REPORT

Tonkin+Taylor

# Harania Flood Resilience Works - Tennessee Bridge

## Ecological Impact Assessment

**Prepared for**
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**Prepared by**
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## Executive summary

The Harania 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 60 homes, which occurred due to poor flood conveyance at the locations of the current Tennessee Avenue and Blake Road embankment dams. Flood resilience works are proposed at the Tennessee Avenue embankment dam, which includes a new pipe bridge and pedestrian bridge, and removal of the existing embankment, located between Lenore Foreshore Reserve to the west and Blake Road Reserve to the east.

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

This report presents an assessment of aquatic and terrestrial effects for the proposed works. The assessment was undertaken in general accordance with the Ecological Impact Assessment (EcIA) guidelines (Roper-Lindsay et al. 2018). A desktop assessment and site investigations were undertaken to assess the ecological characteristics and values at the site. Targeted moho pererū/banded rail (*Gallirallus philippensis*) survey and mokomoko/lizard surveys were undertaken.

Ecological values at the project footprint ranged from **negligible** to **very high** and included manawa/mangrove forest, Tennessee subtidal channel, marine benthic habitat, native and exotic vegetation and fauna (terrestrial and coastal birds, lizards, and fish). These ecological values will be affected by the project through elevated sediment and contaminant discharge to aquatic habitats, disturbance of mangrove and marine benthic habitats, and the potential for fauna disturbance, injury or mortality. Vegetation removal comprising a total of 1,820 $m^2$ of temporary native vegetation loss, 1,000 $m^2$ mangrove habitat clearance, loss of up to seven exotic specimen trees and exotic shrubland and grassland 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 Erosion and Sediment Control Plan (ESCP) and Ecological Management Plan (EMP) have been prepared to accompany this resource consent application and this EcIA.

Within the EMP, an Avifauna Management Plan (AMP), a Mokomoko (skink) Management Plan, a Freshwater Fauna Management Plan (FMP) and Vegetation Management Plan (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.

Following the implementation of the 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

## 1.1 Background

The January 2023 floods, followed closely by Cyclone Gabrielle, marked a period of unprecedented weather challenges for Auckland. Auckland Council is carrying out flood resilience projects with the aim of mitigating flood risk to property through a series of blue-green networks, addressing critical flood-prone areas with sustainable stormwater solutions. The Harania catchment was one of the worst affect areas of Auckland following the January 2023 floods. Healthy Waters identified significant flooding, causing risk to life, and widespread flood damage to homes. This occurred due to poor flood conveyance at the location of the current Tennessee Avenue embankment dam (Figure 1.1).

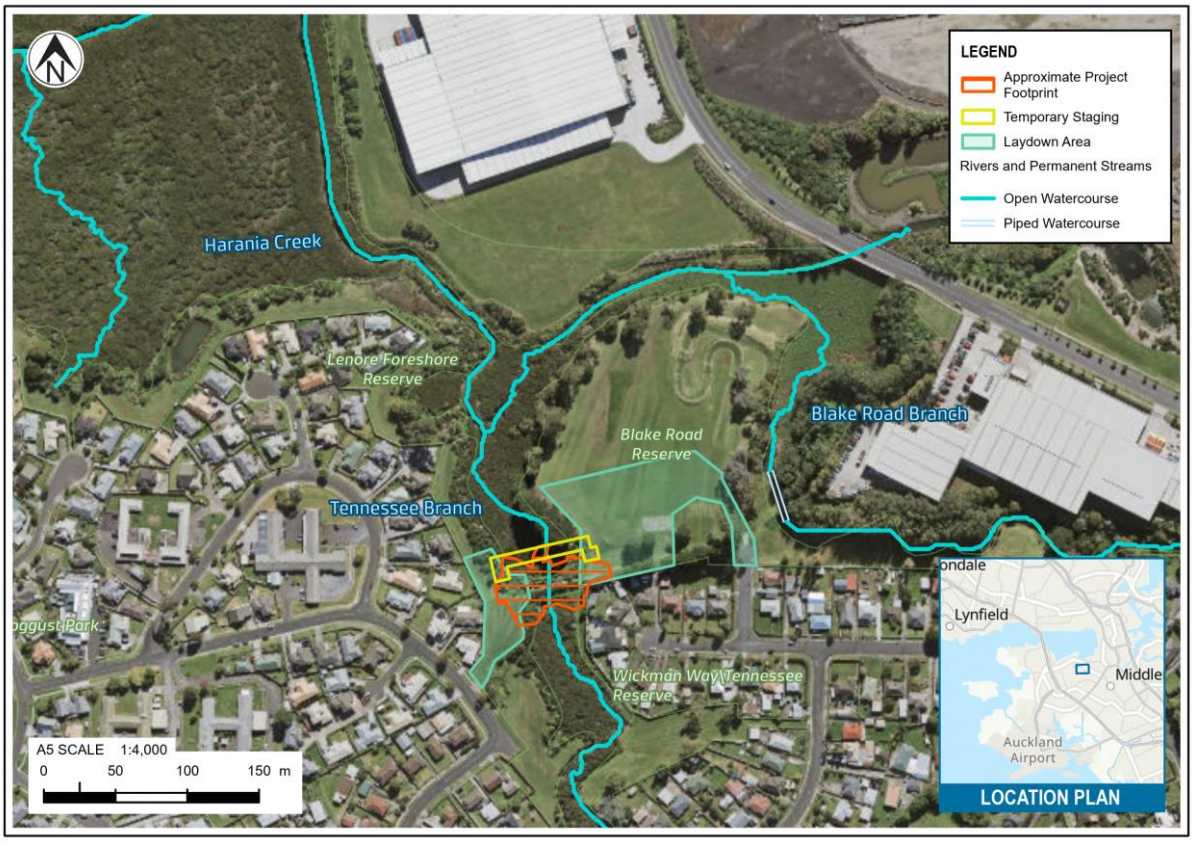



*Figure 1.1: Site location and surrounding area*

## 1.2 Project description

A detailed description of the full project works can be found in the Assessment of Effects on the Environment (AEE) report[1].

The Tennessee Bridge project (the Project) involves removing the current embankment which carries the existing Eastern Interceptor (EI), an approximately 2.6 m diameter reinforced concrete wastewater pipe. The replacement will comprise a new pipe and pipe bridge in the coastal marine area (CMA) to open up the waterway capacity to allow increased flood conveyance. Diversion

[1] *Harania Flood Resilience Works – Tennessee Bridge Assessment of Effects on the Environment*, Beca Limited, November 2024.

chambers are required at either end of the new pipe, connecting it to the existing pipe to facilitate the change over from the old pipe to the new pipe bridge diversion.

## 1.3 Scope

Tonkin & Taylor Ltd (T+T) has been engaged by Auckland Council's Healthy Waters to undertake an EcIA of the Project on the aquatic and terrestrial ecological values related to the proposed Project and this has been prepared to accompany a resource consent application for the Tennessee Bridge project under the Severe Weather Emergency Recovery (Auckland Flood Resilience Works) Order 2024.

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 aquatic and terrestrial environments;
- An assessment of the actual and potential ecological effects of the Project on the ecological values identified; and
- An outline of any further effects management required.

The assessment undertaken within this report relies on the information detailed in the Assessment of Effects on the Environment Report prepared for the application (and associated drawings) by Beca Limited, dated November 2024.

## 1.4 Geographical and ecological context

The site is located in the Tamaki Ecological District (ED) and Harania 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 Blake Road reserve and bordering Harania Creek was pūriri forest (WF7; Singers et al. 2017) (Auckland Council GeoMaps – potential ecosystem extent layer). Presently Blake Road Reserve comprises a recreational area with open parkland and a mountain bike track. Surrounding areas are dominated by residential housing to the south and west, and commercial areas to the east and north. The commercial areas north of Blake Road Reserve are reclaimed land – previously comprising intertidal flats.

Harania Creek is the main shallow estuary downstream of the site, located within the wider Māngere Inlet. It has been significantly impacted in the last 50 years due to land reclamation for the Pacific Steel Plant, industrialisation and the construction of embankments for the Southern Wastewater Interceptor network. Harania Creek contains five watercourses, two of which flow either side of Blake Road Reserve. The system is fed by open and piped watercourses from the surrounding residential and commercial areas. The site is some distance from the mouth of the Harania Creek estuary where the creek enters the Māngere Inlet (~1,000 m; Figure 4.1).

The Zone of Influence (ZOI)[2] includes areas of mangrove habitat, a brackish subtidal channel which connects wetland and freshwater environments to the Māngere Inlet and muddy benthic environments stabilised by mangroves. Manawa/mangroves form the primary vegetation present in Harania Creek estuary and continue upstream until freshwater inputs prevent mangrove establishment.

The Eastern Interceptor runs west to east across the southern edge of the reserve, across both tributaries of Harania Creek. For the purpose of this report, the tributary of Harania Creek affected by the Tennessee Bridge works (the project footprint) will be referred to as 'Tennessee branch', and the other branch to the north of Blake Road Reserve will be referred to as the 'Blake branch'.

Native riparian plantings occur on the peripheries of Harania Creek, with occasional exotic trees and shrubs. A wetland of approximately 0.56 ha dominated by introduced alligator weed (*Alternanthera philoxeroides*) with sparse native wetland vegetation occurs along the Blake branch. Native plantings have recently been established on the edge of the wetland.

A marine Significant Ecological Area (SEA), SEA-M2-23a[3] overlays mangrove forest (SA.1; Singers et al. 2017) north of the Eastern Interceptor crossing of the Tennessee branch. The SEA is listed in the AUP OP as 'Ambury intertidal flats'. The flats provide foraging grounds for wading and other coastal birds, including nationally Threatened species. Mangrove forest continues southward and upstream of the Eastern Interceptor crossing for 200 m, but is not classified as SEA.

[2] As is defined by the EcIAG (2018) guidelines. In this case the Zone of Influence (ZOI) refers to all aquatic water bodies and environments that could be potentially impacted by the Project. It includes the site and any environments beyond the project footprint where 'indirect effects' such as discharges may extend.

[3] 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 Description of activity

A detailed description of the full project works can be found in the AEE report (Beca Limited, November 2024).

In brief, and of relevance to this assessment, the project works comprise:

- Site establishment of the eastern compound on Blake Road Reserve and the western compound on Lenore Foreshore Reserve.
- Two options have been considered for works in the CMA of the Tennessee branch.
  - Option 1 - temporary staging: includes the construction of gravel working platforms, temporary staging, and haul roads.
  - Option 2 - culvert extension and working platform: includes the extension of the existing culverts approximately 10 m downstream, and construction of gravel working platforms across the width of the watercourse. This would not require the temporary staging.
- Installation of three coffer dams (requiring sheet piling) around location of bridge supports.
- Installation of screw piles for bridge supports, pile caps and substructure to support pipe bridge and pedestrian bridge.
- Excavation of the western and eastern connection chambers which will require retention adjacent to property boundary and piling. Construction of connection chambers.
- Pipe sections lifted into place and connected into existing network.
- Removal of redundant pipe, underlying embankment and culverts.
- De-mobilisation from site.
- Revegetation of works footprint, including salt marsh and salt meadow alongside mangrove establishment.

An overview of the Tennessee bridge works is shown below in Figure 2.1. For the purpose of this EcIA, the proposed works in the CMA for Options 1 and 2 have been assessed together within one 'envelope of effects' as both Options will result in similar ecological effects.

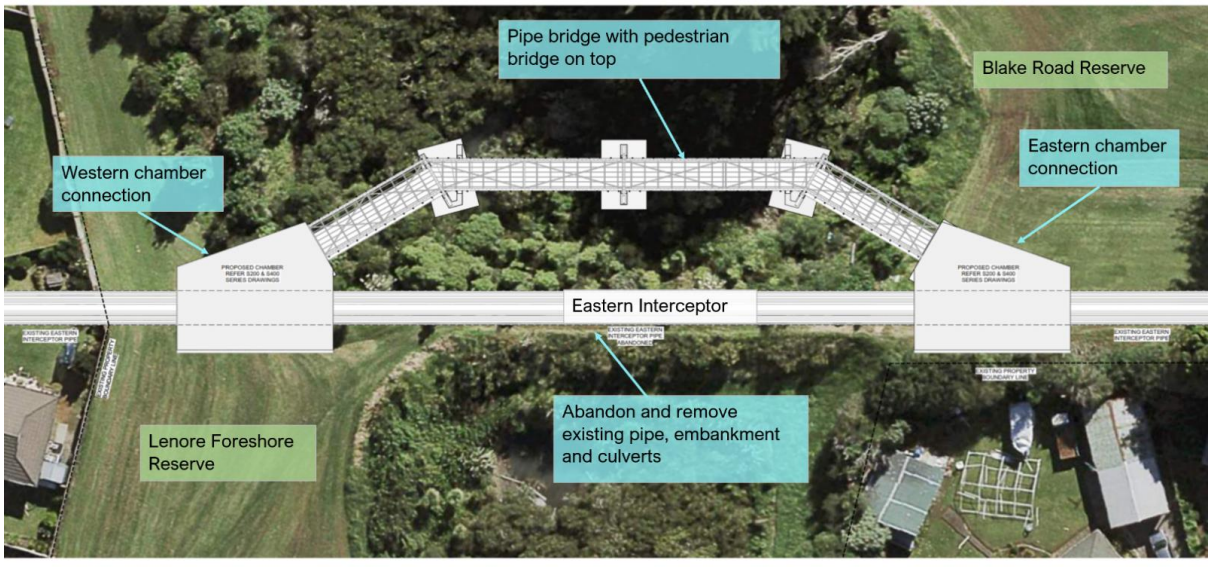



*Figure 2.1: Overview of Tennessee bridge works (taken from AEE)*

## 2.1 Statutory context

While this is a technical EcIA report, there are statutory matters which 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.

