REPORT

Tonkin+Taylor

Healthy Waters - Te Ararata Flood Resilience Works -Walmsley Road Bridge Replacement

Ecological Impact Assessment

Prepared for
Auckland Council

Prepared by
Tonkin & Taylor Ltd

Date
October 2024

Job Number
1017033.2003 v1

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Document control

Title: Te Ararata Improvements Flood Resilience Works - Walmsley Road Bridge					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
October 2024	1	Final EcIA	S. Heggie-Gracie / R. Oliver	J. Quinn L. Kabrle	C. Bauld

Distribution:

Auckland Council 1 PDF copy

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Table of contents

Executive summary

This Ecological Impact Assessment (EcIA) report has been prepared to accompany a resource consent application for the Walmsley Road Bridge replacement project under the Severe Weather Emergency Recovery (Auckland Flood Resilience Works) Order 2024.

Te Ararata catchment was identified by Auckland Council Healthy Waters (Healthy Waters) as one of the worst affected areas of Auckland following the January 2023 floods. Healthy Waters identified significant flooding, causing risk to life, and widespread flood damage to approximately 321 homes, which occurred due to poor flood conveyance along Te Ararata Creek. One of the blockage locations is at the Walmsley Road Bridge, currently a twin box culvert which is proposed to be removed and replaced with a bridge structure to increase flood conveyance capacity. The construction methodology is to close the existing road bridge to facilitate construction.

This report presents an assessment of freshwater and terrestrial values and effects for the proposed works. The assessment was undertaken in general accordance with the Ecological Impact Assessment guidelines (EcIAG) (Roper-Lindsay et al. 2018). A desktop assessment and site investigations were undertaken to assess the ecological characteristics and values at the site. Targeted mokomoko / lizard surveys were also undertaken.

Ecological values in the project footprint range from **negligible** to **very high**; features of note include Te Ararata Creek and native and exotic vegetation and fauna (vegetation, birds, lizards and fish). Potential and actual impacts to the ecological features present at the site include vegetation removal, potential for sediment and contaminant discharge, instream modification, fish passage and fauna disturbance, injury or mortality. Vegetation removal comprises approximately 741 m^2 of native and exotic vegetation.

Instream modification and fish passage barriers are limited to temporary effects, with reinstatement of the stream channel and fish passage to be enabled post construction. Effects management is otherwise proposed through the implementation of management plans and remediation planting. An Erosion and Sediment Control Plan (ESCP) and Ecological Management Plan (EMP) have been prepared to accompany the resource consent application and EcIA.

Within the EMP (appended to the AEE), a Freshwater Fauna Management Plan (FFMP), Avifauna Management Plan (AMP), Mokomoko (lizard) Management Plan (MMP), and Vegetation Management Plan (VMP) are included to manage effects on birds, lizards, fish and vegetation. Remediation planting has been proposed to manage the loss of vegetation as a result of the works.

Following the implementation of the effects management measures, EMP and remediation works, potential adverse effects to the ecological values of the site can be managed to an overall level of effect of **low** or **very low** in the medium term.

1 Introduction

Tonkin & Taylor Ltd (T+T) has been engaged by Auckland Council's Healthy Waters department (Healthy Waters) to undertake an Ecological Impact Assessment (EcIA) for the proposed Te Ararata Walmsley Road bridge replacement works (the Project). The Project is flood resilience works and has been developed to support a resource consent application under the Severe Weather Emergency Recovery (Auckland Flood Resilience Works) Order 2024.

This report assesses the construction and operational ecological effects of the Project based on an indicative construction methodology and concept design developed to support the resource consent application (as per the Assessment of Effects on the Environment (AEE); Beca Ltd., November 2024).

A reasonable worst case and effects envelope (Figure 1.1) has been assumed within this assessment to account for potential changes to activities and programme. Minor changes to the final methodology and detailed design are unlikely to change the overall envelope of effects as presented in this report.

1.1 Project background

The January 2023 floods, followed closely by Cyclone Gabrielle, marked a period of unprecedented weather challenges for Auckland. The floods, and the subsequent cyclone caused significant infrastructural damage, with an estimated 8,000 homes destroyed or damaged and thousands of residents' lives affected. The events underscored the city's vulnerability to extreme weather, prompting Auckland Council to endorse the "Making Space for Water Programme" developed by Healthy Waters. This initiative aims to mitigate flood risks through a series of blue-green networks, addressing critical flood-prone areas with sustainable stormwater solutions.

As part of the overall Programme, Healthy Waters identified a combination of interventions within the Te Ararata catchment (overall referred to as the Te Ararata Project) to collectively address the flood resilience issues further outlined in the AEE.

1.2 Project overview

The first package of works within the overall Te Ararata Project is for the Walmsley Road bridge replacement works (i.e. the Project) and is the subject of this assessment. The Project seeks to achieve greater flow capacity and reduce blockage risk beneath Walsmley Road and within Te Ararata Creek.

A detailed description of the proposed work and indicative methodology is provided in the AEE prepared for the application. The Project is located within the existing Walmsley Road bridge, Te Ararata Creek, Black Bridge Reserve and Walmsley Road Reserve (refer to Figure 1.1). Overall construction of the Project is anticipated to take approximately 10 – 12 months, with closure of the existing Walmsley Road bridge required for approximately seven months during this period.

In summary, the Project includes the following key elements:

- Demolition and removal of the existing Walsmley Road twin culvert.
- Construction of a new replacement Walmsley Road bridge over Te Ararata Creek.
- Works to tie in the new replacement bridge with the existing road network.
- Recontouring of the stream banks under the bridge to achieve a wider stream channel.
- Relocation of the existing Watercare watermain pipe bridge foundations to achieve a wider clearance beneath the structure.
- Existing service relocation and/or realignment.

- Vegetation clearance, including within riparian margins and the removal of trees.
- Earthworks associated with temporary and permanent works, including within the riparian margins.
- Other temporary works and activities to facilitate the construction of the permanent bridge including:
  - The formation and operation of laydown areas and a site compound predominantly within Black Bridge Reserve.
  - Works within and around the Te Ararata Creek including temporary stream diversion.
  - Temporary traffic management measures including a temporary bailey bridge to facilitate pedestrian and active mode diversions between Coronation Road and Walmsley Road. Vehicular traffic will be diverted to the wider existing road network.

An overview of the Walmsley Road Bridge works is shown below in Figure 1.2.

A separate draft Ecological Management Plan (EMP) has been prepared by T+T for the Project to detail specific management measures to address potential adverse effects. The EMP is appended to the AEE.

Figure 1.1: Site location and surrounding area ('the site').

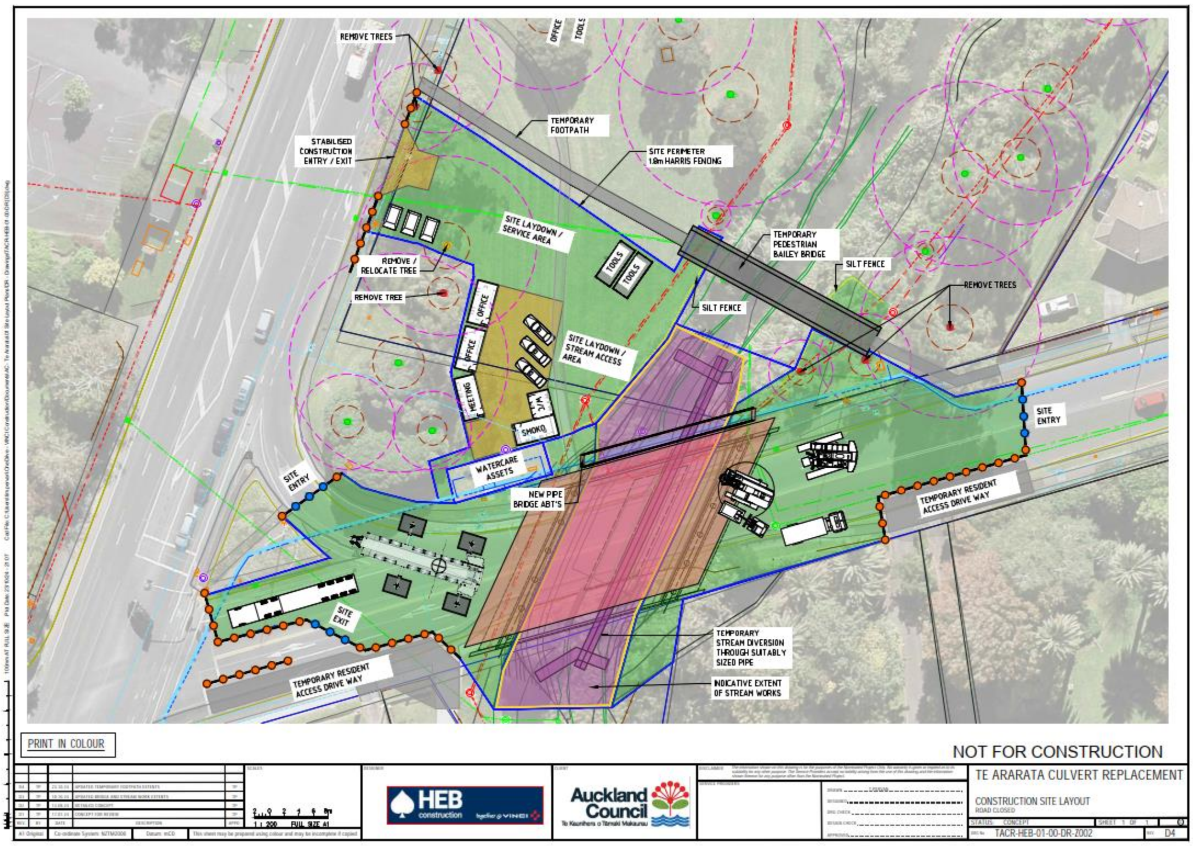


Figure 1.2: Extent of work required under road closure of Walmsley Bridge.

1.3 Scope

The scope of this report is to provide an EcIA of the Project on the terrestrial, wetland and freshwater ecological values of the site.

This report broadly follows the Ecological Impact Assessment Guidelines (EcIAG) (Roper-Lindsay et al., 2018) and includes:

- A description of the proposed activity.
- An outline of assessment methods used.
- A description of the ecological characteristics and values of the terrestrial and freshwater environments.
- An assessment of the actual and potential ecological effects of the Project on the ecological values identified.
- An outline of any further effects management required.

The assessment undertaken within this report relies on the Assessment of Effects on the Environment (and associated drawings) prepared by Beca Ltd (Beca, 2024).

