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ECOLOGICAL ASSESSMENT & REPORTING SERVICES

Maitahi Village, Kākā Valley

Ecological Impact Assessment

For CCKV Maitai Dev Co LP

February 2025

REPORT INFORMATION & QUALITY CONTROL

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Glossary of acronyms

Acronym/Term	Description
AEE	Assessment of Environmental Effects
EcIA	Ecological Impact Assessment
EIANZ	Environment Institute of Australia and New Zealand
ERP	Ecological Restoration Plan
TAR	Threatened or At Risk (species)
NZFFD	New Zealand Freshwater Fish Database
NCC	Nelson City Council
NRMP	Nelson Resource Management Plan
NES-F	National Environmental Standards for Freshwater
NPS-FM	National Policy Statement for Freshwater Management
NPS-IB	National Policy Statement for Indigenous Biodiversity
SNA	Significant Natural Area
RHA	Rapid Habitat Assessment
DOC	Department of Conservation
SEV	Stream Ecological Valuation
TICI	Taxon-Independent Community Index
MCI	Macroinvertebrate Community Index

Glossary of defined terms

Acronym/Term	Description
Impact Management	Includes the full range of actions taken to address adverse effects on indigenous biodiversity and ecosystems. This includes: - Avoid - Remedy (remediate, restore, rehabilitate, reinstate) - Mitigate - Offset - Compensate
Project Area	Refers to the land being developed within the specified property boundary
The Project	Maitahi Village
Zone of Influence (ZOI)	The area of habitats and species potentially affected by the biophysical changes resulting from the proposed Project.
Ecological Baseline	The existing state of ecological features within the Project Area, used as a reference point for assessment.
Ecological Value	A ranking system based on rarity, diversity, representativeness, and ecological context, determining the importance of a species or habitat.
Riparian Vegetation	Vegetation growing along the margins of streams and rivers.
No Net Loss	A principle ensuring that biodiversity losses are balanced by equivalent gains through mitigation measures.
Ecological Restoration Plan (ERP)	A comprehensive plan detailing ecological mitigation and enhancement measures to restore and improve biodiversity within the Project Area
Wetland Delineation	The process of identifying and defining wetland boundaries based on hydrology, soil, and vegetation characteristics following national wetland delineation protocols.
Rapid Habitat Assessment (RHA)	A method to evaluate the ecological condition of aquatic habitats based on habitat parameters.
Stream Offset Restoration Plan	A component of the Ecological Restoration Plan (ERP) that outlines stream restoration measures to achieve No Net Loss or Net Gain for aquatic biodiversity.

Executive Summary

As part of the Maitahi Village Project, CCKV Maitai Dev Co LP intends to subdivide and develop a lowland flat and hillslope property located in Kākā Valley, Nelson, for residential dwellings. To assess the ecological values and potential effects of the Project, Robertson Environmental Limited was engaged to conduct an ecological assessment of the ecological (terrestrial and freshwater) features based on preliminary design, in accordance with the EIANZ Guidelines (2018).

Desktop, database, and field surveys have shown that the tributaries of Kākā Hill Tributary, along with the adjacent lowland and hillslope areas to be directly impacted by the project, are highly modified and hold limited ecological value. This area, influenced by a semi-agricultural catchment, has undergone impacts from both historical and current agricultural land use practices, as well as from pest animals. Key conclusions of the assessment were as follows:

- The terrestrial aspect of the lowland and margin habitat directly affected is dominated by exotic grassland or bare ground with limited indigenous vegetation, common across the adjacent lowland environment, and of relatively low value ecologically.
- The in-stream and riparian habitat directly affected is relatively small in area, highly degraded, dominated by exotic pasture grassland or bare ground with limited riparian vegetation (indigenous or otherwise), common across the adjacent lowland environment, and of relatively low value ecologically.
- The presently degraded Kākā Hill Tributary upper reach (above the existing farmhouse) will be protected, restored, and enhanced through native planting and stabilisation efforts, including the reinstatement of flow through its original course.
- Fragmentation and edge effects were apparent throughout the site, with isolated exotic shrubs and trees and other exotic weed species a common feature and animal stock and pests present.
- Two small exotic wetlands have been mapped and will be protected, restored, and enhanced as part of the Project. These wetlands are not within the area to be directly affected by the proposed development.
- No significant or indigenous habitat types are known to occur within the Project Area and the ultimate downstream receiving environment (Maitahi/Maitai River and Whakatū/Nelson Haven) will be unaffected, provided the volunteered conditions regarding adequate stormwater and erosion and sediment control measures are effectively implemented.
- Regarding native flora and fauna, the potential for adverse effects is considered very low, primarily given the Project Area's modified nature and existing disturbance levels. Native lizards (northern grass skink) and fish (tuna/shortfin eel, kōura, pākoko/upland bully and īnanga) were recorded.
- Predominantly the overall magnitude of the potential effects, both direct and indirect, are low or very low, and the resultant significance of the potential adverse effect (in the absence of any mitigation measures) is generally **Very Low**.

Despite the level of effect for native species being very low, compliance with the Wildlife Act 1953 will be required for any on-site works to ensure native birds, lizards and fish are not impacted. Recommended measures include production of a Lizard Management Plan and Fish Salvage and Relocation Plan and programming works to ensure avoidance of peak bird breeding and fish migratory seasons.

Potential loss of aquatic ecological values that are of a more than **Moderate** effect for which offset enhancement is required includes:

- Temporary loss of permanent and intermittent stream habitat due to the realignment of approximately 1,410 m² of channel, offset by the creation, restoration, and enhancement of approximately 2,085 m². The restoration will include increased sinuosity, improved in-stream habitat

complexity (e.g., riffles, pools, and cover structures), and riparian restoration and enhancement planting alongside both the realigned and existing watercourses to improve ecological function and habitat diversity.

The structure planning process set aside the freshwater enhancement corridor within the property boundary and Kākā Hill Tributary catchment area to ensure there is sufficient space for offset stream restoration and enhancement. A detailed Ecological Restoration Plan (ERP) for the wider Project is mandated by Schedule X (Rule X.15). This plan includes an Offset Stream Restoration Plan, which outlines the appropriate types and quantities of offsets, locations, and management interventions required to ensure, at a minimum, No Net Loss or preferably Net Gain outcomes for freshwater biodiversity values. At the detailed design stage, a comprehensive ERP must be developed as part of the resource consent conditions to confirm stream offset measures. It is anticipated that adherence to the Offset Stream Restoration Plan and its implementation will adequately mitigate the **Moderate** residual adverse effects on streams.

Potential loss of wetland values that are of a more than **Moderate** effect for which mitigation is required includes:

- Potential hydrological impacts on a small exotic wetland, which may lead to loss of wetland extent and values.

To address this, it is recommended that a Wetland Hydrology Assessment for the subject wetland be required as a condition of consent and incorporated into the proposed ERP. This assessment should provide recommendations to avoid potential adverse effects on wetland hydrology, aiming for No Net Loss or preferably Net Gain outcomes for wetland ecology. It is considered that if this measure is implemented that the overall level of effects on wetlands will be reduced to **Low**.

Effects management concepts proposed in this report to address these effects include implementation of ecological management during construction, including:

- Native Fish Salvage and Management plan;
- Erosion and Sediment Control Plan;
- Lizard management;
- Considerations of timing and staging of works;
- Stream offset;
- Riparian and amenity planting.

No major ecological constraints are anticipated in the development of the Site and there are opportunities to enhance aquatic habitat values within the site. With the implementation of the mitigation and compensation measures listed above, the overall level of the ecological effects associated with these works is Very Low with no significant adverse residual effects expected, and a positive ***Net Gain*** for ecology anticipated over a 5 -10 year time period.

1 Introduction

CCKV Maitai Dev Co LP (the Applicant) seeks resource consent to comprehensively subdivide and develop the land for residential development at a lowland and hillslope property located within the Kākā Valley, Nelson.

A preliminary overview of the Project by Davis Ogilvie & Partners (DO) and associated concept landscape plans by Rough Milne Mitchell (RMM) outline the approach and identifies the Project footprint including the extent of aquatic and terrestrial areas where modification, restoration and enhancement works are proposed to occur.

In order to establish a baseline ecology state, and to understand design opportunities and constraints, an assessment of ecological values and potential effects is required.

1.1 Report Purpose & Scope

The following report is an Ecological Impact Assessment (EcIA) commissioned by Landmark Lile on behalf of the Applicant for the purpose of informing the Assessment of Environmental Effects (AEE) Report and associated resource consents for the Maitahi Village development (the Project).

This report considers the actual and potential ecological effects associated with the construction and operation of the Project on the existing and likely future environment and recommends measure that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this EcIA Report are as follows:

(a) Identifying and describing the ecological context of the Project Area;

(b) Identifying and describing the actual and potential ecological effects of the Project;

(c) Recommending measures as appropriate to avoid, remedy or mitigate actual and potential ecological effects (including any conditions/management plan required); and

(d) Presenting an overall conclusion of the level of actual and potential ecological effects of the Project after recommended measures are implemented.

