"APPENDIX 1"

Assessment of Potential Ecological Effects for a Proposed Subdivision at Pōhutukawa Drive, Bell Block, Taranaki

Contract Report No. 6969

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Assessment of Potential Ecological Effects for a Proposed Subdivision at Pōhutukawa Drive, Bell Block, Taranaki

Contract Report No. 6969

October 2024

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1.0 Introduction

W. & C. Bolton own a property at Bell Block, between Pōhutukawa Place and the western side of the Bell Block residential area. The property is zoned Residential and is proposed for subdivision.

The property is currently farmed. The northern and western boundaries adjoin strips of indigenous forest that comprise riparian buffers to the Waipu Lagoons, two separate ecologically-significant coastal lagoon systems.

This report provides an ecological assessment of the potential effects of the proposed subdivision on the rural farmland and also on the adjacent indigenous forest and lagoons.

2.0 Ecological Context

2.1 Overview

The subject property is located between Pōhutukawa Place, Links Road, and the western side of Bell Block. The northern extent of the property is less than one kilometre from the coast, and the bulk of the site is 1-2 kilometres from the coast. As such, the property is in the transition between the coastal and semi-coastal bioclimatic zones, in Egmont Ecological District, within Taranaki Ecological Region.

2.2 Egmont Ecological District

The following descriptions are largely derived from Clarkson 1986, and Bayfield and Benson 1986.

<u>General</u>

Egmont Ecological District has a total area of c.268,091 hectares (Landcare Research New Zealand). It is located on the west coast of the North Island, extending from the Tasman Sea inland to an eastern border with the neighbouring Ecological Districts of North Taranaki, Matemateaonga, and Manawatu Plains. Egmont Ecological District encompasses the volcanic peaks of Mt Taranaki/Egmont, Pouakai, and Kaitake, and the associated ring plains. This District includes environments and habitats that range from coastal and estuarine areas to lowland hill country and alpine environments.

<u>Climate</u>

Rainfall in Egmont Ecological District ranges from c.1,500 millimetres at the North Taranaki coast, to c.1,200 millimetres at the south Taranaki coast, and c.6,500 millimetres at 1,000 metres above sea level (asl), and c.8,000 millimetres at 2,000 metres asl on Mt Taranaki. The freezing level lies between 2,800-4,200 metres asl during summer, and falls to 1,150-2,500 metres asl in mid-winter. On the northern and western sides of Mt Taranaki there is a wet climate of warm humid summers and mild winters with prevailing south west winds. The southern side of Mt Taranaki is a gale-prone area, with west to northwest prevailing winds. In the coastal zone, there are significant salt-laden winds.

Egmont Ecological District has seven bioclimatic zones: coastal, semi-coastal, lowland, lower montane, montane, sub-alpine, and alpine. Each zone is distinguished by various combinations of elevation, distance from the coast, climate, and plant communities that reflect the respective physical environments.



<u>Soils</u>

Soils within Egmont Ecological District are primarily deep, friable, well-drained volcanic ash soils derived from andesitic ashes, with significant areas of shallow and bouldery soils from recent laharic deposits. Soils vary with local topography. Along rivers and estuaries there are well-drained alluvial soils. Organic soils composed of peat and interbedded with volcanic ash occur at the Ahukawakawa Swamp and at several small mires at lower latitudes.

Yellow-brown loams (Inglewood-Patua soils) from thick volcanic ash occur over most of the Pouakai and Kaitake Ranges and on some parts of Mt Taranaki. These soils are derived from the numerous eruptions of Mt Taranaki and are slightly acidic, moderately-strongly leached, fertile soils.

Above the treeline, soils are poorly developed and mainly derived from weathering of exposed rocks. Erosion has removed much of the volcanic ash. As a result, they are shallow and stony with large areas of bare rock or scree.

Present-Day Vegetation

At the time of European settlement (1840) much of the coastal forest had been modified by Māori with small pocket clearings stretching inland as far as five kilometres. The arrival of European settlers resulted in the rapid clearance of nearly all of the remaining coastal forest and most of the semi-coastal and lowland forest to create exotic grassland for farming.

Present-day vegetation cover of Egmont Ecological District has been obtained from the Land Cover Database version 4.1 (LCDB 4.1) (Landcare Research New Zealand 2015). Pasture covers c.78% of the district and exotic forest covers c.1.4%. Thirteen percent of Egmont Ecological District remains in indigenous forest, with further areas mapped as indigenous shrubland and scrub (2.2%), inland wetlands (0.13%), and tussockland (0.27%).

Only 3.6% of the lowland bioclimatic zone (below 440 metres above sea level) remains in indigenous forest.

Protected Areas

Thirteen percent of Egmont Ecological District lies within Egmont National Park and reserves (Department of Conservation 2002). However, less than one percent of coastal and semi-coastal bioclimatic zones, and two percent of the lowlands are legally protected (ibid.). Most of the protected areas are within the alpine, sub-alpine, and montane zones.

The Waipu Lagoons cover c.7.9 ha in the Egmont Ecological District. As a site of multiple Pā, the lagoons are culturally important to Te Atiawa and within the rohe of Puketapu Hapū. Lagoon ecosystems this large are regionally rare and contain high ecological value habitats for aquatic species.

2.3 Key Native Ecosystems in Taranaki Region

The Waipu Lagoons are two irregularly shaped, natural coastal lagoons on the western side of Bell Block, Taranaki. The lagoons are both drained by a small stream (farm drain) that discharges to the coast between the Waiwhakaiho River and Bell Block.

Taranaki Regional Council (TRC) has established and maintains a register of Key Native Ecosystems (KNE) in the region since 2006 and the Waipu Lagoons are recognised as a KNE site, with the following description (TRC 2006):



"The Waipu Lagoons, a Local Purpose Reserve owned and administered by the New Plymouth District Council, are located on the western outskirts of Bell Block. The lagoons lie in the Egmont Ecological District."

"Waipu Lagoons cover 7.9 ha and comprise of two irregularly shaped natural coastal lagoons and their margins. The lagoons provide habitat for a wide variety of birdlife including threatened species. Dune swamps and lagoon systems of this size and condition are regionally rare."

In the TRC KNE inventory, the lagoons have been ranked 'High' for the following criteria: rarity and distinctiveness, representativeness, and ecological context, and also sustainability.

All the eastern wetland is recognised as a KNE site, but only the northern half of the western wetland.

2.4 Ecological Study of Hickford Park (2012)

An ecological study of Hickford Park and route options for the coastal walkway (Bylsma *et al.* 2012) also encompassed the Waipu Lagoons.

