VIRIDIS
Environmental Consultants

Pukekohekohe Gateway Plan Change

Ecological Impact Assessment

Prepared for: Auckland Thoroughbred Racing Incorporated

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Cover photo: Looking south over the Pukekohekohe Gateway Plan Change area, photo taken 5 June 2024.

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1 EXECUTIVE SUMMARY

Auckland Thoroughbred Racing Incorporated (ATR) engaged Viridis Limited (Viridis) to undertake an ecological impact assessment (EcIA) of approximately 22.96 ha of land within the Pukekohe Racecourse at 222-250 Manukau Road that is subject to a proposed Private Plan Change (PPC) to rezone land. The land is currently zoned mainly as Special Purpose – Major Recreation Facility Zone (MRFZ) under the Auckland Unitary Plan Operative in Part (AUP-OP) and is part of the Pukekohe Park sub-precinct (PPSB). It is proposed to be rezoned to "Residential – Mixed Housing Urban (MHU, 20.824 ha) and Open Space – Informal Recreation Zone (OS-ORZ, 2.143 ha).

This report details the ecological assessments that were undertaken by Viridis to determine the ecological features within the Pukekohekohe Gateway Plan Change area and the significance of those features. Within this assessment, Viridis has considered the ecological value of existing terrestrial and freshwater features and evaluated how the proposed land use change from recreational to residential may impact these ecological values. Where required, recommendations are provided to aid in the avoidance, minimisation, or remediation of adverse effects.

The current ecological values of the area assessed are currently low-moderate, with watercourses and terrestrial habitats having been highly modified due to the historic land uses and drainage works. The most significant ecological values associated with the PPC area are the values of the adjacent Tutaenui Stream and the potential values of the streams on the site. The streams on the site are currently in a degraded state due to a history of channel and riparian modifications, however channel restoration and riparian planting has the potential to improve their ecological values. Very little native vegetation is present on the site and the terrestrial ecological values of the site are generally low, providing limited habitat for birds, bats and lizards.

The proposed zone change from MRFZ to MHU and OS-ORZ, along with the site-specific precinct requirements proposed, provides for the maintenance and enhancement of ecosystem services and indigenous biodiversity while enabling the appropriate future subdivision, use, and development of urban land. The assessment has been informed by relevant regulations, including the National Policy Statement for Indigenous Biodiversity (NPS-IB), the National Policy Statement for Freshwater Management 2020 (NPS-FM) the National Environmental Standards for Freshwater 2020 (NES-F) and the AUP-OP.

2 INTRODUCTION

2.1 Overview

The PPC area is comprised of parts of four parcels of land at 222-250 Manukau Road, Pukekohe (Lot 2 DP 337473, Lot 2 DP 100207, LOT 3 DP 511480 and LOT 2 DP 511480), totalling approximately 22.96 ha. The location of the Pukekohekohe Gateway Plan Change area is shown in Figure 1 and the boundaries of the proposed plan change area and the area assessed in this report (which is made up of sub-precincts A and B and is referred to as 'the site' in this report) are shown in Figure 2.

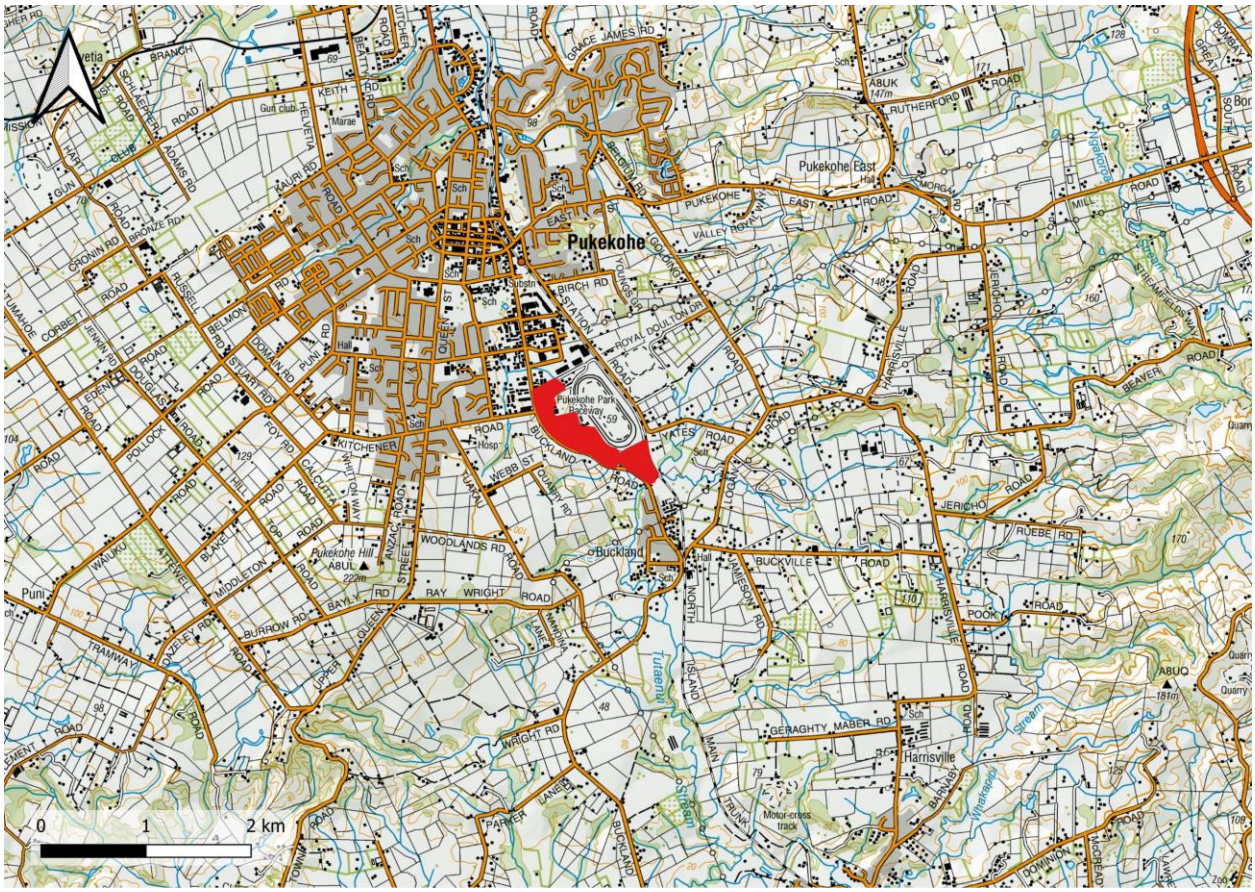


Figure 1. Pukekohekohe Gateway Plan Change area location as indicated by red polygon (map source: LINZ NZ Topo 50).

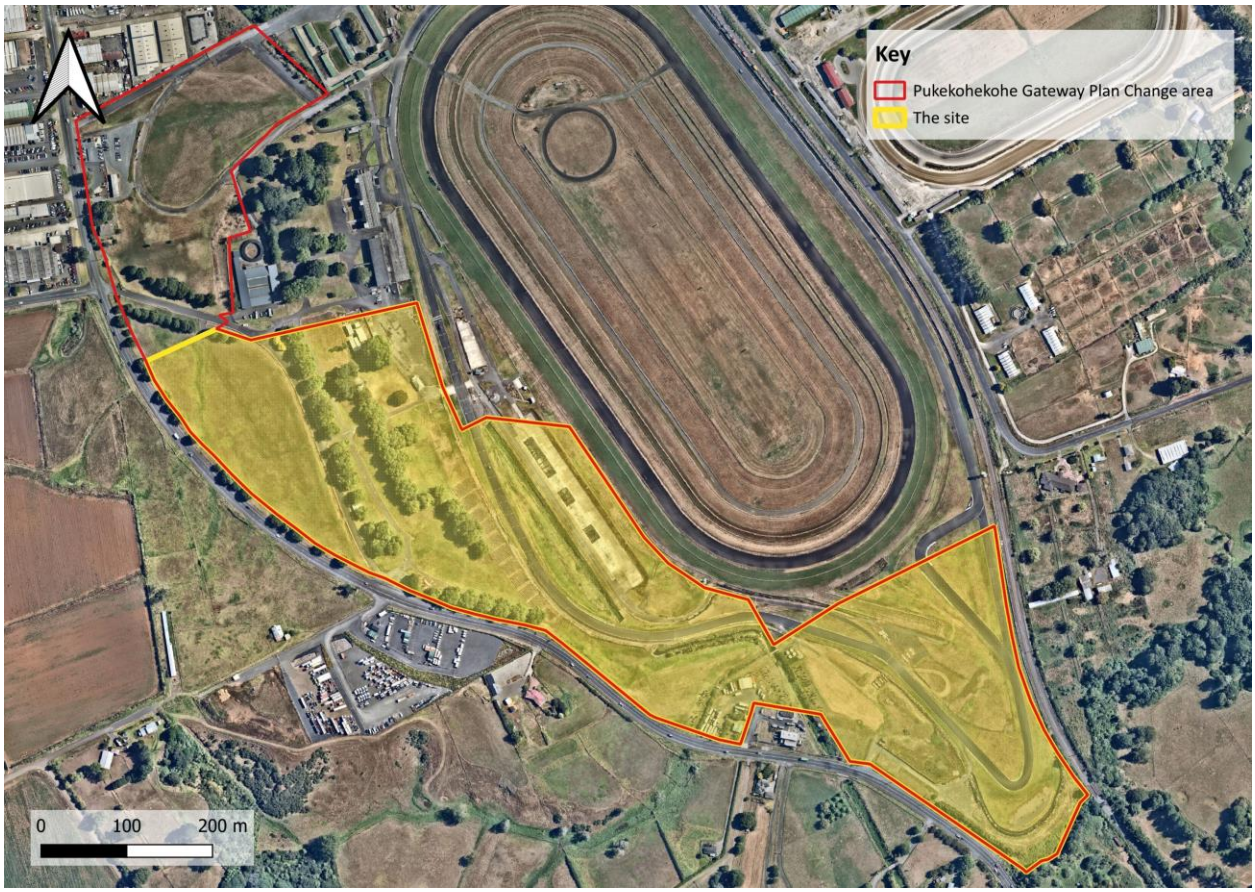


Figure 2. Site extent (aerial source: Nearmaps, 2024).