This report does not include an assessment of effects on māori cultural values, māori cultural concerns may encompass a wider range of values than those covered in the report. This assessment does not denote the ecological features of cultural value to manawhenua, and such assessments should only be made by manawhenua. It is acknowledged that the identification and assessment of the effects on cultural values has been undertaken as an integrated part of this assessment and project design. This aspect of the Project has been facilitated by Thirdspace Projects Aotearoa.

Potential contamination effects that may arise through disturbance of soils on-site have been addressed in the Remedial Action Plan prepared by Envirolink, along with the associated Ecological Recommendations for Contaminant Management memorandum prepared by Robertson Environmental. As these matters are covered elsewhere, they are not discussed further in this report.

1.2 Project Overview

The Maitahi Village Project is a fully integrated and comprehensive subdivision and development that will provide for a range of housing needs, within an enhanced cultural, ecological, landscape and recreational setting in close proximity to Nelson City. There are a total of 11 subdivision stages (stages 1-11), with one additional stage (Stage 0) proposed as a part of undertaking an initial boundary adjustment between the applicant's title (NL11A/1012) and that adjoining title owned by Bayview Nelson Limited (RT 1039028). The planned ecological, cultural and recreational outcomes will be developed progressively at each stage. A comprehensive description of these fully integrated components of the development are provided in the Application and supporting technical reports and plans.

This report assesses the ecological effects of the Project Area identified in Figure 1.1. The indicative footprint and drawings (Appendix X of the main AEE Report prepared by Landmark Lile) have been prepared for assessment purposes and are indicative only. The final design of the Project will be confirmed at detailed design stage.

1.2.1 Resource Consents Required

Resource consent is required for a discretionary activity overall under the the Nelson Resource Management Plan (NRMP) and the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F). Reasons for consent, relevant to this report are set out in the Landmark Lile AEE Report.

1.3 Report Structure

The report is structured as follows:

- Executive Summary
- Section 1 – Introduction
- Section 2 – Assessment Methodology
- Section 3 – Ecological Description
- Section 4 – Project Features and Implementation
    - Sections 3 and 4 include:

        a) Project overview in relation to ecology;

        b) Identification and description of the existing ecological context in the environment (ecological baseline);

        c) Project features in relation to ecology and a description of the construction works;
- Section 5 – Assessment of Effects on Ecological Values
    - Section 5 includes:

        d) Description of the potential positive ecological effects of the Project;

        e) Description of the potential adverse ecological effects of construction of the Project;

        f) Description of the potential adverse ecological effects of operation of the Project;
- Section 6 – Impact Management
- Section 7 – Cumulative Effects
- Section 8 – Summary and Conclusion
    - Sections 6, 7 and 8 include:

        g) Recommended measures to avoid, remedy or mitigate potential adverse ecological effects (including any conditions/management plan required);

        h) Management of any residual effects after measures to avoid, remedy or mitigate have been implemented;

        i) Cumulative effects description for the catchment;

        j) Overall conclusion of the level of potential adverse ecological effects of the Project after recommended measures are implemented.

The project design has been developed through a fully integrated approach involving a multidisciplinary team. This report should be read in conjunction with the AEE, which provides

further details on the project's history and context. The AEE includes a comprehensive description of the proposed works, likely staging, and typical construction methodologies. These have been reviewed by the author of this report and considered as part of the ecological effects assessment. To avoid duplication, this report does not repeat those details unless a description of an activity is necessary to understand the potential effects, in which case it has been included for clarity.

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Figure 1.1 The Maitahi Village Project Area considered in this report, including relevant property boundaries, based on the concept landscape masterplan provided to Robertson Enviro by RMM.

PROJECT: MAITAHI VILLAGE, KĀKĀ VALLEY

Maitahi Village Project Area

| Date: 29 Jan 2025 | Revision: A | Aerial: LINZ 0.075 m (2022)
Plan map prepared for CCKV by Robertson Environmental Limited

Project Manager: Ben.Robertson@robertsonenviro.co.nz

2 Assessment Methodology

The ecological assessment of the Project's actual and potential effects was carried out following the EIANZ Guidelines (2018), which use ecological value ratings (such as Very High, High, Moderate, Low, and Negligible) to categorise subject habitats and their fauna. This assessment is based on a relative scale that indicates the level of intactness or modification/damage to a feature or system. The aim of this approach is to protect the highest value feature while also identifying degraded systems that may have potential for enhancement and restoration, either as part of the Project or through compensation/offset proposals. This approach also allows for the prioritisation of features with greater value if unavoidable. See Appendix A for more detailed information.

2.1 Relevant Standards and Guidelines

The location of the Project Area falls within the jurisdictional boundary of Nelson City Council (NCC) and its operative Nelson Regional Management Plan (NRMP), and is part of the Bryant Ecological District and the Nelson Ecological Region. The Project Area occupies mixed zoned land[1] under the NRMP. The Project has been design to generally align with the underlying zoning and the Maitahi Bayview Structure Plan as recently approved through the Private Plan Change 28 (PPC28) hearings and Environment Court Decision.

A list of relevant legislation, policy, plans and strategies for this assessment are presented below:

- Resource Management Act 1991 and Wildlife Act 1953;
- National Policy Statement for Freshwater Management 2020 (NPS-FM as amended in February 2023);
- National Environmental Standards for Freshwater 2020 (NES-F as amended in December 2022);
- New Zealand Coastal Policy Statement 2010 (NZCPS);
- New Zealand Biodiversity Strategy DOC & MfE 2000;
- Protecting Our Places DOC & MfE 2007;
- Nelson Resource Management Plan (NRMP), including Maitahi Bayview Structure Plan and Schedule X Provisions;
- The Nelson Tasman Land Development Manual 2020 (NTLDM);
- National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB);
- New Zealand's Fish Passage Guidelines 2018; and
- EcIA Ecological Institute of Australia and New Zealand (EIANZ) guidelines for use in New Zealand: Terrestrial and freshwater ecosystems (Roper Lindsay et al. 2018).

2.2 EcIA Assessment

The assessment of ecological effects follows Ecological Impact Assessment guidelines (EcIA) produced by the Environment Institute of Australia and New Zealand (EIANZ, 2018). The EcIA approach is represented as follows and summarised in Appendix A:

1. Ecological Value
    - Desktop assessment and literature review;
    - Site investigation;
    - Data processing;
    - Ecological Value assessment (a) Representativeness, (b) Rarity, (c) Diversity and pattern, (d) Ecological context.

[1] Residential Zone; Residential Zone - Lower Density Area; Residential Zone - Higher Density Area; Open Space Recreation Zone; and Neighbourhood Reserve and Suburban Commercial Zone.

2. Level of Effect
    - Description of Project features and activities;
    - Identification and description of Project effects;
    - Magnitude of Effects assessment based on (1) Type, (2) Extent, (3) Duration, (4) Frequency, (5) Probability and (6) Reversibility;
    - Level of Effect assessment; systematic approach based on the outcome of Ecological Value and Magnitude of Effects assessments.
3. Mitigation
    - In line with No Net Loss principles and mitigation hierarchy;
    - Specific focus on Moderate or higher level of effects that can be avoided, minimised, remedied[2].
4. Residual Effects
    - Assessment of residual effects after measures to avoid, minimise and remedy have been applied;
    - Address residual effects through offset or compensation measures to achieve No Net Loss or Net Gain.

2.3 Project Area and Zone of Influence

The Project's Zone of Influence (ZOI) pertains to the habitats and species within and beyond the Project Area that may be affected by the biophysical changes resulting from the proposed Project and its associated activities, as defined in the EIANZ Guidelines. Throughout this report, ZOI is used to describe the effects of Project construction and operation on freshwater and wetland habitats and their associated native species, which may include indirect impacts on sensitive receiving environments and the potential presence of protected fauna and flora within or near the Project Area.

However, the ZOI of the Project can vary for different species and habitat types, depending on how they use their environment. For instance, mobile species like bats typically have a wider home range and more diverse habitat needs than threatened plant species and lizards, which may be confined to specific habitat types or small areas. These factors were accounted for during our review of relevant literature and site investigations to assess how the Project could impact different species. To reflect the likelihood of a species occurring or dispersing within the Project Area, different search distances were used depending on the species context. In the relevant sections of this report, the size of the search area is indicated alongside any species or habitat records identified. Additionally, ZOI is relevant to habitats, as changes in hydrology resulting from Project design could negatively impact wetlands that require permanent or intermittent inundation, while indirect effects on the receiving environment (such as sedimentation of waterbodies) could extend beyond the Project Area and affect other habitats.

[2] The Wildlife Act 1953 must be complied with, as such management measures must always be implemented to ensure that Project activities do not injure or kill native wildlife.

2.4 Desktop Analysis

Existing biological databases and all published information on aquatic, wetland[3] and terrestrial habitats and species that could be present within the ZOI of the Project Area were researched.