As such it provides useful descriptions of the wetland vegetation associated with the lagoons and terrestrial woody vegetation on their margins. Permanent monitoring plots were also established in riparian and wetland vegetation on the margins of the lagoons.

A map is provided of the lagoons and vegetation on the lagoon margins, and reasonably detailed descriptions of the three main vegetation and habitat types (in addition to open water):

- Raupō-dominant reedland.
- Flaxland.
- Mixed native forest on terrestrial margins.

Bylsma *et al.* (2012) also collated records of 32 bird species that have been recorded at the Waipu Lagoons, including Threatened and At Risk species. They also collated records of aquatic species in the lagoons, and used tracking tunnels to check for the presence of lizards (none were detected).

3.0 Statutory Context

National Policy Statement for Freshwater Management 2020

The National Policy Statement for Freshwater Management (NPS-FM) affords protection to coastal lagoons through multiple pathways - primarily policy, values, and management approaches.

Policy

- 1. Freshwater is managed in a way that gives effect to Te Mana o te Wai.
- 2. Tangata whenua are actively involved in freshwater management (including decision-making processes), and Māori freshwater values are identified and provided for.
- 3. Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.



- 4. Freshwater is managed as part of New Zealand's integrated response to climate change.
- 5. Freshwater is managed (including through a National Objectives Framework) to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.
- 8. The significant values of outstanding water bodies are protected.
- 9. The habitats of indigenous freshwater species are protected.
- 12. The national target (as set out in Appendix 3) for water quality improvement is achieved.
- 13. The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends.
- 14. Information (including monitoring data) about the state of water bodies and freshwater ecosystems, and the challenges to their health and well-being, is regularly reported on and published.

Values

Through Te Mana o Te Wai the NPS-FM imposes a hierarchy of obligations and outlines the joint roles of tangata whenua and Regional Councils in determining local freshwater values and how they will be measured and managed.

Integrated Management

Management of freshwater systems must adopt an integrated approach by recognising the interconnectedness of the whole environment:

- (a) from the mountains and lakes, down the rivers to hāpua (lagoons), wahapū (estuaries) and to the sea; and
- (b) recognise interactions between freshwater, land, water bodies, ecosystems, and receiving environments; and
- (c) manage freshwater, and land use and development, in catchments in an integrated and sustainable way to avoid, remedy, or mitigate adverse effects, including cumulative effects, on the health and well-being of water bodies, freshwater ecosystems, and receiving environments; and
- (d) encourage the co-ordination and sequencing of regional or urban growth.

Regional Freshwater Plan for Taranaki

Further considerations for freshwater ecosystems including lagoons are found in The Regional Freshwater Plan for Taranaki objectives (3.1.3, 3.1.14, 3.1.15, and 3.1.6) and policies (3.1.2 and 3.1.3).



4.0 Previous Relevant Technical Assessments

4.1 Overview

Subdivision has obviously been a potential option for this site for quite some time. Previous technical evaluations include an assessment of potential effects on the lagoons (Apex Consultants 2004), and ecological assessments related to an earlier iteration of the current subdivision proposed.

Two previous ecological assessments have been provided for the subject property:

- Wetland assessment and delineation (Roth 2021a).
- Potential effects of roading and subdivision on water quality (Roth 2021b).

Findings from these three assessments are summarised below.

4.2 Apex Consultants 2004

As noted above, the subdivision site is farmland, with little or no biodiversity features and values, but the site is immediately adjacent to the Waipu Lagoons, which have significant indigenous vegetation and habitat values for plants and fauna.

An assessment of the potential effects of subdivision development on the lagoons was undertaken 20 years ago (Apex Consultants 2004), on behalf of New Plymouth District Council. This assessment was related to the 'Kingsdown Subdivision' but the findings are still relevant. To summarise, it was found that groundwater was contributing 120 m³/day to the eastern lagoon, there was also a rapid response to rainfall events, and a relatively stable base flow level was apparent in the long-term data (Apex Consultants 2004). Other findings addressed stormwater management, the need for monitoring of water levels and water quality, and construction management, including the need for a minimum of a 10 metre buffer (outside of the lagoon boundary fence).

4.3 Wetland Delineation 2021 (Roth 2021a)

Margins of the two lagoons were delineated and wetland assessment plots were established and assessed in two locations (Figure 3 in Roth 2021a):

- At the southern end of the western lagoon: this site is the grazed 'head' of the wetland and associated margins and has some very degraded pasture-dominant depressions that are an integral part of the landform depression where the wetland lies.
- At the southern end of the eastern wetland, where there is a small area of poorly-drained ground in the paddock on the wetland margins.

The wetland evaluation was undertaken under the auspices of the National Policy Statement – Freshwater Management (NPS-FM) (2020) and the National Environmental Standards for Freshwater (NES-F), as they were in 2021. These statutory documents were updated in 2023, and are likely to undergo further change.

In 2021, the poorly-drained site at the southern end of the eastern wetland was considered to comprise 'improved pasture' (Roth 2021a).

In 2021, the poorly-drained site evaluated at the 'head' of the western wetland was considered to comprise 'natural wetland' (Roth 2021a). However, it is clear from the data sheets in Appendix 1 of



Roth (2021a) that all of the five sites assessed were highly degraded and were all predominantly exotic species typical of degraded grazed environments.

Roth (2021a) recommended the establishment of a 20 metre protective buffer adjacent to the wetlands, and this is discussed in Section 13.3 of this report.

4.4 Assessment of Road 2 and Water Quality (Roth 2021b)

This memo provides a high level evaluation of the potential effects of proposed 'Road 2', noting that the road alignment has been moved to be outside of a 20 metre buffer on the wetland margin. The memo includes the following statement:

"A 20 metre riparian buffer is the minimum width that provides significant ecological functions in terms of habitat provisions for fauna, water filtering capacity, sediment trapping and flora diversity."

However, this statement does not acknowledge that ecological functions associated with riparian buffers need to be assessed on a site-by-site basis, to take account of site-specific factors such as slope. This matter is discussed further in Section 13.3 below.

5.0 Methods

The following methods have been used to prepare this ecological assessment:

Site Visits

• Site visits were undertaken on 15 December 2023, 18 March 2024, 1 April 2024, and 3 June 2024.

Existing Information

• Relevant existing database records and information were compiled and evaluated.

Vegetation and Habitats

• High resolution aerial imagery was used in the field to map and evaluate vegetation on and adjacent to the subject property.

<u>Avifauna</u>

- Birds seen and heard in the field were recorded.
- The eBird and INaturalist databases were searched for records within five kilometres of the site.