1.4 Geographical, ecological and cultural context

The site is located in the Tamaki Ecological District (ED) and Te Ararata Creek catchment. Extensive lowland forest dominated the ED prior to human occupancy. The ED has undergone considerable modification since human occupancy, including clearance of vegetation, landform changes and ongoing impacts from the continued urbanisation and growth of Auckland City. Remaining native vegetation is often fragmented or degraded by pest plants and animals.

The previous ecosystem type at Black Bridge Reserve and Walmsley Road Reserve was pūriri forest (WF7; Singers et al. 2017) (Auckland Council GeoMaps – potential ecosystem extent layer). Presently Black Bridge Reserve comprises a recreational area with open parkland, specimen pōhutukawa and exotic trees, and native riparian plantings bordering Te Ararata Creek. Surrounding areas are dominated by residential housing.

Te Ararata Creek flows north under Walmsley Road Bridge and intersects Black Bridge and Walmsley Road Reserves. The system is fed by open and piped watercourses from the surrounding residential and commercial areas.

A marine Significant Ecological Area (SEA), SEA-M2-23a[1] overlays mangrove forest (SA.1; Singers et al. 2017) is located approximately 250 m downstream of the site. The SEA is listed in the Auckland Unitary Plan Operative in part (AUP OP) as 'Ambury intertidal flats'. The flats provide foraging grounds for wading and other coastal birds, including nationally Threatened species. Mangrove forest dominates the areas of this SEA from the estuary mouth upstream.

Two cultural values assessments (CVA) have been provided for the Project, being from Te Ahiwaru Trust (Te Ahiwaru Trust, 2024) and Te Ākitai Waiohua (Te Ākitai Waiohua, 2024). Both CVA's include reference to cultural values that relate to ecological values presented in this report, including the value of tuna (eels), Te Ararata Creek as an ecological area and biodiversity values more broadly. Refer to the AEE and its appendices for more information.

1.5 Statutory context

Notwithstanding that this application is being prepared under the Severe Weather Emergency Recovery (Auckland Flood Resilience Works) Order 2024, the following statutory matters are relevant to the ecological assessment specifically in relation to terms and definitions used. These are identified at a high level in this section and are referred to where relevant within this EcIA and included:

- The Auckland Unitary Plan (AUP) includes a number of schedules outlining Wetland Management Areas, Significant Ecological Areas, Outstanding Natural Features and Notable Trees which are relevant for this assessment.
- National Policy Statement for Freshwater Management (NPS FM 2020, amended February 2024) (Ministry for the Environment, 2024). There are some specific definitions that are relevant to this assessment including:
  - Natural inland wetland.
  - Effects management hierarchy.
  - Aquatic offset and associated principles in Appendix 6.
  - Aquatic compensation and associated principles in Appendix 7.
- National Policy Statement for Indigenous Biodiversity (NPS IB) (Ministry for the Environment, 2023). There are some specific definitions that are relevant to this assessment including:
  - Effects management hierarchy.
  - Biodiversity offset and associated principles in Appendix 3.
  - Biodiversity compensation and associated principles in Appendix 4.

[1] Note SEA-M2 areas are designated as of regional, national, or international significance, but are less vulnerable than SEAs classified as M1 as they are generally more robust.

2 Assessment methods

2.1 Desktop review of available information

Publicly available information and databases were reviewed to inform the methodology and approach to the assessment of ecological values and to establish the ecological context and values of the site. This included a review of the following available information:

- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al. 2017).
- Auckland Council geographic information system (GIS) layers (GeoMaps) (https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html):
  - Significant ecological areas (SEAs).
  - Ecosystem type layers.
  - Aerial imagery assessment of the SEAs and wider landscape to assess habitat suitability for terrestrial fauna.
  - Overland flow paths.
  - Mapped wetlands.
  - Permanent rivers or streams.
- New Zealand Plant Conservation Network Database (NZPCND).
- iNaturalist database (https://iNaturalist.org).
- Bat records from the New Zealand bat distribution database (DOC) (updated August 2024).
- eBird database (https://ebird.org).
- Auckland Council Herpetofauna Database (updated 17 August 2023) and DOC NZ Herpetofauna Atlas Database (updated December 2023).
- Mollusca (snail) database (https://mollusca.co.nz).
- New Zealand Freshwater Fish Database (NZFFD).

2.2 Reliance on previous reporting

LEAD Alliance, for Kāinga Ora, has been leading the redevelopment of areas of state housing across Auckland, including within the Mangere area. T+T's ecologists have been involved in several phases of work for LEAD Alliance within Te Ararata Creek and the surrounding area. As such, ecological information from previous work undertaken by LEAD Alliance in this area has been reviewed and relied on to inform the ecological values of the site.

2.3 Site visit

A number of site visits were undertaken to inform this EcIA, including those undertaken for previous LEAD Alliance work. Site walkovers to gain an overview of the site and observe the key ecological features were undertaken by a terrestrial ecologist on 10 July and 21 August 2024, and by a freshwater ecologist on 19 June 2024. Site visits were undertaken during fine conditions. Additional survey specific site visits are described in the following sections.

2.4 Specific field methods

2.4.1 Vegetation

Vegetation was recorded and mapped during the site visit on 10 July 2024. Nationally and regionally 'At Risk' and 'Threatened' (De Lange et al. 2024; Simpkins et al. 2022) species were recorded.

Ecosystem types were recorded in accordance with those listed in the indigenous terrestrial and wetland ecosystems of Auckland (Singers et al. 2017).

An assessment of potential wetlands within 100 m of the project footprint (

Figure *1.1*) was undertaken. The assessment was undertaken through a visual assessment of potential wetland vegetation and hydrological indicators. Potential wetland areas were assessed against Resource Management Act 1991 (RMA) and NPS FM wetland definitions. No wetland areas were identified and so are not discussed further.

2.4.2 Terrestrial birds

Potential terrestrial bird habitats were recorded and mapped during site visits on 10 July and 21 August 2024. Potential terrestrial bird habitats included native trees and shrubs as foraging habitat and exotic trees as perching and roosting habitat. Incidental observations of avifauna were recorded.

2.4.3 Lizards

Potential lizard habitats were recorded and mapped during site visits on 10 July and 21 August 2024. Based on desktop assessment, only native skinks were considered likely to be present. Potential skink habitats assessed included:

- Deep leaf litter.
- Pampas and harakeke (*Phormium tenax*) mounds.
- Dense shrubland / scrub.
- Rank grass.
- Woody debris.
- Rock piles.
- Anthropogenic debris / rubbish piles.

A total of 30 Artificial Cover Objects (ACOs) were deployed in potential lizard micro-habitats on 21 August 2024. Incidental observations of lizards were recorded. ACOs were checked on 23 September, 2 October and 9 October 2024 and results are presented in this report.

A potential relocation site (Te Pane-o-Mataaho / Te Ara Pueru / Māngere Mountain) was investigated on 31 July 2024. Potential micro-habitat suitability at the site was recorded. A total of 40 ACOs were deployed at the relocation site on 23 September 2024.

2.5 Approach to ecological impact assessment

Under the Severe Weather Emergency Recovery (Auckland Flood Resilience Works) Order 2024, the ecology principles require the effects management hierarchy to be implemented.

The method applied to this ecological impact assessment report broadly follows the Ecological Impact Assessment Guidelines 2018 (EcIAG) published by the Environment Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay et al, 2018). The guidelines provide a standardised framework and matrix allowing a consistent and transparent assessment of ecological effects.

The guidelines were used to establish the following:

- The ecological values within the project footprint and immediate surrounds (ref to Table Appendix B.1 and Table Appendix B.2 in Appendix B).
- The magnitude of effect (ref to Table Appendix B.3 in Appendix B) on ecological values from the proposed project works in the absence of any controls and considering:
  - The spatial scale of the effect.
  - The relative permanence of the effect.
  - The intensity of the effect within the impact footprint.
  - Timing of the effect in respect of key ecological factors.
  - Level of confidence in understanding the expected effect.
- The overall level of effects to determine whether avoidance, minimisation, remediation, or mitigation is required (ref to Table Appendix B.4 in Appendix B).
- The magnitude of effect and overall level of effect, taking into consideration the additional measures to avoid, minimise, remedy or mitigate effects and whether there are residual adverse effects that should be offset or compensated.
  - It is generally accepted under the EcIAG that if, after all efforts to avoid, remedy, mitigate and minimise effects, there remains an overall effect of **moderate** or higher, further efforts are required to address these residual adverse effects in the form of offset or compensation.

Refer to Appendix B for the criteria and tables used in this assessment.

This assessment of ecological effects follows the framework outlined in the EIANZ EcIAG. The EcIAG guidelines state that practitioners may deviate from the guidelines framework where it is considered ecologically relevant and justifiable to do so.

While the assessment criteria for terrestrial values is fairly well defined in the EcIAG (refer Table Appendix B.1 in Appendix B), the freshwater values are less so. For the purpose of this assessment, we have adapted freshwater values criteria based on the EcIAG (refer Table Appendix B.2 in Appendix B) which assigns ecological value based on biodiversity and ecological function values of the freshwater ecosystems.

Note that the NPS FM requires that consideration of the loss of 'potential' value of freshwater systems is incorporated into assessments of effects. As such, the ecological value of freshwater systems is provided as 'current' ecological value and 'potential' ecological value.

3 Ecological characteristics and values

3.1 Freshwater

3.1.1 Ecosystem

Te Ararata Creek subcatchment of Māngere inlet drains a total area of 684 ha. The catchment is heavily urbanised, having been modified primarily by residential development and the construction of district and regional arterial roads, as well as national routes (Young et al., 2013).

Te Ararata Creek is relatively straightened and channelised upstream of the project footprint. There is limited in-stream habitat heterogeneity with substrate primarily comprising soft substrates, along with some areas of gravel and cobble. The riparian margin is primarily mown grass on the true left bank, with periodic riparian vegetation on the true right (Photograph 4.1), most of which has been planted by active local community groups in the upper catchment. Closer to the project footprint at Walmsley Road Bridge, the stream channel exhibits a more natural channel shape, however still has limited in-stream habitat heterogeneity and lacks a cohesive native riparian margin (Photograph 4.2). Where the riparian margin is lacking in woody vegetation, Te Ararata Creek is effectively unshaded contributing to increased solar access leading to elevated instream temperatures and aquatic plant growth. At times in summer, the stream is known to become choked with macrophytes and algae can be present on the hard substrates.

Photograph 3.1: Stream reach upstream of Walmsley Road Bridge,facing usptream.

Photograph 3.2: View of Walmsley Road Bridge twin culvert and proposed works site, facing downstream.