This phase also included preparation of site maps and plans to direct the field survey. The extent and differences in vegetation and habitat type within the site were delineated on geographic information systems (GIS) using topographical maps and aerial photography (LINZ rectified ~0.3 m per pixel resolution flown in 2018/19 - https://data.linz.govt.nz/layer/104165-tasman-03m-rural-aerial-photos-2018-2019/) prior to site visit. Information was derived from known data sets on landforms, soils, climate, and topography of the site. Preliminary vegetation communities and habitat types were identified and described through a combination of New Zealand Land Cover Database (LCDB5), and the use of aerial photographs.

The national threat classification of species was derived from the appropriate threat classification list for each taxa[4] and their regional status was derived from the Draft Conservation Management Strategy for the Nelson/Marlborough Conservancy 1996-2006 (Department of Conservation 1996).

2.4.1 Vegetation and Rare Plants

Local plant species lists obtained from the New Zealand Plant Conservation Network website (http://www.nzpcn.org.nz/observation_site_search.aspx) and other sources (e.g. Courtney et al. 2003), were examined to identify any rare or uncommon plants in which to focus field surveys.

2.4.2 Terrestrial Macroinvertebrates

Macroinvertebrate lists obtained from various representative sources (e.g. Butler 2008) were examined to identify any rare or uncommon species in which to focus field surveys.

2.4.3 Lizards

A list of lizard species in the area, as noted in Department of Conservation's Amphibian and Reptile Distribution Scheme (ARDS) database (accessed April 2022), the National Amphibian and Reptile Database System (Herpetofauna), and van Winkle et al. (2018), was collated.

2.4.4 Birds

A list of bird species in the area, as noted in New Zealand Bird Atlas (Grid BY54 positioned over the Maitai Valley catchment area, August 2019-April 2024) and iNaturalist (5 km radius), was collated.

2.4.5 Bats

A review of bat records from the wider area on the Department of Conservation's bat distribution

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[3] The New Zealand Resource Management Act (1991) defines wetlands as 'permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions'. The NPS-FM excludes wetlands which do not meet their definition of 'natural inland wetlands' as: (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 the NPS-FM, in which case the exclusion in (e) does not apply.

[4] All Department of Conservation Threat Classification Documents are listed in the below webpage. When individual reports are referenced hereafter, they are referenced in-text. https://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system

database (accessed June 2023) was undertaken.

2.4.6 Freshwater Fauna

Macroinvertebrate lists obtained from representative sources were examined to identify any rare or uncommon species in which to focus field surveys. A review of fish records from Maitai River catchment area on the New Zealand Freshwater Fish Database (NZFFD) was undertaken. We also considered data published on NCC's Freshwater Fish Sightings database of fish species observed within the adjacent Maitai River catchment.

2.5 Aquatic Ecology Assessment Methodology

2.5.1 Site investigations

Field surveys were completed during February, March and October 2023 for watercourses associated with the Project Area (see Figure 2.1 for watercourses and survey locations). Relevant information collected as part of PPC28 has been incorporated where appropriate. Table 2.1 outlines the specific methodology employed to determine baseline conditions and ecological value. Representative sites were chosen based on accessibility and location within the Project Area. An overview of the freshwater field assessments and methodologies employed is as follows:

- Synoptic assessment of specific aquatic habitat types and the associated values was completed at the Project Area. All watercourses to be impacted both directly and indirectly were photographed, general notes on the stream and river including name, catchment, hydrological regime, channel morphology, cross-sectional features taken, and REC classification based on the River Environment Classification (REC[5]) (Snelder et al. 2004). The assessment of the waterbodies examined the key physical parameters including, but not limited to hydrological connectivity, thermal regulation, vegetation composition (both aquatic and marginal vegetation);
- Stream classification as per Storey and Wadhwa (2009) into ephemeral, intermittent and permanent hydroperiods[6];
- Water samples were taken from the Kākā Hill Tributary on a monthly basis at representative locations, from 27 November 2020 to 26 October 2021[7]. These samples were analysed for Dissolved Reactive Phosphorus, Ammonia Toxicity, Nitrate, *Escherichia coli*, Suspended Solids, and Turbidity. In addition, Turbidity samples were obtained from three discrete sites located in the lower reach of Kākā Stream (immediately upstream of its confluence with the Maitai River) and in the Maitai River (refer to Figure 2.1)[8]. This sampling was undertaken regularly between June and August 2023 during baseflows (approximately at weekly intervals), and additional samples were collected from each site during the falling limb of floodflows when rainfall exceeded 10 mm in the previous 24-hour period. The water quality data was used to indicate water quality and to interpret aquatic invertebrate and fish data. Where relevant, water quality

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5 https://niwa.co.nz/freshwater/management-tools/river-environment-classification-0

6 ***Permanent*** - requires evidence of continuous flow; ***Intermittent or ephemeral*** - stream reaches that cease to flow for periods of the year because the bed is periodically above the water table. This category is defined by those stream reaches that do not meet the definition of permanent river or stream and meet at least three of the following criteria: a) it has natural pools; b) it has a well-defined channel, such that the bed and banks can be distinguished; c) it contains surface water more than 48 hours after a rain event which results in stream flow; d) rooted terrestrial vegetation is not established across the entire cross-sectional width of the channel; e) organic debris resulting from flood can be seen on the floodplain; or f) there is evidence of substrate sorting process, including scour and deposition; ***Ephemeral*** - stream reaches with a bed above the water table at all times, with water only flowing during and shortly after rain events. This category is defined as those stream reaches that do not meet the definition of permanent river or stream or intermittent stream.

7 Refer Cawthron Report No. 3728.

8 Full results are presented in Appendix B.

results were interpreted in relation to the ANZ default guideline values (DGVs) and the NPS-FM national bottom line values.

- In-stream macroinvertebrate communities were sampled at impact reach locations (Figure 2.1) following protocols developed for the sampling of macroinvertebrates in wadeable, soft-bottomed streams in New Zealand (Stark et al., 2001). Standard community-based invertebrate indices were used to interpret invertebrate data, including %EPT, QMCI-sb and MCI-sb. An assessment of invertebrate habitat diversity and abundance with specific reference to stream dimension and substrata composition and hydraulic diversity was completed for all sites;
- Fish were sampled through a combination of electronarcosis (electric fishing) and spotlight fishing at impact reach locations (Figure 2.1) following the New Zealand Freshwater Fish Sampling Protocols for wadable rivers and streams (Joy et al. 2013). An assessment of fish habitat availability was completed in line with Kleynhans (2007). This is a qualitative assessment of different fish cover and velocity depth classes represented within the reach surveyed. In addition, the availability and quality of Galaxiidae spawning habitat was assessed. The fish assessment also considered any structures likely to impede fish passage within the Project Area, following NIWA fish passage guidelines (Franklin et al. 2018);
- Two eDNA[9] samples were also taken from sites within the upper and lower Kākā Hill Tributary (Figure 2.1). A passive sampler, supplied by Wilderlab NZ, was deployed at each of the sites to collect DNA from the water in order to produce a species list of the fish and macroinvertebrates present at the sites. Wilderlab's standard operating procedures for the collection of samples were followed. The passive samplers were deployed after the water sample had been taken and were left in place for approximately 24 hours. The samples were couriered overnight to Wilderlab NZ for processing. A multi-species eDNA analysis was performed on each of the samples;
- The Taxon-Independent Community Index (TICI) was calculated for each eDNA sample collected to help determine the overall health of the aquatic ecosystem. TICI works by comparing the relative abundance of different taxa in the eDNA sample to a reference dataset of expected taxa abundance in a healthy ecosystem. The ratio of observed to expected abundance for each taxon is calculated and used to derive an overall TICI score. A higher TICI score indicates a more diverse and healthy community, while a lower score indicates a less diverse and potentially compromised community.
- A habitat quality assessment was conducted along four discrete sections (each approximately 100 m in length) of the four main tributaries of Kākā Hill Tributary located within the Project Area, using the Rapid Habitat Assessment (RHA) methods of Clapcott (2015). The rapid habitat assessment involves assigning 10 habitat parameters with a score from 1 to 10. The lowest scores indicate the greatest deviation from the condition expected with no, or minimal, human influence or impact (reference state). These individual parameter scores are then summed to determine an overall Habitat Quality Score: Excellent (>75), Good (51–75), Fair (26–50) or Poor (<26). The habitat parameters include measures of fine sediment cover, habitat diversity and abundance, and riparian width and shade. To bolster this assessment by identifying areas that may be vulnerable to degradation due to habitat modification, we also considered in narrative terms relevant parameters listed in Holmes et al. (2020). We also considered any structures likely to impede fish passage within the Project Area, following NIWA fish passage guidelines (Franklin et al. 2018).

It is noted the Stream Ecological Valuation (SEV) methodology (Storey et al. 2011) would be implemented at the detailed design stage for watercourses where the application of this method is suit-

[9] Environmental Deoxyribonucleic acid (eDNA) testing was employed to address some of the limitations of traditional survey methodologies (i.e. diurnal and seasonal differences in fish activity, electronarcosis bias, streams too small/shallow to fish, under representation of species occurring at low abundances and improved taxonomic confidence).

able to further inform ecological condition and offset measures. Application of the SEV approach is further discussed below at Section 6 - Impact Management.