Wetland Delineation

- Previous wetland delineation work at the site by Roth (2021a) was evaluated.
- A preliminary evaluation of the margin of the eastern lagoon was undertaken on foot on 15 December 2023.
- On 18 March 2024, the entire margins of both the eastern and western lagoons adjacent to the subject property were traversed on foot, in the company of a qualified land surveyor.



- During this traverse, a spade and a steel rod were used to 'probe' the soil on the margins of each wetland, and a combination of soil character (i.e. degree of saturation/bogginess/colour) and vegetation character was used to determine a series of points that demarcated the change from wetland to terrestrial character. If there was any doubt, the point was placed in the terrestrial environment. The land surveyor used a Trimble GNSS RTK 'total station' surveying instrument to record the location of each point.
- Wetland margins delineated in March 2024 were compared with the margins delineated in 2021 (see Section 3.3 above).

Freshwater Fish Database

• The New Zealand Freshwater Fish Database1 (NZFFD, Stoffels 2022) was accessed and searched for records associated with the Waipu Lagoons and Stream. Freshwater fish (indigenous and exotic) and invertebrates captured from the catchment were collated.

Environmental DNA

• Two environmental DNA (eDNA) samples were collected from two sites on 1 April 2024 located at -39.02982139, 174.13526935 and -39.03111248, 174.13222845. The samples were submitted to Wilderlab for analysis.

TRC Request for Further Information

• Taranaki Regional Council has provided a request for further information (RFI) in relation to various matters, as set out in Appendix 1, including various ecological issues.

6.0 Vegetation and Habitats

Overview

The subdivision site comprises a single vegetation and habitat type: grazed exotic pasture.

Vegetation and habitats adjacent to the site comprise two types:

- The lagoons the margins adjacent to the subdivision site have a cover of indigenous forest.
- The wetland complex includes both open water and indigenous-dominant wetland vegetation.

Refer to Figure 1 for a map of vegetation pattern. Descriptions of the above types are provided below.

Grazed Pasture at the Subdivision Site

This is primarily rye grass-clover pasture that is grazed relatively intensively. A range of exotic herbaceous species is present, comprising species that the commonly found in pasture environments. These include broad-leaved dock (*Rumex obtusifolius*), narrow-leaved plantain (*Plantago lanceolatum*), Yorkshire fog (*Holcus lanatus*), local gorse (*Ulex europaeus*), Californian thistle (*Cirsium arvense*), local blackberry (*Rubus fruticosus*), catsear (*Hypochoeris radicata*), and various other exotic

¹ https://nzffdms.niwa.co.nz/search Accessed June 2024.



species. There are very few trees, with two planted pohutukawa (*Metrosideros excelsa*). The site is relatively flat, with little variation, and most of the site is probably seasonally mown for hay production.

Adjacent Indigenous Forest on Wetland Margins

The composition varies but this appears to be planted secondary forest, largely around 10-12 metres tall. The canopy includes pohutukawa, ti kouka (cabbage tree; *Cordyline australis*), mahoe (*Melicytus ramiflorus*), karaka (*Corynocarpus laevigatus*), and local whau (*Entelea arborescens*). Mamaku treefern (*Sphaeropteris medullaris*) is locally abundant, especially on wetland margins.

Exotic flowering cherry (*Prunus* sp.) is present locally.

The forest understorey includes locally abundant kawakawa (*Piper excelsum* subsp. *excelsum*) and karaka seedlings, and local wheki (*Dicksonia squarrosa*) and mamaku.

Litter is the main groundcover.

Wetland Vegetation

Most wetland vegetation is within the fenced and protected area that comprise the western and eastern Waipu lagoons and associated riparian margins and terrestrial forest.

There is a relatively small area at the 'head' of the western lagoon complex where stock have access and have degraded the quality of the wetland vegetation. A narrow strip of highly modified wetland vegetation is also present at the very head of the wetland depression, where exotic grasses are dominant.

There is also a very small area of degraded exotic-dominant wetland on the margin of the eastern lagoon complex that is outside of the marginal fence, also at the 'head' of the lagoon complex.

Parts of the adjacent Waipu Lagoon cmplex that are not open water are predominantly raupō (*Typha* orientalis) reedland with local harakeke (flax, *Phormium tenax*) and abundant swamp kiokio (*Parablechnum minus*). Harakeke is locally dominant, especially in the western wetland). Kuta (*Eleocharis sphacelata*) is locally abundant, especially on the margins of open water.

Grey willow (*Salix cinerea*) is present locally on wetland margins. Water purslane (*Ludwigia palustris*) is locally abundant on water margins.

7.0 Flora

A list of vascular plant species recorded on the subject property and in adjacent riparian forest and wetland vegetation and habitats is provided in Appendix 2.

Species recorded on the subject property are all common and/or exotic species (predominantly the latter) and no naturally-occurring indigenous species are classified as Threatened or At Risk, as per de Lange *et al.* 2024.





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Z	Data Acknowledgment "Contains data sourced from the LINZ Data Service licensed for reuse under CC BY 4.0" Report: 6969 Ref: 11211 Client: - Name: Figure_Vegetation.aprx Path: Eigis/PohutukawaPlace_56/mxd/Figure_Vegetation.aprx	Figure 1. Vegetation and habitats within and adjacent to the proposed Parklands Subdivision	© 2024 Wildlands.co.nz, 0508 WLDNZ Scale: 1:3,000 Date: 9/10/2024 Cartographer: FM Format: A3



8.0 Avifauna

The subdivision site encompasses only one vegetation and habitat type, grazed pasture, as described above. The site also adjoins similar grazed pasture to the west and the north. As described above, the Waipu Lagoons are also adjacent to the site. Bird use is described for the following habitats:

- Grazed pasture.
- Forest margins to the Waipu Lagoons.
- Wetland open water habitat at the Waipu Lagoons.

Grazed Pasture

This relatively extensive area is utilised by a range of common indigenous and exotic species, such as pūkeko, kahu, spur-winged plover, and a range of small exotic passerines. White-faced heron are present occasionally. Large numbers of Canada geese roost and graze in the grassed paddocks, and hundreds can be present at times. Canada geese are classified as a pest species in Aotearoa New Zealand and can be killed humanely at any time, anywhere in the country.

Forest Margins Adjacent to the Wetlands

This habitat is utilised by a range of common indigenous species, including pīwakawaka (fantail), tauhou (silvereye), and riroriro (grey warbler). Tūī and korimako (bellbird) will also be present, at least seasonally. Common exotic species include blackbird, song thrush, and starling.