2.2 Report Scope

Viridis was engaged by the client to undertake an EcIA for the PPC application under the AUP-OP and other relevant statutory documents. 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 terrestrial and freshwater 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 terrestrial and freshwater 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, site visits by suitably qualified ecologist and fauna surveys. 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 on Auckland Council's Geomaps (such as current biodiversity layers, predicted watercourses and site topography) was also undertaken.

An initial site assessment was undertaken on 14 August 2024[1], during which the presence and extent of freshwater and terrestrial features within the plan change area and the 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.

3.2 Terrestrial Ecology

3.2.1 Overview

The vegetation on the site was assessed during the 14 August 2024 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. In addition, fauna surveys were undertaken for lizards, bats and birds in accordance with the methodologies described below.

3.2.2 Herpetofauna survey

During the site visits, opportunistic observations of potential lizard habitat were made. In addition, formal lizard surveys were undertaken under the oversight of a DoC certified herpetologist.

Artificial cover object (ACO) survey

A lizard survey that utilised artificial cover objects (ACOs) was undertaken within the site. A total of 37 stations were set. The survey was undertaken in general accordance with DOC's 'Herpetofauna: artificial retreats' protocol with the aim of determining species presence/absence (Lettink 2012).

Each ACO consisted of a stack of two Onduline sheets (corrugated roofing material). Small woody debris (e.g., twigs/sticks) were placed between the sheets to create space for lizards to inhabit. ACOs were placed in transects in areas of potentially suitable lizard habitat (e.g., rank grass, piles of woody debris, dense ground cover vegetation) (Figure 3). Note that the location of each ACO along the transect was determined by the shape of the habitat type and constraints such as potential disturbance by grounds-keeping workers and access. Therefore transects were not necessarily straight lines and ACOs were not equidistant along the transect. Figure 4 shows the locations of the deployed ACOs.

The ACOs were left in place for more than four weeks prior to being checked, to allow any lizards to inhabit them. Each ACO stack was checked during fine weather conditions on 1/11/2024, 3/12/2024 and 10/12/2024. ACOs were approached quietly prior to checking, and the Onduline sheets lifted (with one

[1] The weather at the time of the 14/8/24 site visit was fine. 4.5 mm of rain had fallen in the preceding 48 hours and 20.5 mm in the preceding 7 days (Auckland Council rainfall monitoring station Ngakoroa @ Donovans).

side still on the ground) one at a time to record any lizards present. The number of lizards and species found in/under each ACO was recorded. Any lizards observed basking on top of the ACOs were included in the counts. Note that several ACOs had to be abandoned over the course of the survey:

- Three were unable to be found at the south-eastern end of the site during the later surveys due to significant weed growth and/or possible disturbance;
- One ACO along the south-western boundary was buried beneath a pile of mulch before the last survey; and
- One ACO near buildings in the north-west of the site had to be retrieved partway through deployment due to disturbance during site operations.

Potential skink habitat in the areas where the ACOs were placed were hand-searched on site alongside the ACO checks – habitat investigated included beneath wood pallets, fallen signs, other debris, logs and weedy vegetation.

Figure 3. Examples of ACOs made of Onduline stacks placed in areas of potential lizard habitat within the site (e.g. rank grass, leaf litter, woody debris).

Nocturnal spotlighting

To survey for potential presence of semi-arboreal and arboreal geckos, night spotlighting was undertaken on 3 and 10 December 2024 during dry, warm and calm weather. Visual searches began approximately one hour after dark and continued for 1.5 hours. Searches occurred across two nights and were undertaken by two ecologists, with a total of six search hours completed.

The areas spotlighted are shown in Figure 4. Searches involved using torches to visually scan any potential habitat across the site (e.g., tree foliage along watercourses and shelterbelts) for signs of lizard presence, such as eye reflections and visual anomalies of colour amongst the foliage (Hare 2012).

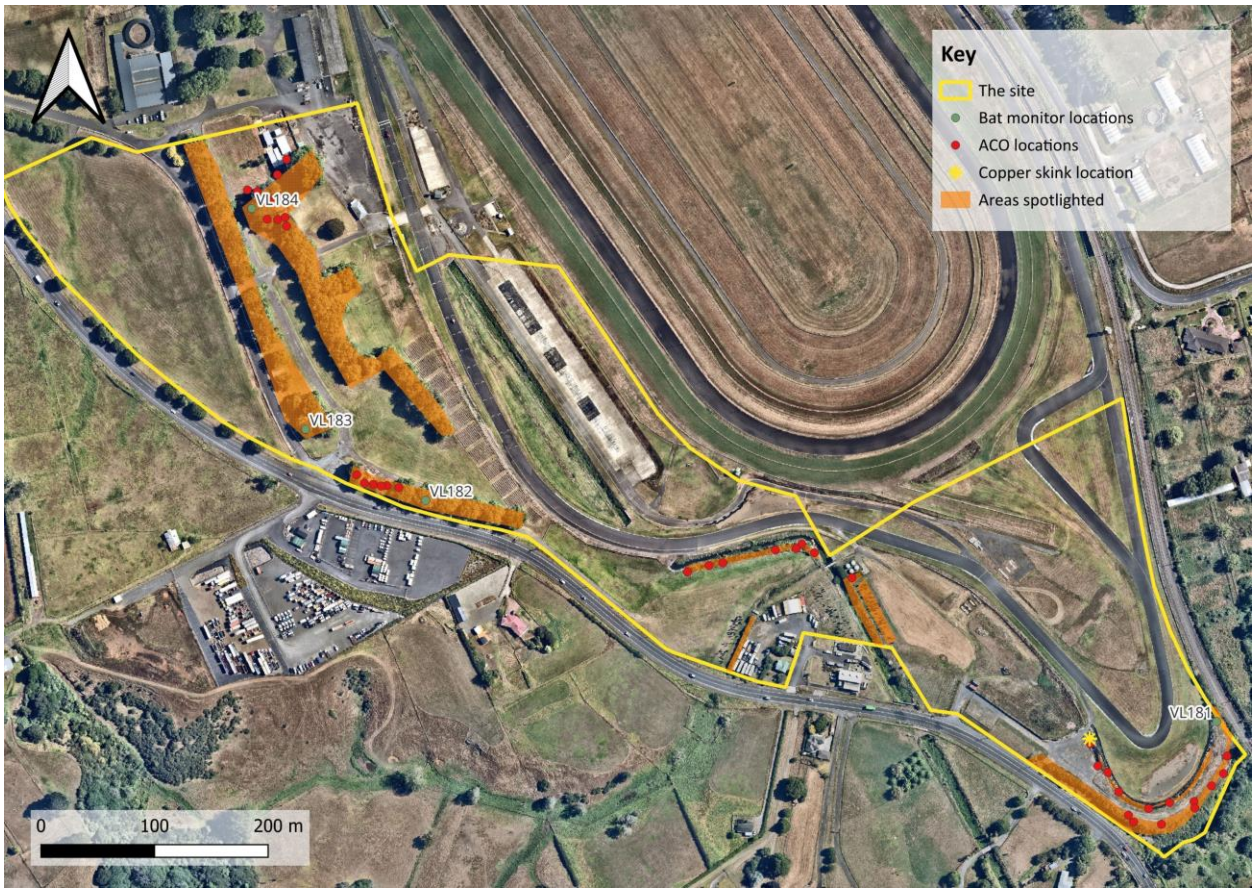


Figure 4. Fauna survey locations.

3.2.3 Bat survey

An acoustic bat survey using automatic bat monitors (ABMs) was undertaken within the site to detect potential bat presence. Four 'Song Meter Mini Bat Ultrasonic Recorders' were placed within the most likely areas of bat habitat (i.e. trees with features that indicate roost potential e.g. cavities) between 11 September 2024 and 1 November 2024 (51 nights). Their locations are denoted by "VL18X" and green dots in Figure 4 and examples of their placement shown in Figure 5.

The survey was undertaken in accordance with DOC's bat inventory and monitoring toolbox (Sedgeley 2012). ABMs were deployed across the site in locations where bat activity was considered most likely (e.g., mature trees, near watercourses). Each ABM was secured to a tree approximately two metres off the ground. The ABMs were set to record from 30 minutes before sunset until 30 minutes after sunrise.

There are no standardised environmental variables for acoustic surveys for long-tailed bat activity in New Zealand, and acoustic detection may only detect bats on a subset of surveyed nights, even in locations where bats are known to occur. Bat activity is generally known to be influenced by weather conditions such as temperature, rainfall, wind, humidity and moon phases (e.g., O'Donnell 2000; Borkin et al. 2023). The literature indicates that determining optimal weather conditions is complex and can vary between species and regions (Borkin et al. 2023).

However, based on the best available data, the following key environmental conditions have been considered when assessing the number of optimal nights surveyed:

- Temperature of ≥ 8 °C within the first four hours following sunset
- Rainfall of < 2.5 mm within the first four hours following sunset

- No more than light average wind speeds (<10 km/hr)

Climatic information for these factors were reviewed using the Auckland Council weather monitoring station "742824 - Mauku RAWS @ Mauku", which is 8.8 km to the west of the site. Thirty-two nights out of those surveyed fell within the optimal weather wind conditions outlined above.

Analysis of echolocation data files captured by the ABMs was carried out using Anabat Insight software.

It should be noted that acoustic surveys provide presence/absence and distribution data, rather than abundance information.

Figure 5. Examples of ABMs set out on site.

3.2.4 Avifauna

Opportunistic sightings of avifauna were recorded during each of the six site visits and the conservation status of the species, as defined in Robertson et. al. (2021), was noted.

3.3 Freshwater Ecology

3.3.1 Initial assessment

During the initial 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 AUP-OP definitions to determine, in accordance with the definitions in the AUP-OP, the ephemeral, intermittent or permanent status of the watercourse.

3.3.2 SEV

The Stream Ecological Valuation (SEV) methodology is a comprehensive method for quantifying the value of aquatic ecosystems, enabling the overall function of the streams to be assessed and compared to the quality of other streams in the Auckland region. It considers 16 different stream functions that

are grouped into four categories: hydraulic, biogeochemical, habitat provision and biodiversity. Each function is scored and the SEV score is an average of all the function scores. The background and basis for the method is described in Storey *et al*. (2011) and details of its application in Neale *et al.* (2011). Data collection involves flow estimation, analysis of stream channel morphology (width, depth and substrate particle size, or roughness) from ten transects across each reach assessed. Field data is complemented by desktop information such as the area of impervious surfaces, flooding frequency and catchment size. The data is manipulated using a series of formulae in order to produce an SEV score of between 0 (severely degraded with no ecological value) and 1 (a pristine stream with very high ecological value).

