VIRIDIS
Environmental Consultants

Mangawhai East Private Plan Change

Ecological Impact Assessment – Northern Area

Prepared for: Cabra

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Cover photo: Looking across paddocks from the north-eastern corner of the plan change site towards the south-west.

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1 EXECUTIVE SUMMARY

Cabra Mangawhai Limited (Cabra), engaged Viridis Limited (Viridis) to undertake an ecological impact assessment (EcIA) of the northern portion of a proposed Private Plan Change (PPC) to rezone land over at Black Swamp and Raymond Bull Roads, Mangawhai ('the site'). The land is currently zoned as 'Rural' within the Operative Kaipara District Plan and is within the Mangawhai 'Harbour' overlay. It is also identified as an 'Indicative Growth Area – Greater Growth Area Catchment'.

This report details the results of ecological assessments that have been undertaken by Viridis for the part of the PPC area mainly to the north of Black Swamp Road. The ecological assessment for the area of the plan change south of Black Swamp Road has been undertaken by Rural Design Limited (RDL). This report should be read in conjunction with the RDL assessment.

Within this assessment, Viridis has considered the ecological value of existing terrestrial and freshwater features on site and evaluated how the proposed land use change from rural to urban may impact these ecological values. Where required, recommendations are provided to aid in the avoidance, minimisation, or remediation of adverse effects.

The terrestrial ecological values of the site were generally low due to a history of agricultural land use, with the limited vegetation present largely consisting of exotic planted shelterbelts, orchards and amenity planting. Mixed native and exotic vegetation is present along the coastline. There is a large salt marsh area in the north-western portion of the site and salt marsh and freshwater wetland to the south, which are of moderate – high ecological value and potentially contain threatened bird species.

The proposed zone change is expected to provide for adequate maintenance and enhancement of ecosystem services, indigenous biodiversity and opportunities for enhancement through revegetation planting, while enabling the appropriate future subdivision, use and development of urban land, as long as the recommendations made in this report are implemented. The assessment has been informed by relevant regulations, including the National Policy Statement for Indigenous Biodiversity 2023 (updated October 2024) (NPS-IB), the National Policy Statement for Freshwater Management 2020 (NPS-FM) the National Environmental Standards for Freshwater 2020 (NES-F), the Operative Kaipara District Plan 2013 (KDP) and the Northland Regional Policy Statement 2016 (NRPS).

2 INTRODUCTION

2.1 Overview

The northern portion of the PPC area covered by this ecological report is comprised of 26 individual lots totalling an area of approximately 63 hectares. These lots are collectively referred to as 'the site' in this report. The location of the site is shown in Figure 1 and the site extent and individual lots comprising the site are shown in Figure 2.

Figure 1. Location of the Proposed Plan Change area as indicated by red polygon (map source: LINZ, NZ Topo50)

Figure 2. The site extent and individual lots comprising the site (aerial source: Google satellite).

2.2 Report Scope

Viridis was engaged by Cabra to undertake an EcIA for the northern part of the PPC application under the KDP and other relevant statutory documents. The EcIA for the southern part of the PPC application area has been prepared by RDL. This ecological assessment has been prepared to inform the assessment of environmental effects that will support the PPC application.

The overarching approach of this EcIA is to ascertain the existing ecological values on the site and determine the impact of the proposed land use change and associated activities on those values. Recommended measures to avoid, remedy, or mitigate adverse effects on ecology are provided as required. Recommendations for addressing anticipated residual adverse effects on the ecological values of the site through enhancement are also made where applicable.

3 METHODOLOGY

3.1 Overview

The assessment included a desktop review of existing reports and data and site visits undertaken by a suitably qualified ecologist. The desktop review involved an examination of current and historical aerial imagery of the site, during which factors such as changes in vegetation and surface water were noted. A review of data available on the Kaipara District Council and Northland Regional Council's GIS systems was also undertaken. A review of title records identified existing covenanted areas.

Site assessments of the area of the site to the north of Black Swamp Road were undertaken on 11 June 2024 and 2 July 2024[1]. During the site visits, the presence and extent of freshwater, terrestrial and coastal features within the site and surrounding area were recorded and the quality of associated habitat (if any) was visually assessed, in accordance with the methodology detailed in Sections 3.2 through 3.3, below. Note that some of the properties not owned by the client were unable to be visited, and their features have been assessed from views from adjacent properties, aerial imagery and contour data. This is considered sufficient for the purposes of the plan change assessment as the flat topography allowed reasonable views from public areas and adjacent properties and the desk top analysis provided sufficient background data. More detailed on-site assessment would be required during any future applications for resource consents.

3.2 Terrestrial Ecology

The vegetation within the site was assessed during the site visit. The botanical value of both exotic and native vegetation was recorded, and the quality, extent and connectivity of vegetation was considered. Terrestrial fauna habitat was assessed qualitatively, in conjunction with database reviews (e.g., Department of Conservation's (DoC) ARDs, Bioweb, eBird and iNaturalist) and considered indigenous lizards, birds, and bats. A desktop review of local bat and herpetofauna records from specific databases was undertaken. Opportunistic sightings of avifauna were recorded, and the conservation status of the species, as defined in Robertson et. al. (2021), was noted.

The ecological values of terrestrial features were determined in accordance with the methodology prescribed in the Environment Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment guidelines (EcIAG) for use in New Zealand (Roper-Lindsay et. al. 2018).

3.3 Freshwater Ecology

During the site assessment, the presence and extent of streams and wetlands on site (if any) were noted and the quality of any freshwater habitat was visually assessed. Watercourses were classified as per the Proposed Regional Plan for Northland February 2024 (NRC PRP, 2024) and NES-F definitions to determine their flow status (ephemeral, intermittent or permanent) and their natural, modified or artificial nature. Freshwater habitat was assessed, noting ecological aspects such as channel modification, hydrological heterogeneity, riparian vegetation extent, substrate type and any fish or macroinvertebrate habitat observed. Riparian and catchment information was also reviewed and the

[1] The weather during the 11/6/24 site visit was fine, there had been 19mm rain in the 48 hours preceding the site visit and 28 mm rain in the preceding 7 days. The weather during the 2/7/24 site visit was showery, there had been 5.5mm rain in the 48 hours preceding the site visit and 11 mm rain in the preceding 7 days (data from Northland Regional Council's Hakaru at Tara rainfall monitoring station approximately 5.6 km from the site).

NIWA New Zealand Freshwater Fish Database (NZFFD) was examined for fish species potentially present within the site.

Where appropriate, potential wetland areas were assessed in accordance with Ministry for the Environment (MfE) wetland delineation protocols (MfE 2022a, Clarkson 2014) and pasture exclusion methodology (MfE 2022b), to determine if an area met the regulatory definition of 'natural inland wetland' (NPS-FM 2020). Potential wetland areas were assessed based on the prevalence of certain vegetation species and their indicator status ratings, as defined in Clarkson et. al. (2021):

- Obligate wetland (OBL) vegetation, which almost always is a hydrophyte (a plant which only grows in wet environments), rarely found in uplands (non-wetland areas).
- Facultative wetland (FACW) vegetation, which usually is a hydrophyte but can occasionally be found in uplands.
- Facultative (FAC) vegetation, which is commonly either a hydrophyte or non-hydrophyte.
- Facultative upland (FACU) vegetation, which is occasionally a hydrophyte but is usually found in uplands.
- Upland (UPL) vegetation, which is rarely a hydrophyte and is almost always found in uplands.

Where the dominance or prevalence tests showed unclear results, hydric soils and hydrology tests were undertaken in accordance with methodology outlined in MfE (2022) and Clarkson (2014).

Wetland assessments also included identifying native and exotic vegetation species, examining the structural tiers within wetland areas, and assessing the quality and abundance of aquatic habitats. Signs of wetland degradation such as pugging and grazing from stock access, structures such as culverts impeding hydrological function, and weed infestation were also noted.

The ecological values of freshwater features were determined in accordance with the methodology prescribed in the EcIAG.

3.4 Ecological Impact Assessment

The ecological values of the site, relating to species, communities and systems, were determined as per the EcIAG. This report also identifies statutory guidelines and regulation with respect to ecology (such as watercourses, wetlands, high value vegetation and habitats) where relevant to the proposed development. Using this framework, the EcIAG describes a simple ranking system to assign value to species as well as other matters of ecological importance such as species assemblages and levels of organisation. The overall ecological value is then determined on a scale from '*Negligible*' to '*Very High*'.

Criteria for describing the magnitude of effects are given in Chapter 6 of the EcIAG. The level of effect can then be determined through combining the value of the ecological feature/attribute with the score or rating for magnitude of effect to create a criterion for describing level of effects (Table 1). A moderate level of effect requires careful assessment and analysis of the individual case. For moderate levels of effects or above, measures need to be introduced to avoid through design, or appropriate mitigation needs to be addressed (Roper-Lindsay et al. 2018).

Table 1. Criteria for describing the level of effects (from Roper-Lindsay et al. 2018).

Magnitude of Effect	Ecological Value				
	Very High	**High**	**Moderate**	**Low**	**Negligible**
Very High	*Very High*	*Very High*	*High*	*Moderate*	Low
High	*Very High*	*Very High*	*Moderate*	Low	Very Low
Moderate	*High*	*High*	*Moderate*	Low	Very Low
Low	*Moderate*	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

Notes: Where text is italicised, it indicates 'significant effects' where mitigation is required.

4 SITE ENVIRONMENT

4.1 Ecological Context

The site is situated in the Rodney Ecological District (ED) of Eastern Northland, which has been described by Goldwater *et al*. (2012). In summary, this area covers approximately 21,000 ha in the southeastern corner of the Northland Region and contains 38 significant natural areas covering 22% of the ED. It is one of the most depauperate ecological districts for terrestrial natural areas in Northland. Mangawhai Harbour is one of the largest sites in the ED containing 'Threatened', 'At Risk' and regionally significant species. The Rodney ED (Northland) has a long history of human occupation and modification of the natural landscape and the remaining natural areas are highly modified and fragmented. Freshwater wetlands and swamp forests have been significantly reduced from their original extent and are very under-represented in the ED.