Table 2.1 Methodologies employed to determine baseline conditions and ecological value associated with stream reaches associated with the Project Area.

Watercourse Survey Reference (see Figure 2.1)	Water quality & in-stream fine sediment	RHA	Macroinvertebrate & habitat available	Fish & habitat available
Lower Kākā Hill Tributary (Site A / KHT1)	✓	✓	✓	✓
Upper Kākā Hill Tributary (Site B)	✓	✓	✓	✓
Unnamed Tribuary on Eastern Hillslope (KHT2)		✓	✓	✓
Unnamed Tribuary on Eastern Hillslope (KHT3)		✓	✓	✓
Unnamed Tribuary on Western Hillslope (KHT4)		✓	✓	✓

2.5.2 Assessing Aquatic Ecological Value

Several methods of assessing aquatic ecology were employed to determine the ecological significance of streams features linked to the Project Area. These methods were consistent with the guidelines provided by EIANZ. The assessment involved utilising various aspects of different methods (Table 2.1) to evaluate factors that impact the ecological sensitivity and importance of the receiving environment (refer to Section 2.2). A summary of each EcIA "Matter" and the corresponding methods used to analyse them are presented in Table 2.2. The value categories used ranged from "Very High" to "Negligible." Further information on different value categories concerning the methods used is available in Appendix A.

Table 2.2 Summary of how different methods of assessment have been applied to inform aquatic ecological value.

EcIA Matter	Habitat availability (macroinvertebrates and fish)	Macroinvertebrate community	Fish community
Matter 1 - Representativeness		✓	✓
Matter 2 - Rarity/distinctiveness	✓		✓
Matter 3 - Diversity and pattern	✓		
Matter 4 - Ecological context			✓

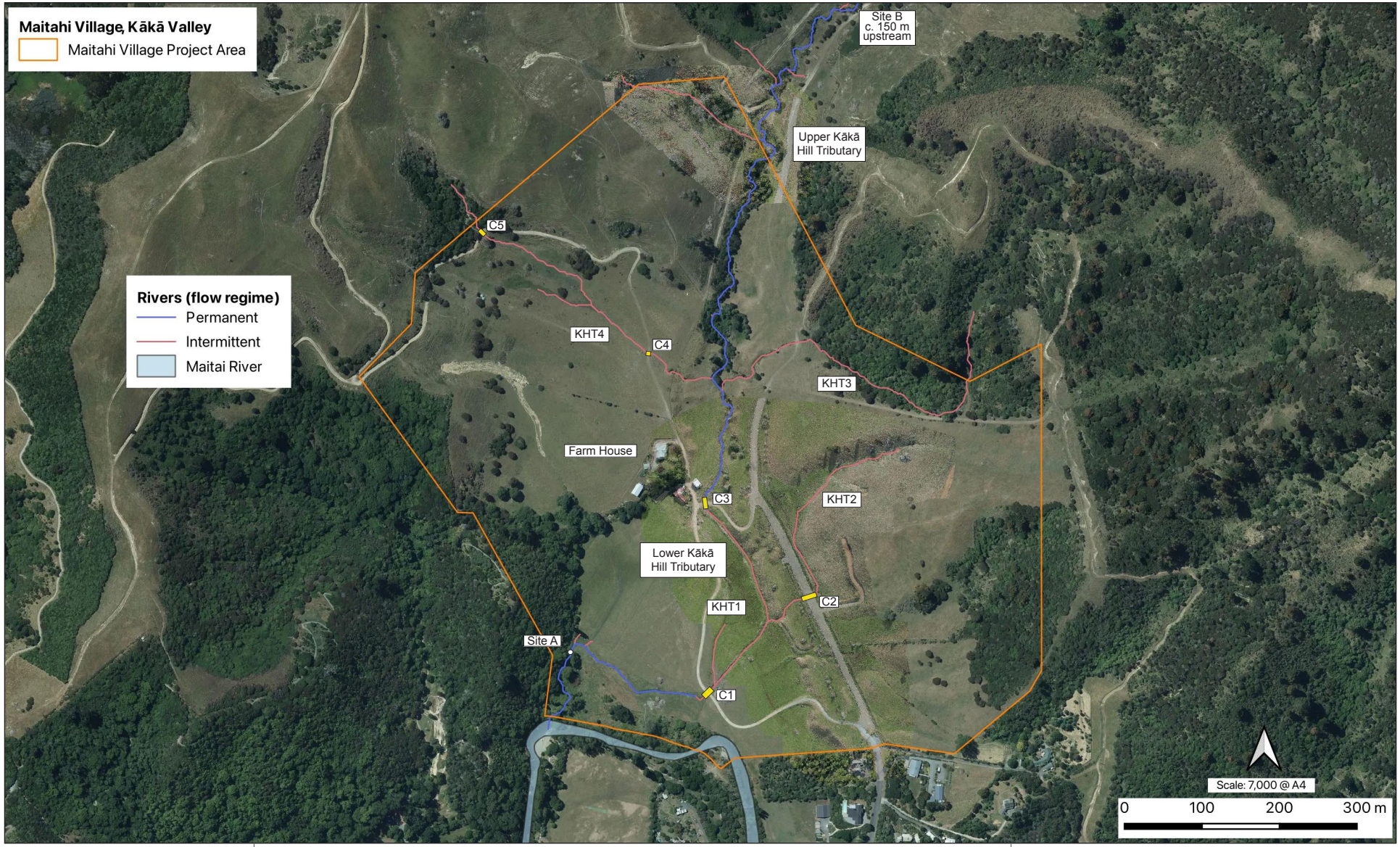

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Figure 2.1. Existing watercourse survey locations, showing individual stream reaches and existing culverts C1-5 (▭) associated with Kākā Hill Tributary. General direction of in-stream water flow is from north to south across the property. Note mapped permanent and intermittent stream reaches meet the RMA (Part 1, Section 2) and NPS-FM/NES-F definition of a 'river'.

PROJECT: MAITAHI VILLAGE, KĀKĀ VALLEY

Existing Watercourses

| Date: 29 Jan 2025 | Revision: A | Aerial: UAV May 24, LINZ 0.075m (22)
Plan map prepared for CCKV by Robertson Environmental Limited

Project Manager: Ben.Robertson@robertsonenviro.co.nz

2.6 Wetland Ecology Assessment Methodology

2.6.1 Site investigations

Wetland habitat initially identified in the PPC28 area was surveyed on 6 March 2024. This later survey included a synoptic inspection of vegetation and habitat in the adjacent riparian margins.

2.6.2 Wetland Verification and Delineation

The wetland delineation method followed the protocols outlined by the Ministry for the Environment (2020) which is incorporated within the NES-F[10]. This method relies on vegetation plot sampling and hydrophytic vegetation determination tool outlined within Clarkson (2013) and the refinements described in Clarkson (2018), as well as an assessment of the presence of hydric soils and wetland hydrology when required. This process is described in detail below.

2.6.3 Prevalence Test

A prevalence test is carried out to determine the vegetation species and their affinity for water. The wetland indicator rating status for each plant species follows Clarkson et al. (2013)[11], with the meaning of these classifications as follows:

- OBL: Obligate. Almost always is a hydrophyte, rarely in uplands (estimated probability >99% occurrence in wetlands);
- FACW: Facultative Wetland. Usually is a hydrophyte but occasionally found in uplands (estimated probability 67–99% occurrence in wetlands);
- FAC: Facultative. Commonly occurs as either a hydrophyte or non-hydrophyte (estimated probability 34–66% occurrence in wetlands);
- FACU: Facultative Upland. Occasionally is a hydrophyte but usually occurs in uplands (estimated probability 1–33% occurrence in wetlands); and,
- UPL: Obligate Upland. Rarely is a hydrophyte, almost always in uplands (estimated probability <1% occurrence in wetlands).

Based on these data, a Prevalence Index Score of between 1 and 5 was calculated for each plot. 1 indicates entirely wetland community (OBL), and 5 indicates entirely upland community (UPL). A score below 3 is indicative of a wetland/hydrophilic community. However, Clarkson (2013) cautions that a score between 2.5 and 3.5 is not reliable for determining a hydrophilic community on vegetation measures alone and further tests are required.

2.6.4 Dominance Test

Where prevalence scores fell within the ambiguous 2.5-3.5 range, a dominance test was undertaken in accordance with Clarkson (2013) to determine if the plant community can be considered hydrophytic. This test ascertains the “dominant” species following a 50/20 rule, whereby all species are ranked according to their percentage cover, and the highest covering species are sequentially selected until cumulative coverage immediately exceeds 50%. Any other species which comprise at least 20% coverage are also selected. The “Dominance Test” threshold is then met if more than 50% of the dominant species are OBL, FACW, or FAC.

