BEFORE THE INDEPENDENT HEARINGS PANEL

UNDER	the Resource Management Act 1991
AND	
IN THE MATTER OF	the submissions of B & A Stokes on the Waimakariri Proposed District Plan (#214) and Variation 1 (#29)

PRIMARY EVIDENCE OF
ROLAND KAHURANGI PAYNE ON
BEHALF OF B AND A STOKES

(Ecology)

4 March 2024

GREENWOOD ROCHE
LAWYERS
CHRISTCHURCH
Solicitor: R Murdoch
(rmurdoch@greenwoodroche.com)

Kettlewell House
Level 3, 680 Colombo Street
P O Box 139
Christchurch
Phone: 03 353 0574

1 QUALIFICATIONS AND EXPERTISE

1.1 My name is Roland Kahurangi Payne.

1.2 I hold the position of Senior Ecologist at Wildland Consultants Ltd (**Wildlands**), based in Christchurch.

1.3 I hold the degrees of Bachelor of Science from the University of Canterbury and a Masters in Science Communication with distinction from the University of Otago.

1.4 I have worked as both a field botanist and team leader undertaking the measurement of more than two hundred individual 20 m × 20 m vegetation monitoring plots throughout New Zealand, including on the Chatham Islands. This included the measurement of plots for the Land Use and Carbon Analysis System (**LUCAS**). The vegetation measured in these plots covered nearly every land environment in New Zealand from coastal bluffs and wetlands to sub-alpine tussock and shrub-land communities.

1.5 My work as an ecological consultant has included ecological investigations of areas of vegetation throughout New Zealand, including sites in Canterbury, Otago, Westland, Tasman, Marlborough, Auckland, Northland, Bay of Plenty, Horowhenua, Wellington, Whanganui and the Manawatū. I have provided assessments of ecological effects for numerous developments in natural areas and have previously provided expert evidence in respect of those assessments in council hearings. I have also undertaken numerous ecological significance assessments for landholders and councils and I am an author of over 60 contract reports.

1.6 I have frequently provided technical advice to clients in relation to vegetation clearance and development plans, including providing solutions for achieving no net loss of biodiversity and/or net gains.

1.7 Wildlands was engaged on behalf of B & A Stokes to undertake an ecological assessment of the 144ha site located at 81 Gressons and 1375 Main North Road, Waikuku (the **site**). I was one of the primary authors of that ecological assessment, which is attached as Appendix 1 to my evidence (the **Assessment**). The purpose of that Assessment was to inform the proposed rezoning of the site for residential purposes, as

sought by the Stokes in their submission on the proposed Waimakariri District Plan (**PDP**) (the **Proposal**).

2 CODE OF CONDUCT

2.1 Although this is not an Environment Court proceeding, I confirm that I have read the Code of Conduct for Expert Witnesses set out in the Environment Court Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and will continue to comply with it while giving oral evidence. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

3 SCOPE OF EVIDENCE

3.1 This evidence summarises the findings of the Assessment, specifically as they pertain to:

(a) the ecological context for the site;

(b) the ecological features of the site;

(c) the current ecological values of the site and the significance of those values; and

(d) recommendations for the Proposal in respect of ecological matters.

3.2 The methodology used to complete the Assessment is set out in section 2 of that Assessment. The Assessment also records the various reference documents and reports which informed, and were utilised in, that Assessment.[1]

4 ECOLOGICAL CONTEXT

4.1 The site is located within the Low Plains Ecological District (**ED**) that covers the eastern part of the Canterbury Plains. That eastern part comprises a sloping plain formed by the deposition of glacial outwash and recent river gravels.

---

[1] Wildland Consultants (2023). *Ecological assessment of a proposed rezoning site, 1301 Main North Road, Waikuku*, Canterbury. Wildlands Consultants Contract Report No. 7043. Prepared for Suburban Estates. 61pp. References.

4.2 Based on the Black Maps, historical survey maps which recorded vegetation zones in the period 1848- 1870, much of the site and wider area to the north and west was previously wetland and was mapped as flax (*Phormium tenax*) swamp.[2] The northern and eastern margins of the site were recorded as grass, flax, tūpāki/tutu (*Coriaria* species) and presumably comprised the swamp margins.

4.3 The whole wetland was created by a large upwelling of groundwater that was pushed underground at the nearby bend of the Ashley River, resulting in springs emerging in the area. Spring-fed streams also flowed into the wetland from the west near Coldstream and Marchmont Roads. Water largely flowed out of the wetland via the Waikuku Stream and the stream flow that was later rerouted and channelised into what is now known as Stokes Drain.

5 ECOLOGICAL FEATURES

Vegetation and habitats

5.1 The site is predominately covered in improved pasture, which is intersected by numerous shelter belts, hedgerows and drainage channels. The terrestrial vegetation and habitats on the site are illustrated in Figure 1 below. In summary these are:

i. Exotic shelterbelt forest

ii. Oak forest

iii. Mixed exotic forest

iv. Hawthorn-gorse-exotic grass hedgerows

v. Ornamental plantings, gardens and dwellings

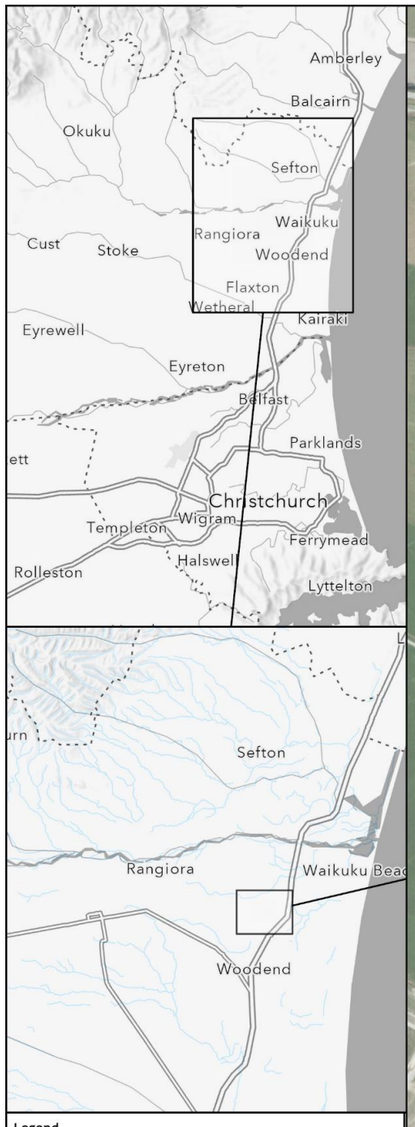
vi. Rank exotic grass with farm debris and buildings

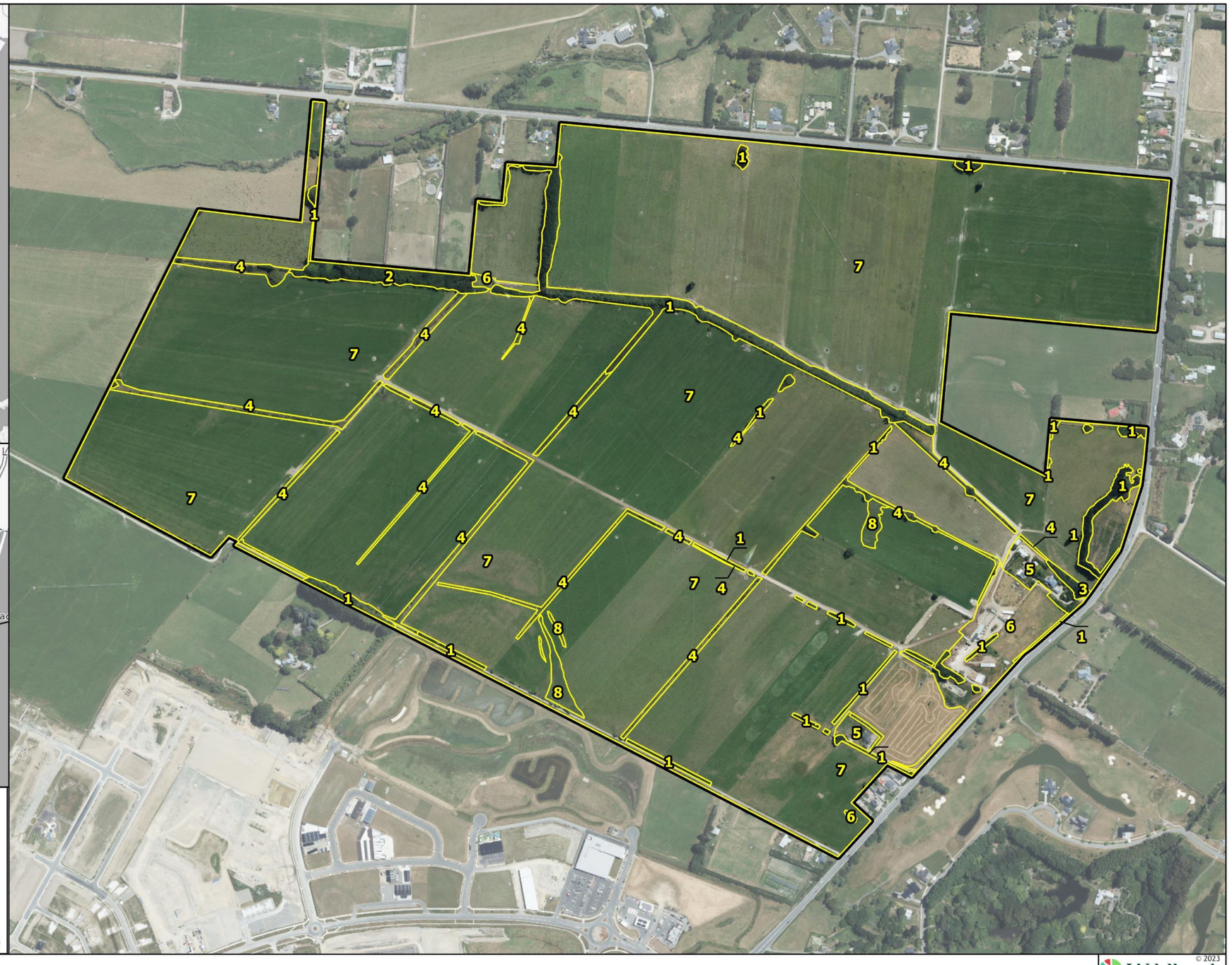
vii. Perennial ryegrass (white clover) grassland

viii. Wetlands (blue sweet grass-kneed foxtail grassland).

---

[2] Black Maps, digitised: https://opendata.canterburymaps.govt.nz/maps/c5f7d946b8fb43ce80fd3441cde5b78e/explore





Legend

- Property boundary
- **Vegetation and habitat types**
  1. Exotic shelterbelt forest
  2. Oak forest
  3. Mixed exotic forest
  4. Hawthorn-gorse-exotic grass hedgerows
  5. Ornamental plantings, gardens and dwellings
  6. Rank exotic grass with farm debris and buildings
  7. Perennial ryegrass (white clover) grassland
  8. Blue sweet grass-kneed foxtail grassland (wetlands)

N

Data Acknowledgment

"Contains data sourced from the LINZ Data Service licensed for reuse under CC BY 4.0"

Report: 7043
Ref: 11140
Client:
Name: Vegetation.aprx
Path: E:\gis\Main North Road, Waikuku\mxd\

Figure 1. Vegetation and habitats at proposed rezoning site, Main North Road Waikuku.

0 250 500 m

Wildlands
www.wildlands.co.nz, 0508 WILDNZ

Scale:	1:6,500
Date:	5/12/2023
Cartographer:	BL
Format:	A3R

Flora

5.2 Twenty-five indigenous and 114 exotic vascular plants species were recorded during the survey (Appendix 1 of the Assessment). Naturally occurring taonga[3] plant species on the site include karamū, harakeke, kōhūhū, tī kōuka, and wīwī.

5.3 Other than two species growing within ornamental plantings on the site, no other Threatened or At-Risk indigenous plant species were recorded and there is no reason why the flora values would impede the rezoning of the site.

Birds

5.4 Due the proximity of the Tūhaitara Coastal Park and the Pegasus town wetlands, and other coastal habitats, a large number of Threatened and At Risk bird species were recorded in the desktop survey of the area within a two kilometre radius. Table 5 of the Assessment identifies the relative likelihood of those species being present within the site. Eight indigenous and four exotic bird species were seen or heard at the site during the survey. The indigenous species included one At Risk species tōrea/South Island pied oystercatcher (*Haematopus finschi* At Risk – Declining).

5.5 The desktop survey also identified potential habitat for three further At Risk species including māpunga/black shag *(Phalacrocorax carbo novaehollandiae* At Risk – Relict), tōrea tai/variable oystercatcher (*Haematopus unicolor* At Risk – Recovering) and pohowera/banded dotterels (*Charadrius bicinctus bicinctus* At Risk – Declining). However, there is abundant similar habitat nearby for these species.

Lizards

5.6 Of the four species of lizard recorded within a 10km search radius of the site, the only species likely to be present on the site is the Canterbury grass skink (*Oligosoma aff. polychroma Clade 4* At Risk – Declining).

---

[3] Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998: https://www.legislation.govt.nz/act/public/1998/0097/latest/DLM431337.html#DLM431337

Wetlands

5.7 As illustrated in **Figure 2**, two wetland areas were found within pasture grassland on the site, and were assessed, using vegetation and hydrology indicators, as meeting the definition of a "natural inland wetland" under the National Policy Statement for Freshwater Management (**NPS-FM**). The ecological values of those wetlands are summarised in the next section of my evidence.

5.8 The site is currently irrigated and at the time of the survey a significant amount of water was entering the site from the Ravenswood development to the south, which appeared to be associated with dewatering activities. These activities may be contributing or even inducing the wetlands on the site especially over summer when the ground would likely become very dry without irrigation. Further assessment would be needed to verify the extend of effect that irrigation and dewatering was having on these wetland habitats.

Waterways

5.9 As illustrated in **Figure 2** below, the site is dissected by Stokes Drain, which is the main waterway on the site, and is fed by numerous smaller tributaries. Stokes Drain and most smaller tributaries are modified natural waterways that were formed when historic wetlands in the area were drained for agriculture.

5.10 Stokes Drain and the tributary waterways on the site, that are spring and groundwater fed, are classified as 'rivers' in the Resource Management Act 1991 (**RMA**)[4]. 'River' is the 'catch-all' term used for all waterways in the RMA regardless of size (refer Section 2.4 the Assessment). Based on the current survey, tributary Drains 1-8 (Figure 2) would be classed as RMA rivers, as well as, another small spring fed drain in the north west (not named in Figure 2). However, dewatering activities on the neighbouring Ravenswood development site, was significantly elevating the water levels in Drain 3 and 4 at the time of

[4] Resource Management Act 1991, section 2: **river** means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal).

the survey, and their 'river' status would need further investigation once this development is completed.

5.11 Waterways in the north eastern corner of the site (which are not tributaries to Stokes Drain) were completely dry and appear to be ephemeral and only feed by rainwater and/or irrigation runoff.

5.12 The ecological values of these waterways are summarised in the next section.

Figure 2. Observed waterways and wetlands of 1323 Main North Road, Waikuku, November 2023

Freshwater fauna

5.13 Based on records in the wider catchment and the fish observed during the site visit,[5] the fish community present in Stokes Drain and its tributaries are likely dominated by tuna/eels (*Anguilla* spp.), with inanga (*Galaxias maculatus*) and bully (*Gobiomorphus* spp.) species also common.

5.14 Stokes Drain has the most instream habitat diversity, riparian shading and no significant barriers to fish migration and therefore, is likely to have the most diverse fish population with tuna/eels, inanga, bullies and introduced brown trout (Salmo trutta) expected. The upstream areas of the Stokes Drain tributaries, are generally less connected due to culverts and are more degraded, with less shading and more aquatic macrophytes. This means these areas will be more affected by overheating and/or drying out during summer and therefore, galaxiids and bullies are less likely, but these areas are still likely to contain tuna/eels.

6 ECOLOGICAL VALUES AND SIGNIFICANCE ASSESSMENT

Vegetation

6.1 Vegetation on the site is highly modified. The land has been cleared of any remnant indigenous vegetation and planted/over-sown with exotic pasture grasses, crops and trees. The naturally occurring indigenous plant species are nearly all confined to the riparian margins of Stokes Drain. These indigenous plant species are all common throughout Canterbury and New Zealand, and are considered to be of low ecological value.

6.2 It is nevertheless noted that exotic vegetation on the site provides potential habitat for indigenous fauna, including At Risk lizard and bird species.

---

[5] Two small schools of inanga and six tuna/eels were seen during the site visit. The inanga were within Drain 1, the eels were along Stokes Drain (Figure 2). One eel was identified as a longfin eel (*Anguilla dieffenbachii*, At Risk - Declining), with the other individuals being either a longfin eel or shortfin eel (*Anguilla australis*, Not Threatened).

Wetlands

6.3 The delineated wetlands on the site are within actively grazed farmland and are affected by stock browse, pugging, irrigation and potentially cultivation. The impact of irrigation on these wetlands is unknown, but the vegetation and surface characteristics are likely to change seasonally. The only indigenous species observed in the wetlands, *Juncus edgariae*, is a common, Not Threatened species, and the ecological values of these areas are low.

6.4 However, At Risk tōrea/South Island oystercatcher were observed foraging within Wetland 2 and potentially breeding nearby. Given the proximity of significant coastal wetland areas around Pegasus town and Tūtaepatu Lagoon, a number of other Threatened or At Risk bird species could potentially frequent the site and forage in these wetlands and other boggy areas (refer Table 5).

Waterways

6.5 The waterways within the site are highly modified natural waterways, fed by natural springs and seepages, and dug to prevent the area reverting to wetland. These channelised waterways are further degraded by the lack of riparian fencing, planting, or shade in many places, increased nutrients and sediment, and instream structures such as culverts.

6.6 The values of the waterways are summarised as follows:

(a) *Stokes Drain* has mature, exotic riparian cover along much of its length providing shade, as well as low-growing plants extending across the water surface providing fish cover. It has many characteristics of a natural healthy stream, including good flow variation and diverse, instream habitat for fish and invertebrates, which allow more species and life stages to be resident. This drain is cleaned annually. The ecological values have been assessed moderate.

(b) *Drain 1 and Drain 5* are well connected to Stokes Drain, with good water flow and better riparian vegetation and stream shading than

the other drains. They are therefore likely to have moderate ecological values.