Historically (pre-human) the site, which is low-lying, would have likely contained the ecosystem type 'mānuka, gumland grass tree–Machaerina scrub/sedgeland [Gumland]' (WL1). Native flora would have been characterised by low scrub, sedgeland and fernland, with manuka (*Leptospermum scoparium*) and gumland grass tree (*Dracophyllum lessonianum*) on better drained sites and tangle fern (*Gleichenia* spp.) in the poorly drained higher-nutrient sites. Close to the coastal edge with increasing saline influence, communities would have transitioned to salt marsh and mangrove forest habitats. This ecosystem type would have supported a diverse community of invertebrates, amphibians, reptiles, birds and bats (Singers *et. al.* 2017).

The site is located on the edge of the Mangawhai Harbour, which has been identified as a Level 1 Natural Area by the Department of Conservation (Goldwater *et al*., 2012) and a Significant Bird Area under the NRD PRP as it is utilised by a variety of Threatened and At Risk bird species. Most of the coastal edge of the site and the inlet just south of Black Swamp Road are identified as areas of High Natural Character in the NRC PRP. The Mangawhai Government Purpose Wildlife Refuge Reserve is a 245 hectare nature reserve that covers the large sand spit forming the mouth of the Mangawhai Harbour, approximately 1.8 km north east of the site. It is an important roosting and breeding habitat for various shorebirds.

4.2 Local Context

Much of the site is flat and low lying, with the highest elevation in the north-eastern corner of the site. The north-western portion of the site is at a lower elevation than the rest of the site. A review of historical aerial imagery indicates that the site, and much of the surrounding landscape, was cleared over 60 years ago for agricultural purposes (Figure 3 – the land was likely cleared much longer ago however no aerial photos are available pre-1961), with land being used mainly for pasture until the late 1970s/early 1980s when most of the western part of the site was converted to horticulture. The land is currently in rural land uses, with grazed pasture in the eastern side of the site and smaller lifestyle blocks with a mix of orchards and other businesses on the western portion of the site, including a camping ground and brewery.

A stop bank was historically constructed along the north-western coastal edge. Historical aerials are of relatively poor resolution, making it difficult to be certain when this was constructed. It does not appear to be present in the 1961 aerial, and there is some suggestion that it was present in the 1966 aerial. It is clearly visible in the 1982 aerial. Therefore it is likely around 60 years old. This stop bank is of raised

earth, with a degraded concrete barrier on the sea-ward side. Its purpose was likely to try to reclaim areas of salt marsh for use as pasture.

Along the sea-frontage of the camping ground, also in the north west of the site, a retaining wall has been constructed. Aerial images indicate that this, along with a small jetty, have likely been constructed since 1996.

Figure 3. Historical aerial imagery of the site dated 1961 (aerial source: Retrolens).

5 TERRESTRIAL ECOLOGY

5.1 Vegetation

5.1.1 Overview

Utilising observations from the site and aerial images, the vegetation has been classified and mapped (Figure 4). The majority of the vegetation present was grass and pasture. Orchard trees, shelter belts and amenity planting make up most of the trees present on the site and only a relatively small amount of native vegetation was present.

Figure 4. Terrestrial vegetation on the site

5.1.2 Exotic trees

Mature exotic trees were present across the site, mainly planted as shelterbelts along paddock edges, or along waterways. Species present included pines (*Pinus radiata*), poplar (*Populus* sp.), she-oaks (*Casuarina cunninghamiana*), Japanese red cedar (Cryptomeria japonica), white cedar (*Thuja occidentalis*), wattle (*Acacia* sp.), gums (*Eucalyptus* sp.), macrocarpa (*Hesperocyparis macrocarpa*), blackwoods (*Acacia melanoxylon*) and willows (*Salix* spp.).

The ecological value of the stands of exotic trees was considered to be generally **low**, given the high edge effects and exotic species. It is possible they provide habitat for bats, but as discussed below there is a lack of suitable vegetation and corridors for bats in the surrounding environment. The exotic trees are not expected to provide important habitat for native lizards.

a)

b)

c)

Figure 5. a) – c) Exotic tree examples in the northern PPC area.

5.1.3 Mixed native / exotic

Areas of mixed native / exotic vegetation have mainly been planted for amenity purposes near dwellings, driveways or along the road frontage. Species included Norfolk pine (*Araucaria heterophylla*), macrocarpa, gum, flame tree (*Erythrina ×sykesii*), banana (family Musaceae), pōhutukawa (*Metrosideros excelsa*), pūriri (*Vitex lucens*), kōhūhū (*Pittosporum tenuifolium*), puka (*Meryta sinclairii*) and kāpuka (*Griselinia littoralis*). Weed species in these areas include agapanthus[2] (*Agapanthus praecox*), English

[2] Identified as a plant pest in Northland Regional Council (2018).

ivy[2] (*Hedera helix*), arum lily (*Zantedeschia aethiopica*), pampas (*Cortaderia selloana*), smilax (*Asparagus asparagoides*), climbing asparagus (*Asparagus scandens*), tree privet[2] (*Ligustrum lucidum*) and bamboo (Phyllostachys sp).

The exotic-native vegetation was considered to be of **low** ecological value. The dominance of the vegetation by exotic species reduces the botanical quality of the vegetation and the patchy nature of the vegetation means that there are high edge effects and generally a lack of connectivity to other vegetation.

a) **b)**

Figure 6. Examples of mixed native / exotic vegetation on the site.

5.1.4 Native dominant

There are limited areas of native dominant vegetation on the site. There is a strip of native restoration planting in the north-western area of the site near the edge of the salt marsh. This looks to have been planted within the last couple of years and includes species such as tī kōuka / cabbage tree (*Cordyline australis*), harakeke / flax (*Phormium tenax*) and mānuka, and weeds such as kikuyu grass (*Cenchrus clandestinus*) and woolly nightshade[2] (*Solanum mauritianum*). Along some of the road edges are scattered kānuka (*Kunzea robusta*), tōtara (*Podocarpus totara*), ponga (*Alsophila tricolor*), red mapou (*Myrsine australis*), mingimingi (*Leucopogon fasciculatus*) and karo (*Pittosporum crassifolium*). Along the north-eastern boundary of the camping ground is a strip of planted natives, including karo, cabbage tree, akeake (*Dodonaea viscosa*) and manuka. Along the coastal stop bank on the north-western edge of the site there are scattered pōhutukawa trees (Figure 9a) - it is unclear whether these have naturally seeded or whether they were planted. Further south on the coast is a mix of pōhutukawa, houpara (*Pseudopanax lessonii*), ngaio (*Myoporum laetum*), karo, mingimingi and flax.

The ecological value of the areas of native vegetation on the site have been classified as being of **low-moderate** ecological value, as although they are of low diversity, small, fragmented and vulnerable to edge effects, they include the threatened species kānuka and pōhutukawa, which are both classed as Threatened – Nationally Vulnerable as a precautionary measure as they are potentially susceptible to myrtle rust disease, *Austropuccina psidii*.

a) **b)**

Figure 7. Native dominant vegetation a) a strip of revegetation planting in the north-west of the site and b) Native vegetation along the coastal edge.

5.1.5 Orchard / crops

Areas of the site have been planted in orchards (particularly olives, but also some fruit trees) and grape vines.

While the orchard trees may provide some food sources for birds from time to time, their exotic nature and low diversity mean that their overall ecological value is considered to be **low**.

a) **b)**

Figure 8. Examples of orchards on the PPC site.

5.1.6 Weedy vegetation / rank grass

These areas are dominated by rank grass and weedy exotic species such as dense pampas, woolly nightshade[2], golden wattle[2] (*Acacia longifolia*) and are mainly around the northern and north-western edges of the site, adjacent to the coast. Dense kikuyu grass mixed with *Juncus pallidus* is present along the inland edge of salt marsh in the north-west of the site.

The ecological value of the areas of weedy vegetation and rank grass is considered to be **low** due to the lack of habitat diversity and low botanical values. However, these areas could contain native lizard species as discussed in Section 5.2.

a) **b)**

Figure 9. a) Weedy vegetation and pōhutukawa trees along the coastal stop bank and b) along drains in the north-west of the site.

5.1.7 Pasture /grass

Most of the site is covered in pasture or mown grass. The pasture areas appear to be regularly grazed by cattle. There are some areas of longer grass along drains and edges. The ecological value of the pasture areas is considered to be **low** due to the lack of habitat diversity, however areas of longer grass may contain native lizard species.

5.1.8 Terrestrial connectivity and ecological function

The terrestrial vegetation on the site is limited and is confined mostly to shelterbelts, orchards, amenity planting around houses and driveways and vegetation along the coast. Edge communities such as these increase with fragmentation of native vegetation within a landscape, and are heavily influenced by increased exposure to sunlight, wind and competition from pest plants. These factors restrict establishment of some native flora and fauna to forest interiors. Fragmentation of native vegetation increases the edge effect and decreases the availability of habitat for species that would normally occur in the interior of vegetated areas. Connectivity between areas of vegetation is important to facilitate ecological function, and loss of connectivity can impair reproductive function for both flora and fauna communities.

There were only small areas of vegetation, both exotic and native, present within the site and these were generally long and narrow. As a result, all vegetation within the site is subject to very high edge effects and as such the functioning of the vegetated areas and their ability to persist and resist the effects of adverse weather and weed invasion are significantly reduced. This is demonstrated on the site by the presence of exotic weedy species. Despite this degradation, the vegetation present does provide some ecological functions such as bank stability, erosion protection, a buffer to the adjacent wetlands and marine area and potential habitat for fauna.

The presence of the wetlands on the site (see Section 6.2) provides an interesting ecotone, or transition, between the Mangawhai estuary and the terrestrial environment, and although modifications have

been made historically, this ecotone contributes significantly to the biodiversity of the site and is an important part of the wider Mangawhai estuary environment.