- The Auckland Unitary Plan (AUP) is the principal statutory planning document for Auckland.
- The AUP includes a number of schedules outlining Wetland Management Areas, Significant Ecological Areas, Outstanding Natural Features and Notable Trees.
- National Policy Statement for Freshwater Management (NPS FM 2020, amended January 2024) (Ministry for the Environment, 2024a).
  - 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, 2023b).
  - There are some specific definitions that are relevant to this assessment including:
    - Effects management hierarchy
    - Highly mobile fauna
    - Biodiversity offset and associated principles in Appendix 3
    - Biodiversity compensation and associated principles in Appendix 4

Of note within this assessment is the statutory classification of the aquatic environment within the project footprint. The northern side of the existing embankment marks the upper, landward edge of the Coastal Marine Area (CMA). Upstream of this, the aquatic environment is considered to be a 'river or stream' under the Resource Management Act 1991 (RMA) and the AUP. While these classifications apply within the context of the planning assessment, this EcIA focusses on the ecological values observed which do not entirely correspond with the statutory classifications.

# 3 Assessment methods

## 3.1 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)
- Land Air Water Aotearoa (LAWA) estuary health database

### 3.1.1 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 the vicinity of Blake Road Reserve, including specifically ecological surveys and reporting. 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.Site visits

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 and coastal ecologist on 18 June, and by a freshwater ecologist on 19 June. Site visits were undertaken during fine conditions, with observations made at the Blake Road / stream culvert location, and the Tennessee branch / culvert location.

Additional survey specific site visits are described in the following sections.

## 3.2 Specific field methods

### 3.2.1 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 RMA and NPS FM wetland definitions.

### 3.2.2 Avifauna

#### 3.2.2.1 Terrestrial birds

Potential terrestrial bird habitats were recorded and mapped during site visits on 10 July and 21 August 2024. Incidental observations of birds were recorded.

#### 3.2.2.2 Coastal birds

Based on desktop assessment, moho pererū/banded rail (*Gallirallus philippensis*) were considered to potentially utilise the vegetation present in and adjacent to the footprint. A moho pererū playback and footprint survey was undertaken on 23 September 2024 within mangrove habitat in the project footprint.

Moho pererū were surveyed on 23 September 2024 during low tide through:

- A five-minute listening survey at dawn adjacent to mangrove habitat commencing at 5.45 am.
- Playback surveys comprising 30 mins covering mangrove habitats upstream and downstream of the culverts.
- A footprint survey comprising complete searches of mangrove habitats within the project footprint, and within 20 m of the project footprint.

### 3.2.3 Lizards

Potential lizard habitats were recorded and mapped during the site visits. 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

Potential gecko habitat, if present, would be considered as regenerating or mature native vegetation contiguous with mature native vegetation, and/or nearby gecko records as determined through desktop assessment.

A total of 30 Artificial Cover Objects (ACOs) were deployed in potential lizard micro-habitats in the project footprint on 31 July 2024. A potential relocation site was also investigated, and a further 30 ACOs were deployed across this area (Appendix A Figure 1). Incidental observations of lizards were recorded. A check of all ACOs (project footprint and relocation site) was undertaken on 23 September, 2 October and 8 October 2024.

## 3.3 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 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 (refer to Table Appendix B.1,Table Appendix B.2,Table Appendix B.3,Table Appendix B.4 in Appendix B);
- The magnitude of effect (refer to Table Appendix B.5 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 (refer to Table Appendix B.6 in Appendix B); and
- 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 are fairly well defined in the EcIAG (refer to Table Appendix B.3 in Appendix B), the freshwater and marine values are less so. For the purpose of this assessment, we have adapted freshwater and marine values criteria based on the EcIAG (refer to Table Appendix B.2 and Table Appendix B.4 in Appendix B) which assigns ecological value based on biodiversity and ecological function values of the freshwater and marine 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.

# 4 Ecological characteristics and values

## 4.1 Aquatic ecology

The Tennessee branch drains a 250 ha catchment area which includes the Māngere East neighbourhood area, and primarily runs through reserve corridors behind residential properties. The watercourse is used to varying extents by private landowners using the riparian corridor for personal uses (i.e. vegetable gardens) and locals for access. The stream is also subject to a number of stormwater inputs.

The CMA is defined by Auckland Council as the area downstream (north) of the Tennessee embankment. During low tide, a low flow channel meanders through the mangroves providing connection between the subtidal area and the upstream permanently flowing freshwater environment (Photograph 4.1). An embankment housing the Eastern Interceptor Sewer pipe forms a partial barrier between the lower tidal reaches from the upper freshwater reaches; twin culverts of approximately 1200 mm Ø maintain flow connectivity through the embankment. Similar mangrove habitat exists upstream and downstream of the embankment (described further in Section 4.2.3.1).

The extent of the Tennessee branch to the south/upstream is considered to be a 'river or stream' under the RMA, despite the predominantly estuarine/coastal characteristics (Photograph 4.2). While deemed a 'river', its freshwater elements are limited to those present during low tide within a shallow subtidal channel. The twin culverts that connect the upper and lower reaches of the Tennessee branch are not currently acting as a significant barrier to fish passage.

*Photograph 4.1: Coastal mangrove habitat north/downstream of the Tennessee embankment.*

*Photograph 4.2: Coastal mangrove habitat south/upstream of the Tennessee embankment.*

Within the Auckland region, shallow subtidal channels and flats in the upper reaches of estuaries are often associated with muddy fine sand and soft mud. These shallower channels weave their way through mangrove-lined estuaries and can have reduced benthic diversity, but still provide habitat for infaunal and faunal species such as mud crabs, polychaete worms and smaller bivalves (Hayward et al., 1999). At low tide, the subtidal/stream channel north of the embankment is approximately 2 m wide, while during high tide, the entire mangrove area within the project footprint is inundated with saline/brackish water.

The subtidal channel/stream within the project footprint provides wading and foraging habitat for coastal avifauna and fish species (see Sections 4.3.2.23.2.2.2 and 4.3.4 respectively). Further to this, the channel connects freshwater and coastal environments, providing fish passage for diadromous fish species (species which migrate to and from the sea as part of their lifecycle).

Assessments undertaken in the upper freshwater reaches of the Tennessee branch indicate that the stream is of low water quality. Sediment inputs from the existing stormwater as well as ongoing erosion of the streambed and banks, will be contributing to sedimentation within the watercourse, with most reaches within the Māngere Inlet catchment having 'high' sediment loads (LEAD Alliance, 2023; Young et al., 2013). The 2013 Māngere Inlet Watercourse Management Plan found that 'Tennessee Stream' had "desirable" levels of dissolved oxygen and copper, but an exceedance of desirable levels of zinc in both water and sediment samples (according to Auckland City Urban Stream Classification criteria). The macroinvertebrate community index score was 80, indicating poor-fair water quality and habitat with probable moderate pollution (LEAD Alliance, 2023; Young et al., 2013). More recent water quality monitoring (2023 – 2024) has indicated that bacterial contamination (i.e. *E. coli*) is also of concern within Tennessee branch (LEAD Alliance, 2024).

A Stream Ecological Value (SEV) assessment has been previously undertaken in the upper solely freshwater reaches of 'Tennessee Stream' by Morphum Environmental Ltd on behalf of Auckland Council (Young et al., 2013). A total of 14 variables representative of hydraulic function, biogeochemical function, habitat provision and biodiversity were recorded at the site to calculate an overall SEV score of 0.35. While this score is not immediately applicable to the project footprint, it is useful to ascertain the likely ecological values of the wider freshwater catchment.

Considering this information on the whole, the value of the subtidal channel/stream is considered to be **moderate**.

In the event that the project was not to occur, the potential ecological value of the subtidal 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 the Tennessee branch has been assessed to be **moderate**.

## 4.2 Ecosystems and vegetation

### 4.2.1 Terrestrial ecosystems

Ecosystem types comprised native planted vegetation (PL; Singers et al. 2017), exotic specimen trees (TL; Singers et al. 2017), exotic shrubland (ES; Singers et al. 2017) and rank grass (EG; Singers et al. 2017) (Photograph 4.3; Photograph 4.4; Photograph 4.5; Photograph 4.6; Appendix A Figure 1).

Native vegetation was dominated by typical native revegetation species including kānuka (*Kunzea robusta*), mānuka (*Leptospermum scoparium*), harakeke (*Phormium tenax*), lemonwood (*Pittosporum eugenioides*), karamu (*Coprosma robusta*), ngaio (*Myoporum laetum*), taupata (*Coprosma repens*) and tī kōuka/cabbage tree (*Cordyline australis*). The canopy was approximately five to six meters tall. The understory was mostly bare but occasional native ferns including rasp fern (*Doodia australis*) and exotic annuals were present. Pest plant species included Chinese privet (*Ligustrum sinense*) and Sydney golden wattle (*Acacia longifolia*). To the south side of the Eastern Interceptor and within the project footprint, an area of approximately 150 $m^2$ of rank exotic kikuyu grass (*Cenchrus clendestinus*) occurred.

Exotic specimen trees in the vicinity of the project footprint include Montery cypress (*Hesperocyparis macrocarpa),* coastal redwood (*Sequoia sempervirens*) and *Eucalyptus* species. Exotic shrubland comprising hedgerows of exotic monkey apple (*Syzigium smithii*) were recorded to the east of the project footprint on the periphery of residential housing.

The native and exotic vegetation supports a suite of urban bird species and may support native skinks (refer to Section 4.3).

Terrestrial ecosystem values are outlined in Table 4.1 below and summarised as:

- Native vegetation is of **moderate** ecological value
- Exotic specimen trees and shrubland are of **negligible** ecological value
- Rank kikuyu grass is of **low** ecological value

**Table 4.1: Ecosystem assessment in accordance with EIANZ guidelines at Tennessee Bridge**

| Ecosystem type (Singers et al. 2017) | Assessment matters | Summary value |
|---|---|---|
| Native vegetation (PL) | **Representativeness**<br>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.<br>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**<br>Common ecosystem type. However urban areas often have low amounts of native vegetation so provides important habitat. No distinctive ecological features. Provides habitat for common native urban birds. Provides habitat for nationally At Risk copper skink (*Oligosoma aeneum*).<br>Area rates **moderate** for this assessment matter due to supporting a small suite of rare/distinctive fauna and flora. | |
| | **Diversity and pattern**<br>Level of natural diversity is relatively low. Low complexity/vegetation structure.<br>Area rates **low** for this assessment matter. | |
| | **Ecological context**<br>Site history of modification due to Eastern Interceptor construction.<br>Relatively small area of vegetation but connected to other riparian vegetation and buffers and protects Harania Creek. High level of edge effects and impacted by invasive species.<br>Area rates **moderate** for this assessment matter. | |
| Exotic specimen trees (TL) and shrubland (ES) | **Representativeness**<br>Exotic trees are common in the wider environment and provide limited ecological value.<br>Area rates **very low** for this assessment matter. | Area rates **very low** for all four assessment matters and is therefore of **negligible** ecological value. |
| | **Rarity/distinctiveness**<br>Does not support rarity or distinctiveness criteria.<br>Area rates **very low** for this assessment matter. | |
| | **Diversity and pattern**<br>Does not support diversity and pattern criteria.<br>Area rates **very low** for this assessment matter. | |
| | **Ecological context**<br>Provides limited support to ecological networks and linkages.<br>As a result, the area rates **very low** for this assessment matter. | |

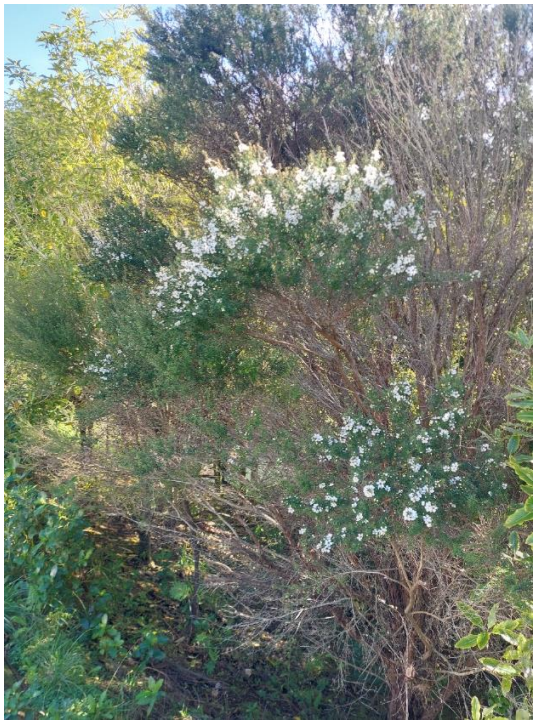
| Ecosystem type (Singers et al. 2017) | Assessment matters | Summary value |
|---|---|---|
| Rank kikuyu grassland (EG) | **Representativeness**<br>Exotic grassland is common in the wider environment and provides limited ecological value.<br>Area rates **very low** for this assessment matter. | Area rates **low** or **very low** for all four assessment matters and is therefore of **low** ecological value. |
| | **Rarity/distinctiveness**<br>Rank grassland may support native copper skinks. It otherwise provides limited rarity/distinctiveness value.<br>Area rates **low** for this assessment matter. | |
| | **Diversity and pattern**<br>Low diversity and pattern.<br>Area rates **very low** for this assessment matter. | |
| | **Ecological context**<br>Exotic grassland forms part of the buffer to Harania Creek, but otherwise contributes little to ecological networks and linkages.<br>As a result, the area rates **very low** for this assessment matter. | |

### 4.2.2 Vegetation

Of the species present, kānuka is classified as nationally 'Not Threatened' and regionally 'At Risk – Declining' while mānuka is classified as nationally 'Not Threatened' and 'Regionally Endangered' (de Lange et al. 2024; Simpkins et al. 2022). Taupata and ngaio are nationally 'Not Threatened' but 'Regionally At Risk – Declining'. The heightened regional threat classifications of mānuka and kānuka are due to the potential threat of myrtle rust (*Austropuccinia psidii*). For taupata, natural populations are at risk due to predators – taupata at this site has been planted and therefore of lesser concern. Ngaio is threatened by hybridisation. All species are otherwise common in the local and wider environment. All other species are classified as nationally and regionally Not Threatened or exotic.