SEV assessments were undertaken on 11/09/2024[2] of 100 m representative reaches within Watercourses 1 and 2 in order to assess the current ecological values of the streams (the locations of these watercourses are shown in Figure 13).

3.3.3 Fish

To provide an indication of the fish communities present, four fyke nets and eight Gee's minnow traps were set out overnight on 3/12/2024[3] in Watercourse 1 and two fyke nets and five Gee's minnow traps in Watercourse 2 (see Figure 13 for the watercourse locations) in the same reaches assessed in the SEV. The nets and traps were baited with marmite and left overnight. Only fine meshed fykes with a separator grill were used and all nets and traps were set with an airspace to provide trapped fish access to atmospheric oxygen (Figure 6). All traps were checked the following morning, and all fish captured were identified and counted before being returned to their habitats.

An index of biotic integrity (IBI) was calculated for each stream based on fish species present, altitude and distance inland (MfE, 2023).

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

Figure 6. a) Fyke net and b) Gee's minnow trap set in the assessment reaches.

[2] The weather at the time of the 11/09/24 site visit was fine. 1 mm of rain had fallen in the preceding 48 hours and 12.2 mm in the preceding 7 days (Auckland Council rainfall monitoring station Ngakoroa @ Donovans).

[3] The weather at the time of the 3/12/24 and 4/12/24 site visits was fine. 1.5 mm of rain had fallen in the preceding 48 hours and 23.5 mm in the preceding 7 days (Auckland Council rainfall monitoring station Ngakoroa @ Donovans).

3.3.4 Macroinvertebrates

Sampling

The assessment reaches were the same as the SEV survey reaches. These streams are modified streams with soft-bottoms, with the dominant substrate being silt. As such, protocol 'C2: soft-bottomed, semi-quantitative' was applied for macroinvertebrate sampling (Stark et al., 2001). A composite sample was collected by sweeping a net (with an aperture of 400 mm and mesh size of 0.5 mm) through the stream substrate for a distance of one metre, and/or woody debris brushed to dislodge organisms, followed by three cleaning sweeps to collect organisms in the water column. The substrates were sampled in proportion to their prevalence along the reach. Each sample unit was approximately 0.3 m^2. This was repeated at 10 different locations within the 100 m stream reach, to give a total sampling area of 3 m^2 at each site.

All samples were preserved in 70% ethanol for later identification and inventory.

Analysis

Benthic macroinvertebrates were identified and counted to a level suitable for calculating taxa richness, abundance, EPT taxa richness and % EPT, macroinvertebrate community index (MCI) and quantitative MCI (QMCI) following protocols outlined in NEMS (2022) and Stark et al. (2001).

EPT is the number of taxa that belong to the Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxonomic groups.

Taxa richness is a measure of the number of invertebrate taxa in a sample. In general, watercourses that support a high number of invertebrate taxa are more likely to be of a higher environmental quality than watercourses with few taxa present. However, interpretation of taxa number data as an environmental indicator is dependent on the pollution sensitivity or tolerance of taxa present.

Abundance is a measure of the total number of invertebrates in a sample. Invertebrate abundance tends to increase in the presence of organic or nutrient enrichment and decreases in the presence of toxic contaminants.

EPT taxa are generally sensitive to changes in water and habitat quality. Percent EPT (%EPT) is a measure of the proportion of EPT taxa making up the community. EPT and % EPT values can provide a good indication of stream health, with high values indicating good water/habitat quality and low values indicating poor water/habitat quality.

The MCI and QMCI are biological indices that are based on indicator scores between 1 and 10, which are assigned to each taxon based on their sensitivity to organic enrichment. Although developed to assess nutrient enrichment, these scores are now used to assess the general health of New Zealand streams. MCI scores are based on presence/absence data, while the QMCI incorporates abundance data. Higher MCI and QMCI indicate better habitat and water quality. Scores were compared to the attribute bands and national bottom line (NBL) defined in the National Policy Statement for Freshwater Management 2020 (NPS-FM). The relevant NPS-FM attribute bands and NBLs are reproduced in Table 1.

Table 1. Estimates of stream health using MCI and QMCI indices.

NPS-FM (2020)			
Attribute band	**Description**	**Numeric attribute states**	
		MCI	**QMCI**
A	Pristine conditions	>130	≥6.5
B	Mild pollution	≥110 and <130	≥5.5 and <6.5
C	Moderate pollution	≥90 and <110	≥4.5 and <5.5
National bottom line		90	4.5
D	Severe pollution	<90	<4.5

Macroinvertebrate samples were analysed and statistics calculated by Environmental Impact Assessments Ltd (EIA).

3.3.5 Wetlands

Where appropriate, potential wetland areas were assessed in accordance with wetland delineation protocols (MfE 2022, Clarkson 2014) to determine if an area met the regulatory definition of 'natural inland wetland' (NPS-FM 2020). Assessments were carried out within the 'growing season' for the Auckland region (MfE, 2021). 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), MfE (2021) and Fraser *et al*. (2018).

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.

3.4 Ecological Impact Assessment

The overarching approach of this analysis and reporting is to ascertain the existing ecological values on the site and determine the impact of the proposed works on those values.

The ecological value of the site, relating to species, communities and systems, were determined as per the Environment Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment guidelines (EcIAG) for use in New Zealand (Roper-Lindsay et. al. 2018). 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 2. 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 Manukau Ecological District (ED) of the Auckland Region. The original forest of the Manukau ED included the most southerly common occurrence of characteristic North Island lowland forest types containing abundant taraire (*Beilschmiedia tarairi*) and pūriri (*Vitex lucens*). Alluvial flats and terraces throughout the Manukau ED once supported extensive stands of kahikatea swamp forest, but these have been largely drained and converted to farmland. Only around 2% of the original podocarp / broadleaf forest and 0.4% of the original freshwater and wetland forest remains (Lindsay *et al*., 2009).

Auckland Council's Geomaps Ecosystem extent layers indicate that historically (pre-human), most of the site would have been pūriri and taraire forest (WF7-2 from Singers *et al*., 2017). The north eastern, flatter parts of the site would have been bog /fen mosaic (WL2, WL3, WL12). A variety of native flora would potentially have been present, including mānuka (*Leptospermum scoparium*), greater wire rush (*Empodisma robustum*), tangle fern (*Gleichenia dicarpa*), bamboo rush (*Sporadanthus ferrugineus*), *Coprosma, Dracophyllym*, kahikatea, pukatea (*Laurelia novae-zelandiae*), swamp maire (*Syzygium maire*), pūriri, karaka (*Corynocarpus laevigatus*) and kohekohe (*Didymocheton spectabilis*). This would have supported a diverse community of invertebrates, amphibians, fish, reptiles, birds and bats (Singers *et. al.* 2017).

4.2 Local Context

The topography of the site is fairly flat along the eastern and north eastern sides, and sloping upwards in the west. A review of the historical aerial imagery shows that the site, and much of the surrounding landscape was already developed for agricultural purposes by 1942, with vegetation having being cleared, drainage channels constructed, wetlands drained and the adjacent horse racing track already constructed (Figure 3). With the railway line connection occurring around 1875 and major market gardens in the area from the 1890s, it is likely that the site was initially developed around 120 years ago. The adjacent horse racecourse is understood to have been constructed around 1920.

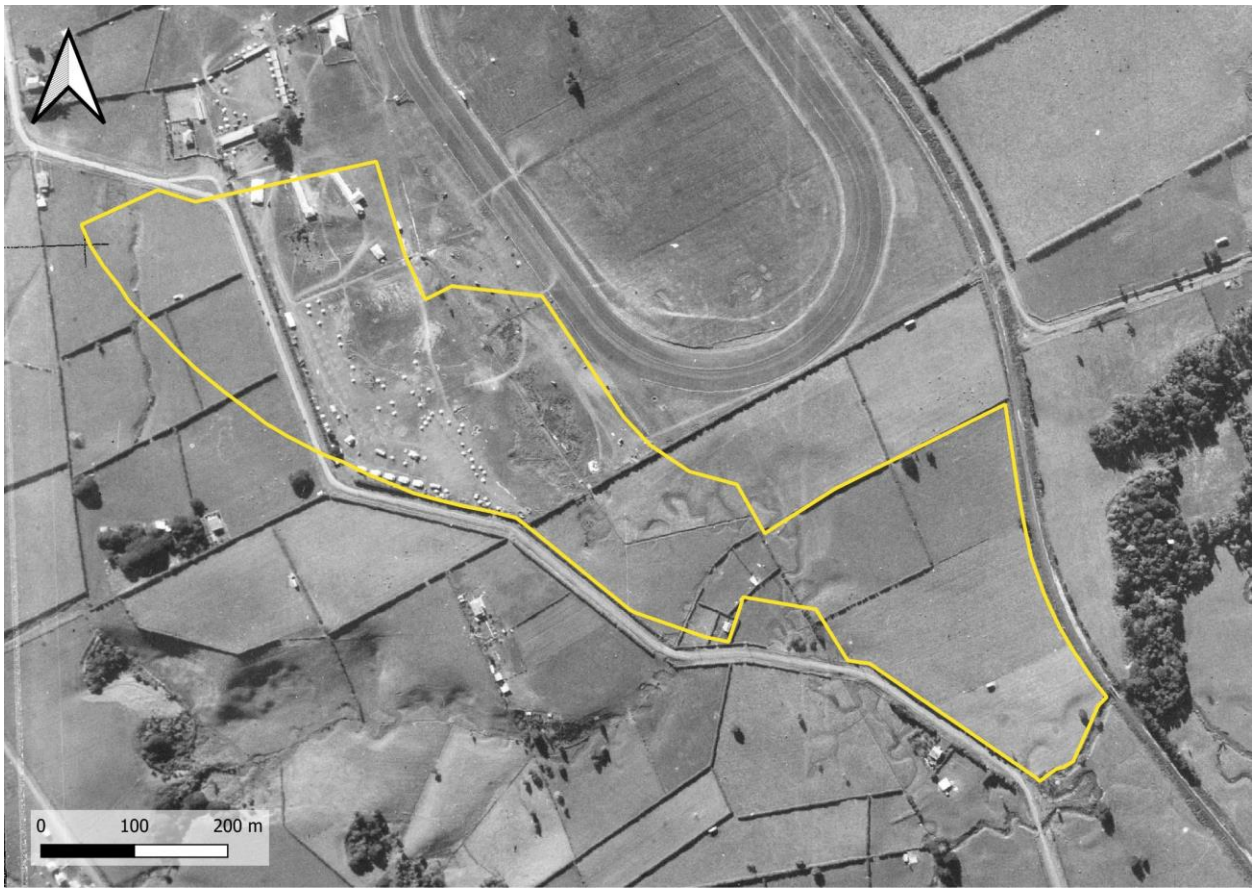


Figure 7. Historical aerial imagery of the site, dated 1942 (aerial source: Retrolens).