The estuary and salt marsh habitats on and adjacent to the site (Section 6.2) also provide opportunities for improving ecological connectivity within and beyond the site. In the wider area are some recently covenanted and replanted areas surrounding streams and wetlands to the south and south-east which in the long term provide some opportunities for improving ecological connectivity in the wider area for highly mobile terrestrial fauna such as birds or bats that move between habitats while foraging, nesting and roosting.

The connectivity and ecological functioning values of the site were considered to be **low -moderate** because of the limited terrestrial vegetation on the site and the ecotone and linkages between streams, wetlands, salt marsh and estuarine habitats.

5.2 Terrestrial Fauna Habitat

5.2.1 Avifauna (birds)

Avifauna habitat within the site includes pasture, wetlands, salt marsh, ponds and small areas of native and exotic trees (refer Figures 4 and 10). Site observations made during site visits on 11 June and 2 July 2024 and a review of bird records near to the site in eBird and iNaturalist have been used to compile a list of bird species found within the site or the surrounding area (Table 2).

The dominant avifauna community within the site is expected to contain a combination of common exotic and native species that are common in the wider area including urban, urban fringe, and rural areas, such as the introduced magpie, skylark, black bird, finches, starling, thrush and myna and the native spur winged plover, paradise shelduck, Australasian harrier, white faced heron, king fisher, welcome swallow and ruru. Birds usually associated with forest habitat such as tūī, fantail, and kererū are not expected to be abundant due to the small amount of suitable habitat within the site.

Pipits (At-Risk, Declining) are more common in areas of rough pasture with patches of fern, marshes or bogs and nest on the ground under clumps of tussock or long grass (NZbirdsonline, 2023). This preferred habitat type is limited across much of the site, although the salt marsh areas may provide some suitable habitat. Therefore, it is possible that pipits may utilise the site.

The salt marshes and mangrove habitats of the Mangawhai Harbour are known to support the 'Nationally critical' Australasian bittern, the 'At Risk / Declining' banded rail and the 'At Risk / Declining' fernbird. The wetland and salt marsh areas close to the coast on the site may provide foraging and nesting habitat for these species. The main threat to these species in New Zealand is ongoing loss of wetland habitat. Predation by introduced mammals such as mustelids and rats has also had a significant impact.

Birds associated with the adjacent coastal marine area may also use the site from time to time. The salt marsh and paddocks may be used as high tide roost sites – variable oyster catchers were observed on the site during one of the site visits and the Nationally Critical fairy tern is known to use open areas such as sparsely vegetated salt marsh as high tide roosting sites (NZ Birds Online, 2024). Larger trees along the coastal and salt marsh edges may provide roosting or nesting habitat for coastal birds such as heron, royal spoonbill and shags.

The ecological value of the site for avifauna was considered to be **high** for the salt marsh areas (due to the potentialpresence of several At Risk species), **moderate** for the native vegetation along the coast and **low** for the remainder of the site.

Table 2. Birds known to be present in the wider area.

Common name	Species name	Conservation status	Recorded on site
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised	✓
Australasian harrier	*Circus approximans*	Not Threatened	✓
Australasian bittern / matuku-hūrepo	*Botaurus poiciloptilus*	Threatened / nationally critical	
Banded rail	*Moho pererū*	At Risk / declining	
Banded dotterel	*Charadrius bicinctus*	At Risk / Declining	
Bar tailed godwit	*Limosa lapponica*	At Risk / declining	
Blackbird	*Turdus merula*	Introduced and Naturalised	✓
Black shag	*Phalacrocorax carbo*	At risk / relict	
Black backed gull	*Larus dominicanus*	Not threatened	
Caspian tern	*Hydroprogne caspia*	Threatened / Nationally Vulnerable	
Chaffinch	*Fringilla coelebs*	Introduced and Naturalised	✓
Eastern rosella	*Platycercus eximius*	Introduced and Naturalised	
Eurasian skylark	*Alauda arvensis*	Introduced and Naturalised	
Fairy tern	*Sternula nereis*	Threatened / Nationally Critical	
Fantail	*Rhipidura fuliginosa placabilis*	Not Threatened	✓
Fernbird/ mātātā	*Poodytes punctatus*	At risk / declining	
Goldfinch	*Carduelis carduelis*	Introduced and Naturalised	
Grey duck	*Anas superciliosa*	Threatened / Nationally Vulnerable	
Grey warbler	*Gerygone igata*	Not Threatened	✓
House sparrow	*Passer domesticus*	Introduced and Naturalised	✓
Kererū	*Hemiphaga novaeseelandiae*	Not Threatened	✓
Kingfisher	*Todiramphus sanctus vagans*	Not Threatened	✓
Little black shag	*Phalacrocorax sulcirostris*	Naturally uncommon	
Little shag	*Microcarbo melanoleucos*	At Risk / Relict	
Mallard duck	*Anas platyrhynchos*	Introduced and Naturalised	✓
Morepork / ruru	*Ninox novaeseelandiae*	Not Threatened	
Myna	*Acridotheres tristis*	Introduced and Naturalised	✓
New Zealand dotterel	*Charadrius obscurus Gmelin*	At Risk / Recovering	

Common name	Species name	Conservation status	Recorded on site
Paradise shelduck	*Tadorna variegata*	Not Threatened	✓
Pheasant	*Phasianus colchicus*	Introduced and Naturalised	✓
Pied shag	*Phalacrocorax varius*	At Risk / recovering	
Pied stilt	*Himantopus himantopus*	Not Threatened	
Pipit / Pīhoihoi	*Anthus novaeseelandiae*	At risk / declining	
Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	✓
Red billed gull	*Chroicocephalus novaehollandiae*	At Risk / Declining	
Reef heron	*Egretta sacra*	Threatened / Nationally Endangered	
Royal spoonbill / Kōtuku ngutupapa	*Platalea regia*	Naturally uncommon	
Shining cuckoo	*Chrysococcyx lucidus*	Not Threatened	
Silvereye	*Zosterops lateralis lateralis*	Not Threatened	✓
Song thrush	*Turdus philomelos*	Introduced and Naturalised	✓
Spur winged plover	*Vanellus miles novaehollandiae*	Not Threatened	✓
Starling	*Sturnus vulgaris*	Introduced and Naturalised	✓
Tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened	
Variable oystercatcher	*Haematopus unicolor*	At risk / recovering	✓
Welcome swallow	*Hirundo neoxena*	Not threatened	
White faced heron	*Egretta novaehollandiae*	Not Threatened	✓
White fronted tern	Sterna striata	At Risk - Declining	
Wrybill	*Anarhynchus frontalis*	At Risk – Nationally Increasing	
Yellowhammer	*Emberiza citrinella*	Introduced and Naturalised	✓

5.2.2 Herpetofauna (lizards)

Herpetofauna (reptiles and amphibians) comprise a significant component of New Zealand's terrestrial fauna. There is currently 135 endemic herpetofauna taxa recognised in New Zealand (Hitchmough et al., 2021), 85.9% of which are considered 'Threatened' or 'At-Risk'. All indigenous reptiles and amphibians are legally protected under the Wildlife Act 1953, and vegetation and landscape features that provide significant habitat for native herpetofauna are protected by the Resource Management Act 1991 (RMA). Statutory obligations require management of resident reptile and amphibian populations if they are threatened by a disturbance i.e., land development.

A review of the DoC's Herpetofauna database (accessed 8/4/2024) identified a limited number of lizard records within 10 km of the site. The most commonly recorded species was the shore skink (*Oligosoma smithi*, At Risk-Declining). There were nine records for this species along the coastal area between Te

Arai and Bream Tail, with the closest record being 2.4 km to the east. There were three records of the elegant gecko (*Naultinus elegans*, At Risk – Declining) in native forest remnants, with the closest being 2.3 km to the south-east. The forest gecko (*Mokopirirakau granulatus*, At Risk-Declining) had three records between the period 1949 and 1980. There was one record for the moko skink (*Oligosoma moco*, At Risk – Relict). The introduced plague skink (*Lampropholis delicata*) was also recorded in the area.

During the site visit, opportunistic observations of potential lizard habitat were made. The main potential skink habitat present was in the vegetation along the coastal edge – such as areas of weedy vegetation and rank grass, and areas of native vegetation and mixed native / exotic vegetation. Copper skink (*Oligosoma aeneum*, At Risk – Declining) may be present on site in suitable habitat (thick rank grass, log/rock/vegetation/rubbish debris), although there were no records in the DoC database for copper skink within 10 km of the site. Given the paucity of observations in the surrounding area, it is considered unlikely that the ornate skink (*Oligosoma ornatum*, At Risk – Declining) and moko skink are present, although there is potentially suitable habitat in areas of weedy vegetation / rank grass near the coast. The shore skink is often associated with open habitats such as dunelands, but can also be found in narrower habitats such as rocky coastal platforms and pebble / boulder beaches (NZ Herpetological Society, 2024). This type of habitat is not present on the site, and therefore it is unlikely that this species is present. The introduced plague skink is likely present.

The minimal amount of native vegetation on the site, lack of connection to other areas of bush, and the low number of observations in the surrounding area mean that it is unlikely that geckos are present on the site.

Overall, the ecological values of the herpetofauna habitat on the PPC site are conservatively assessed to be **low** across most of the site, and**-moderate** along the coastal edge and areas of weedy vegetation / rank grass due to the potential for the 'At-Risk' copper skink to be present in these areas. The herpetofauna values have been degraded due to a history of land clearance, disturbance, predation by pest mammals and habitat fragmentation.

5.2.3 Chiroptera (bats)

New Zealand has two species of endemic bats on the mainland. The most widespread is the long-tailed bat (*Chalinolobus tuberculatus*, Threatened – nationally critical), although colonies are assumed to be small and their health is largely unknown (O'Donnell et al., 2023).