As a result of their regional threat classifications, kānuka, mānuka, taupata and ngaio are considered 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. Photographs 4.3 to 4.6 give an indication of each of the key vegetation types present.

*Photograph 4.3: Native vegetation either side of the Eastern Interceptor pipeline.*



*Photograph 4.4: Mānuka shrub forming part of the native vegetation along the Eastern Interceptor pipeline.*

*Photograph 4.5: Exotic specimen trees Monterey cypress.*

*Photograph 4.6: Rank grassland south of the Eastern Interceptor pipeline.*

### 4.2.3 Marine

#### 4.2.3.1 Mangrove habitat

Mangrove forests (manawa/*Avicennia marina*) grow extensively within the Manukau Harbour, with the average mangrove tree growing to a height of 1.5 – 3 m, often lining the banks of tidal and subtidal channels (Hayward et al., 1999). Mangroves within Māngere Inlet are estimated from recent aerials as of 2017, to cover an area of approximately 1.5 $km^2$, predominantly at the eastern end of the Inlet, and in Harania, Te Ararata and Anns Creeks. Upstream and downstream of the Tennessee embankment is dominated by established mangrove forests. There is a recently cleared patch of mangroves extending an area of approximately 600 $m^2$ downstream of the Tennessee embankment, as can be seen in Photograph 4.7. This was undertaken as emergency works and is not within the scope of the current assessment.

*Photograph 4.7: Area of cleared mangroves, north/downstream of the Tennessee embankment.*

The aerial roots (pneumatophores), trunks and lower branches of mangrove habitat, which are submerged at high tide, provide habitat for smaller invertebrate species including filter feeding species such as encrusting barnacles (*Elminius modestus*), small black mussels (*Xenostrobus pulex*) and pacific oysters (*Crassostrea gigas*). Gastropods such as cats eye (*Turbo smaragdus*) and top shell (*Melagraphia aethiops*) may be present, grazing on the surface algal film of lower mangrove branches (Hayward et al., 1999). Univalves such as green and snakeskin chitons (*Chiton glaucus* and *C. pelliserpentis*) and the limpet (*Notoacmea helmsi*) can also occupy this habitat. Mangrove forest provides protection, foraging, breeding and nursery habitat for fish (Section 4.3.4) and coastal birds (Section 4.3.2.2), including species that are classified as At Risk (Robertson et al., 2021). As mangrove habitat is a heterogenous transitional environment, providing important ecosystem functions which can support increased biodiversity on a localised scale, mangrove habitat value at the project footprint is considered **moderate**.

#### 4.2.3.2 Marine benthic habitat

Environmental characteristics associated with benthic habitat and fauna in the project footprint are reflective of muddy sediments bound by mangrove growth, with pneumatophores and seedlings present across the area. Intertidal mud in upper intertidal estuarine environments is often deep and

soft with a black anaerobic, sulphurous layer beneath the surface. Low species diversity is often associated with this benthic habitat (Hayward et al., 1999).

A State of the Environment (SoE) monitoring site has been routinely sampled as part of a wider SoE monitoring programme undertaken by Auckland Council (Drylie et al., 2021). The Harania Creek SoE site is at the entrance to the Harania arm of the inlet, approximately 1200 m from the project footprint.

Previous benthic monitoring at the SoE site has found low species diversity and evenness, with a dominance of mud crabs and polychaete worms (data provided by Auckland Council, 2024). Estuarine areas within the project footprint are likely reflective of this. Benthic invertebrates which may inhabit muddy substrates include the mud crab (*Helice crassa*) and mud snails such as tītiko (*Amphibola crenata*) and the less common horn shell (*Zeacumantus lutlentus*) and top shell (*Diloma sp*.). The small estuarine snail, *Potamopyrgus estuarinus,* can be found at the high tide fringe of mangrove forests, especially in areas with lower salinity (Hayward et al., 1999). Polychaete worms such as the rag worm (*Nereididae* sp.) will also be present within sediment substrate (Hayward et al., 1999). Benthic fauna described above provides a source of food for transient or resident coastal birds and transient fish species within the area.

Benthic Health Models (BHMs) have previously been applied to the Harania SoE benthic monitoring site described above. National Benthic Health Models were developed in 2020 as a standardised measure to assess the impacts of sedimentation and metal contamination to benthic invertebrate communities (Clark et al. 2020). Within an estuary, benthic invertebrates are commonly used as bioindicators of environmental change due to anthropogenic disturbance, including sedimentation and metal contaminants. Results from 2021 monitoring and application of the national BHM found a BHMmud score of 5.5, indicating a very high level of impact from sedimentation and a BHMmetals score of 5.1, indicating a very high level of impact from metal contaminants copper, lead and zinc. These scores indicate a poor level of health.

Further estuary health indicators of this site are captured in the Land Air Water Aotearoa (LAWA) estuary health database[4]. Although a very high level of impact was found within the BHMmetals score; zinc, copper, lead, arsenic and mercury are all found to fall below the ANZG (2018) Default Guideline Values – Low. Mud content is high at the SoE site, which is a ubiquitous condition of benthic environments within the Māngere Inlet (LAWA Estuary Health Database) and from visual observations is a characteristic of marine sediments within the project footprint.

Due to the above information and when considering the characteristics associated with ecological values outlined in Table Appendix B.3, the value of benthic habitat and fauna at the site is considered **negligible**. Within the cleared area there is remaining detritus and general rubbish sitting on the remaining benthic habitat which should be cleared during works.

[4] https://www.lawa.org.nz/explore-data/estuaries


*Figure 4.1: The project footprint (Tennessee embankment) in relation to the Māngere Estuary, Auckland Council State of the Environment (SOE) monitoring site and previous bird survey undertaken within the area (De Luca et al, 2016).*

### 4.2.4 Wetland

Mangrove habitat is present both upstream and downstream of the existing embankment (as described in Section 4.2.3.1). Mangroves are an 'obligate' wetland plant, therefore meet the definition of a 'wetland' under the RMA. In determining whether the wetland is also a natural inland wetland, the following definition from the NPS FM was considered.

> ***Natural inland wetland*** *means a wetland (as defined in the Act) that is not*
>
> *a) in the coastal marine area; or*
>
> *b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or*
>
> *c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or*
>
> *d) a geothermal wetland; or*
>
> *e) a wetland that:*
>
> *i. is within an area of pasture used for grazing; and*

*ii. has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless*

*iii. the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply*

The CMA includes habitats to the north/downstream of the existing Tennessee embankment, however does not include habitats to the south of the embankment. On this basis, the mangrove habitat to the north of the embankment does meet exclusion a) and is not considered to be a natural inland wetland.

Mangrove habitat to the south/upstream of the embankment does not meet exclusion a), nor does it meet any other exclusion. Therefore, the mangrove habitat upstream of the embankment is considered to be a natural inland wetland. It is well described within the earlier Section 4.2.3.1 and no further description is provided here.

No other natural inland wetlands have been identified within 100 m of project footprint, however a constructed stormwater device (Geomaps SAP ID 3000052110) with wetland characteristics is present at 81R Archboyd Avenue. A wetland is noted as being present on the Blake Road branch, however this is more than 100 m from the project footprint.

## 4.3 Fauna

### 4.3.1 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[5]. 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.

### 4.3.2 Avifauna

#### 4.3.2.1 Terrestrial birds

Through desktop assessment a total of 18 native terrestrial birds were recorded, four of which are classified as nationally At Risk, with the remaining classified as nationally Not Threatened (Robertson et al. 2021) (Table Appendix C.2).

Five native species were identified during the site visit, riroriro/grey warbler (*Gerygone igata*), tauhou/silvereye (*Zosterops lateralis*), pīwakawaka/New Zealand fantail (*Rhipidura fuliginosa*), matuku moana/white-faced heron (*Egretta novaehollandiae*) and kawaupaka/little shag (*Phalacrocorax melanoleucos brevirostris*). Kawaupaka was recorded 150 m from the project footprint. The suite of terrestrial bird species expected at this site are common urban forest birds.

Nationally 'At Risk' species identified by desktop and site assessments are presented in Table 4.2. Of these, North Island kākā (*Nestor meridionalis septentrionalis*) may intermittently forage at the site and are unlikely to nest at the site. Kāruhiruhi/pied shag (*Phalacrocorax varius*) and kawaupaka are

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

likely to utilise tall exotic trees for perching and potentially nesting. They may forage in Harania Creek.

Due to their threat classifications, nationally 'Not Threatened' bird species are of **low** ecological value and North Island kākā, kāruhiruhi and kawaupaka are of **moderate** 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.

**Table 4.2: Native terrestrial birds potentially present at site with a raised national threat classification (Robertson et al. 2021).**

| Common name | Species name | National threat classification (Robertson et al. 2021) | Regional threat classification (Woolly et al. 2024) | Observed on site | Habitat use |
|---|---|---|---|---|---|
| North Island kākā | *Nestor meridionalis septentrionalis* | At Risk - Recovering | At Risk – Regionally Recovering | No | Unlikely to nest at site. May forage intermittently at site. |
| Kāruhiruhi/ Pied shag | *Phalacrocorax varius* | At Risk - Recovering | At Risk – Regionally Declining | No | May use tall exotic trees (*Populus spp.*) as perching habitat. Likely forages in Harania Creek. |
| Kawaupaka/ Little shag | *Phalacrocorax melanoleucos brevirostris* | At Risk - Relict | Threatened – Regionally Endangered | Yes | Uses tall exotic trees (*Populus spp.*) as perching habitat. Likely forages in Harania Creek.<br>Observed 150 m from the project footprint. |

#### 4.3.2.2 Coastal birds

A portion of the project footprint is in SEA M2 23a - wading bird habitat within mangrove ecosystems along the coastline (see Appendix A). The SEA-M overlay in the Māngere Inlet recognises the importance of the extensive intertidal flats that provide foraging habitat for nationally 'Threatened' and 'At Risk' endemic and migratory species. Large areas of mangrove forest with small pockets of contiguous salt marsh vegetation are also recognised within the SEA to provide foraging and nesting habitat for the At Risk – Declining (Threatened – Regionally Vulnerable within Tāmaki Makaurau/Auckland[6]) moho pererū / banded rail (*Gallirallus philippensis*) (Robertson et al. 2021).

No moho pererū were observed during the listening or playback survey, however, moho pererū footprints were found in mangrove habitat downstream of the Eastern Interceptor and within the project footprint.

A number of surveys have identified international and endemic migratory species within the Māngere Inlet, many of which predominantly occupy the intertidal mudflats. A bird survey was undertaken by Boffa Miskell in 2016, with a bird count station positioned at Norana Park (approximately 1.3 km from the project footprint) and coastal birds and waders identified during this

[6] Regional threat classification (Woolly et al. 2024)

survey are presented in Table Appendix C.2 (De Luca et al., 2016). Coastal birds associated with Harania Creek which may use mangrove habitat specific to the project footprint include the matuku moana (iNaturalist) and moho pererū, and species that have been observed by T+T during the site visit include kōtare / sacred kingfisher (*Todoramphus sanctus*), kāruhiruhi and kawaupaka. National and regional threats statuses of these birds can be found in Table Appendix C.2.

There is the potential for northern New Zealand dotterel/tūturiwhatu (*Charadrius obscurus aquilonius*) to utilise the land-based areas of the project footprint including the Eastern compound at Blake Road Reserve (5,500 $m^2$ in total) and the Western compound at Lenore Foreshore Reserve (1,750 $m^2$ in total). Northern NZ dotterel is an endemic shorebird with a national threat status of 'Threatened - Nationally Increasing' and a regional threat status of 'Threatened - Regionally Increasing'. Due to increased development and reduced natural beach habitat, dotterels have taken to establishing breeding sites in less traditional areas such as earthwork sites, stockpiles and maintained grass areas.