2.6.5 Pasture Dominance Test

Where the dominance test indicated the plant community was hydrophytic, the proportion of pasture grasses[12] was determined to further ascertain if it can be considered a natural wetland ac-

[10] Wetland delineation protocols - Ministry for the Environment: https://environment.govt.nz/publications/wetland-delineation-protocols/.

[11] refer Appendix 9 of Clarkson et al. (2013).

[12] Per https://environment.govt.nz/assets/publications/National-list-of-exotic-pasture-species.pdf

cording to the NPS-FM.

2.6.6 Soil Profile Test

In instances where vegetation tests remain ambiguous and/or bare ground was prevalent (i.e. if a wetland is dominated by FAC plants and the dominance test and prevalence index do not agree), field testing of the soils is undertaken to check for hydric soils in accordance with Fraser et al. (2018). This field test can assist in determining if a wetland that has a high percentage area of bare ground will tend towards a wetland or terrestrial plant community as it develops.

This assessment includes digging at least two holes in the ambiguous area to a minimum of 500 mm to determine if there are indicators of hydric soils (mottles, gley soils, peat) within the profile (but below the topsoil). Each soil layer is smelt for signs of "rotten eggs" which can indicate hydric soils, and the topsoil layer is inspected for any black manganese concretions in the topsoil.

2.7 Terrestrial Ecology Assessment Methodology

2.7.1 Site investigations

2.7.1.1 Vegetation Communities and Habitats

In addition to the fieldwork carried out to inform PPC28, several site walkovers were carried out on October and November 2023 to survey and document the habitats within the Project ZOI. Additionally, an assessment was conducted to determine the potential of observed habitats to support indigenous fauna, including birds, lizards and macroinvertebrates.

During the habitat assessment, particular attention was paid to areas of significant ecological value, such as stream corridors and vegetated regions (including trees and scrub). This was achieved through the examination of aerial photographs and on-site investigations. To streamline the search process, existing species records from relevant literature and biodiversity databases were consulted, enabling a focused investigation of specific areas within the Project Area.

The mapping of indigenous vegetation communities was carried out using recent aerial photography, and the resulting data was incorporated into the Project's Geographic Information System (GIS) database. The vegetation assessment involved documenting the dominant or characteristic species present, as well as evaluating the overall quality of the vegetation, including factors such as structure, maturity, presence of weeds, and signs of disturbance. Throughout this report, common plant names are predominantly used, while botanical names can be found in Appendix C. To provide visual representation, broadscale habitat maps illustrating the vegetation cover within the Project ZOI can be found in Section 3.1.

2.7.1.2 Terrestrial Biota

Vegetation and Rare Plants — The desktop delineated vegetation communities were ground-truthed in the field, where each identified community type was described on-site. Native and exotic vegetation was noted across the Project Area with a focus on the presence of indigenous species (Appendix C).

Macroinvertebrates — No surveys of terrestrial invertebrates were undertaken. Rather, we relied on the vegetation community and habitat type descriptions obtained from the field investigations to identify areas of potential habitat for species likely to occur within the area, as well as published accounts of macroinvertebrates present within similar habitats nationally.

Herpetofauna — A targeted survey of terrestrial lizards was conducted between 26 January and 29 March 2023. The survey was carried out by RMA Ecology Ltd and the full report is presented in Appendix D.

Birds — A roaming inventory of birds sighted or heard was taken during the field survey. We also

relied on the vegetation community and habitat type descriptions obtained from the field investigations to identify areas of potential habitat for species likely to occur within the area, as well as published accounts of birds present within nearby habitats.

Bats — Field surveys for terrestrial lizards were not conducted[13]. We also relied on the vegetation community and habitat type descriptions obtained from the field investigations to identify areas of potential habitat for species likely to occur within the area, as well as published accounts of birds present within nearby habitats.

2.8 Assessing Ecological Value

To evaluate the ecological value of terrestrial and aquatic habitat within the Project ZOI, various assessment methods were employed in accordance with the EIANZ guidelines. These methods were selected based on their ability to provide relevant information on the ecological significance and sensitivity of the receiving environment. The application of these methods varied depending on the specific ecological matter being addressed. A summary of each ecological matter and the corresponding method(s) used to assess it can be found in Table 2.3. The value categories assigned to the assessed habitats ranged from Very High to Negligible.

Table 2.3 Summary of how different methods of assessment have been applied to inform terrestrial and aquatic ecological value.

EcIA Matter	Habitat quality and quantity (macroinvertebrates, fish, lizards and birds)	Presence of Threatened or At Risk (TAR) species or habitats
Matter 1 - Representativeness	✓	✓
Matter 2 - Rarity/distinctiveness	✓	✓
Matter 3 - Diversity and pattern	✓	
Matter 4 - Ecological context	✓	

When assessing the ecological value of species within areas that could potentially be affected by the Project, consideration was given to the threat classification of those species. The assigned value for the ecological importance of each species was determined based on the information provided in Appendix A, Table A.2. For instance, Exotic species were assigned a value of Negligible ecological importance, while Indigenous Threatened species (Nationally Critical/Endangered/Vulnerable) were assigned a value of Very high ecological importance.

2.9 Habitat Classification

Broad ecological or habitat zones in the study area were identified, and with the aid of a handheld Garmin GPSMAP 64sc WW unit (accuracy approx. ±5-10 m) broadly delineated. Each habitat was subjectively classified into one of several different qualitative habitat type descriptors according to unique features identified. Qualitative inspection of habitats was then conducted to note key flora and fauna for each zone. Upon completion of field work the broad habitat zones where then imported into a georeferenced aerial photo of the area using Garmin BaseCamp and ArcMap GIS

[13] In accordance with Dr Ben Robertson's comments in his PPC28 Statement of Evidence at [48], and following on-site discussions with ecologists from the Department of Conservation, it has been confirmed that there are no notable habitat features for bat species present within Project Area.

software. Using colour aerial photos and Digital Surface Modelling (as appropriate) delineated habitat zones were adjusted accordingly, to more accurately reflect the likely tonal gradations of respective habitats, and a map of different habitats was produced.

3 Ecological Description

3.1 Existing Environment (Ecological Baseline)

This section presents the findings of the desktop analysis and site investigations for all of the habitats and species ('ecological features') present within the Project Area. Based on this information, an ecological value has been calculated for each ecological feature using the assessment method outlined in Section 2.2.

Key ecological features within the Project Area are listed below and described in the following sections. The photographs in Figure 3.1 provide an overview of existing land use, dominant vegetation cover and freshwater habitat features within the Project Area. An example of how habitat margins were delineated is provided in Figure 3.2. A summary of the approximate proportions of each habitat type mapped within the Project Area is presented in Table 3.1. A GIS-based broad scale map of the Project Area is provided in Figure 3.3.

3.1.1 Historic Ecological Context

The Bryant Ecological District (47.03) encompasses the Maitai Valley catchment and the surrounding coastal and lowland flats and hill country and the Project Area. The district is sunny and sheltered, with very warm summers and mild winters (TDC 2020).

The Project Area is primarily situated within the lowland flats and lower hillslopes of Kākā Valley, above the modified floodplains of the Maitai River to the south. It extends towards a low-relief ridgeline at the western boundary near Bayview, while the steeper eastern hillslopes of Kākā Hill are characterised by a mix of regenerating native and exotic vegetation. Historically, it has been used for pastoral farming, hop cultivation, and forestry, with significant land clearance occurring from the 1840s onward and is currently surrounded by a mix of rural and residential land uses.

The Kākā Hill Tributary and its tributaries form the main catchment in the area, which runs into the Maitai River and ultimately the Nelson Haven. The Maitai River, with a catchment area exceeding 9,000 hectares, has a mean annual flow of 2.35 cubic meters per second. Its upper reaches maintain high water quality, protected by surrounding conservation lands. However, water quality declines in the lower reaches, impacted by runoff from agricultural and forestry activities, alongside urban inputs, reducing associated ecological values.

Geologically, the surface and near-surface rock type of the Project Area is classified as either Strong Igneous[14] (hillslope) or Loose Sedimentary[15] (floodplain).

The terrestrial environment encompassing the Project Area is highly modified, and its exposure to disturbance and impacts from humans, pest plant and animal species is very high. The area is classified as either Category 1 (<10% indigenous cover left — i.e., floodplain area), Category 2 (20-30% indigenous cover left — i.e., lowland hill country area), or Category 6 (> 30% left and > 20% protected — i.e., higher slopes of Kākā Hill) under the Threatened Environment Classification (TEC) version 2012. In the Category 1 areas, habitats are highly fragmented and indigenous biodiversity is likely significantly reduced[16].

The LENZ prediction (Landcare Research Ltd, 2012) of the historic land cover for this Project Area is mixed rimu-broadleaf-beech forest type.

[14] Very loose to compact (e.g. peat, loess, sands, alluvium, glacial till and unconsolidated sands, silts and clays); Landcare Research NZ Limited 2009-2022.

[15] Very compact to weak (e.g. mudstones, sandstones, weak conglomerates and crushed argillite); Landcare Research NZ Limited 2009-2022.

[16] Manaaki Whenua Landcare Research, Our Environment threatened environment classifications.