Auckland Council has undertaken long-term State of the Environment (SoE) freshwater health monitoring assessments in a suite of watercourses across the Auckland region, including at a sampling site in Te Ararata Creek approximately 650 m upstream of the project footprint (Chaffe, 2021). Stream Ecological Valuation (SEV) and macroinvertebrate surveys were undertaken over a 10 year period, extending from 2010 to 2019 inclusive. SEV scores for Te Ararata monitoring site ranged from 0.28 to 0.41, with a 5 year median of 0.33. Results are indicative of poor ecological function, owed to poor habitat provision and biodiversity values. Macroinvertebrate Community Index (MCI) scores ranged from 65.6 to 79.7, with a five-year median of 75.0, indicative of 'poor' water and habitat quality. While the monitoring site is outside of the project footprint, the sites have similar characteristics and is considered representative of conditions at the project footprint.

Further macroinvertebrate sampling was undertaken at two sites in Te Ararata Creek by LEAD Alliance in 2023 and 2024 (LEAD Alliance, 2024). Sampling sites were located approximately 100 m and 600 m upstream of the project footprint. MCI values ranged from 63.2 at the upstream site, to 42.5 at the downstream site closest to the project footprint. MCI scores at both sites were lower in 2024 than in 2023. All macroinvertebrate data collected indicates that Te Ararata Creek is of 'poor' ecological quality (Stark & Maxted, 2007).

Alongside the macroinvertebrate sampling LEAD Alliance undertook a comprehensive water quality monitoring programme in Te Ararata Creek from May 2023 to May 2024 (LEAD Alliance, 2024). Results showed nearly all samples exceeded the Australian and New Zealand guidelines for fresh and marine water quality (ANZG) 95 % default guideline values (DGV) for zinc at both sites, and a large proportion of samples also exceeded the 95 % DGV for copper at both sites. A smaller proportion of samples also exceeded the 80% DGV for zinc at both sites. Approximately half of the samples at both sites exceeded the NPS FM national bottom line for *E. coli*, which is likely indicative of wastewater discharges to the streams and a pathway for avian and canine faecal contamination to enter Te Ararata Creek. These findings, along with those from the macroinvertebrate sampling, indicate that the water quality in Te Ararata Creek is poor.

Based on the above findings, the current ecological value of the stream habitat has been assessed to be **moderate.** If the project was not to occur, the potential ecological value of the stream is considered to be the same as the current value. The stream is heavily urbanised with catchment wide water quality issues and is unlikely to undergo significant natural regeneration in the absence of intervention. The potential ecological value of Te Ararata Creek has been assessed to be **moderate**.

3.1.2 Fauna

Eight native fish species have been recorded in Te Ararata Creek on the New Zealand Freshwater Fish Database (NZFFD) and following previous survey work by LEAD Alliance (Table 3.1). Three of these species, longfin eel (*Anguilla dieffenbachii*), giant kōkopu (*Galaxias argenteus)* and inanga (*Galaxias maculatus*), have a national conservation status of At Risk – Declining (Dunn et al., 2018); giant kōkopu is also classified as Threatened – Regionally Critical in Auckland (Bloxham et al., 2023). Redfin bully (*Gobiomorphus huttoni*) has a national conservation status of Not Threatened, but its regional classification is At Risk – Regionally Declining. Smelt (*Retropinna retropinna*) has a national threat classification of Not Threatened but is Threatened – Regionally Vulnerable.

Mosquitofish *Gambusia affinis*, a non-native invasive species, have also been recorded in Te Ararata Creek.

Species listed as Nationally At Risk – Declining are of **high** ecological value based on the EIANZ EcIAG criteria (Table Appendix B.1). Redfin bully and smelt have been given a **moderate** and **high** ecological value as while they are nationally Not Threatened, they do have elevated regional threat classifications.

Giant kōkopu are vulnerable to a range of pressures including habitat modification, declines in water quality, predation, extreme weather events related to climate change and recruitment failure. Ordinarily, they are restricted to relatively undisturbed forested catchments and/or forested local parks and reserves where fewer pressures exist and have largely disappeared from Auckland's urban watercourses (Bloxham et al., 2023). The population within Te Arata Creek is thus notable, although it is acknowledged that there have not been recent records of giant kōkopu within Te Ararata Creek. Whilst there are no set values provided for species listed as Threatened – Regionally Critical within the EIANZ guidelines, the ecological value of giant kōkopu has been assessed to be **very high** at a regional level and given the importance of the population at this location.

Table 3.1: Records of native fish species present within Te Ararata Creek retrieved from the NZFFD and LEAD Alliance (2024)

Common name	Scientific name	National conservation status	Regional conservation status	Ecological value
Shortfin eel	*Anguilla australis*	Not Threatened	Regionally Not Threatened	Low
Banded kōkopu	*Galaxias fasciatus*	Not Threatened	Regionally Not Threatened	Low
Common bully	*Gobiomorphus cotidianus*	Not Threatened	Regionally Not Threatened	Low
Redfin bully	*Gobiomorphus huttoni*	Not Threatened	At Risk – Regionally Declining	Moderate
Smelt/pōrohe	*Retropinna retropinna*	Not Threatened	Threatened – Regionally Vulnerable	High
Longfin eel	*Anguilla dieffenbachii*	At risk – Declining	At Risk – Regionally Declining	High
Inanga	*Galaxias maculatus*	At risk – Declining	At Risk – Regionally Declining	High
Giant kōkopu	*Galaxias argenteus*	At risk – Declining	Threatened – Regionally Critical	Very high

3.2 Terrestrial flora and fauna

3.2.1 Ecosystem

Native riparian plantings and exotic-dominated forest were present at the Walmsley Road Bridge site. The extent of each ecosystem type is presented in Appendix A Figure 1. Refer to Appendix C for a full species list of the site.

Native riparian plantings were present to the north of Walmsley Road Bridge and across both Black Bridge Reserve and Walmsley Road Reserve (Photograph 3.3; Photograph 3.4). Native riparian plantings were approximately 5 m in height and dominated by typical riparian planting species.

Canopy species included mānuka (*Leptosperum scoparium*), kānuka (*Kunzea robusta*), pūriri (*Vitex lucens*), tī kōuka (*Cordyline australis*), karaka (*Corynocarpus laevigatus*), māhoe (*Melicytus ramiflorus*), lemonwood (*Pittosporum eugenioides*) and ngaio (*Myoporum laetum*). The understory was dominated by harakeke (*Phormium tenax*) on the peripheries, with occasional native ferns, ground covers and seedlings including trembling brake (*Pteris tremula*), mercury bay weed (*Dichondra repens*) and purei (*Carex secta*). Kohekohe (*Didymocheton spectabilis*) seedlings were naturally established. Introduced species included German ivy (*Delairea odorata*), brush wattle (*Paraserianthes lophantha*) and nasturtium (*Trapaeolum majus*). Introduced she-oak (*Casuarina cunninhamiana*) trees and saplings occurred on the eastern side of Te Ararata Creek in Walmsely Road Reserve. This ecosystem type supports native forest birds and skinks. It protects and buffers Te Ararata Creek. Native riparian plantings are of **moderate** ecological value (refer to Table 3.2 for justification).

Exotic forest occurred to the south of Walmsley Road Bridge on the eastern side of Te Ararata Creek (Photograph 3.5). Exotic forest was dominated by flame tree (*Erythrina x sykesii*) and phoenix palm (*Phoenix canariensis*). The understory was dominated by common introduced species including bear's britches (*Acanthus mollus*), nasturtium and tradescantia (*Tradescantia fluminensis*). The western side of Te Ararata Creek was dominated by introduced grasses and herbs including kikuyu grass (*Cenchrus clandestinus*), nasturtium, montbretia (*Crocosmia x crocosmiiflora*), creeping buttercup (*Ranunculus repens*) and broad-leaved doc (*Rumex obtusidolius*). This ecosystem type supports native forest birds and skinks. It protects and buffers Te Ararata Creek. Exotic forest is of **low** ecological value (refer to Table 3.2 for justifications).

Table 3.2: Ecosystem assessment in accordance with EIANZ guidelines

Ecosystem type	Assessment matters	Summary value
Native vegetation	**Representativeness** Typical structure and composition for native vegetation plantings. Plantings are relatively young (only five to six metres tall). Indigenous species dominate but some introduced species invasion. Overall, relatively low indigenous biodiversity. Area rates **moderate** for this assessment matter.	Area rates **low** for one matter and **moderate** for three assessment matters and is therefore of **moderate** ecological value.
	Rarity / distinctiveness Common ecosystem type. However urban areas often have low amounts of native vegetation and therefore provides important habitat. No distinctive ecological features. Provides habitat for common native urban birds. Provides habitat for At Risk copper and ornate skinks. Area rates **moderate** for this assessment matter due to supporting a small suite of rare / distinctive fauna and flora.	
	Diversity and pattern Level of natural diversity is relatively low. Low complexity / vegetation structure. Area rates **low** for this assessment matter.	
	Ecological context Relatively small area of vegetation but connected to other riparian vegetation and buffers and protects Te Ararata Creek. High level of edge effects and impacted by invasive species. Area rates **moderate** for this assessment matter.	
Exotic forest	**Representativeness** Exotic forest and shrubland is common in the wider environment and does not provide habitat for many native species. Area rates **low** for this assessment matter.	Area rates **low** for three assessment matters and moderate for one assessment matter and is therefore considered of **low** ecological value.
	Rarity / distinctiveness Supports common native birds and provides habitat for At Risk copper and ornate skinks. Area rates **moderate** for this assessment matter.	
	Diversity and pattern Level of natural diversity is relatively low. Low complexity / vegetation structure. Area rates **very low** for this assessment matter.	

Ecosystem type	Assessment matters	Summary value
Native vegetation	**Representativeness** Typical structure and composition for native vegetation plantings. Plantings are relatively young (only five to six metres tall). Indigenous species dominate but some introduced species invasion. Overall, relatively low indigenous biodiversity. Area rates **moderate** for this assessment matter.	Area rates **low** for one matter and **moderate** for three assessment matters and is therefore of **moderate** ecological value.
	Rarity / distinctiveness Common ecosystem type. However urban areas often have low amounts of native vegetation and therefore provides important habitat. No distinctive ecological features. Provides habitat for common native urban birds. Provides habitat for At Risk copper and ornate skinks. Area rates **moderate** for this assessment matter due to supporting a small suite of rare / distinctive fauna and flora.	
	Diversity and pattern Level of natural diversity is relatively low. Low complexity / vegetation structure. Area rates **low** for this assessment matter.	
	Ecological context Relatively small area of vegetation but connected to other riparian vegetation and buffers and protects Te Ararata Creek. High level of edge effects and impacted by invasive species. Area rates **moderate** for this assessment matter.	
	Ecological context Provides limited support to ecological networks and linkages. Buffers Te Ararata Creek. As a result, the area rates **low** for this assessment matter.	

