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Wellsford North: Ecological Impact Assessment

March 2022

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DOCUMENT APPROVAL

Document title:	Wellsford North: Ecological Impact Assessment
Prepared for:	Wellsford Welding Club Limited)
Version:	Version 1
Date:	4 March 2022
Document name:	64449 Wellsford North Ecological Impact Assessment

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REVISION HISTORY

Rev. No.	Date	Description	Author(s)	Reviewed By
1	4 March 2022	Version 1	AN & NK	MD

Reference: Bioresearches (2022). Wellsford North: Ecological Impact Assessment. 64449. Report for Wellsford Welding Club Limited).

Cover Illustration: Southern view of the site at Monowai Road, Wellsford.

CONTENTS

1. INTRODUCTION

Bioresearches was engaged by Barker & Associates Limited, on behalf of their client Wellsford Welding Club, to undertake an ecological impact assessment (EcIA) for an approximate 72 ha area located in the Auckland suburb of Wellsford, at Rodney Street and Monowai Street ('the site') (Figure 1). This assessment has been prepared to support the proposed Wellsford North Structure Plan ("the Structure Plan").

The Structure Plan area is primarily currently zoned Future Urban (≈53 ha) with the remaining area zoned as Rural - Countryside Living (≈14 ha), Rural – Production (≈4 ha) and Residential Single House (≈1 ha). The Structure Plan seeks to provide a variety of land use types including countryside living (≈6 ha), lower density residential (≈32 ha), medium density residential (≈4 ha), a village centre (≈0.8 ha) and ecological/open areas (≈13.8 ha), as well as the supporting infrastructure and landscape buffers.

This report details the ecological assessments that were undertaken by Bioresearches to determine the ecological features within the site and the significance of those features. Within this report, Bioresearches considers the ecological value of existing terrestrial and freshwater features on site and evaluates how the Structure Plan may impact the value of these features.

Figure 1. The Structure Plan area at Rodney Street and Monowai Street, Wellsford. Approximate extent is shown in yellow, with predicted overland flow paths shown in blue, as per the Auckland Council Geomaps.

2. METHODS

Site assessments were undertaken by experienced ecologists during October 2018, May, 2019, July 2019, December 2021 and February 2022 to assess the ecological values within the site. Prior to the field surveys, a map of the site was created from Auckland Council Geomaps, which defined overland flow paths of watercourses, contours of the property and any ecological overlays. Assessments of freshwater habitats, vegetation and potential fauna habitats were noted during the site visit and photographs of the site were taken. These notes and photographs were used to assess the ecological values of the terrestrial, freshwater, and estuarine ecosystems. A desktop analysis of relevant databases was also undertaken.

2.1 Terrestrial Ecology

The vegetation and terrestrial fauna values within the property were assessed during the initial site visit. The botanical value of both exotic and native vegetation was recorded, and the quality and extent of vegetation present on site was considered. Additionally, a desktop review of terrestrial characteristics was undertaken.

Fauna habitats were assessed qualitatively, in conjunction with database reviews (e.g. Department of Conservation's ARDs, Bioweb, eBird, iNaturalist) and considered indigenous lizards, birds, and bats. Opportunistic fauna observations (birds seen or heard) were also recorded during the site visit. A desktop analysis considered local records of bats and herpetofauna from specific databases.

2.2 Freshwater Ecology

During the site assessment, the presence and extent of streams and wetlands within the site were noted and the quality of any freshwater habitat was visually assessed.

Watercourses were classified under the Auckland Unitary Plan – Operative in Part (AUP-OP) to determine, in accordance with the definitions in this plan, the ephemeral, intermittent or permanent status of these watercourses. Stream 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 NIWA New Zealand Freshwater Fish Database (NZFFD) was examined for fish species potentially present within the site.

The Ministry for the Environment's (MfE) latest guidance (MfE, 2021) and wetland delineation protocols (MfE, 2020) were utilised to classify areas as a *'natural wetland'* under the National Policy Statement for Freshwater Management 2020 (NPS-FM). Wetland value assessments 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.

Stream Ecological Valuation

A detailed assessment of a representative reach within the site was undertaken using the Stream Ecological Valuation (SEV) methodology (Auckland Council Technical Report 2011/009). The SEV methodology (Storey *et al*., 2011) enables the overall function of the stream to be assessed and compared to the quality of other streams in the Auckland Region. The SEV assessment involves the collection of habitat data (e.g. stream depth, substrate type, riparian cover), and sampling of fish communities and macroinvertebrates (e.g. insect larvae, snails), the latter being recognised indicators of habitat quality. The SEV method gives a score between 0 (low quality) and 1 (high quality) for each of a number of attributes which are weighted in terms of their contribution to overall stream value. These attributes are then combined to give an overall SEV score, also on a scale of 0 to 1.

Macroinvertebrates

Macroinvertebrates were sampled from instream habitats within the representative reach to obtain semi-quantitative data in accordance with the Ministry for the Environment's current "Protocols for Sampling Macroinvertebrates in Wadeable Streams" (Stark *et al*., 2001). Sampling was undertaken along the SEV reaches, using protocol 'C2: soft-bottomed, semi-quantitative' as the streams were dominated by silt substrate. The macroinvertebrate sample was preserved in 70% ethyl alcohol (ethanol), returned to the laboratory and sorted (using protocol 'P3: full count with sub-sampling option' (Stark *et al*., 2001)). Macroinvertebrates were then identified to the lowest practicable level and counted to enable biotic indices to be calculated.

Several biotic indices were calculated, namely the number of taxa, the number and percentage of Ephemeroptera (mayflies); Plecoptera (stoneflies) and Trichoptera (caddisflies) recorded in a sample (%EPT), the Macroinvertebrate Community Index (MCI) and the Semi-Quantitative Macroinvertebrate Community Index (SQMCI) (Stark & Maxted, 2007a). EPT are three orders of insects that are generally sensitive to organic or nutrient enrichment, but exclude Oxyethira and Paroxyethira as these taxa are not sensitive and can proliferate in degraded habitats. The MCI and SQMCI are based on the average sensitivity score for individual taxa recorded within a sample, although the SQMCI is calculated using coded abundances instead of actual scores (raw macroinvertebrate data are presented in Appendix I). For the MCI and SQMCI, respectively, scores of:

- ≥ 120 and ≥ 6.0 are indicative of excellent habitat quality,
- 100 – 119 and 5.0 – 5.9 are indicative of good habitat quality,
- 80 – 99 and 4.0 – 4.9 are indicative of fair habitat quality and
- < 80 and < 4.0 are indicative of poor habitat quality (Stark & Maxted, 2007b).

Fish Surveys

To sample fish communities, single-pass electric fishing was undertaken within the representative reach, using an EFM300 backpack electric fishing machine in accordance with methodology in Joy *et al*. 2013. The electric fishing machine temporarily stuns the fish, allowing them to be caught. The size of each individual was estimated and the number of fish caught and fish condition (taking into account anomalies such as parasites, lesions and wounds) was recorded before fish were returned to their habitats. All fish handling was carried out by suitably qualified and experienced ecologists.

The Fish Index of Biotic Integrity (IBI) for the Auckland Region was calculated for each site based on fish species present, altitude and distance inland (Joy & Henderson, 2004).