<u>Wetlands</u>

Open water habitat and its margins is utilised by Canada geese, mallard duck (and mallard-grey duck hybrids), Australasian coot, pūkeko, and tētē (grey teal). It is likely that pūweto (spotless crake) are present in the raupō stands, and that mātuku-hurepo (bittern) utilise the site. Large numbers of Canada geese are present at times, with groups of 50-100 birds, or more.

Species Records

A list of bird species recorded at the Waipu Lagoons between 1999 and 2011 is provided below, and a list of records from the eBird and INaturalist databases is provided in Appendix 3. Records in Appendix 3 are from within five kilometres of the site so some species (e.g. seabirds) will not utilise habitats at the site or adjacent to it.

 Table 1 – Bird species recorded at the Waipu Lagoons, Hickford Park, by Barry Hartley (Ornithological Society of New Zealand, Taranaki representative) 1999 to 2011, reproduced from Bylsma *et al.* 2012.

Common Name	Scientific Name
Australasian harrier	Circus approximans
Australasian shoveler	Anas rhynchotis
Australian magpie	Gymnorthina tibicen
Black shag	Phalacrocorax carbo
Black swan	Cygnus atratus
Black-backed gull	Larus dominicanus
Blackbird	Turdus merula
Canadian goose	Branta canadensis
Cattle egret	Bubulucus ibis



Common Name	Scientific Name
Chaffinch	Fringilla celebs
Fantail	Rhipidura fuliginosa
Feral pigeon	Columba livia
Goldfinch	Carduelis carduelis
Greenfinch	Carduelis chloris
Grey duck	Anus superciliosa
House sparrow	Passer domesticus
King fisher	Halcyon sancta
Little black shag	Phalacrocorax sulcirostris
Mallard	Anas platyrhynchos
Muscovy duck	Cairina moschata
Myna	Acridothered tristis
New Zealand dabchick	Poliocephalus rufopectus
New Zealand pipit	Anthus novaeseelandiae
New Zealand scaup	Aythya novaeseelandiae
Paradise shelduck	Tadorna variegata
Pheasant	Phasianus colchicus
Pied oystercatcher	Haematopus ostralagus
Pied shag	Phalacrocorax varius
Pied stilt	Himantopus himantopus
Pukeko	Porphyrio porphyrio
Red-billed gull	Larus novaehollandiae
Silvereye	Zosterops lateralis
Skylark	Alauda arvensis
Song thrush	Turdos philomelos
Spur-winged plover	Vanellus miles
Starling	Sturnus valgaris
Tui	Prosthemandera novaeseelandia
Welcome swallow	Hirundo tahitica
White-faced heron	Ardea novaehollaniae
Yellowhammer	Emberiza citrinella

9.0 Freshwater Habitats

Waipu Lagoons – General

The Waipu lagoons are a regionally rare ecosystem and they retain high value habitat for fish and invertebrates. Although no recent fish surveys have been recorded for the lagoons, the most recent occurred more than 20 years ago, analysis of eDNA samples collected in 2024 indicate that At Risk-Declining longfin eels may be present (Dunn *et al.* 2018 and Grainger *et al.* 2018).

Freshwater Fish Database

The New Zealand Freshwater Fish Database (Stoffels 2022) holds three records for the lagoons and no records for the channelised stream that drains the lagoons. The three records were provided by the Department of Conservation, which used nets and traps to undertake the surveys. Just one indigenous freshwater fish species has been recorded in the database - an unidentified galaxiid in 2003 – along with goldfish in 1995, and goldfish and perch in 2002 (Table 2).



Table 2– New Zealand Freshwater Fish Database records for the Waipu Lagoons. Threat rankings are as per Dunn *et al.* 2017 and Grainger *et al.* 2018.

Scientific Name	Common Name	Threat Ranking	Number of Occurrences in the NZFFD
Carassius auratus	Goldfish	Introduced and Naturalised	5
Galaxias	Unidentified galaxiid		Present
Perca fluviatilis	Rudd	Introduced and naturalised	27

Similar records were collated by Bylsma et al. (2012).

Environmental DNA

eDNA results included one order, Cypriniformes, and four species, longfin eel and shortfin eel, perch, and goldfish (Table 3). Although eels are highly likely in lagoon environments such as this, additional fish surveys using nets would be required to confirm the eDNA findings and update records for the lagoons in the New Zealand Freshwater Fish Database.

Table 3 – Wilderlab eDNA results from the two samples collected from the Waipu Lagoons in April 2024. Threat rankings are from Dunn *et al.* 2017 and Grainger *et al.* 2018.

Scientific Name	Common Name	Threat Ranking
Anguilla australis	Shortfin eel	Not Threatened
Anguilla dieffenbachii	Longfin eel	At Risk-Declining
Carassius auratus	Goldfish	Introduced and Naturalised
Perca fluviatilis	Perch	Introduced and naturalised

10.0 Bats

A search of the Department of Conservation Bat Database was undertaken on 6 September 2024 and found the following records of pekapeka/long-tailed bats (*Chalinolobus tuberculatus*; Threatened-Nationally Critical):

- 18 records at a site 22 kilometres southeast of Bell Block.
- One record about 22 kilometres south of Bell Block.

There are numerous closer sites where bat surveys have been undertaken but no bats were detected.

11.0 Lizards

Species recorded within 15 kilometres of the site in the last 20 years:

- Goldstripe gecko (*Woodworthia chrysosiretica*): 12 records, closest 3.7 kilometres, most recent 2024.
- Copper skink (*Oligosoma aeneum*): five records, closest six kilometres, most recent 2024.
- Pacific gecko (*Dactylocnemis pacificus*): one record, just over 15 kilometres from the site in 2012.
- Numerous plague skinks found at Lake Rotomanu (two kilometres from the site) in 2016.

Historic records of other species within 10 kilometres of the site:



- Striped skink (Oligosoma striatum) last recorded in 1991.
- Forest gecko (*Mokopirirakau granulatus*) last recorded in 1965.
- Northern grass skink (Oligosoma polychroma) last recorded in 1950.

Additional species known within the Ecological District (Bell and Wiles 2015):

- Elegant gecko (Naultinus elegans).
- Ornate skink (Oligosoma ornatum).
- Glossy brown skink (Oligosoma zelandicum).

Table 4 below provides a list of species that could be present in the wider area, and their habitat preferences.

Table 4 – Lizard species that are potentially present in the wider Bell Block area, threat status, and their habitat preferences.