Due to the above information and based on EcIA guidelines (Table Appendix B.1) and the values presented in Appendix C, the value of coastal avifauna range from **low** to **very high**. Although national and regional threat statuses differed for certain species, such as moho pererū, regional threat statuses have been applied when assigning values to coastal birds.

### 4.3.3 Lizards

Based on desktop assessment, copper (*Oligosoma aeneum*) and ornate skinks (*O. ornatum*) were considered potentially present at site[7]. The site habitat assessment confirmed potential skink habitat at both Tennessee and Blake Road areas, comprising rank grass, rocks, exotic ground covers and occasional debris. One copper skink was recorded within the project footprint during ACO checks on 23 September 2024. Three copper skinks were recorded within 100 m of the project footprint during checks of ACOs in land adjacent to the Blake Road branch of the Eastern Interceptor. No copper skinks have been recorded at the relocation site.

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.

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.

### 4.3.4 Fish

The Manukau Harbour has historically been an important habitat for a variety of fish species. Morrisey et al. (2007) found that typical fish species that use mangrove habitats included the sand and yellow-belly flounder (*Rhomboselea plebeian* and *R. leporina)* and tāmure/snapper *(Pagrus auratus*). Within the Māngere Inlet, notable estuarine fish species identified from previous surveys include the kātaha / yellow-eyed mullet (*Aldrichetta forsteri*), mottled triplefins (*Grahamina capito*) and small amounts of anchovy (*Engraulis australis*), exquisite goby (*Favonigobius exquisitus* ), pōrohe / smelt (*Retropinna retropinna*), speckled sole and pātiki tōtara / yellow-belly flounder (*Rhombosolea leporina*). Juvenile parore (*Girella tirscuspidata*) and grey mullet (*Mugil cephalus*) may also be present within the Māngere Inlet (Kelly et al., 2008; De Luca et al., 2016). The national threat statuses of species listed above range from Introduced and Naturalised to Not Threatened, while several do not have a threat

[7] 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).

status (Dunn et al., 2018). The regional threat statuses range from Data Deficient to Threatened – Regionally Vulnerable (pōrohe/smelt) (Bloxham et al., 2023).

Five native freshwater and diadromous fish species have been recorded in Harania Creek on the New Zealand Freshwater Fish Database (NZFFD). These include the shortfin eel (*Anguilla australis*), longfin eel (*Anguilla dieffenbachii*), common bully (*Gobiomorphus cotidianus*), inanga (*Galaxias maculatus*) and banded kōkopu (*Galaxias fasciatus*). Longfin eel and inanga have a conservation status of Nationally 'At Risk – Declining' and 'At Risk – Regionally Declining', while the rest have a threat status of Not Threatened (Dunn et al., 2018, Bloxham et al., 2023). Mosquitofish *Gambusia affinis*, a non-native invasive species, have also been recorded in Harania Creek. All fish species described above are presented in Table 4.3.

**Table 4.3: Freshwater/diadramous[1] and marine[2] fish identified in the Harania Creek or present within the Māngere Inlet.**

| Common names | Species name | Regional conservation status | National conservation status | Value | Recorded in Harania Creek |
|---|---|---|---|---|---|
| Anchovy[2] | *Engraulis australis* | - | - | Low | |
| Banded kōkopu[1] | *Galaxias fasciatus* | Regionally Not threatened | Not Threatened | Low | ✓ |
| Common bully[1] | *Gobiomorphus cotidianus* | Regionally Not threatened | Not Threatened | Low | ✓ |
| Exquisite goby[2] | *Favonigobius exquisitus* | - | - | Low | |
| Flounder/pātiki[2] | *Rhomboselea spp.* | - | Not Threatened | Low | |
| Grey mullet[2] | *Mugil cephalus* | Data Deficient | Not Threatened | Low | |
| Inanga[1] | *Galaxias maculatus* | At Risk – Regionally Declining | At Risk – Declining | High | ✓ |
| Longfin eel/tuna[1] | *Anguilla dieffenbachii* | At Risk – Regionally Declining | At Risk – Declining | High | ✓ |
| Mottled triplefins[2] | *Grahamina capito* | Data Deficient | Not Threatened | Low | |
| Mosquitofish[1] | *Gambusia affinis* | - | Introduced and Naturalised | Negligible | |
| Parore (juvenile)[1] | *Girella tirscuspidata* | - | - | Low | |
| Shortfin eel/tuna[1] | *Anguilla australis* | Regionally Not Threatened | Not Threatened | Low | ✓ |

| Common names | Species name | Regional conservation status | National conservation status | Value | Recorded in Harania Creek |
|---|---|---|---|---|---|
| Smelt/pōrohe[1] | *Retropinna retropinna* | Threatened – Regionally Vulnerable | Not Threatened | High | |
| Snapper/tāmure [2] | *Pagrus auratus* | - | - | Low | |
| Speckled sole flounder[2] | *Peltorhamphus latus* | - | - | Low | |
| Yellow-eyed mullet/kātaha[2] | *Aldrichetta forsteri* | Data Deficient | Not Threatened | Low | |

Species listed as Nationally 'At Risk – Declining' and 'Threatened - Regionally Vulnerable' are of **high** ecological value based on EIANZ EcIAG criteria (Table Appendix B.1). The value of fish that may have the potential to occupy/frequent habitats within the project footprint based on the above descriptions range from **low** to **high** ecological value**.**

## 4.4 Summary of ecological values

Aquatic and terrestrial species and habitat values associated with the Tennessee embankment, project footprint and ZOI range from **negligible** to **very high** and are detailed in Table 4.4 below.

**Table 4.4: Habitats and species identified within the project footprint, their location, characteristics and values.**

| Habitat/Species | Characteristics | Location | Ecological value |
|---|---|---|---|
| **Aquatic values** | | | |
| Shallow subtidal channel of Tennessee branch | A modified urban stream with poor water quality and high sediment loads. Subject to stormwater and wastewater inputs as well as ongoing erosion resulting in high sediment loads. The subtidal channel within the project footprint provides wading and foraging habitat for coastal avifauna and fish species, while providing fish passage for indigenous diadromous fish species. | Upstream and downstream of existing Tennessee embankment. | **Moderate** |
| **Flora and habitat values** | | | |
| Native planted vegetation | Characterised by typical native riparian plantings. | Borders Tennessee branch | **Moderate** |
| Exotic specimen trees and shrubland | Planted exotic specimen trees distributed throughout reserve. | Blake Road Reserve | **Negligible** |
| Rank grassland | Relatively small area located within native planted vegetation. | Borders Tennessee branch | **Low** |

| Habitat/Species | Characteristics | Location | Ecological value |
|---|---|---|---|
| Kānuka, mānuka, taupata, ngaio | Planted individuals up to 4 m tall forming part of planted native vegetation areas. | Borders Tennessee branch | **Moderate** |
| Not Threatened vegetation | Planted individuals up to 4 m tall forming part of planted native vegetation areas. | Borders Tennessee Branch | **Low** |
| Mangrove habitat | Mangrove forests are important habitats which promote biodiversity. They provide protection, foraging and breeding and nursery habitat for fish and coastal birds, including species that are classified as At Risk. | Above and below Tennessee embankment | **Moderate** |
| Marine benthic habitat and fauna | Benthic habitat are characterised by muddy intertidal sediments bound by mangrove growth. Low biodiversity is likely within the sediments and the health of similar habitats close to the project footprint are considered poor. | Above and below Tennessee embankment | **Negligible** |
| **Fauna values** | | | |
| Terrestrial birds | Typical suite of urban and forest birds. | Vegetation bordering Tennessee branch | **Low - Moderate** |
| Coastal birds | Coastal birds identified within the area and in the project footprint have threat statuses ranging from Not Threatened – to At Risk Declining. Further to this there is potential for northern NZ dotterel (Threatened – Nationally Increasing) to utilise the compound yards during works. | Tennessee embankment, Eastern compound at Blake Road Reserve and the Western compound at Lenore Foreshore Reserve | **Low – Very high** |
| Copper skink, Ornate Skink | May be present in planted native vegetation. | May be present in riparian vegetation of Tennessee branch | **High** |
| Fish | A variety of indigenous marine fish have the potential to be present within the Māngere Inlet and within the project footprint at high tide. These are all common species with a threat status of Not Threatened. Five native fish species have been recorded in Harania Creek, including longfin eel and inanga, both of which are nationally 'At Risk – Declining' and smelt which are 'Threatened - Regionally Vulnerable'. | Upstream and downstream of the Tennessee embankment | **Low** – **High** |

# 5 Assessment of ecological effects

The following section describes the proposed activities and the potential effects of those activities, before and after effects management measures, on the ecological features and values discussed in Section 4 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.

## 5.1 Proposed works and summary of actual and potential ecological effects

A detailed description of the full project works can be found in the AEE report (Beca Limited, November 2024).

A summary of potential adverse effects of the project works on aquatic ecological values include:

- Temporary effects to benthic habitats in the CMA including the smothering of 710 $m^2$ to support construction works.
- Piling within the CMA and Tennessee branch/subtidal channel.
- Temporary disturbance to sediments during several stages of the works with the potential for excess in-stream suspended solids and sedimentation and the potential for redistribution of sediment further within the coastal area and to the Māngere Inlet.
- Effects to marine and freshwater fish during works including disturbance of foraging and nursery habitat, potential for fish injury or mortality during works and potential for obstruction of fish passage during the removal of existing culverts.

A summary of potential adverse effects on flora and habitat ecological values include:

- Loss of vegetation including:
  - 1,820 $m^2$ of native vegetation.
  - Approximately seven exotic specimen trees.
  - 65 $m^2$ of exotic shrubland (monkey apple hedgerow).
  - 181 $m^2$ of rank grassland.
- 1,000 $m^2$ of mangrove clearance and disturbance to sediments involved with this activity.

A summary of potential adverse effects on fauna ecological values include:

- Injury or mortality to fauna during vegetation clearance.
- Effects to coastal birds, some of which are Threatened – Regionally Vulnerable, including disturbance of foraging, wading and nesting habitats.
- Further to this there is the potential for the establishment of construction compounds to become favourable habitat for prospective nest northern New Zealand dotterels. New Zealand dotterels are vulnerable to disturbance, injury or mortality when they establish on or near construction sites.

An Ecological Management Plan (EMP) has been prepared to detail effects management measures (and is appended to the AEE). The EMP includes the Fish Management Plan (FMP), Avifauna Management Plan (AMP), Mokomoko (skink) Management Plan (MMP) and Vegetation Management Plan (VMP).

Remediation of vegetation will occur following construction. Remediation planting includes planting native species, comprising native ecosystems that are either being lost or are representative of a natural estuarine ecosystem (Planting Plan; Boffa Miskell, 2024). The total area of planting will include in the order of 900 $m^2$ of saltmarsh/meadow planting and 1,100 $m^2$ of riparian planting (to nearest 100 m).

Native revegetation will include eco-sourced native plantings, of a similar composition to the species removed (Planting Plan, Boffa Miskell, 2024).

## 5.2 Aquatic ecology

### 5.2.1 Sedimentation and contaminant effects during construction

Earthworks and works within and adjacent to coastal water bodies and streams ('stream works') can result in an uncontrolled discharge of sediment laden water during construction. Sediment laden discharges can have negative effects on benthic habitats and 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 (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.

Disturbance effects on the Tennessee branch habitats are expected during the construction phase of the project. The works compound construction, pile driving and coffer dam installation, redundant pipe excavation, and culvert removal all have the potential to result in sediment and contaminant discharge in the absence of suitable control measures. Specifically:

- Temporary effects from the construction of the access staging where the foundations are in the vicinity of the channel, including piling in the channel. Piling will involve hollow steel-cased piling driven into the subtidal channel/stream using a vibro-hammer suspended from a crane. It is anticipated that this pile driving method will minimise the generation of excess sediment runoff and no further Erosion and Sediment Control (ESC) management will be required.
- Temporary disturbance during the placement of coffer dams including the potential for the structures to impede channel flow and create sediment disturbance. However, once the coffer dams are in place, disturbance to sediments and likelihood of sediment release during piling will be reduced. All works will be undertaken at low tide.
- Disturbance of sediments during construction works and culvert removal/embankment removal which could result in sediment laden discharges, or the release of sediment bound contaminants to the subtidal channel.

An Erosion and Sediment Control Plan (ESCP) (T+T, 2024) has been developed for the proposed works. This document sets out measures to be implemented during construction that will minimise ecological impacts associated with the works and is in accordance with GD05 – Guidance for Erosion and Sediment Control[8]. Measures to be implemented during works are described in detail in the ESCP and include the following:

- The use of silt fences to prevent coarse sediment runoff, to divert the overland flow path and manage sediment runoff during embankment and pipe excavation.
- Excavated material from within the coffer dams will be transported out of the CMA.
- The sheet piles will be driven to rock level minimising the need for pumping of coastal water.

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

- Dirty water diversions and silt fences will be installed to capture and pump out dirty water running off the excavation chambers.
- Stream flow will be maintained through the existing culvert pipes until the embankment excavation is complete. The removal of the embankment will be a weather sensitive activity and geotextile will be used to cover and stabilise it during bad weather. The existing culverts will be left in situ to allow stream water flow while the cutting down of the bank begins from the opposite side (the reserve side) working toward the culverts to cut the final profile.
- During culvert removal, stream flows will be diverted into the western culvert to allow for removal of the eastern culvert and stream construction activities. Following completion of the stream construction, the flows will be diverted into the new channel to enable removal of the western culvert. These works will be undertaken each within a single tidal cycle.
- A concrete wash down area will be provided outside the CMA.