Water Quality

In situ spot measurements of basic water quality parameters (temperature, dissolved oxygen and conductivity) were undertaken a within the representative reach. Measurements were undertaken using a Yellow Springs Instruments (YSI) Professional Series combined dissolved oxygen/temperature/conductivity meter.

2.3 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 Structure Plan and resulting residential development on those values.

The ecological value of the site, relating to species, communities and systems, were determined as per the EIANZ Ecological Impact Assessment guidelines (EcIAG) for use in New Zealand (Roper-Lindsay, Fuller, Hooson, Sanders, & Ussher, 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 matters of ecological importance such as species assemblages and levels of organisation (Table 1). The overall ecological value is then determined on a scale from '*Negligible*' to '*Very High*' (Table 2).

Criteria for describing the magnitude of effects are given in Chapter 6 of the EcIAG (Table 3). 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 4). The cells in italics in Table 5 represent a 'significant' effect under the EcIAG. Cells with low or very low levels of effect represent low risk to ecological values rather than low ecological values per se. 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: Attributes to be considered when assigning ecological value or importance to a site or area of vegetation / habitat / community (as per Table 4 of Roper-Lindsay *et al.* 2018).

Matters	Attributes to be considered
Representativeness	*Criteria for representative vegetation and aquatic habitats:* • Typical structure and composition • Indigenous species dominate • Expected species and tiers are present • Thresholds may need to be lowered where all examples of a type are strongly modified. *Criteria for representative species and species habitats:* • Species assemblages that are typical of the habitat • Indigenous species that occur in most of the guilds expected for the habitat type
Rarity/distinctiveness	*Criteria for rare/distinctive vegetation and habitats:* • Naturally uncommon or induced scarcity • Amount of habitat or vegetation remaining • Distinctive ecological features • National Priority for Protection *Criteria for rare/distinctive species or species assemblages:* • Habitat supporting nationally threatened or At-Risk species, or locally uncommon species • Regional or national distribution limits of species or communities • Unusual species or assemblages • Endemism
Diversity and Pattern	• Level of natural diversity, abundance and distribution • Biodiversity reflecting underlying diversity • Biogeographical considerations- pattern, complexity • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation
Ecological context	• Site history and local environment conditions which have influenced the development of habitats and communities • The essential characteristics that determine an ecosystems integrity, form, functioning and resilience (from 'intrinsic value' as defined in RMA) • Size, shape and buffering • Condition and sensitivity to change • Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material • Species role in ecosystem functioning - high level, key species identification, habitat as proxy

Table 2. Assigning value to areas (Roper-Lindsay *et al.* 2018)

Value	Determining Factors
Very High	Area rates 'High' for at least three of the assessment matters of Representativeness, Rarity/distinctiveness, Diversity and Pattern, and Ecological Context. Likely to be nationally important and recognised as such.
High	Area rates 'High' for two of the assessment matters, and 'Moderate' and 'Low' for the remainder OR area rates 'High' for one of the assessment matters and 'Moderate' for the remainder. Likely to be regionally significant and recognised as such.
Moderate	Area rates 'High' for one of the assessment matters, 'Moderate' or 'Low' for the remainder OR area rates as 'Moderate' for at least two of the assessment matters and 'Low' or 'Very Low' for the remainder. Likely to be important at the level of the Ecological District.
Low	Area rates 'Low' or 'Very Low' for majority of assessment matters, and 'Moderate' for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates 'Very Low' for three assessment matters and 'Moderate', 'Low' or 'Very Low' for the remainder.

Table 3. Criteria for describing the magnitude of effects (Roper-Lindsay *et al.* 2018)

Magnitude	Description
Very High	Total loss of, or a very major alteration to, key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature.
High	Major loss of major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.
Low	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances and patterns; AND/OR Having minor effect on the known population or range of the element/feature.
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature.

Table 4. Criteria for describing the level of effects (Roper-Lindsay *et al.* 2018). Where text is italicised, it indicates 'significant effects' where mitigation is required.

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

3. EXISTING ENVIRONMENT

3.1 Background and Ecosystem Classification

The site is situated within the Otamatea Ecological District of the Auckland Region and is bordered by residential developments and large agricultural properties. Currently, the site consists of managed pasture, some mix exotic/native bush and a few residential buildings (Figure 1). The site does not currently support or border any terrestrial ecosystem types as classified under the AUP-OP: Biodiversity current extent. The site itself is not subject to any Significant Ecological Area (SEA) overlay.

Historically (pre-human era), the site would likely have been comprised of the ecosystem types; pūriri, taraire forest (WF7-2) and kauri, podocarp, broadleaved forest (WF11) (Singers *et al.,* 2017). Flora characteristic of the pūriri forest ecosystem includes mixed broadleaved species, such as pūriri, karaka, kohekohe and, locally, taraire and kohekohe. The northern and western areas of the site would have previously contained a mixture of kauri, podocarp and broadleaved trees. Both these ecosystem types would have supported a diverse range of invertebrates, amphibians, reptiles, birds, and bats. However, historical images indicate that the site, and much of the surrounding landscape, has been cleared for at least 60 years and has been managed for agricultural and horticultural purposes (Figure 2).

Figure 2. Historical aerial image of the site, dated 1961. The approximate site boundary is shown in yellow. Base image sourced from Retrolens.

3.2 Terrestrial Ecology

The site predominately consists of managed pastural grasses. The main terrestrial ecology values of the site are associated with the mixed exotic and native riparian vegetation situated along streams intersecting the site. A significant ecological feature of the site is an area of regenerating native podocarp forest in the southern portion of the site. The ecological values of these features are linked to the terrestrial fauna that are expected to utilise these features.

3.2.1 Vegetation

Utilising site visit observations and aerial images, Bioresearches classified and mapped the site's vegetation cover (Figure 3). The main terrestrial vegetation types are discussed below.