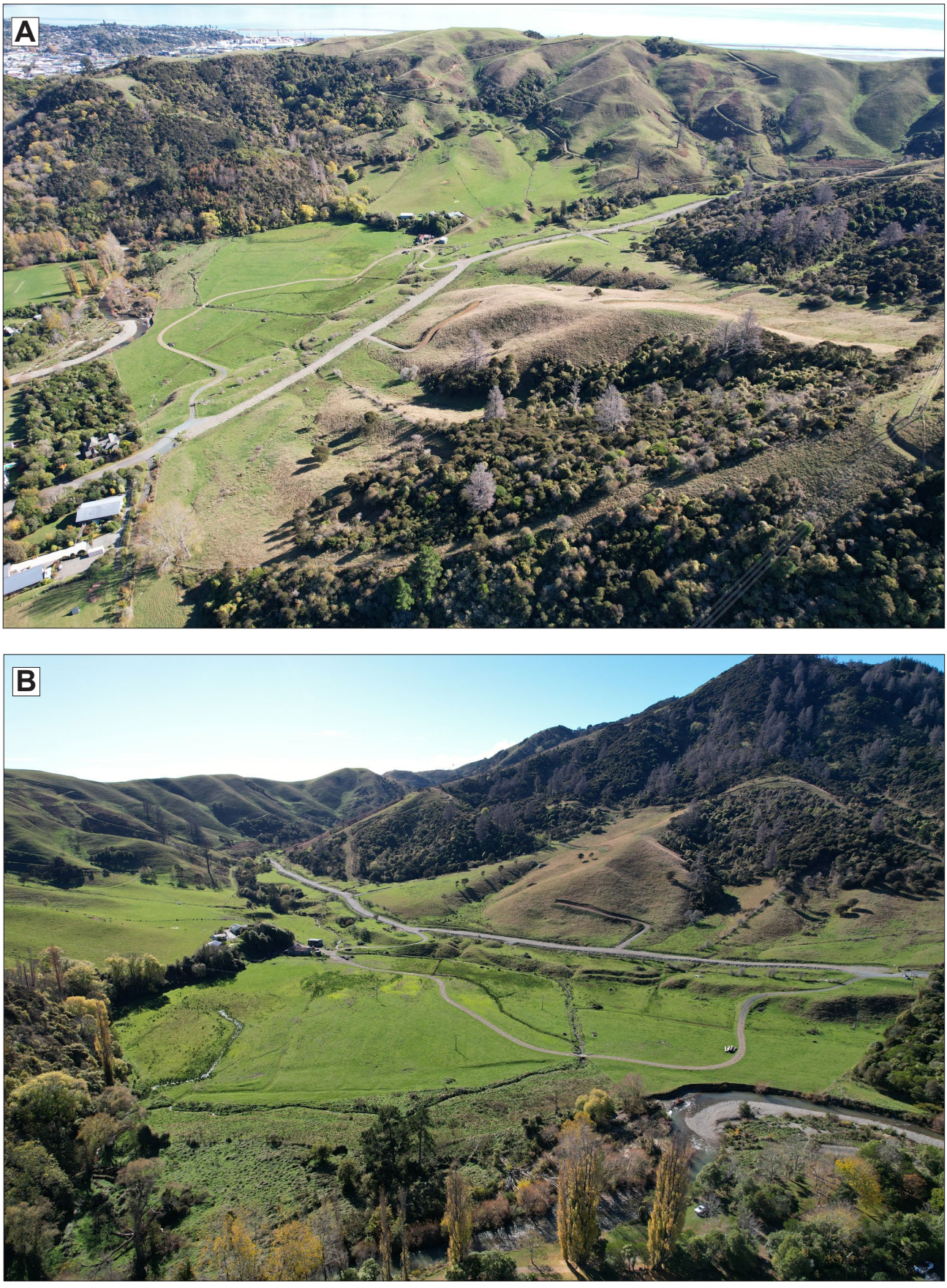

Figure 3.1. (A) Looking northwest toward the low-relief ridgeline at the western boundary near Bayview, across predominantly exotic grassland, access way, and cleared land contiguous with modified reaches of Kākā Hill Tributary. (B) Looking northeast across the Maitai River and similar land cover toward the steeper eastern hillslopes of Kākā Hill, characterised by pasture grassland grading into regenerating native and exotic vegetation, within the Project Area, Kākā Valley, October 2023.

Figure 3.2. Example of the different habitats in the Project Area and mapped during the field investigation. Dashed yellow lines show watercourses. Habitat boundaries are indicative only and do not accurately reflect those presented in Figure 3.3.

Table 3.1 Summary of current broad scale wetland and terrestrial habitat types present within the Project Area.

Dominant Habitat Feature		Project Area (ZOI)[a]	
		ha	%
1.	Regenerating kānuka shrubland	5.37 ha	10.83%
2.	Mixed exotic-native scrub/shrubs/trees	3.65 ha	7.36%
3.	Rank and pasture exotic grassland with occasional rushes/ shrubs/trees	38.26 ha	77.15%
4.	Bare land/access way (no vegetation)	1.95 ha	3.93%
5.	Wetland	0.36 ha	0.73%
	Total	50.02 ha	100%

[a] Reflects the total extent of the Project Area footprint as shown in Figure 3.3.

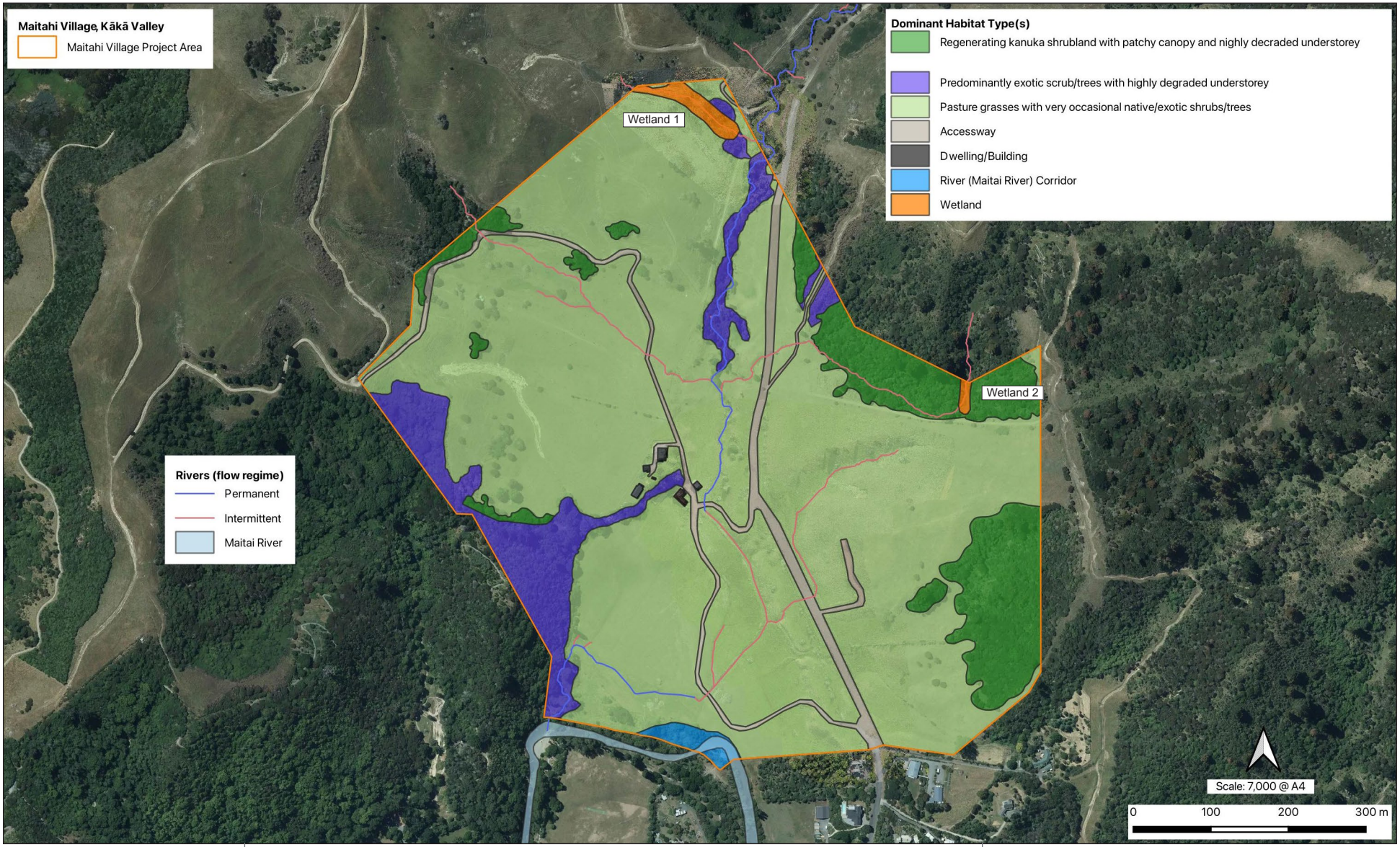

Figure 3.3. Broad scale (indicative) map of existing habitats within the Project Area based on the mapping of freshwater and vegetation features visible in aerial imagery, supported by ground-truthing to validate the visible features. General direction of in-stream water flow is from north to south across the property.