The magnitude of erosion and sedimentation effect before effects management is considered **moderate**. With the above ESC methods in place, the magnitude of effects to the Tennessee branch and subtidal channel considered **low**. A **moderate** ecological value for Tennessee branch and subtidal channel combined with a **low** magnitude of effect results in an overall **low** level of effect according to the EIANZ EcIAG level of effects matrix (Table Appendix B.5).

### 5.2.2 Potential accidental release of sewage during construction

The Eastern Interceptor is a live sewage pipe carrying wastewater to Māngere Water Treatment Plant. Whilst every effort will be made to ensure that wastewater is contained during the diversion and demolition, there is the potential for an uncontrolled discharge of sewage material to occur during construction.

Sewage discharge into the freshwater and intertidal environment could have a suite of effects on ecosystem and fauna health. Sewage contains an array of organic and inorganic solids, including heavy metals such as cadmium, mercury, arsenic, zinc and copper; microbes and pathogens including faecal coliform, *E coli*, salmonella, as well as viruses, fungi, and parasitic worms; and a rich concentration of nutrients such as nitrogen and phosphorous (Bhat and Qayoom, 2021; Mallin et al., 2007).

The excess nutrients discharged in a sewage spill can affect in-stream biogeochemical cycling, resulting in the decay of benthic and microbial communities as rapid biological growth causes overconsumption of oxygen and eutrophication (Wells et al., 2013). Oxygen depletion in the freshwater and intertidal environment can lead to rapid fish kills. Whilst some species such as shortfin and longfin eels may be able to tolerate reduced dissolved oxygen levels, inanga, common bully (juvenile) and banded kokopu have all been shown to be sensitive to low dissolved oxygen levels (Dean & Richardson, 1999; Franklin, 2013). Harmful pathogens and contaminants within sewage can also lead to fish kills through acute toxicity, infection and disease.

The magnitude of effect of a sewage spill into the freshwater and intertidal environment would be dependent on the scale of the spill, the volume of wastewater discharged and the tidal cycle. The input of a large volume over a period of hours or days would likely have a **very high** magnitude of effect on the habitat and fauna present at the site, resulting in major alterations to ecological features and conditions. Tidal influence could result in the distribution of sewage both upstream and downstream from the source. A small discharge of residual sewage material during the final demolition of the interceptor pipe would likely have a **low** magnitude of effect, given that the existing stream water quality is already degraded; the input is unlikely to result in more than a minor shift from baseline conditions.

Sewage spills are not anticipated to occur during construction given that comprehensive construction methodology has been developed for the project as per the draft Construction

Environmental Management Plan. Provided that the methodology is implemented correctly, the magnitude of effect and overall level of effect should be **negligible**. A **moderate** ecological value combined with a **negligible** magnitude of effect results in an overall **very low** level of effect.

## 5.3 Ecosystems and vegetation

### 5.3.1 Terrestrial ecosystems and vegetation

Potential adverse effects on terrestrial vegetation include:

- Temporary loss of native vegetation (1,820 $m^2$).
- Potential permanent loss of exotic specimen trees (approximately seven).
- Loss of 181 $m^2$ of rank kikuyu grassland and 65 $m^2$ of exotic shrubland.

The loss of vegetation will be remediated following construction. Remediation of vegetation will include a planting composition of native species similar to those lost, comprising native ecosystems (Planting Plan; Boffa Miskell, 2024). The total area of planting will include in the order of 900 $m^2$ of saltmarsh/meadow planting and 1,100 $m^2$ of riparian planting (to nearest 100 m).

The temporary loss of a relatively small proportion of native vegetation is considered to have 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 trees and rank kikuyu grassland is considered to have a **low** magnitude of effect (due to the loss of exotic vegetation that provide limited ecological benefit).

As a result, for native vegetation, a **moderate** ecological value combined with a **moderate** magnitude of effect for the construction phase results in an overall **moderate** level of effect (short term). However, following remediation, the magnitude of effect reduces to **low** over the medium term, resulting in an overall **low** level of effect.

For exotic grassland, a **low** ecological value combined with a **low** magnitude of effect results in an overall **very low** level of effect. For exotic specimen trees and shrubland a **negligible** ecological value combined with a **low** magnitude of effect results in an overall **very low** level of effect.

With regard to kānuka, mānuka, taupata and ngaio the magnitude of effect is potentially **moderate** during the construction phase, but following remediation of native plantings including kānuka, mānuka, taupata and ngaio, 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 in the medium term.

The VMP, which forms part of the EMP, outlines measures to ensure vegetation management is undertaken in a way that minimises vegetation loss where possible.

### 5.3.2 Mangrove habitat

The removal of approximately 1,000 $m^2$ of mangroves upstream and downstream of the embankment will adversely affect mangrove forest within the project footprint. As described in Section 4.2.3.1, mangroves provide habitat for multiple species including coastal birds and a range of native fish and invertebrate species. Although important in providing habitat, mangrove expansion is occurring at an accelerated rate due to increase in suspended sediments from surrounding catchments (Kelly, 2008).

Any proposal to remove mangroves should consider the location and scale of mangrove removal, the ability of mangroves to grow back and the expected timescale within which this will occur. Within the wider Harania Creek estuary (upstream of the Favona Road bridge) mangrove forest covers an

area of 120,000 $m^2$. Proposed mangrove clearance associated with the project comprises a small proportion of this larger area, equating to approximately 0.83%. The removal of mangroves associated with the works is considered to have a short term effect (less than 5 years) as mangroves will recolonise the area within a five year time period. Once the removal of the embankment occurs, the intertidal area and consequently the available mangrove and marine benthic habitat will be increased. Further to this, mangrove habitat will eventually become contiguous with the removal of the embankment and culvert barriers.

Due to the small amount of mangrove clearance occurring relative to the wider area (0.838%), the timescale within which mangroves are expected to recolonise the site, plus additional intertidal habitat created with the removal of the embankment, the magnitude of effect is **low**; this magnitude of effect will be the low with or without management measures. With the **moderate** level of value of mangroves, the overall level of effect is **low**.

Notwithstanding the low overall level of effect, appropriate mangrove clearance techniques are proposed to be implemented (and will be outlined in the EMP for the Project) to minimise adverse effects to aquatic ecology and marine benthic values, including:

- Mangrove removal will occur only during low tide and CMA access will be limited to one entry point at the Blake Road Reserve.
- All vegetation will be removed via excavator with a selector grab and transported to land for processing.
- Machinery will work only from the gravel platforms or the temporary bridge.
- All mangrove material will be removed from the CMA and transported from the site to be disposed to green waste.

### 5.3.3 Marine benthic habitat

Potential adverse effects to benthic habitats and fauna include:

- Temporary effects:
  - Disturbance of sediments and benthic fauna resulting from tracking of machinery and removal of mangroves in the CMA, including potential for sediment dispersal with ingoing and outgoing tides.
  - Effects from the construction, occupation and disestablishment of a continuous level platform (access staging) approximately 70 m in length and 8.5 m wide across the CMA. This will involve piling above and below MHWS with the potential for some piles to remain in the CMA post construction (cut below the bed).
  - Placement of either one or two gravel platforms within the CMA which will be used to support coffer dam construction. The gravel platform(s) will be removed post construction, however the platforms will temporarily smother sediments and associated fauna.
  - Disturbance to sediments during the placement of sheet piles to form three coffer dams and piling (18 piles) to a depth of 25 m with concrete poured within the CMA (isolated by the coffer dams).
  - Disturbance of sediments with the potential for sediment release during the removal of the existing pipe, excavation of the remaining embankment and removal of the existing culverts.
  - The potential for extreme wet weather events to overwhelm the site and increase sediment loads in the CMA during construction.
- Permanent effects:

- Occupation of the piles equating to the loss of 120 $m^2$ of benthic habitat and associated fauna (below MHWS).

While there are no management measures to address permanent effects associated with the proposed works, the loss of 120 $m^2$ of benthic habitat within the project footprint represents a fraction of available benthic habitat within the wider Harania Creek estuary (area). With the removal of the embankment, there is expected to be a localised gain in marine benthic habitat once the project is complete.

Measures to manage temporary potential effects to marine benthic habitats associated with the construction works include erosion and sediment controls in accordance with GD05 guidelines, including:

- Geotextile fabric placed down before gravel pads are put in place.
- Minimal sediment will be released during initial piling of driven hollow steel tubes.
- Gravel will stabilise the ground during cofferdam sheet piling.
- Excess material will be taken out and moved to the hard standing area on the reserve to be taken away with trucks.
- Mangrove removal and construction of the temporary access will occur at low tide. Once the cofferdams are established there will be less tidal restrictions while working within the isolated cofferdam areas.
- Further management methods within mangrove habitat detailed in Section 5.3.2 above.

Once the coffer dams are fully installed, including reinforcement steel cages placed, concrete will be poured using a concrete pump from the access staging. A concrete wash down area will be provided outside of the CMA in the form of a plastic lined skip with a water blaster on standby.

In the absence of any effects management methods the magnitude of effect to benthic ecology is potentially **moderate.** With the above management methods in place, the magnitude of effects to benthic habitat and fauna within this area are reduced to **low**. Benthic habitats within the area are low in diversity, degraded and considered to have a **negligible** value. Considering the above, the overall level of effect is **very low**.

## 5.4 Fauna

### 5.4.1 Avifauna

#### 5.4.1.1 Terrestrial birds

Potential adverse effects on terrestrial birds include:

- Temporary habitat loss of native vegetation (1,820 $m^2$).
- Potential permanent loss of exotic specimen trees (approximately seven) and shrubland (65 $m^2$).
- Disturbance, injury or mortality during habitat clearance.

The loss of approximately 1,820 $m^2$ constitutes a relatively minor loss of habitat for native terrestrial birds (there is over 1.3 ha of similar habitat along the upstream Harania Creek riparian zone). Furthermore, 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 the local terrestrial/urban bird populations could be **moderate** without efforts to remediate habitat or protect birds during peak bird breeding season.

Habitat will be re-instated with native eco-sourced vegetation following the completion of works. This will include in the order of 2,000 $m^2$ terrestrial and salt marsh/meadow plantings. In addition, it is recommended to avoid habitat clearance during peak forest bird breeding season. Given current project timeframes, works are likely to commence in March and avoid peak forest bird breeding season.

In the unlikely case that habitat clearance (i.e. of native vegetation or exotic specimen trees) is required during peak forest 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 if trees have been identified with cavities potentially used by cavity nesters (such as kōtare/sacred kingfisher (*Todiramphus sanctus*), or 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 recommendations, the magnitude of effect on terrestrial birds is considered to be **low.**

A **low** to **moderate** ecological value combined with a **low** magnitude of effect results in an overall **low** to **very low** level of effect for terrestrial birds.

#### 5.4.1.2 Coastal birds

Potential adverse effects on coastal birds within the project footprint and associated with the Tennessee bridge works and embankment removal include:

- Injury or mortality of birds present within the mangrove clearance zone.
- Disturbance effects on coastal birds during construction works including noise disturbance.
- Creation of potential dotterel nesting habitat during the construction period, resulting in disturbance, injury or mortality to nesting dotterels.
- Impacts on foraging, roosting and nesting habitat as a result of mangrove removal and disturbance of soft sediment habitat.
- Increase in suspended sediments within the subtidal channel and during high tide, impacting visual ability to forage in the water column.

Moho pererū were confirmed as present within the project footprint. It is possible other At Risk bird species may be present within or near to the project footprint and may be adversely impacted by

the construction works. Potential effects are expected to be within the ZOI and temporary in nature. Behavioural changes are likely to occur in coastal birds who will likely avoid the area due to habitat and noise disturbance within and near to the project footprint.

Potential effects on foraging habitat quality and quantity for waders might arise as a result of increased sediment release and discharges from the site during construction, including sediment that is potentially contaminated. The same can be said for impacts on birds feeding in the water column, where suspended sediment could potentially impact visual foraging ability. In both cases, ESC implemented prior to and during works on site, along with mangrove removal methods detailed within Section 5.3.2 and the EMP, are expected to appropriately manage potential uncontrolled sediment discharges from the site.

Removal of mangroves and vegetation and general disturbance from works such as piling will have an impact on bird behaviour. Resting and foraging birds will likely relocate to similar environments, while breeding birds will likely abandon their nests. Due to their ability to relocate and the availability of suitable environments close to the project footprint, the magnitude of effect to resting and foraging birds is low.

It is recommended to avoid mangrove clearance during peak coastal bird breeding season (September to March inclusive). However, given the project timeframes, it may not be possible to do this. Where mangrove clearance is required during peak coastal bird breeding season bird nest checks will be required in accordance with the project AMP and as outlined in Section 5.4.1.1 above. Moho pererū are the main coastal bird species that utilise mangroves. They typically roost and nest in saltmarsh habitat. Rarely, they nest on the periphery of mangrove habitat. The risk of moho pererū nesting is considered to be very low but cannot be excluded.