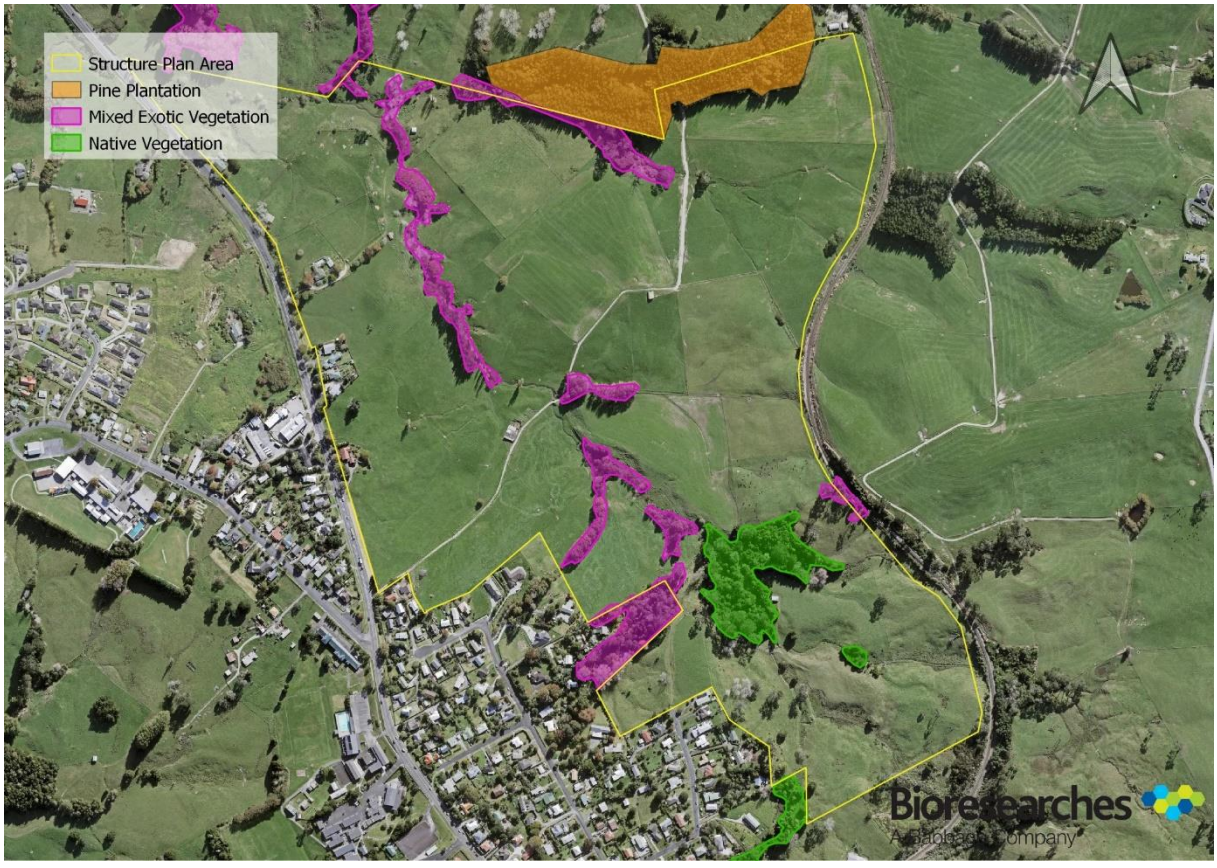

Figure 3.Main vegetation types within the site.

3.2.1.1 Pine Plantation

A relatively small pine plantation is located along the northern border of the site. The canopy is a monoculture of maturing pine (*Pinus radiata*). The understorey consists predominately of exotic species with a few common native species establishing. Exotic species present included high infestations of pest plant species such as arum lily (*Zantedeschia aethiopica*), tree privet (*Ligustrum lucidum*), Chinese privet (*Ligustrum sinense*), blackberry (*Rubus fruticosus agg.*), woolly nightshade (*Solanum mauritianum*) and wild ginger (*Hedychium gardnerianum*). Native species included māhoe *(Melicytus ramiflorus*), kawakawa (*Piper excelsum*) and tī kōuka (*Cordyline australis*).

Due to the monoculture exotic canopy, the high abundance of exotic species including pest plant species with the understorey and the low diversity of native species, the pine plantation was considered to be of negligible terrestrial and botanical value.

Figure 4. Pine plantation along the northern boundary

Figure 5. Understory within the pine plantation.

3.2.1.2 Mixed Exotic Vegetation

Narrow pockets of mixed exotic vegetation are scattered throughout the site. The majority of these patches of exotic vegetation are associated with the riparian margins of streams. The exotic species within these areas predominately include, pine, macrocarpa (*Cupressus macrocarpa*), poplars (*Populus* sp.), willows (*Salix* sp.), elms (*Ulmus* sp.), European oak (*Quercus robur*) and brush wattle (*Paraserianthes lophantha*).

The understorey of these areas typically included either pasture or pest plant species such as gorse (*Ulex europaeus*), tradescantia (*Tradescantia fluminensis*), pampas (*Cortaderia selloana*), privet, arum lily and wild ginger. Also, within the mixed exotic vegetation, a few common native species were present which predominately included tōtara (*Podocarpus totara*), harakeke (*Phormium tenax*), tī kōuka and māhoe.

Due to the high abundance of exotic species including pest plant species with the understorey, the high edge effects and the low diversity of native species, the mixed exotic vegetation was considered to be of negligible terrestrial and botanical value.

Figure 6. Mixed exotic vegetation along the central stream

Figure 7. Understory within the exotic vegetation.

3.2.1.3 Native Vegetation

Within the southern portion of the site an approximate 1.8 ha patch of regenerating native podocarp forest is present. The vegetation within this area forms the riparian margin of two streams and consists of a canopy of predominately tōtara. Although native species were dominant, there was a high abundance of exotic vegetation within the canopy, including pines, brush wattle and Chinese privet. The understorey appears damaged from grazing/browsing by stock and pests (evidence of goats and cattle access was observed) and was made up of māpou (*Myrsine australis*), Carex species, hangehange (*Geniostoma ligustrifolium*) and multiple ground fern species including hard shield fern (*Polystichum* sp.), crown fern (*Lomaria discolor*), kiokio (*Parablechnum procerum*) and hounds' tongue (*Microsorum pustulatum*). Exotic species were also abundant, including pest plant species such as, arum lily, tradescantia, woolly nightshade and blackberry.

This area was considered of moderate terrestrial and botanical value due to the diverse native vegetation, however the exotic species, many of which are considered pest plants, along with the damaged understorey, decreased the value.

Figure 8. Native vegetation within the site

Figure 9. Understory within the native vegetation.

3.2.1.4 Other Vegetation

The remainder of the site consisted of predominately pasture with a few isolated exotic trees and tōtara as well as amenity plantings that surrounded the residential dwellings. Due to the lack of diversity and generally low stature and structural complexity of the remaining vegetation within the site, these areas were considered to be of negligible terrestrial and botanical value.

3.2.2 Connectivity and Ecological Function

Connectivity between areas of vegetation is important to facilitate ecological function. Edge communities are heavily influenced by increased exposure to light, drying winds and competitive weeds. This 'edge effect' restricts some native flora and fauna to forest interiors. Patch fragmentation increases the edge effect and decreases the availability of habitat for interior species. Loss of ecological connectivity can also impair reproductive function for both flora and fauna.

The main area of terrestrial significance within the site is the patch native vegetation. Currently, this vegetation provides low connectivity or ecological function to the surrounding environment. It is surrounded by pasture, suburban development, and a small amount of exotic vegetation, which is of very low botanic quality. The site is not in close proximity to any large areas of native vegetation, however one relatively small SEA is located approximately 900m to the west (Figure 10). The grazed pasture and sparse exotic trees likely do not act as connectivity between areas of vegetation.

The remaining areas of vegetation (shelter belts, exotic plantations, amenity plantings and pasture) were considered to have a negligible amount of ecological connectivity and function.

Figure 10. A terrestrial SEA (green crosses) was located approximately 900m west of the native vegetation within the site (yellow polygon). Larger SEAs or areas of native vegetation were not in close proximity to the site.

3.2.3 Pest Animals

No formal pest animal surveys were undertaken and no evidence of pest control was observed within the site. It is reasonable to assume due to the surrounding urban and agricultural land use that the typical density of rats, mice, feral cats, mustelids and hedgehogs are present within the site.

3.2.4 Native Fauna

3.2.4.1 Herpetofauna

Herpetofauna (reptiles and amphibians) comprise a significant component of New Zealand's terrestrial fauna. There is currently 104 endemic herpetofauna taxa recognised in New Zealand (Hitchmough, et al., 2016), 80% 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. Statutory obligations require management of resident reptile and amphibian populations if they are threatened by a disturbance i.e., land development.