(c) *Drain 2, Drain 6, and Drain 7* are likely to have lower ecological values as they are less connected to Stokes Drain and have slower flows, which increases the risk of heating up, becoming anoxic and/or drying out. However, it is still likely that these waterways contain fish, particularly tuna/eels.

(d) *Drain 3, Drain 8* and the other smaller drains have low ecological value, due to their small size, increased likelihood of drying up, and being unlikely to support fish.

(e) The ephemeral drains in the northeast of the site have very low ecological value.

Freshwater fauna

6.7 Despite the highly modified and degraded nature of the habitat, the waterways are home to a potentially large population of tuna/eels and inanga and probably also large populations of bully species.

6.8 The ecological values of those freshwater habitats on the site should not impede rezoning l. However, as all of the active waterways within the site likely contain fish, any work involving channel dewatering, or work that will disturb the bed and/or submerged banks of a watercourse will require a fish management plan and fish salvage and relocation.

Significance assessment

6.9 The ecological significance of these values have been assessed against the significance criteria used in the Canterbury Regional Policy Statement 2016 (**CRPS**) and the PDP, and the Appendix 1 criteria in the National Policy Statement for Indigenous Biodiversity 2023 (**NPS-IB**).[6]

[6] Refer Wildlands (2023) *Ecological Assessment of a Proposed Rezoning site, 1301 Main North Road, Waikuku, Canterbury,* section 9.4.

6.10 In summary:

(a) The site contains areas with potential habitat for Threatened or At Risk lizards which could potentially meet the ecological significance criteria for Rarity/Distinctiveness in the CRPS, the PDP and the NPS-IB. Habitat for At Risk tōrea/South Island oystercatcher and potentially other threatened bird species, also exist on the site. If tōrea/South Island oystercatcher (or other Threatened bird) species were found to be breeding in any of these habitats, they would meet the significant criteria for Rarity and Distinctiveness under the CRPS and PDP, but may not meet the same criteria of the NPS-IB (unless other At Risk fauna are also found to be present), as tōrea/South Island oystercatcherand other bird species assessed as 'likely' to be present, are widespread in at least three other regions. However, because these habitats are exotic dominated, wide spread and otherwise have otherwise low ecological values, they are not considered significant.

(b) The majority of the waterways meet the significance criteria within the CRPS and PDP. The criteria met are habitat that supports At Risk species (criterion 4), habitat that provides important linkages (criterion 8) and permanent habitat of indigenous species (Aquatic indigenous biodiversity is not covered by the NPS-IB).

7 RECOMMENDATIONS FOR THE PROPOSAL

7.1 In light of those ecological values (and their significance), the Assessment makes the following recommendations in respect of any future development of the site.

Waterways

7.2 Regarding Stokes Drain:

(a) It should be retained and naturalised (without instream works).

(b) The riparian buffer along this Drain should be planted with appropriate indigenous vegetation. The tall exotic trees currently shading the stream should initially be retained to maintain instream habitat quality, but should be slowly removed as indigenous riparian plantings establish.

(c) Springs on the site should be protected and linkages to surrounding waterways maintained or established. These areas should then be enhanced with indigenous plantings in the riparian buffer zones.

7.3 Regarding the main tributaries of Stokes Drain (Drains 1 – 8):

(a) These are mostly of low ecological value.

(b) Where practical/feasible, these should be retained and enhanced, and extensive fish relocation should be avoided.

(c) However, alternatively newly constructed waterways with enhanced ecological values could replace the existing low value waterways, increasing the overall extent of waterways within the site.

(d) Building new waterways will also allow for creation of a more varied instream and riparian habitat, increasing ecosystem values. The development of a realigned waterway system that avoids the loss of river extent, and provides a high-quality instream habitat for indigenous fauna is likely to result in a net biodiversity gain.

(e) Any instream works would likely require a fish management plan and the relocation of fish from the affected area prior to commencing works. Fish removal would be a substantial undertaking for any waterways that are to be realigned or filled. Therefore, the realignment of waterways should be considered carefully if time and cost of removing fish is a limitation.

(f) A Stream Naturalisation Plan should be prepared with detailed plans for each waterway.

Wetlands

7.4 The wetlands identified on the site are fragmented and of low ecological value. As noted above, these wetlands may also be partially maintained and induced by summer irrigation and dewatering on the neighbouring Ravenswood development, which will cease following completion of that development. Construction will likely change groundwater movements

with unpredictable outcomes on the wetlands and therefore it is not recommended to retain these wetlands.

7.5 Instead, their loss should be mitigated by developing diverse replacement wetlands, with reliable hydrology and indigenous wetland plantings, within the large stormwater reserve planned for the east of the site.

Terrestrial fauna habitats

7.6 The development of the site could potentially lead to some loss of habitats used by indigenous terrestrial fauna, including birds and lizards. However, any potential loss of avifauna habitat could easily be offset through ecological enhancement of the proposed stormwater management area. If appropriately designed, this area could be used to provide improved indigenous avifauna habitat. The loss of lizard habitat and opportunities to mitigate this should also be considered during the development design phase and could include restoration of lizard habitat in areas peripheral to the stormwater management area. If these peripheral areas are of an appropriate size, lizards salvaged from other areas of the site could be released into this location.

7.7 Prior to any development works, additional surveys would be required to better understand the size and extent of indigenous fauna populations on the site, and potential mitigation required.

7.8 Provided these recommendations, and those set out in the report in Appendix 1, are followed, the Proposal should result in no net loss of biodiversity, and could possibly result in a biodiversity net gain. Opportunities for further gains should be considered as part of detailed development scheme for the site.

Roland Kahurangi Payne

4 March 2024

Appendix 1 - Assessment

Ecological assessment of a proposed rezoning site at 1301 Main North Road, Waikuku, Canterbury

Contract Report No. 7043

Providing outstanding ecological services to sustain and improve our environments

Wildlands

Ecological assessment of a proposed rezoning site at 1301 Main North Road, Waikuku, Canterbury

Contract Report No. 7043

February 2024

Project Team:

Roland Payne – report author

Stella McQueen – report author

Lucian Funnell – report author

Della Bennet – report author

Morgan Tracy-Mines – field work

Prepared for:

Suburban Estates

26 Peterborough Street, Central Christchurch

Reviewed and approved for release by:

13/02/2024
Des Smith
Senior Principal Ecologist, South Island Regional Manager
Wildland Consultants Ltd

Cite this report as follows:

Wildland Consultants (2023). *Ecological assessment of a proposed rezoning site, 1301 Main North Road, Waikuku, Canterbury.* Wildlands Consultants Contract Report No. 7043. Prepared for Suburban Estates. 60pp.

Christchurch Office
238 Annex Road, Middleton, PO Box 9276, Tower Junction, Ph 03 338-4005

Head Office
99 Sala Street, PO Box 7137, Te Ngae, Rotorua Ph 07-343-9017 Fax 07-343-9018 Email: rotorua@wildlands.co.nz

www.wildlands.co.nz

Contents

Ecological assessment of a proposed rezoning site at 1301 Main North Road, Waikuku, Canterbury		**1**
1.0	**Introduction**	**4**
2.0	**Methods**	**4**
2.1	Desktop survey	4
2.2	Site survey	4
2.3	Natural wetlands	4
2.4	Natural Waterways	6
3.0	**Ecological Context**	**6**
4.0	**Vegetation and habitats**	**7**
4.1	Terrestrial habitats	7
4.2	Wetland assessment	13
4.3	Aquatic habitats	15
5.0	**Flora**	**19**
5.1	Overview	19
5.2	Threatened or At-Risk species	19
5.3	Taonga plants	19
5.4	Pest plants	19
6.0	**Freshwater fauna**	**20**
7.0	**Birds**	**22**
8.0	**Lizards**	**25**
9.0	**Ecological values**	**26**
9.1	Vegetation	26
9.2	Wetlands	26
9.3	Waterways	27
9.4	Significance assessment	28
10.0	**Statutory regulations and policy statements**	**29**
10.1	Overview	29
11.0	**Ecological considerations and rezoning recommendations**	**31**
11.1	Overview	31
11.2	Recommendations	33
12.0	**Conclusions**	**34**
Acknowledgements		**37**
References		**37**
Appendix 1		**39**
Plant species recorded during the survey. Species marked with * have been planted on the site.		39
Appendix 2		**43**
Detailed Plot information – wetland assessment		43

Wetland vegetation assessment plot photographs 47

Appendix 3 **49**

All bird species identified in the eBird desktop survey. * indicate species observed during site visits, + are taonga species in Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998. 49

Appendix 4 **51**

EVALUATION OF THE SITE USING THE ECOLOGICAL SIGNIFICANCE CRITERIA IN THE CANTERBURY REGIONAL POLICY STATEMENT AND PROPOSED WAIMAKARIRI DISTRICT PLAN 51

Appendix 5 **53**

EVALUATION OF THE SITE USING THE ECOLOGICAL SIGNIFICANCE CRITERIA IN THE NATIONAL POLICY STATEMENT ON INDIGENOUS BIODIVERSITY 53

Appendix 6 **58**

Site Photographs: aquatic habitats 58

1.0 Introduction

B. and A. Stokes have lodged a submission on the proposed Waimakariri District Plan (PDP) seeking to rezone approximately 144 hectares of their property located between Ravenswood and Gressons Road, in Waikuku, north of Christchurch City. The land is currently zoned rural and largely comprises farmland, with high producing exotic grassland. Under the PDP the site would become a combination of Large Lot Residential Zone (LLRZ) and Rural Lifestyle Zone (RLZ). The client is seeking to rezone the area to either Medium density Residential Zone (MRZ) or General Residential Zone (GRZ). An Outline Development Plan (ODP; Rough Milne Mitchell, RMM 2024) has been prepared for the site that provides for approximately 1500 new residential lots of varying density, as well as recreation space, roads, services, and a stormwater retention area.

Wildland Consultants Ltd (Wildlands) have been asked to provide an ecological assessment of the property which will be used as evidence at a hearing in late May. This assessment includes identifying mapping the vegetation and habitats present, including any wetland habitat and an assessment of existing farm drains to determine if they are classed as natural under RMA definitions.

2.0 Methods

2.1 Desktop survey

A desktop assessment was undertaken to determine the known ecological values of the site, including assessing recent and historical aerial imagery, historical survey records (Canterbury black maps) and reviewing database records. Online databases (iNaturalist, eBird, New Zealand Freshwater Fish database, DOC Bioweb) were searched for information on invertebrate, lizard, bird, fish, and vegetation values within and around the site. Lizard records were searched within a 10-kilometre radius, while eBird records were restricted to two kilometres between 1 January 2017 and 30 April 2023. Freshwater Fish Database survey records considered relevant to the site were all those in the catchments of Waikuku Stream and Taranaki Creek (which includes Stokes Drain).

2.2 Site survey

Terrestrial vegetation, wetlands and waterways were surveyed on the site on 15 November 2023. All vegetation and associated habitat types were mapped and described following the structural classes in Atkinson (1985). Potential natural inland wetland areas were assessed and delineated where present, using methods described in Section 2.3 below. Field mapping was digitised onto aerial imagery using ArcGIS. All vascular plant species observed are listed in Appendix 1.

2.3 Natural wetlands

A walk over of the entire site was undertaken to identify and (if necessary) delineate any natural inland wetlands. The vegetation and habitats on the site were evaluated for wetland status according to the Resource Management Act (RMA; 1991), which defines wetlands as “permanently or intermittently wet areas, shallow water, and land/water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions”, and the National Policy Statement for Freshwater Management (NPS-FM; 2020). A natural inland wetland is defined in the operative NPS-FM as a wetland (as defined in the RMA) that is not:

a) In the coastal marine area; or

b) A deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or
c) A wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or
d) A geothermal wetland; or
e) A wetland that:
    I. Is within an area of pasture used for grazing; and
    II. Has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology); unless
    III. The wetland is a location of a habitat of a threatened species identified under clause 3.8 of the NPS-FM, in which case the exclusion in (e) does not apply.

The NPS-FM refers to the Ministry for the Environment (MfE) wetland delineation protocols (December 2022) in order to determine the status of wetlands. The hydrophytic vegetation test relies on the presence of hydrophytes. Hydrophytes are plant species capable of growing in soils that are often or constantly saturated with water during the growing season. The hydrophyte categories (wetland indicator status ratings: Clarkson 2013 and subsequent updates) are:

- Obligate (OBL): occurs almost always in wetlands (estimated probability >99% in wetlands).
- Facultative Wetland (FACW): occurs usually in wetlands (67–99%).
- Facultative (FAC): equally likely to occur in wetlands or non-wetlands (34–66%).
- Facultative Upland (FACU): occurs occasionally in wetlands (1–33%).
- Upland (UPL): rarely occurs in wetlands (<1%), almost always in 'uplands' (non-wetlands).

In accordance with the methods described in MfE (2022), in areas of potential wetland we applied the following methods:

- Firstly, the Rapid wetland test was completed. For this test to confirm the area as a wetland, all dominant species must be either OBL or FACW species. If the Rapid Wetland test fails (or is uncertain), additional hydrophytic vegetation tests are required.
- Two tests are required for the hydrophytic vegetation determination (Dominance test and Prevalence index). Representative plots (2 metre × 2 metre for herb strata) were established in different vegetation types and geomorphic positions in a potential wetland on the site. In each plot, the species in each stratum (i.e. tree, sapling/shrub, herb) were identified and percent cover estimated. Species hydrophytic categories were taken from Manaaki Whenua (2021) and the dominant species were noted.
    - For the Dominance test to confirm the area as a wetland, >50% of the dominant species must be OBL, FACW or FAC and all/most dominant species must not be FAC.
    - For the Prevalence Index (PI) test, a plot-based algorithm derived from the unique combination of OBL–UPL plants and their cover is calculated. The vegetation is hydrophytic (wetland) if PI ≤ 3.0, but values around 3.0 can also be considered wetlands when other wetland indicators are present.
- If the Rapid, Dominance, and Prevalence tests are inconclusive, then indicators of wetland hydrology were used to determine if there was wetland hydrology present.
- If the hydrology and surface characteristics indicate the presence of wetland conditions, and no exclusions applied (i.e. pasture exclusion test) then the definition of a wetland was met for the site under the RMA and NPS-FM.

For more detailed methodology refer to MFE (2022; 2021) and/or Clarkson (2013).

2.4 Natural Waterways

The process for identifying natural waterways is based on 'River' definition of the RMA (1991) as follows:

> "River means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal)."

A watercourse is considered a 'river' if the source is natural, it flows for at least part of the year, and it was not constructed for artificial purpose. A 'river' may be highly modified from the natural state, such as a straightened farm drain or a piped urban stream. Natural sources of water can include surface and ground water, as well as lakes and wetlands[1]. Man-made channels used to drain wetlands or direct water from springs and seepages are likely to be 'rivers' as these are natural sources of water with flow (Greer 2021, Otago Regional Council 2022). Artificial waterways move water to or from a human purpose, rather than the natural flow of water across the land (stormwater removal, water for stock, irrigation, hydroelectricity etc.). Drains that do not carry water from a pre-existing or historical watercourse/waterbody (i.e. wetland, lake, or ground water) but only carry water from surface runoff are not 'rivers' (Greer 2021, Otago Regional Council 2022). Also excluded are drains that only carry stormwater, as these are ephemeral rather than intermittent.

3.0 Ecological Context

The property is located within the Low Plains Ecological District (ED), that covers the eastern part of the Canterbury Plains. The Low Plains ED stretches from Waipara in the north to Timaru in the south. The following description is adapted from Harding (2009).

The ED covers a sloping plain formed by the deposition of glacial outwash and recent river gravels. It extends from sea level to approximately 300 metres asl, and has no significant hills. Older surfaces are covered with loess; younger surfaces comprise recent river gravel. The long coastline of the district comprises sand and sand/gravel beaches with low dunes, dune lakes, and lagoons north of Banks Peninsula.

Droughts, wind, and occasional natural fires would have strongly influenced the pre-human vegetation of Low Plains ED. The presence of only a few small remnants of indigenous vegetation in the district makes interpretation of the pre-human vegetation difficult. Early European surveyors noted the presence of areas of forest at a number of locations on the coastal plain north of Christchurch, presumably remnants of previously more-extensive forests. Intervening areas supported raupō (*Typha orientalis*) swamp, flax (*Phormium tenax*) swamp, swamp forest, or grassland.

It is likely that the severity of the climate on the open plains, including the desiccating effect of frequent strong northwest winds and relatively low rainfall (<800mm per annum), and the frequency of natural fires, prevented the perpetuation of extensive forests. More extensive areas of podocarp forest and wetland would have been present at well-watered sites nearer the coast, such as north of Christchurch. Freshwater wetlands were relatively extensive on eastern parts of the plains, and saline wetlands present along the coast.

[1] RMA (1990) 'Water': (a) Means water in all its physical forms whether flowing or not and whether over or under the ground. (b) Includes fresh water, coastal water, and geothermal water. (c) Does not include water in any form while in any pipe, tank, or cistern.

The original vegetation of Low Plains ED has been substantially depleted by human-induced fire, and land clearance for agriculture and settlement. Nearly all parts of the ED outside of Christchurch are intensively farmed. Most soils have been cultivated and many areas are irrigated. Remnants of wetland and coastal vegetation are present north of Christchurch. Only a very small part (c.1%) of Low Plains ED is protected. There appear to be few opportunities for further protection.

Based on the Black Maps[2], historical survey maps which recorded vegetation zones in the period 1848-1870, much of the property and wider area to the north and west was previously wetland and was mapped as flax swamp. The northern and eastern margins of the property was recorded as grass, flax, tūpāki/tutu (*Coriaria species*), and presumably comprised the swamp margins. The whole wetland was created by a large upwelling of groundwater that was pushed underground at the nearby bend of the Ashley River, resulting in springs emerging in the area[3]. Spring-fed streams also flowed into the wetland from the west near Coldstream and Marchmont Roads. Water largely flowed out of the wetland via the Waikuku Stream and the stream that was later rerouted and channelised and is now known as Stokes Drain.