The lesser short-tailed bat has three described subspecies; the northern lesser short-tailed bat (*Mystacina tuberculata aupourica,* Threatened – nationally vulnerable), the central lesser short-tailed bat (*Mystacina tuberculata rhyacobia,* At-risk – declining) and the southern lesser short-tailed bat (*Mystacina tuberculata tuberculata,* Threatened – nationally increasing) (O'Donnell et al., 2023). There are no known populations of the short-tailed bat in the Kaipara District, with the closest known population being the northern lesser tailed bat population to the south-east on Te Hauturu-o-Toi/Little Barrier Island.

Bats roost in tree hollows and under split bark of native and exotic trees, and also in rocky overhangs. Over the breeding season, large communal roosts occur in similar habitat. Bats tend to utilise linear features in the landscape, including vegetation edges, gullies, waterways, and road corridors as they transit between roosts and foraging sites. Long-tailed bats in particular are known to be highly mobile, with large home ranges (>5,000 ha) and can travel large distances (~25 km) each night during foraging.

Short-tailed bats require specific habitat consisting of good-quality forest vegetation, so are highly unlikely to be present on the site.

No formal survey for long tailed bats was completed as part of the investigations for this report. A review of data in the DoC's bat database (accessed May 2024), found that the nearest records for long tailed bat were in the Brynderwyn hills 10+ km to the north-west and in the Dome Valley area 20+ km to the south. There appears to be a paucity of surveys that have been undertaken in the area.

The larger exotic trees on the site may provide some suitable roosting and/or nesting habitat (cavities, large sections of flaking bark) habitat for bats. However, the lack of corridors or stands of indigenous vegetation in the surrounding area and the dominance of agriculture nearby reduce the suitability of the area for bats.

It is therefore considered possible that long tailed bats may periodically be present in the area, and potentially within the site, however any use is expected to be transitory or intermittent and the habitat is not expected to support regular visits or large communal roosts. The site is not likely to be a high use bat area. Therefore the ecological value of the site for bats is conservatively considered to be **low-moderate**, as a small amount of vegetation may provide suitable habitat, and their presence cannot be ruled out.

6 FRESHWATER ECOLOGY

6.1 Watercourses

All watercourses within the site were classified and mapped according to the definitions within the NRC PRP as either permanent, intermittent, ephemeral, or artificial drains (Figure 10). The watercourse classification types are described in this section. Maps with labelled watercourses and a table showing the criteria met for each watercourse and details of watercourse history are provided in Figure 10 and Appendix A respectively.

Figure 10. Watercourses and wetlands on the site

6.1.1 Artificial watercourses

Multiple artificial watercourses were present within the site (Appendix A), and these have been identified as drains and swales in Figure 10. These features were constructed for drainage purposes. Swales and drains were identified based on attributes including alignment with natural topography, presence/absence of a historic natural channel, catchment size, and artificial characteristics such as deepening and straightening. Swales are shallow artificial watercourses that typically only contain surface water during periods of rainfall. Drains are incised artificial watercourses that contain water permanently or intermittently. Some of these drains and swales were present in 1961, and by 1981 most were present in their current configuration. Figures 11 and 12 show some examples of swales and drains on the site.

Artificial drainage channels are excluded from the relevant stream protection rules under the NRC PRP and the NPS-FM.

a)

b)

c)

d)

Figure 11. Examples of swales across the site a) watercourse 16; b) watercourse 21; c) watercourse 27; and d) watercourse 28.

a)

b)

c)

d)

e)

f)

Figure 12. Examples of drains across the site a) Watercourse 1; b) Watercourse 5; c) watercourse 23; watercourse 29; e) watercourse 42; f) watercourses 48-49.

6.1.2 Streams

No natural intermittent or permanent streams were identified on the site, either currently or in the earliest historical aerial (1961). One of the watercourses on the site (watercourse 28, Figure 12d) has been identified as either an artificial swale or an historic natural channel remnant (refer Appendix A for more detail) because its path is somewhat meandering. However, its shallow nature, small catchment size, flat surrounding topography and lack of water in the channel at the time of the site assessment

(11/6/24) means that if it was an historic natural channel it would be classed as ephemeral, and therefore not protected.

6.1.3 Aquatic fauna

There is a lack of stream habitat on the site, however some of the drains that contain water for most of the year may contain some native fish species. Drains do not provide ideal fish habitat as they generally lack hydrological heterogeneity and shelter for fish such as bank overhangs and woody debris, are poorly shaded, and likely suffer from poor water quality. The short-finned eel (*Anguilla australis*, not threatened) is the most likely to be present as it is tolerant of degraded conditions, however the long-finned eel (*Anguilla dieffenbachii*, At Risk – Declining) may also be present. The drains close to the coast (e.g. watercourses 40, 44 and 45) may also contain some migratory galaxiids such as īnanga (*Galaxias maculatus*, At Risk – Declining) at times.

6.2 Indicative Wetlands

6.2.1 Natural inland wetlands – freshwater

Natural inland wetlands have been identified inland of what is understood to be the Coastal Marine Area boundary.

Natural inland wetlands A, B, C

Some small areas of potentially induced freshwater natural inland wetland (A, B, C) were identified in the north-west of the site during the site visits. These areas are depressions are in grazed pasture close to the adjacent salt marsh. They had saturated soil at the time of the site visit 11/6/24). Species present included creeping buttercup (*Ranunculus repens*, FAC), kikuyu grass (*Cenchrus clandestinus*, FACU), soft rush (*Juncus effusus*, FACW), saltwater paspalum (*Paspalum vaginatum*, FACW), creeping bent (*Agrostis stolonifera*, FACW) and paspalum (*Paspalum dilatatum,* FACU). A vegetation plot undertaken in Wetland C is shown in Table 3. The soil here is a sandy / peaty mix.

Table 3. Details of vegetation plot within putative wetland area C

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Ranunculus repens	Creeping buttercup	FAC	Exotic	40	Yes
Juncus effusus	Soft rush	FACW	Exotic	30	Yes
Paspalum dilatatum	Paspalum	FACU	Exotic	10	
Bromus catharticus	Praire grass	UPL	Exotic	10	
Lotus pedunculatus	Lotus	FAC	Exotic	10	
% of dominant species that are FAC/FACW/OBL					**100%**
Prevalence value					**3.0**

Aerial photos indicate that these wetlands are in an area that was previously in orchards. Google Earth imagery indicates that the orchard trees were cleared between 2019 and 2021. Historical aerial photographs do not show historical evidence of these wetlands being present. Therefore, although these areas technically meet the definition of natural inland wetlands, their extent may fluctuate over time and may have arisen due to land use changes / modifications in recent years.

The ecological value of these small wetlands was assessed as **low** due to the dominance by exotic species, lack of riparian vegetation, grazed nature and small size.

Natural inland wetland F

This wetland area is close to the southern boundary of the site and is described by RDL (2023). Briefly, it is degraded mānuka fen habitat beneath a canopy of poplar (Populus sp.), with a variety of native species such as kuawa (*Schoenoplectus tabernaemontani*), tussock swamp sedge (*Machaerina juncea*), tangle fern (*Gleichenia dicarpa*), manuka (*Leptospermum scoparium*), orange nut sedge (*Machaerina rubignosa*), (*Machaerina teretifolia*), *Netrostylis capillaris*[3], sharp spike sedge (*Eleocharis acuta*), ring fern (*Paesia scaberula*) and kiokio (*Blechnum novae-zelandiae*)

This wetland area is considered to be of **moderate** ecological as it contains a variety of native species, including some regionally significant species and provides good connectivity and linkages to the adjacent salt marsh area.

a) **b)**

Figure 13. a) Natural inland wetland C, b) natural inland wetland F.

6.2.2 Natural inland wetlands – salt marsh

Natural inland wetland D

There is an extensive area of salt marsh in the north-western portion of the site behind a man-made stop bank. This saltmarsh shows natural zonation of vegetation communities dominated by native species. Further away from the coastal edge, the vegetation is dominated by remuremu (*Selliera radicans,* FACW, native) and glasswort (*Salicornia quinqueflora*, FACW, native), which grades into areas dominated by oioi (Apodasmia similis, FACW, native) and salt marsh ribbonwood (Plagianthus divaricatus, FACW, native) closer to the coast. Other species present include sea rush (*Juncus kraussii*, FACW, native), arrow grass (*Triglochin striata,* OBL, native, regionally significant[3]), *Juncus pallidus* (FACW, native), *Austrostipa stipoides*, sea primrose (*Samolus repens*), *Machaerina juncea*, *Carex* species, manawa / mangroves (Avicennia marina, OBL, native). Exotic species include buffalo grass (*Stenotaphrum secundatum*, exotic) on a raised area within the wetland, saltwater paspalum, pampas, and she-oak (several young specimens were present adjacent to a drain in the central wetland area). Along the inland edge of the wetland is a strip of dense kikuyu grass with some emergent *Juncus pallidus*.

[3] identified as a regionally significant plant species by Goldwater *et al*., 2012

This area meets the rapid vegetation test for wetland delineation and contains permanent hydrological indicators such as saturated ground or surface water. Wetland extent was delineated based on contours and a clear change in vegetation community from OBL/FACW dominant to FACU/UPL dominant.

This area is subject to a protective covenant under the Reserves Act 1977. The covenant requires exclusion of domestic cats, dogs and grazing animals, animal and plant pest control, fencing and protection of its ecological value.

The ecological value of this wetland has been assessed as **high** as although it has been subject to modification through construction of a stop bank and drains, it is dominated by native species, is a relatively large area, contains at least one regionally significant plant species, and provides potential habitat for several bird species that are identified as 'Nationally critical' or 'At Risk'.

a) **b)**

Figure 14. Natural inland wetland D a) central areas and b) along the edge of the stop bank.

Natural inland wetland E

This area of salt marsh and mangrove habitat runs along the southern most extent of the site. It is described by RDL (2023). Briefly, the centre is dominated by mangroves. Around the edges is scattered salt marsh ribbonwood, grading to areas of sea rush and oioi. Smaller saltmarsh species such as bachelors' button (*Cotula coronopifolia*), glasswort, shore celery (*Apium prostratum*), slender club rush (*Isolepis cernua*) and arrow grass are also present.