The site is currently occupied by ATR and is known as Pukekohe Park. The site contains a motor sport racing track, which was in use since the 1960s and recently ceased operation. A horse racing track is immediately adjacent to the north-east. The site contains a number of buildings associated with horse and motor sport racing. The wider area is mainly rural, with the commercial and residential areas of Pukekohe nearby to the north and north-west.

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 8). The majority of the vegetation present was mown grass. Amenity plantings make up most of the trees present on the site. Only a relatively small amount of native vegetation was present.

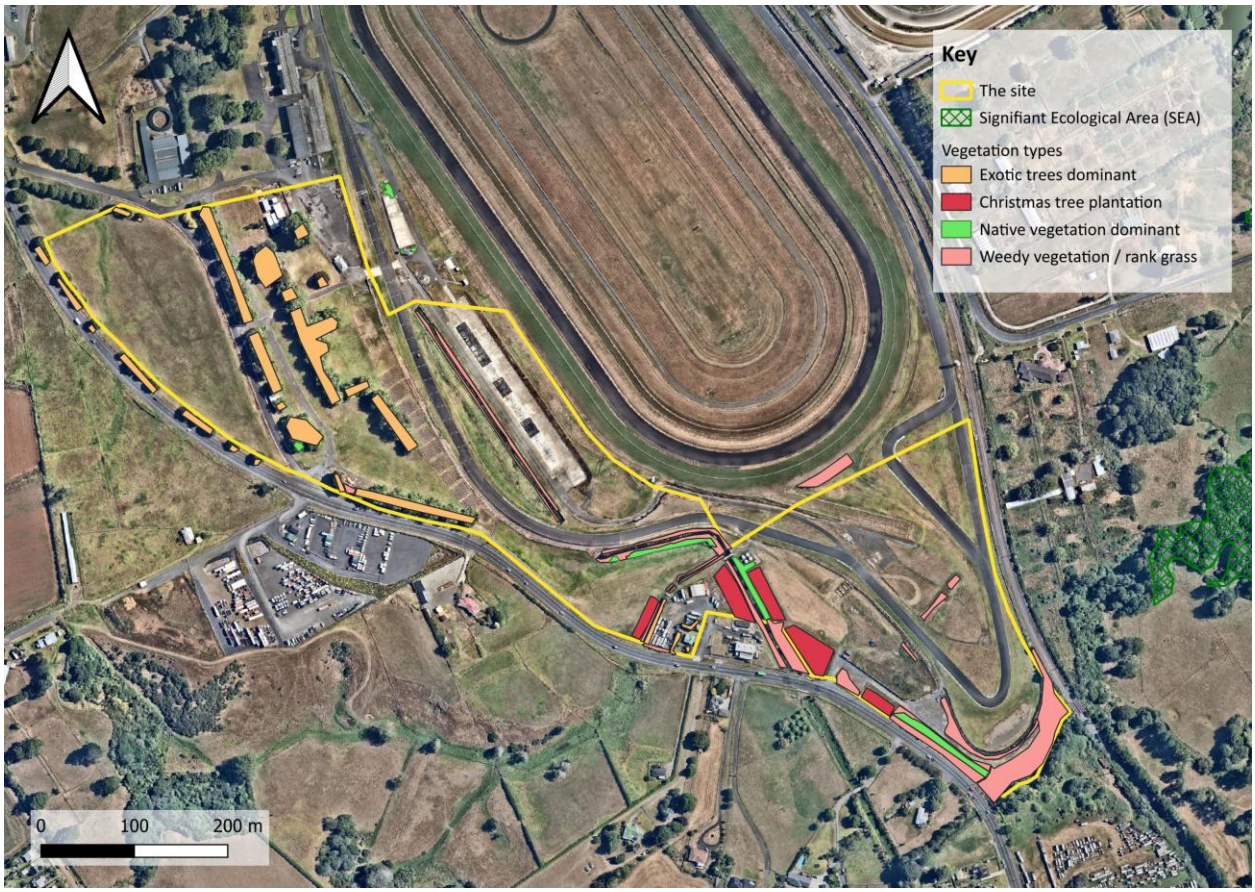


Figure 8. ~~Vegetation types on the site~~ (aerial source: Nearmaps, 2024).

5.1.2 Exotic trees dominant

There are a number of large exotic trees in the northwestern end of the site, planted for amenity purposes. Most of these trees are London Plane (*Platanus x acerifolia*). The arborist's report (Greenscene, 2024) details the range of other species present. These trees are underlain for the most part by mown grass (Figure 9a), except for a group in a sloping area that is unmown beneath (Figure 9b).

Approximately 100 trees have been scheduled as notable trees, however the specific locations of these trees have not been recorded by Auckland Council and Greenscene (2024) has found significant issues with the accuracy and detail (including in relation to the quality) of trees within the schedule. Therefore there is the potential that the Notable Tree schedule in the AUP-OP will be revised in the future and the number of trees protected may decrease.

a)

b)

Figure 9. Exotic trees on the site.

The ecological value of these areas dominated by exotic trees is considered to be **low**, given the high edge effects and exotic species. However, as described in Section 5.2, it is possible they may provide some habitat for bats and lizards.

5.1.3 Christmas tree plantations

In several locations around the site small pine trees are planted in rows with mown grass beneath. It is understood that these are harvested as Christmas trees.

a)

b)

Figure 10. Christmas tree plantations on the site.

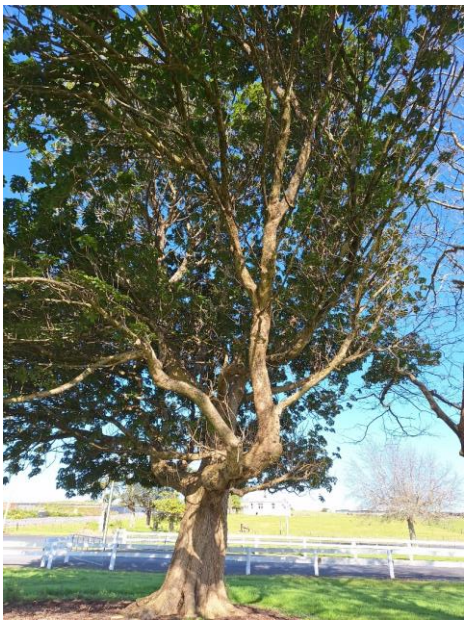
The ecological value of these plantations is considered to be **low**, given the exotic species, lack of complexity of habitat and mown grass beneath.

5.1.4 Native vegetation dominant

Some limited native revegetation planting has been undertaken along some stream riparian margins and the site boundary in the south-eastern end of the site. The species present include flax (*Phormium tenax*), cabbage tree (*Cordyline australis*), karo (*Pittosporum crassifolium*), kauri (*Agathis australis*), pūriri, karamū (*Coprosma robusta*), taupata *(Coprosma repens*), tarata (*Pittosporum eugenioides*), *Olearia paniculata*, akeake (*Dodonaea viscosa*) and mānuka. There is also a single large specimen pūriri tree in the north-western end of the site. There are no Significant Ecological Areas (SEA) present on the site.

The ecological value of these areas of native vegetation are considered to be **low-moderate**, given the high edge effects, lack of mature trees, and their lack of linkages to other areas of native vegetation. These areas do provide potential lizard habitat (although the lizard surveys only found the exotic plague skink in these locations) however, the mature pūriri tree provides potential bat habitat, and the vegetation along stream riparian margins provides some values to streams such as limited shading and filtering.

a)



b)

c)

Figure 11. Native vegetation on the site a) mature pūriri, b) riparian planting, c) boundary planting.

5.1.5 Weedy vegetation / rank grass

Most of the grass on the site is mown and short, however there are some areas of longer grass present along stream riparian margins and drains, although this appears to be managed through spraying, restricting the extent of growth. There are also some areas of weedy, mainly exotic, vegetation along riparian margins and tyre barriers associated with the car racing track. There is a particularly extensive area of thick weedy vegetation at the eastern end of the site along the margins of the Tutaenui Stream. Species include pampas grass[4] (*Cortaderia selloana*), woolly nightshade[4] (*Solanum mauritianum*),

[4] Identified as a plant pest in the Auckland Regional Pest Management Plan 2020-2030 (Auckland Council, 2020)

periwinkle[4] (*Vinca major*), brush wattle[4] (*Paraserianthes lophantha*), Chinese privet[4] (*Ligustrum sinense*), tree privet[4] (*Ligustrum lucidum*), blackberry[4] (*Rubus fruticosus*), black nightshade (*Solanum nigrum*), barberry[4] (*Berberis darwinii* sp.), gorse[4] (*Ulex europaeus*), nasturtium (*Tropaeolum majus*), moth plant[4] (*Araujia hortorum*) and arum lily[4] (*Zantedeschia aethiopica*). Some native species are also present including karamū, wheki (*Dicksonia squarrosa*) and toatoa (*Haloragis erecta*).

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 5.2.2 (lizard surveys confirmed the presence of copper skinks) and provide some benefits where adjacent to streams.

a) **b)**

Figure 12. Weedy vegetation / rank grass on the site.

5.1.6 Mown grass

Much of the site that is not paved or in buildings is covered in grass. Site observations and aerial photos indicate that this is regularly mown. The ecological value of the mown grassed areas is considered to be **low** due to the lack of habitat diversity.