As is described in Section 4.3.2.2, there is the potential for northern NZ dotterel to utilise the Eastern compound at Blake Road Reserve and the Western compound at Lenore Foreshore Reserve during the construction period. NZ dotterel has not been observed at the site, but given the proximity to the coast, NZ dotterels cannot be excluded from potentially utilising construction areas. The NZ dotterel breeding season period is from July to March inclusive. Disturbance, injury and mortality to nesting dotterels can occur on construction sites due to movement of vehicles, machinery and personnel around the site.

Management measures to deter dotterel in the first instance and surveys to detect dotterel presence will be outlined within the AMP. Deterrence measures include the establishment of silt fences at 10 m intervals if dotterels are observed prospecting at the site. It is important to be proactive in dotterel management, deterrence and detection so as not to impede on construction works and timelines. They establish breeding sites before the earthwork season starts which often means when works begin, dotterels may have already established breeding territories (Bannock, 2012).

With no management methods in place, the magnitude of effect on sensitive coastal bird populations, which are vulnerable to further loss of individuals, is **high**. With the AMP in place, the magnitude of effect on coastal birds is considered **negligible**. With the value of coastal birds ranging from **low** to **very high** the overall level of effect on coastal birds is **low** to **very low.**

### 5.4.2 Lizards

Potential adverse effects on native lizards (copper and ornate skinks) include:

- Temporary habitat loss of native vegetation (1,820 $m^2$), rank grass (181 $m^2$) and exotic shrubland (65 $m^2$).
- Injury or mortality during habitat clearance.

The loss of habitat constitutes a relatively minor loss of habitat for native skinks (there is over 1.3 ha of similar habitat along the upstream Harania Creek riparian zone). However, without measures to avoid, remedy or mitigate effects, the potential magnitude of effect on native lizards could be **moderate**. 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 or log discs and planting of *Muehlenbeckia*) (as outlined in the Landscape Plan; Boffa Miskell, 2024). As a result, in the short term (0-5 years following completion of construction) there will be no overall loss in potential lizard habitat.

A Mokomoko (skink) Management Plan (MMP) has been prepared as part of the EMP and has been prepared and submitted with the AEE to manage potential lizard injury or death during habitat clearance, and provision habitat at the relocation site. It was also prepared as part of an application for a Wildlife Act Authority (WAA) application to DOC. A WAA is required to handle and salvage native lizards. 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. Includes the following methods:
  - Iwi engagement and collaboration with any proposed salvage.
  - Artificial Cover Object (ACO) salvage.
  - Manual habitat salvage.
  - Machine-assisted salvage.
  - Establishment of a silt fence to prevent native lizards from homing.
  - 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.

### 5.4.3 Fish

Potential adverse effects to fish within the project footprint and associated with the Tennessee bridge works and embankment removal include:

- Increase in suspended sediments within the subtidal channel and during high tide, impacting visual ability to forage in the water column as is outlined in Section 5.2.1 above.
- Injury or mortality to fish during any piling works, specifically piling within the subtidal channel or any instream works as is outlined in Section 5.4.3.1 below.
- Impacts on fish passage during construction as outlined in Section 5.4.3.2 below.
- Impacts on fish habitat as a result of mangrove removal and disturbance of soft sediment habitat as is outlined in Section 5.2.1 above.

#### 5.4.3.1 Injury or mortality of freshwater and marine fish during construction

Works within the subtidal channel have the potential to cause injury or mortality to native freshwater and estuarine fauna. The magnitude of potential effect(s) on native fauna is driven by the nature of the activity, the area of stream disturbance, density of fauna 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. Injury or mortality to fish would result in a **very high** magnitude of effect at the site scale. When applied to a feature of **high** ecological value, this would result in an overall level of effect of **very high**.

The pile driving and coffer dam installation, as well as the removal of the existing culverts, has the potential to result in injury or mortality to native diadromous fish species present at the time of works. Salvage, relocation and exclusion of fauna from the works area prior to the commencement of any in-stream works can significantly reduce the likelihood of injury/mortality occurrence and therefore magnitude of effect. Therefore, before the commencement of any works within the subtidal channel the works area will be isolated and fish management undertaken. This will involve the installation of fish exclusion nets, and the use of a drag or seine net to guide fish out of the works area.

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

- The methodology and frequency of effort for fauna capture prior to stream works (i.e use of a drag or seine net to guide fish out of the works area);
- 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; and
- Reporting requirements.

The FMP will be implemented by a suitably qualified and experienced ecologist with appropriate permits (Ministry of Primary Industries). On the basis that fish salvage and relocation will be successfully implemented for construction activities within all available habitat within the site via the FMP, it is considered that the magnitude of effect of injury or mortality of aquatic fauna will be **low**. A **low** magnitude of effect applied to a feature of **low** to **high** ecological value results in a **very low** to **low** overall level of effect (Table Appendix B.5).

#### 5.4.3.2 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 and poor culvert design can restrict fish migration, often by culverts being perched, too steep or long or increases in water flow with insufficient roughness to allow effective fish movement. In addition, temporary restrictions to fish passage during construction may impact a population's reproductive success. The resultant decrease in fish mobility can cause fragmented populations, a reduction in population size and limit overall habitat for

freshwater fauna. This potential effect is less relevant to estuarine fish which do not need to pass structures/enter freshwater environments to complete their lifecycle.

Freshwater fauna, including eels (longfin and shortfin), banded kōkopu, common bully, and īnanga may be present in the Tennessee branch based on NZFFD records. Eels are catadromous, living in freshwater but migrate to sea to breed, with juveniles returning to freshwater. Both longfin and shortfin eels are accomplished climbers and are well adapted to negotiating barriers to reach upstream environments. Banded kōkopu are diadromous, in that adults live and breed in freshwater, while larvae migrate to the sea and return to freshwater as juveniles. When considering their ability to pass barriers, banded kōkopu are classified as good climbers. Īnanga and common bully, however, are weak swimmers (Franklin et al., 2018). Smelt are sensitive to stress and are diadromous. If present they may utilise the stream/subtidal channel during low tide, particularly mature individuals, which are known to migrate upstream during spring.

The twin culverts that connect the upper and lower reaches of Tennessee branch are not currently acting as a significant barrier to fish passage; with the exception of common bully, all freshwater species recorded in the Tennessee branch have been recorded both up and downstream of the culverts. The culverts will remain in place for the majority of the construction works maintaining fish passage. Once the embankment excavation has been completed the culverts will be removed one at a time, to allow flows to continue through the remaining culvert. Each culvert removal will take place within a single tidal cycle. The construction works for the culvert removal will be of short duration and could avoid peak migration time for key species.

The magnitude of effect of the construction phase of the project on native fish passage has been assessed to be **low**. Given that the native freshwater fauna value has been assessed to be **low** to **high**, this results in a **very low** to **low** overall level of effect. The removal of the embankment and culverts and reversion to a more naturalised stream environment will improve fish passage in Tennessee branch; the long-term effect of the project on native fish passage has been assessed to be **positive**.

## 5.5 Summary of effects and management measures

Aquatic ecological values (including fish) range from **negligible** to **high**. Measures are proposed to address potential and actual effects on these values.

An EMP has been developed to outline protocols to avoid, minimise and remedy potential adverse effects on the ecological and biodiversity values within the project area associated with the proposed works. It includes the FMP, AMP, MMP and VMP.

The EMP includes a summary of the roles and responsibilities of those implementing the EMP, accidental discovery protocols, adaptive management measures and reporting requirements. Specific management measures for fish, avifauna, lizards and vegetation are summarised below.

Fish management measures largely involve the establishment of fish exclusion barriers and management of fish through the use of a drag or seine net, moving downstream from an upstream barrier, effectively guiding fish downstream and out of the works area.

Measures to avoid impacts on native avifauna include the removal of vegetation outside of bird breeding season. Where this is not possible, bird nest checks are required. Management measures for dotterels are detailed, including the establishment of silt fences 10 m apart to deter dotterel nesting if construction works have created potential nesting habitat on site, and dotterels are observed prospecting the site.

Management of mokomoko/skinks will be undertaken during October to April inclusive when mokomoko are active. Management includes salvage before and during construction through the checking of ACOs, manual searches and machine-assisted salvage. Relocation site enhancement will

be undertaken through the placement of rock piles and planting on the edge of the site. Pest mammal management may be required if more than 20 skinks are salvaged.

Vegetation management includes the use of experienced arborists, demarcating the clearance extent, seasonal restrictions on vegetation clearance, and minimising impacts to adjacent vegetation. Measures to minimise impacts during mangrove removal have been proposed which include minimising machinery disturbance, mangrove removal measures, and seasonal restrictions where possible.

Provided that the measures outlined within the EMP (including the FMP and AMP) and ESCP are implemented during construction, the magnitude of effect for all aquatic values are considered to be **low**, while the overall effects ranged from **low** to **very 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** in the medium term. The overall level of effect for all terrestrial ecological values in the medium term is considered to be **low** to **very low**.

**Table 5.1: Summary of effects**

| Ecological characteristic | Ecological value | Proposed effects management | Magnitude of effect after effects management | Overall level of effect |
|---|---|---|---|---|
| **Aquatic Ecology** | | | | |
| Tennessee branch and shallow subtidal channel | Moderate | ESCP including use of silt fences, transportation of excavated material, dirty water diversions; Construction Environmental Management Plan | Negligible to Low | Very low to Low |
| **Flora and habitat types** | | | | |
| Native planted vegetation | Moderate | Remediation planting | Moderate (short term)<br>Low (medium term) | Moderate (short term)<br>Low (medium term) |
| Exotic specimen trees and shrubland | Negligible | Remediation planting | Low | Very low |
| Rank grassland | Low | Remediation planting | Low | Very low |
| Kānuka, mānuka, taupata, ngaio | Moderate | Remediation planting | Moderate (short term)<br>Low (medium term) | Moderate (short term)<br>Low (medium term) |
| Not Threatened native vegetation | Low | Remediation planting | Low | Very low |
| Mangrove habitat | Moderate | Natural regeneration allowed to occur | Low | Low |
| Marine benthic habitat and fauna | Negligible | Erosion and sediment controls | Low | Very low |

| Ecological characteristic | Ecological value | Proposed effects management | Magnitude of effect after effects management | Overall level of effect |
|---|---|---|---|---|
| | | in accordance with GD05 guidelines | | |
| **Fauna** | | | | |
| At Risk – Recovering/Relict terrestrial birds, tūī, kererū | Moderate | AMP: bird nest checks, habitat remediation | Low | Low |
| Not Threatened terrestrial birds | Low | AMP: bird nest checks, habitat remediation | Low | Very low |
| Coastal avifauna | Low to Very High | AMP: bird nest checks, habitat remediation, dotterel deterrents and management | Negligible | Low to Very low |
| Copper and ornate skink | High | MMP: salvage and relocation, habitat remediation, habitat enhancement measures including pest mammal control if certain thresholds of lizards are salvaged. | Low | Low |
| Fish | Low to High | FMP: Fish exclusion measures. Maintenance of fish passage throughout construction period.<br>Improved fish passage as a result of works. | Low (construction phase)<br>Positive (long term) | Low to Very low (construction phase)<br>Net gain (long term) |

# 6 Summary and conclusion

This assessment of ecological values and effects has incorporated aquatic and terrestrial habitats and species associated with the Harania Flood Resilience Works - Tennessee Bridge

Ecological values at the project footprint ranged from **negligible** to **very high** and included manawa/mangrove forest, Tennessee subtidal channel, marine benthic habitat, native and exotic vegetation and fauna (terrestrial and coastal birds, lizards, and fish). These ecological values will be affected by the project through elevated sediment and contaminant discharge to aquatic habitats, disturbance of mangrove and marine benthic habitats, and the potential for fauna disturbance, injury or mortality. Vegetation removal comprising, a total of 1,820 $m^2$ of temporary native vegetation loss, 1,000 $m^2$ mangrove habitat clearance, loss of up to seven exotic specimen trees and exotic shrubland and grassland 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 under 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.

Within the EMP, an AMP, a MMP, a FMP and VMP are proposed to manage effects on birds, lizards, fish and vegetation. Remediation planting in the order of 900 $m^2$ of saltmarsh/meadow planting and 1,100 $m^2$ of riparian planting (to nearest 100 m).has been proposed to manage the loss of vegetation as a result of the works.

Provided that the methodologies outlined in these documents are appropriately implemented during the construction phase, the magnitude of effect on aquatic fauna has been assessed to be **low**. Long-term, the project is likely to have a **positive** effect on fish passage and stream ecological function given that it will be reverted to a more naturalised system.

Further environmental management associated with coastal habitat and species will be captured within the AMP which will include methods for mangrove clearance and managing any impacts on coastal birds, including mitigation and deterrent measures for the northern NZ dotterel. With effects management in place, the potential overall adverse effects on coastal avifauna are **low** to **very low**.

Following the implementation of the 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.