4.0 Vegetation and habitats

The site is predominately covered in improved pasture, which is intersected by numerous shelter belts, hedgerows and drainage channels (Figure 1). In total nine vegetation types (Seven terrestrial and one wetland) and one aquatic habitats were identified:

Terrestrial Vegetation

1. Exotic shelterbelt forest
2. Oak forest
3. Mixed exotic forest
4. Hawthorn-gorse-exotic grass hedgerows
5. Ornamental plantings, gardens and dwellings
6. Rank exotic grass with farm debris and buildings
7. Perennial ryegrass (white clover) grassland

Wetlands

8. Blue sweet grass-kneed foxtail grassland

Aquatic

1. Waterways (drainage channels)

4.1 Terrestrial habitats

1. Exotic shelterbelt forest

Exotic shelterbelts are present around parts of the site boundary, some paddock margins and along much of north side of Stokes Drain. These shelterbelts are mostly formed by densely planted rows of a single tree species including macrocarpa (*Cupressus macrocarpa*.), Lawson cypress (*Chamaecyparis lawsoniana*), pines (*Pinus* spp.), eucalyptus (*Eucalyptus species*), poplars (*Populus nigra*), and hawthorn (*Crataegus monogyna*), (Plate 1). The ground cover beneath these shelterbelts various considerably.

[2] Black Maps – Digitised: https://opendata.canterburymaps.govt.nz/maps/c5f7d946b8fb43ce80fd3441cde5b78e/explore
[3] Canterbury maps: Groundwater Flow Lines https://mapviewer.canterburymaps.govt.nz/

On dry road sides paddock boundaries, it is dominated by exotic grasses and herbs including cocksfoot (*Dactylis glomerata*), and prairie grass (*Bromus catharticus*), and hedgemustard (*Sisymbrium officinale*). However, when associated with waterways and drainage channels there is often a subcanopy with sycamore *(Acer pseudoplanatus*), elder (*Sambucus nigra*), and grey willow (*Salix cinerea*) common as well as a dense understorey and scrubby margin. Understorey and margin species include blackberry (*Rubus fruticosa*), gorse (Ulex europaeus), hemlock (*Conium maculatum*), and exotic grasses. Pockets of indigenous species also occur along the waterway margins including pōhuehue (*Muehlenbeckia complexa*), kohuhu (*Pittosporum tenuifolium*), kiokio (*Blechnum novae-zelandiae*), and thousand-leaved fern (*Hypolepis millefolium*).

2. Oak forest

A stand of mature English oaks (*Quercus robur*), follows old farm track along Stokes Drain in the northwest of the of the site. The canopy is predominantly English oaks, with scattered sycamore *(Acer pseudoplanatus*) and London plane (*Platanus x acerifolia*), with a well-developed subcanopy of hawthorn (*Crataegus monogyna*) and sycamore (Plate 1). The groundcover comprises multiple exotic grass species, hemlock, nodding thistle (*Carduus nutans*), vetch (*Vicia sativa*) and the indigenous fireweed (*Senecio glomeratus* subsp. *glomeratus*).

3. Mixed exotic forest

A small stand of mixed exotic forest is present along both sides of Stoke Drain at the eastern Main North Road site boundary. This forest is continuous with an adjacent house and garden and comprises numerous common garden plants. The canopy dominated by a few very large trees including English oak, horse chesnut (*Aesculus hippocastanum*) magnolia (*Magnolia grandiflora*), and maple (*Acer* species). Within the subcanopy, sycamore and cherry (*Prunus* species) and laurel (*Laurelia* species), and common along with the indigenous species kohuhu (*Pittosporum tenuifolium*), and karamū (*Coprosma robusta*). The ground cover is dominated by aluminium plant (*Lamium galeobdolon*), ivy (*Hedera helix*) and stinking iris (*Iris foetidissima*), (Plate 1). Along the Stoke Drain margin in this area a few naturalised indigenous species are present including kiokio (*Blechnum novae-zelandiae*), harakeke/flax (*Phormium tenax*) and pūkio (*Carex secta*).

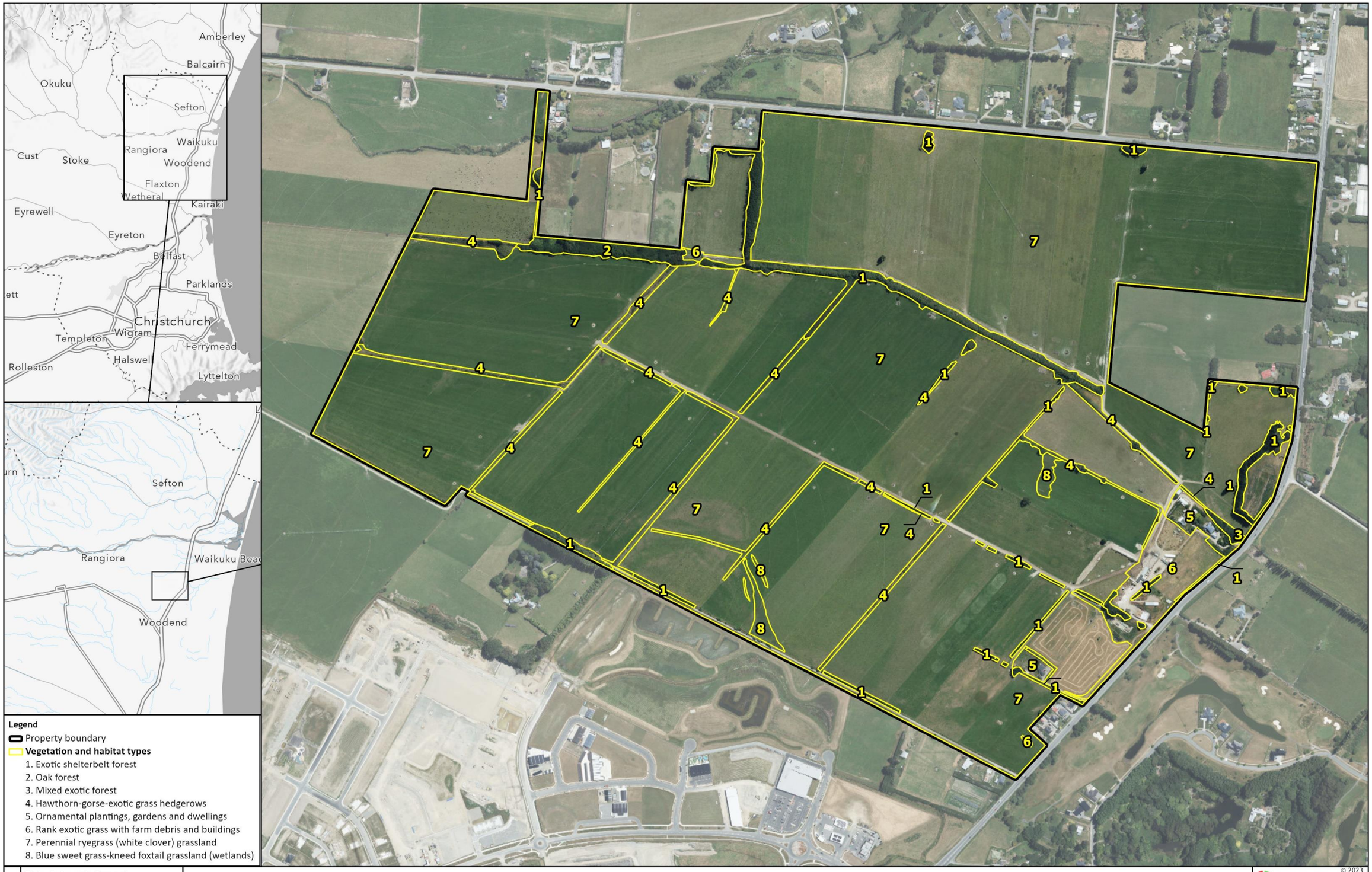


Figure 1. Vegetation and habitats at proposed rezoning site, Main North Road Waikuku.

Plate 1. Exotic shelterbelt forest, hawthorn with dense blackberry understory (top left), and poplar and pines, without understory (top right). Oak forest (bottom left), and mixed exotic forest, with aluminium plant ground cover (bottom right).

4. Hawthorn-gorse-exotic rank grass hedgerows

This habitat is mostly associated with the tributaries of Stokes Drain, which drain northwards from the site's southern boundary into Stokes Drain. The shrub canopy is highly variable with hawthorn and gorse most common, but in places crack willow (*Salix x fragilis*), grey willow and pampas grass (*Cortaderia selloana*) dominate. There are also large stretches without shrub cover where rank exotic grasses and herbs, including cocksfoot, prairie grass and creeping buttercups (*Ranunculus repens*) dominate, with scattered blackberry (*Rubus fruticosa*) (Plate 2). Where this habitat follows wider, more open drains hydrophytic species including blue sweet grass (*Glyceria declinata*), monkey musk (*Erythranthe guttata*), watercress (*Nasturtium officinale*) and indigenous rush, wīwī (*Juncus edgariae*), often fill the channel (Plate 2).

5. Ornamental plantings, gardens and dwellings

There are three existing dwellings on the site with associated gardens and ornamental plantings. These areas where not extensively investigated, but species observed included english oak, Mexican orange (*Choisya ternate*), teucrium (*Teucrium fruticans*), hydrangea (*Hydrangea macrophylla*), rhubarb (*Rheum rhabarbarum*), black locust (*Robinia pseudoacacia*) and agapanthus (*Agapanthus praecox* subsp. *orientalis*). Along a driveway leading to one of the houses there is also a mature area of shrub planting which contain numerous indigenous species including kāpuka/broadleaf (*Griselinia littoralis*), kōhūhū (*Pittosporum tenuifolium*), korokio (*Corokia cotoneaster*) akeake (*Dodonaea viscosa*) and wind grass (*Anemanthele lessoniana*) (Plate 3).

Plate 2. Hawthorn-gorse-exotic rank grass hedgerow habitats, dominated by gorse (left), and dominated by hawthorn (right).

6. Rank exotic grass with farm debris and buildings

There are several areas on the site where debris from old buildings and farm machinery have been left and are now overgrown with rank exotic grasses and herbs (Plate 3). This includes the areas around barns, milking sheds, and yards where tractors and materials are stored. Common species include sweet vernal (*Anthoxanthum odoratum*), cocksfoot, hemlock (*Conium maculatum*), and ripgut brome (*Bromus diandrus*).

Plate 3. Ornamental plantings habitat, with a mix of indigenous and exotic shrubs (left), and rank exotic grass with farm debris and buildings (right).

7. Perennial ryegrass (white clover) grassland

Grazed pasture covers the majority of the site, with perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*), dominant in most places (Plate 4). Other common, or locally dominant species include prairie grass (*Bromus catharticus*), Kentucky bluegrass (*Poa pratensis*), creeping butter cup, dandelion (*Taraxacum officinale*), and plantains *(Plantago lanceolata, P. major*).

Plate 4. Perennial ryegrass (white clover) grassland habitats, with short recently grazed grass (left), and less recently grazed, with abundant white clover and creeping butter visible (right).

Wetlands

Most of the western side of the site was historically wetland[4]. Although, historical imagery[5] shows that by the 1940s this site, and all of the surrounding land had been drained and converted to pasture, but the water table remains high and boggy areas and surface flooding appears to be common, especially in more recent satellite imagery[6]. The wetlands that remain on the site today appear to have an ephemeral nature. They are in low lying areas of pasture that become saturated during the wetter months and most likely dry out completely over summer. The large wetland on the southern boundary appears to be gaining water from drainage ditches along Wards Road, off the site to the south. Property owner Brian Stokes commented that surface water ponding in this area had increased after the construction works on the adjoining Ravenswood development site (pers. comm.). The wetlands that were delineated, were observed to have a distinctive change in grass composition, from pasture species to a dominance of hydrophytic, blue sweetgrass (OLB), and kneed foxtail (*Alopecurus geniculatus*, FACW), indicating the possible presence of a natural wetland (Plate 5).

There were also a number of other areas across the site where surface water inundation was visible on current and historic areal imagery, which seemed to be associated with low lying ground and depressions. Investigations of these area found that pasture grasses were dominant with little or, no hydrophytic vegetation present. Some wetland hydrology indicators including, sparsely vegetated concave surfaces, inundation on aerial imagery and geomorphic position, were present in these areas indicating potential wetland hydrology. However, as the site is grazed and the vegetation is dominated by species listed in the National List of Exotic Pasture Species, these areas are excluded from the NPS-FM wetland definition.

8. Blue sweet grass-kneed foxtail grassland

Four wetlands were identified on the site, within areas of grazed pasture, but three of these were in a cluster and are considered to be part of the same wetland complex (Wetland 2). These wetlands were dominated by blue sweet grass (OBL) and kneed foxtail (FACW), with scattered celery-leaved buttercup (*Ranunculus sceleratus*, OBL), curly dock (*Rumex crispus,* FAC), and creeping buttercup (FAC) and creeping bent (*Agrostis stolonifera*, FACW). In the southern part of Wetland 2 the rush species' wīwī (FACW), jointed rush (*Juncus articulatus*, FACW) and toad rush (*Juncus bufonius*, FACW) were also common.

[4] Refer: Black Maps https://mapviewer.canterburymaps.govt.nz/?webmap=0db87348adef4595a91994a3dc85cefe
[5] Refer: Canterbury Historical Aerial Imagery https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/
[6] Refer: Google Earth Pro https://www.google.com/earth/about/versions/#earth-pro

Plate 5. Blue sweet grass-kneed foxtail grassland, wetland habitats, with surface water evident (left), heavy cattle pugging and scattered clumps of wīwī (right).

4.2 Wetland assessment

Within the potential wetland areas on the site (described above) 2 × 2 metre vegetation plots were used to measure the representative vegetation types found in these areas (Figure 2; photopoints of the two plots are shown in Appendix 2). They were located as follows:

Wetland 1

- Plot 1, in the centre of the low-lying area with hydrophytic (wetland) vegetation (wetland plot).
- Plot 2, within adjoining pasture grass outside of wetland vegetation area (upland plot).

Wetland 2 (complex)

- Plot 1, in the centre of the low-lying area with hydrophytic (wetland) vegetation (wetland plot)
- Plot 2, within adjoining pasture grass outside of wetland vegetation area (upland plot).
- Plot 3, in the centre of the shallow concaved, sparsely vegetated area with surface soil cracks (wetland plot).

Wetland 1

Plot 1 passed the rapid test, dominance test and the prevalence index test, consistent with natural wetland status. As expected, Plot 2 failed all vegetation tests and therefore is not a considered a wetland. Plot 2 also passed the pasture test and is located within grazed farmland and is therefore, excluded from the NPS-FM definition.

Wetland 2 (complex)

Plot 1 passed the rapid test, dominance test and the prevalence index test, consistent with natural wetland status. Plot 2 failed all vegetation tests and also passed the pasture test therefore is not a considered a wetland. Plot 3 passed the rapid test, dominance test and the prevalence index test, consistent with natural wetland status. These three plots were run in a transect across the northern and dryer end of this wetland and used to delineation the larger area, which became wetter and boggier towards the southern boundary.

The results of these assessments are summarised in Table 1 and 2 (full results Appendix 2). Primary and secondary wetland hydrology indicators including, surface soil cracks, sparsely vegetated concave surface and saturation in aerial imagery were also observed in the location of both wetlands. Soil

investigations were not undertaken due to the conclusive results of the vegetation test and vegetation pattern was used for wetland delineation.

The site is currently irrigated and at the time of the survey a significant amount of water was entering the site from the Ravenswood development to the south, which appeared to be associated with dewatering activities. These activities may be contributing or even inducing the wetlands on the site especially over summer when the ground would likely become very dry without irrigation. Further assessment would be needed to verify the extend of effect that irrigation and dewatering was having on these wetland habitats.

Table 1: Wetland 1, assessment of the plots using vegetation and hydrology indicators.

Criteria	Plot 1	Plot 2
Hydrophytic vegetation	Exotic blue sweetgrass (OBL) and kneed foxtail (FACW), make up 60% of the total vegetative cover. The prevalence test outcome was 2.33	Exotic perennial ryegrass (FACU) makes up 70% of the total vegetative cover. The prevalence test outcome was 4.02.
Hydrology	Primary indicators: Surface soil cracks (2F) Sparsely vegetated concave surface (2H) Oxidised rhizosphere on roots (3B) Secondary indicators: Saturation in aerial imagery (3F) FAC-neutral test (4D)	No hydric soil indicators
Resulting classification	**Natural Wetland**	**Not a wetland**

Table 2: Wetland 2 (complex), assessment of the plots using vegetation and hydrology indicators.

Criteria	Plot 1	Plot 2	Plot 3
Hydrophytic vegetation	Exotic blue sweetgrass (OBL), makes up 80% of the total vegetative cover. The prevalence test outcome was 1.50	Exotic perennial ryegrass (FACU) makes up 80% of the total vegetative cover. The prevalence test outcome was 4.01.	
Hydrology	Primary indicators: Sparsely vegetated concave surface (2H) Secondary indicators: Saturation in aerial imagery (3F). FAC-neutral test (4D)	No hydric soil indicators	Primary indicators: Surface soil cracks (2F) Sparsely vegetated concave surface (2H) Oxidised rhizosphere on roots (3B) Secondary indicators: Saturation in aerial imagery (3F). FAC-neutral test (4D)
Resulting classification	**Natural Wetland**	**Not a wetland**	**Natural Wetland**

4.3 Aquatic habitats

Stokes Drain and its tributaries

Stokes Drain and its tributaries are modified natural waterways that were dug to drain the large wetland that historically covered much of the property[7]. Stokes Drain is the main waterway on the property. It is fed from springs to the west, entering the property through western boundary and flowing east then southeast across it. It leaves the property on the eastern boundary, passing under Main North Road, and continues until it connects with Taranaki Creek. The three largest tributaries of Stokes Drain (Drains 1, 4, and 5; Figure 2) originate offsite to the south of Wards Road and flow north until they connect with Stokes Drain. At least three of these drains (Drain 1, 2 and 5) are spring-fed and property owner Brian Stokes (pers. comm.) has identified two more springs on the site. There are likely other groundwater seepages and springs within the waterways.

Stokes Drain

Where Stokes Drain enters the site on the western boundary it has incised banks covered with rank exotic grasses including cocksfoot, prairie grass and blue sweet grasses, which also floats on the water margins (Plate A6-1). This section of the stream is less than one metre wide and is relatively straight, with a moderately flowing run, over a sandy-gravel streambed.