5.1.7 Terrestrial Connectivity and Ecological Function

The terrestrial vegetation on the site is limited and is confined mostly to amenity plantings of exotic trees, and native plantings and weedy vegetation along waterways and the site boundaries. Edge communities such as these increase 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 are only small areas of vegetation, both exotic and native, present within the site and these are 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 clearly demonstrated on the site by the abundance of exotic weedy species. Despite this degradation, the vegetated margins of waterways

on the site provide some ecological functions. These include limited shading, bank stability, erosion protection, surface water filtration, and potential habitat for fauna.

There is very little native terrestrial vegetation in the surrounding area, with just a few pockets present. The nearest vegetation identified as SEA is a small area along the margins of the Tutaenui Stream 200 m to the north-east of the site. There are a few other small fragments 400m and more from the site associated with the same stream or its tributaries. Whilst the closest SEAs have the potential to be connected to the site through the Tutaenui Stream corridor, most of the vegetation present along the stream close to the site is dominated by exotic species. This means that there are currently limited opportunities for the vegetation on site to provide connectivity for highly mobile terrestrial fauna such as birds or bats that move between habitats while foraging, nesting and roosting. However, there is potential for an improvement in connectivity values in the future if a corridor of native vegetation is established along the Tutaenui Stream.

The connectivity and ecological functioning values of the site are considered to be **low**.

5.2 Terrestrial Fauna Habitat

5.2.1 Avifauna (birds)

Avifauna habitat within the site was limited to native revegetation planting, weedy vegetation, amenity plantings, and isolated trees. The limited tree and shrub vegetation within the site may provide low quality nesting and roosting habitat.

Table 3 provides a list of species that are expected to be present, at least periodically, within the site, and those that were observed on the site during the six site visits. Records retrieved from eBird.org and iNaturalist for nearby sites were used to indicate what other species may be present that were not observed during the site visits between August and December 2024.

The dominant avifauna community within the site is expected to contain a combination of common exotic and native species that are abundant in the wider Auckland region 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, 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 lack of suitable habitat within the site. It is possible that kākā (*Nestor meridionalis* – At-Risk, Recovering) may visit the area, although this would be expected to be present only fleetingly if at all.

Pipits (*Anthus novaeseelandiae*, At-Risk, Declining) can occur 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). There are very few records of this species in the surrounding area and as most of the site is highly managed, their preferred habitat type is limited, so it is unlikely that they would use this site for nesting and would likely only visit occasionally in low numbers.

The red billed gull (*Chroicocephalus novaehollandiae*, At Risk-Declining) is regularly recorded in the Pukekohe area. It is commonly found in towns and coastal areas. They breed in dense colonies in coastal areas. Therefore they may be found on the site from time to time, however would not use the site for nesting.

Birds within the site are expected to provide limited ecological functions within the site itself (e.g., seed dispersal, flower pollination, predation) due to the limited habitat available.

The ecological value of the site for avifauna was considered to be **low**.

Table 3. Birds known to be present in the wider area.

Common name	Species name	Conservation status	Observed on site
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised	
Australasian harrier	*Circus approximans*	Not Threatened	
Blackbird	*Turdus merula*	Introduced and Naturalised	✓
Black backed gull	*Larus dominicanus*	Not Threatened	
Canada goose	*Branta canadensis*	Introduced and Naturalised	
Californian quail	*Callipepla californica*	Introduced and Naturalised	
Chaffinch	*Fringilla coelebs*	Introduced and Naturalised	
Eastern rosella	*Platycercus eximius*	Introduced and Naturalised	✓
Fantail	*Rhipidura fuliginosa placabilis*	Not Threatened	✓
Goldfinch	*Carduelis carduelis*	Introduced and Naturalised	✓
Greenfinch	*Chloris chloris*	Introduced and Naturalised	✓
Grey teal	*Anas gracilis*	Not threatened	
Grey warbler	*Gerygone igata*	Not Threatened	✓
Kererū	*Hemiphaga novaeseelandiae*	Not Threatened	
Kingfisher	*Todiramphus sanctus vagans*	Not Threatened	✓
Mallard duck	*Anas platyrhynchos*	Introduced and Naturalised	✓
Morepork / ruru	*Ninox novaeseelandiae*	Not Threatened	
Myna	*Acridotheres tristis*	Introduced and Naturalised	✓
Paradise shelduck	*Tadorna variegata*	Not Threatened	
Pheasant	*Phasianus colchicus*	Introduced and Naturalised	✓
Pipit / Pīhoihoi	*Anthus novaeseelandiae*	At Risk, Declining	
Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	✓
Rock pigeon	*Columba livia*	Introduced and Naturalised	
Red-billed gull / Tarāpunga	*Chroicocephalus novaehollandiae*	At Risk, Declining	
Silvereye	*Zosterops lateralis lateralis*	Not Threatened	✓
Shining cuckoo	*Chrysococcyx lucidus*	Not Threatened	✓
Skylark	*Alauda arvensis*	Introduced and Naturalised	
Song thrush	*Turdus philomelos*	Introduced and Naturalised	
Sparrow	*Passer domesticus*	Introduced and Naturalised	✓
Spotted dove	*Spilopelia chinensis*	Introduced and Naturalised	✓

Common name	Species name	Conservation status	Observed on site
Spurwinged plover	*Vanellus miles novaehollandiae*	Not Threatened	✓
Starling	*Sturnus vulgaris*	Introduced and Naturalised	✓
Tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened	✓
Turkey	*Meleagris gallopavo*	Introduced and Naturalised	
Welcome swallow	*Hirundo neoxena neoxena*	Not Threatened	✓
White faced heron	*Egretta novaehollandiae*	Not Threatened	
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 are 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 6/11/2024) found a low number of records for lizard species within 10 km of the site. The most commonly recorded species were the introduced plague skink (*Lampropholis delicata*) and the copper skink (*Oligosoma aeneum* – At-Risk, declining). There was one record for ornate skink (*Oligosoma ornatum* – At-Risk, declining) in 1955. There were no records for gecko species found in the Auckland Region such as forest gecko (*Mokopirirakau granulatus* – At-Risk, declining) and elegant gecko (*Naultinus elegans* – At-Risk, declining).

During the site visits, opportunistic observations of potential lizard habitat were made. The main potential skink habitat present was in the areas of weedy vegetation and long grass along watercourses and the site boundaries. Copper skink may be present in these areas in suitable habitat (thick rank grass, log/rock/vegetation/rubbish debris). Given the paucity of observations in the surrounding area and lack of connection to other suitable habitat, it is considered unlikely that other skink species such as the ornate skink are present. The lack of mature native vegetation on the site, lack of connection to other areas of bush, and the lack of observations in the surrounding area mean that it is unlikely that geckos are present on the site. Pest mammals present on the site are also likely to adversely affect native lizard populations on the site.

The ACO surveys and hand searches beneath other debris and amongst long grass found a large number of the introduced plague skink (61 in total, with more observed incidentally amongst grass and weedy vegetation during the site visits). A single copper skink was found.

Most plague skinks and the copper skink were found at the south-eastern end of the site, near to the Tutaenui Stream. This area is along an accessway that runs parallel to the Tutaenui Stream and has significant amounts of weedy vegetation and debris / rubbish. Low numbers of plague skinks were found in two other locations which had long grass present and/or debris.

The surveys have confirmed a relatively high density of plague skinks in the south-eastern end of the site, and low numbers elsewhere on the site in weedy areas and associated with debris. The surveys confirmed the presence of copper skink, however indicate that the numbers are very low.

Table 4. Summary of lizard survey results.

ACO survey date	Location	Numbers and species found		Notes
		Under ACOs	Under other debris	
1/11/2024	South-eastern end of site	17 *L. delicata*	7 *L. delicata*	
	Watercourse 2 riparian margin	3 *L. delicata*		
3/12/2024	South-eastern end of site	4 *L. delicata*	15 *L. delicata* 1 *O. aeneum*	Copper skink (*O. aeneum*) found beneath discarded pallet
10/12/2024	South-eastern end of site	2 *L. delicata*	12 *L. delicata*	
	Adjacent south-western boundary		1 *L. delicata*	

No geckos were found during the spotlighting surveys across the site.

The current ecological values of the herpetofauna habitat are conservatively assessed to be **low-moderate** due to the presence of low numbers of the 'At-Risk' copper skink present within the site.

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, regionally critical), although colonies are assumed to be small and their health is largely unknown (O'Donnell *et al.,* 2023; Woolly *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 on the mainland in the Auckland region, with the closest known population being the northern lesser tailed bat population 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.

A review of data in the DoC's bat database (accessed May 2024), found that there are a number of records of long-tailed bats within 10 km of the site, with the closest being approximately 2.6 km to the north. The records are generally associated with remaining fragments of native forest, and all recorded within the last 10 years.

No bat passes were recorded during the acoustic survey, which included 32 nights of 'optimal' conditions. A lack of bat presence picked up in the surveys does not guarantee that bats are never intermittently present on the site. There is limited suitable bat habitat on the site and there is a lack of connection to stands of vegetation elsewhere in the landscape. However some of the large trees on the site may provide limited 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, the dominance of agriculture nearby, and the urban influences of the wider area such as lighting, noise and disturbance all reduce the suitability of the site for bats.

Overall, while long tailed bats may periodically be present in the area, the habitat present on the site is not expected to support regular visits or large communal roosts, and this is supported by the findings of the bat survey. Therefore the ecological value of the site for bats is considered to be currently **low**, as a small amount of vegetation may provide suitable habitat and the survey did not detect bats, however 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 AUP-OP as either permanent, intermittent, ephemeral, or artificial drains. Artificial drains were classified according to their flow regime (i.e. ephemeral or intermittent). Each modelled overland flow path shown in Auckland Council's Geomaps was investigated, and its status assessed.

The watercourse classification types are described in this section. A map of the labelled watercourses (numbers 1 – 13) is shown in Figure 13.

6.1.1 Modelled overland flow paths

Many of the modelled overland flow paths (OLFPs) investigated on the site had no discernible channel, no surface water, no pools, no flood debris and rooted terrestrial vegetation across the area and therefore did not meet the definition of stream in the AUP-OP. They are shown in Figure 13 as "modelled OLFP". Photos of some are provided in Figure 14 below.

a)

b)

c)

d)

Figure 13. Modelled overland flow paths a) 7 b) 9 and 10, c) 11, d) 12 and 13 (down gradient end).