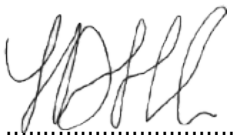
# 7 Applicability

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

Report prepared by:



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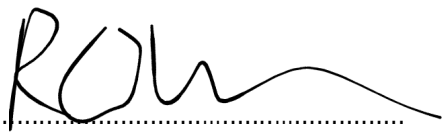
Sam Heggie-Gracie
Ecologist



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Ross Oliver
Ecologist

Report prepared by:

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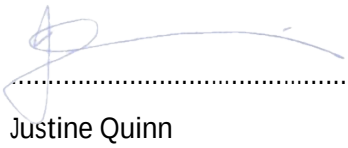
Vanessa Taikato PhD
Ecologist



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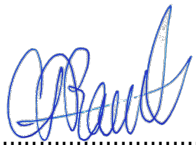
Justine Quinn
Technical Director – Freshwater Science & Ecology

Authorised for Tonkin & Taylor Ltd by:



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Chris Bauld
Project Director

Technical review by Liza Kabrle (Principal Aquatic Ecologist), Susan Jackson (Senior Marine Ecologist)

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# Appendix A Site Figure

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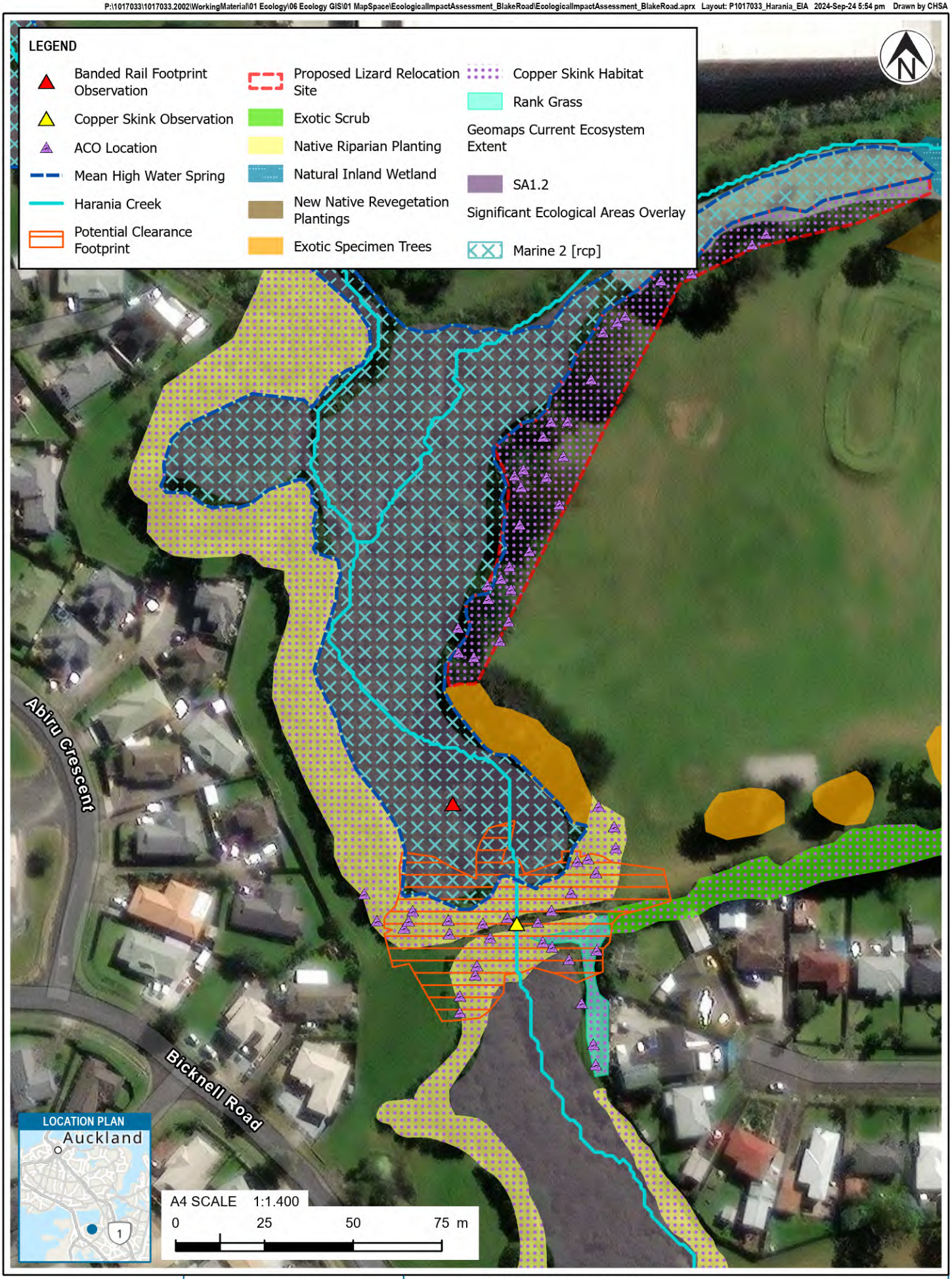


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CLIENT **AUCKLAND COUNCIL**

PROJECT **HARANIA BLUE GREEN NETWORKS STAGE 2: DESIGN**

TITLE ECOLOGICAL IMPACT ASSESSMENT

SCALE (A4) 1:1,400 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 marine, 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<br>• 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. |

*In this case the Zone of Influence (ZOI) refers to all estuarine and marine water bodies and environments that could be potentially impacted by the Project. It includes the project footprint and any environments beyond the project footprint Area where 'indirect effects' such as discharges may extend.

**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.<br>Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments.<br>Benthic community typically with no single dominant species or group of species.<br>MCI scores typically 120 or greater.<br>EPT richness and proportion of overall benthic invertebrate community typically high.<br>SEV scores high, typically > 0.8.<br>Fish communities typically diverse and abundant.<br>Riparian vegetation typically with a well-established closed canopy.<br>Stream channel and morphology natural.<br>Stream banks natural typically with limited erosion.<br>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.<br>Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and settled sediments.<br>Benthic community typically with no single dominant species or group of species.<br>MCI scores typically 80 - 100 or greater.<br>EPT richness and proportion of overall benthic invertebrate community typically moderate to high.<br>SEV scores moderate to high, typically 0.6-0.8.<br>Fish communities typically diverse and abundant.<br>Riparian vegetation typically with a well-established closed canopy.<br>No pest or invasive fish (excluding trout and salmon) species present.<br>Stream channel and morphology natural.<br>Stream banks natural typically with limited erosion.<br>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.<br>Moderate to high degradation e.g. high-intensity agriculture catchment. | Benthic invertebrate community typically has low diversity, species richness and abundance.<br>Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments.<br>Benthic community typically with dominant species or group of species.<br>MCI scores typically 40 - 80.<br>EPT richness and proportion of overall benthic invertebrate community typically low.<br>SEV scores moderate, typically 0.4 - 0.6. |

| Value | Explanation | Characteristics |
|---|---|---|
| | | Fish communities typically moderate diversity of only 3 - 4 species.<br>Pest or invasive fish species (excluding trout and salmon) may be present.<br>Stream channel and morphology typically modified (e.g. channelised)<br>Stream banks may be modified or managed and may be highly engineered and/or evidence of significant erosion.<br>Riparian vegetation may have a well-established closed canopy.<br>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.<br>Benthic invertebrate community dominated by taxa that are not sensitive to organic enrichment and settled sediments.<br>Benthic community typically with dominant species or group of species.<br>MCI scores typically 60 or lower.<br>EPT richness and proportion of overall benthic invertebrate community typically low or zero.<br>SEV scores moderate to high, typically less than 0.4.<br>Fish communities typically low diversity of only 1 - 2 species.<br>Pest or invasive fish (excluding trout and salmon) species present.<br>Stream channel and morphology typically modified (e.g. channelised).<br>Stream banks often highly modified or managed and maybe highly engineered and/or evidence of significant erosion.<br>Riparian vegetation typically without a well-established closed canopy.<br>Habitat highly modified. |

**Table Appendix B.3 : Ecological values assigned to vegetation, habitats and communities**

| Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/habitat/community. | |
|---|---|
| **Matters** | **Attributes to be considered** |
| Representativeness | Attributes for representative vegetation and aquatic habitats:<br>• Typical structure and composition<br>• Indigenous species dominate<br>• Expected species and tiers are present<br><br>Attributes for representative species and species assemblages:<br>• Species assemblages that are typical of the habitat<br>Indigenous species that occur in most of the guilds expected for the habitat type |
| Rarity/distinctiveness | Attributes for rare/distinctive vegetation and habitats: |

| Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/habitat/community. | |
|---|---|
| **Matters** | **Attributes to be considered** |
| | • Naturally uncommon, or induced scarcity<br>• Amount of habitat or vegetation remaining<br>• Distinctive ecological features<br>• National priority for protection<br>Attributes for rare/distinctive species or species assemblages:<br>• Habitat supporting nationally Threatened or At-Risk species, or locally uncommon species<br>• Regional or national distribution limits of species or community<br>• Unusual species or assemblages<br>Endemism |
| Diversity and Pattern | • Level of natural diversity, abundance and distribution<br>• Biodiversity reflecting underlying diversity<br>• Biogeographical considerations – pattern, complexity<br>Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation |
| Ecological context | • Site history, and local environmental conditions which have influenced the development of habitats and communities<br>• The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA)<br>• Size, shape and buffering<br>• Condition and sensitivity to change<br>• Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material<br>• Species role in ecosystem functioning – high level, key species identification, habitat as proxy |

**Table Appendix B.4 : Characteristics of estuarine and marine areas/habitats and associated ecological values[9].**

| Ecological Value | Characteristics |
|---|---|
| **Very High** | • Benthic invertebrate community typically has very high diversity, species richness and abundance for the habitat type.<br>• Benthic invertebrate community is dominated by taxa that are sensitive to organic enrichment, contaminants and mud e.g. rated as 'Excellent' using the Auckland Council (AC) Benthic Health Model (BHM)[10] or similar index.<br>• Marine sediments typically comprise < 20% silt and clay grain sizes (mud) or rated as 'Excellent' using the AC BHMmud or similar index. |

[9] The characteristics of marine and estuarine sites with 'Negligible' to Very High ecological values were originally developed by Dr Sharon De Luca, Boffa Miskell Ltd, then modified further here, to guide valuing estuarine environments, and to provide a transparent approach that can be replicated. The characteristics have been accepted by decision-makers in Environment Court and Board of Inquiry hearings, including a number of NZTA projects (Transmission Gully, MacKays to Peka Peka, Ara Tūhono Project Puhoi to Warkworth and Warkworth to Wellsford Sections). Table 2 is based on the approach taken in these projects, and has been further developed with additional available indices to improve its use for the current consent applications.

[10] Hewitt, J E., Lohrer, A M and Townsend, M (2012). Health of estuarine soft-sediment habitats: continued testing and refinement of state of the environment indicators. Prepared by NIWA for Auckland Council. Auckland Council technical report, TR2012/012.

| Ecological Value | Characteristics |
|---|---|
| | • Surface sediment oxygenated to > 5 cm depth[11] with no anoxic sediment present.<br>• Annual average sedimentation rates typically less than 1 mm above background levels [12].<br>• Contaminant concentrations in surface sediment significantly below DGV and AC ERC-Orange effects threshold concentrations[13].<br>• Water quality high, with no toxicants above effects threshold concentrations.<br>• Water column contaminant values typically at or better than ANZG 99% species protection level and/or scored as 'Excellent' on a recognised Water Quality Index (WQI)[14].<br>• Fish community typically has very high diversity, species richness and abundance[15].<br>• Invasive opportunistic and disturbance tolerant species absent[16].<br>• Threatened or At Risk marine species present.<br>• Threatened ecosystems present.<br>• Vegetation likely to be nationally important and recognised as such.<br>• Native estuarine vegetation or Macroalgae sequences community intact and provides significant habitat for native fauna.<br>• No evidence of nuisance phytoplankton or macroalgal blooms[10].<br>• Physical habitat unmodified. |
| **High** | • Benthic invertebrate community typically has high diversity, species richness and abundance.<br>• Benthic invertebrate community contains many taxa that are sensitive to organic enrichment, contaminants and mud. E.g. rated as 'Good' using the AC BHM or similar index.<br>• Marine sediments typically comprise < 40% silt and clay grain sizes or rated as 'Good' using the AC BHMmud or a similar index.<br>• Surface sediment oxygenated up to 5 cm depth.<br>• Annual average sedimentation rates typically less than 2 mm above background levels.<br>• Contaminant concentrations in surface sediment rarely exceed DGV and AC ERC-Orange effects threshold concentrations.<br>• Water quality does not have any toxicants above effects thresholds.<br>• Water column contaminant values typically between ANZG 95% and 99% species protection levels and/or scored as 'Good' on a recognised WQI.<br>• Fish community typically has high diversity, species richness and abundance.<br>• Invasive opportunistic and disturbance tolerant species largely absent.<br>• Vegetation likely to be regionally important and recognised as such. |

