tributary A	Moderate - instream habitat highly modified, with moderately modified riparian zone.	Low – no 'At Risk' or 'Threatened' species present	Low – highly modified	Moderate - stream with permanent flow.	Moderate
Hingaia Stream Tributary A (also referred to as the 'Transpower Stream' (Boffa Miskell, 2018))	Moderate - instream habitat highly modified, with moderately modified riparian zone.	Moderate – At risk declining longfin eel present within the catchment.	Moderate – some hydrological variation.	Moderate - stream, with permanent flow.	Moderate
Hingaia Stream Tributary B	Low - Riparian zone has been highly modified by human activities. There is also no upstream habitat.	Low – Although longfin eel is present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	Low
Hingaia Stream Tributary C	Moderate - Riparian zone has been highly modified by human activities. The instream habitat is now degraded from nutrient and contaminant inputs, as well as the altered flow regime.	Moderate – At risk declining longfin eel are present within the catchment.	Low – Highly modified stream with no connectivity to upstream habitats.	Low – likely to only be seasonally wet.	Moderate

6.2.2.2 Freshwater habitats – Streams of NoR 2 and 4 - Section 2

Four stream branches were identified within 100 m of the designation boundary, all of which are located within the NoR 2 and 4 – Section 2 footprint. These streams are mapped in Figure 6-9 and Figure 6-10; and described in Table 6-16.


Table 6-16: Summary of streams associated with NoR 2 and 4 – Section 2.

Stream	Classification	Site verified?	Brief description
<p>Hingaia Stream Tributary D (also referred to as the 'Harrison Stream' (Boffa Miskell, 2018))</p>	<p>Permanent</p>	<p>Only upstream reach (west of SH1) field verified</p>	<p>The western reach drains in a west to north-easterly direction, passing through primarily agricultural land before entering a culvert beneath SH1. The footprint of Section 2 intersects approximately 53.4 m of stream.</p> <p>From digital satellite imagery, it appears that the western upstream reach (which has an approximate length of 157 m in the ZOI) has been historically straightened and incised, with no access to the floodplain. Several roads cross this stream reach via culverts. The stream banks show no presence of trees or shrubs and are likely dominated by exotic pasture grass species. Macrophytes can be seen within the stream.</p> <p>The eastern part of the stream, situated east of SH1, is part of the Drury South Residential and Industrial Precincts development and is currently undergoing ongoing earthworks. This stream is also referred to as the 'Harrison Stream' (Boffa Miskell, 2018). Similar to its upstream reach, limited vegetation is present along the stream embankments. According to the Stream Environmental Compensation Plan (Boffa Miskell, 2018), no streamworks are proposed for this stream. Restoration thereof is proposed, which will offset effects elsewhere in the precinct development. The stream corridor will be revegetated to a width of 20 m (10 m to either side of the stream).</p> <div data-bbox="573 826 2063 1337"> </div>

Figure A: Hingaia Stream Tributary upstream reach, west of SH1 (left) and downstream reach, east of SH1 (right).

Stream	Classification	Site verified?	Brief description
Hingaia Stream Tributary E (also referred to as the 'Roslyn Stream' (Boffa Miskell, 2018))	Permanent	No	Drury South Limited has obtained Resource Consent for streamworks for the Drury South Project. These consents will enable development in accordance with the Drury South Residential and Industrial Precincts under the AUP. This development will reclaim streams. This stream (Roslyn Stream) is a newly diverted stream which runs along SH 1 to the west of the proposed development. The purpose of this diversion is to realign the stream to permit land development, while maintaining open stream channels with ecological and flow conveyance values. This stream ties in with the Hingaia Stream catchment. As part of the Stream Environmental Compensation Plan (Boffa Miskell, 2018), a 20 m riparian buffer (10 m to either side of the stream embankments) will be established along this stream.
Hingaia Stream Tributary F	Intermittent	No	A short reach of approximately 127 meters of intermittent stream is present outside and west of the Section 2 footprint. This stream ultimately drains into Hingaia Stream Tributary D. Despite the surrounding agricultural land uses, shrubs are found along the stream banks, although it's likely that exotic pasture grasses and macrophytes dominate the stream embankments.
Hingaia Stream Tributary G	Intermittent	No	<p>Two short, intermittent stream reaches drain into a pond located on the Section 2 western boundary. A third stream branch drains from the pond into a culvert underneath SH1, and discharges into Hingaia Stream Tributary E. Because of their similarities and short lengths, they have been assessed as one habitat unit. A short stream section (approximately 40 m length) which drains from the pond through a culvert underneath SH1, is located within the Section 2 footprint.</p> <p>The pond was constructed in the 1970's, likely as part of the stormwater management of SH1. The embankment of the pond and streams have been replanted (c. 2020) with native riparian vegetation species, specifically cabbage trees and flax. The pond (and other culverts below it) likely act as at least partial barriers to fish passage, although shortfin eels (Not Threatened) are likely to be present within the pond.</p> <p>No records are held for At Risk or Threatened fish species within the streams or pond.</p>



Stream	Classification	Site verified?	Brief description											
Hingaia Stream Tributary E.1	Intermittent	Yes	<p>A short intermittent stream (approximate length of 54 m) is present within the Section 2 footprint. Water enters the stream via a culvert and drains in a northerly direction into a downstream piped section (46 m long). Upon daylighting, the 10 m open stream reach drains through another culvert whereafter is piped underground (for approximately 380 m) to presumably discharge into Hingaia Stream Tributary E.</p> <p>The stream is confined to a straightened channel, dominated by water celery. The embankments have been planted with native species (terrestrial habitat unit P.1). 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.</p> <p>Due to the isolated nature of this stream, no fish species are expected to be present in the stream.</p> <p>Rapid habitat assessment score for the stream was moderate:</p>											
			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
			7	2	2	5	5	1	7	6	7		5	47