VIRIDIS Environmental Consultants

Figure 13

Watercourses and wetlands on and adjacent to the site

Legend

- The site

Watercourses

- Artificial watercourse
- Modelled OLFP
- Permanent stream
- Modified permanent stream
- Intermittent stream
- Piped stream
- Fish passage barrier

Wetlands

- Potential natural inland wetland
- Vegetation plots

SOURCES

Aerial source: Nearmaps, 2024

DISCLAIMER:
This map/plan is not an engineering draft. This map/plan is illustrative only and all information should be independently verified on site before taking any action.

SCALE **1:4,800** @ A4

PROJECT NO.	10247
DRAWN BY:	A.T.
DATE:	3 April 2025

6.1.2 Artificial watercourses

Four artificial watercourses were identified on the site. These features were constructed for drainage purposes. Drains were identified based on attributes including alignment with natural topography, presence/absence of a historic natural channel, catchment size, artificial characteristics such as deepening and straightening and a review of historic aerial photos. Artificial drainage channels are excluded from the relevant stream protection rules under the AUP-OP and the NPS-FM. The artificial drains are considered to be of **low** ecological value due to their intermittent flows, limited connection to natural watercourses and low habitat heterogeneity.

Watercourse 3

This watercourse (Figure 15 a) has a gravel bed and the covering of leaves during the site visit indicates it would only flow during periods of heavy rainfall.

Watercourse 4

This artificial watercourse (Figure 15 b and c) appears to be an area where water ponds during and after periods of rainfall and is intermittently flowing. There are two small culverts present at either end, and a larger one in the centre beneath an accessway, and while there was some standing water present at the time of the site visit, there was no flow. Aerial photos show that there was no watercourse present in this area in 1942 and 1961. A drain appears to have been constructed here around the time of the car racing track construction between 1961 and 1975.

Watercourse 5

Historical aerial photos indicate that there was no watercourse present in this area from 1942 to 1988. Google Earth imagery indicates that there was a drain present in this area in 2001, and the current drain was likely constructed between 2001-2009 and modified in 2012-2013. This is likely intermittently flowing. Figure 15d shows its nature.

Watercourse 6

This watercourse is a roadside drain that would only likely flow during periods of heavy rainfall, as indicated by the presence of leaf litter during the site visit (Figure 15e).

a)

b)

c)

d)

e)

Figure 15. Artificial watercourses a) watercourse 3; b) and c) watercourse 4; d) watercourse 5; e) watercourse 6.

6.1.3 Streams

Tutaenui Stream

A large, permanently flowing reach of the Tutaenui Stream flows along the south-eastern boundary of the site. Historic aerial photographs suggest that there may have been some modification (straightening) to this stream channel prior to the 1940s, and there was further straightening of the previously meandering channel undertaken immediately south of the site between 1940 and 1961. Figure 16 shows the nature of this reach.

a) **b)**

Figure 16. Tutaenui Stream along the south-eastern boundary of the property.

The channel along the boundary is fairly straight, wide and deep in places. The channel is fairly incised with steeply sloping banks down to the water and no wetland areas were observed in the margins. There is some instream habitat variability with macrophytes, undercut banks and some woody debris present. Water flow is low-moderate and the stream has a soft sediment base. Water clarity was moderate at the time of the site visit. Areas of emergent and submergent macrophytes such as oxygen weed (*Lagarosiphon major*, introduced), water pepper (*Persicaria hydropiper*, introduced) and water celery (*Helosciadium nodiflorum*, introduced) occur in places. The degree of macrophyte growth reflects the often low level of shading from the surrounding riparian vegetation and likely high nutrient loadings from surrounding agriculture. It is likely that oxygen levels are depleted during the night due to respiration of aquatic plants and decaying organic matter. This reach of the Tutaenui Stream is not grazed, and the riparian margins are densely vegetated by weedy vegetation, with some deciduous exotic trees on the bank opposite to the site. The riparian vegetation on the site is a dense mix of mainly exotic species such as pampas grass[5], woolly nightshade[5], periwinkle[5], brush wattle[5], Chinese privet[5], tree privet[5], blackberry[5], moth plant[5], arum lily[5] and patches of toatoa. There was evidence of a history of dumping along the banks in this area with a mix of debris present.

Overall, the current ecological value of this reach of the Tutaenui Stream is considered to be **low-moderate** because although it has been significantly impacted by the surrounding agricultural land use and channel modification, it does have some instream habitat variability and likely contains the 'At Risk' long fin eel (*Anguilla dieffenbachii*).

[5] Identified as a plant pest in the Auckland Regional Pest Management Plan 2020-2030 (Auckland Council, 2020)

Tutaenui Stream tributary (Watercourse 1)

This permanent stream tributary of the Tutaenui Stream has been extensively modified. Parts of the stream have been piped, and the reaches that are above ground have been straightened and deepened. The banks are reinforced with gabion baskets in places. Historical aerials show that the stream had been straightened to approximately its current course by 1942. The 1942 aerial shows some remnants of an historic, meandering channel.

The wetted width is around 3 m wide. The bed is generally soft, with some gravel present. There is limited instream habitat diversity and the stream is incised with little connection to its flood plain. Water clarity was good at the time of the site visit. Plants such as reed sweetgrass[4] (*Glyceria maxima*, introduced), arum lily[4] and *Persicaria* sp. occur in places. The banks in the central area of the site have grass and weedy vegetation, with some native riparian planting present along one bank in the southern reaches of the stream on the site.

Figure 16 shows the nature of this tributary.

a)

b)

c)

d)

Figure 17. Watercourse 1 (Tutaenui Stream tributary).

Overall, the current ecological value of this reach of the Tutaenui Stream is considered to be **low** because it has been significantly impacted by channel modifications and piping. However the 'At Risk' long fin eel does occur here, as shown by the survey results set out in Table 6.

Tutaenui Stream tributary (Watercourse 2)

This permanently flowing tributary of Watercourse 1 and the Tutaenui Stream has also been extensively modified through straightening and installation of culverts. As with Watercourse 1, historical aerials indicate that the stream had been straightened to approximately its current course by 1942. The 1942 aerial shows some remnants of an historic, meandering channel.

Water width here is on average 1 m, ranging from 0.5 - 2 m. The bed is mainly soft sediment or clay. Dense growths of macrophytes are present in places, including *Potamogeton crispus* (introduced) and water celery (*Helosciadium nodiflorum*, introduced). The channel is mainly unshaded, although some shade is provided by some dense weedy vegetation present along part of one bank.

A perched culvert here (Figure 18c) is a barrier to fish passage.

Figure 18 shows the nature of Watercourse 2.

a)

b)

c)

Figure 18. Watercourse 2 (Tutaenui Stream tributary)

Overall, the current ecological value of this reach of the Tutaenui Stream is considered to be **low** because it has been significantly impacted by channel modifications. However it may contain the 'At Risk' longfin eel.

Stream Ecological Valuation

SEV results are summarised in Table 5 and presented in full in Appendix A. The SEV scores were 0.267 and 0.238. These are quite low SEV scores for rural streams, reflecting the extensive modification of the channel of each stream reach and the impact of surrounding land uses.

Table 5. Summary of SEV data for the two assessment reaches.

Function Category	Function	Assessment reach	
		Watercourse 1	Watercourse 2
Hydraulic	Natural flow regime	0.09	0.31
	Floodplain effectiveness	0.04	0.06
	Connectivity for species migrations	1.00	0.00
	Natural connectivity to groundwater	0.56	0.55
	Hydraulic function mean score	**0.42**	**0.23**
Biogeographical	Water temperature control	0.00	0.32
	Dissolved oxygen levels maintained	0.60	0.45
	Organic matter input	0.00	0.20
	In-stream particle retention	0.20	0.20
	Decontamination of pollutants	0.65	0.49
	Biogeochemical function mean score	**0.29**	**0.33**
Habitat Provision	Fish spawning habitat	0.05	0.05
	Habitat for aquatic fauna	0.17	0.39
	Habitat provision function mean score	**0.11**	**0.22**
Biodiversity	Fish fauna intact	0.33	0.27
	Invertebrate fauna intact	0.04	0.06
	Riparian vegetation intact	0.00	0.00
	Biodiversity function mean score	**0.12**	**0.11**
Overall mean SEV Score		**0.267**	**0.238**

6.2 Aquatic fauna

6.2.1 Fish communities

Fish surveys in the area reported in Spyksma *et al*. (2018) found the short fin eel (*Anguilla australis*, Not Threatened), longfin eel (At Risk – Declining), common bully (*Gobiomorphus cotidianus*), and the introduced *Gambusia affinis* and goldfish (*Carassius auratus*). Freshwater Solutions (2019) reported relocating a large number of short fin eel in the Tutaenui Stream tributary upstream of the site during a channel realignment in 2018. A review of historical fish records for the area using the NZFFD found a record of short fin eel upstream of the site. The only other fish records in the wider area associated with the Tutaenui Stream or associated tributaries were from downstream areas, and found both eel species and common and red finned bullies (*Gobiomorphus cotidianus*, *G. huttoni*, Not Threatened). A previous

report on the Tutaenui Stream (Wilding, 2007) found several natural partial barriers to fish passage further downstream on the Tutaenui Stream, therefore it is considered likely that only climbing or land locked fish species would occur in the reach of the Tutaenui Stream along the south-eastern boundary, or in the tributaries present on the site.

The fish species caught, recorded and released during the survey undertaken by Viridis are shown in Table 6. Species richness was low, with a total of three species captured, two of which were indigenous. The most abundant species was shortfin eel (10 captured), with six longfin eel also captured. The exotic fish gambusia was also captured.

Table 6. Fish caught during survey.