No formal herpetofauna surveys were undertaken. However, a review of historic lizard records from within 5 km of the project area shows that there are only two records; a single elegant gecko (*Naultinus elegans*) from 1965 and the exotic plague skink (*Lampropholis delicata*) from 1994 which is an introduced species classified as an invasive pest. Due to the date (≈60 years ago) of the elegant gecko sighting and the fact that no other sightings have occurred, it is unlikely that this species still inhabits the area. One plague skink was found during an informal habitat search of the leaf litter debris on site (May 2019 site visit). No other species were observed, indicating that if native skinks are present, they are likely to occur only in very low numbers.

Forest gecko (*Mokopirirakau granulatus*), elegant gecko and pacific gecko (*Dactylocnemis pacificus*) are typically arboreal (tree dwelling) and normally associated with regenerating scrubland and forests. Pacific and forest geckos will also inhabit clay banks and rock walls within and around such forests or scrubland. For populations of these species to persist, vegetated areas with good connectivity need to be relatively stable over time. Additionally, geckos prefer dense foliage typical of early seral vegetation communities. The native vegetation located on site was found to be isolated and contained a damaged understorey but expected to provide a moderate valued habitat in the form of mature native trees. As such, this vegetation was only considered of moderate habitat quality.

Copper skink (*Oligosoma aeneum*) and ornate skink (*Oligosoma ornatum*) are generally found in dense ground cover or under logs or other debris around forest edge habitats. Copper skink are widespread within the Auckland region, however ornate skinks tend to be patchily distributed. Moko skink (*Oligosoma moco*) are relatively common on offshore islands, however populations that are not on inshore / offshore islands are rare. Within the native vegetation, edge habitat was common, but the damaged understorey generally provided little groundcover and debris. As such the native vegetation was considered of low habitat quality.

Due to the lack of suitable habitat for native lizards outside of the regenerating native, the herpetofauna habitat value within the rest of the site was considered negligible.

3.2.4.2 Avifauna

During the site visit, indigenous avifauna heard or observed consisted of pūkeko (*Porphyrio melanotus*) were observed. Within the wider site, paradise shelduck (*Tadirna variegate*), fantail (*Rhipidura fuliginosa placabilis*) and kingfisher (*Todiramphus sanctus*) were seen. Other non-threatened native species that were not recorded, but may visit the property intermittently include ruru (*Ninox novaeseelandiae*), grey warbler (*Gerygone igata*), harrier (*Circus approximans*), tūī (*Prosthemadera novaeseelandiae*), white-faced heron (*Egretta novaehollandiae*) and silvereye (*Zosterops lateralis*). No 'At Risk' or 'Threatened' species were recorded, or are likely to utilise the property, even on an intermittent basis.

Although the native vegetation is isolated and has a damaged understorey, due to the mature and diverse native species present, the native vegetation was considered to be of moderate avifauna habitat value.

Due to the isolated nature and high edge effects the avifauna habitat value within the rest of the site was considered negligible.

3.2.4.3 Bats

Long-tailed bats (LTBs; *Chalinolobus tuberculatus*) are classified as 'Nationally Vulnerable' in the North Island (O'Donnell et al., 2013). This classification is given the qualifier "Data Poor" which indicates that there is low confidence in the rating due to poor data available on the species populations and distribution (Townsend et al., 2008). LTBs have large home ranges of up to 5,629 ha (O'Donnell 2001).

No formal surveys were undertaken for LTBs. While LTBs are known to occur at several sites across the Auckland Region with scattered records through the Rodney and Otamatea Districts, there are no records of bats within close proximity of the site. However, this lack of records may be an artifact of poor or no survey effort.

Some of the larger pines tree within the site, may support roosting or nesting habitat (cavities, large sections of flaking bark) for LTBs, however, due to the isolation of these trees it is unlikely that these trees are utilised by LTBs. The remaining vegetation provided no suitable habitat for bats and as such the site was considered of low bat habitat value.

3.3 Freshwater Ecology

Aerial images obtained for the site indicated the presence of multiple watercourses on the property. These were ground-truthed and classified during the site visits as permanent or intermittent streams, ephemeral flow paths, natural wetlands, or constructed features (**Figure 11**).

Figure 11. Freshwater features identified on site, including the permeant, intermittent or ephemeral status of streams, and wetland areas.

3.3.1 Streams

Numerous streams (S-A to S-P, **Figure 11**) were identified within the site. One main permanent stream (S-A & S-D) flows from the south of the site to the north and generally bisects the site in half. All other streams identified with the site were tributaries of this main stream. The catchments within the site feed the Whakapirau Creek, which eventually drains to the Kaipara Harbour via the Oruawharo River.

All the streams within the site have been highly modified and impacted through historic and current agricultural practices. Stock have access to the majority of the streams and many streams have been straightened, deepened and maintained to optimise the drainage of the surrounding land.

Riparian vegetation associated with the streams generally consisted of manged pasture, which provided no effective shading and low levels of filtration and organic matter input. However, the riparian vegetation of some streams and reaches consisted of shelter belts (S-H & S-J), pine plantations (S-B), exotic vegetation (lower reach of S-E) and native vegetation (mid/upper reach of S-E) which formed a canopy over the streams. Where a canopy formed over the streams the riparian vegetation provided a high degree of shading, filtration, organic input and bank stability.

Where shading was low, macrophytes were often abundant within the stream channel. Macrophytes observed included water pepper (*Persecaria hydropiper*), watercress (*Nasturtium officianle*), starwort (*Callitriche stagnalis*), parrot's feather (*Myriophyllum aquaticum*) and water celery (*Helosciadium nodiflorum*).

Stream substate predominately consisted of soft sediment with a high loading of fines silt in places. Patches of gravel and small cobble were observed where stream S-E flowed through the native vegetation.

The majority of the streams had low hydrologic variation and low amount of habitat diversity, generally consisting of runs with a few relatively small pools. However, where stream S-E flowed through the native vegetation, a higher amount of hydrologic variation and habitat diversity was observed including riffles, large pools and undercut banks.

A number of culverts and farm crossings are located throughout the site. Some of these culverts are perched, such as the culvert within stream S-E upstream of the native vegetation, and form a significant fish passage barrier. A weir is also present within stream S-E, just downstream of the confluence with S-I, and forms another significant fish passage barrier.

With the exception of the S-E and S-L stream reaches (reaches within the native vegetation) and the stream within the pine plantation (S-B), the streams within the site were considered to be overall of low ecological value due to the general lack of riparian vegetation and the low abundance of habitat diversity and hydrologic heterogeneity. The stream reaches within the native vegetation and the stream S-B were considered of moderate-high ecological value due to the relatively extensive riparian vegetation and habitat diversity.

Figure 12. Stream S-A.

Figure 13. Stream S-B.

Figure 14. True left branch of Stream S-C.

Figure 15. Middle branch of Stream S-C.

Figure 16. True right branch of Stream S-C.

Figure 17. Stream S-D.

Figure 18. Lower reach of Stream S-E.

Figure 19. Mid reach of Stream S-E.

Figure 20. Reach of Stream S-E within native bush.

Figure 21. Upper SEV reach of Stream S-E.

Figure 22. Stream S-F.

Figure 23. Ephemeral reaches within area S-G.

Figure 24. Highly modified stream S-H.

Figure 25. Artificial watercourse S-I.

Figure 26. Stream S-J.