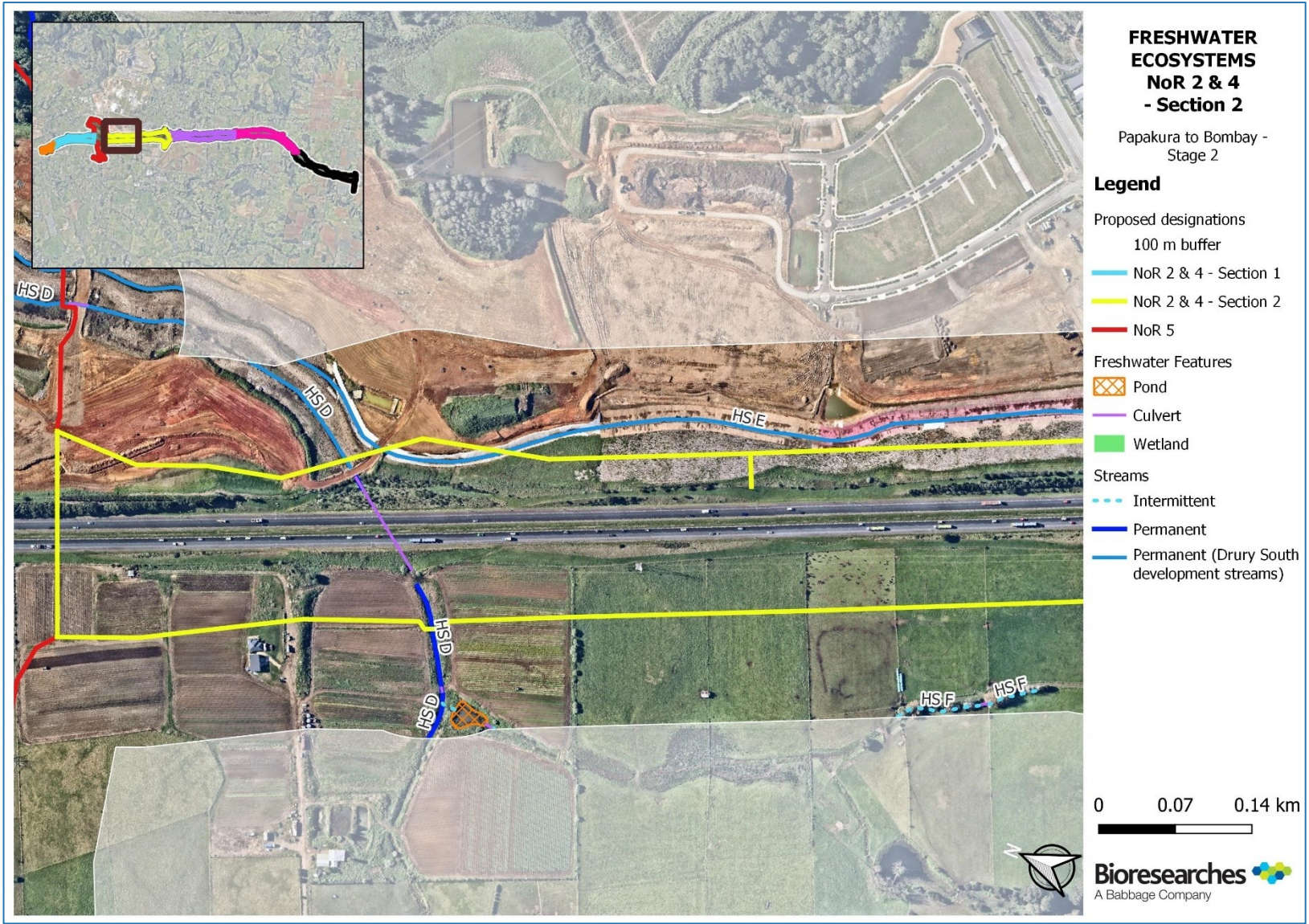


Figure 6-9: Potential freshwater habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 2.