This wetland area is considered to be of **moderate-high** ecological value because it contains some regionally significant plant species, and provides potential habitat for several bird species that are identified as 'Nationally critical' or 'At Risk'.

Figure 15. Natural inland wetland E.

6.2.3 Putative wetlands

A number of vegetation plots were undertaken in pasture areas throughout the site, particularly in paddocks where aerial imagery indicated potential differences in colouring of pasture vegetation. The results of these vegetation plots are shown in Tables 4 to 13[4] and their locations are shown in Figure 10. Because these vegetation tests failed the dominance test and the prevalence index test, these areas are not considered to be natural inland wetlands as per the definition within the NPS-FM and are not subject to the consenting requirements of the NPS-FM.

Table 4. Details of vegetation plot VP 1

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Lolium perenne	Perennial ryegrass	FACU	Exotic	30	Yes
Trifolium repens	White clover	FACU	Exotic	30	Yes
Cenchrus clandestinus	Kikuyu grass	FACU	Exotic	20	Yes
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**4.0**

Table 5. Details of vegetation plot VP 2

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Lolium perenne	Perennial ryegrass	FACU	Exotic	25	Yes
Trifolium repens	White clover	FACU	Exotic	25	Yes
Cenchrus clandestinus	Kikuyu grass	FACU	Exotic	20	Yes
Rumex obtusifolius	Broad leaved dock	FAC	Exotic	10	
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**3.9**

Table 6. Details of vegetation plot VP 3

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Lolium perenne	Perennial ryegrass	FACU	Exotic	40	Yes
Trifolium repens	White clover	FACU	Exotic	30	Yes
Cenchrus clandestinus	Kikuyu grass	FACU	Exotic	10	
Rumex obtusifolius	Broad leaved dock	FAC	Exotic	5	
Plantago lanceolata	Narrow leaved plantain	FACU	Exotic	5	
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**3.9**

[4] Note that the percentage coverage does not add up to 100% for a number of the plots because some bare ground was present.

Table 7. Details of vegetation plot VP 4

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Lolium perenne	Perennial ryegrass	FACU	Exotic	30	Yes
Trifolium repens	White clover	FACU	Exotic	20	Yes
Ranunculus repens	Creeping buttercup	FAC	Exotic	5	
Plantago lanceolata	Narrow leaved plantain	FACU	Exotic	5	
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**3.9**

Table 8. Details of vegetation plot VP 5

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Lolium perenne	Perennial ryegrass	FACU	Exotic	30	Yes
Trifolium repens	White clover	FACU	Exotic	30	Yes
Rumex obtusifolius	Broad leaved dock	FAC	Exotic	5	
Ranunculus repens	Creeping buttercup	FAC	Exotic	5	
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**3.9**

Table 9. Details of vegetation plot VP 6

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Lolium perenne	Perennial ryegrass	FACU	Exotic	40	Yes
Trifolium repens	White clover	FACU	Exotic	20	Yes
Lotus pedunculatus	Lotus	FAC	Exotic	5	
Rumex obtusifolius	Broad leaved dock	FAC	Exotic	5	
Ranunculus repens	Creeping buttercup	FAC	Exotic	5	
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**3.8**

Table 10. Details of vegetation plot VP 7

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Lolium perenne	Perennial ryegrass	FACU	Exotic	25	Yes
Trifolium repens	White clover	FACU	Exotic	20	Yes
Cenchrus clandestinus	Kikuyu grass	FACU	Exotic	15	
Rumex obtusifolius	Broad leaved dock	FAC	Exotic	5	
Ranunculus repens	Creeping buttercup	FAC	Exotic	5	
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**3.9**

Table 11. Details of vegetation plot VP 8

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Cenchrus clandestinus	Kikuyu grass	FACU	Exotic	90	Yes
Rumex obtusifolius	Broad leaved dock	FAC	Exotic	5	
Ranunculus repens	Creeping buttercup	FAC	Exotic	5	
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**3.9**

Table 12. Details of vegetation plot VP 9

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Cenchrus clandestinus	Kikuyu grass	FACU	Exotic	90	Yes
Rumex obtusifolius	Broad leaved dock	FAC	Exotic	2	
Juncus edgariae		FACW	Native	2	
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**3.9**

Table 13. Details of vegetation plot VP 10

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Cenchrus clandestinus	Kikuyu grass	FACU	Exotic	70	Yes
Juncus effusus	Soft rush	FACW	Exotic	15	
Paspalum dilatatum	Paspalum	FACU	Exotic	15	
% of dominant species that are FAC/FACW/OBL					**0%**
Prevalence value					**3.7**

6.3 Constructed ponds

There is a small area of pooled water in the north-western part of the site (Figure 14). It becomes clearly visible in Google Earth aerial imagery from 2013 – 2016. It is absent from the 1982 aerial photo and earlier imagery. The surrounding vegetation is dominated by kikuyu grass. Because of the historical aerial imagery, this area of standing water is assumed to be a constructed pond.

A large pond is also located in the northern-central part of the site. Aerial imagery indicates that this was constructed between 1982 and 1996. It is understood to be used for water supply for the surrounding orchards.

Figure 16. Small pond located in the north-western part of the site

7 COASTAL ENVIRONMENT

The site is bounded in the west by the Mangawhai Estuary, which identified as a Level 1 Natural Area by DoC (Goldwater *et al*., 2012) and a Significant Bird Area under the NRC PRP. Most of the coastal edge of the site and the inlet just south of Black Swamp Road are identified as areas of High Natural Character in the NRC PRP.

The harbour contains a wide variety and representative succession of habitats spanning dunes, tidal flats, channels, mangroves, saltmarsh and freshwater wetlands and adjacent shrubland. It is the single most important breeding ground for the Nationally Critical fairy tern, which breeds on the sandspit, and individuals forage in the estuary or just offshore for much of the year. The estuary is also important for breeding of a number of other threatened or at risk birds, notably northern New Zealand dotterel, Caspian tern, pied shag, reef heron, white-fronted tern and variable oystercatcher, with several migrant species visiting at different times of the year. The saltmarshes and mangroves support Australasian bittern, banded rail, fernbird and others.

Around much of the coastal edge is a thin strip of salt marsh vegetation, with mangroves beyond, except along the camp site where the channel is closer. In some areas there is evidence that mangroves have been removed. Most of the coastal edge has been modified by construction of retaining walls and a stop bank. An informal path along the coastline goes north from the campground, seaward of the stop bank to the paper road end of Raymond Bull Road. Figure 17 shows the nature of the coastal environment.

The value of the coastal environment to the west of the site is considered to be **high** given the potential for threatened species to be present and the classifications of the coastal environment by DoC and NRC.

a)

b)

c)

d)

e)

Figure 17. The coastal environment a) northern coastline at the end of Raymond Bull Road; b) & c) north-western end along the stop bank; d) retaining wall along the south-western end; e) weedy vegetation and salt marsh vegetation along the south-western end near Black Swamp Road.

8 SUMMARY OF ECOLOGICAL VALUES

The ecological values of the habitat features on the site are summarised in Table 14. The terrestrial ecological values of the site are generally low, except for the native vegetation around the coast that is considered to be of low to moderate value and may provide some habitat for birds, bats and lizards. Very little native vegetation remains across the site to provide any significant habitat for indigenous fauna, with most of the site being covered in pasture or orchards. There are no permanent or intermittent streams in the northern part of the PPC area. Areas of salt marsh of moderate to high value are present on or adjacent to the site, and the presence of freshwater wetlands is limited. The adjacent coastal area is of high ecological significance.

Table 14. Summary of the ecological values within and adjacent to the site.

Ecological feature	Ecological Value
Exotic trees	Low
Mixed native / exotic vegetation	Low
Native dominant vegetation	Low - moderate
Orchard / crops	Low
Weedy vegetation / rank grass	Low
Pasture / grass	Low
Terrestrial connectivity and ecological function	Low-moderate
Avifauna (birds)	Low - high
Herpetofauna (lizards)	Low-moderate
Chiroptera (bats)	Low-moderate
Artificial watercourses	Low
Natural inland wetlands - freshwater	Low - moderate
Natural inland wetlands – salt marsh	Moderate - high
Coastal environment	High

9 ASSESSMENT OF ECOLOGICAL EFFECTS

9.1 Proposal

The PPC seeks to rezone the site from Rural under the KDP to a mix of residential (mainly low density residential (750 m^2 minimum lot size), with a small area of medium density residential (minimum lot size 400 – 600 m^2), Business Mixed Use, Business Neighbourhood Centre and Rural Lifestyle (5000 m^2 – 8000 m^2) zones. A Coastal Hazard Overlay is proposed to apply to land in the north-west of the site where greater consideration of the impacts of development on coastal hazards is required. A Development Area is proposed to set out the objectives, policies, rules, standards, and assessment matters for the plan change area. A Structure Plan will be incorporated into the Development Area to spatially secure required outcomes such as pedestrian and cycling connections, open space, landscaping, fire fighting water supply and road connections.

This section assesses the potential effects of the proposed PPC on the current and potential ecological values within the Site and the associated wider landscape. Note that at the time of writing the proposed PPC provisions were not yet available, and hence recommendations have been made relating to what should be proposed where appropriate.

9.2 Impact on Terrestrial Ecology

9.2.1 Vegetation

The main threats to the long-term viability of ecosystems in the Northland / Auckland region are often intensified by increases in urbanisation and human population density. These include habitat destruction, fragmentation, increased edge effects, and subsequent invasion by pest plants and animals. The clearance of native vegetation will be avoided where practicable during future development. Any proposed vegetation clearance within the PPC areas will be assessed at resource consent stage, and the effects management hierarchy applied to avoid, minimise, mitigate, or otherwise offset/compensate to address residual effects.

Vegetation values within the site are significantly limited due to the small amount of trees and shrubs present on the site and the dominance of exotic vegetation and pasture.