Approximately 200 metres east of the western boundary, Stokes Drain is shaded by tall trees. First, by oak forest (habitat 2) and then exotic shelterbelt forest (habitat 1), dominated by mature Lawson cypress and macrocarpa. Both forest habitats are on the true left, northern side of Stoke Drain and provide important stream shade, bank stability, and wood debris, which adds to the instream habitat (Plate A6-2 & A6-3). The stream bed is stone cobbles with varying amounts of sediment and a good diversity of flow types with, riffles, fast and slow runs and pools. The stream in this section is about 1-1.5 metres wide and 0.3-1 metre deep with a moderate flow. Several mature eels (*Anguilla* spp.) where observed along this section of the stream during the field survey (Figure 2).

Towards the western end of the site, Stokes Drain flows out in an open area where the riparian vegetation is again dominated by exotic grasses and herbs, with blue sweet grass and monkey musk on the margins and floating on the surface. The overhanging vegetation provides some fish cover on the stream margins (Plate A6-4), but is subject to annual clearance, as part of the drain maintenance (Brian Stokes Pers. comm). The stream flow is 1.5–2 metres wide with a deeper and fast flow than upstream consisting mainly of a fast unbroken run. The lack of stream shading has resulted in a significant increase of instream macrophytes, with watercress, monkey musk and water speedwell (*Veronica anagallis-aquatica*) completely covering the water in places.

At the eastern end of the site, Stokes Drain flows through another short (>100 m) forested reach. This area of mixed exotic forest (habitat 3) is associated with a garden area and contains a diverse mix of species (Plate A6-5). The stream here is 1.5–2 metres wide with a fast, run and riffle flow over a cobble and gravel stream bed. The forested riparian vegetation provides good stream shade and bank stability. A mature eel (*Anguilla* spp.) was observed during the field survey in this section of the stream (Figure 2). The east end of Stokes Drain passes under Main North Road through a wide square culvert that is semi-submerged with continual stream bed substrate (Plate A6-6).

[7] Refer: Black Maps https://mapviewer.canterburymaps.govt.nz/?webmap=0db87348adef4595a91994a3dc85cefe

Tributary Drain 1

Drain 1 is fed by a spring to the south of the site. It is a modified natural waterway, approximately 1–1.5 metres wide with a slow flow over a stream bed of fine sediment (Plate A6-7). The waterway gets wider and slightly faster as it flows towards the confluence with Stokes Drain. The riparian vegetation mostly consists of hawthorn-gorse-exotic grass hedgerow (habitat 4), with hawthorn trees becoming taller and more common on the true right, towards the confluence with Stokes Drain. Two small schools of 5-7 inanga (*Galaxias maculatus*) were observed in the lower section of Drain 1 (Figure 2).

There were three culverts in Drain 1 within the property, and one culvert outside of the boundary (Figure 2). The two culverts in the lower section of Drain 1 are unlikely to prevent fish passage. The other culvert in the upper section was partly submerged, so was unable to be properly accessed, but likely is not a full fish barrier. At the time of the site visit, there was a temporary fine-mesh fence across the stream on the downstream end of the culvert entering the property, likely installed as sediment control, or as a fish barrier because of the construction work in the neighbouring property, to the south.

Drain 1 has two main tributaries; Drain 2, which starts within the paddocks on the property to the west of Drain 1, and Drain 3, which runs along the southern, Wards Road property boundary.

Drain 2, originates from ground water and an intermittent spring source, in a paddock close to Wards Road. The water flows east in a cut channel through the paddock and then north along the paddock edge to the main cattle track through the farm where it is directed east again to the confluence with Drain 1. The western section, through the paddock, has little riparian vegetation or shading and has a large amount of iron-oxide precipitate from iron bacteria, often associated with groundwater seeps with naturally high dissolved iron and low oxygen (Plate A6-8). The sections, along the paddock margins are deeper, with slow flow and more riparian vegetation (habitat 4), which covers the banks and grows in the stream, leaving little open water.

There were three observed culverts in Drain 2. The culvert in the western most section is unlikely to allow fish to pass through. The culvert in the middle is a partially submerged old metal culvert, that may act as a partial barrier. The culvert at the confluence between Drain 2 and Drain 1 is partially submerged and may also act as a partial barrier.

Drain 3 is a relatively small, shallow waterway that drains the wetland habitat next to Wards Road. It enters Drain 1 through a small culvert which likely prevents most fish access to the drain.

The confluence of Drain 1 with Stoke Drain was not observed during the field visit, but as inanga were observed within the lower section of the drain, there is unlikely to be any significant fish barriers preventing fish access to the lower section.

Data Acknowledgment

"Contains data sourced from the LINZ Data Service licensed for reuse under CC BY 4.0"

Report: 7043
Ref: 11140
Client:
Name: Waterways.aprx
Path: E:\gis\Main North Road, Waikuku\mxd\

N

Figure 2. Observed waterways and wetlands of 1323 Main North Road, Waikuku, November 2023

0 250 500 m

Scale: 1:6,500
Date: 12/02/2024
Cartographer: BL
Format: A3R

Tributary Drain 4

Drain 4 originates off site to the south of Wards Road. It is a channelised waterway, approximately 1-1.5 metres wide, with a deep, slow flow (Plate A6-9). At the time of the survey, the water was a turbid milky colour, associated with high sediment load. This sediment input was coming from offsite to the south. The stream bed was not observed, but likely has a layer of fine sediment. The riparian vegetation was again hawthorn and gorse with exotic rank grass (habitat 4). There was a lot of grass growing out of the water, indicating that the flow levels were elevated. At the confluence of Drain 4 to Stokes Drain there is a culvert overhanging edge about 0.3 metres high, this will reduce the number of fish that will be able to gain access the Drain 4. There is another observed culvert in Drain 4, which was mostly submerged so could not be properly assessed, but as it submerged, it is unlikely to create a full fish barrier.

Tributary Drain 5

Drain 5 originates from offsite spring sources, to the south of Wards Road. It is a channelised waterway, approximately 1-1.5 metres wide, with a deep, slow flow of clear water (Plate A6-10). The stream bed was not observed but likely has a layer of fine sediment. The riparian vegetation consists of hawthorn, gorse and blackberry with exotic rank grass (habitat 4). With aquatic grasses and macrophytes growing in open parts of the channel. Towards the confluence with Stokes Drain, the stream flow becomes faster, stream banks become more incised with a riparian cover containing more woody species, creating more stream shade. There is no culvert at the confluence between Drain 5 and Stokes Drain, meaning fish will have unimpeded access to Drain 5. There are other observed culverts in Drain 5, one was large and half submerged, therefore unlikely to impede on fish access, the other was mostly submerged so could not be properly assessed, but as it submerged, it is unlikely to create a complete fish barrier.

Drain 5 gains most of its water from the offsite springs, but also has inputs from a Drain 7 and Drain 8 and maybe Drain 6 (Figure 2).

Drain 6 is relatively short, with a similar character of the other drains on the property, however during the survey no flow could be detected and it could not be found where the drain connects to the other drains.

The upstream area of Drain 7 contained water that did not appeared to be flowing, however towards the confluence to the Drain 5 the water had a slight flow.

At the time of the survey, Drain 8 was slowly flowing at the confluence to the spring area, however the upstream area of the drain was dry. This drain flowed through an overhanging culvert into the spring area.

Northeastern Drains

The drains in the northeast corner of the property are not tributaries of Stokes Drain. They start within the property and drain towards the east and flow out through two different culverts running underneath Main North Road, and continue east until they connect with Taranaki Creek. At the time of the survey these drains were completely dry, implying they are only feed by rainwater and/or irrigation runoff.

Waikuku Stream

There is a short stretch of Waikuku Stream which passes through the paper road that connects the property to Gressons Road at the western end. The Waikuku Stream is part of a different sub-catchment to Stokes Drain, but both flow into the Ashley River/Rakahuri Catchment. This stretch of

stream is about 5 metres wide, with a deep fast flowing run over a stream bed of cobbles and gravel (Plate A6-11 & A6-12). The riparian vegetation is predominantly exotic, with grasses, scattered willows (*Salix* spp) and watercress, which is floating on the surface. Some indigenous vegetation is present (and may have been planted) including harakeke, tī kōuka/cabbage tree (*Cordyline australis*) and pūkio. The grasses, harakeke and pūkio overhang the stream and provide great fish cover, along the stream banks. There is little stream shade so there are significant mates of submerged macrophytes and green algae within the stream.

5.0 Flora

5.1 Overview

Twenty-five indigenous and 114 exotic vascular plants species were recorded during the survey (Appendix 1). However, six of the indigenous species were planted and a number of the others appeared to have naturalised from garden plantings.

5.2 Threatened or At-Risk species

Wind grass (*Anemanthele lessoniana*, At Risk – Relict), and *Brachyglottis greyi* (At Risk – Naturally Uncommon), (de Lange et al 2018), were both observed growing within ornamental plantings on the site. Neither species was observed to be naturalised and *Brachyglottis greyi* does not naturally occur in Canterbury, therefore, these species are not considered Threatened in the context of this site. No other threatened or at-risk indigenous plant species were recorded and there is no reason why the flora values would impede the rezoning of the site.

5.3 Taonga plants

Naturally occurring taonga plant species[8] on the site include karamū, harakeke, kōhūhū, tī kōuka, and wīwī.

5.4 Pest plants

Thriteen plant species recorded on the site are identified as either 'Pest' or Organisms of Interest (OoI) under the Environment Canterbury Regional Pest Management Plan (RPMP) (2018-2038), (Table 3). Pines and conifers recorded on the site had all been planted. These are not wilding conifers and are therefore not considered pest plants under the RPMP.

Table 3: Environment Canterbury RPMP (Pest) and Organisms of Interest (OoI) found on the site.

Species	Common Name	Pest Classification
Arctium minus	burdock	RPMP-OoI
Betula pendula	silver birch	RPMP-OoI
Chamaecytisus palmensis	tree lucerne	RPMP-OoI

[8] Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998: https://www.legislation.govt.nz/act/public/1998/0097/latest/DLM431337.html#DLM431337

Species	Common Name	Pest Classification
Clematis vitalba	old man's beard	RPMP-Pest
Conium maculatum	hemlock	RPMP-Ool
Crataegus monogyna	hawthorn	RPMP-Ool
Cytisus scoparius	Broom	RPMP-Pest
Ilex aquifolium	holly	RPMP-Ool
Lupinus arboreus	tree lupin	RPMP-Ool
Marrubium vulgare	horehound	RPMP-Ool
Rosa rubiginosa	sweet brier	RPMP-Ool
Rubus fruticosus	blackberry	RPMP-Ool
Ulex europaeus	gorse	RPMP-Pest

6.0 Freshwater fauna

The waterways of the property are in two separate tributaries of the lower Ashley River/Rakahuri Catchment. Waikuku Stream one direct tributary and Stokes Drain flows into the Taranaki Creek and then the Ashley River. Waterways near the property have been moderately well surveyed for fish.

Two small schools of inanga and six eels were seen during the site visit. The inanga were within Drain 1, the eels were along Stokes Drain (Figure 2). One eel was identified as a longfin eel (*Anguilla dieffenbachii*, At Risk - Declining), with the other individuals being either a longfin eel or shortfin eel (*Anguilla australis*, Not Threatened).

The Taranaki Creek sub-catchment has 63 survey records in the New Zealand Freshwater Fish Database and the Waikuku Stream sub-catchment has nine records. The surveys were conducted using electrofishing and traps and most of these records are within the last six years, making it a very recent dataset. The fish and invertebrate species recorded during these surveys are listed in Table 4 below. Threat classifications for fish and invertebrates are taken from Dunn et al (2018) and Grainger et al (2018) respectively. The 'likelihood' column is the estimated likelihood of each species being detected within the waterways throughout the property, based on what was observed during the site visit, how frequently they are recorded in the local and wider area, number of individuals found in each survey, and the altitude and distance inland of the site.

Table 4 – Freshwater fish and invertebrate species from 63 records in the Taranaki Creek sub-catchment and nine records in the Waikuku Stream sub-catchment. Also, the estimated likelihood of each species being present in the property area. Asterisks (*) marks species observed on the property and confirmed to species during the site visit.

Common name	Scientific name	Threat classification	Likelihood in Stokes Drain and its tributaries	Likelihood in Waikuku Stream
Shortfin eel	*Anguilla australis*	Not Threatened	Very high	Very high
Longfin eel	*Anguilla dieffenbachii*	At Risk - Declining	Very high*	Very high
Inanga	*Galaxias maculatus*	At Risk - Declining	High*	Moderate
Canterbury galaxias	*Galaxias vulgaris*	At Risk - Declining	Low	Very low
Common bully	*Gobiomorphus cotidianus*	Not Threatened	High	Moderate
Giant bully	*Gobiomorphus gobioides*	At Risk - Naturally Uncommon	Moderate	High
Canterbury Mudfish	*Neochanna burrowsius*	Threatened - Nationally Critical	Very low	Very low
Common smelt	*Retropinna retropinna*	Not Threatened	Very low	Low
Black flounder	*Rhombosolea retiaria*	Not Threatened	Very Low	Low
Brown trout	*Salmo trutta*	Introduced	High	High
Freshwater Shrimp	*Paratya curvirostris*	Not Threatened	Low	Very low

Based on records in the wider catchment and the fish observed during the site visit, the fish community present in Stokes Drain and its tributaries are likely dominated by eels with inanga and bully (*Gobiomorphus* spp.) species also common.

Inanga are one of New Zealand's many indigenous species that has a lifecycle requiring a migration to and from the sea. Being a weak swimmer and without jumping or climbing abilities, inanga are only found inland where the gradient is low and there are no major barriers to migration, such as weirs or culverts with fast flow, or overhanging outflows. It also implies that any migratory fish species could potentially reach the site. However, there are multiple culverts within the property – some with overhanging outflows – that will be acting as full or partial fish barriers, preventing less able climbers such as inanga from accessing part of the drainage system.

Stokes drain has the most instream habitat diversity, riparian shading and no significant barriers preventing fish migration and therefore, likely have the most diverse fish population with eels, inanga, bullies and introduced brown trout (*Salmo trutta)* expected. The upstream areas of the Stokes Drain tributaries, are generally less connected due to culverts and are more degraded, with less shading and more aquatic macrophytes. This means these areas will be more affected by overheating and/or drying

out during summer and therefore, galaxiids and bullies are less likely, but these areas are still likely to contain eels.

The section of the Waikuku stream is relatively small, but is a part of the main waterway of the Waikuku sub-catchment and is therefore an important pathway for fish migrating up or downstream. The stream section on site is likely used by eels, galaxiids, bullies and brown trout.

7.0 Birds

The eBird desktop database search identified 34 indigenous and 24 exotic species (Appendix 3). Of these, one Threatened – Nationally Endangered, two Threatened – Nationally Vulnerable, six At Risk – Declining, one At Risk – Naturally Uncommon, two At Risk – Recovering and one At Risk – Relict species were recorded (threat classification as per Robertson *et al*. 2021; Table 5). A large number of Threatened and At Risk species were recorded in the desktop survey due the proximity of the Tūhaitara Coastal Park and the Pegasus town wetlands.

Eighteen bird species identified in the desktop survey are listed as taonga species in Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998 (marked with $^{+}$ in Table 5 and Appendix 3).

Eight indigenous and four exotic bird species were seen or heard at the site during the survey. The indigenous species included one AT Risk species tōrea/South Island pied oystercatcher (*Haematopus finschi* At Risk – Declining), as well as seven Not Threatened species (Table 6).

In addition to the pūtangitangi/paradise shelduck observed using waterways and breeding on the site, it is possible that māpunga/black shag (*Phalacrocorax carbo novaehollandiae* At Risk – Relict) may nest in the willow or poplar trees close to water on the site. Tōrea tai/variable oystercatcher (*Haematopus unicolor* At Risk – Recovering) and pohowera/banded dotterels (*Charadrius bicinctus bicinctus* At Risk – Declining) may also forage in open farmland and wetland areas. It is possible that tōrea/South Island pied oystercatchers and pohowera/banded dotterels could also nest in the open farmland on site. However, there is abundant similar habitat nearby for these species.

Table 5 – Desktop results of the eBird database search within a two kilometre radius of Waikuku rezoning area and an assessment of the likelihood of the presence of these species within the site. Threat Classification as per Robertson *et al*. 2021. The likelihood of occurrence for each species is given based on their known habitat preferences and distribution in the area and surrounds. Asterisks (*) marks species observed on the property and confirmed to species during the site visit.

Common name	Scientific name	Threat classification	Likelihood	Preferred habitats
Black-fronted tern/tarapirohe+	*Chlidonias albostriatus*	Threatened – Nationally Endangered	Possible	Riverbeds, waterways, river flats and farmlands by rivers during breeding. More coastal habitats, including coastal pasture, during autumn and winter.
Australasian crested grebe/pūteketeke+	*Podiceps cristatus australis*	Threatened – Nationally Vulnerable	Highly Unlikely	Coastal lakes and estuaries, especially Lake Ellesmere in Canterbury.
Caspian tern/taranui+	*Hydroprogne caspia*	Threatened – Nationally Vulnerable	Unlikely	Estuarine shell banks and sandpits, sandy beaches and harbours
New Zealand pipit/23ihoihoi+	*Anthus novaeseelandiae*	At Risk – Declining	Possible	Beaches, riverbeds, high-country river flats, gravel roads and verges, rough pasture, tussockland, cleared areas of exotic forests.
Banded dotterel/pohowera	*Charadrius bicinctus bicinctus*	At Risk – Declining	Possible	Sandy coasts, streams and river mouths, shingle and braided river beds, terraces and coastal lakes, lagoons and beaches
White-fronted tern/tara+	*Sterna striata*	At Risk – Declining	Highly unlikely	Sandy beaches, low-lying sand spits, shingle or shell banks, rocky islets, rock stacks, steep cliffs, offshore islands. Rarely inland
Black-billed gull/tarāpuka	*Chroicocephalus bulleri*	At Risk – Declining	Possible	Breed on braided riverbeds and inland lakes. Arable farmland. During winter, coastal estuaries, harbours, open coastlines and urban centres.
Red-billed gull/tarāpunga	*Chroicocephalus scopulinus*	At Risk – Declining	Likely	Sand spits, boulder banks, shell banks, gravel beaches, rocky headlands, rocky islets.
South Island pied oystercatcher/tōrea*	*Haematopus finschi*	At Risk – Declining	Seen	Breed on braided riverbeds, farmland, fringes of lakes, subalpine bogs. Estuaries and sandy beaches outside of breeding.
Australian coot	*Fulica atra australis*	At Risk – Naturally Uncommon	Highly unlikely	Shallow sheltered bays fringed with extensive raupo beds, and willows.
Pied shag/kāruhiruhi+	*Phalacrocorax varius varius*	At Risk – Recovering	Unlikely	Sheltered coasts, harbours, harbours and offshore islands.
Variable oystercatcher/tōrea pango	*Haematopus unicolor*	At Risk – Recovering	Possible	Coastal and island habitats, especially estuaries, sandy beaches, lagoons.
Black shag/māpunga+	*Phalacrocorax carbo*	At Risk – Relict	Possible	Sheltered coastal waters, estuaries, harbours, rivers, streams, dams and lakes up to subalpine zone.