[11] Robertson, B.M, Stevens, L., Robertson, B., Zeldis, J., Green, M., Madarasz-Smith, A., Plew, D., Storey, R., Oliver, M. 2016. NZ Estuary Trophic Index Screening Tool 2. Determining Monitoring Indicators and Assessing Estuary Trophic State. Prepared for Envirolink Tools Project: Estuarine Trophic Index, MBIE/NIWA Contract No: C01X1420. 68p.
[12] Townsend and Lohrer (2015). ANZECC Guidance for Estuary Sedimentation. Prepared for Ministry for the Environment by NIWA.
[13] ANZG (2018) Default Guideline Value concentrations, or Auckland Council's Environmental Response Criteria contaminant threshold concentrations (Auckland Regional Council TP168, 2004).
[14] E.g., Ingley, R (2021). Coastal and estuarine water quality state and trends in Tāmaki Makaurau / Auckland 2010-2019. State of the environment reporting. Auckland Council technical report, TR2021/02.
[15] https://www.mpi.govt.nz/legal/legislation-standards-and-reviews/fisheries-legislation/maps-of-nz-fisheries/
[16] https://www.marinebiosecurity.org.nz/

| Ecological Value | Characteristics |
|---|---|
| | • Native estuarine vegetation or Macroalgae community dominated by native species and provides high quality habitat for native fauna.<br>• Nuisance phytoplankton or macroalgal blooms may occur infrequently at a limited spatial scale.<br>• Physical habitat largely unmodified. |
| **Moderate** | • Benthic invertebrate community typically has moderate species richness, diversity and abundance.<br>• Benthic invertebrate community has both tolerant and sensitive taxa to organic enrichment, contaminants and mud present. E.g. rated as 'Fair' using the AC BHM or similar index.<br>• Marine sediments typically comprise < 60% silt and clay grain sizes or rated as 'Fair' using the AC BHMmud or similar index.<br>• Shallow depth of oxygenated surface sediment to 1 - 2 cm depth.<br>• Annual average sedimentation rates typically less than 5 mm above background levels.<br>• Contaminant concentrations in surface sediment generally below DGV-high or AC ERC-Red effects threshold concentrations.<br>• Water quality has concentrations of toxicants below effects thresholds.<br>• Water column contaminant values typically between ANZG 90% and 95% species protection levels and/or scored as 'Fair' on a recognised WQI.<br>• Fish community typically has moderate species richness, diversity and abundance.<br>• Few invasive opportunistic and disturbance tolerant species present.<br>• Vegetation likely to be important at the level of the ecological district.<br>• Native estuarine vegetation and macroalgae community dominated by native species and provides moderate habitat for native fauna.<br>• Nuisance phytoplankton or macroalgal blooms may occur sporadically over a moderate spatial scale.<br>• Physical habitat modification limited. |
| **Low** | • Benthic invertebrate community degraded with low species richness, diversity and abundance.<br>• Benthic invertebrate community dominated by organic enrichment tolerant, contaminant tolerant, and mud tolerant organisms with few/no sensitive taxa present. E.g. rated as 'Marginal' using the AC BHM or similar index.<br>• Marine sediments dominated by silt and clay grain sizes (> 70 %) or rated as 'Marginal' using the AC BHM or similar index.<br>• Surface sediment predominantly anoxic (lacking oxygen).<br>• Annual average sedimentation rates typically less than 10 mm above background levels.<br>• Elevated contaminant concentrations in surface sediment, above DGV-high or AC ERC-Red effects threshold concentrations.<br>• Water quality compromised by some toxicants above effects thresholds.<br>• Water column contaminant values typically between ANZG 80% and 90% species protection levels and/or scored as 'Marginal' on a recognised WQI.<br>• Fish community depleted with low species richness, diversity and abundance.<br>• Invasive, opportunistic and disturbance tolerant species dominant.<br>• Vegetation has limited ecological value other than as local habitat for tolerant native species. |

| Ecological Value | Characteristics |
|---|---|
| | • Native estuarine vegetation and/or macroalgae community provides minimal/limited habitat for native fauna.<br>• Nuisance phytoplankton or macroalgal blooms may occur commonly over a moderate scale.<br>• Physical habitat highly modified. |
| **Negligible** | • Benthic invertebrate community degraded with very low species richness, diversity and abundance for the habitat type.<br>• Benthic invertebrate community dominated by organic enrichment tolerant, contaminant tolerant, and mud tolerant organisms with no sensitive taxa present. E.g. rated as 'Poor' using the AC BHM or a similar index.<br>• Marine sediments dominated by silt and clay grain sizes (> 80%) or rated as 'Poor' using the AC BHM or similar index.<br>• Surface sediment anoxic (lacking oxygen).<br>• Annual average sedimentation rates typically greater than 10 mm above background levels.<br>• Elevated contaminant concentrations in surface sediment, above ANZG DGV-high effects threshold concentrations.<br>• Water quality degraded, with the concentration of many toxicants above effects thresholds.<br>• Water column contaminant values typically at or worse than ANZG 80% species protection levels and/or scored as 'Poor' on a recognised WQI.<br>• Where shellfish are present, flesh has moderate-high contaminant concentrations as compared to reference site data.<br>• Fish community depleted with very low species richness, diversity and abundance.<br>• Invasive, opportunistic and disturbance tolerant species highly dominant.<br>• Native estuarine vegetation and/or Macroalgae absent or so sparse as to provide very limited ecological value.<br>• Nuisance phytoplankton or macroalgal blooms may occur frequently over a large spatial scale.<br>• Physical habitat extremely modified. |

**Table Appendix B.5 : 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; AND/OR<br>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; AND/OR<br>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<br>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; AND/OR<br>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; AND/OR<br>Having negligible effect on the known population or range of the element/feature. |

**Table Appendix B.6 : 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 Plant and avifauna species lists

**Table Appendix C.1 : Vascular plant species list**

| Common name | Species name | National conservation status (De Lange et al. 2024) | Regional conservation status (Simpkins et al. 2022) | Ecological value (EIANZ criteria; Roper-Lindsay et al. 2018) |
|---|---|---|---|---|
| Sydney golden wattle | *Acacia longifolia* | Introduced | - | Negligible |
| Onion weed | *Allium triquetrum* | Introduced | - | Negligible |
| Manawa / mangrove | *Avicennia marina* | Not Threatened | Not Threatened | Low |
| Kikuyu | *Cenchrus clandestinus* | Introduced | - | Negligible |
| Taupata | *Coprosma repens* | Not Threatened | At Risk – Regionally Declining | Moderate |
| Karamu | *Coprosma robusta* | Not Threatened | Not Threatened | Low |
| Tī kōuka / cabbage tree | *Cordyline australis* | Not Threatened | Not Threatened | Low |
| Pampas | *Cortaderia selloana* | Introduced | - | Negligible |
| Wild carrot | *Daucus carota* | Introduced | - | Negligible |
| Rasp fern | *Doodia australis* | Not Threatened | Not Threatened | Low |
| Fleabane | *Erigeron sp.* | Introduced | - | Negligible |
| Fennel | *Foeniculum vulgare* | Introduced | - | Negligible |
| Macrocarpa | *Hesperocyparis macrocarpa* | Introduced | - | Negligible |
| Kānuka | *Kunzea robusta* | Not Threatened | At Risk - Declining | Moderate |
| Mānuka | *Leptospermum scoparium* | Not Threatened | Regionally Vulnerable | Moderate |
| Tree privet | *Ligustrum lucidum* | Introduced | - | Negligible |
| Chinese privet | *Ligustrum sinense* | Introduced | - | Negligible |
| Ngaio | *Myoporum laetum* | Not Threatened | At Risk – Regionally Declining | Moderate |
| Brush wattle | *Paraserianthes lophantha* | Introduced | - | Negligible |
| Harakeke | *Phormium tenax* | Not Threatened | Not Threatened | Low |
| Karo | *Pittosporum crassifolium* | Not Threatened | Not Threatened | Low |
| Tarata / lemonwood | *Pittosporum eugenioides* | Not Threatened | Not Threatened | Low |

| Common name | Species name | National conservation status (De Lange et al. 2024) | Regional conservation status (Simpkins et al. 2022) | Ecological value (EIANZ criteria; Roper-Lindsay et al. 2018) |
|---|---|---|---|---|
| Creeping buttercup | *Ranunculus repens* | Introduced | - | Low |
| Broad-leaved doc | *Rumex obtusifolius* | Introduced | - | Negligible |
| Redwood | *Sequoia sempervirens* | Introduced | - | Negligible |
| Monkey apple | *Syzigium smithii* | Introduced | - | Negligible |
| Nasturtium | *Tropaeolum majus* | Introduced | - | Negligible |

**Table Appendix C.2 : List of native terrestrial[1] and coastal[2] bird species present or potentially present in or near the project footprint (data from iNaturalist, eBird, De Luca et al., 2016 and on-site observations).**

| Common name | Species name | National conservation status (Robertson et al. 2021) | Regional conservation status (Woolly et al. 2024) | Observed on site | Ecological value (EIANZ criteria; Roper-Lindsay et al. 2018) |
|---|---|---|---|---|---|
| Australian magpie[1] | *Gymnorhina tibicen* | Introduced | Introduced | | Negligible |
| Banded rail / moho pererū [2] | *Gallirallus philippensis* | At Risk - Declining | Threatened - Regionally Vulnerable | * | Very High |
| Bar-tailed godwit / kuaka[2] | *Limosa lapponica* | At Risk - Declining | Not Threatened | | High |
| Black-billed gull / tarāpuka[1,2] | *Larus bulleri* | Threatened – Nationally critical | Threatened – Regionally Endangered | | Very High |
| Chaffinch[1] | *Fringilla coelebs* | Introduced | Introduced | | Negligible |
| Common myna[1] | *Acridotheres tristis* | Introduced | Introduced | | Negligible |
| Common starling[1] | *Sturnus vulgaris* | Introduced | Introduced | | Negligible |
| Eastern rosella[1] | *Platycercus eximius* | Introduced | Introduced | | Negligible |
| Eurasian blackbird[1] | *Turdus merula* | Introduced | Introduced | | Negligible |
| European goldfinch[1] | *Carduelis carduelis* | Introduced | Introduced | | Negligible |
| European greenfinch[1] | *Chloris chloris* | Introduced | Introduced | | Negligible |
| Grey warbler / rirorirо[1] | *Gerygone igata* | Not Threatened | Not Threatened | * | Low |

| Common name | Species name | National conservation status (Robertson et al. 2021) | Regional conservation status (Woolly et al. 2024) | Observed on site | Ecological value (EIANZ criteria; Roper-Lindsay et al. 2018) |
|---|---|---|---|---|---|
| House sparrow[1] | *Passer domesticus* | Introduced | Introduced | * | Negligible |
| Kererū[1] | *Hemiphaga novaeseelandiae* | Not Threatened | Not Threatened | | Moderate |
| Little shag / kawaupaka[2] | *Phalacrocorax melanoleucos brevirostris* | At Risk - Relict | Threatened – Regionally Endangered | * | Moderate |
| Mallard / rakiraki | *Anas platyrhynchos* | Introduced | Introduced | | Negligible |
| Morepork / ruru[1] | *Ninox novaeseelandiae* | Not Threatened | Not Threatened | | Low |
| New Zealand dotterel / tūturiwhatu | *Charadrius obscuras* | Threatened – Nationally Recovering | Threatened - Regionally Increasing | | Very high |
| North Island kākā[1] | *Nestor meridionalis septentrionalis* | At Risk - Recovering | At Risk – Regionally Recovering | | Moderate |
| North Island fantail / pīwakawaka[1] | *Rhipidura fuliginosa placabilis* | Not Threatened | Not Threatened | * | Low |
| Pied shag / kāruhiruhi[2] | *Phalacrocorax varius* | At Risk - Recovering | At Risk – Regionally Recovering | | Moderate |
| Pied stilt / poaka[2] | *Himantopus Himantopus* | Not Threatened | Not Threatened | | Low |
| Pūkeko[2] | *Porphyrio melanotus* | Not Threatened | Not Threatened | | Low |
| Red-billed gull / tarāpunga[1,2] | *Chroicocephalus novaehollandiae* | At Risk - Declining | Threatened – Regionally Vulnerable | | High |
| Rock pigeon[1] | *Columba livia* | Introduced | Introduced | | Negligible |
| Sacred kingfisher / kōtare [2] | *Todiramphus sanctus vagans* | Not Threatened | Not Threatened | | Low |
| Shining cuckoo / pīpīwharauroa[1] | *Chrysococcyx lucidus* | Not Threatened | Not Threatened | | Low |
| Silvereye / tauhou [1] | *Zosterops lateralis* | Not Threatened | Not Threatened | * | Low |
| Song thrush[1] | *Turdus philomelos* | Introduced | Introduced | | Negligible |
| South Island pied oystercatcher / tōrea pango[2] | *Haematopus finschi* | At Risk - Declining | At Risk – Regionally Declining | | High |

| Common name | Species name | National conservation status (Robertson et al. 2021) | Regional conservation status (Woolly et al. 2024) | Observed on site | Ecological value (EIANZ criteria; Roper-Lindsay et al. 2018) |
|---|---|---|---|---|---|
| Southern black-backed gull / karoro[1,2] | *Larus dominicanus* | Not Threatened | Not Threatened | | Low |
| Spotted dove[1] | *Spilopelia chinensis* | Introduced | Introduced | | Negligible |
| Spur-winged plover[2] | *Vanellus miles* | Not Threatened | Not Threatened | | Low |
| Tūī[1] | *Prosthemadera novaeseelandiae* | Not Threatened | Not Threatened | | Moderate |
| Welcome swallow / warou[1] | *Hirundo nexoena* | Not Threatened | Not Threatened | | Low |
| White-faced heron / matuku moana[2] | *Egrett novaehollandiae* | Not Threatened | Not Threatened | * | Low |
| White-fronted tern / tarānui [2] | *Sterna striata* | At Risk - Declining | Threatened – Regionally Vulnerable | | High |

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