Figure 27. Stream S-K.

Figure 28. Upper reach of stream S-L.

Figure 29. True right ephemeral trib of stream S-L.

Figure 30. Upper reach of stream S-M.

Figure 31. Ephemeral tributary of stream S-M.

Figure 32. Stream S-O.

Figure 33. Ephemeral reaches within area S-P.

3.3.1.1 Stream Ecological Valuation

A Stream Ecological Valuation (SEV) was undertaken (May 2019) on a reach within stream S-E directly upstream of the native vegetation (Figure 21). While not a complete true reflection of all the differing streams ecological values within the site, the SEV reach was considered a fair general representation of the degraded stream environments throughout the site.

The SEV reach had an average width of 1.09m and ranged between 0.87m and 1.61m. Depth varied throughout the reach and was between 0.02m and 0.64m with an average of 0.12m deep.

The instream aquatic habitat was of low quality. Substrate was made up entirely of silt and was often more than 0.1m deep. The abundance of surface reaching macrophytes was high in places and included parrot's feather, watercress (*Nastrutium officianale*), water pepper and water celery. There was no effective shading for the majority of the reach.

A perched culvert was located within the downstream end of the SEV reach, which was determined to be a significant barrier to native fish passage.

The *in situ* water quality results showed parameters such as dissolved oxygen and temperature were at levels that would not cause stress to aquatic organisms (Biggs *et al*. 2002). Conductivity was elevated, indicating moderate nutrient enrichment from the surrounding landscape and was reflective of the pastoral catchment.

The macroinvertebrate community sample was dominated by dragonfly larvae (*Xanthocnemis zealandica*), a pollutant tolerant taxa, which made up 31% of the sample. The reach contained a reasonably low diversity of macroinvertebrates, with 23 taxa recorded including 11% EPT taxa. The EPT taxa, identified as caddisflies, suggests more sensitive species are able to survive in the reach, however the MCI score of 76.26 and SQMCI of 3.78 both represent 'Poor' habitat quality. Raw macroinvertebrate data is presented in Appendix I.

No native fish were caught in the reach during single-pass electric fishing and no evidence of native fish, such as macrophyte movement or sudden substrate suspension were observed. The perched culvert downstream of the reach likely presents a total barrier to fish passage. Potential native fish

habitat within the reach was poor, and limited to macrophytes. Downstream of the perched culvert, within the native vegetated area, spot electric fishing was carried out. Three juvenile shortfin eels (*Anguilla australis*), one juvenile longfin eel (*Anguilla dieffenbachii*) and five kōura (*Paranephrops* sp.) were caught. Native fish habitat within this stream reach was much more abundant, with deep pools, woody debris, riffles, cobbles and undercut banks all common.

The reach had an SEV score of 0.27, which is indicative of a stream highly impacted by land use change and in poor ecological condition. It reflects the low fish and macroinvertebrate diversity and the lack of riparian vegetation. The SEV function scores are presented in Appendix II. The reach was determined to be of very-low ecological value in its current state.

Table 5. Physical characteristics of the representative reach within stream S-E.

Average width (m)	1.09
Average depth (m)	0.12
Dominant substrate	Silt
Macrophyte abundance	Common
Macrophyte species	Watercress, parrots feather, water pepper, water celery
Shading	No effective shading to low shading
Riparian vegetation	Pasture grass A few *Juncus* spp. 1x tōtara and 1x macrocarpa
Water Quality	
Date and Time	1100; 30th May 2019
Temperature (°C)	13.7
Dissolved Oxygen (mg/L)	9.50
Dissolved Oxygen (%)	91.6
Conductivity (µS/cm)	273.9
Macroinvertebrates	
Sampling protocol	SB
Number of taxa	23
Dominant taxon	Dragonfly larvae (*Xanthocnemis zealandica*)
Number of EPT	3
%EPT*	8.7
MCI	76.26
MCI Ranking	Poor
SQMCI	3.78
SQMCI Ranking	Poor
Fish	
Sampling protocol	EFM
Species recorded	0
Fish size	-
Fish IBI	0
Fish IBI Ranking	'No Native Species'
SEV score	**0.27**

3.3.2 Ephemeral Streams

A number of ephemeral streams or overland flow paths were identified within the site, namely the reaches within areas S-G and S-P of **Figure 11** (Figure 23 & Figure ***33***). These overland flow paths had ill-defined channels, no flowing water 48 hrs after a rain event, no natural pools, rooted terrestrial vegetation (pasture grasses) across their widths and no evidence of substrate sorting. As such, these overland flow paths were classified as ephemeral reaches and due to the complete lack of freshwater habitat these reaches were considered of negligible ecological value.

3.3.3 Artificial Watercourse

One artificial watercourse was identified within the site (S-I, Figure 11). The watercourse is uniform and has clearly been constructed and maintained to improve the drainage of the surrounding land (Figure 25). Early aerials from 1961 show no evidence of this watercourse (Figure 2), as such it was considered that this watercourse contained no natural portions from its confluence with the connecting stream to its headwaters.

3.3.4 Freshwater Fauna

Aquatic fauna data from surrounding stream catchments was extracted from the NIWA New Zealand Freshwater Fish Database (NZFFDB), to determine the likely presence of aquatic fauna (fish, crustaceans and bivalves) within the site. Within the local catchments, of similar elevation and distance to sea, only shortfin eels, gambusia (*Gambusia affinis*, an introduced pest fish), freshwater mussels (*Echyridella menziesii*, kākahi), freshwater shrimp (*Paratya curvirostris*) and kōura have been recorded (Figure 34). No previous records have been recorded within the site itself or in the adajcent catchments.

A fish survey within the stream S-E reach, located within the native vegetation, was undertaken in 2019 as a part of the SEV assessment. Three juvenile shortfin eels, one juvenile longfin eel and five kōura were caught. This diversity of fauna gives an IBI score of 28 which has a ‘fair’ rating.

A number of fish barriers were observed, most notable was the perched culvert within S-E upstream of the native vegetation, and the weir within stream S-E, just downstream of the confluence with S-J.

Figure 34. Aquatic fauna data from the NIWA New Zealand Freshwater Fish Database (NZFFDB) for the surrounding catchments.

3.3.5 Wetlands

Four wetlands were identified within the site (W-A to W-D, **Figure 11**). Wetlands were identified and classified using the latest MfE wetland protocols and guidance.

3.3.5.1 Wetland W-A

Wetland W-A, is a series of small wetland sequences/patches associated with the floodplain and riparian margins of streams S-A and S-F. A distinct stream channel ran through the wetland and outside of the channel no aquatic habitat was present, (i.e. no standing or flowing water just damp or boggy ground), indicating the wetland is intermittent or ephemeral. The area is actively grazed as pasture.

The wetland vegetation consisted of common pasture species and pasture weeds such as mercer grass (*Paspalum distichum*, FACW), creeping bent (Agrostis stolonifera, FACW), soft rush (*Juncus effusus*, FACW) and water pepper (FACW). These areas passed the vegetation rapid test and as such were considered wetlands under the NPS-FM.

Not all of the floodplain and riparian margins of streams S-A and S-F were considered wetlands, as relatively large areas were comprised of upland pasture species such as kikuyu (*Cenchrus clandestinus*, FACU), paspalum (*Paspalum dilatatum*, FACU) and perennial rye grass (*Lolium perenne*, FACU). The distinction between the wetland and non-wetland areas was clearly defined by the vegetation, hydrology and contours present.