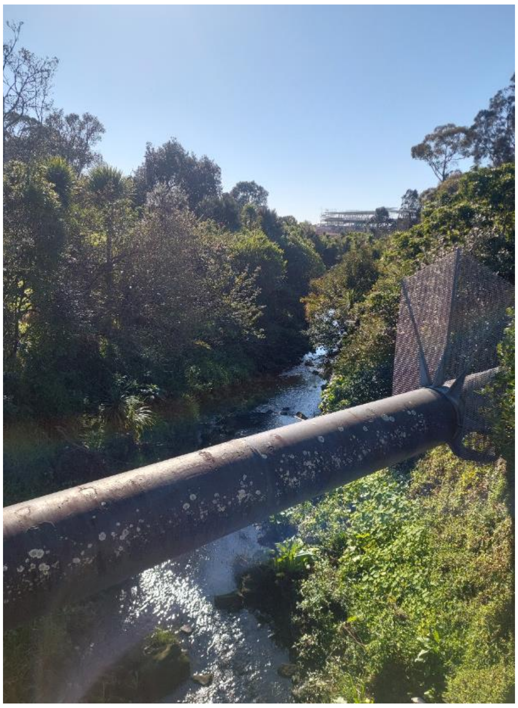
3.2.2 Vegetation

A number of specimen pōhutukawa trees (*Metrosideros excelsus*) were present at Black Bridge Reserve (Photograph 3.6). Pōhutukawa trees were approximately 80 cm to 140 cm DBH (Diameter at Breast Height; average of 86 cm) and 11 m in height.

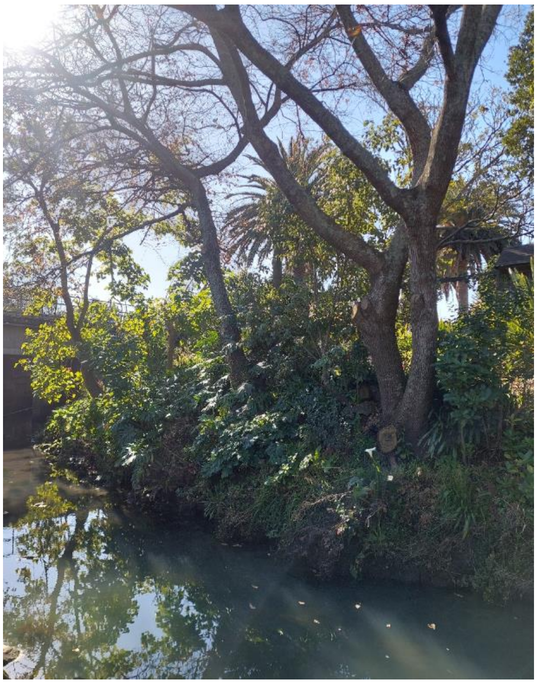
Of the species recorded, kānuka, mānuka, ngaio and pōhutukawa are classified as nationally Not Threatened (De Lange et al. 2024) but regionally, kānuka, ngaio and pōhutukawa are classified as At Risk – Regionally Declining, with mānuka classified as Threatened – Regionally Vulnerable (Simpkins et al. 2022). The threat classifications for kānuka, mānuka and pōhutukawa are raised due to the potential threat of myrtle rust (*Austropuccinia psidii*). Ngaio has a heightened threat classification due to hybridisation with exotic species. They are otherwise common in the local and wider environment. Korokio (*Corokia buddleioides*) is classified as nationally Not Threatened, but At Risk – Regionally Declining. Korokio has been planted under specimen pōhutukawa and may be a garden variety. Korokio is located outside of the project footprint. All other species are classified as nationally Not Threatened or introduced.

As a result of their threat classifications, kānuka, ngaio, mānuka, pōhutukawa and korokio are of **moderate** ecological value. All other identified species are of **low** ecological value due to their threat classification, age / size (five to six metres) and having been planted.

Photograph 3.3: Native riparian plantings buffering Te Ararata Creek.



Photograph 3.4: Native riparian planting buffering Te Ararata Creek.



Photograph 3.5: Exotic forest on the eastern bank of Te Ararata Creek.

Photograph 3.6: Planted pōhutukawa specimen tree.

3.2.3 Bats

No native bats have been recorded in the suburbs in the vicinity of Māngere. Recent surveys at the nearby Te Pane o Mataoho / Māngere Mountain targeting long-tailed bats (*Chalinolobus tuberculatus*; Threatened – Nationally Critical (O'Donnell et al. 2022)) did not detect native bats following a month of monitoring during April 2024 (T+T, 2024) and as recorded in the DOC Bat Database[2]. Monitoring at nine other maunga in the Auckland isthmus also did not detect long-tailed bats.

The site is highly urbanised, with no direct linear habitat features or corridors to known bat populations. Noise and light disturbance at the site further limit the likelihood of potential bat presence. As result, native bats are not considered to be present at the site and are not considered further.

3.2.4 Birds

Through desktop assessment a total of 15 native birds were recorded in and around the project area, two of which are classified as nationally At Risk (Robertson et al. 2021) and regionally At Risk and Threatened (Woolly, 2024), with the remaining classified as nationally and regionally Not Threatened (Appendix C).

Four native species were identified during the site visit, riroriro (*Gerygone igata*), tauhou (*Zosterops lateralis*), pīwakawaka (*Rhipidura fuliginosa*), and tūī (*Prosthemadera novaeseelandiae*). The suite of terrestrial bird species expected at this site are common urban forest birds.

Two nationally At Risk species were identified as potentially being present at site, North Island kākā (*Nestor meridionalis septentrionalis*; nationally At Risk – Recovering; At Risk – Regionally Recovering) and tarāpunga / red-billed gull (*Chroicocephalus novaehollandiae*; At Risk – Declining; Threatened – Regionally Vulnerable). Both species may intermittently forage or roost at the site but are unlikely to nest at the site.

Due to their threat classifications, nationally Not Threatened bird species are of **low** ecological value, North Island kākā are of **moderate** ecological value and tarāpunga are of **high** ecological value. Tūī (*Prosthemadera novaeseelandiae*) and kererū (*Hemiphaga novaeseelandiae*), despite being nationally Not Threatened, are considered of **moderate** ecological value as key pollinators and seed dispersers.

3.2.5 Lizards

Based on desktop assessment, copper (*Oligosoma aeneum*) and ornate skinks (*O. ornatum*) were considered potentially present at site[3]. The habitat assessment confirmed potential skink habitat comprising logs, harakeke, and dense exotic groundcovers. One copper skink was incidentally recorded while deploying ACOs within the riparian plantings of Walmsley Road Reserve. In addition, during the ACO check undertaken on 23 September 2024, a single ornate skink was recorded. No native skinks were identified during ACO checks on the 2 and 9 October 2024.

No geckos are expected to be present based on desktop assessment and marginal habitat quality for geckos which included vegetation approximately 4 - 5 m tall, potentially 10 years in age, separate from any existing populations of geckos or remnant forest.

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[2] DOC Bat Database (2024). ID 54277. 15/04/2024. Tonkin & Taylor.

[3] DOC Herpetofauna Database. Copper skink ID 647297 (700 m from site, observation date 1972). Ornate skink ID 715994 (1 km from site, observation date 1978).

Copper and ornate skinks are classified as nationally (Hitchmough et al. 2021) and regionally (Meltzer et al. 2022) At Risk – Declining. Due to their threat classification they are of **high** ecological value.

3.3 Summary of ecological values

Freshwater and terrestrial species and habitat values associated with Walmsley Road Bridge project footprint range from **low** to **very high** and are detailed in Table 3.3 below.

Table 3.3: Habitats and species identified within the project footprint, their location, characteristics and values.

Habitat / Species	Characteristics	Location	Ecological value
Freshwater values			
Te Ararata Creek	A modified urban stream with poor habitat heterogeneity and water quality.	Flow below Walmsley Road Bridge	**Moderate**
Freshwater fauna	Eight native fish species have been recorded in Te Ararata Creek, including longfin eel, inanga and giant kōkopu, all of which are nationally At Risk – Declining. Giant kokopu is also classified as Threatened – Regionally Critical at a regional level. Redfin bully and smelt are not threatened nationally, but have regional threat classifications of At Risk - Declining and Threatened – Regional Vulnerable respectively.	Te Ararata Creek	**Low to Very high**
Terrestrial values			
Native planted vegetation	Characterised by typical native riparian plantings.	Te Ararata Creek riparian zone	**Moderate**
Exotic forest	She-oak and other exotic species dominate some areas of the riparian margin.	Te Ararata Creek riparian zone	**Low**
Kānuka, mānuka, ngaio, korokio	Planted mānuka, kānuka and ngaio up to 4 m tall forming part of planted native vegetation areas. Korokio shrubs planted under specimen pōhutukawa.	Te Ararata Creek riparian zone	**Moderate**
Pōhutukawa	Individual specimen trees present at Black Bridge Reserve.	Black Bridge Reserve	**Moderate**
Not Threatened vegetation	Planted individuals up to 4 m tall forming part of planted native vegetation areas.	Te Ararata Creek riparian zone	**Low**
Birds	Generally comprise typical urban and terrestrial birds. May also include tarāpunga.	May use Black Bridge Reserve and native and exotic vegetation.	**Low to high**

Habitat / Species	Characteristics	Location	Ecological value
Terrestrial values			
Lizards	Recorded in planted native vegetation.	Te Ararata Creek riparian zone	**High**

4 Assessment of ecological effects

The following section will describe the proposed activities and the potential effects of those activities, before and after mitigation measures, on the ecological features and values discussed above. Measures to address those effects are included within the relevant section and conclusions are drawn as to the overall effect considering those ecological values.

4.1 Proposed works and summary of actual and potential ecological effects

The Project involves the demolition and removal of the existing twin culvert beneath Walmsley Road Bridge, relocation of the existing Watercare watermain pipe bridge foundations, the widening and stabilisation of the existing stream banks, and subsequent construction of a new three-lane- bridge. A temporary bailey bridge will be constructed immediately north of the existing bridge so as to maintain pedestrian / active mode transport flow for the duration of the construction phase.

Potential adverse effects of the project works on freshwater ecological values include:

- Injury and mortality to freshwater fauna during demolition of the existing culvert and associated in-stream works.
- Sediment and contaminant discharge to the freshwater environment during demolition, earthworks, concrete pouring, chemical spills, and rainfall events.
- Obstruction of fish passage during construction.