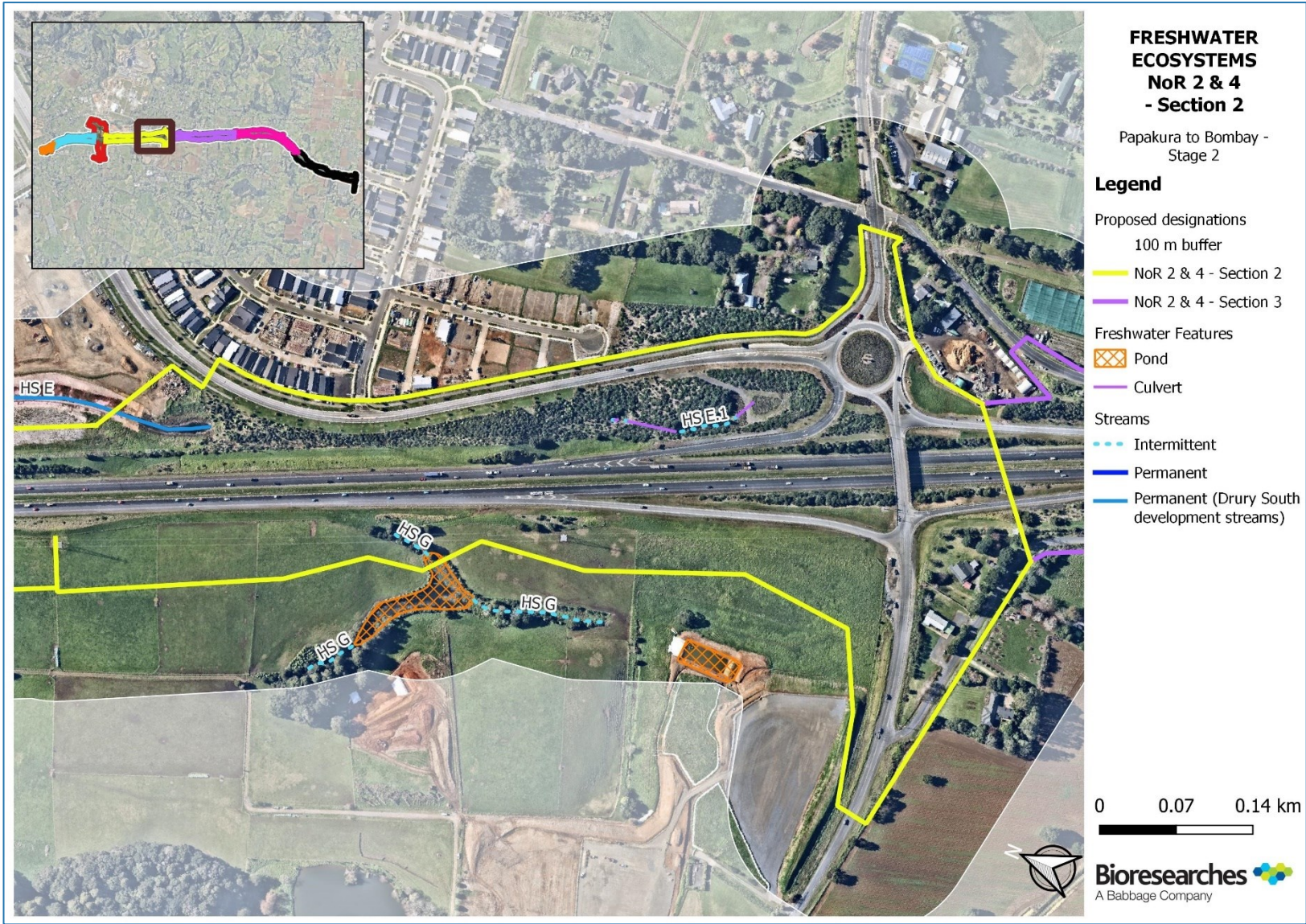


Figure 6-10: Potential freshwater habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 2.

6.2.2.2.1 Freshwater ecological value – Streams of NoR 2 and 4 - Section 2

Table 6-17 presents the ecological value for the freshwater habitats identified within NoR 2 and 4 - Section 2. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.


Table 6-17: Ecological values of streams within the ZOI of NoR 2 and 4 - Section 2.

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Hingaia Stream Tributary D (also referred to as the 'Harrison Stream' (Boffa Miskell, 2018))	Currently undergoing riparian yard restoration. As such, no accurate ecological value assessment could be undertaken. Nonetheless, it is expected that the overall ecological value will be moderate, which is an improvement to the ecological value prior to any restoration.				Moderate
Hingaia Stream Tributary E (also referred to as the 'Roslyn Sstream' (Boffa Miskell, 2018))	Currently being diverted and restored. As such, no accurate ecological value assessment could be undertaken. Nonetheless, it is expected that the overall ecological value will be moderate, which is an improvement to the ecological value prior to any restoration.				Moderate
Hingaia Stream Tributary F	Low - Riparian zone has been highly modified by human activities. There is also no upstream habitat.	Low – Although longfin eel are present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	Low
Hingaia Stream Tributary G	Low - Riparian zone has been highly modified by human activities. There is also no upstream habitat.	Low – Although longfin eel are present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	Low
Hingaia Stream Tributary E.1	Low - Riparian zone has been highly modified by human activities. There is also no upstream habitat.	Low – Although longfin eel are present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	Low


6.2.2.3 Freshwater habitats – Streams of NoR 2 and 4 - Section 3


Five stream branches were identified within 100 m of the designation boundary, however, only one of these were not within the NoR 2 and 4 – Section 3 footprint. These streams are mapped in Figure 6-11 and Figure 6-12; and described in Table 6-18.


Table 6-18: Summary of streams associated with NoR 2 and 4 – Section 3.

Stream	Classification	Site verified?	Brief description																			
Ngaakoora Stream Tributary B	Permanent	Yes	<p>This stream is situated along the western side of SH1 within the Section 3 footprint. The stream originates outside the southwestern extent of Section 3 and enters the ZOI as an intermittent stream. The stream becomes permanent when it becomes confined along the property boundary and SH1. The total reach length within the ZOI is approximately 908 m (of which 655 m is intersected by the Section 3 footprint).</p> <p>Due to the straightened nature of the stream, it is incised, and floods are contained within the stream banks. Several roads intersect this stream through culvert crossings. Notably, the stream banks lack native vegetation species, and exotic scrub species (gorse) dominate the embankments.</p> <p>The embankments of the upstream intermittent reaches do appear to have been replanted with native vegetation species.</p> <p>No records are held for At Risk or Threatened fish species, within this stream, but are likely present within the broader Ngaakoora Stream catchment.</p> <p>Rapid habitat assessment score was very low.</p>																			
																						
			<table border="1"> <thead> <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> </thead> <tbody> <tr> <td>3</td> <td>2</td> <td>2</td> <td>7</td> <td>6</td> <td>2</td> <td>5</td> <td>4</td> <td>2</td> <td>7</td> <td>21</td> </tr> </tbody> </table>	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	3	2	2	7	6	2	5	4
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												
3	2	2	7	6	2	5	4	2	7	21												

Stream	Classification	Site verified?	Brief description
Hingaia Stream Tributary H	Intermittent (TBC)	Yes – classification to be confirmed in fine weather	<p>A culvert underneath Hillview Road, discharges water into a narrow channel (69 m), which drains over a well vegetated slope and eventually into a series of ponds, which ultimately drains into the Hingaia Stream.</p> <p>Significant rainfall occurred at the time of the site assessment, resulting in fast flowing water in the channel, as such it is recommended that a follow up site visit be undertaken in fine weather to accurately classify if this is an intermittent or ephemeral stream. For the purpose of this assessment, the stream was conservatively classified as an intermittent stream.</p> <p>The channel is narrow and shallow, and shaded by dense rank grasses and exotic scrub.</p> 
Hingaia Stream Tributary I	Permanent	Yes	<p>A culvert underneath Hillview Road discharges water into a permanent stream located immediately west of Hillview Road, within the footprint of Section 3. This stream reach is approximately 66 m in length. The stream flows in a generally northern direction and eventually discharges into a large amenity pond.</p> <p>The relatively shallow channel is confined by low embankments, which are covered by rank grasses and exotic scrub (gorse). Water celery and willow weed (<i>Persicaria maculosa</i>) dominate the stream channel.</p> <p>Longfin eel (At Risk - Declining) has been recorded in the stream catchment, and likely pass through this stream reach and the pond.</p> <p>Rapid habitat assessment score was low:</p> 