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PROJECT: MAITAHI VILLAGE, KĀKĀ VALLEY

Existing Habitat Occupying Project Area

| Date: 29 Jan 2024 | Revision: A | Aerial: UAV May 24, LINZ 0.075m (22)
Plan map prepared for CCKV by Robertson Environmental Limited

Project Manager: Ben.Robertson@robertsonenviro.co.nz

3.1.2 Aquatic Ecology

3.1.2.1 Desktop Observations

The reach of Kākā Hill Tributary within the Project Area can be split into two distinct sections (Figure 3.3). The largely intermittent lower reaches that flow through a historic floodplain downstream of the farmhouse culvert (Culvert ID: C3, Lower Kākā Hill Tributary; Figure 2.1) and the steeper permanently flowing upper reaches upstream of the farmhouse culvert (Upper Kākā Hill Tributary).

The Kākā Hill Tributary flows southward in a predominantly incised channel along the valley floor and floodplain. In its upper catchment, the watercourse follows a permanent, steeper gradient with limited riparian vegetation and passes through culvert (C3; Figure 2.1). This culvert leads into a flat, historic meander floodplain at the downstream end, including another culvert (Culvert ID: C1; Figure 2.1), before the tributary joins the Maitai River and eventually flows into Nelson Haven, the ultimate receiving environment. Approximately 380 m of the Upper Kākā Hill Tributary is within the Project Area, of which about 270 m support secondary mixed native/exotic shrubland. This vegetation offers functional benefits, such as providing shade and limiting the growth of macrophytes.

Approximately 640 m of Lower Kākā Hill Tributary falls within the Project Area. Site reference KTH1 represents this reach in this assessment (Figure 2.1). This reach has been realigned (Young 2020)[17]. Comparison of historical maps and evidence on the ground show that it once ran against the base of the Branford Park hill and into Dennes Hole, Maitai River. It has been channelled away from this area on the western side of the floodplain to the eastern side. Based on aerial imagery riparian cover consists of mature rank pasture grass. The open pasture area provided no protection from stock access to the stream. Downstream of the Project Area and before its confluence with the Maitai River, the Lower Kākā Hill Tributary flows through a combination of rank pasture and boggy lowlands featuring mature (mostly exotic trees/shrubs) vegetation.

Approximately 300 m of an unnamed watercourse, which traverses the eastern hillslope before meeting the Lower Kākā Hill Tributary, is situated within the Project Area. The reach is represented by site reference KTH2.

There are also two smaller unnamed watercourses which run through the western and eastern hillslopes before discharging into the Upper Kākā Hill Tributary approximately 50-60 m upstream of the farmhouse culvert. Site reference KTH3 represents the eastern stream (150 m in length) and site reference KTH4 represents the western stream (470 m in length) in this assessment.

Based on a comparison of aerial photographs taken before and after the August 2022 flood event, it is evident that the flooding has impacted the vast majority of the watercourses across the Project Area through scouring and incising of banks.

An assessment of the ecological values associated with the Kākā Hill Tributary was undertaken by Tonkin and Taylor on December 12 and 13, 2019[18]. The survey targeted representative sites within the Lower Kākā Hill Tributary (site reference herein Site A) and the Upper Kākā Hill Tributary (site reference Site B), as illustrated in Figure 2.1. As part of the assessment, macroinvertebrate and fish sampling was completed. The Lower Kākā Hill Tributary was characterised by a predominantly soft bottom (with sand, silt, mud, and clay dominating the streambed) and sections closer to the farmhouse culvert where small gravel and cobble substrates were dominant. The Upper Kākā Hill Tributary comprised a mixture of boulders, cobbles, and mixed gravels, and with isolated areas of increased sediment cover (>70%) in pools and slower flowing areas. The results of the 2019 study are further discussed in Section 3.1.2.2 below.

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[17] Private Plan Change Request Historical & Archaeological Assessment for CCKV Maitai Dev Co LP and Bayview Nelson Limited 17 December 2020, p. 3, para. 2; p. 13, para. 1.

[18] Tonkin & Taylor (2021). We note in the five days prior to the site assessment, approximately 23.2 mm of rain fell over a 48-hour period between 7 and 8 December 2019, based on observations recorded at the Maitai at Forks Rain Gauge.

3.1.2.2 Site Investigations

Stream Description

At the time of the field surveys, completed during February, March and October 2023, all watercourses within the Project Area and identified for PPC28[19] were groundtruthed and assessed at representative locations (sites KTH1, KTH2, KTH3 and KTH4) (Figure 2.1). Figure 3.3 shows the extent and observed flow regime of the watercourses assessed. Table 3.2 summarises a description of the hydrogeomorphic (flow, channel and substrata) features for each of the sites assessed.

The Lower Kākā Hill Tributary (Figure 3.4, Plate A, site KTH1) is a predominatly intermittent stream that flows through the Project Area from north to south. This ~640 m reach comprises dry sections, pooled and riffled areas, and shallow slow runs, with little to no flow evident from the farmhouse culvert (C3) to culvert C1 during prolonged low-flow periods (Figure 2.1). Typical width is c. 1 meters and depths range from 2 to 30 cm with occasional deeper pooled sections. The lower banks on both sides are incised and relatively steep with some areas of bare exposed ground. Bank slumping occurs on both banks and there is likely a high potential for erosion, especially during higher flow events. The stream reach lacks any notable natural features with limited meanders and gently sloping banks, and no natural flood benches or back wetlands. Historical modifications are evident by the presence of the drainage ditches, the farmhouse culvert, a small bridge, bare soil and in some areas loose fill and woody debris.

The unnamed tributary, which traverses the eastern hillslope before emptying into the Lower Kākā Hill Tributary (Figure 3.4, Plate B, site KTH2), is considered to be a highly modified, intermittent stream. Cross sectional features are modified; both stream reaches are within a deepened channel with flood banks and therefore connection to its original floodplain is reduced. Riparian margins (at top of incised/contoured channel banks) consisted of grazed pasture and rank grass. A review of historical aerial imagery indicated that the watercourse has undergone modifications, including the construction of a consented accessway that crosses over a low terrace above the floodplain on the eastern hillslope. Consequently, the watercourse now runs parallel to the upland side of the accessway, then flows through a culvert (Culvert ID: C2; Figure 2.1) beneath it, cascades down the steepened terrace, and finally discharges into the Lower Kākā Hill Tributary within the floodplain. Typical width is c. 0.5 meters and depths range from 2 to 10 cm with occasional deeper pooled sections. Flow is very sluggish during base flow conditions.

The two remaining unnamed tributaries (Figure 3.4, Plate C and Plate D, sites KTH3 and KTH4), which are smaller tributaries flowing into the Upper Kākā Hill Tributary, are located on the eastern and western hillslopes within the Project Area. They are also considered to be highly modified, intermittent streams. Both have typical widths of c. 0.5 meters and depths of 2-10 cm with some deeper pooled sections. Modifications include culverts (C4 and C5, KHT4; Figure 2.1) associated with accessways, and rank pasture grasses dominate the riparian margins (apart from the eastern stream's upper catchment). Stream banks are heavily incised with slumping evident.

In-stream (artificial) structures included several culverts (Figure 2.1) to provide for access ways. Based on cursory observations during the field visit, none of the inlets and outlets of existing culverts included perched or vertical sections >1 m in height with flows sufficient to support fish passage. Fish passage potential is further discussed below.

In general, riparian margins (at top of incised channel banks) consisted of grazed pasture and rank grass. The open pasture area provided no protection from stock access to the stream and extensive pugging and animal tracks were observed. The majority of the stream banks have been contoured recently and lack vegetation cover, while the remaining banks are generally steep, incised, and contain some areas of bare ground. Bank slumping has been observed, indicating a high potential for erosion on both sides, particularly during higher flow events.

[19] Based on on-site stream classification surveys by Morphum Environmental, 15 and 16 October 2020, using Auckland Council guidance (https://content.aucklanddesignmanual.co.nz/regulations/practice-notes/Documents/RC%203.3.17%20Stream%20Classification.pdf). It is noted that in the five days prior to the site assessment, approximately 49 mm of rain fell over a 48-hour period between 9 and 15 October 2020, based on observations recorded at the Maitai at Forks Rain Gauge.

Figure 3.4. Highly modified tributaries of Kākā Hill Tributary contiguous with grazed pasture cover down to the wetted stream edge on floodplain and low relief and low slopes within the Project Area, October 2023. Identifier text in top left indicates stream reach as shown in Figure 2.1.

Figure 3.4 (Cont.). Highly modified tributaries of Kākā Hill Tributary contiguous with grazed pasture cover down to the wetted stream edge on floodplain and low relief and low slopes within the Project Area, October 2023. Identifier text in top left indicates stream reach as shown in Figure 2.1.