Potential adverse effects of the project works on terrestrial ecological values include:

- Temporary loss of native riparian plantings (approximately 571 m^2).
- Temporary loss of exotic forest (approximately 170 m^2).
- Disturbance, injury or mortality to birds and lizards.
- One specimen pōhutukawa tree is proposed to be translocated if practicable. However, if the pōhutukawa cannot be translocated, or dies as a result of translocation, there is the potential loss of one specimen pōhutukawa tree.

Approximately 500- 1,000 m^2 of native revegetation will be undertaken following the completion of work. Native revegetation will include eco-sourced native plantings, of a similar composition to the species removed. Refer to Section 4.3.1 for further detail.

4.2 Freshwater

4.2.1 Sedimentation and contaminant effects during construction

Earthworks and works within and adjacent to the bed of streams (‘stream works’) can result in an uncontrolled discharge of sediment laden water during construction. Sediment laden discharges can have negative effects on freshwater fauna, including fish and macroinvertebrates.

The effect of excess in-stream sedimentation is recognised as a major impact of changing land use on river and stream health, through changes in water clarity and sediment deposition dynamics. Sediment entering stream systems can impact water clarity through sediment suspended within the water column (‘suspended sediments’). Many native species (including longfin eels) are tolerant of elevated suspended sediment, measured either by turbid water or high concentrations of total suspended solids (TSS) (Clapcott et al., 2011). However, deposited sediment also affects the available physical habitats within streams, alters food sources and removes egg laying sites for freshwater fauna (Clapcott et al., 2011). Fish migration can also be impacted by high levels of suspended sediment preventing migratory fish from reaching upstream habitat. For the species recorded as being present within Te Ararata Creek, banded kōkopu and redfin bully are the most likely to exhibit avoidance behaviours related to elevated levels of suspended sediment.

There are two key potential sources of sediment and contaminants associated with the construction phase of the Project; land based earthworks including within the riparian margin and in-stream works.

The AEE sets out the indicative construction methodology for the Project. An Erosion and Sediment Control Plan (ESCP) which will include measures for in-stream works, has also been prepared for the works and is appended to the AEE.

This document sets out measures to be implemented during construction that will minimise and has been prepared in accordance with GD05 – Guidance for Erosion and Sediment Control[4].

At a high level, the measures proposed to reduce the potential for sediment (or other contaminant) generation and an uncontrolled discharge of sediment laden water are as follows:

- Land based earthworks:
  - Installation of silt fences at the boundary of the site and along the top of the bank of the creek. These serve to prevent any sediment contaminated water discharging to the freshwater environment and will be maintained throughout the entire project life.
  - Stabilisation of any earthworks using hay mulch, environmental geotextile or biodegradable blanket.
- Other contaminant management:
  - Implementation of appropriate response protocols to potential hazardous chemical spills in line with HEB Construction's spills response steps.
  - Implementation of water treatment, pH monitoring and capture measures during concrete pile pouring and dumping of any concrete into lined containers where there is no risk of discharge.
- Streamworks:
  - Staged isolation of streamworks areas during culvert demolition to create a dry working environment approaching this one culvert at a time.
  - Sand bagging Te Ararata Creek and diverting stream flows through a closed pipe system so as to avoid any debris associated with the culvert demolition and bridge construction entering the waterway.
  - Intention to undertake work in low flow conditions as much as possible, however anticipate that some instream works will be required in winter.
  - Following cutting back of the stream banks, exposed soils will be stabilised prior to the placement of rip rap.
  - Dewatering and appropriate treatment of any water that enters the works area through groundwater leakage or rainfall prior to discharging back to the stream.
  - A suitably qualified ecologist will undertake a site visit of the works area prior to removing the dams and livening the stream flow through each culvert so as to ensure that all potential contaminants have been appropriately removed from the area.

The ESCP outlines that adaptive management will occur throughout the construction phase to ensure that the proposed erosion and sediment control measures are being implemented correctly and functioning effectively. Visual assessments of the receiving environment will also be undertaken

[4] Auckland Council Guideline Document GD2016/005, https://knowledgeauckland.org.nz/publications/erosion-andsediment-control-guide-for-land-disturbing-activities-in-the-auckland-region/

throughout the construction phase with particular attention during and after periods of rainfall. Any noticeable change in water clarity within the stream channel, upstream and downstream of the works area will result in a review of the erosion and sediment control measures and changes made as necessary. It is acknowledged that there is likely to be some in-stream works during autumn and winter months. The proposed works area is small relative to the wider environment, with only one side of the culvert being 'open' to works at any given time. Further the sediment generating works within the stream channel are limited to bank side works and almost all of the works are above normal flow levels.

Weather forecast monitoring will also be undertaken to, where practicable, ensure that critical works only occur during a suitable weather window and that where major flows are expected, measures can be taken in advance.

The isolation of the works area to minimise sediment entering the stream alongside the additional ESC measures avoids to the extent practicable potential sediment effects on fish species. In the unlikely event of an unexpected, uncontrolled discharge of sediment from the works area during low flow conditions, it is expected that sediment sensitive species (banded kōkopu and redfin bully) would be able to easily avoid small sediment plumes. Should there be an uncontrolled discharge of sediment during higher flow events, the contribution of the project related works area to the sediment load within Te Ararata Creek would be negligible (given the scale of works compared to the contributing catchment).

In the absence of appropriate control measures, the magnitude of effect of sediment and contaminant discharge on the freshwater environment is likely to be **high**. Provided that the ESCP and in-stream works are implemented correctly, the magnitude of effect has been assessed to be **low**. For the reasons outlined above, it is expected that the potential effects on banded kokopu and redfin bully would be **negligible**, which compared to a **very low** or **low** overall level of effect.

4.2.2 Instream habitat modification

The proposed works do not include permanent modification of the wetted stream channel. Specifically, it is intended that the concrete base of the culvert remain in-situ, whilst the twin culvert will be removed (cut) to enable a flat wider open base.

During construction, in order to gain access to the stream banks and centre of channel, works will be undertaken in dry conditions (as described in section 4.2.1 above). Some rock or stabilising material may need to be placed into the dry sections of the stream channel (upstream and downstream of the existing culvert base) to provide a suitable platform for the machinery to operate from.

Following completion of works, the materials will be removed to the extent practicable, to return the stream channel to a similar state as to what it was prior to construction works commencing. It may be necessary to leave some rock material within the stream channel if it is not practicable to remove it all. A suitably qualified ecologist will undertake a site visit of the works area following removal of stabilising materials to ensure that any remaining materials contribute to, and do not retract from, habitat enhancement within the stream channel.

This temporary effect is considered necessary to contribute to the management of sediment and to minimise permanent damage to the stream bed. Upstream and downstream of the culvert there are existing rocks within the channel, which appear to be residual rock rip rap.

The stream is of **moderate** ecological value and the potential effect of a small amount of residual material being left following the removal of stabilising materials (if required) is expected to have a **negligible** magnitude of effect, leading to an overall very **low** level of effect.

4.2.3 Injury or mortality of freshwater fauna during construction

Instream works have the potential to cause injury or mortality to native freshwater fauna. The magnitude of potential effect on native freshwater fauna is driven by the nature of the activity, the area of stream disturbance, density of fish present in each area, the ability of fish to escape disturbance and the controls applied. The conservation status of fish species is also relevant when assessing the potential overall level of effect.

Effects on freshwater fauna as a result of the works will be avoided to the extent practicable by salvage and relocation of fauna prior to construction commencing.

The existing twin culvert will be demolished one side at a time. To manage sediment generation (as described in section 4.2.1, works need to be undertaken in dry conditions. Te Ararata Creek will therefore be dammed and diverted through a pipe with flow diverted through a pipe either side during demolition works.

Prior to works commencing, fish salvage and relocation will occur. The final order of the dam and divert methodology is not known at this stage. However, the following key steps will be carried out:

- Prior to in stream works commencing, the works area will be de-fished. Exclusion barriers will be set up and the works area fished, via a combination of trapping and/or electric fishing.
- It is likely that the dammed area will then need to be dewatered, which will occur under the supervision of a suitably qualified ecologist.
- Any remaining native freshwater fauna discovered during the dewatering process will be salvaged and relocated to an appropriate relocation site by the supervising ecologist.

A freshwater fauna management plan (FFMP) has been prepared as part of the EMP and submitted alongside this report (T+T, 2024). The FFMP details the measures proposed to be implemented to minimise the injury and mortality effects on freshwater fauna. It is recommended that the FFMP is updated following confirmation of the construction methodology to ensure alignment with measures proposed and activities anticipated on site. The FFMP includes:

- The methodology and frequency of effort for fauna capture prior to stream.
- Information regarding appropriate timing of works to provide consideration for migration and spawning timing.
- Discovery protocols for unexpected species.
- Identification of suitable relocation sites including consideration of carrying capacity, available habitat and proximity to future works (if within the site).
- The storage and transport measures to be utilised, including measures to prevent predation and death during capture / relocation.
- Euthanasia methods for diseased or pest species.
- Reporting requirements.

In the absence of stream diversion measures and native fish salvage, the magnitude of effect of stream works is likely to be **high**, given the potential for fish injury or mortality. Provided that the above methodology is implemented, the magnitude of effect has been assessed to be **negligible**. A **negligible** magnitude of effect applied to a feature of **very high** ecological value (based on the potential presence of giant kōkopu) results in a **low** overall level of effect.

4.2.4 Effects on fish passage

Many of New Zealand's native fish are diadromous, meaning they migrate to and from the sea as part of their lifecycle. Artificial structures, poor culvert design and certain construction methodologies can restrict fish migration by preventing fish passage. Temporary restrictions to fish passage during construction may impact a population’s reproductive success by preventing fish to move upstream during their migration period. The resultant decrease in fish mobility can cause fragmented populations, a reduction in population size, and limit overall available habitat for freshwater fauna.

The Project requires that flows through the existing twin culvert are modified for a period of 6-8 months, with an aim to commence works during low flow, summer / autumn months. It is expected the works will continue into winter.

The stream flows will be diverted through a pipe to enable the demolition of the culvert (as described in earlier sections). This effect relates to the works at the existing Walmsley Road Bridge only.

The pipe size has not yet been confirmed, however, the size of the pipe will be much smaller than the width of the current stream channel and will not meet the culvert permitted activity standards of the National Environmental Standards for Freshwater (regulation 70). Therefore, there is likely to be an increase in velocity and potential for the pipe to be a velocity barrier to upstream migration of fish under some flow conditions.

The works, anticipated to be undertaken in early 2025, are likely to coincide with the peak upstream migration of some species as shown in (Figure 4.1) and summarised here in order of ecological value (highest to lowest):

- Works will avoid the peak upstream migration period of giant kōkopu.
- Works are likely to coincide with just the end of the upstream migration period for redfin bully, long fin eel, common bully, and shortfin eel.
- Works are likely to be undertaken during several months of the upstream migration period for inanga.
- Works are likely to be nearing completion at the beginning of the peak upstream migration for common smelt and banded kōkopu.