Stream	Classification	Site verified?	Brief description									Total		
			Deposited Sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation	Riparian width		Riparian Shade	
			1	4	1	1	6	1	10	4	8	1	37	
Hingaia Stream Tributary J	Intermittent	Yes	<p>An approximate 34 m intermittent stream reach is located east of SH1 and Hillview Road. A culvert underneath Hillview Road discharges water into this stream, after which the stream converges with Hingaia Stream Tributary I and ultimately flows into an artificial pond.</p> <p>The stream is shallow, with steep embankments dominated by primarily exotic rank grasses and gorse. The channel is largely covered by macrophytes, mainly water celery.</p> <p>Longfin eel (At Risk - Declining) has been recorded in the stream catchment, and likely pass through this stream reach and the pond.</p> <p>Rapid habitat assessment score was low.</p>											
			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
			2	4	1	1	6	1	10	4	8		1	38

Stream	Classification	Site verified?	Brief description											
Hingaia Stream Tributary K	Intermittent	Yes	<p>A short reach of an intermittent stream, which originates as a roadside drain along Hillview Road, passes through the Section 3 footprint. This stream segment within the ZOI is approximately 133 m long.</p> <p>The channel is relatively narrow and shallow, and it flows through a dense exotic scrub area before passing through a small pond. Upon exiting the pond, the stream flows through an exotic wetland area dominated by willow weed and ultimately discharges into an artificial pond.</p> <p>The stream's channel is shallow and incised, particularly in the downstream portion. Longfin eel have been recorded within the wider stream catchment, and shortfin eels were observed in the stream during the site visit.</p> <p>Rapid habitat assessment score was moderate:</p>											
			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	
			3	3	2	5	8	1	6	5	7	6	46	

Stream	Classification	Site verified?	Brief description											
Hingaia Stream Tributary L	Intermittent	No (Observed from public access road)	<p>A 107 m reach of this intermittent stream is situated within the ZOI but outside the footprint of Section 3. A small culvert underneath Hillview Road discharges water into this stream.</p> <p>Due to the surrounding agricultural land uses, this stream is characterized by exotic macrophytes (such as water celery) and is bordered by typical pasture grasses along its banks. The stream banks lack native shrub or tree vegetation and are primarily dominated by soft rush (<i>Juncus effusus</i>).</p> <p>A soft rush dominated wetland is associated with this stream, which likely resulted due to an undersized culvert crossing over the stream.</p> <p>The abovementioned culvert likely also poses as a fish barrier. No records are held for At Risk or Threatened fish species, within this stream, but are present within the broader Hingaia Stream catchment.</p> <p>Rapid habitat assessment score was very low (inferred based on observations made from public access road crossing):</p>											
			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	2	2	2	2	1	4	2		2	1	24