Table 6 – Indigenous and exotic birds seen on the site during the site survey. Threat Classification as per Robertson et al. 2021.

Common name	Scientific name	Threat/status	Preferred habitats
Indigenous			
kāhu/swamp harrier Not	*Circus approximans*	Not Threatened	Open country, wetlands, farmlands, grasslands, high-country tussockland, forest margins, riverbeds.
karoro/southern black-backed gull	*Larus dominicanus dominicanus*	Not Threatened	Estuaries, harbours, open coastlines, rivers, lakes, wet pasture, lambing paddocks, farmland, rubbish tips and urban environments
Pīwakawaka/South Island fantail	*Rhipidura fuliginosa fuliginosa*	Not Threatened	Forest, scrubland (second growth), farmland with scattered trees, suburban environments
Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	Wetland margins, grassland, tussockland, farmland, lakes, riverbeds
Pūtangitangi/paradise shelduck	*Tadorna variegata*	Not Threatened	Grassland, pond, tussockland, farmland, lakes, riverbeds
Riorio/grey warbler	*Gerygone igata*	Not Threatened	Temperate forest, scrubland, pasture, and urban environments. From sea level to subalpine zone.
South Island pied oystercatcher/tōrea	*Haematopus finschi*	At Risk – Declining	Breed on braided riverbeds, farmland, fringes of lakes, subalpine bogs. Estuaries and sandy beaches outside of breeding
Warou/welcome swallow	*Hirundo neoxena neoxena*	Not Threatened	Lowland open country, less common in open high country
Exotic			
blackbird	*Turdus merula*	Introduced and Naturalised	Suburban environments, paddocks, hedgerows, grassland, scrub and indigenous forests
Eurasian skylark	*Alauda arvensis*	Introduced and Naturalised	Open country, grassland, dunes, farmland, tussockland. Sea level to subalpine herbfields
European goldfinch	*Carduelis carduelis*	Introduced and Naturalised	Low altitudes. Farmlands and suburban environments.
yellowhammer	*Emberiza citrinella*	Introduced and Naturalised	Farmland, orchids, open tussockland from sea level to subalpine herbfields.

8.0 Lizards

The Waimakariri District is not well surveyed for lizards, and the low plains represent a highly modified environment, which is not of particularly high value for indigenous lizards. Species known from near the site include Canterbury grass skink (*Oligosoma* aff. *Polychroma* Clade 4; At Risk – Declining), Waitaha gecko (*Woodworthia* cf. *Brunnea*; At Risk – Declining), and jewelled gecko (*Naultinus gemmeus*; At Risk – Declining) (Table).

Although no records of Canterbury spotted skink (*Oligosoma lineoocellatum*, Threatened – Nationally Vulnerable) were detected within a 10-kilometre radius of the Waikuku rezoning area, their known distribution covers this area, and therefore were included.

Table 7 – Results of the Department of Conservation Bioweb Herpetofauna database search within a 10-kilometre radius of Waikuku rezoning area and an assessment of the likelihood of the presence of these species within the site. Conservation status as per Hitchmough et al. 2021. The likelihood of occurrence for each species is given based on their known habitat preferences and distribution in the area and surrounds.

Species	Common Name	Conservation Status	Nearest Record (km)	Year of record	Preferred habitats	Likelihood
Oligosoma aff. *polychroma* Clade 4	Canterbury grass skink	At Risk – Declining	3.0	2022	Lowland/montane shrublands grasslands, and rocky or boulder areas around farm building and debris.	Highly likely
Woodworthia cf. *brunnea*	Waitaha gecko	At Risk – Declining	3.1	2021	Loose rocks, rock tors, and outcrops, and occasionally forest from mid Canterbury to southern Marlborough.	Unlikely
Oligosoma lineoocellatum	Canterbury spotted skink	Threatened – Nationally Vulnerable	*	*	Wide range of habitats including grasslands, scrubland, forest edged, and rocky habitats	Unlikely
Naultinus gemmeus	Jewelled gecko	At Risk – Declining	5.1	Pre-1970	Scrub, regenerating forest, shrubland	Highly unlikely

*No records within 10 kilometre search radius, but included as the site is within known range.

Of the lizard species listed in Table 6, it is highly unlikely that jewelled gecko are still persisting within such a highly modified environment, and are therefore not considered further.

Canterbury spotted skink have a wide range of known habitats, which are present within the site but, they are becoming increasingly rare in the Canterbury area. Therefore, it is unlikely that Canterbury spotted skink are present within the Waikuku rezoning area.

Waitaha gecko are also unlikely to be present given the habitat available and the extent of land use modification. It may be possible that a remnant population is present around the three existing dwellings, but this species would likely be undetectable at low densities.

Canterbury grass skink is the most likely species to be present given the habitat quality and extent within the site. This species is most likely to inhabit modified environments where there is a complex of rank grass, fence lines, unmanaged hedgerows and woody or anthropogenic debris. Such habitat can be found in habitat types 1 – Exotic shelterbelt forest; 4 – Hawthorn-gorse-exotic rank grass hedgerows; 6 – Rank exotic grass with farm debris and buildings; and ,7 – Perennial ryegrass (white clover) grassland. Although few records of Canterbury grass skink were found within the search radius, this species is commonly found within the Canterbury region and is likely under reported, therefore it is possible they are present in low numbers on the site. A skink was also seen (but not captured) during vegetation surveys of the site. Is it most likely that the skink seen was a Canterbury grass skink, and this confirms the presence of a lizard population on site.

However, there is no reason why this should impede rezoning provided more detailed lizard surveys are undertaken prior to any subdivision development, and if present managed to avoid, or mitigate impacts in accordance with Wildlife Act (1953) (refer section 10.0 below).

9.0 Ecological values

9.1 Vegetation

Vegetation on the site is highly modified. The land has been cleared of any remnant indigenous vegetation and planted/over-sown with exotic pasture grasses, crops and trees. The naturally occurring indigenous plant species are nearly all confined to the riparian margins of Stokes Drain. These indigenous plant species are all common throughout Canterbury and New Zealand, and are considered to be of low ecological value.

However, exotic vegetation on the site provides habitat for indigenous fauna, including At Risk lizard and bird species. These habitat values are unlikely to be high, given these are all highly modified habitats dominated by exotic species. Further targeted surveys are required to determine the ecological values of these habitats for indigenous fauna.

9.2 Wetlands

The original wetland shown on Black Maps was historically drained, with a loss of many flora and fauna species from the site. The delineated wetlands on the site are within actively grazed farmland and are affected by stock browse, pugging, irrigation and potentially cultivation. The impact of irrigation on these wetlands is unknown, but the vegetation and surface characteristics are likely to change seasonally. The only indigenous species observed in the wetlands (*Juncus edgariae*) is a common, Not Threatened species, and the ecological values of these areas are **low**.

However, tōrea/South Island pied oystercatcher (*Haematopus finschi* At Risk – Declining) were observed foraging within Wetland 2 and potentially breeding nearby. Given the proximity of significant coastal wetland areas around Pegasus town and Tūtaepatu Lagoon, a number of other Threatened or At Risk bird species could potentially frequent the site and forage in these wetlands and other boggy areas (refer Table 5).

9.3 Waterways

The waterways within the property are highly modified natural waterways, fed by natural springs and seepages, and dug to prevent the area reverting to wetland. These channelised waterways are further degraded by the lack of riparian fencing, planting, or shade in many places, increased nutrients and sediment, and instream structures such as culverts. Despite the highly modified and degraded nature of the habitat, the waterways are home to a possibly large population of eels and inanga and probably also bully species. However, the habitat values will fluctuate with drain maintenance, with fish needing to move from recently-maintained to unmaintained reaches within the catchment. The drains on the property being are typically on a one- or two-year maintenance cycle. Drain maintenance is extremely destructive to waterway ecosystems, injuring or killing fish, disrupting the decomposition of sediment, remobilising sediment, making nutrients within the sediment available for excess plant or algal growth, deepening and destabilising banks, and increasing the frequency that drain maintenance is required.

Stokes Drain

Stokes Drain is a spring-fed, modified natural waterway. It has mature, exotic riparian cover along much of its length providing shade, as well as low-growing plants extending across the water surface providing fish cover. It has many characteristics of a natural healthy stream, including good flow variation and diverse, instream habitat for fish and invertebrates, which allow more species and life stages to be resident. This drain is cleaned annually. The ecological values are therefore **moderate**.

Stokes Drain tributaries

The ecological values of Stokes Drain tributaries range from very-low to moderate and would fluctuate with drain maintenance. All of the drains are cleaned of weed growth regularly, with Drain 5 and Drain 1 cleaned annually and other drains cleaned as required, but normally at least every second year (Brian Stokes, pers. comm.).

Drain 1 and Drain 5 are both spring-fed and likely to have **moderate ecological values** as they are well connected to Stokes Drain, with good water flow. These drains have better riparian vegetation and stream shading than the other drains.

Drain 2, Drain 6, and Drain 7 are likely to have **lower ecological values** as they are less connected to Stokes Drain and have slower flows, which increases the risk of heating up, becoming anoxic and/or drying out. However, it is still likely that these waterways contain fish, particularly eels.

Drain 3, Drain 8 and the other smaller drains have **low ecological value**, due to their small size, increased likelihood of drying up, and being unlikely to support fish.

The **ephemeral drains** in the northeast of the property have **very low ecological value**.

Waikuku Stream

Waikuku Stream has **high ecological value** as it is home to several species of fish and is a passageway for migrating fish to reach further upstream. Any work or installed structure within or over this waterway should not impede fish passage.

The ecological values of freshwater habitats on the site should not impede the rezoning. However, all of the active waterways within the property likely contain fish, any work involving channel dewatering or work that will disturb the bed and/or submerged banks of a watercourse, will require fish salvage.

Springs and ground water

Springs within the site were not observed during the survey, but there is anecdotal information on spring locations from landowner Brian Stokes (Pers Comm.), which are shown in Figure 2. Other springs and upwellings are likely present within the drain channels themselves. The influence of irrigation on the site hydrology, as well as recent development works in Ravenswood to the south, is currently unknown. It is recommended that a groundwater hydrologist investigates the groundwater system and the effects of residential development on this to inform the subdivision design.

9.4 Significance assessment

The site was evaluated for ecological significance against the Canterbury Regional Policy Statement (CRPS Appendix 3)[9] and the proposed Waimakariri District Plan (pWDP,ECO-APP1)[10], which both use the same criteria (Appendix 4). A second evaluation was undertaken using the Appendix 1 Criteria[11], from the National Policy Statement for Indigenous Biodiversity (NPS-IB, Appendix 5). A site only needs to meet one criterion to count as ecologically significant.

All of the terrestrial habitats on the site contain areas with potential habitat for Threatened or At Risk lizards. These habitats could potentially meet the ecological significance criteria for Rarity/Distinctiveness in the CRPS, pWDP and the National Policy Statement for Indigenous Biodiversity (NPSIB). This is due to the likely presence of Canterbury grass skink within the site, which are At Risk – Declining and found in less than three regions (Canterbury and Westland). However, these are all highly modified exotic dominated habitats with otherwise low ecological values and therefore, despite meeting the criteria, they are not considered to be significant as habitat.

At least two habitats, perennial ryegrass (white clover) grassland and wetlands (blue sweet grass-kneed foxtail grassland) provide foraging habitat for At Risk South Island pied oystercatcher (and potentially other threatened bird species). Exotic shelter belt forest and hawthorn-gorse-exotic grass hedgerows, adjacent to waterways, may also provide nesting habitat At Risk black shag. If these (or other Threatened bird) species were found to be breeding in any of these habitats, they would meet the significant criteria for Rarity and Distinctiveness under the CRPS and pWDP, but may not meet the same criteria of the NPS-IB, as South Island pied oystercatcher and black shag are both widespread in at least three other regions. The exception would be if two (or more) Threatened or At Risk species were found to be present in the same habitat, as this exclusion only applies to a single species, or if another Threatened bird species, that is not widespread was found.

Again, these are all exotic dominated habitats which are widespread in the surrounding landscape and therefore, not considered to be important habitat for indigenous birds and not crucial to the survival of above mention species. Therefore, despite potentially meeting the criteria this is not significant habitat for indigenous birds.

The majority of the waterways meet the significance criteria within the CRPS and pWDP. The criteria met are habitat that supports At Risk species (criterion 4), habitat that provides important linkages (criterion 8) and permanent habitat of indigenous species. Aquatic indigenous biodiversity is not covered by the NPS-IB.

[9] CRPS; APPENDIX 3 - Criteria for determining significant indigenous vegetation and significant habitat of indigenous biodiversity.
[10] pWDP; ECO-APP1 - Criteria for determining significant indigenous vegetation and significant habitat of indigenous fauna
[11] NPS-IB; Appendix 1: Criteria for identifying areas that qualify as significant natural areas (SNAs).

10.0 Statutory regulations and policy statements

10.1 Overview

Legislation and policy statement guidance that should be considered in relation to the proposed rezoning includes:

- National Environmental Standards for Freshwater (NES-F; 2020).
- National Policy Statement – Freshwater Management (NES-FM, 2020).
- National Policy Statement for Indigenous Biodiversity.
- Proposed Waimakariri District Plan (pWDP).
- Wildlife Act (1953).

10.1.1 National Environmental Standards for Freshwater

The National Environmental Standards for Freshwater regulations, protect urban and rural streams from in-filling and prohibits earthworks in, and around wetlands.

Waterways

Stokes drain and the tributary waterways on the property, that are spring and groundwater fed, are classified as 'rivers' in the RMA. 'River' is the 'catch-all' term used for all waterways in the RMA regardless of size (refer Section 2.4). Based on the current survey, tributary Drains 1-8 (Figure 2) would be classed as RMA rivers, as well as, another small spring fed drain in the north west (not named in Figure 2). However, dewatering activities on the neighbouring Ravenswood development site, was significantly elevating the water levels in Drain 3 and 4 at the time of the survey, and their 'river' status would need further investigation once this development is completed.

Under NES-F (2020) regulations the reclamation of the bed of any river (or infilling streams) is a discretionary activity, requiring resource consent (Regulation 57 NES-F 2020).

In the NPS-FM (2020), sets out a number of policies for the protection of rivers including:

- Policy 7: The loss of river extent and values is avoided to the extent practicable.
- Policy 9: The habitats of indigenous freshwater species are protected.

The NPS-FM also requires that:

"Every regional council must include the following policy (or words to the same effect) in its regional plan:

a) "The loss of river extent and values is avoided, unless the council is satisfied that: there is a functional need for the activity in that location; and
b) the effects of the activity are managed by applying the effects management hierarchy."

An assessment of any proposed development of the Site would need to account for the existing river extent and values of the Site, and any proposed replacement of/addition to those waterways, and whether the existing waterways are intermittent or ephemeral.

Wetlands

Under NES-F (2020) regulations, earthworks, vegetation clearance, or disturbance of natural wetlands, or within a 10 metre setback from a natural wetland, is heavily restricted and in most cases a Non-complying activity (Regulation 53, 54 NES-F 2020).

Earthworks and water use/discharge is also controlled (non-complying activities) within 100 metres of natural wetlands if it is likely to cause complete or partial wetland drainage, or change the water level range or hydrological function of a wetland (Regulations 52 and 54, NES-F 2020).

In addition, NPS-FW (2020), Policy 6 states that 'there is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted'

The ecological values of the existing wetlands on site are considered to be low. Nevertheless, the above policies will need to be considered as part of any future development of the site.

10.1.2 National Policy Statement for Indigenous Biodiversity

The objective of the NPS-IB is to maintain indigenous terrestrial biodiversity across Aotearoa New Zealand so that there is at least no overall loss in indigenous biodiversity. For subdivisions or developments outside of a Significant Natural Area (SNA), any significant adverse effects on indigenous biodiversity must be managed by applying the effects management hierarchy (Clause 3.16(1)). Note that the NPS-IB does not include freshwater species.

A full Assessment of Ecological Effects (AEE) for the proposed rezoning has not been undertaken. However, provided the recommendations in this report are followed, it is not considered that the rezoning and current ODP (RMM 2024) for the site would result in significant adverse effects on indigenous biodiversity. Therefore, the absence of an AEE should not preclude rezoning of the Site. Furthermore, the proposed indigenous planting within the stormwater management/wetland area to the east of the site and the green corridors along the streams will likely result in a net gain for biodiversity.

Specified highly mobile fauna

The site contains habitat for tōrea/South Island pied oystercatcher and potentially pohowera/banded dotterel which are listed as specified highly mobile fauna within Appendix 2 of the NPS-IB. However, as the surrounding landscape contains a large amount of similar habitat (pasture/farmland), the proposed development of the site would not have a significant impact on these species even if they were found to be using the site. However, if tree removal or ground works are to occur during between July and February, a bird survey would be useful to confirm no shag species, paradise shelduck, South Island pied oystercatcher or banded dotterel are nesting within the site.

10.1.3 Wildlife Act

Most indigenous terrestrial vertebrate animal species are protected under the Wildlife Act (1953, s63 (1) (c)). In cases where proposed activities affect may harm or disturb indigenous fauna, a Wildlife Act Authority (WAA) must be applied for and approved by the Department of Conservation (DOC). A permit under the Wildlife Act must also be obtained from DOC before any indigenous fauna (and/or their habitats) can be disturbed, handled, translocated or killed. Additionally, the submission of a species-specific management plan (for example, a Lizard Management Plan) would be required if indigenous lizards were found within vegetation on the site that was proposed for clearance.

Vegetation and habitats on the site provide foraging and breeding habitat for protected indigenous birds and lizards. While this should not constrain rezoning, further surveys will be required prior to any site development, to assess impacts on birds, lizards and potential.