Rezoning the site will result in low adverse effects on the existing vegetation. It is expected that some of the vegetation beyond the coastal area, riparian yards and wetland margins will be removed (e.g. the shelterbelts and amenity planting), however much of this vegetation this can already be removed as a permitted activity. Areas of predominantly indigenous vegetation will be protected by vegetation clearance rules, which are more restrictive in urban zones.

There will be landscaping and amenity planting included in any development of the site. It is expected that landscaping will provide species diversity and periodic areas of vegetation similar to what is currently present on site.

It is important that a buffer around the coast and wetlands on and adjacent to the site is protected from development and enhanced through planting and weed and pest control to protect and improve the ecological values of these areas. The proposed plan provisions should enable this to be required.

Overall, it is expected that rezoning of the site will result in low adverse effects on terrestrial vegetation. There is the potential for the development to result in a net gain in terrestrial vegetation values if planting and weed control increases the extent of appropriate indigenous plants and trees.

9.2.2 Pest mammals

An increase in human population density has been found to decrease possum and rodent numbers and, expectedly, increase domestic cats in residential areas (Miller, 2020). With the close proximity of Mangawhai and the existing housing on the site, roaming domestic cats are likely already present within the site alongside feral cats. In turn, the number of mustelids can become very limited, where cats are in abundance. Hedgehogs are often abundant in urban areas due to the abundance of anthropogenic food and shelter (Miller, 2020). Rabbit abundance is likely to decrease with a change to urban land use. Therefore, the reduction in agricultural land with a re-zone to residential will likely result in an overall decrease in the possum, mustelid and rodent abundance, and an overall increase in hedgehog, cat and dog numbers in urban areas, if there are no controls put in place.

Some evidence of pest control was observed in the salt marsh area to the north-west during the site visits, which is required by the conservation covenant in place there, but it is expected that there is limited control elsewhere across the site. Some of the land on the site is subject to controls on keeping of mammals as pets (Lots 1-8, DP 84426). On these lots the keeping of cats, mustelids and rodents is prohibited. Dogs can only be kept on these lots if they meet conditions such as being kept secured at all times so they cannot roam beyond the boundaries of the lot or into the covenanted salt marsh area.

Given the sensitivity of the adjacent coastal environment, the salt marsh area and the potential presence of several Threatened and At Risk bird species, it is recommended that keeping of mammals (particularly cats) is restricted as subdivision and development occurs, at least close to the coast and wetland areas. Any walkway proposed within or adjacent to the salt marsh areas should be required to have dogs on lead at all times. Alongside this, pest control should be required to decrease possum, mustelid, hedgehog and rodent densities.

Overall, it is considered that the rezoning of the site will result in low pest animal effects if the above recommendations are adopted.

9.2.3 Terrestrial indigenous fauna

There is the potential for a loss of low quality bat habitat associated with removal of some of the larger exotic trees. Assessment of effects on bats will be required at resource consent stage and where appropriate bat management may be required to mitigate any effects.

Much of the potential lizard habitat on the site is within the coastal yard. Areas of rank grass and weedy vegetation could contain native skink species. When the PPC site is developed, resource consent applications will be required to consider the potential impact on these lizards, and it is expected that where appropriate consent conditions will require lizard management plans to mitigate any effects.

Most of the birds likely to be present on the site are common and exotic species that are abundant in the wider landscape. For those birds that may be present and have an At Risk or Threatened conservation status, most would be restricted to the coastal or wetland areas that would be protected within the rules of the KDP and restrictions on the keeping of mammals and potentially enhanced / protected from future development through buffer planting.

Any potential direct adverse effects on native terrestrial fauna as a result of subsequent development works (e.g. earthworks) would be assessed at the resource consenting phase and can be appropriately mitigated through the implementation of fauna management plans, landscape planting and buffer planting, which provides opportunity to increase terrestrial habitat values.

Overall, it is considered that the rezoning of the site will result in a low level of effect on terrestrial indigenous fauna.

9.3 Impact on Freshwater Ecology

9.3.1 Watercourses

It is expected that artificial drains on the site (which were found to be of low ecological value) will be reclaimed during future works or incorporated into onsite stormwater management. Artificial channels are not subject to protection or management rules under the NRC PRP and the NPS-FM. However, there is the potential for native fish species to be present in some of the larger drains that contain water on a more permanent basis, and works within these drains have the potential to result in injury or mortality of native fish such as eels. These potential effects can be appropriately addressed at the resource consent stage.

9.3.2 Wetlands

There is a large area of salt marsh in the north-western portion of the site, some small wetlands adjacent to this, and an area of salt marsh and freshwater wetland to the south of the site. The main threats to wetlands on or adjacent to the site as a result of the change from rural to residential zoning are:

- There is no wetland yard for residential areas in the KDC (in rural zones there is a 30 m yard from indigenous wetlands);
- Future walkways or accessways within or adjacent to the wetland areas;
- The potential for increased impervious surfaces as a result of residential development; and
- The potential increase in contaminant runoff as a result of residential development.

The low density Rural Lifestyle zoning proposed in the north-west area of the site will help to minimise impacts on wetland D.

It is recommended that objectives, policies and rules be included in the Development Area to provide protection and enhancement to wetland areas. Protection with a 20 m buffer and requiring planting and weed and pest control within the buffer area would be appropriate for the larger and higher value wetland areas (i.e. D, E and F). For smaller wetlands of lower ecological value (e.g. A, B and C) protection with a 10 m buffer would be appropriate.

Any walkways or accessways along the coastal edge would need KDC approval to construct as this is already esplanade reserve. If walkways were proposed within or close to the wetland areas, resource consent would be required for any associated works or vegetation removal.

Wetlands are protected from development by the NRC PRP and the NES-F. Any future works within, or earthworks or vegetation removal within 10 m of any wetland (or works within 100 m if it will result in drainage of the wetland) will be subject to a resource consent application. It should be noted that as the zoning is currently rural, it is a prohibited activity to reclaim natural inland wetlands under the NES-F. The urban rezoning will provide a consenting pathway for wetland reclamation under Regulation 45C of the NES-F, however functional need would have to be demonstrated for this to occur and the impact management / mitigation hierarchy followed.

Identification of indicative wetland areas at this stage allows future development to be designed around the wetlands and their catchments to help ensure no complete or partial drainage occurs. Wetlands are

dynamic ecosystems, responsive to changes in land use (e.g. mowing, grazing, fertilising, drainage, irrigation etc.) and natural environmental variation (e.g. seasonal variation, droughts and prolonged wet periods). It is expected that the indicative wetland extents will change in the short and long term, contracting and expanding in response to landuse changes and natural variation and wetlands may develop elsewhere on the site. In future resource consent applications it is expected that wetland presence and extent will be further mapped in accordance with relevant/current best practice methodology.

Indirect adverse effects on wetlands such as sedimentation and stormwater contaminants are expected to be adequately mitigated through appropriate controls and following best practice guidelines, to ensure adverse effects on ecological values are no more than minor.

Compliance with relevant NES-F regulations in relation to natural inland wetlands will be required for subsequent development following rezoning. Overall, the recommendations regarding wetland and buffer protection will help secure the protection and enhancement of natural inland wetlands as part of the PPC, and any future adverse effects arising from development on wetlands will be able to be assessed and managed appropriately at resource consent stage.

9.3.3 Stormwater management

If not appropriately designed and mitigated, a land use change from rural to urban land uses may threaten freshwater ecological values through greater runoff from impervious surfaces (which can threaten freshwater and coastal ecological values through changes in hydrology, scouring and erosion) and increased contaminant input. Some contaminant inputs associated with rural land uses such as nutrients from fertiliser and stock inputs may decrease.

The Stormwater Management Plan (Aspire, 2024) proposes the following key stormwater management strategies for the PPC area:

- Use of a treatment train approach;
- Treatment of road and carpark runoff via rain gardens or swales;
- Inert building materials for roof areas to reduce contaminant input;
- Maintain pre-development flows to wetlands; and
- Groundwater recharge (retention) to maintain existing groundwater levels if peat remains in place.

9.3.4 Erosion and sediment control

Future earthworks will be supported by erosion and sediment control measures which should be designed in accordance with the appropriate guidelines. The detail of these measures will be developed during future resource consent applications.

9.4 Impact on Coastal Ecology

The coastal environment will be protected from development by the 20 m coastal esplanade reserve and the existing provisions requiring coastal esplanade reserves upon subdivision. The recommended wetland buffers and enhancement will also benefit the coastal environment. These provisions will keep works away from the coastline and allow for maintenance of a vegetated buffer. This will also enable retention of the existing vegetation around the coastal fringe, and provides ecological benefits such as habitat for roosting birds, lizards and protects against coastal erosion.

Light pollution has the potential to affect migratory birds that feed within the adjacent marine protected areas. Currently the PPC area produces a low level of light during the night, however when the area is developed it is expected that the levels of light will increase with light from buildings and street lighting. This could potentially affect communication, feeding and migratory behaviour of birds using the adjacent coastal areas. The coastal setback and vegetation along the coast will help to reduce the amount of light pollution experienced in the coastal area. The potential impact of lighting on birds should be considered during the resource consenting phases of development and best practice lighting design approaches should be adopted. Best practice lighting design includes:

- Adding light only for specific purposes;
- Use of adaptive light controls to manage light timing, intensity and colour;
- Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill;
- Use the lowest intensity lighting appropriate for the task;
- Use non-reflective, dark coloured surfaces; and
- Use lights with reduced or filtered blue, violet and ultraviolet wavelengths.

More information is available from DCCEEW, 2023.

Activities that may affect the coastal environment will require assessment during future resource consenting processes. It is considered that the effects management hierarchy will be appropriate for managing adverse effects of future proposals. All threats can be effectively managed with appropriate controls such as stormwater management plans, erosion and sediment control plans, appropriate design and planting and weed and pest control. As such, the proposed rezoning is not anticipated to result in residual adverse effects on the coastal environment.