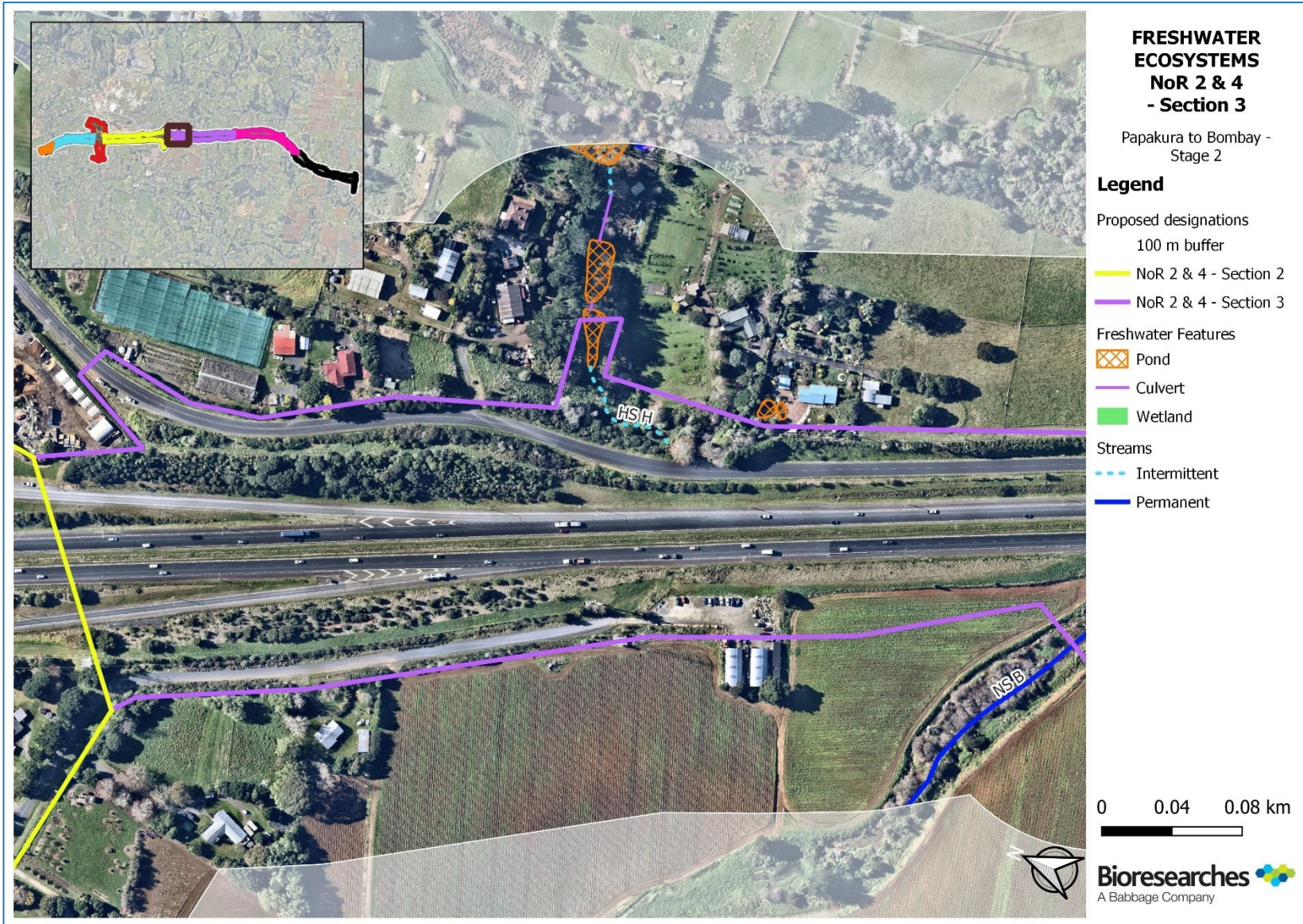


Figure 6-11: Potential freshwater habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 3.

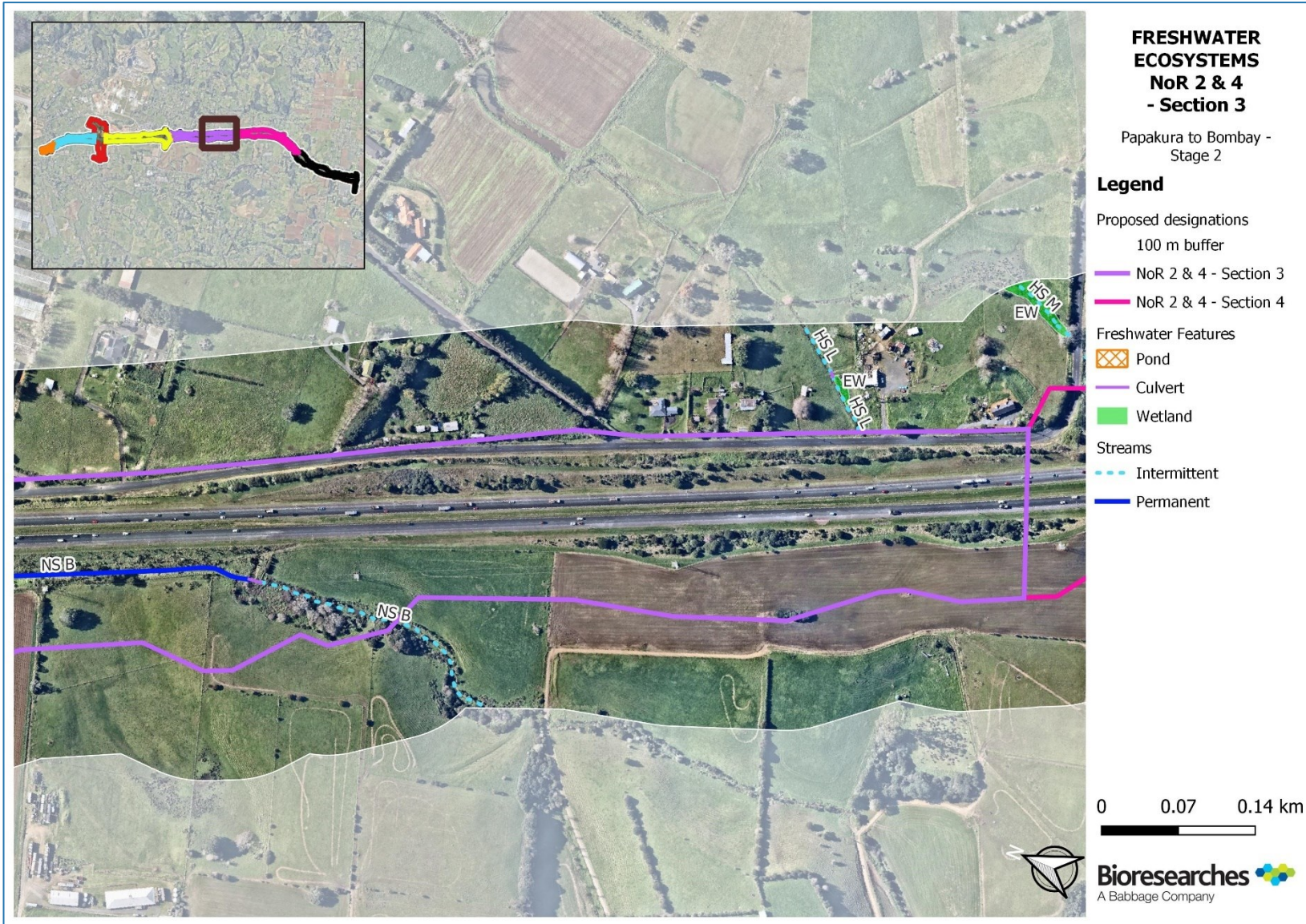


Figure 6-12: Potential freshwater habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 3.

6.2.2.3.1 Freshwater ecological value – Streams of NoR 2 and 4 - Section 3

Table 6-19 presents the ecological value for the freshwater habitats identified within NoR 2 and 4 - Section 3. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.


Table 6-19: Ecological values of streams within the ZOI of NoR 2 and 4- Section 3.