For the purposes of this assessment, the focus is on the potential impacts to fish passage on inanga, and to a lesser extent, common smelt and banded kōkopu.

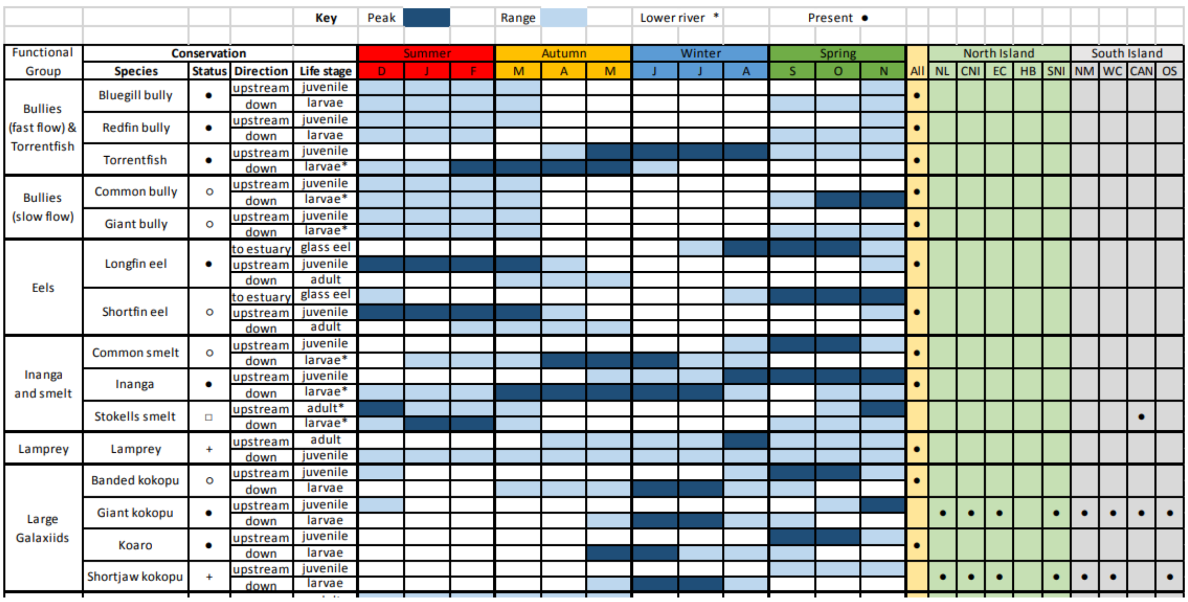

*Figure 4.1: Freshwater fish migration calendar for key New Zealand species. Showing migration range and peak periods, migration direction and life stage at the time of migration. * indicates the life stages that are present*

only within the lower reaches of rivers and streams (NIWA, 2014). Refer to Table 3.1 for current conservation status.

The pipe invert will be submerged, and the grade will be equivalent to the existing channel and mussel spat ropes will be installed in the pipe to provide some resting areas and variability in flow. It is acknowledged that this is unlikely to be sufficient to reduce the potential velocities to provide for those target species (under some or all flow conditions).

It is not possible to avoid this potential effect, without potentially causing sediment effects or increasing the works footprint. For the purpose of this assessment, it is considered that the pipe may form a partial or complete barrier under certain flow conditions for a total period of 6-8 months and will primarily affect elvers, banded kokopu and inanga. For all other species, the magnitude of effect is considered **negligible**, resulting in an overall **low** or **very low** level of effect.

The works will coincide with the peak upstream migration period of elvers (juvenile eels) (likely one month overlap) and banded kōkopu (likely one month overlap). This is assessed to be equivalent to a **low** magnitude of effect for elvers and banded kōkopu in that the overlap with peak migration period is limited and both species are likely to still be able to travel upstream through the pipe albeit sometimes restricted. The overall level of effect on elvers (**high** value) and banded kōkopu (**low** value) is **low**.

Upstream migration for inanga commences in May, peaking between August and November. The works will therefore overlap with up to five months of construction, including two months of peak migration period. Inanga are poor swimmers, being restricted to low flows and shallow grades. Inanga are known to be present upstream of the site, where there is available habitat and there are also records of spawning, which indicates that the current arrangement and associated velocities do not restrict passage. While the temporary pipe will likely have higher velocities than the current configuration, the actual velocities through this pipe are unknown. It is expected that for flows where inanga cannot pass the pipe, they will congregate downstream where there is plentiful habitat. Following removal of the barrier they will be able to continue their upstream passage. On this basis and acknowledging the temporary nature of the barrier, it is considered that the magnitude of effect on inanga is **low,** resulting in an overall **low** level of effect.

It is anticipated that all species will be able to move downstream over the construction period without restriction.

This assessment has been undertaken on the basis that the works commence in March. Should the construction start date change, or the construction period move, the level of effect on different fauna may change.

4.3 Terrestrial flora and fauna

4.3.1 Terrestrial vegetation

Potential adverse effects on terrestrial vegetation include:

- Temporary loss of native riparian plantings (571 m^2).
- Temporary loss of exotic forest (170 m^2).
- Potential loss of one specimen pōhutukawa tree (if the proposed translocation fails).

The loss of vegetation will be remediated following construction and will comprise approximately 500 to 1,000 m^2 stream edge and riparian bank planting (Planting Plan; Boffa Miskell, 2024). Remediation of vegetation will include planting of native species similar to those lost. The historic ecosystem type at this site comprised pūriri forest (WF7). The proposed remediation species list comprises ‘nursery / starting crop’ species and ‘enrichment crop/late successional’ species. The starting crop will be established to provide an initial canopy cover and provision of suitable conditions for the enrichment crop. It is recommended that ‘canopy gap formation’ is undertaken at year five. Canopy gap formation comprises artificially creating light gaps in the canopy through trimming. The above-listed late-successional species can then be planted into the artificially formed gaps. This method aims to accelerate the successional trajectory to a pūriri forest. The vegetation selected aligns with the recommendations of Te Ahiwaru Trust in their Cultural Values Assessment (CVA).

The temporary loss of a relatively small proportion of native riparian plantings is considered to comprise a **moderate** magnitude of effect during the construction phase, and a **low** magnitude of effect in the medium term (5 - 15 years) following remediation works.

The loss of exotic specimen forest is considered to comprise a **low** magnitude of effect (due to the loss of exotic vegetation that provides limited ecological benefit). Similarly, the extent of exotic forest lost will be replaced with native plantings, resulting in a **negligible** magnitude of effect in the medium term. For loss of exotic forest, a **low** ecological value combined with a **low** to **negligible** magnitude of effect results in an overall **very low** level of effect.

With regard to kānuka, mānuka and ngaio the magnitude of effect is potentially **moderate** during the construction phase but following remediation of native plantings including kānuka and mānuka, the magnitude of effect reduces to **low** in the medium term. A **moderate** ecological value combined with a **low** magnitude of effect in the medium term, results in an overall **low** level of effect.

Korokio is located outside the project footprint and therefore there will be no effect.

The single pōhutukawa tree in the footprint may be able to be transplanted. Successfully transplanting the tree within the park would reduce the magnitude of effect to **negligible.** With the implementation of transplantation, a **moderate** ecological value combined with a **negligible** magnitude of effect results in a **very low** overall level of effect. The method for transplanting the tree is outlined in the Arboricultural Assessment of Effects and Tree Protection Plan (The Tree Consultancy Company, 2024).

If translocation cannot be undertaken or is unsuccessful, a total of nine remediation replacement pōhutukawa will be established at the reserve (as outlined in the Arboricultural Assessment, The Tree Consultancy Company, 2024). This will result in a **moderate** magnitude of effect for the construction phase, and a **low** magnitude of effect in the medium term. A **moderate** ecological value combined with a **low** magnitude of effect (in the medium term) results in a **low** overall level of effect (in the medium term).

4.3.2 Birds

Potential adverse effects on birds include:

- Temporary habitat loss of native riparian planting (571 m^2) and exotic forest (170 m^2) (total of 741 m^2).
- Injury or mortality during habitat clearance.

The loss of approximately 741 m^2 constitutes a relatively minor loss of habitat for native birds (there is over 10,000 m^2 of similar habitat along the upstream Te Ararata Creek riparian zone).

Habitat removal during the peak forest bird breeding season (September to January inclusive) can result in direct harm to nests, eggs and nestlings. Most native birds are protected by the Wildlife Act 1953.

The temporary loss of approximately 741 m^2 constitutes a relatively minor loss of habitat for native terrestrial birds (there is over 10,000 m^2 of similar habitat along the upstream Te Ararata Creek riparian zone). Habitat will be remediated following works. Habitat removal during the peak forest bird breeding season (September to January inclusive) can result in direct harm to nests, eggs and nestlings. Most native birds are protected by the Wildlife Act 1953.

Without measures to avoid, remedy and mitigate effects, the potential magnitude of effect on birds could be **moderate** without efforts to remediate habitat or protect birds during peak bird breeding season.

It is therefore recommended that habitat is re-instated following the completion of works with native vegetation. In addition, it is recommended to avoid habitat clearance during peak bird breeding season. However, given the project timeframes, it may not be possible to avoid habitat clearance during peak bird breeding season.

Where habitat clearance (i.e. of riparian native planting or exotic forest) is required during peak bird breeding season, it is recommended that bird nest checks are undertaken in accordance with the Project EMP which includes an Avifauna Management Plan (AMP). In summary, bird nest checks include the following protocols:

- Footprint delineation, marking out the area required for clearance.
- A suitably qualified ecologist to undertake a thorough survey of the clearance area and vegetation immediately adjacent (within 10 m). For arboreal nests, binoculars will be used. Bird behaviours will be observed to inform the potential for nests to be present (some birds undertake behavioural displays to protect nests).
  - Arborists may be required to climb tall exotic specimen trees to check nest activity in tall trees.
- If no active native bird nests are found, checked vegetation may be cleared within three days of the survey.
- Where active native bird nests are identified, individual trees and immediate surrounding vegetation to be left in situ, cordoned off until nesting birds have fledged or nests have been naturally abandoned, as verified by a suitably qualified ecologist. A buffer of 10 m is considered suitable for nationally Not Threatened species, while a 30 m buffer should be established for nationally At Risk species.

Following the EMP and above management measures, the magnitude of effect on birds is considered to be **low**. A **low to high** ecological value combined with a **low** magnitude of effect results in an overall **low to very low** level of effect for terrestrial birds.