The wetland was considered of low ecological value due to the lack of aquatic habitat, the low diversity and structural complexity of plant species and lack of native species. This wetland represents degraded pasture rather than an ecologically functioning wetland.

3.3.5.2 Wetland W-B

Wetland W-B is a relatively large wetland (≈0.5 ha) located approximately midway along stream S-E. An instream weir is present (Figure 36) which has at least partially induced the wetland. Permanent wetland hydrology was evident consisting of standing water, flowing water and boggy ground.

The area was dominated by obligate and facultative wetland plants and as such met the vegetation tool rapid test. Vegetation present within the wetland included water celery (OBL), parrot's feather (OBL), mercer grass (FACW), water pepper (FACW) and carex spp. (FACW or OBL).

Due to the hydrology, contours and distinct change in vegetation composition, a clear demarcation was apparent between wetland and non-wetland areas.

W-B was considered of moderate ecological value, due to its relatively large size and high hydrological variation. However, its low native diversity and low structural complexity reduced the overall value.

3.3.5.3 Wetland W-C

At the confluence of the S-G ephemeral reaches and adjacent to the permanent stream S-E, a small wetland (approximately 40m2) has formed where the land flattens out. The area contained watercress, an exotic obligate wetland plant species, and the ground was saturated even during the December site visit. Due to the presence of the obligate wetland plant and the permanent wetland hydrology present, the small area was classified as a natural wetland under the NPS-FM. The wetland was considered of low ecological value due its small size, lack of aquatic habitat, low diversity and structural complexity of plant species and lack of native plant species.

3.3.5.4 Wetland W-D

Wetland W-D is a constructed wetland within stream S-N. A dam was created prior to 1961 (Figure 2) to purposefully create open water/water storage. This dam has induced wetland features, namely hydrophytic vegetation and wetland hydrology along its margins and further upstream. Due to the wetland being purposefully constructed, it is excluded as a 'natural wetland' under the NPS-FM. However, the area would still be considered a wetland under the RMA definition.

Stock have direct access to the wetland. Wetland vegetation identified included parrot's feather, soft rush, mercer grass, carex spp. and water pepper. The wetland was considered of low ecological value due to its degraded and artificial nature, the low diversity and structural complexity of plant species and lack of native species. This wetland represents a constructed pond with degraded pasture rather than a natural wetland.

Figure 35. Wetland sequence within W-A.

Figure 36. Weir within wetland W-B.

Figure 37. Wetland W-B.

Figure 38. Wetland W-C.

Figure 39. Wetland W-D lower extent.

Figure 40. Wetland W-D upper extent (centre of photo).

3.3.5.5 Additional Features

Throughout the rest of the site, and namely within overland flow paths, a few soft rushes were scattered amongst the pasture grasses. Additionally, creeping buttercup (*Ranunculus repens*), an exotic facultative species, is also present. Both of these species are considered common pasture weeds and were present in low abundance (≤10% coverage). No standing water was present outside of the identified wetlands and streams, and the soils were not saturated, indicating that wetland hydrology is not present. Due to the absence of evident wetland hydrology and the dominance (≥90%) of facultative upland and upland plant species (e.g. perennial ryegrass, kikuyu grass, dallis

grass/paspalum and clover) these areas were not considered natural wetlands under the NPS-FM. It should also be noted that these areas are currently, and have historically, been used and managed as pasture.

3.3.6 Receiving Environment

The catchments within the site are tributaries of the Whakapirau Creek, which eventually drains to the Kaipara Harbour via the Oruawharo River.

The Whakapirau Creek and the Oruawharo River are significant high-order streams within the Auckland region. These streams are home to many native freshwater fauna including shortfin eels, longfin eels (At Risk – Declining), banded kōkopu (*Galaxias fasciatus*), īnanga (*Galaxias maculatus*, At Risk – Declining), freshwater mussels and kōura. Through agricultural practices and urban development, the ecological value of these streams has declined.

The Kaipara Harbour is recognised and valued as a significant cultural, ecological, social and economic taonga. However, it has been negatively impacted by high levels of nutrients and sediment entering into the harbour through water ways.

3.4 Summary of Ecological Values

The terrestrial ecological value of the site is predominately linked to the presence of the 1.8 ha regenerating native podocarp ecosystem. The remainder of the site itself is largely comprised of low-ecological value pasture. The freshwater values of the site are linked to the presence of a main central stream and its tributaries, and multiple wetland habitats. The values of the site are summarised in Table 6.

Table 6. Summary of the terrestrial and freshwater ecological values on site.

Ecological Feature	Assigned Ecological Value
Native Vegetation	Moderate
Pine Planation	Negligible
Mixed Exotic Vegetation	Negligible
Other Vegetation (pasture, shelterbelts, amenity plants etc..)	Negligible
Stream S-B	Moderate
S-E and S-L stream reaches within the native vegetation	Moderate-High
All Other Streams	Low
Wetland W-A, W-C and W-D	Low
Wetland W-B	Moderate

4. ASSESSMENT OF ECOLOGICAL EFFECTS

The Structure Plan area is primarily currently zoned Future Urban. The Structure Plan seeks to provide a variety of land use types including countryside living, lower density residential, medium density residential, a village centre and ecological/open areas, as well as the supporting infrastructure and landscape buffers.

No additional provisions are proposed as part of this Structure Plan. All Auckland-wide and the relevant zone provisions of the AUP will apply to the Structure Plan area and will enable Auckland Council to regulate and manage future subdivision development.

The main threats to the long-term viability of ecosystems in Auckland include; habitat destruction, fragmentation, edge effects and invasion by pest plants and animals. These threats are often augmented through an increase in human population density.

This section assesses the potential effects of the proposed Structure Plan on the current and potential ecological values within the Site and the associated wider landscape.

4.1 Terrestrial Ecology

4.1.1 Vegetation

The main area that holds significant ecological value on site is the 1.8 ha regenerating native podocarp forest. This area is not subject to a SEA overlay, however it is currently a restricted discretionary activity to remove vegetation within 20 m of rural streams, within 10 m of an urban stream and greater than 250 m^2 of contiguous indigenous vegetation outside of the rural urban boundary.

The Structure Plan seeks to incorporate approximately 75% of the native vegetation within public ecological areas. The remainder of the native vegetation would be within private land and subject to the AUP's objectives, policies and rules.

The remaining vegetation, outside of the native vegetation, is of negligible-low ecological value and has been degraded by historical and current agricultural land use. The Structure Plan seeks to include an additional approximately 12 ha of land as public ecological areas and open spaces.

The assigning of 13.8 ha of land as ecological areas or open spaces will retain the existing ecological values, protect this land from further degradation and provides the opportunity to further significantly enhance the terrestrial ecological values through the enhancement of the existing native vegetation and the planting and protection of the 10 m and 20 riparian margins. These potential plantings will greatly increase the quantity and diversity of native vegetation as well as result a large increase in ecological connectivity and terrestrial habitat.

As such, it is considered that the Structure Plan will likely result in an overall large ecological gain in regard to terrestrial ecology.