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Ngaakooroa Stream Tributary B	Low - Riparian zone has been highly modified by human activities. The instream habitat is now degraded from nutrient and contaminant inputs, as well as the altered flow regime.	Moderate – At risk declining longfin eel present within the catchment.	Low – highly modified	Moderate - stream, with permanent flow.	Moderate
Hingaia Stream Tributary I	Low - instream habitat highly modified, with modified riparian zone.	Moderate – At risk declining longfin eel present within the catchment.	Low – highly modified	Moderate - stream, with permanent flow.	Moderate
Hingaia Stream Tributary J	Low - instream habitat highly modified, with modified riparian zone.	Low – Although longfin eel is present within the catchment, they are unlikely to be present within this stream.	Low – highly modified	Very low – only seasonally wet, very limited connectivity to any other habitat.	Low
Hingaia Stream Tributary K	Low - instream habitat highly modified, with modified riparian zone.	Low – Although longfin eel is present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	Low
Hingaia Stream Tributary L	Low - instream habitat highly modified, with modified riparian zone.	Low – Although longfin eel is present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	Low

6.2.2.4 Freshwater habitats – Streams of NoR 2 and 4 - Section 4

Two stream branches were identified within 100 m of the designation boundary, both of which are within the NoR 2 and 4 – Section 4 footprint. These streams are mapped in Figure 6-13 and Figure 6-14; and described in Table 6-20.

Table 6-20: Summary of streams associated with NoR 2 and 4 – Section 4.

Stream	Classification	Site verified?	Brief description										
Hingaia Stream Tributary M	Intermittent	Yes, only limited to the eastern downstream reach.	<p>This intermittent stream originates within the western extent of the ZOI, flows under SH1 via a culvert, and then runs along Hillview Road. The stream passes under Hillview Road via a culvert and continues to flow in a northeasterly direction. The total approximate length of the stream within the ZOI is 358 m, with 95 m of it within the Section 4 footprint.</p> <p>The channel along Hillview Road is incised with steep embankments. Most of the stream banks lack riparian vegetation and are vegetated with exotic rank grasses. Along the stretch adjacent to Hillview Road, exotic scrubs are present along the true left embankment.</p> <p>No records are held for At Risk or Threatened fish species, within this stream, but are present within the broader Hingaia Stream catchment.</p> <p>Rapid habitat assessment score was moderate:</p>										
			Deposited Sediment	Invertebrate habitat diversity	Invertebrate habitat abundance	Fish cover diversity	Fish cover abundance	Hydraulic heterogeneity	Bank erosion	Bank vegetation			
			1	2	6	1	7	1	9	4	8	4	43

Stream	Classification	Site verified?	Brief description
Hingaia Stream Tributary N	Intermittent	No	<p>This intermittent stream originates from a pond and drains in a general northerly direction. The length of stream within the ZOI is approximately 380 m, of which approximately 27 m is intercepted by the Section 4 footprint.</p> <p>The stream reach located within the ZOI appears to have undergone historical straightening. The stream embankments were replanted with a mix of native species in the early 2000's, which provides effective shading to the stream. Due to the stream straightening, the stream heterogeneity is low.</p> <p>Shortfin eel has been recorded in the downstream reach of this stream (outside the ZOI), and likely pass through this stream reach. However, there are several culvert crossings within this stream reach which may pose as fish barriers.</p>



Figure 6-13: Potential freshwater habitats associated with the northern portion of the proposed NoR 2 and 4 – Section 4.

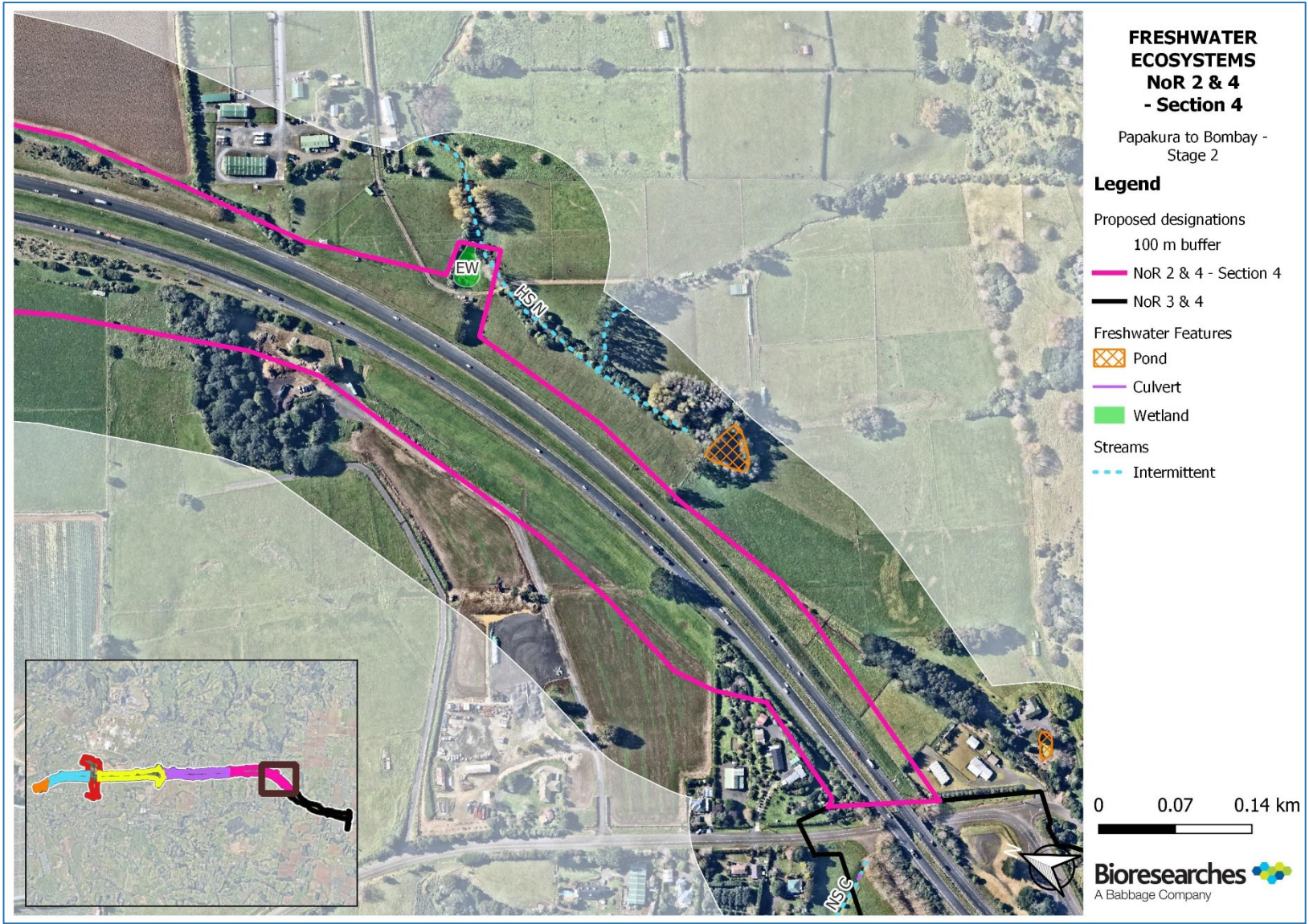


Figure 6-14: Potential freshwater habitats associated with the southern portion of the proposed NoR 2 and 4 – Section 4.