9.5 Relevant Policies

9.5.1 National Policy Statement for Indigenous Biodiversity 2023 (updated October 2024)

The NPS-IB sets out objectives, policies and implementation requirements to manage natural and physical resources to maintain indigenous biodiversity in the terrestrial environment under the RMA. It outlines a system for the management of biodiversity outside of public conservation land.

The salt marsh (natural inland wetland D, Figure 10) has been identified as a “natural inland wetland” under the NPS-FM)because it meets the criteria for natural inland wetlands in the NPS-FM and the Coastal Marine Area (“CMA”) boundary has been identified in the Regional Coastal Plan for Northland 2004 as falling seaward of the salt marsh beyond the stopbank.

The NPS-IB applies to indigenous biodiversity in the terrestrial environment (Section 1.3 (1)) and the terrestrial environment is defined as “land and associated natural and physical resources above mean high-water springs, excluding land covered by water, water bodies and freshwater ecosystems … and the coastal marine area (Section 1.6)”. Although “freshwater ecosystems” are not defined in the NPS-IB (or in other resource management legislation), natural inland wetlands are generally considered to be a type of freshwater ecosystem.

The NPS-IB does include wetlands in provisions relating to promoting restoration and increasing indigenous vegetation cover (clauses 3.21 and 3.22) and allows wetlands to be identified as an SNA if

that SNA contains a natural inland wetland (clause 1.3 (2)(e)). This latter provision implies that a wetland would only be identified as an SNA as part of a wider SNA in the terrestrial environment.

An SNA is defined in the NPS-IB (Appendix 1) as follows:

> *(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.*

Most of the site has been assessed as low or low-moderate ecological value in terms of terrestrial vegetation and habitats, and the terrestrial habitats are not considered to meet the criteria to be identified as an SNA because of the low diversity of indigenous species, low level of ecological integrity and low level of values in terms of ecological context and buffering[5]. Because of the lack of connectivity to a terrestrial SNA, then given clause 1.3 (2)(e) it seems that the salt marsh area likely also should not be considered an SNA.

However, given the potential uncertainty of interpretation here, the high level of ecological value of wetland D identified in Section 6 and the fact that the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna is a matter of national importance under the Resource Management Act (1991) Section 6(c), a conservative approach could be taken here to considering whether this salt marsh should be considered an SNA.

Table 15 considers the SNA criteria in light of wetland D.

[5] Note that Rural Design Limited has assessed potential SNA areas to the south of Black Swamp Road separately.

Table 15. Assessment of Wetland D against the SNA criteria of the NPS-IB (Appendix 1).

Criteria	Attributes	Discussion	Criteria met?
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.	Wetland D contains indigenous vegetation and habitat for a moderate range of indigenous fauna which is typical of modified salt marsh within the Rodney Ecological District of Eastern Northland.	Yes
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.	Wetland D is likely to have at least a moderate diversity of indigenous species, vegetation, habitats of indigenous fauna in the context of the ecological district and it contains gradient or sequence of vegetation that reflects the differences in hydrology and salinity across the wetland.	Yes
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 pre-human extent in the ecological district, region, or land environment: (e) indigenous vegetation or habitat of indigenous fauna occurring on naturally uncommon ecosystems:	Wetland D potentially provides foraging and nesting habitat for the 'Nationally critical' Australasian bittern, the 'At Risk / Declining' banded rail and the 'At Risk / Declining' fernbird. It may also provide high tide roosting habitat for the Nationally Critical fairy tern.	Yes

Criteria	Attributes	Discussion	Criteria met?
	(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.		
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.	Wetland D has a moderate size and compact shape and connects to the Mangawhai Harbour, which has been identified as a Level 1 Natural Area by the Department of Conservation (Goldwater *et al*., 2012) and a Significant Bird Area under the NRD PRP as it is utilised by a variety of Threatened and At Risk bird species.	Yes

Therefore, as wetland D has been assessed as meeting the criteria to be considered an SNA, and if a conservative approach is taken regarding the interpretation of the NPS-IB with regard to wetlands as discussed above, it is recommended that wetland D is identified as an SNA. Figure 18 shows the extent of the area to be considered SNA.

Overall, the effects management hierarchy will be applied to manage residual ecological effects on areas identified as SNA. The PPC will provide opportunities to increase indigenous vegetation cover through planting and enhancements of riparian areas, wetlands and the coastal margin.

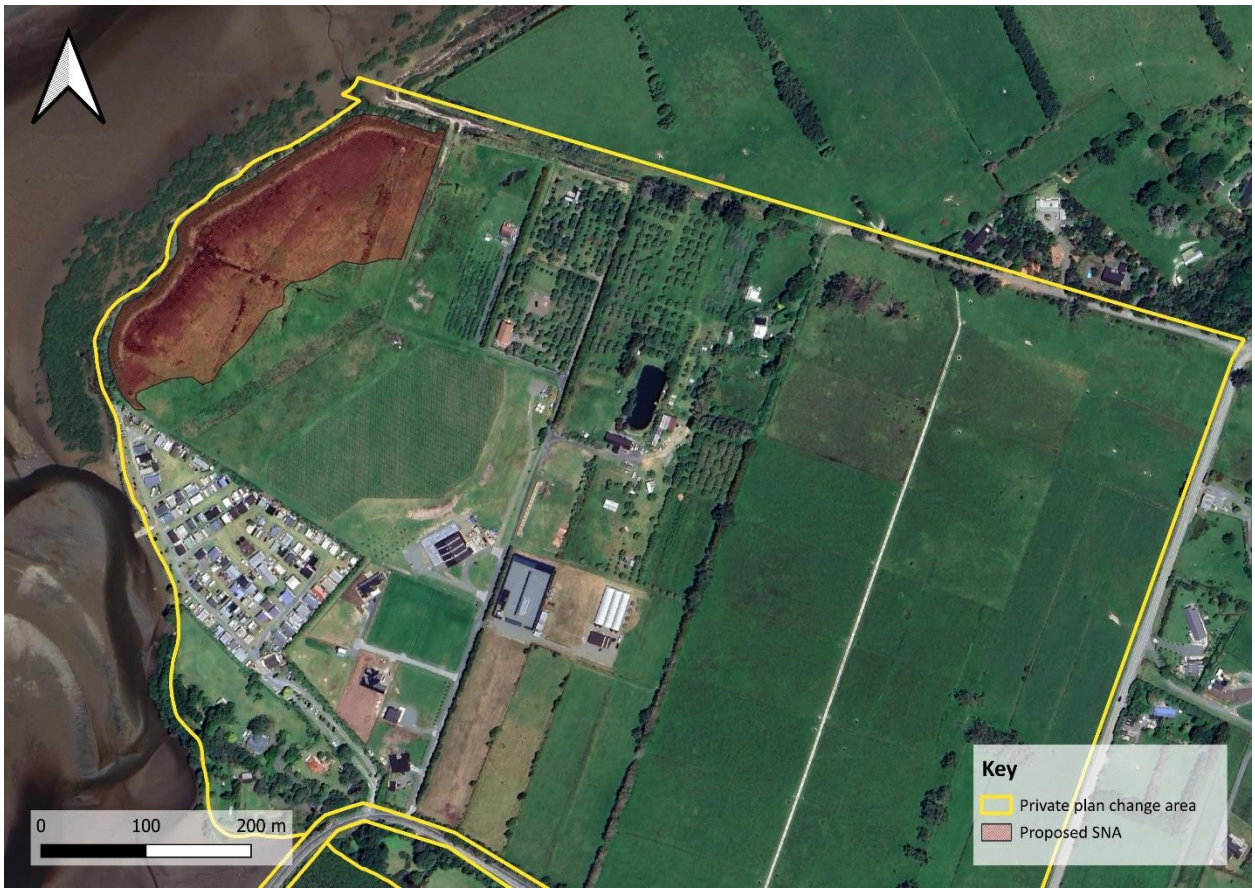

Figure 18: Proposed SNA – northern PPC area

9.5.2 National Policy Statement for Freshwater Management 2020

The NPS-FM provides national direction for decisions regarding water quality and quantity, and the integrated management of land, freshwater and coastal environments under the RMA. The NPS-FM contains national objectives for protecting ecosystems, indigenous species and the values of outstanding water bodies and wetlands.

Future resource consents required for the development of the site will require compliance with relevant NES-F regulations in relation to natural inland wetlands, noting that a consenting pathway is provided for urban development (refer Regulation 45C).

9.5.3 Operative Kaipara District Plan 2013

The operative KDP sets out a number of policies and objectives that gives effect to the RMA to promote the sustainable management of natural and physical resources. This section addresses the objectives and policies set out in the KDP pertaining to ecology.

Chapter 3A – Mangawhai Growth Area

Consistent with the relevant objectives within Chapter 3A of the KDP (Objectives 3A.4.4 & 3A4.6), the PPC provides for public open ecological spaces and parks within the Mangawhai Structure Plan Area. All areas of terrestrial and freshwater ecological value of note within the site are proposed to be protected, and protection of buffer areas provides opportunities for enhancement.

Chapter 4 – Mangawhai Harbour Overlay

The relevant objectives of the Mangawhai Harbour Overlay relate to protection of habitats and ecological values and protection and enhancement of the coastal edge, estuarine wetland and saltmarsh systems, wetlands and riparian corridors. There are specific policies requiring identification and mapping of areas of valued natural environment at the time of subdivision and development and careful management of subdivision and land use activities to avoid, remedy or mitigate adverse effects (including discharges) on the receiving environments. The PPC will identify the areas of valued natural environment, propose protection of these through the recommended restrictions on mammals, buffers and planting, lower density development adjacent to the north-western salt marsh and protection of harbour water quality through appropriate stormwater management.

Chapter 6 – Ecological Areas

Consistent with the objectives and policies in Chapter 6 of the KDP, through the recommended terrestrial vegetation protection and enhancement, the PPC will provide opportunity to maintain and enhance the quality of the existing ecological features and their fauna habitat values through revegetation planting, while allowing for appropriate subdivision.

Additionally, it has been demonstrated above that the adverse environmental effects of the PPC, including significant adverse effects from urban development on receiving waters, can be appropriately avoided, remedied or mitigated through water sensitive design.