10.1.4 Proposed Waimakariri District Plan

Waterways on the site (including Waikuku stream) are not currently named in the in the proposed Waimakariri District Plan (pWDP), Natural Character schedule (NATC-SCHED) of freshwater bodies. Unscheduled streams require a minimum five metre riparian setback from any development[12]. The plan states that:

> *"Not all freshwater bodies have been investigated. Those investigated have only been for a limited number of attributes, such as high ecological values, cultural or spiritual values, or are close to their natural state, and only for a limited area. All natural freshwater bodies are important and even if they are not presently scheduled, it does not mean that they do not have natural character values. These will be investigated during the life of the District Plan."*

Stokes Drain (and tributaries), as well as the two separate, dry waterways in the northeast of the site, are tributaries of Taranaki Stream, which is a Schedule 2 waterway (NATC-SCHED2) in the pWDP. Waikuku Stream is a tributary of the Ashley River/Rakahuri River which is Schedule 1 waterway (NATC-SCHED1).

Waikuku Stream has attributes (e.g. natural channel, high ecological values) that contribute to the natural character values and it is considered likely that over the life of the Plan it would become Scheduled 3 waterway. Stokes Drain is highly channelised and has lost most of its natural character, but further investigation would be required to determine its status in the pWDD Natural Character schedule.

11.0 Ecological considerations and rezoning recommendations

11.1 Overview

Ecological considerations that may constrain the development of the site will be primarily be related to the waterways and wetlands. Some indigenous fauna habitats occur on the site, as discussed above, but are largely exotic vegetation habitats that are widespread throughout Canterbury, and therefore should not be a viewed as an ecological constraint to rezoning, but it is envisaged that they would need to be addressed in the consenting process of specific development projects. A summary of these potential ecological constraints are provided in Table 7.

[12] https://waimakariri.isoplan.co.nz/draft/rules/0/228/0/0/0/226

Table 7 – Ecological considerations, potential constraints and rezoning recommendations for the Waikuku rezoning site.

Habitat	Consideration/ constraint	Explanation	Recommendations
Waterways	Preserving drain/'river' extent	The permanently and intermittently flowing drains are 'rivers' under the RMA, NES-F, and pWDP. Reclamation of the bed of any 'river' is a discretionary activity under the NES-F. Consent may be granted only if there was a functional need for the activity to occur in that place causing the loss of extent. In the NPS-FM, Policy 7 states that 'the loss of river extent and values is avoided to the extent practicable'.	• Design the subdivision layout to retain as many drains as possible. • Naturalise drains without instream works (recontour carefully from the waterline up). • The creation of new waterways with good ecological values can increase the extent, replacing low value waterways with higher value ones.
Waterways	Fish	Any instream works would likely require a fish management plan and relocation of fish from the affected area prior to commencing works. The fish population is expected to be large and there are at least 5 kilometres of waterway on site. Fish removal would be a significant undertaking if many/all waterways were realigned, recontoured in-situ, and/or filled. The time required for fish removal in any reach is difficult to estimate prior to starting.	• Realign as few waterways as possible if time and cost of removing fish is a limitation. • Naturalise drains without instream works (recontour banks carefully from the waterline up).
Vegetation	Bird and lizard habitat	Vegetation habitats on the site provide foraging and breeding habitat for indigenous birds and lizards, which are protected under the Wildlife Act. If indigenous birds and lizards are affected by any proposed developments, and this cannot be avoided, a Wildlife Act Authority (WAA) may be required, and this would involve preparation of an avifauna and/or lizard management plan.	• Further surveys will be required during the consenting process of specific development to assess impacts on birds, lizards and potential impacts on other fauna including invertebrates. • Preserve and enhance and area of lizard habitat on the site.
Wetlands	Extant wetlands	Wetland habitats are highly valued and protected under the law. However, the wetlands present are fragmented, of low ecological value, and have only one common, indigenous plant species present. Summer irrigation may be helping to maintain their presence, which will be absent after the	• As the ecological values and indigenous biodiversity is low, mitigate for the loss of these wetland fragments through developing diverse replacement wetlands with reliable hydrology

Habitat	Consideration/ constraint	Explanation	Recommendations
		development. Construction will likely change groundwater movements, with unpredictable outcomes on the wetlands.	through the waterways or stormwater systems.
Across site	Terrestrial indigenous biodiversity	The objective of the NPS-IB is to maintain indigenous biodiversity across Aotearoa New Zealand so that there is at least no overall loss in indigenous biodiversity. For subdivisions or developments outside of a Significant Natural Area (SNA), any significant adverse effects on indigenous biodiversity must be managed by applying the effects management hierarchy (Clause 3.16(1)).	• A full Assessment of Ecological Effects will be required, for proposed developments, to determine indigenous species presence and values, and how to reduce adverse effects through applying the effects management hierarchy.

11.2 Recommendations

Stokes Drain

Stokes Drain is a spring-fed modified natural waterway good instream fish and invertebrate habitat and moderate ecological values. It is considered that a plan that does not include the naturalisation of Stokes drain would result in substantial adverse ecological effects.

It is recommended that Stokes Drain is maintained and naturalised as part of the development. Tall exotic trees, within tall current riparian vegetation, should be maintained initially to provided stream shade, bank stability, and terrestrial inputs (invertebrates, woody debris) into the stream and limit aquatic weed and algae growth. Over time these trees should be replaced by taller indigenous vegetation.

Tributaries of Stokes Drain

The tributaries of Stokes Drain (Drains 1–8) have low to moderate ecological values, because they channelised highly modified waterways, with exotic riparian habitat, that only provides a thin buffer to surround land use. However, they do have high quality, spring-fed water sources and together provide a large area of available freshwater habitat for use by At Risk freshwater species.

Where practicable, it is recommended that these tributary waterways are retained, replanted and naturalised as this will minimise the time and cost associated with fish management and removal. Where retention is not practicable, it is recommended that new realigned waterways are created on the site with good ecological values. This could involve redirecting the waterways to work with the proposed residential areas. Building new waterways offline will also allow for creation of better instream and riparian habitat, with more varied stream flow, channel shape and planting variation.

If the realigned waterway system design avoids a net loss of river extent and provides high-quality instream habitat available to fish, while still connecting to Stokes Drain, it is likely to result a net biodiversity gain.

Stream Naturalisation Plan

Once rezoned, a detailed assessment of Stokes Drain and any other tributaries to be retained, should be undertaken and a Stream Naturalisation Plan prepared by a suitably qualified and experienced practitioner. This plan should also cover any new realigned waterways that are created on the site.

Wetland habitats

The wetlands present on the site are fragmented, of low ecological value with only one common indigenous plant species present. These wetlands are also likely been partly induced and maintained by summer irrigation and dewatering on the neighbouring Ravenswood development, which will be absent after the development. If the site is rezoned and developed, construction activities will likely change groundwater movements, with unpredictable outcomes on the wetlands, making the preservation of these small wetland fragments unviable.

Therefore, it is not recommended to retain these wetlands and instead mitigate for their loss through developing diverse replacement wetlands with reliable hydrology and indigenous wetland plantings within the large stormwater reserve in the east of the site.

Fauna habitats

Developing the site will lead to loss of fauna habitat. Loss of avifauna (bird) habitat could be offset through the development of the stormwater management area. Also, an area to offset the loss of any lizard habitat should also be considered, this could include areas of indigenous planting around the periphery of the stormwater reserve with predator control to enhance the habitat.

12.0 Conclusions

The proposed rezoning site covers approximately 143 hectares of actively grazed and cultivated farmland. The site is dissected by Stokes Drain, which is fed by numerous smaller farm drains. These flow from springs and groundwater sources to the south and west, some of which are off site. Stokes Drain and most smaller tributaries are modified natural waterways that were formed when historic wetlands in the area were drained for agriculture, and therefore considered 'rivers' under the RMA. These waterways also provide habitat for at least one At Risk freshwater fish species and are therefore considered ecologically significant under CRPS (and pWDP) criteria. Aquatic species and habitats are not covered under the NPS-IB.

Based on this assessment, it is recommended that if rezoning occurs Stokes, drain is retained and naturalised (without instream works). The riparian buffer along this drain should be planted with appropriate indigenous vegetation. The tall exotic trees currently shading the stream should initially be retained to maintain instream habitat quality, but should be slowly removed as indigenous riparian plantings establish. The springs on the site should be protected and linkages to waterways maintained or established. These areas should then be enhanced with indigenous plantings in the buffer zones.

The main tributaries of Stokes Drain (Drains 1-8) are mostly of 'low' ecological value and their current locations cut around paddocks as part of historic wetland drainage and pasture conversion. While it is recommended to retain and enhance these drains where possible and avoid extensive fish relocation, another solution would be to create new waterways on the site with good ecological values. This approach could increase the extent of waterways on the site and replace a network of low value waterways with higher value ones. Building new waterways will also allow for creation of more varied instream and riparian habitat, increasing ecosystem values. The development of a realigned waterway

system that avoids the loss of river extent, and provides high-quality instream habitat for indigenous fauna is likely to result in a net biodiversity gain.

The fish population on the site is expected to be large due to the extent of the waterway network and fish being seen during the surveys. Any instream works would likely require a fish management plan, and relocation of fish from the affected area prior to commencing works. Fish removal would be a substantial undertaking for any waterways that are to be realigned or filled. Therefore, the realignment of waterways should be considered carefully if time and cost of removing fish is a limitation.

Once rezoned, a detailed assessment of plans for each waterway should be undertaken and a Stream Naturalisation Plan prepared.

Two natural wetland areas were found within pasture grassland on the site. The vegetation within these wetlands is predominately exotic blue sweetgrass and kneed foxtail. The vegetation in the wetlands does not constitute ecologically significant vegetation under the CRPS or the NPS-IB criteria, but the wetlands are protected under the NES-F regulations. Additionally, these wetlands may provide some habitat for At-Risk indigenous birds.

Wetland habitats are highly valued and protected under the law. However, the wetlands present on the site are fragmented and of low ecological value. These wetlands may also be partially maintained and induced by summer irrigation and dewatering on the neighbouring Ravenswood development, which will be absent after the development. Construction will likely change groundwater movements, with unpredictable outcomes on the wetlands. Therefore, it is not recommended to retain these wetlands and instead mitigate for their loss through developing diverse replacement wetlands with reliable hydrology and indigenous wetland plantings within the large stormwater reserve in the east of the site.

Exotic shelterbelt forest and hedgerow habitats are present along some property margins and along the line of most of the waterways. The desktop assessment determined that these areas may provide habitat for indigenous fauna, including At Risk indigenous lizards. Grazed and cultivated grassland on the site also provides foraging and potentially breeding habitat for indigenous birds, including At Risk species. The margins of these grassland habitats are also likely to provide temporary habitat for At Risk lizards.

If At Risk Canterbury grass skinks are present, some habitats on the site would be considered ecologically significant under both CRPS and NPS-IB criteria, as this species is only found in two regions. If At Risk bird species are present, habitats on the site would be considered ecologically significant under CRPS criteria but not the NPS-IB, unless multiple At Risk species were present in the same habitat. However, further surveys would be required to determine the presence of At Risk fauna identified as being possibly present in the desktop survey. In general, the habitat values identified appear to have low ecological value due to the highly modified nature of the site, and the predominance of exotic vegetation.

Therefore, developing the site could potentially lead to loss of habitats used by indigenous terrestrial fauna. However, this potential loss of avifauna habitat could easily be offset through ecological enhancement of the stormwater management area. If appropriately designed, this area could be used to provide improved indigenous avifauna habitat. The loss of lizard habitat and opportunities to mitigate this should also be considered during the development design and could include restoration of lizard habitat in areas peripheral to the stormwater management area. If these peripheral areas are of an appropriate size, lizards salvaged from other areas of the site could be released into this location.

Prior to any development works, additional surveys would be required to better understand the size and extent of indigenous fauna populations on the site, and potential mitigation required.

Provided the ecological recommendations of this report are followed, the ODP (RMM 2024) proposed for the site could result in at least no net loss of biodiversity, and possibly a biodiversity net gain. Opportunities for further gains should be considered as part of detailed development scheme for the site.

Acknowledgements

Brian Stokes, for providing site information and access and Sean Monaghan (Suburban Estates), for compiling and coordinating project information.

References

Atkinson I.E. 1985: Derivation of vegetation mapping units for an ecological survey of Tongariro National Park, North Island, New Zealand. *New Zealand Journal of Botany 23*: 361-378.

Clarkson B. 2013: A vegetation tool for wetland delineation in New Zealand. *Manaaki Whenua Landcare Research Contract Report LC1793.*

Crow S. 2017. New Zealand Freshwater Fish Database. Version 1.2. The National Institute of Water and Atmospheric Research (NIWA). (Accessed August 2021).

de Lange P.J., Rolfe J.R., Barkla J.W., Courtney S.P., Champion P.D., Perrie L.R., Beadel S.M., Ford K.A., Breitwieser I., Schonberger I., Hindmarsh-Walls R., Heenan P.B., and Ladley K. 2018: Conservation status of New Zealand indigenous vascular plants, 2017. New Zealand Threat Classification Series 22. Department of Conservation, Wellington. 82 pp.

Dunn N.R., Allibone R.M., Closs G.P., Crow S.K., David B.O., Goodman J.M., Griffiths M, Jack D.C., Ling N., Waters J.M. and Rolfe J.R., 2017: Conservation status of New Zealand freshwater fishes. *New Zealand Threat Classification Series 24*. Department of Conservation, Wellington. 11 pp.

Environment Canterbury 2013: Canterbury Regional Policy Statement 2013. Environment Canterbury.

Grainger N., Harding J., Drinan T., Collier K., Smith B., Death R.; Makan T., Rolfe J., 2018: Conservation status of New Zealand freshwater invertebrates, 2018. *New Zealand Threat Classification Series 28*. Department of Conservation, Wellington. 25 pp.

Greer M. 2021: Guidance Note: How to determine whether a watercourse is a river, ephemeral watercourse, highly modified river or stream or artificial watercourse. Aquanet Consulting Ltd.

Harding M.A. 2009: Canterbury Land Protection Strategy. Published by the Nature Heritage Fund, Wellington.

Manaaki Whenua 2021: New Zealand Wetland Plant List 2021. This report was prepared by Manaaki Whenua – Landcare Research for Hawke's Bay Regional Council. 66 pp.

Ministry for the Environment 2022: Wetland delineation protocols. Wellington: Ministry for the Environment. 14 pp.

Ministry for the Environment 2021: Wetland delineation hydrology tool for Aotearoa New Zealand. Wellington: Ministry for the Environment. 83 pp.

Ministry for the Environment 2022: Pasture exclusion assessment methodology. Wellington: Ministry for the Environment. 51 pp.

New Zealand Government 1991: Resource Management Act. Wellington.

New Zealand Government 2020: National Policy Statement for Freshwater Management. Wellington. Ministry for the Environment. 70 pp.

New Zealand Government 2020: Resource Management (National Standards for Freshwater) Regulations. Wellington: Ministry for the Environment. 62 pp.

New Zealand Government 2023. National Policy Statement for Indigenous Biodiversity. Wellington: Ministry for the Environment. 48 pp.

Otago Regional Council 2022: Practice Note: What is 'Water' and What is an 'Artificial Watercourse'? Otago Regional Council.

Robertson H.A., Baird K., Dowding J.E., Elliott G.P., Hitchmough R.A., McArthur N., Makan T.D., Miskelly C.M., O'Donnell C.F.J., Sagar P.M., Scofield R.P., Taylor G.A., and Michel P. 2021: Conservation status of birds in Aotearoa New Zealand, 2021. *New Zealand Threat Classification Series 36*. Department of Conservation, Wellington. 47 pp.

Rough Milne Mitchell 2024. Proposed Outline Development Plan Stokes Ravenswood Waikuku Land Drawing M.P 1.0. Revision 1 (18/01/2024)

Appendix 1

Plant species recorded during the survey. Species marked with * have been planted on the site.

Species name	Common Name(s)	Growth form	Status
Acacia melanoxylon	Blackwood	Tree	Exotic
Acanthus mollis	Bear's breeches	Herb	Exotic
Acer pseudoplatanus	Sycamore	Tree	Exotic
Acer species	Maple	Tree	Exotic
Achillea millefolium	Yarrow	Forb	Exotic
Aesculus hippocastanum	Horse chestnut	Tree	Exotic
Agapanthus praecox	Agapanthus	Graminoid	Exotic
Agrostis capillaris	Browntop	Graminoid	Exotic
Agrostis stolonifera	Creeping bent	Graminoid	Exotic
Alopecurus geniculatus	Kneed foxtail	Graminoid	Exotic
Anemanthele lessoniana	Wind grass	Graminoid	Indigenous Endemic*
Anemone x hybrida	Japanese anemone	Herb	Exotic
Anthoxanthum odoratum	Sweet vernal	Graminoid	Exotic
Arctium minus	Burdock	Subshrub	Exotic
Arrhenatherum elatius	Tall oat grass	Graminoid	Exotic
Asplenium bulbiferum	Mouku, hen and chicken fern	Fern	Indigenous Endemic
Azolla filiculoides	Retoreto, azolla	Fern	Indigenous Non-Endemic
Bellis perennis	Lawn daisy	Herb	Exotic
Betula pendula	Silver birch	Tree	Exotic
Blechnum minus	Swamp kiokio	Fern	Indigenous Non-Endemic
Blechnum novae-zelandiae	Kiokio	Fern	Indigenous Endemic
Brachyglottis greyi		Shrub	Indigenous Endemic*
Bromus catharticus	Prairie grass	Graminoid	Exotic
Bromus diandrus	Ripgut brome	Graminoid	Exotic
Calystegia silvatica	Great bindweed	Vine	Exotic
Callitriche stagnalis	Starwort	Herb	Exotic
Camellia japonica	Camellia	Tree	Exotic
Capsella bursa-pastoris	Shepherds purse	Herb	Exotic
Carduus nutans	Nodding thistle	Herb	Exotic
Carex secta	Pūkio	Graminoid	Indigenous Endemic
Cedrus libani	Lebanese cedar	Tree	Exotic
Cerastium fontanum	Mouse-ear chickweed	Herb	Exotic
Chamaecyparis lawsoniana	Lawson cypress	Tree	Exotic
Chamaecytisus palmensis	Tree lucerne	Tree	Exotic
Choisya ternata	Mexican orange	Shrub	Exotic
Cirsium arvense	Californian thistle	Herb	Exotic
Cirsium vulgare	Scotch thistle	Herb	Exotic