6.2.2.4.1 Freshwater ecological value – Streams of NoR 2 and 2 - Section 4

Table 6-21 presents the ecological value for the freshwater habitats identified within NoR 2 and 4 - Section 4. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 6-21: Ecological values of streams within the ZOI of NoR 2 and 4- Section 4.

Stream	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Hingaia Stream Tributary M	Moderate - Riparian zone has been highly modified by human activities.	Moderate – At risk declining longfin eel present within the catchment.	Moderate – some hydrological variation.	Low – likely to only be seasonally wet.	Moderate
Hingaia Stream Tributary N	Low - Riparian zone has been highly modified by human activities. There is also no upstream habitat.	Low – Although longfin eel is present within the catchment, they are unlikely to be present within this stream.	Low – Highly modified stream with no connectivity to upstream habitats.	Very low – only seasonally wet, very limited connectivity to any other habitat.	Low

6.2.3 Freshwater habitats – Wetlands

6.2.3.1 Freshwater habitats – Wetlands of NoR 2 and 4 - Section 1

A potential wetland was identified during the desktop study. This wetland is described in Table 6-22 and depicted in Figure 6-8.

Table 6-22: Wetlands associated with NoR 2 and 4 – Section 1.

Wetland	NES:F Classification	Classification process	Description
Exotic wetland	TBC	Desktop	Associated with Hingaia Stream Tributary B, located within the NoR footprint. Likely dominated by exotic sedges and rushes (such as soft rush).
		Site assessed – potential classification update in fine weather	Associated with Hingaia Stream Tributary N, located within the NoR footprint. Dominated by water celery, creeping buttercup. Outer edges planted with native species, such as flax and cabbage trees.

6.2.3.1.1 Freshwater ecological value – Wetlands of NoR 2 and 4 - Section 1

Table 6-23 presents the ecological value for the wetland habitats identified within NoR 1 and 2- Section 1. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 6-23: Ecological values of wetlands within the ZOI of NoR 2 and 4 - Section 1.

Wetland	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Exotic wetland	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


6.2.3.2 Freshwater habitats – Wetlands of NoR 2 and 4 - Section 2


No natural inland wetlands are associated with NoR 2 and 4 – Section 2.

6.2.3.3 Freshwater habitats – Wetlands of NoR 2 and 4 - Section 3

Two wetlands were identified during the desktop study. These wetlands are described in Table 6-24 and depicted in Figure 6-11 and Figure 6-12.

Table 6-24: Wetlands associated with NoR 2 and 4 – Section 3.

Wetland	NES:F Classification	Classification process	Description
Exotic wetland	TBC	Desktop	<p>Located outside the eastern boundary of the NoR footprint, associated with an intermittent stream. Dominated by exotic willow weed.</p> 

Wetland	NES:F Classification	Classification process	Description
Exotic wetland	TBC	Desktop	<p>Located outside the eastern boundary of the NoR footprint, associated with an intermittent stream. Likely developed upstream of an undersized culvert crossing, which has impeded natural drainage. Dominated by exotic soft rush.</p> 

6.2.3.3.1 Freshwater ecological value – Wetlands of NoR 2 and 4- Section 3

Table 6-25 presents the ecological value for the wetland habitats identified within NoR 1 and 2- Section 3. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.



Table 6-25: Ecological values of wetlands within the ZOI of NoR 1 and 2- Section 3.

Wetland	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Exotic wetlands	Low – the wetlands appear to be highly modified watercourses.	Low - Unlikely to contain habitat for anything other than common, non-threatened species.	Low – largely uniform habitat	Low – highly modified wetlands in a local environment with multiple wetlands which have retained their features.	Low

6.2.3.4 Freshwater habitats – Wetlands of NoR 2 and 4- Section 4

Two wetlands were identified during the desktop study. These wetlands are described in Table 6-26, and depicted in Figure 6-13 and Figure 6-14.

Table 6-26: Wetlands associated with NoR 2 and 4 – Section 4.

Wetland	NES:F Classification	Classification process	Description
Exotic wetland	TBC	Desktop	<p>Located outside the eastern boundary of the NoR footprint, south of Hillview Road. Dominated by exotic soft rush species. Partially fenced off.</p> 
Exotic wetland	TBC	Desktop	<p>Located outside the eastern boundary of the NoR footprint. The wetland is dominated by exotic soft rush species and has been subjected to pugging.</p> 

6.2.3.4.1 Freshwater ecological value – Wetlands of NoR 2 and 4 - Section 4

Table 6-27 presents the ecological value for the wetland habitats identified within NoR 2 and 4 - Section 4. Information obtained for the ecological baseline was used to assist in scoring where necessary, such as assessing how common a habitat type is within the wider area.

Table 6-27: Ecological values of wetlands within the ZOI of NoR 2 and 4 - Section 4.

Wetland	Representativeness	Rarity / Distinctiveness	Diversity and pattern	Ecological context	Ecological value
Exotic wetlands	Low – the wetlands appear to be highly modified watercourses.	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

6.3 Future environment

Zoning within the ZOI of Stage 2 NoR 2 and 4 is a combination of rural- mixed rural zone (to the west) and rural- rural production zone to the east of SH1. It is expected that these areas will continue to be utilised for agriculture and horticultural purposes over the next 10 years.