Species	Common Name	Threat Status	Preferred Habitats
Dactylocnemis pacificus	Pacific gecko	Not Threatened	Indigenous forest, scrub, and treeland, harakeke, rocks
Mokopirirakau granulatus	Forest gecko	At Risk - Declining	Indigenous forest, scrub, and treeland
Naultinus elegans	Elegant gecko	At Risk - Declining	Indigenous forest, scrub, and treeland
Oligosoma aeneum	Copper skink	At Risk - Declining	Leaf-litter, dense understorey vegetation, rank grass, harakeke, woody debris, rocks
Oligosoma ornatum	Ornate skink	At Risk - Declining	Forest, shrubland, grassland, damp leaf litter, rock/log piles, dense ground vegetation
Oligosoma polychroma	Northern grass skink	Not Threatened	Rock piles, grassland, flaxland, shrubland, forest margin
Oligosoma striatum	Striped skink	At Risk - Declining	Indigenous forest, scrub, treeland, rank grass, pampas, woody debris
Oligosoma zelandicum	Glossy brown skink	At Risk - Declining	Boulder beaches/riverbeds, grasslands, wetlands, scrub, damp forests, gardens
Woodworthia chrysosiretica	Goldstripe gecko	At Risk - Declining	Indigenous forest, scrub, and treeland, and harakeke

Grazed (and trampled) pasture environments that cover almost the entire site do not provide lizard habitat. However, it is possible that various skink and gecko species utilise the forested margins of the two lagoons.

12.0 Other Fauna

As noted above, the entire site is currently grazed, with dairy/beef animals. A suite of common introduced pest animals will also be present, including feral cats (*Felis catus*), Norway rats (*Rattus norvegicus*), possibly ship rats (*Rattus rattus*), mice (*Mus musculus*), possums (*Trichosurus vulpecula*), stoats (*Mustela erminea*), weasels (*Mustela nivalis vulgaris*), ferrets (*Mustela furo*), and hedgehogs (*Erinaceus europaeus*). Domestic cats will range over the entire site from adjacent residential houses.



13.0 Potential Ecological Effects and Effects Management

13.1 Overview

The following potential effects have been considered and evaluated:

Terrestrial Environments

- Vegetation clearance.
- Birds that utilise pasture habitats.
- Bat feeding and roosting habitat.
- Lizard habitat.
- Rubbish dumping into adjacent forest.

Wetland Environments

- Wetland vegetation.
- Sediment losses into the wetlands.
- Wetland water levels.
- Wetland nutrient levels.
- Setback buffers to protect wetlands.
- Fish passage.

These effects are all addressed below.

13.2 Terrestrial environments

Vegetation Clearance

• All of the vegetation to be cleared to establish the subdivision is grazed exotic pasture. Ecological effects on vegetation due to this clearance will be negligible.

Birds that Utilise Pasture Habitats

• A range of common, highly mobile, terrestrial and wetland bird species utilise pasture environments for feeding and roosting. The loss of this habitat is very unlikely to result in adverse effects on any species.

Bat Feeding and Roosting Habitat

- Given the habitat types present, the distance to the nearest bat records (22 kilometres) and the lack of bat records at survey locations west, south, and east of Bell Block, it is unlikely that bats are utilising the site, and it is very unlikely that bats would be adversely affected by the proposed development.
- No potential bat roost trees are to be removed.

Lizard Habitat

• Almost the entire site is intensively-grazed pasture that is subject to seasonal mowing and hay production so it is unlikely that indigenous lizards are present. If present, they will be in extremely low numbers due to the composition of the habitat and also the effects of exotic predators such as rodents, mustelids, hedgehogs, and cats.



Rubbish Dumping into Adjacent Forest

• This issue is discussed below in relation to setback buffers to protect the wetlands.

13.3 Wetland Environments

Wetland Vegetation

- Wetland vegetation has been delineated (see the methods in Section 5 and Figure 2) and no wetland vegetation is to be cleared.
- No earthworks, or vegetation clearance, are to be undertaken within 10 metres of the boundary of any wetland shown in Figure 2.
- A relatively small area of grazed degraded wetland is present at the head of the depression at the western lagoon complex. All of this area is to be retired and restored.
- The very small area of grazed exotic-dominant wetland on the margins of the eastern lagoon complex is to be retired and restored.
- Wetland vegetation could potentially be affected by changes to water levels and this is discussed further below.

Sediment Losses Into Wetlands

- Freshwater ecosystems are sensitive to sedimentation, and alterations to hydrology caused by urbanisation, earthworks and/or vegetation clearance. These types of works can lead to adverse effects on habitats for indigenous freshwater fish and invertebrate species.
- The Waipu Lagoons are high quality wetlands and additional sediment inputs need to be avoided.
- Although the earthworks and construction activity associated with the proposed development will be appropriately set back from the lagoons, a robust sediment management plan should nevertheless be implemented to avoid sediment reaching the lagoons.
- Losses of sediment into the wetland, and other contaminants, could potentially also carry heavy metals and baseline heavy metal samples have been collected from the wetland.

Wetland Water Levels

 Water discharges from the site post-development, as surface flows and subsurface infiltration, have been analysed by Red Jacket (August 2024). Results from their stormwater flooding assessment indicate that there will be only a small (<20 mm) potential increase in water levels in the wetlands due to storm events. The composition of vegetation in the wetlands (aquatic communities, raupō-dominant reedland, and flaxland), and the species that make up these communities, can all tolerate small increases in water levels. Small increases in levels are strongly preferable to decreases in water levels.





	Polyulana Pierre Polyulan	
Data Acknowledgment "Contains data sourced from the LINZ Data Service licensed for reuse under CC BY 4.0"	Figure 2. Extent of the proposed Parklands Subdivision and boundaries of adjacent wetlands	Wildlands
Report: 6969 Ref: 11211 Client: -	0 100 200	Scale: 1:2,500 Date: 7/11/2024
Name: Figure_Subdivision.aprx Path: E:\gis\PohutukawaPlace_56\mxd\Figure_Subdivision.aprx	· · · · · · · · · · · · · · · · · · ·	Cartographer: FM Format: A3



Wetland Nutrient Levels

• Coastal wetlands naturally have relatively low nutrient levels but the composition of the wetland vegetation indicates that nutrient levels currently are likely to be relatively high. Cessation of farming, and associated application of fertiliser, particularly nitrogenous fertiliser, is likely to result in lower inputs of nutrients to both wetlands, which would be a positive change.