Species name	Common Name(s)	Growth form	Status
Clematis vitalba	Old man's beard	Vine	Exotic
Conium maculatum	Hemlock	Herb	Exotic
Coprosma robusta	Karamū	Tree	Indigenous Endemic
Cordyline australis	Tī kōuka, cabbage tree	Tree	Indigenous Endemic
Corokia cotoneaster	Korokio	Shrub	Indigenous Endemic*
Cortaderia selloana	Pampas grass	Graminoid	Exotic
Crataegus monogyna	Hawthorn	Tree	Exotic
Crepis capillaris	Hawksbeard	Herb	Exotic
Cupressus macrocarpa	Macrocarpa	Tree	Exotic
Cupressus species	Cypress	Tree	Exotic
Cytisus scoparius	Broom	Shrub	Exotic
Dactylis glomerata	Cocksfoot	Graminoid	Exotic
Dodonaea viscosa	Akeake	Tree	Indigenous Non-Endemic*
Dryopteris filix-mas	Male fern	Fern	Exotic
Ehrharta erecta	Veldt grass	Graminoid	Exotic
Eleocharis acuta	Spike sedge	Graminoid	Indigenous Non-Endemic
Erythranthe guttata	Monkey musk	Herb	Exotic
Eucalyptus species	Eucalyptus	Tree	Exotic
Eucalyptus globulus	Blue gum	Tree	Exotic
Euonymus europaeus	Spindle tree	Shrub	Exotic
Foeniculum vulgare	Fennel	Herb	Exotic
Fumaria muralis	Scrambling fumitory	Herb	Exotic
Galium aparine	Cleavers	Herb	Exotic
Geranium molle	Dovesfoot cranesbill	Herb	Exotic
Geranium robertianum	Herb robert	Herb	Exotic
Glyceria declinata	Blue sweet grass	Graminoid	Exotic
Griselinia littoralis	Kāpuka	Tree	Indigenous Endemic
Gunnera tinctoria	Chilean rhubarb	Herb	Exotic
Hedera helix	Ivy	Herb	Exotic
Hoheria species		Tree	Indigenous Endemic*
Holcus lanatus	Yorkshire fog	Graminoid	Exotic
Hydrangea macrophylla	Hydrangea	Shrub	Exotic
Hypolepis millefolium	Thousand-leaved fern	Fern	Indigenous Endemic
Ilex aquifolium	Holly	Tree	Exotic
Iris foetidissima	Stinking iris	Graminoid	Exotic
Juncus articulatus	Jointed rush	Graminoid	Exotic
Juncus bufonius	Toad rush	Graminoid	Exotic
Juncus edgariae	Wi, wīwī	Graminoid	Indigenous Endemic
Juncus effusus	Soft rush	Graminoid	Exotic
Lamium galeobdolon	Aluminium plant	Herb	Exotic
Lamium purpureum	Red dead nettle	Herb	Exotic
Laurelia species	Laurel	Tree	Exotic

Species name	Common Name(s)	Growth form	Status
Lavandula species	Lavender	Shrub	Exotic
Lemna disperma	Kārearea	Herb	Indigenous Non-Endemic
Lolium perenne	Ryegrass	Graminoid	Exotic
Lupinus arboreus	Tree lupin	Shrub	Exotic
Magnolia grandiflora	Laurel magnolia	Tree	Exotic
Malva neglecta	Dwarf mallow	Herb	Exotic
Malva species	Mallow	Herb	Exotic
Marrubium vulgare	Horehound	Herb	Exotic
Muehlenbeckia australis	Puka	Vine	Indigenous Non-Endemic
Muehlenbeckia complexa	Pōhuehue	Vine	Indigenous Non-Endemic
Nasturtium officinale	Watercress	Herb	Exotic
Pastinaca sativa	Wild parsnip	Herb	Exotic
Phormium tenax	Harakeke	Graminoid	Indigenous Endemic
Pinus nigra	Black pine	Tree	Exotic
Pinus radiata	Radiata pine	Tree	Exotic
Pinus species	Pine	Tree	Exotic
Pittosporum crassifolium	karo	Shrub	Indigenous Endemic*
Pittosporum tenuifolium	Kōhūhū	Tree	Indigenous Endemic
Platanus × hispanica	London plane	Tree	Exotic
Plantago lanceolata	Narrow-leaved plantain	Herb	Exotic
Plantago major	Broad-leaved plantain	Herb	Exotic
Poa annua	Annual poa	Graminoid	Exotic
Poa pratensis	Kentucky blue grass	Graminoid	Exotic
Polystichum vestitum	Pūniu, prickly shield fern	Fern	Indigenous Endemic
Polygonatum × hybridum	Solomon's seal	Herb	Exotic
Populus nigra	Lombardy poplar	Tree	Exotic
Populus species	Poplar	Tree	Exotic
Potamogeton crispus	Curly pondweed	Herb	Exotic
Prunus cerasifera	Cherry plum	Tree	Exotic
Pseudotsuga menziesii	Douglas fir	Tree	Exotic
Quercus robur	English oak	Tree	Exotic
Ranunculus repens	Creeping buttercup	Herb	Exotic
Ranunculus sceleratus	Celery-leaved buttercup	Herb	Exotic
rheum rhabarbarum	Garden rhubarb	Herb	Exotic
Robinia pseudoacacia	False acacia, black locust, robinia	Tree	Exotic
Rosa species	Climbing rose	Shrub	Exotic
Rosa rubiginosa	Sweet brier	Shrub	Exotic
Rubus fruticosus	Blackberry	Subshrub	Exotic
Rumex crispus	Curled dock	Herb	Exotic
Rumex obtusifolius	Broad-leaved dock	Herb	Exotic
Salix cinerea	Grey willow	Tree	Exotic

Species name	Common Name(s)	Growth form	Status
Salix fragilis	Crack willow	Tree	Exotic
Sambucus nigra	Elder	Shrub	Exotic
Senecio glomeratus	Pukatea	Herb	Indigenous Non-Endemic
Senecio minimus	Native fireweed	Herb	Indigenous Non-Endemic
Sisymbrium officinale	Wild mustard, hedge mustard	Herb	Exotic
Solanum chenopodioides	Velvety nightshade	Subshrub	Exotic
Solanum dulcamara	Bittersweet	Subshrub	Exotic
Sonchus asper	Prickly puha	Herb	Exotic
Stellaria media	Chickweed	Herb	Exotic
Taraxacum officinale	Dandelion	Herb	Exotic
teucrium fruticans	Teucrium	Shrub	Exotic
Trifolium pratense	Red clover	Herb	Exotic
Trifolium repens	White clover	Herb	Exotic
Ulex europaeus	Gorse	Shrub	Exotic
Urtica urens	Nettle	Herb	Exotic
Veronica anagallis-aquatica	Blue water speedwell	herb	Exotic
Veronica serpyllifolia	Turf speedwell	Herb	Exotic
Viburnum tinus	Laurustinus	Tree	Exotic
Vicia sativa	Vetch	Herb	Exotic
Zantedeschia aethiopica	Arum lily	Herb	Exotic

Appendix 2

Detailed Plot information – wetland assessment

Wetland 1: Plot 1 (Plate A3-1)

Common Name	Species (Scientific name)	Absolute Cover	Dominant Species?	Indicator Status	Pasture Species
Glaucous sweetgrass	*Glyceria declinata*	30	YES	OBL	N
Celery-leaved buttercup	*Ranunculus sceleratus*	2		OBL	N
Browntop	*Agrostis capillaris*	30		FACU	Y
Curled dock	*Rumex crispus*	1		FAC	N
Kneed foxtail, Marsh foxtail	*Alopecurus geniculatus*	30	YES	FACW	N
Annual poa	*Poa annua*	1	NO	FACU	N

Pasture Exclusion Test	
Pasture Species Cover =	30
Total Vegetation Cover =	94
% Cover of Pasture Species =	32%
Pasture determination =	**NOT PASTURE**

Number of dominant species OBL, FACW, or FAC (A) =	2
Total number of dominant species across all strata (B) =	2
Percent of dominant species that are OBL, FACW, or FAC (A/B) =	100%
Wetland vegetation determination =	**WETLAND**

Prevalence Index			
Indicator Status	**Total % Cover**	**Multiplication Factor**	**Multiplied % Cover**
OBL	32	x 1 =	32
FACW	30	x 2 =	60
FAC	1	x 3 =	3
FACU	31	x 4 =	124
UPL	0	x 5 =	0
Total (A)	94	Total (B)	219
		Prevalence Index (B/A) =	2.33
		Wetland vegetation determination =	**WETLAND**

Wetland 1: Plot 2 (Plate A3-1)

Common Name	Species (Scientific name)	Absolute Cover	Dominant Species?	Indicator Status	Pasture Species
White clover	*Trifolium repens*	8	NO	FACU	Y
Kneed foxtail, Marsh foxtail	*Alopecurus geniculatus*	1		FACW	N
Kentucky bluegrass	*Poa pratensis*	1		FACU	Y
Curled dock	*Rumex crispus*	1		FAC	N
Perennial ryegrass	*Lolium perenne*	70	YES	FACU	Y
Prairie grass	*Bromus catharticus*	5	NO	UPL	Y
Broad-leaved plantain	*Plantago major*	2		FACU	N
Daisy	*Bellis perennis*	1		FACU	N
Hawksbeard	*Crepis capillaris*	1		FACU	N

Pasture Exclusion Test	
Pasture Species Cover =	84
Total Vegetation Cover =	90
% Cover of Pasture Species =	93%
Pasture determination =	**PASTURE**

Number of dominant species OBL, FACW, or FAC (A) =	0
Total number of dominant species across all strata (B) =	1
Percent of dominant species that are OBL, FACW, or FAC (A/B) =	0%
Wetland vegetation determination =	**NOT WETLAND**

Prevalence Index			
Indicator Status	**Total % Cover**	**Multiplication Factor**	**Multiplied % Cover**
OBL	0	x 1 =	0
FACW	1	x 2 =	2
FAC	1	x 3 =	3
FACU	83	x 4 =	332
UPL	5	x 5 =	25
Total (A)	90	Total (B)	362
		Prevalence Index (B/A) =	4.02
		Wetland vegetation determination =	**NOT WETLAND**

Wetland 2: Plot 1 (Plate A3-2)

Common Name	Species (Scientific name)	Absolute Cover	Dominant Species?	Indicator Status	Pasture Species
Glaucous sweetgrass	*Glyceria declinata*	80	YES	OBL	N
Broad-leaved dock	*Rumex obtusifolius*	1		FAC	N
Kentucky bluegrass	*Poa pratensis*	5		FACU	Y
Kneed foxtail, Marsh foxtail	*Alopecurus geniculatus*	2		FACW	N
Perennial ryegrass	*Lolium perenne*	2		FACU	Y
White clover	*Trifolium repens*	1		FACU	Y
Prairie grass	*Bromus catharticus*	5		UPL	Y

Pasture Exclusion Test	
Pasture Species Cover =	13
Total Vegetation Cover =	96
% Cover of Pasture Species =	14%
Pasture determination =	**NOT PASTURE**

Number of dominant species OBL, FACW, or FAC (A) =	1
Total number of dominant species across all strata (B) =	1
Percent of dominant species that are OBL, FACW, or FAC (A/B) =	100%
Wetland vegetation determination =	**WETLAND**

Prevalence Index			
Indicator Status	**Total % Cover**	**Multiplication Factor**	**Multiplied % Cover**
OBL	80	x 1 =	80
FACW	2	x 2 =	4
FAC	1	x 3 =	3
FACU	8	x 4 =	32
UPL	5	x 5 =	25
Total (A)	96	Total (B)	144
		Prevalence Index (B/A) =	1.50
		Wetland vegetation determination =	**WETLAND**

Wetland 2: Plot 2 (Plate A3-2)

Common Name	Species (Scientific name)	Absolute Cover	Dominant Species?	Indicator Status	Pasture Species
Curled dock	Rumex crispus	1	NO	FAC	N
White clover	Trifolium repens	5		FACU	Y
Dandelion	Taraxacum officinale	1		FACU	N
Broad-leaved plantain	Plantago major	1		FACU	N
Kentucky bluegrass	Poa pratensis	1		FACU	Y
Perennial ryegrass	Lolium perenne	80	YES	FACU	Y
Narrow-leaved plantain	Plantago lanceolata	1		FACU	Y
Prairie grass	Bromus catharticus	3		UPL	Y
Creeping buttercup	Ranunculus repens	1		FAC	N

Pasture Exclusion Test	
Pasture Species Cover =	90
Total Vegetation Cover =	94
% Cover of Pasture Species =	96%
Pasture determination =	**PASTURE**

Number of dominant species OBL, FACW, or FAC (A) =	0
Total number of dominant species across all strata (B) =	1
Percent of dominant species that are OBL, FACW, or FAC (A/B) =	0%
Wetland vegetation determination =	**NOT WETLAND**

Prevalence Index			
Indicator Status	**Total % Cover**	**Multiplication Factor**	**Multiplied % Cover**
OBL	0	x 1 =	0
FACW	0	x 2 =	0
FAC	2	x 3 =	6
FACU	89	x 4 =	356
UPL	3	x 5 =	15
Total (A)	94	Total (B)	377
		Prevalence Index (B/A) =	4.01
		Wetland vegetation determination =	**NOT WETLAND**

Wetland 2: Plot 3 (Plate A3-3)

Common Name	Species (Scientific name)	Absolute Cover	Dominant Species?	Indicator Status	Pasture Species
Glaucous sweetgrass	Glyceria declinata	10	YES	OBL	N
Celery-leaved buttercup	Ranunculus sceleratus	1		OBL	N
Creeping bent	Agrostis stolonifera	5		FACW	N
White clover	Trifolium repens	1		FACU	Y
Curled dock	Rumex crispus	1		FAC	N
Kneed foxtail, Marsh foxtail	Alopecurus geniculatus	1	NO	FACW	N
Annual poa	Poa annua	1		FACU	N

Pasture Exclusion Test	
Pasture Species Cover =	1
Total Vegetation Cover =	20
% Cover of Pasture Species =	5%
Pasture determination =	**NOT PASTURE**

Dominance Test	
Number of dominant species OBL, FACW, or FAC (A) =	1
Total number of dominant species across all strata (B) =	1
Percent of dominant species that are OBL, FACW, or FAC (A/B) =	100%
Wetland vegetation determination =	**WETLAND**

Prevalence Index			
Indicator Status	**Total % Cover**	**Multiplication Factor**	**Multiplied % Cover**
OBL	11	x 1 =	11
FACW	6	x 2 =	12
FAC	1	x 3 =	3
FACU	2	x 4 =	8
UPL	0	x 5 =	0
Total (A)	20	Total (B)	34
		Prevalence Index (B/A) =	1.70
		Wetland vegetation determination =	**WETLAND**

Wetland vegetation assessment plot photographs

Plate A3-1: wetland 1 Plot 1 (left) and Plot 2 (right).

Plate A3-2: Wetland 2. Plot 1 (left) and Plot 2 (right).

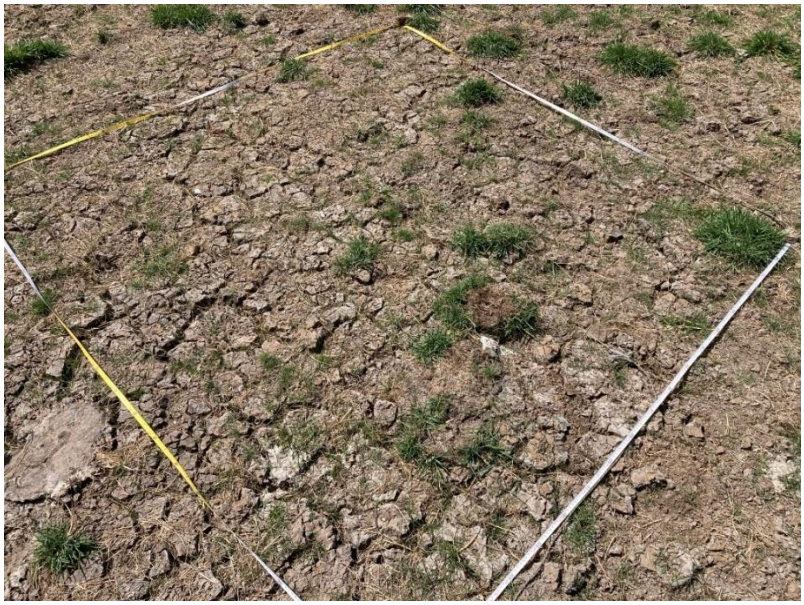


Plate A3-3: Wetland 2 Plot 3.

Appendix 3

All bird species identified in the eBird desktop survey. * indicate species observed during site visits, [+] are taonga species in Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998.