4.3.3 Lizards

Potential adverse effects on native lizards include:

- Temporary habitat loss of native riparian planting (571 m^2) and exotic forest (170 m^2) (total of 741 m^2).
- Injury or mortality during habitat clearance.

Without measures to avoid, remedy or mitigate effects, the potential magnitude of effect on native lizards could be moderate. However, the following measures will be implemented to reduce adverse effects.

Lizard habitat in the footprint will be remediated following construction works. Habitat remediation will include the planting of native vegetation and lizard habitat reconstruction (such as placement of rock piles). As a result, in the short term (0 - 5 years) there will be no overall loss in potential lizard habitat.

A Mokomoko (lizard) Management Plan (MMP) has been prepared to manage potential lizard injury or death during habitat clearance and is presented in the project EMP. The MMP outlines the following:

- Responsibilities of personnel involved in lizard management.
- Summary of lizard ecological values, effects and effects management.
- Salvaging protocols for mokomoko, including the following methods:
  - Iwi engagement and collaboration with any proposed salvage.
  - ACO salvage.
  - Manual habitat salvage.
  - Machine-assisted salvage.
  - Habitat enhancement measures such as relocation of logs and rocks.
  - Monitoring and pest mammal control of certain thresholds of lizards are relocated.
- Lizard relocation protocols including relocation site description.
- Adaptive management protocols.
- Reporting requirements.
- A figure showing descriptions of potential lizard habitats and relocation site.
- Key principles for mokomoko salvage.

As a result of habitat remediation measures and measures outlined in the MMP, the magnitude of effect on native lizards is reduced to **low**. A **high** ecological value combined with a **low** magnitude of effect results in an overall **low** level of effect for copper and ornate skinks.

4.4 Summary of effects

Freshwater ecological values range from **low** to **very high**. Following effects management, the magnitude of effect for all freshwater ecological values was reduced to **low or negligible.** The overall level of effect for all freshwater ecological values in the medium term is considered to be **low**.

Terrestrial ecological values ranged from **low to very high**. Following effects management, the magnitude of effect for all terrestrial ecological values was reduced to **low or negligible** in the medium term. The overall level of effect for all terrestrial ecological values in the medium term is assessed to be **low to very low**.

Table 4.1: Summary of effects

Ecological characteristic or activity	Ecological value	Magnitude of effect after effects management	Overall level of effect
Sedimentation or contaminant generation during construction – stream habitat	Moderate	Low	Low
Sedimentation or contaminant generation during construction – sediment sensitive species	Low and High	Negligible	Very low and Low
Instream habitat modification	Moderate	Negligible	Very low
Injury or mortality of freshwater fauna	Low to very high	Negligible	Low

Ecological characteristic or activity	Ecological value	Magnitude of effect after effects management	Overall level of effect
Fish passage (elvers, banded kōkopu, inanga)	Low to high	Low	Low
Riparian native planted vegetation	Moderate	Moderate (construction phase) Low (medium term)	Moderate (construction phase) Low (medium term)
Exotic forest	Low	Low (construction phase) Negligible (medium term)	Very low (construction phase) Very low (medium term)
Pōhutukawa specimen tree	Moderate	If translocation is successful: low If translocation is not possible or unsuccessful: Moderate for the construction phase, low in the medium term.	If translocation is successful: Very low If translocation is not possible or unsuccessful: Moderate (construction phase) Low (medium term)
Kānuka, mānuka, ngaio	Moderate	Moderate (construction phase) Low (medium term)	Moderate (construction phase) Low (medium term)
Korokio	Moderate	No effect	
Not Threatened native vegetation	Low	Low	Very low
Tarāpunga	High	Low	Low
North Island kākā, tūī, kererū	Moderate	Low	Low
Not Threatened terrestrial birds	Low	Low	Very low
Copper and ornate skink	High	Low	Low

5 Summary and conclusion

Te Ararata catchment was identified by Auckland Council Healthy Waters (Healthy Waters) as one of the worst affected areas of Auckland following the January 2023 floods. In order to increase flow capacity and reduce the risk of future flooding in the area, Healthy Waters have proposed flood resilience works throughout the watercourse.

At the Walmsley Road Bridge site, the Project involves the demolition of the existing twin culvert, widening of the stream banks, and subsequent construction of a new two lane bridge.

Freshwater ecological values within the project footprint range from low to very high; features of interest present include Te Ararata Creek and native freshwater fauna. In the absence of effects management, there could be freshwater effects related to sediment and contaminant discharge, instream modification, injury or mortality of native freshwater fauna and barriers to fish passage.

Terrestrial ecological values ranged from low to very high and included native riparian vegetation, exotic forest, rank grass, urban forest birds, native copper skinks and ornate skinks. Overall, a total of 741 m^2 of temporary vegetation loss is expected as a result of the works.

These effects are proposed to be managed through a range of management plans and remediation planting. An ESCP has been developed to mitigate the impacts of sediment and contaminant discharge on aquatic habitats and fauna during works, which adheres to best practice in accordance with the GD05 guidelines – Auckland Council Guideline Document for Erosion and Sediment Control. Adaptive management during the construction programme will be undertaken to assist with the on-going erosion and sediment control management.

Instream modification and fish passage barriers are limited to temporary effects, with reinstatement of the stream channel and fish passage to be enabled post construction.

Within the EMP (appended to the AEE), an AMP, a MMP, a FFMP and VMP are proposed to manage effects on birds, lizards, fish and vegetation. Remediation planting has been proposed to manage the loss of vegetation as a result of the works.

Provided the effects management measures outlined above are appropriately implemented, the magnitude of effect on Te Ararata Creek, native freshwater fauna and terrestrial ecological values has been assessed to be **negligible** to **low** in the medium term.

Following the implementation of the effects management measures, EMP and remediation works, potential adverse effects to the ecological values of the site can be managed to an overall level of effect of **low** or **very low** in the medium term.

6 Applicability

This report has been prepared for the exclusive use of our client Auckland Council (Healthy Waters), with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that Auckland Council (Regulatory) as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

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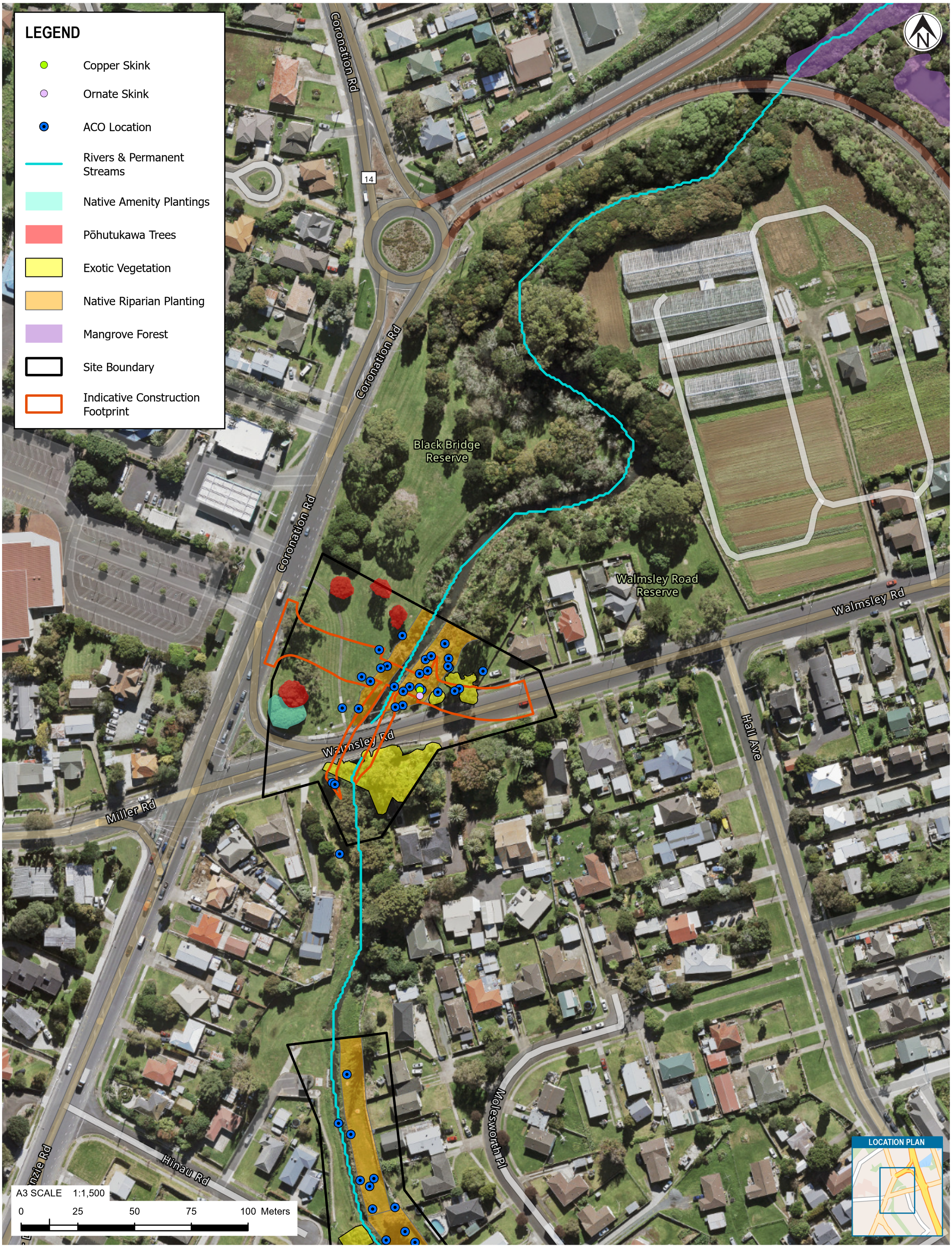
Appendix A Figures



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NOTES:
Rivers & Permanent Streams sourced from Auckland Council Catchment & Hydrology map.
Basemap NZ Hybrid Reference (Vector): Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors. NZ Navigation Map: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors. NZ Imagery: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors.

REV	DESCRIPTION	GIS	CHK	DATE	APPROVED	DATE
0	First version	MONW	DSMI	9/10/24		

PROJECT No.	1017033.2003	
DESIGNED	MONW	OCT.24
DRAWN	MONW	OCT.24
CHECKED	DSMI	OCT.24

CLIENT **AUCKLAND COUNCIL**
PROJECT **LIZARD MANAGEMENT TE ARARATA**
TITLE WALMSLEY ROAD BRIDGE

SCALE (A3) 1:1,500 FIG No. FIGURE 1. REV 0

Appendix B EIANZ EcIAG (2018) modified guidelines summary tables

Table Appendix B.1: Criteria for assigning ecological value to freshwater and terrestrial species.