Setback Buffers to Protect the Wetlands

- Roth (2021a) suggested that a 20 metre buffer from the identified boundaries of the wetland would provide a sufficient ecological buffer to improve habitat for indigenous flora and fauna that utilise the area, as well as provide filtering of overland water flow to reduce sedimentation and potential contaminants entering the water bodies.
- This matter was addressed in the consent application to TRC where a 20 metre buffer was proposed, to be vested as reserves with NPDC, along with a further proposal that there would be ".... a restriction on buildings within 2 metres of the wetland boundary fencing to ensure garages, sheds etc are not constructed close to the wetland further avoiding any potential effects to the wetland ecology."
- The Royal Forest and Bird Protection Society (RFBPS), in March 2023, also submitted that the riparian buffer strip was not wide enough:

"A greater width of the riparian buffer strip should ensure that marginal weed infestations affect only a small proportion of the buffer strip, further reducing the probability of weed incursion into the interior of the SNA/high value area. The greater buffer width should reduce the need for maintenance, and enhance the succession of indigenous vegetation, maximising the likelihood that the buffer strip will support self-sustaining indigenous vegetation with virtually no maintenance required. Garden escapes from subdivisions can greatly deplete wetlands and buffer systems, so a greater buffer area will help to eliminate this risk of encroachment to the Significant natural Area."

- The following comments are provided on these matters:
 - Current riparian buffers (on the subject property) around the wetlands are predominantly fenced and planted indigenous forest, with buffer widths ranging from *c*.7.5 to *c*.85 metres.
 - There are two sites where the strips of forest are narrower or non-existent, as noted in Section 6.0 above: (a) a relatively small area at the 'head' of the western lagoon complex where stock currently have access to wetland vegetation and a wet area where exotic grasses are dominant, and (b) a very small area at the 'head' of the eastern lagoon complex.
 - The two areas referred to above are both to be retired and planted with eco-sourced ecologically-appropriate indigenous species.
 - On easy terrain, as per the subject property, 20 metre wide riparian buffers are ecologicallysustainable and self-supporting (Parkyn *et al.* 2000).
 - All of the riparian buffers to the wetlands adjacent to the subdivision are either currently fenced or are to be retired and fenced.
 - Existing riparian strips of planted indigenous forest currently already have significant infestations of exotic weed species, originating from bird- or wind-carried seeds but also from



historic dumping, e.g. an old informal farm dump adjacent to the western lagoon complex. Ongoing weed monitoring and maintenance will be required.

- Dumping of garden waste is a significant and long-recognised issue for natural areas adjacent to residential housing (Timmins and Williams 1991) and this issue will need to be addressed at the site. Various mechanisms can be applied: (i) establish and maintain fencing to clearly demarcate the boundary of the riparian setback, (ii) covenants on property titles prohibiting the dumping of garden waste in the riparian setback, (iii) covenants on property titles prohibiting the planting of species known to be invasive pests, i.e. as listed in the Regional Pest Management Plan for Taranaki (TRC 2021, and subsequent versions) and in the National Pest Plant Accord (NPPA 2020).
- Overall, a 20 metre buffer, subject to controls on stormwater, is an appropriate riparian setback from the wetland margins.
- There would be merit in providing a succinct planting plan for the areas to be retired and planted, with specifications for site preparation, species to be planted, plant sourcing, spacings, monitoring, and maintenance.

Fish Passage

• Tuna/eels are present in the wetlands, and at least one indigenous galaxiid species. It will be necessary to maintain fish passage from the wetlands to the sea, noting that the waterways that connect to the coast are on land not controlled/managed by the applicant.

13.4 Monitoring

- Development and implementation of a pre-construction baseline, construction, and postconstruction freshwater environmental monitoring plan, to include measures for fine sediment inputs, hydrocarbons, heavy metals. Post-construction monitoring of wetland sediments is proposed at five-yearly intervals.
- Development and implementation of a pre-construction, construction, and post-construction freshwater fish monitoring plan.

14.0 Conclusion

The proposed Parklands subdivision is to be located in an area of grazed pasture and direct ecological effects will be low to negligible. However, the site is adjacent to the Waipu Lagoons complex – two separate areas at the western and eastern sides of the site – and these have very high ecological values. Detailed analysis of stormwater flows, pre- and post-development, indicate that inflows to the lagoon wetland complexes will remain similar, with the potential for a small increase in water levels in the wetlands. A small increase in water levels in this type of coastal wetland will not result in adverse effects.

Various on-site measures – such as rain gardens and swales - are proposed to ensure that stormwater leaving the site is treated to a high standard.

A 20 metre wide riparian buffer is to be established and maintained, and this will involve additional fencing and indigenous planting to protect wetland margins. This width of riparian buffer is adequate to protect wetland margins and to provide a sustainable strip of terrestrial indigenous vegetation.



Indigenous planting should be undertaken using ecologically-appropriate eco-sourced species, matched to the local soil conditions.

There is potential for weeds to spread from residential properties, including from dumping of garden waste, and various measures are proposed to address this issue.

Overall, subject to the above measures, potential ecological effects on the subject site will be less than minor and potential effects on the wetland complex are also likely to be less than minor.

Acknowledgments

Ben Lawn of McKinlay Surveyors provided project liaison. Scott Grieve of Connect Legal Taranaki provided useful comments on drafts of this report.

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Appendix 1

TRC request for further information on wetlands

Wetland Information

- Please provide a map showing the extent of all natural wetlands within 100 m of any
 proposed discharge/diversion of water.
- Please provide an updated wetland delineation report for the Waipu Lagoons (and all other natural wetlands identified within 100 m of any proposed discharge/diversion of water) in accordance with the National Environmental Standards for Freshwater 2020 – Amendments Dec 2022. This delineation should include, but not be limited to:
 - o A delineation of the entire extent of each natural inland wetland.

Note: The full extent of wetlands needs to be identified within 100 m of any part of the development. This includes the full delineation of each lagoon area, and any adjoining degraded natural wetland area, regardless of what title or land parcel the wetland is on. The wetland extent needs to be assessed even when a 20 m buffer of vegetation is present.

- Using the exotic pasture species list of NZ 2022.
- Correctly following the vegetation assessment methods of Clarkson, 2014 (A vegetation tool for wetland delineation in New Zealand)
- Using vegetation plots at the correct size for stratum levels (2 m x 2 m for herb, 5 m radius for shrubs and 10 m radius for trees)
- An assessment of hydrology and soils using the hydric soils and hydrology tools, which were published in 2018 and 2021 respectively.
- Please provide an assessment of effects on ecosystem health and indigenous biodiversity, which takes into account the updated wetland delineation report (requested above), and details of how these effects will be managed through applying the effects management hierarchy.
- Please provide an assessment of effects on amenity values as a result of the proposed activities, and details of how these effects will be managed through applying the effects management hierarchy.
- Please provide current (baseline) heavy metal and hydrocarbon concentrations in the wetland sediments.
- Please confirm whether heavy metal and hydrocarbon concentration monitoring will
 occur in wetland sediments directly downstream and further away from the
 discharge point.