Common Name(s)	Scientific name	Threat status
Indigenous		
Black-fronted tern/tarapirohe[+]	*Chlidonias albostriatus*	Threatened – Nationally Endangered
Australasian crested grebe/pūteketeke[+]	*Podiceps cristatus australis*	Threatened – Nationally Vulnerable
Caspian tern/taranui[+]	*Hydroprogne caspia*	Threatened – Nationally Vulnerable
Banded dotterel/pohowera	*Charadrius bicinctus bicinctus*	At Risk – Declining
Black-billed gull/tarāpuka	*Chroicocephalus bulleri*	At Risk – Declining
New Zealand pipit/pīhoihoi	*Anthus novaeseelandiae novaeseelandiae*	At Risk-Declining
Red-billed gull/tarāpunga	*Chroicocephalus scopulinus*	At Risk – Declining
South Island pied oystercatcher/tōrea	*Haematopus finschi*	At Risk-Declining
White-fronted tern/tara	*Sterna striata striata*	At Risk – Declining
Australian coot	*Fulica atra australis*	At Risk – Naturally Uncommon
Pied shag/kāruhiruhi[+]	*Phalacrocorax varius varius*	At Risk – Recovering
Variable oystercatcher/tōrea pango	*Haematopus unicolor*	At Risk – Recovering
Black shag/māpunga[+]	*Phalacrocorax carbo novaehollandiae*	At Risk – Relict
Little pied shag/kawaupaka[+]	*Microcarbo melanoleucos*	Non-resident Native – Vagrant
Australasian shoveler/kuruwhengi	*Spatula rhynchotis*	Not Threatened
Bellbird/korimako	*Anthornis melanura*	Not Threatened
Black swan/kakīānau	*Cygnus atratus*	Not Threatened
Grey duck – mallard hybrid	*Anas platyrhynchos x superciliosa*	Not Threatened
Grey teal/tētē-moroiti	*Anas gracilis*	Not Threatened
Grey warbler/riroriro*	*Gerygone igata*	Not Threatened
New Zealand kingfisher/kōtare	*Todiramphus sanctus vagans*	Not Threatened
New Zealand scaup/pāpango	*Aythya novaeseelandiae*	Not Threatened
Paradise shelduck/pūtangitangi*	*Tadorna variegata*	Not Threatened
Pied stilt/poaka[+]	*Himantopus leucocephalus*	Not Threatened
Pūkeko*	*Porphyrio melanotus melanotus*	Not Threatened
Shining cuckoo/pīpīwharauroa	*Chrysococcyx lucidus lucidus*	Not Threatened
Silvereye/tauhou	*Zosterops lateralis lateralis*	Not Threatened
South Island fantail/pīwakawaka*	*Rhipidura fuliginosa fuliginosa*	Not Threatened
Southern black-backed gull/karoro*	*Larus dominicanus dominicanus*	Not Threatened
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened
Swamp harrier/kāhu*[+]	***Circus*** *approximans*	**Not** Threatened
Welcome swallow/warou*	*Hirundo neoxena neoxena*	Not Threatened
White-faced heron/matuku moana	*Egretta novaehollandiae*	Not Threatened
Exotic		
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised
California quail	*Callipepla californica*	Introduced and Naturalised
Canada goose	*Branta canadensis*	Introduced and Naturalised
Chaffinch	*Fringilla coelebs*	Introduced and Naturalised
Cirl bunting	*Emberiza cirlus*	Introduced and Naturalised
Dunnock	*Prunella modularis*	Introduced and Naturalised

Common Name(s)	Scientific name	Threat status
Eastern cattle egret	*Bubulcus ibis coromanda*	Introduced and Naturalised
Eurasian blackbird*	*Turdus merula*	Introduced and Naturalised
Eurasian skylark*	*Alauda arvensis*	Introduced and Naturalised
European greenfinch	*Chloris chloris*	Introduced and Naturalised
European starling	*Sturnus vulgaris*	Introduced and Naturalised
Goldfinch*	*Carduelis carduelis*	Introduced and Naturalised
Graylag goose	*Anser anser*	Introduced and Naturalised
House sparrow	*Passer domesticus*	Introduced and Naturalised
Lesser redpoll	*Acanthis cabaret*	Introduced and Naturalised
Little owl	*Athene noctua*	Introduced and Naturalised
Mallard	*Anas platyrhynchos*	Introduced and Naturalised
Mute swan	*Cygnus olor*	Introduced and Naturalised
Ring-necked pheasant	*Phasianus colchicus*	Introduced and Naturalised
Rock pigeon	*Columba livia*	Introduced and Naturalised
Song thrush	*Turdus philomelos*	Introduced and Naturalised
Wild turkey	*Meleagris gallopavo*	Introduced and Naturalised
Yellowhammer*	*Emberiza citrinella*	Introduced and Naturalised
Lesser redpoll	*Acanthis cabaret*	Introduced and Naturalised

Appendix 4

EVALUATION OF THE SITE USING THE ECOLOGICAL SIGNIFICANCE CRITERIA IN THE CANTERBURY REGIONAL POLICY STATEMENT AND PROPOSED WAIMAKARIRI DISTRICT PLAN

Ecological Significance Criteria	Exotic shelter belt forest	Oak forest	Mixed exotic forest	Hawthorn-gorse-exotic grass hedgerows	Ornamental plantings, gardens and dwellings	Rank exotic grass with farm debris and buildings	Perennial ryegrass (white clover) grassland	Wetland	Waterways
Representativeness									
1. Indigenous vegetation or habitat of indigenous fauna that is representative, typical or characteristic of the natural diversity of the relevant ecological district. This can include degraded examples where they are some of the best remaining examples of their type, or represent all that remains of indigenous biodiversity in some areas.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold
2. Indigenous vegetation or habitat of indigenous fauna that is a relatively large example of its type within the relevant ecological district.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold
Rarity/Distinctiveness									
3. Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent in the Region, or relevant land environment, ecological district, or freshwater environment.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold
4. Indigenous vegetation or habitat of indigenous fauna that supports an indigenous species that is Threatened, At Risk or uncommon, nationally or within the relevant ecological district.	**May meet threshold** Potential habitat for At Risk indigenous lizard (Canterbury grass skink). Potential nesting habitat in areas containing willow and poplar trees over hanging or adjacent to water for At Risk māpunga/black shag	**May meet threshold** Potential habitat for At Risk indigenous lizard (Canterbury grass skink).	**May meet threshold** Potential habitat for At Risk indigenous lizard (Canterbury grass skink).	**May meet threshold** Potential habitat for At Risk indigenous lizard (Canterbury grass skink). Potential nesting habitat in areas containing willow and poplar trees over hanging or adjacent to water for At Risk māpunga/black shag	**May meet threshold** Potential habitat for At Risk indigenous lizard (Canterbury grass skink) identified.	**May meet threshold** Potential habitat for At Risk indigenous lizard (Canterbury grass skink) identified.	**May meet threshold** Potential breeding habitat for At Risk – Declining tōrea/South Island pied oystercatcher and banded dotterel.	**May meet threshold** Potential breeding habitat for At Risk – Declining tōrea/South Island pied oystercatcher and banded dotterel	**Threshold met** Habitat for At Risk - indigenous inanga (*Galaxias maculatus*). and At Risk indigenous longfin eel (*Anguilla dieffenbachia*).
5. The site contains indigenous vegetation or an indigenous species at its distribution limit within Canterbury Region or nationally.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold
6. Indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, occurs within an originally rare ecosystem, or has developed as a result of an unusual environmental factor or combination of factors.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold		Does not meet threshold

Ecological Significance Criteria	Exotic shelter belt forest	Oak forest	Mixed exotic forest	Hawthorn-gorse-exotic grass hedgerows	Ornamental plantings, gardens and dwellings	Rank exotic grass with farm debris and buildings	Perennial ryegrass (white clover) grassland	Wetland	Waterways
Diversity and Pattern									
7. Indigenous vegetation or habitat of indigenous fauna that contains a high diversity of indigenous ecosystem or habitat types, indigenous taxa, or has changes in species composition reflecting the existence of diverse natural features or ecological gradients1.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold
Ecological Context									
8. Vegetation or habitat of indigenous fauna that provides or contributes to an important ecological linkage or network, or provides an important buffering function.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	**Meets threshold** The Waikuku Stream and Stokes Drain sections within the property are important linkages for migratory diadromous fish to access upstream habitats.
9. A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal system.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold
10. Indigenous vegetation or habitat of indigenous fauna that provides important habitat (including refuges from predation, or key habitat for feeding, breeding, or resting) for indigenous species, either seasonally or permanently.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	**Meets threshold** Waterways on the property provide permanent rearing and adult habitat for a possibly large population of eels and inanga.

Appendix 5

EVALUATION OF THE SITE USING THE ECOLOGICAL SIGNIFICANCE CRITERIA IN THE NATIONAL POLICY STATEMENT ON INDIGENOUS BIODIVERSITY

1 What qualifies as an SNA

(1) An area qualifies as an SNA if it meets any one of the attributes of the following four criteria:
- (a) representativeness:
- (b) diversity and pattern:
- (c) rarity and distinctiveness:
- (d) ecological context.

(2) If an area would qualify as an SNA solely on the grounds that it provides habitat for a single indigenous fauna species that is At Risk (declining), and that species is widespread in at least three other regions, the area does not qualify as an SNA unless:
- (a) the species is rare within the region or ecological district where the area is located; or
- (b) the protection of the species at that location is important for the persistence of the species as a whole.

(3) If an area would qualify as an SNA solely on the grounds that it contains one or more indigenous flora species that are Threatened or At Risk (declining), and those species are widespread in at least three other regions, the area does not qualify as an SNA unless:
- (a) the species is rare within the region or ecological district where the area is located; or
- (b) the protection of the species at that location is important for the persistence of the species as a whole.

2 Context for assessment

(1) The context for an assessment of an area is:
- (a) its ecological district; and
- (b) for the rarity assessment only, its ecological district, its region and the national context.

3 Manner and form of assessment

(1) Every assessment must include at least:
- (a) a map of the area; and
- (b) a general description of its significant attributes, with reference to relevant criteria (as specified below); and
- (c) a general description of the indigenous vegetation, indigenous fauna, habitat, and ecosystems present; and
- (d) additional information, such as the key threats, pressures, and management requirements; and
- (e) for SNAs in areas of Crown-owned land referred to in clause 3.8(8), the conservation management strategy or plan or national park management plan that applies to the area.

(2) An assessment under this appendix must be conducted by a suitably qualified ecologist (which, in the case of an assessment of a geothermal ecosystem, requires an ecologist with geothermal expertise).

Ecological Significance Criteria	Exotic shelter belt forest	Oak forest	Mixed exotic forest	Hawthorn-gorse-exotic grass hedgerows	Ornamental plantings, gardens and dwellings	Rank exotic grass with farm debris and buildings	Perennial ryegrass (white clover) grassland	Wetland	Waterways
A. Representativeness criterion									
1. Indigenous vegetation or habitat of indigenous fauna that is representative, typical or characteristic of the natural diversity of the relevant ecological district. This can include degraded examples where they are some of the best remaining examples of their type, or represent all that remains of indigenous biodiversity in some areas. *Key assessment principles* 2. Significant indigenous vegetation has ecological integrity typical of the indigenous vegetation of the ecological district in the present-day environment. It includes seral (regenerating) indigenous vegetation that is recovering following natural or induced disturbance, provided species composition is typical of that type of indigenous vegetation. 3. Significant indigenous fauna habitat is that which supports the typical suite of indigenous animals that would occur in the present-day environment. Habitat of indigenous fauna may be indigenous or exotic. 4. Representativeness may include commonplace indigenous vegetation and the habitats of indigenous fauna, which is where most indigenous biodiversity is present. It may also include degraded indigenous vegetation, ecosystems and habitats that are typical of what remains in depleted ecological districts. It is not restricted to the best or most representative examples, and it is not a measure of how well that indigenous vegetation or habitat is protected elsewhere in the ecological district. 5. When considering the typical character of an ecological district, any highly developed land or built-up areas should be excluded. 6. The application of this criterion should result in identification of indigenous vegetation and habitats that are representative of the full range and extent of ecological diversity across all environmental gradients in an ecological district, such as climate, altitude, landform, and soil sequences. The ecological character and pattern of the indigenous vegetation in the ecological district should be described by reference to the types of indigenous vegetation and the landforms on which it occurs. *Attributes of representativeness* 7. An area that qualifies as an SNA under this criterion has at least one of the following attributes: a) indigenous vegetation that has ecological integrity that is typical of the character of the ecological district: b) habitat that supports a typical suite of indigenous fauna that is characteristic of the habitat type in the ecological district and retains at least a moderate range of species expected for that habitat type in the ecological district.	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Does not meet threshold	Only terrestrial indigenous biodiversity is covered by this legislation.

Ecological Significance Criteria	Exotic shelter belt forest	Oak forest	Mixed exotic forest	Hawthorn-gorse-exotic grass hedgerows	Ornamental plantings, gardens and dwellings	Rank exotic grass with farm debris and buildings	Perennial ryegrass (white clover) grassland	Wetland	Waterways
B Diversity and pattern criterion									
1. Diversity and pattern is the extent to which the expected range of diversity and pattern of biological and physical components within the relevant ecological district is present in an area. *Key assessment principles* 2. Diversity of biological components is expressed in the variation of species, communities, and ecosystems. Biological diversity is associated with variation in physical components, such as geology, soils/substrate, aspect/exposure, altitude/depth, temperature, and salinity. 3. Pattern includes changes along environmental and landform gradients, such as ecotones and sequences. 4. Natural areas that have a wider range of species, habitats or communities or wider environmental variation due to ecotones, gradients, and sequences in the context of the ecological district, rate more highly under this criterion. *Attributes of diversity and pattern*. 5. An area that qualifies as a significant natural area under this criterion has at least one of the following attributes: a) at least a moderate diversity of indigenous species, vegetation, habitats of indigenous fauna or communities in the context of the ecological district: b) presence of indigenous ecotones, complete or partial gradients or sequences.	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Only terrestrial indigenous biodiversity is covered by this legislation.**
C Rarity and distinctiveness criterion									

Ecological Significance Criteria	Exotic shelter belt forest	Oak forest	Mixed exotic forest	Hawthorn-gorse-exotic grass hedgerows	Ornamental plantings, gardens and dwellings	Rank exotic grass with farm debris and buildings	Perennial ryegrass (white clover) grassland	Wetland	Waterways
1. Rarity and distinctiveness is the presence of rare or distinctive indigenous taxa, habitats of indigenous fauna, indigenous vegetation or ecosystems. *Key assessment principles.* 2. **Rarity** is the scarcity (natural or induced) of indigenous elements: species, habitats, vegetation, or ecosystems. Rarity includes elements that are uncommon or threatened. 3. **The list of Threatened and At Risk species** is regularly updated by the Department of Conservation. Rarity at a regional or ecological district scale is defined by regional or district lists or determined by expert ecological advice. The significance of nationally listed Threatened and At Risk species should not be downgraded just because they are common within a region or ecological district. 4. **Depletion of indigenous vegetation or ecosystems** is assessed using ecological districts and land environments. 5. **Distinctiveness** includes distribution limits, type localities, local endemism, relict distributions, and special ecological or scientific features. *Attributes of rarity and distinctiveness* 6. An area that qualifies as an SNA under this criterion has at least one of the following attributes: a. provides habitat for an indigenous species that is listed as Threatened or At Risk (declining) in the New Zealand Threat Classification System lists: b. an indigenous vegetation type or an indigenous species that is uncommon within the region or ecological district: c. an indigenous species or plant community at or near its natural distributional limit: d. indigenous vegetation that has been reduced to less than 20 per cent of its prehuman extent in the ecological district, region, or land environment: e. indigenous vegetation or habitat of indigenous fauna occurring on naturally uncommon ecosystems: f. the type locality of an indigenous species: g. the presence of a distinctive assemblage or community of indigenous species: h. the presence of a special ecological or scientific feature.	**May meet threshold** Potential habitat identified for At Risk – Declining Canterbury grass skink – only found to two reigns (Canterbury and Westland).	**May meet threshold** Potential habitat identified for At Risk – Declining Canterbury grass skink – only found to two reigns (Canterbury and Westland).	**May meet threshold** Potential habitat identified for At Risk – Declining Canterbury grass skink – only found to two reigns (Canterbury and Westland).	**May meet threshold** Potential habitat identified for At Risk – Declining Canterbury grass skink – only found to two reigns (Canterbury and Westland).	**May meet threshold** Potential habitat identified for At Risk – Declining Canterbury grass skink – only found to two reigns (Canterbury and Westland).	**May meet threshold** Potential habitat identified for At Risk – Declining Canterbury grass skink – only found to two reigns (Canterbury and Westland).	**May meet threshold** Potential breeding habitat for At Risk – Declining South Island pied oystercatcher However, species widespread /common in more than three reigns (refer above 1 (2) What qualifies as SNA)	**May meet threshold** Potential breeding habitat for At Risk – Declining South Island pied oystercatcher However, species widespread /common in more than three reigns (refer above 1 (2) What qualifies as SNA)	**Only terrestrial indigenous biodiversity is covered by this legislation.**
D Ecological context criterion									

Ecological Significance Criteria	Exotic shelter belt forest	Oak forest	Mixed exotic forest	Hawthorn-gorse-exotic grass hedgerows	Ornamental plantings, gardens and dwellings	Rank exotic grass with farm debris and buildings	Perennial ryegrass (white clover) grassland	Wetland	Waterways
1. Ecological context is the extent to which the size, shape, and configuration of an area within the wider surrounding landscape contributes to its ability to maintain indigenous biodiversity or affects the ability of the surrounding landscape to maintain its indigenous biodiversity. *Key assessment principles* 2. Ecological context has two main assessment principles: a) the characteristics that help maintain indigenous biodiversity (such as size, shape, and configuration) in the area; and b) the contribution the area makes to protecting indigenous biodiversity in the wider landscape (such as by linking, connecting to or buffering other natural areas, providing 'stepping stones' of habitat or maintaining ecological integrity). *Attributes of ecological context* 3. An area that qualifies as an SNA under this criterion has at least one of the following attributes: a) at least moderate size and a compact shape, in the context of the relevant ecological district: b) well-buffered relative to remaining habitats in the relevant ecological district: c) provides an important full or partial buffer to, or link between, one or more important habitats of indigenous fauna or significant natural areas: d) important for the natural functioning of an ecosystem relative to remaining habitats in the ecological district.	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Does not meet threshold**	**Only terrestrial indigenous biodiversity is covered by this legislation.**

Appendix 6

Site Photographs: aquatic habitats

Plate A6-1 – Stokes Drain at western boundary looking upstream: Stream has a slow, stright flow.

Plate A6-2 — Stokes Drain within the Oak forest. Stream flow contains sections of fast flowing riffles with stony stream bed.

Plate A6-3 – Stokes Drain within the riparian forest, the flow is slower then down stream and has more shading from the mature macrocarpa trees on the true left. Photo looking downstream.

Plate A6-4 — Stokes Drain flowing as a relativly fast run through the open area, photo looking upstream.

Plate A6-5 – Stokes Drain within the Oak forest, stream flow conatins more areas of fast flowing riffles with stoney stream bed. Stokes Drain flowing relativly fast through the garden forested area, with good stream shade and stream flow varity, photo looking upstream.

Plate A7-6 — Stokes Drain culvert going under Main North Road. The culvert is partially submerged with streambed subsight throughout the culvert, providing good fish access.

Plate A6-7 – Drain 1 looking downstream, riparian vegetation and stream banks provide better shade then most other drains within the property. Inanga were observed in the open water.

Plate A6-8 — Western end of Drain 2 with orange algae growth. Little riparian vegetation leads to high sun exposure and increased algal growth. Unlikely to support fish. Looking towards a submerged culvert.

Plate A6-9 – Drain 4, looking downstream. Riparian vegetation providing some stream shade, milky water originating from outside of the property.

Plate A6-10 — Drain 5 looking upstream. Riparian vegetation providing some stream shade, vegetation growing with stream common for site, water is likely deep underneath. Clear water is originating from the spring outside of the property.

Plate A6-11 – Waikuku Stream looking downstream. wide open stream with a fast flow.

Plate A6-12 — Waikuku Stream, stony stream bed with macrophytes attached.