Ecological Value	Species
Very High	Internationally or 'Nationally Threatened' species (Nationally Critical, Nationally Endangered, Nationally Vulnerable) found in the ZOI either permanently or seasonally.
High	Species listed as Internationally or Nationally At Risk – Declining, found in the ZOI either permanently or seasonally.
Moderate	Locally uncommon or distinctive species; or Species listed as any other category of At Risk, found in the ZOI either permanently or seasonally.
Low	Nationally and locally common indigenous species.
Negligible	Exotic species, including pests, species having recreational value.

Table Appendix B.2: Ecological values assigned to freshwater ecology

Value	Explanation	Characteristics
Very High	A reference quality watercourse in condition close to its pre-human condition with the expected assemblages of flora and fauna and no contributions of contaminants from human induced activities including agriculture. Negligible degradation e.g. stream within a native forest catchment.	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 120 or greater. EPT richness and proportion of overall benthic invertebrate community typically high. SEV scores high, typically > 0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat natural and unmodified.
High	A watercourse with high ecological or conservation value but which has been modified through loss of riparian vegetation, fish barriers, and stock access or similar, to the extent it is no longer reference quality. Slight to moderate degradation e.g. exotic forest or mixed forest/agriculture catchment.	Benthic invertebrate community typically has high diversity, species richness and abundance. Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments. Benthic community typically with no single dominant species or group of species. MCI scores typically 80 - 100 or greater. EPT richness and proportion of overall benthic invertebrate community typically moderate to high. SEV scores moderate to high, typically 0.6-0.8. Fish communities typically diverse and abundant. Riparian vegetation typically with a well-established closed canopy.

Value	Explanation	Characteristics
		No pest or invasive fish (excluding trout and salmon) species present. Stream channel and morphology natural. Stream banks natural typically with limited erosion. Habitat largely unmodified.
Moderate	A watercourse which contains fragments of its former values but has a high proportion of tolerant fauna, obvious water quality issues and/or sedimentation issues. Moderate to high degradation e.g. high-intensity agriculture catchment.	Benthic invertebrate community typically has low diversity, species richness and abundance. Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments. Benthic community typically with dominant species or group of species. MCI scores typically 40 - 80. EPT richness and proportion of overall benthic invertebrate community typically low. SEV scores moderate, typically 0.4 - 0.6. Fish communities typically moderate diversity of only 3 - 4 species. Pest or invasive fish species (excluding trout and salmon) may be present. Stream channel and morphology typically modified (e.g. channelised). Stream banks may be modified or managed and may be highly engineered and/or evidence of significant erosion. Riparian vegetation may have a well-established closed canopy. Habitat modified.
Low	A highly modified watercourse with poor diversity and abundance of aquatic fauna and significant water quality issues. Very high degradation e.g. modified urban stream.	Benthic invertebrate community typically has low diversity, species richness and abundance. Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments. Benthic community typically with dominant species or group of species. MCI scores typically 60 or lower. EPT richness and proportion of overall benthic invertebrate community typically low or zero. SEV scores moderate to high, typically less than 0.4. Fish communities typically low diversity of only 1 - 2 species. Pest or invasive fish (excluding trout and salmon) species present. Stream channel and morphology typically modified (e.g. channelised). Stream banks often highly modified or managed and maybe highly engineered and/or evidence of significant erosion. Riparian vegetation typically without a well-established closed canopy.

Value	Explanation	Characteristics
		Habitat highly modified.

Table Appendix B.3: Summary of the criteria for describing the magnitude of effect.

Magnitude	Description
Very High	Total loss of, or 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. Loss of a very high proportion of the known population or range of the element / feature.
High	Major loss or 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. 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. 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 or patterns. Having a 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. Having negligible effect on the known population or range of the element / feature.

Table Appendix B.4: Criteria for describing overall level of ecological effects.

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

Overall level-of-effect categories are used to determine if residual effects management is required over and above measures to reduce the severity of effects through efforts to avoid, remedy or mitigate adverse effects. Usually, if the level of residual effect is assessed as being "Moderate" or greater, this warrants efforts to offset or compensate for these effects.

Appendix C Species lists

Table Appendix C.1: Plant species list at Walmsely Road Bridge.

Species name	Common name	National conservation status (De Lange et al. 2024)	Regional conservation status (Simpkins et al. 2022)	Ecological value
Acanthus mollus	Bear's britches	Introduced	-	Negligible
Cardamine hirsuta	Bittercress	Introduced	-	Negligible
Carex secta	Purei	Not Threatened	Not Threatened	Low
Casuarina cunninghamiana	She-oak	Introduced	-	Negligible
Cenchrus clandestinus	Kikuyu	Introduced	-	Negligible
Coprosma robusta	Karamu	Not Threatened	Not Threatened	Low
Cordyline australis	Tī kōuka	Not Threatened	Not Threatened	Low
Corokia buddleioides	Korokio	Not Threatened	At Risk – Declining	Low
Cortaderia selloana	Pampas	Introduced	-	Negligible
Corynocarpus laevigatus	Karaka	Not Threatened	Not Threatened	Low
Crocosmia × crocosmiiflora	Montbretia	Introduced	-	Negligible
Delairea odorata	German ivy	Introduced	-	Low
Dichondra repens	Mercury bay weed	Not Threatened	Not Threatened	Low
Didymocheton spectabilis	Kohekohe	Not Threatened	Not Threatened	Low
Erythrina × sykesii	Coral tree	Introduced	-	Negligible
Eucalyptus spp.	Eucalyptus	Introduced	-	Negligible
Kunzea robusta	Kānuka	Not Threatened	At Risk – Regionally Declining	Moderate
Leptospermum scoparium	Mānuka	Not Threatened	Regionally Vulnerable	Moderate
Ligustrum lucidum	Tree privet	Introduced	-	Negligible
Lotus pedunculatus	Lotus	Introduced	-	Negligible
Melicytus ramiflorus	Māhoe	Not Threatened	Not Threatened	Low
Metrosideros excelsa	Pōhutukawa	Not Threatened	At Risk – Regionally Declining	Moderate
Muehlenbeckia complexa	Small-leaved pohuehue	Not Threatened	Not Threatened	Low
Myoporum laetum	Ngaio	Not Threatened	At Risk – Regionally Declining	Low
Paraserianthes lophantha	Brushwattle	Introduced	-	Negligible
Phoenix canariensis	Phoenix palm	Introduced	-	Negligible

Species name	Common name	National conservation status (De Lange et al. 2024)	Regional conservation status (Simpkins et al. 2022)	Ecological value
Phormium tenax	Harakeke	Not Threatened	Not Threatened	Low
Pittosporum eugenioides	Lemonwood	Not Threatened	Not Threatened	Low
Plantago lanceolata	Narrow-leaved plantain	Introduced	-	Negligible
Pseudopanax lessonii	Houpara	Not Threatened	Not Threatened	Low
Pteris tremula	Trembling brake	Not Threatened	Not Threatened	Low
Ranunculus repends	Creeping buttercup	Introduced	-	Negligible
Rumex obtusifolius	Broad-leaved doc	Introduced	-	Negligible
Solanum mauritianum	Woolly nightshade	Introduced	-	Negligible
Solanum nigrum	Black nightshade	Introduced	-	Negligible
Tradescantia fluminensis	Tradescantia	Introduced	-	Negligible
Tropaeolum majus	Nasturtium	Introduced	-	Negligible
Vitex lucens	Puriri	Not Threatened	Not Threatened	Low
Zantedeschia aethiopica	Arum lily	Introduced	-	Negligible

Table Appendix C.2: List of native terrestrial[1] bird species present or potentially present in or near the project site (data from iNaturalist, eBird and on-site observations).

Species name	Common name	National threat classification (Robertson et al. 2021)	Regional threat classification (Woolly et al 2024)	Observed on site	Ecological value (EIANZ criteria)
Acridotheres tristis	Common myna	Introduced	Introduced	✓	Negligible
Anas platyrhynchos	Rakiraki / mallard	Introduced	Introduced		Negligible
Carduelis carduelis	European goldfinch	Introduced	Introduced		Negligible
Chloris chloris	European greenfinch	Introduced	Introduced		Negligible
Chroicocephalus novaehollandiae	Tarāpunga / red-billed gull	At Risk - Declining	Threatened – Regionally Vulnerable		High
Chrysococcyx lucidus	Pīpīwharauroa / shining cuckoo	Not Threatened	Not Threatened		Low
Columba livia	Rock pigeon	Introduced	Introduced		Negligible

Species name	Common name	National threat classification (Robertson et al. 2021)	Regional threat classification (Woolly et al 2024)	Observed on site	Ecological value (EIANZ criteria)
Egrett novaehollandiae	Matuku moana / white-faced heron[2]	Not Threatened	Not Threatened		Low
Fringilla coelebs	Chaffinch	Exotic	Exotic		Negligible
Gerygone igata	Riroriro / grey warbler	Not Threatened	Not Threatened	✓	Low
Gymnorhina tibicen	Australian magpie	Introduced	Introduced		Negligible
Hemiphaga novaeseelandiae	Kererū	Not Threatened	Not Threatened		Moderate
Hirundo nexoena	Warou / welcome swallow	Not Threatened	Not Threatened		Low
Larus dominicanus	Karoro / Southern black-backed gull	Not Threatened	Not Threatened		Low
Nestor meridionalis septentrionalis	North Island kākā	At Risk - Recovering	At Risk - Regionally Recovering		Moderate
Ninox novaeseelandiae	Ruru / morepork	Not Threatened	Not Threatened		Low
Passer domesticus	House sparrow	Introduced	Introduced		Negligible
Platycercus eximius	Eastern rosella	Introduced	Introduced		Negligible
Porphyrio melanotus	Pūkeko	Not Threatened	Not Threatened		Low
Prosthemadera novaeseelandiae	Tūī	Not Threatened	Not Threatened	✓	Moderate
Rhipidura fuliginosa placabilis	Pīwakawaka / North Island fantail	Not Threatened	Not Threatened	✓	Low
Spilopelia chinensis	Spotted dove	Introduced	Introduced		Negligible
Sturnus vulgaris	Common starling	Introduced	Introduced		Negligible
Todiramphus sanctus vagans	Kōtare / sacred kingfisher	Not Threatened	Not Threatened		Low
Turdus merula	Eurasian blackbird	Introduced	Introduced		Negligible
Turdus philomelos	Song thrush	Introduced	Introduced		Negligible
Vanellus miles	Spur-winged plover	Not Threatened	Not Threatened		Low
Zosterops lateralis	Tauhou / silvereye	Not Threatened	Not Threatened	✓	Low