Appendix 2

Vascular plant species list for 56 Pohutukawa Avenue and adjacent vegetation, March 2024

Key

* Source: Colin Ogle species lists (1989a&b).

INDIGENOUS SPECIES

Monocot. trees and shrubs

Cordyline australis (planted)

Dicot. trees and shrubs

Coprosma repens (planted) Coprosma robusta (planted) Corynocarpus laevigatus (planted) Geniostoma ligustrifolium var. ligustrifolium Melicytus ramiflorus subsp. ramiflorus Metrosideros excelsa (planted) Myoporum laetum (planted) Olearia paniculata (planted) Piper excelsum subsp. excelsum (planted?) Pittosporum crassifolium (planted) Pomaderris kumeraho (planted?) Pseudopanax lessonii (planted)

Dicot. lianes

Calystegia sepium subsp. roseata Muehlenbeckia australis Rumex sagittatus *

Ferns (excludes psilopsids)

Alsophila dealbata Azolla rubra * Dicksonia squarrosa Diplazium australe * Histiopteris incisa Lecanopteris pustulata subsp. pustulata Paesia scaberula Parablechnum minus Parablechnum novae-zelandiae Parablechnum minus × P. novae-zelandiae Pteris macilenta Pteris tremula Pyrrosia elaeagnifolia tī kōuka, cabbage tree

taupata karamū, kāramuramu karaka hangehange māhoe pōhutukawa ngaio akiraho kawakawa karo kūmarahou houpara

pōhue puka climbing dock

ponga, silver fern kārearea, rotoreto, returetu whekī

mātātā, water fern kōwaowao, pāraharaha, hound's tongue fern mātātā, hard fern swamp kiokio kiokio, horokio

titipo, sweet fern turawera, shaking brake leather-leaf fern



Sphaeropteris medullaris

Grasses

Amphibromus fluitans * Isachne globosa Microlaena stipoides

Sedges

Carex geminata agg. Carex maorica Carex secta Carex virgata Cyperus ustulatus Eleocharis acuta Eleocharis sphacelata Isolepis distigmatosa Machaerina arthrophylla Machaerina rubiginosa

Rushes

Juncus edgariae Juncus planifolius *

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

Lemna disperma	karearea
Phormium tenax	harakeke, flax
Potamogeton suboblongus	rerewai
Sparganium subglobosum	maru, burr reed
Typha orientalis	raupō

Composite herbs

Euchiton involucratus *

Dicot. herbs (other than composites)

Centella uniflora *	
Gratiola sexdentata *	
Haloragis erecta subsp. erecta *	toatoa
Persicaria decipiens	
Solanum americanum	raupeti
Solanum americanum	raupeti

water brome swamp millet pātītī, meadow rice grass

mamaku, black tree fern

rautahi

pūrei, makura, pūreirei, pūrekireki, pūkio pūrei toetoe upoko-tangata spike sedge giant spike sedge, ngāwhā, kuta.kutakuta, paopao

wi, wīwī



NATURALISED AND EXOTIC SPECIES

Gymnosperms

Pinus pinaster

Dicot. trees and shrubs

Escallonia rubra Euonymus japonicus Prunus sp. Salix cinerea Salix babylonica * Salix ×fragilis f. fragilis Solanum mauritianum Ulex europaeus Viburnum sp.

Dicot. lianes

Hedera helix Vinca major *

Grasses

Agrostis capillaris Agrostis stolonifera Aira caryophyllea subsp. caryophyllea Anthoxanthum odoratum Arrhenatherum elatius subsp. bulbosum Avena barbata Cenchrus clandestinus Cortaderia selloana Dactylis glomerata Lolium arundinaceum subsp. arundinaceum Lolium perenne Paspalum dilatatum Paspalum distichum Poa annua Sporobolus africanus

Rushes

Juncus articulatus * Juncus bufonius var. bufonius Juncus effusus var. effusus Juncus tenuis var. tenuis maritime pine

red escallonia Japanese spindleberry ornamental cherry grey willow weeping willow crack willow woolly nightshade gorse

ivy periwinkle

- browntop creeping bent silver hairy grass sweet vernal onion twitch slender oat kikuyu grass pampas cocksfoot tall fescue rye grass paspalum Mercer grass annual poa ratstail
- jointed rush toad rush soft rush, leafless rush track rush

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

Allium triquetrum * Amaryllis belladonna Crocosmia ×crocosmiiflora onion weed naked lady montbretia

Hedychium gardnerianum Iris foetidissima Zantedeschia aethiopica 'Green Goddess'

Composite herbs

Arctotheca calendula Cirsium arvense Cirsium vulgare Crepis capillaris Erigeron sumatrensis Lapsana communis Sonchus oleraceus

Dicot. herbs (other than composites)

Cerastium fontanum subsp. vulgare Euphorbia peplus Foeniculum vulgare Hydrocotyle bonarensis Lotus pedunculatus Lotus suaveolens Ludwigia palustris Lythrum hyssopifolia Malva neglecta Modiola caroliniana Myosotis laxa subsp. caespitosa Oxalis incarnata Persicaria hydropiper Phytolacca octandra Plantago australis Plantago lanceolata Plantago major Persicaria masculosa Polycarpon tetraphyllum Ranunculus flammula Ranunculus repens Rumex acetosella Rumex conglomeratus Rumex crispus * Rumex obtusifolius Solanum nigrum Trifolium pratense Trifolium repens Veronica arvensis

kahili ginger, wild ginger stinking iris

cape weed Californian thistle Scotch thistle hawksbeard broad-leaved fleabane nipplewort puha, sow thistle

mouse-ear chickweed milkweed fennel marsh pennywort lotus hairy birdsfoot trefoil water purslane hyssop loosestrife dwarf mallow creeping mallow water forget-me-not lilac oxalis water pepper inkweed swamp plantain narrow-leaved plantain broad-leaved plantain willow weed allseed spearwort creeping buttercup sheep's sorrel clustered dock curled dock broad-leaved dock black nightshade red clover white clover field speedwell



BIRDS

Indigenous

Prosthemadera novaeseelandiae novaeseelandiae Circus approximans tūī, kōkō kāhu; swamp harrier

Introduced

Alauda arvensis Branta canadensis Platycercus eximius Eurasian skylark Canada goose eastern rosella



Appendix 3

Avifauna records within five kilometres

The following records were compiled from the eBird and INaturalist databases.