Fish	Binomial name	Threat status[1]	Total (lengths, mm)
Watercourse 1			
Longfin eel / tuna	*Anguilla dieffenbachii*	At Risk – Regionally Declining	6 (100, 90, 50, 25, 40, 50)
Shortfin eel / tuna	*Anguilla australis*	Not Threatened	7 (40, 45, 40, 40, 30, 50, 10)
Gambusia	*Gambusia affinis*	Introduced and Naturalised	1
Watercourse 2			
Shortfin eel / tuna	*Anguilla australis*	Not Threatened	3 (30, 35, 65)
Gambusia	*Gambusia affinis*	Introduced and Naturalised	1

Notes: 1. Bloxham *et al.*, 2023

The Fish Index of Biotic Integrity (F-IBI) was 20 (out of 60) for watercourse 1 (NPS category C) and 16 for watercourse 2 (NPS category D). Scores in category C indicate a low integrity of the current fish community, with habitat and/or migratory access considerably impairing and stressing the community. Scores in category D indicate a severe loss of fish community integrity with substantial loss of habitat and/or migratory access, causing a high level of stress on the community. The rating is slightly higher for Watercourse 1 because of the presence of the longfin eel, which is more sensitive to degraded conditions than the shortfin eel.

Figure 19. Shortfin eels caught during the fish survey.

6.2.2 Macroinvertebrate communities

The results of the macroinvertebrates recorded in the samples taken from Watercourses 1 and 2 are provided in Table 7.

Table 7. Macroinvertebrate data collected from watercourse 1 and 2 on 11/9/2024.

Higher taxonomic group	Lowest taxonomic group identified	Common name	MCI-sb score	Presence (1) / absence	
				Watercourse 1	Watercourse 2
Order Trichoptera	*Oxyethira* sp.	Caddisfly	1.2	1	1
Order Odonata	*Xanthocnemis* sp.	Damselfly	1.2	1	1
Order Odonata	*Hemicordulia* sp.	Dragonfly	0.4	1	1
Order Coleoptera	Staphylinidae	Beetles	6.2	1	-
Order Diptera	Orthocladiinae	Midges	3.2	1	1
Order Diptera	Tanytarsini	Midges	4.5	-	1
Class Crustacea	Ostracoda	Seed shrimp	1.9	-	1
Class Arachnida	*Dolomedes* sp.	Spider	6.2	-	1
Phylum Mollusca	*Gyraulus* sp.	Snail	1.7	1	-
Phylum Mollusca	Physella	Snail	0.1	1	1
Phylum Mollusca	*Potamopyrgus* sp.	Snail	2.1	1	1
Subclass Hirudinea		Leeches	1.2	1	-
Number of Taxa				**9**	**9**
EPT richness				**1**	**1**
sb-MCI value[1]				**38.44**	**46.22**

Note: 1. Only presence-absence data was recorded by the laboratory and therefore the QMCI has not been calculated

The macroinvertebrate community was dominated by common, tolerant taxa. No sensitive taxa were present. The sb-MCI values of 38.44 and 46.22 were both well below 80 and show macroinvertebrate communities largely composed of taxa insensitive to inorganic pollution/nutrient enrichment. This is indicative of severe organic pollution or nutrient enrichment.

6.3 Wetlands

No wetlands were identified within the site. One vegetation plot was undertaken in an area near OLFPs 9 and 10 that was identified as being damp at the time of the site visit and had some rushes present (see Figure 13 for the location). Calculation of the dominance test and the prevalence index (as per MfE 2022) found that it failed both tests and therefore is not considered a natural inland wetland as per the definition within the NPS-FM.

Table 8. Details of vegetation plot

Binomial name	Common name	Rating	Biostatus	Cover (%)	Dominant
Axonopus fissifolius	Carpet grass	FACU	Exotic	40	Yes
Lolium perenne	Perennial rye	FACU	Exotic	20	Yes
Cenchrus clandestinus	Kikuyu	FACU	Exotic	20	Yes
Paspalum dilatatum	Paspalum	FACU	Exotic	10	
Juncus effusus	Soft rush	FACW	Exotic	5	
% of dominant species that are FAC/FACW/OBL					**0**
Prevalence value					**3.9**

Review of aerial photos indicated a couple of areas of potential natural inland wetland present on neighbouring properties within 100 m of the site. These are identified in Figure 13 and are located up gradient of the site.

7 SUMMARY OF ECOLOGICAL VALUES

The ecological values of the habitat features on the site are summarised in Table 9. The terrestrial ecological values of the site are generally low. Very little native vegetation remains across the site to provide any significant habitat for indigenous fauna, with most of the site being covered in mown grass. There are no natural inland wetlands in the PPC area. Streams that cross the site are highly modified, have low levels of riparian vegetation, lack hydrological variation and are affected by the surrounding agricultural land uses.

Table 9. Summary of the ecological values within and adjacent to the site.

Ecological feature	Ecological Value
Vegetation – exotic trees dominant	Low
Vegetation – Christmas tree plantations	Low
Vegetation – native vegetation dominant	Low-moderate
Vegetation - weedy vegetation / rank grass	Low
Vegetation – mown grass	Low
Terrestrial connectivity and ecological function	Low
Avifauna (birds)	Low
Herpetofauna (lizards)	Low - moderate
Chiroptera (bats)	Low
Artificial drains	Low
Permanent Tutaenui stream tributaries on site	Low
Tutaenui Stream	Low-moderate

8 ASSESSMENT OF ECOLOGICAL EFFECTS

8.1 Proposal

ATR seeks to rezone approximately 22.96 ha of land from MRFZ to "Residential – Mixed Housing Urban (MHU, 20.83 ha) and Open Space – Informal Recreation Zone (OS-ORZ, 2.143 ha). The relevant zone provisions of the AUP-OP and the proposed precinct provisions will apply to the rezoned land and will enable Council to exert control over subdivision development. Where relevant, national environmental standards (e.g. the NPS-FM and the NPS-IB) and legislation (such as the Wildlife Act 1953) will also apply to development activities.

The site will also be subject to site-specific precinct provisions. Briefly, the precinct provisions (based on draft precinct provisions provided by Barker & Associates on 26 Feb 2025) will include:

- An objective that stormwater quality and quantity is managed to minimise effects on water quality or flooding;
- An objective that ecological values within the stream habitats on site are protected, restored, maintained and enhanced;
- Policies that development enhances the stream network and contributes to improvements to water quality, habitat and biodiversity, including by providing planting on the riparian margins of permanent and intermittent streams;
- A rule requiring planting of the riparian margins of permanent and intermittent streams to a minimum width of 10 m;
- A rule requiring buildings to be set back from the banks of streams more than 3 m in width by at least 20 m;
- Rules regarding stormwater treatment, retention and controls on building materials to protect water quality in streams;
- Assessment criteria relating to retaining protected trees, stormwater management, riparian margins and stormwater quality; and
- A requirement for riparian planting plan to be provided for land modification, development and subdivision applications adjoining permanent and intermittent streams.

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.

8.2 Impact on Terrestrial Ecology

8.2.1 Vegetation

The main threats to the long-term viability of ecosystems in the 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.

Ecological values associated with vegetation within the site are limited due to the small amount of trees and shrubs present on the site and the dominance of exotic vegetation. Some of the native vegetation present on the site is located within 10 m of permanent or intermittent streams and therefore would be protected from removal by the vegetation management (Chapter E15) rules of the AUP-OP. Some of the large trees on the site are specifically protected by the Notable Trees Overlay of the AUP-OP.

Rezoning the site will result in low adverse effects on the existing vegetation. It is expected that vegetation beyond the riparian yards and scheduled trees will be removed, however this can already be removed as a permitted activity. Existing vegetation within riparian margins may be removed if stream restoration and realignment occur, however this would be mitigated by replanting.

Due to the current low value and through zone and precinct provisions, the PPC provides the opportunity to enhance the terrestrial values of the site, and to improve ecological corridors and linkages along the tributaries of the Tutaenui Stream. There will be landscaping and amenity planting included in any development of the site. Relevant provisions that will likely result in planting being required include:

- Policy H7.5.3 of the AUP-OP which requires maintaining or enhancing the natural character values in the (OS-ORZ by retaining significant vegetation (where appropriate and practical) and through weed removal, new planting and landscaping;
- Policies H5.3(2) and (3) and Standard H5.6.11 of the AUP-OP which require landscaped areas in the MHU zone; and
- Proposed precinct rules requiring the planting of intermittent and permanent stream riparian margins.

8.2.2 Pest mammals

Rezoning the site from MRFZ to MHU and OS-ORZ zones is expected to increase human population density in the area.

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 the suburban areas of Pukekohe, roaming domestic cats are likely already present within the site alongside feral cats. However, increased numbers are inevitable as a result of the rezoning. 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.

No evidence of pest control was observed during the site visit, therefore most pests are likely at carrying capacity. Several rats and mice were observed during the site visits. It is likely that some pest control would be required as part of enhancement required with development of the site, which will aim to decrease possum, mustelid, hedgehog and rodent densities within the proposed ecological spaces.

Overall, it is considered that the rezoning of the site will result in negligible effect on pest animal effects.

8.2.3 Terrestrial indigenous fauna

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

mitigate any effects. There is also the potential for the quality and extent of bat habitat to improve over the long term if revegetation occurs on the site, particularly around the streams.

Areas of rank grass, weedy vegetation and debris 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 Auckland landscape. The pipit and red billed gull are the only species with an At-Risk conservation status that could occur on the site, however as discussed above most of the habitat on site is not suitable for pipits to nest, and red billed gulls nest in coastal areas, and therefore they are only likely to be present in low numbers, if at all.

Overall, 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 and the riparian planting, which provides opportunity to increase terrestrial habitat values.

8.3 Impact on Freshwater Ecology

8.3.1 Watercourses

The main threats to and opportunities for streams as a result of a change to the zoning of the site are:

- Increased development close to the streams on the site;
- The potential for increased impervious surfaces as a result of residential development;
- The potential increase in contaminant runoff as a result of residential development;
- The potential for naturalisation of the stream channels within the proposed plan change area and associated improvements in ecological values; and
- Stream works.

The permanent streams on the site are considered to be of low ecological value and currently have limited riparian vegetation. Activities that may affect the stream (e.g. riparian yard infringements, riparian vegetation clearance, stream reclamation, discharges, stream works) will require assessment during future resource consenting processes. It is considered that the effects management hierarchy and the AUP-OP, NPS-FM and NES-F policies and regulations will be appropriate for managing adverse effects of future proposals and mitigating / offsetting where required. Any direct effects on fish can be mitigated appropriately through fish management plans. All threats can be effectively managed with appropriate controls such as erosion and sediment control plans, stormwater management, appropriate design, riparian planting and management and fish relocation if required. As such, the proposed rezoning is not anticipated to result in residual adverse effects on the stream.