6.4 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. 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.

Freshwater habitats are considered a Regional Plan matter, no effects assessment thereof is provided in this report. Should regional resource consent be required, this will be separately sought.

6.4.1 Assessment of 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 native 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.

6.4.1.1 Terrestrial Vegetation

Vegetation to be removed which is subject to District Plan controls includes vegetation within existing road corridors.

The effects of the removal of this vegetation are assessed below in Table 6-28.

Table 6-28: Effects of vegetation removal for terrestrial habitats associated with NoR 2 and 4.

Vegetation type	Alpha-numeric code*	Ecological Value	Magnitude of effect	Level of effect prior to impact management	Impact management and residual level of effect	Management of residual effects
Exotic scrub	ES	Negligible	Very Low	Negligible	Not required	N/A
Planted vegetation	PL.1	Negligible	Very Low	Negligible	Not required	N/A
	PL.3	Negligible	Very Low	Negligible	Not required	N/A
Treeland	TL.3	Negligible	Very Low	Negligible	Not required	N/A
Anthropogenic tōtara forest	AVS1	Moderate	Very Low	Negligible	Not required	N/A
TBC – Native/exotic scrubs	TBC - N/ES	Low	Very Low	Negligible	Not required	N/A
TBC – Native/exotic trees	TBC - N/ET	Low	Very Low	Negligible	Not required	N/A
TBC – Native trees	TBC - NT	Moderate	Very Low	Negligible	Not required	N/A
Pūriri forest	WF7	High	Low*	Low*	Not required	N/A

*Assuming that the designation will avoid this habitat unit.

6.4.1.2 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 6-29.

Table 6-29: Assessment of ecological effects encountered during construction for bats.

Effect	Disturbance and displacement of bats potentially crossing the NoR as they use streams as a flight corridor
Magnitude of effect	As the Project area is already lit with road lighting and as the main southern connection to and from Auckland, with continuous traffic, including heavy trucks, 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.
Level of effect prior to impact management	Moderate

Effect	Disturbance and displacement of bats potentially crossing the NoR as they use streams as a flight corridor
Impact management and residual level of effect	<p>Surveys should be completed prior to construction commencing to confirm bat presence.</p> <p>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.</p> <p>The post mitigation level of effect can be reduced to Negligible.</p>
Management of residual effects	Not required

6.4.1.3 Native 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 6-30.

Table 6-30: Assessment of ecological effects encountered during construction for birds.

Effect	Disturbance and displacement of native birds due to construction activities	Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill native birds (Not threatened native birds only)
Magnitude of effect	<p>Adjacent habitats are periodically used by birds. Although birds present are likely to be habituated to a level of disturbance due to existing proximity to the motorway and urban environments in which they are found, the magnitude of effect is expected to be Low, as habitat availability is poor quality and very limited relative to the surrounding environment.</p>	<p>There is a reasonable probability that native birds utilise these trees for nesting, however habitat quality is poor, being predominantly exotic, narrow, isolated strips of vegetation. The magnitude of effect is expected to be Low.</p>
Level of effect prior to impact management	<p>Very Low for Not Threatened bird species. Low for TAR species.</p>	Low

Effect	Disturbance and displacement of native birds due to construction activities	Loss of District Plan vegetation which may remove nests and foraging habitat, and injure or kill native birds (Not threatened native birds only)
Impact management and residual level of effect	<p>Pre-construction bird surveys should be undertaken to determine if Spotless Crane, New Zealand Dabchick, Grey Duck and other native wetland bird species are present.</p> <p>If At risk or Threatened wetland birds are present, a Wetland Bird Management Plan should be developed which could include the following management controls:</p> <p>Where practicable, construction works should commence prior to the breeding season/s of the native wetland birds identified as present; in order to discourage bird nesting.</p> <p>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 native 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.</p> <p>Where practicable, works should be set back from wetland edges by at least a 10 m buffer.</p> <p>Light spillage from construction areas should be minimised as far as practicable.</p>	<p>Under the Wildlife Act 1953, impact management measures will be required to prevent killing or injuring native birds during tree felling.</p> <p>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.</p>
Management of residual effects	Not required	Not required

6.4.1.4 Lizards

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

The effects of the works upon lizards are described below in Table 6-31.

Table 6-31: Assessment of ecological effects encountered during construction for lizards.

Effect	Disturbance and displacement of lizards due to construction activities
Magnitude of effect	The magnitude of effect is assessed as Negligible due to unlikelihood of lizard disturbance due to construction related noise and vibration.
Level of effect prior to impact management	Low
Impact management and residual level of effect	Not required
Management of residual effects	Not required

6.4.2 Operational effects – terrestrial ecology

The Project involves the widening of the SH1 and a shared use path. The future environment is a mix of different rural zones. The stream corridors and existing habitats associated with these are highly likely to remain as they have significant protections under current legislation.

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.

6.4.2.1 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 low magnitude of effect, over and above the existing motorway environment and consequently a moderate level of effect; and therefore, is discussed further in Table 6-32; 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 10 years (when the Project is expected to begin), impacts on roosting bats have not been considered.

Table 6-32: 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
Magnitude of effect	The habitat is already fragmented by the presence of the existing motorway, which is lit at night with high traffic movement, 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 .
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

6.4.2.2 Native 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**, and consequently the level of effect is considered to be **Very Low** for Not Threatened birds and **Low** for At Risk birds.

Birds may also be affected by vehicle strike; however, this is only likely to occur infrequently and is unlikely to occur with greater frequency than current conditions. 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 At Risk birds.

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

6.4.2.3 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**, 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.

6.4.3 Conclusions

Ecological effects assessed as moderate or greater include:

- Moderate level of effect to bats during construction may occur due to disturbance to bats potentially utilising the streams which the NoR crosses as flight corridors;
- Moderate level of effect to At Risk birds may occur due to disturbance to birds nesting in adjacent habitats; and
- Moderate level of effect to bats during operation may occur due to fragmentation of habitat and impacts of lighting and noise.

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