Te Reo	English	Threat Rankings*
Kōtuku	White heron	T-NC
Matuku-hūrepo	Australasian bittern	T-NC
Weweia	New Zealand dabchick	T-NC
Matuku moana	Reef heron	T-NE
Tarapiroke	Black-fronted tern	T-NE
Koekoeā	Long-tailed cuckoo	T-NV
Pārera	Grey duck	T-NV
Taranui	Caspian tern	T-NV
Ngutu pare	Wrybill	T-NI
Kororā	Little blue penguin	AR-D
Kuaka	Bar-tailed godwit	AR-D
Mātātā	Fernbird	AR-D
Pohowera	Banded dotterel	AR-D
Rako	Buller's shearwater	AR-D
Tara	White-fronted tern	AR-D
Tarāpuka	Black-billed gull	AR-D
Tarāpunga	Red-billed gull	AR-D
Tītī	Sooty shearwater	AR-D
Tōrea	South Island pied oystercatcher	AR-D
Toroa	Buller's mollymawk	AR-D
Toroa	White-capped mollymawk	AR-D
Toutoutwai	North Island robin	AR-D
Kawau tūī	Little black shag	AR-NU
Kōtuku ngutupapa	Royal spoonbill	AR-NU
Pīhoihoi	New Zealand pipit	AR-NU
	Australian coot	AR-NU
	Black-fronted dotterel	AR-NU
Kākā	Kaka	AR-Rec
Kārearea	New Zealand falcon	AR-Rec
Kāruhiruhi	Pied shag	AR-Rec
Pāngurunguru	Northern giant petrel	AR-Rec
Tōrea pango	Variable oystercatcher	AR-Rec
Tūturiwhatu	New Zealand dotterel	AR-Rec
Kawaupaka	Little shag	AR-Rel
Kuaka	Common diving petrel	AR-Rel
Māpunga	Black shag	AR-Rel
Pakahā	Fluttering shearwater	AR-Rel



Te Reo	English	Threat Rankings*
Tarahikare	White-faced storm petrel	AR-Rel
Tītī wainui	Fairy prion	AR-Rel
Toanui	Flesh-footed shearwater	AR-Rel
Kāhu	Swamp harrier	NT
Kakīānau	Black swan	NT
Karoro	Black-backed gull	NT
Kererū	New Zealand pigeon	NT
Korimako	New Zealand bellbird	NT
Kōtare	Sacred kingfisher	NT
Kuruwhengi	Australasian shoveler	NT
Matuku moana	White faced heron	NT
Miromiro	Tomtit	NT
Ōi	Grey-faced petrel	NT
Pāpango	New Zealand scaup	NT
Pīpīwharauroa	Shining cuckoo	NT
Pīwakawaka	Fantail	NT
Poaka	Pied stilt	NT
Pūkeko	Pukeko	NT
Pūtangitangi	Paradise shelduck	NT
Biroriro	Grev warbler	NT
Buru	Morepork	NT
Tākapu	Australasian gannet	NT
Taubou	Silvereve	NT
Tētē moroiti	Greviteal	NT
	Tui	NT
Warou	Welcome swallow	NT
	Spur-winged plover	NT
Kuriri	Pacific golden plover	Migrant
	Arctic skua	Migrant
	Cattle egret	Migrant
		Migrant
	Buddy turnstone	Migrant
	Right and a solution	Vagrant
	Back-tailed gouwit	Vagrant
		Introduced
	Plackbird	Introduced
		Introduced
		Introduced
		Introduced
	Chaffinch	Introduced
	Common myna	Introduced
	Common redpoll	Introduced
	Dunnock	Introduced
	Eastern rosella	Introduced
	Eurasian skylark	Introduced
	European goldfinch	Introduced



Te Reo	English	Threat Rankings*
	Greenfinch	Introduced
	Grey duck x mallard hybrid	Introduced
	Greylag goose	Introduced
	House sparrow	Introduced
	Mallard	Introduced
	Muscovy duck	Introduced
	Mute swan	Introduced
	Ring-necked pheasant	Introduced
	Rock pigeon	Introduced
	Rook	Introduced
	Song thrush	Introduced
	Starling	Introduced
	Yellowhammer	Introduced

* Threat Rankings

T-NC	Threatened – Nationally Critical	
T-NE	Threatened – Nationally Endangered	
T-NV	Threatened – Nationally Vulnerable	
T-NI	Threatened – Nationally Increasing	
AR-D	At Risk – Declining	
AR-NU	At Risk – Nationally Uncommon	
AR-Rec	At Risk – Recovering	
AR-Relict	At Risk – Relict	
NT: Not Threatened		



Appendix 4

Selected site photographs



Plate A4-1: Grassed paddock in the centre of the subject property. December 2023.



Plate A4-2: Grassed paddock in the centre of the subject property. December 2023.





Plate A4-3: Grassed paddock in the centre of the subject property. December 2023.



Plate A4-4: Grassed paddock in the centre of the subject property. December 2023.





Plate A4-5: Farm buildings and yards. December 2023.



Plate A4-6: Existing residential housing immediately adjacent to the eastern lagoon. December 2023.





Plate A4-7: Wetland vegetation adjacent to the eastern lagoon. December 2023.



Plate A4-8: Wetland vegetation adjacent to the eastern lagoon. December 2023.





Plate A4-9: Indigenous forest understorey adjacent to the eastern lagoon. December 2023.



Plate A4-10: Indigenous forest understorey adjacent to the eastern lagoon. December 2023.





Plate A4-11: Pest control trap in indigenous forest adjacent to the eastern lagoon. December 2023.



Plate A4-12: Arum lily "green goddess", which is common in poorly-drained sites in forest adjacent to the eastern lagoon. December 2023.





Plate A4-13: Eastern lagoon. December 2023.



Plate A4-14: Flax-dominant-wetland adjacent to the western lagoon. March 2024.





Plate A4-15: Flax-dominant-wetland adjacent to the western lagoon. March 2024.



Plate A4-16: Forest margin adjacent to the western lagoon. March 2024.





Plate A4-17: Forest margin adjacent to the western lagoon. March 2024.



Plate A4-18: Planted margin near the 'head' of the western lagoon complex. December 2023.





Plate A4-19: Planted margin near the 'head' of the western lagoon complex. December 2023.



Plate A4-20: Poorly-drained depression at the head of the western lagoon. December 2023.





Plate A4-21: Poorly drained depression at the 'head' of the western lagoon complex. December 2023.



Plate A4-22: Poorly drained depression at the 'head' of the western lagoon complex. December 2023.





Plate A4-23: Grazed wetland, at the 'head' of the western lagoon complex. December 2023.



Plate A4-24: Grazed wetland, at the 'head' of the western lagoon complex. December 2023.





Plate A4-25: Outlet to the eastern lagoon. June 2024.



Plate A4-26: Adjacent to the outlet of the eastern lagoon. June 2024.

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