Furthermore, there is the opportunity for the ecological values of the streams to be increased through appropriate native riparian planting, reducing piped lengths (i.e., “daylighting”), ensuring fish passage through culverts and improvements to habitat features such as increasing instream habitat and hydrological heterogeneity. The proposed precinct provisions encourage improvements to the ecological values of streams through the objectives and policies, and requires planting of their riparian margins in the rules. While not required or guaranteed, stream naturalisation works are proposed to be

undertaken as part of a separate resource consent application and aim to improve the watercourses, provide amenity to future residential lots and enhance the flood storage currently available within the precinct boundaries.

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 AUP-OP and therefore no change in effects is anticipated.

8.3.2 Wetlands

Identification of the wetlands at this stage allows future development to be designed around the wetlands and their catchments to help ensure no complete or partial drainage occurs. No natural inland wetland areas have been identified within the site. Some potential natural inland wetlands were identified within 100 m of the site on neighbouring properties upgradient of the site. As they are upgradient, they are unlikely to be affected by the proposed development.

Wetlands are dynamic environments 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). Wetland presence and extent can change in the short and long term, contracting and expanding in response to landuse changes and natural variation and it is possible that wetlands may develop 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.

If wetlands are found to be present in the future, there is the potential for wetlands to be affected by future land use changes in the same manner as watercourses. Wetlands are protected from development by the AUP-OP (Chapter E3) 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.

Indirect adverse effects on any 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 minor.

8.3.3 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.

The Stormwater Management Plan (Woods, 2024) proposes a Stormwater Management Area Control – Flow 1 (SMAF 1) level of control. This is applied to catchments that discharge to sensitive or high value streams that have relatively low levels of existing impervious areas. The following key stormwater management strategies for the PPC area are proposed:

- Water quality treatment of all new impervious areas, using a combination of at source (e.g. raingardens) and communal (e.g. wetlands) methods;
- Use of non-contaminant generating roofing and cladding materials to minimise heavy metal contaminants such as zinc leaching into stormwater;

- Retention (volume reduction) of a minimum of 5 mm of runoff from all impervious areas using a combination of underground tanks and communal wetlands; and
- Detention (temporary storage) with a draindown period of 24 hours for the difference between the pre-development and post development runoff volumes using a combination of underground tanks and communal wetlands.

8.3.4 Erosion and sediment control

Future earthworks will be supported by erosion and sediment control measures which should be designed in accordance with the Auckland Council Guideline Document GD05 – Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region (Auckland Council, 2016). The detail of these measures will be developed during future resource consent applications.

8.4 Relevant Policies

8.4.1 National Policy Statement for Indigenous Biodiversity 2023

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.

There is no significant indigenous biodiversity in the terrestrial environment within the site and no areas that meet the definition of a Significant Natural Area as per the NPS-IB Appendix 1. The effects management hierarchy will be applied to manage residual ecological effects. The PPC will provide opportunities to increase indigenous vegetation cover through planting and enhancements of riparian areas.

8.4.2 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 and the PPC provides opportunities to improve the ecological values of the streams on the site.

8.4.3 Auckland Unitary Plan – Operative in Part 2016

The AUP-OP sets out a number of policies and objectives that give 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 AUP-OP pertaining to ecology.

Chapter B7 – Natural Resources

In line with the objectives and policies in this chapter, areas of significant indigenous biodiversity value and freshwater environments have been identified. Freshwater habitat will be protected from inappropriate adverse effects of subdivision use and development, or otherwise the effects management hierarchy applied to manage ecological effects. The planned stream restoration and planting of riparian margins will improve the linkages between other surrounding areas and improve the ecological values of the streams and wetlands on the site.

Chapter E1 – Water Quality and Integrated Management

Consistent with Chapter E1, the development of the site will provide opportunities for the appropriate integrated management of water discharges, subdivision and greenfield development to maintain and/or enhance water quality, flows, intermittent/permanent streams and associated riparian margins.

Chapter E3 – Lakes, Rivers, Streams and Wetlands

All potential streams, rivers and wetlands have been identified within the sites in line with per Chapter E3. Additionally, significant adverse effects can be avoided though retaining all intermittent and permanent streams where practicable, and where avoidance cannot be achieved, through implementation of the effects management hierarchy. The PPC will also provide opportunities to improve the ecological values of these freshwater features through restoration, planting, enhancements and weed and pest control.

Chapter E15 – Vegetation Management and Biodiversity

Consistent with Chapter E15, the vegetation and biodiversity values of the site have been identified. Development of the site provides opportunities to maintain and enhance ecosystem services and indigenous biodiversity values, while providing for appropriate subdivision, use and development.

8.4.4 Auckland Plan 2050

The Auckland Plan is a long-term spatial plan that aims to ensure Auckland grows in a sustainable way that supports people and the local environment and ecosystems. When considering environmental outcomes, the plan seeks to preserve, protect, and care for the natural environment, and use development as an opportunity to do so, as well as future-proof Auckland's infrastructure.

The PPC aligns with the Auckland Plan, through incorporation of ecological and active mode/green corridors into the design, to connect Aucklanders to their environment. It will also incorporate sustainable infrastructure, while providing for appropriate development.

Consistent with the Auckland Plan 2050, the PPC provides opportunity to restore degraded ecosystems where appropriate, while providing for appropriate development.

8.4.5 Auckland's Urban Ngahere (Forest) Strategy 2018

Auckland's Urban Ngahere (Forest) Strategy aims to promote the protection, expansion, management, and education around the network of vegetation within current and future urban Auckland. The includes remaining forest fragments, native trees, natural stormwater assets, community gardens and parks, and private gardens.

The vegetation within the PPC sites has been identified and classified, and the PPC provides opportunities that align with the strategy's nine principles: Right tree in the right place; Preference for native species; Ensure urban forest diversity; Protect nature, healthy trees; Create ecological corridors and connections; Access for all residents; Management urban forest on public and private land; and deploy regulatory and non-regulatory tools.

9 SUMMARY

Viridis has assessed a 22.96 ha area within the proposed PPC area. The impact of rezoning from Special Purpose – Major Recreation Facility Zone and Pukekohe Park sub-precinct to Residential – Mixed Housing Urban and Open Space – Informal Recreation Zone and the Pukekohekohe Gateway Precinct has been considered in relation to the terrestrial and freshwater values present on the site. It is considered that the proposed plan change is appropriate for the site to maintain and enhance the existing ecological values.

The current ecological values of the site are currently low-moderate, with watercourses and terrestrial habitats having been highly modified due to the historic land use. The most significant ecological values associated with the PPC area are the values of the adjacent Tutaenui Stream and the potential values of the streams on the site. The streams on the site are currently in a degraded state due to a history of channel and riparian modifications, however channel restoration and riparian planting has the potential to improve their ecological values. Very little native vegetation is present on the site and the terrestrial ecological values of the site are generally low, although provides some limited habitat for birds, bats and lizards.

The proposed approach to stormwater management will help to protect the site's streams and the Tutaenui Stream. Proposed precinct provisions relating to improving stream values and planting of stream riparian yards are expected to provide opportunities for an increase in indigenous biodiversity and improved habitat values for indigenous fauna. A proposed resource consent application offers the opportunity for naturalisation of the stream channels on the site.

Overall, it is considered that the outcomes of the proposed PPC and precinct plan are consistent with the objectives and policies of the AUP-OP. The AUP-OP, NPS-IB, NPS-FM, NES-F and the Wildlife Act 1953 provide a framework that 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 and precinct provisions is anticipated to result in the appropriate protection and enhancement of indigenous terrestrial, freshwater and coastal biodiversity values of the site.

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Appendix A
SEV summary data

Function category	Report section*	Function	Worksheet #	Variable (code)	WC 1	WC 2
				Vchann	0.10	0.10
				Vlining	0.74	0.72
				Vpipe	0.30	1.00
Hydraulic	**4.1**	**NFR**		**=**	**0.09**	**0.31**
				Vbank	0.20	0.20
				Vrough	0.21	0.30
Hydraulic	**4.2**	**FLE**		**=**	**0.04**	**0.06**
				Vbarr	1.00	0.00
Hydraulic	**4.3**	**CSM**		**=**	**1.00**	**0.00**
				Vchanshape	0.20	0.20
				Vlining	0.74	0.72
Hydraulic	**4.4**	**CGW**		**=**	**0.56**	**0.55**
			Hydraulic function mean score		**0.42**	**0.23**
				Vshade	0.00	0.32
biogeochemical	**4.5**	**WTC**		**=**	**0.00**	**0.32**
				Vdod	0.60	0.45
biogeochemical	**4.6**	**DOM**		**=**	**0.60**	**0.45**
				Vripar	0.00	0.20
				Vdecid	1.00	1.00
biogeochemical	**4.7**	**OMI**		**=**	**0.00**	**0.20**
				Vmacro	0.52	0.60
				Vretain	0.20	0.20
biogeochemical	**4.8**	**IPR**		**=**	**0.20**	**0.20**
				Vsurf	1.00	0.75
				Vripfilt	0.30	0.22
biogeochemical	**4.9**	**DOP**		**=**	**0.65**	**0.49**
			Biogeochemical function mean score		**0.29**	**0.33**
				Vgalspwn	0.00	0.00
				Vgalqual	0.00	0.00
				Vgobspwn	0.10	0.10
habitat provision	**4.10**	**FSH**		**=**	**0.05**	**0.05**
				Vphyshab	0.24	0.39
				Vwatqual	0.00	0.07
				Vimperv	0.20	0.70
habitat provision	**4.11**	**HAF**		**=**	**0.17**	**0.39**
			Habitat provision function mean score		**0.11**	**0.22**
				Vfish	0.33	0.27
Biodiversity	**4.12**	**FFI**		**=**	**0.33**	**0.27**
				Vmci	0.00	0.07
				Vept	0.00	0.00
				Vinvert	0.12	0.12
Biodiversity	**4.13**	**IFI**		**=**	**0.04**	**0.06**
				Vripcond	0.10	0.19
				Vripconn	0.00	0.00
Biodiversity	**4.14**	**RVI**		**=**	**0.00**	**0.00**
			Biodiversity function mean score		**0.12**	**0.11**
Overall mean SEV score (maximum value 1)					**0.267**	**0.238**

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