4.1.2 Pest Animals

The Structure Plan is expected to lead to an increase in the human population density within the area. An increase in human population density often brings an increase in rat, mice and domestic cat abundance. However, the current site does not have pest control measures, and most pests are likely at carrying capacity. Pest control is likely to be implemented on site once the number of residential properties increase. Additionally, any potential native vegetation protection and enhancement, as a result of future development, will likely require pest control. Overall, it is considered that there may be a low increase in rat and mice abundance.

Due to the surrounding residential and commercial properties to the west and south, roaming domestic cats would currently likely be present within the Site, as such an increase in density is not expected to have a significant impact on the current ecological values.

It is not expected that possum, mustelid, hedgehog and rabbit abundance would increase as a result of the Structure Plan, in fact there will likely be a decrease due to the reduction in agricultural land.

Overall, it is considered that the rezoning of the Site will result in a negligible increase of pest animal effects.

4.1.3 Terrestrial Fauna

Bat and lizard habitat within the site was considered to be generally of negligible-low quality. The native vegetation was considered to represent moderate valued avifauna habitat, while the remaining areas were considered of negligible value. The Structure Plan provides the opportunity to further enhance the terrestrial fauna habitat through the enhancement of the existing native vegetation and the planting and protection of the 10 m and 20 riparian margins.

Any potential direct adverse effects on native terrestrial fauna as a result of subsequent development works (e.g. earthworks or vegetation removal) would be assessed at the resource consenting phase and can be appropriately mitigated through the implementation of fauna management plans. It should be noted that, any site works resulting from any rezoning of the Future Urban Zone will result in the same or similar potential adverse effects on native fauna.

4.2 Freshwater Ecology

With the exception of the S-E and S-L stream reaches (reaches within the native vegetation) and the stream within the pine plantation (S-B), all streams within the site were considered to be of low ecological value. The stream reaches within the native vegetation and the stream within the pine plantation were considered of moderate-high ecological value.

The Structure Plan seeks to incorporate approximately 90% of all intermittent and permanent streams into the public ecological and open space areas. The remainder of the streams will be within private land and subject to the AUP's objectives, policies and rules. In addition, the Structure Plan avoids any direct impacts on natural wetlands and seeks to incorporate them into the public ecological and open space areas.

Multiple stream crossing would likely be required for the Structure Plan to provide the required infrastructure for appropriate development. The Structure Plan provides the opportunity to upgrade existing culverts to the current NES-FW standards and also provides the opportunity to remove redundant farm crossings and rectify fish passage barriers.

The Structure Plan also provides the opportunity to significantly enhance and protect the freshwater systems through the planting and protection of the 10 m and 20 riparian margins.

Stormwater

The main threats to the freshwater ecology, as a result of a potential increase in residential density, are in relation to stormwater. Any potential residential development will likely result in an increase in impervious surfaces. This increase can amplify the adverse stormwater effects on the receiving environment by resulting in increased scouring, erosion or high levels of contaminant input.

Through the implementation of stormwater management on site, any adverse stormwater effects can be appropriately managed to prevent impacting ecological values on site.

The downstream receiving environment include the Whakapirau Creek, the Oruawharo River and the Kaipara Harbour. These receiving environments have already been highly impacted through nutrient and sediment inputs and therefore warrants protection from further degradation through appropriate controls based on the objectives and policies of Sections B7.3 and B7.4 of the AUP.

4.3 Policy Documents

4.3.1 National Policy Statement for Freshwater Management 2020

The main objective of the NPS-FM is to ensure health and well-being of water bodies and freshwater ecosystems are prioritised. The Structure Plan is in accordance with the NPS-FM as all freshwater ecosystems have been identified within the site, no reclamation is proposed and any potential significant adverse effect can be appropriately avoided, minimised, remedied or offset. Furthermore, the Structure Plan provides opportunities to protect and enhance the freshwater ecosystems.

4.3.2 Auckland Unitary Plan

The AUP 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 AUP pertaining to ecology.

4.3.2.1 B2 – Urban Growth and Form

Consistent with B2, through t vegetation protection and enhancement, the Structure Plan will provide ample opportunity to maintain and enhance the quality of the natural environment, including those scheduled in the AUP, while promoting quality compact urban form.

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

4.3.2.2 B7 – Natural Resources

Consistent with B7, areas of significant indigenous biodiversity value and freshwater environments have been identified within the site. All freshwater habitat would be protected from inappropriate adverse effects of subdivision use and developmen.

Additionally, the Structure Plan will provide further opportunities to maintain ingenious biodiversity through the protection, restoration and enhancement of areas where ecological values are degraded and where development is occurring, namely through planting and protection of riparian margins.

4.3.2.3 E1 – Water Quality and Integrated Management

Consistent with E1, the Structure Plan can appropriately manage discharges, subdivision and development that affect freshwater systems to maintain or enhance water quality, flows, stream channels and their margins.

4.3.2.4 Lakes, Rivers, Streams and Wetlands

Consistent with E3, all potential streams, rivers and wetland have been identified within the Site. Additionally, reclamation and significant adverse effects can be avoided and the Structure Plan provides opportunities to protect and enhance the freshwater systems.

4.3.2.5 E15 – Vegetation Management and Biodiversity

Consistent with E15, the vegetation and biodiversity values of the site have been identified. The Structure Plan provides opportunities to maintain and enhance ecosystem services and indigenous biodiversity values, particularly in sensitive environments, and areas of contiguous indigenous vegetation cover, while providing for appropriate subdivision, use and development.

4.3.2.6 Appendix 1 – Structure Plan Guidelines

Consistent with the Structure Plan Guidelines, it has been demonstrated that the Structure Plan provides opportunities and mechanisms to protect, maintain or enhance natural resources, particularly those that have been scheduled in the AUP and integrate green networks, namely through the protection and enhancement of the native riparian vegetation.

4.3.3 Auckland Plan 2050

The Auckland Plan 2050, states that Auckland's natural environment is inextricably connected to Aucklanders' sense of identity and place. Auckland's natural environment not only supports its people, but it is home to many special local ecosystems and is essential for the survival of both indigenous wildlife and species from across the world. However, many of Auckland's treasured natural environments, ecosystems, and indigenous species are already under significant pressure from human activity, and some are in decline. To reverse this decline, Auckland must ensure that development is sustainable and has minimal negative impacts on the natural environment.

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

4.3.4 Auckland's Urban Ngahere (Forest) Strategy

This Strategy was formed to protect what Auckland's urban ngahere in the face of a growing and urbanising population through supporting principles such as; preference for natives, ensure urban forest diversity, protect mature, healthy trees, create ecological corridors and connections and access for all residents.

The Structure Plan is consistent with the Urban Ngahere Strategy, as the Structure Plan has identified the ngahere of the site and provides opportunities for enhancement of ecological corridors, connections and diversity through the planting of native riparian vegetation and maintaining existing vegetation where practicable, while also providing for public access.

5. SUMMARY AND RECOMMENDATIONS

Bioresearches have assessed the proposed Wellsford North Structure Plan. The impact of the Structure Plan has been considered in relation to the terrestrial and freshwater values present on site. It is considered that the Structure Plan is appropriate for the site, and any future subdivision and development can result in the protection and enhancement of indigenous terrestrial and freshwater ecological values of the site. It is recognised that the AUP-OP and the NES-FW provides a framework that manage any proposed future development at the resource consenting phase to ensure development aligns with the appropriate polices and regulations.