9.5.4 Northland Regional Policy Statement

Consistent with the relevant objectives within the NRPS, the PPC proposes/provides for the following:

- Protect and improve freshwater and coastal water quality through the enhancement and protection of streams and wetlands within the site, water sensitive design, erosion and sediment control and the retirement of land from agricultural farming (Objective 3.2 Region-wide water quality).
- Stormwater management through water sensitive design to maintain flows to freshwater features (streams and wetlands) on site (Objective 3.3 Ecological flows and water level).
- Protection of significant indigenous vegetation and habitats of indigenous fauna, as well as enhancement of the existing areas through the recommended planting and weed and pest control (Objective 3.4 Indigenous ecosystems and biodiversity; Objective 3.15 Active management).

10 SUMMARY AND RECOMMENDATIONS

Viridis has assessed the site, which consists of the northern portion of the proposed PPC area. The impact of the rezoning from rural to residential and business zones has been considered in relation to the terrestrial, freshwater and coastal values present on and adjacent to the site. It is considered that a plan change is appropriate for the site to maintain and enhance the existing ecological values.

The most significant ecological values associated with the site are the values of the wetlands present on and adjacent to the site and the adjacent coastal environment. The wetlands have been degraded in the past by agricultural land use, modifications, weeds and pests, however there is potential to improve ecological values through buffer planting and weed and pest control. Very little native vegetation remains across most of the site and the terrestrial ecological values of the site are low - moderate.

The proposed approach to stormwater management will help to protect the site's wetlands, streams and adjacent coastal environment. Recommendations have been made regarding maintenance of buffers around the wetlands and coast and requiring planting and weed and pest control to improve the ecological values of these areas. Implementation of these recommendations and landscaping across the site will provide the opportunity to increase indigenous biodiversity and improve habitat values for indigenous fauna. Light pollution may affect birds utilising the adjacent coastal environment, and this should be considered in the design of the future developments. Mammals kept as pets may affect the ecological values of the wetlands and adjacent coastal areas, and therefore it is recommended that keeping of mammals (particularly cats) is controlled through covenants on properties and any walkways require dogs to be on-leash. Any walkway proposed within or adjacent to wetland and coastal areas should be designed to avoid adverse ecological effects on these environments.

Overall, it is considered that the outcomes of the proposed PPC are consistent with the objectives and policies of the KDP and NRPS. The KDP, NRPS, NRC PRP, NPS-IB, NPS-FM, NES-F and the Wildlife Act 1953 provide a framework to manage any proposed future development at the resource consenting phase, to ensure any development aligns with the relevant policies and regulations. Future subdivision and development in accordance with the proposed zoning is anticipated to result in the appropriate protection and enhancement of indigenous terrestrial, freshwater and coastal biodiversity values of the site as long as the recommendations in this report are implemented.

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Appendix A Watercourse Classification

Watercourse number	Classification	Natural pools	Well-defined channel, such that the bed and banks can be distinguished	Contains surface water more than 48 hours after rain	Rooted terrestrial vegetation is NOT established across the entire cross-sectional width	Organic debris resulting from flooding can be seen on the floodplain	Evidence of substrate sorting, including scour and deposition	Comments
1	Artificial drain	N/A	N/A	N/A	N/A	N/A	N/A	This watercourse receives water from the roadside drains along Black Swamp Road, which in turn are fed by a network of drains to the north of Black Swamp Road. The channel is straight and is visible in the 1961 aerial. There is no indication of remnant natural stream channels in this area in the historic aerials.
2	Artificial drain	N/A	N/A	N/A	N/A	N/A	N/A	Roadside drain along Black Swamp Road.
3	Artificial drain	N/A	N/A	N/A	N/A	N/A	N/A	Roadside drain along Black Swamp Road.
4	Artificial drain	N/A	N/A	N/A	N/A	N/A	N/A	Roadside drain along Raymond Bull Road.
5	Artificial drain	N/A	N/A	N/A	N/A	N/A	N/A	Drain appears to be present in 1961 aerial. Intermittently flowing.
6-10	Artificial drains and swales	N/A	N/A	N/A	N/A	N/A	N/A	Network of drains in area of pasture. Constructed 1977 – 1982. Prior to 1977 an alternative arrangement of constructed drains was present running diagonally to the current drain layout.
11-13	Swales	N/A	N/A	N/A	N/A	N/A	N/A	Aerials indicate these swales were constructed between 1977 and 1982.
14	Swale	N/A	N/A	N/A	N/A	N/A	N/A	This appears to be visible in the 1961 aerial. Its straight nature along a fence line indicates its artificial nature.

Watercourse number	Classification	Natural pools	Well-defined channel, such that the bed and banks can be distinguished	Contains surface water more than 48 hours after rain	Rooted terrestrial vegetation is NOT established across the entire cross-sectional width	Organic debris resulting from flooding can be seen on the floodplain	Evidence of substrate sorting, including scour and deposition	Comments
15-17	Swales	N/A	N/A	N/A	N/A	N/A	N/A	Aerials indicate these swales were constructed between 1982 and 1996. Prior to this there was an alternative drain layout with drains/swales running diagonally to the present swales (18-20).
18-20	Swale	N/A	N/A	N/A	N/A	N/A	N/A	Aerials indicate these swales were constructed prior to 1961. They do not appear to have been maintained in recent years.
21	Swale	N/A	N/A	N/A	N/A	N/A	N/A	Aerials indicate this swale was constructed 1977-1982.
22	Swale	N/A	N/A	N/A	N/A	N/A	N/A	This swale was likely constructed prior to 1961, although it is obscured by vegetation in aerial photos.
23	Drain	N/A	N/A	N/A	N/A	N/A	N/A	This is a main drain along an accessway connecting to the road side drain. Aerials indicate it was likely constructed prior to 1961. There was water present in this drain at the time of the site visits.
24	Drain	N/A	N/A	N/A	N/A	N/A	N/A	Aerials indicate this drain was likely constructed prior to 1961.
25-27	Swales	N/A	N/A	N/A	N/A	N/A	N/A	Aerials indicate these swales were likely constructed prior to 1961.

Watercourse number	Classification	Natural pools	Well-defined channel, such that the bed and banks can be distinguished	Contains surface water more than 48 hours after rain	Rooted terrestrial vegetation is NOT established across the entire cross-sectional width	Organic debris resulting from flooding can be seen on the floodplain	Evidence of substrate sorting, including scour and deposition	Comments
28	Swale / modified ephemeral stream	✗	✓	✗	✗	✗	✗	This watercourse has some meandering visible in aerial imagery, suggesting that it may be a remnant of a natural feature, however it is not connected to any other apparently natural feature. The channel is shallow, dished and swale-like. It was present in 1961. At the time of the 11/6/24 site visit (which followed rainfall) there was no water present in the channel. The catchment area is small and the surrounding topography is flat. If it is a remnant natural watercourse, the classification assessment indicates that it would be an ephemeral stream.
29	Drain	N/A	N/A	N/A	N/A	N/A	N/A	This drain was clearly visible in the 1982 aerial. There is some suggestion that it may have been present earlier, perhaps prior to 1961, however it was obscured by vegetation.
30, 31, 34	Drains	N/A	N/A	N/A	N/A	N/A	N/A	Aerials indicate these were likely present prior to 1961
32	Swale	N/A	N/A	N/A	N/A	N/A	N/A	It is unclear from aerial imagery when this swale was constructed.
33	Drain	N/A	N/A	N/A	N/A	N/A	N/A	
35	Drain	N/A	N/A	N/A	N/A	N/A	N/A	Aerials indicate this drain was constructed prior to 1961.

Watercourse number	Classification	Natural pools	Well-defined channel, such that the bed and banks can be distinguished	Contains surface water more than 48 hours after rain	Rooted terrestrial vegetation is NOT established across the entire cross-sectional width	Organic debris resulting from flooding can be seen on the floodplain	Evidence of substrate sorting, including scour and deposition	Comments
36	Swale	N/A	N/A	N/A	N/A	N/A	N/A	It is unclear from aerial imagery when this swale was constructed.
37	Drain	N/A	N/A	N/A	N/A	N/A	N/A	This drain was constructed between 1982 and 1996 with construction of the farm accessway.
38-39	Swales	N/A	N/A	N/A	N/A	N/A	N/A	These swales were constructed 1977 – 1982 with establishment of horticulture.
40	Drain	N/A	N/A	N/A	N/A	N/A	N/A	It is unclear from aerial photos when this drain was constructed – possibly prior to 1961, or 1977-1982. There is no evidence of a natural watercourse in this location previously. There is saltwater influence in the lower reaches of this drain.
41	Drain	N/A	N/A	N/A	N/A	N/A	N/A	This drain was likely constructed 1977-1982 with construction of an accessway. It was not visible in aerials prior to this. There is some salt water influence in this drain.
42	Drain							This drain was likely constructed since 1982. It was not visible in aerials prior to that date. There is some salt water influence in this drain.
43-44	Drain	N/A	N/A	N/A	N/A	N/A	N/A	These drains were likely constructed 1977-1982. They are not visible in aerials prior to this. There is some salt water influence in these drains.

Watercourse number	Classification	Natural pools	Well-defined channel, such that the bed and banks can be distinguished	Contains surface water more than 48 hours after rain	Rooted terrestrial vegetation is NOT established across the entire cross-sectional width	Organic debris resulting from flooding can be seen on the floodplain	Evidence of substrate sorting, including scour and deposition	Comments
45-47	Drains (within salt marsh)	N/A	N/A	N/A	N/A	N/A	N/A	These drains were likely constructed 1977-1982 with establishment of paddocks within the salt marsh area. As they are within wetland / salt marsh, they are technically classified as wetland.
48-49	Drain / swales	N/A	N/A	N/A	N/A	N/A	N/A	This drain and swale were constructed 1977-1982.
50-51	Drain / swale	N/A	N/A	N/A	N/A	N/A	N/A	Roadside drains.

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