The significant ecological values on site are the linked to the regenerating native forest and the freshwater systems. The adverse effects of the Structure Plan on these natural features can be appropriately and effectively managed through existing planning provisions and policy framework within the AUP. Additionally, the Structure Plan provides opportunities to protect and significantly enhance the terrestrial and freshwater values of the site. Appropriate stormwater management, pest-control, maintenance programmes and biodiversity enhancement are expected to be implemented during development of the site.

Bioresearches supports the proposed Wellsford North Structure Plan, given that the existing ecological values will be appropriately protected, enhanced, or managed.

6. REFERENCES

Biggs B.J.F., Kilroy C., Mulcock C.M., Scarsbrook M.R. and Ogilvie S.C. (2002). *New Zealand Stream Health Monitoring and Assessment Kit, Stream Monitoring Manual, Version 2K – a tool for Kaitiaki*. NIWA Technical Report 111-1: 190 p.

Bioresearches. (2016). *Ecological Assessment: 149-159 Clark Road, Hobsonville.*

Clarkson, B. R., Fitzgerald, N. B., Champion, P. D., Forester, L., & Rance, B. D. (2021). *New Zealand Wetland Plant List 2021.* Manaaki Whenua – Landcare Research.

Hitchmough, R., Barr, B., Lettink, M., Monks, J., Reardon, J., Tocher, M., . . . Dylan, J. (2016). *Conservation status of New Zealand reptiles, 2015.* Department of Conservation.

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

MfE. (2021). *Defining 'natural wetlands' and 'natural inland wetlands'.* Wellington : Ministry for the Environment.

Robertson, H. A., Baird, K., Dowding, J. E., Elliott, G. P., Hitchmough, R. A., Miskelly, C. M., . . . Taylor, G. A. (2017). *Conservation status of New Zealand birds, 2016.* Department of Conservation.

Roper-Lindsay, J., Fuller, S., Hooson, S., Sanders, M., & Ussher, G. (2018). *EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems* (2nd ed.).

Singers, N., Osborne, B., Lovegrove, T., Jamieson, A., Boow, J., Sawyer, J., . . . Webb, C. (2017). *Indigenous terrestrial and wetland ecosystems of Auckland* . Auckland Council.

Stark J.D., Boothroyd I.K.G., Harding J.S., Maxted J.R. and Scarsbrook M.R. (2001). *Protocols for sampling macroinvertebrates in wadeable streams*. Ministry for the Environment. 57pp.

Stark J.D., and Maxted J.R. (2007a) *A biotic index for New Zealand's soft-bottomed stream*. New Zealand Journal of Marine and Freshwater Research: 41, 43-61pp.

Stark J.D., and Maxted J.R. (2007b) *A user guide for the Macroinvertebrate Community Index*. Cawthron Institute for the Ministry for the Environment. 58pp.

Storey, R.G.; Neale, M.W.; Rowe, D.K.; Collier, K.J.; Hatton, C.; Joy, M.K.; Maxted, J. R.; Moore, S.; Parkyn, S.M.; Phillips, N.; and Quinn, J.M. (2011). *Stream Ecological Valuation (SEV): a method for assessing the ecological function of Auckland streams*. Auckland Council Technical Report 2011/009.

7. APPENDICES

Appendix I. Raw Macroinvertebrate Data

PHYLUM	CLASS: Order	Family	Taxa	Taxa MCI hb	Taxa MCI sb	Site S-D
ANNELIDA	**OLIGOCHAETA**		Oligochaeta	1	3.8	8
	HIRUDINEA		*Glossiphonia* sp.	3	1.2	3
PLATYHELMINTHES			Platyhelminthes	3	0.9	1
MOLLUSCA	**GASTROPODA**	Hydrobiidae	*Potamopyrgus antipodarum*	4	2.1	2
		Physidae	*Physella fontinalis*	3	0.1	
	BIVALVIA	Sphaeriidae	*Pisidium hodgkini*	3	2.9	
ARTHROPODA	**ARACHNIDA: Acari (mites)**		Acari	5	5.2	1
	ARACHNIDA: Araneae		*Dolomedes* sp.	5	6.2	1
	CRUSTACEA: Copepoda		Copepoda	5	2.4	1
	Ostracoda		Ostracoda	3	1.9	14
			Paraleptamphopus subterraneus	5	5.5	
	INSECTA: Odonata	Zygoptera	*Xanthocnemis zealandica*	5	1.2	59
			Austrolestes colensonis	6	0.7	2
	Trichoptera	Hydroptilidae	*Oxyethira albiceps*	2	1.2	3
		Hydrobiosidae	*Costachorema* sp.	7	7.2	1
		Polycentropodidae	*Polyplectropus puerilis*	8	8.1	20
	Coleoptera	Hydrophilidae	*Enochrus tritus*	5	2.6	31
	Diptera	Tipulidae	*Zelandotipula* sp.	6	3.6	2
		Hexatomini	*Paralimnophila skusei*	6	7.4	2
		Simuliidae	*Austrosimulium australense* gp	3	3.9	1
		Chironomidae	*Chironomus*	1	3.4	16
			Orthcladiinae	2	3.2	11
			Tanypodinae	5	6.5	1
		Muscidae	Muscidae	3	1.6	
		Culicidae	*Culex*sp.	3	1.2	1
		Dixidae	*Paradixa* sp.	4	8.5	3
	Collembola	Collembola .	Collembola	6	5.3	4
		TOTALS:	**NO. TAXA**			23
			NO. EPT TAXA			3
			NO. INDIVIDUALS			188

Appendix II. SEV Function Summary Table

Ecological Function	Variable	SEV Values
Hydraulic		
Natural Flow Regime	Vchann	0.37
	Vlining	0.72
	Vpipe	1.00
	=	**0.49**
Floodplain Effectiveness	Vbank	0.58
	Vrough	0.22
	=	**0.13**
Connectivity for Natural Species Migration	Vbarr	0.00
	=	**0.00**
Natural Connectivity to Groundwater	Vchanshape	0.90
	Vlining	0.72
	=	**0.78**
Hydraulic function mean score		**0.35**
Biogeochemical		
Water Temperature Control	Vshade	0.28
	=	**0.28**
Dissolved Oxygen Levels	Vdod	0.40
	=	**0.40**
Organic Matter Input	Vripar	0.05
	Vdecid	1.00
	=	**0.05**
In-Stream Particle Retention	Vmacro	0.26
	Vretain	0.20
	=	**0.20**
Decontamination of Pollutants	Vsurf	0.59
	Vripfilt	0.34
	=	**0.47**
Biogeochemical function mean score		**0.28**
Habitat Provision		
Fish Spawning Habitat	Vgalspwn	1.00
	Vgalqual	0.00
	Vgobspwn	0.10
	=	**0.05**
Habitat for Aquatic Fauna	Vphyshab	0.32
	Vwatqual	0.10
	Vimperv	0.70
	=	**0.36**
Habitat provision function mean score		**0.20**
Biodiversity		
Fish Fauna Intactness	Vfish	0.00
	=	**0.00**
Invertebrate Fauna Intactness	Vmci	0.46
	Vept	0.50
	Vinvert	0.47
	=	**0.47**
Riparian Vegetation Intactness	Vripcond	0.16
	Vripconn	0.40
	=	**0.06**
Biodiversity function mean score		**0.18**
Overall mean SEV score		**0.267**