Table 3.2 Description of hydrogeomorphic features for each of the stream reach locations assessed during site visit.

Watercourse / Site[a]	Hydrological regime	Channel morphology	Cross-sectional features	Dominant streambed substrata
Lower Kākā Hill Tributary (KHT1)	Intermittent (lacking flow during prolonged low-flows and sluggish in parts)	Incised, alluvial, limited meander	Terrace on left and right bank, occasional flood bench	Silt, mud and clay (>75% of reach) with limited sand/gravel/cobble/boulder material
Unnamed Tribuary on Eastern Hillslope (KHT2)	Intermittent (sluggish)	Incised, alluvial, limited meander	Terrace on left and right bank, limited flood bench	Silt, mud and clay (>75% of reach) with limited sand/gravel/cobble material
Unnamed Tribuary on Eastern Hillslope (KHT3)	Intermittent (sluggish)	Incised, alluvial, limited meander	Terrace on left and right bank, limited flood bench	Sand/gravel/cobble/boulder material with limited silt, mud and clay
Unnamed Tribuary on Western Hillslope (KHT4)	Intermittent (sluggish)	Incised, alluvial, limited meander	Terrace on left and right bank, limited flood bench	Sand/gravel/cobble material with limited silt, mud and clay

[a] As shown in Figure 2.1.

Water Quality Analysis

Water samples were collected from Kākā Hill Tributary on a monthly basis at two sites from 27 November 2020 to 26 October 2021[20] (Appendix E). One site (the lower catchment site), representative of site reference Site A herein, was located above the confluence with the Maitai River (NZTM E1625825 N5431183; Figure 2.1). The second site (the upper catchment site), hereafter called Site B, was located above the farmhouse where the valley transitions from farmland to scrubland (NZTM E1626295 N5432119; Figure 2.1). A summary of the results from the water sampling are shown in Table 3.3. Results are compared with relevant ANZ default guideline values (DGVs)[21], with any exceedances of guideline values marked in bold.

Turbidity and Suspended Solids: Site B exhibits a higher mean turbidity (13 NTU) compared to Site A (7.6 NTU). Both sites exceed the guideline value of 4.2 NTU, indicating prevalent particulate matter. Similarly, mean total suspended solids are higher at Site B (25.7 g/m3) than at Site A (13.4 g/m3), surpassing the guideline value of 4.6 g/m3. The maximum turbidity at Site B peaks at 61 NTU, and suspended solids reach 93 g/m3.

High turbidity and suspended solids are indicators of potential ecological stress in stream environments. Turbidity can reduce light penetration, affecting photosynthetic aquatic plants and disrupting food webs. High levels of suspended solids can smother benthic habitats where many aquatic invertebrates live, reducing habitat quality and food availability for fish and other wildlife. The high mean values at both sites suggest that the stream is likely under ecological stress.

Microbial Contamination: The microbial contamination levels, measured by Escherichia coli, are

[20] MacNeil C (2021). Kākā stream water quality monitoring: 27 November 2020 - 26 October 2021. Prepared for CCKV Maitai Dev Co LP and Bayview Nelson Ltd. Cawthron Report No. 3728 13 p. plus appendices.

[21] ANZ default guideline values (DGVs) for 80% level of species protection in freshwater streams.

high at both sites in their pre-development states. Site A has a mean level of 3312 cfu/100 ml, significantly higher than Site B's 840 cfu/100 ml, both exceeding the NPS-FM bottom line value of 540 cfu/100 ml. The maximum contamination at Site A reaches up to 11000 cfu/100 ml.

Elevated levels of *E. coli* are indicative of fecal contamination, which poses serious health risks to wildlife and humans. Such high levels, especially noted at Site A, suggest significant pollution inputs from agricultural runoff, which can lead to eutrophication. Eutrophication can cause algal blooms that deplete oxygen in the water at night, leading to anoxic conditions that are limiting to aquatic life.

Nutrient Levels: Nitrate-nitrogen levels are elevated above the guideline (0.195 g/m3) at both sites, with mean levels of 1.867 g/m3 at Site A and 2.315 g/m3 at Site B. This highlights nutrient enrichment from upstream sources impacting both sites. Dissolved reactive phosphorus shows a mean value slightly above the guideline at Site A (0.008 g/m3) and below at Site B (0.004 g/m3), suggesting differential impacts or management efficiencies. In terms of ammoniacal nitrogen, for Site A, where it was measured to be above detectable analytical ranges, the mean total ammoniacal nitrogen (0.023 g/m3) exceeds the guideline value of 0.017 g/m3.

The elevated levels of nitrate-nitrogen and phosphorus are classic indicators of nutrient pollution, likely associated to agricultural discharges. If excessive these nutrients can lead to eutrophication. Additionally, ammoniacal nitrogen, particularly at the elevated levels observed at Site A, is toxic to aquatic organisms. Together, these results indicate a risk of ecological impacts that could compromise the stream's resilience and the overall health of its aquatic ecosystems.

Table 3.3 Summary results for water quality and in-stream fine sediment compared with relevant guideline values. Bold values denote DGVs exceedences. Results reflect monthly sampling from sites immediately above the confluence with the Maitai River (Site A) and above proposed land use change (Site B), November 2020–October 2021.

Parameter	Unit	Site[a]						Default Guideline Value[b]
		Site A			Site B			
		Min	Mean	Max	Min	Mean	Max	
Turbidity	NTU	2.9	**7.6**	**36.0**	1.4	**13.0**	**61.0**	4.2
E. coli[d]	cfu/100 ml	330	**3312**	**11000**	71	**840**	**3700**	540[c]
Total Suspended Solids	g/m3	3.0	**13.4**	**67.0**	3.0	**25.7**	**93.0**	4.6
Total Ammoniacal-N	g/m3	0.010	**0.023**	**0.108**	<0.010	<0.010	<0.010	0.017
Nitrate-N	g/m3	0.023	**1.867**	**5.400**	**0.330**	**2.315**	**4.900**	0.195
Dissolved Reactive Phosphorus	g/m3	0.004	**0.008**	**0.023**	0.004	0.004	0.006	0.007

[a] As shown in Figure 2.1.
[b] 80th Percentile DGV.
[c] NPS-FM national bottom line value.
[d] As noted by Cawthron (2020) (Appendix E), several *E. coli* samples should be treated with caution as these may be based on statistically estimated counts and/or may have been received by Hill Laboratories outside the optimum temperature range for the methodology.

Rapid Habitat Assessment

Six (6) Rapid Habitat Assessment (RHA) surveys were conducted to assess the ecological condi-

tion of the tributaries in the Project Area. Each survey covered a reach approximately 100 meters in length, heading upstream from the discrete site locations shown in Figure 2.1.

The results are presented below (Table 3.4), with the Habitat Quality Scores for the full width of the sites, including both wetted and riparian areas, reveal significant differences in ecological conditions. Site B stands out with a 'Good' habitat quality score of 53, indicating a healthier ecological state with better invertebrate habitat diversity and abundance, more diverse and abundant fish cover, and greater hydraulic heterogeneity. In contrast, Site A and the other sites (KHT1, KHT2, KHT3, KHT4) are rated as 'Poor' to 'Fair', with scores ranging from 14 to 34. These sites are impacted by sediment deposition, limited habitat diversity for both fish and invertebrates, and inadequate riparian features such as shade and vegetation cover.

Table 3.4 Rapid habitat assessment results summary based on Clapcott (2015) protocol — Overall Habitat Quality Score: Excellent (>75), Good (51–75), Fair (26–50) or Poor (<26).

Zone	Habitat Parameter	Watercourse / Site[a]					
		Site A	Site B	KHT1	KHT2	KHT3	KHT4
Wetted area	Deposited sediment	1	8	6	2	3	5
	Invertebrate habitat diversity	2	5	6	2	2	1
	Invertebrate habitat abundance	2	5	3	1	1	1
	Fish cover diversity	3	5	3	1	1	1
	Fish cover abundance	5	6	5	1	1	2
Riparian area	Hydraulic heterogeneity	2	8	2	2	4	2
	Bank erosion	3	6	4	1	1	1
	Bank vegetation	2	3	2	2	2	1
	Riparian width	2	2	2	1	1	1
	Riparian shade	3	5	1	1	2	4
Habitat quality score (of 100)		**25**	**53**	**34**	**14**	**18**	**19**

[a] As shown in Figure 2.1.

Macroinvertebrate Community Assemblage

This section provides the results of the aquatic macroinvertebrate community assessments (Table 3.5) for the four impact reaches associated with Kākā Hill Tributary (KHT1-4). Detailed results are presented in Appendix F. Overall a total of 33 taxa were sampled during the 2023 assessment. Taxa numbers were similar across the sites, with the highest numbers sampled at KHT1 and KHT2, while the lowest number was observed at the KHT4 site (Table 3.5).

Average invertebrate sensitivity scores for the four sites indicated probable moderate to severe pollution with MCI-sb scored ranging between 82 (site KHT2) and 107 (site KHT3). The QMCI-sb, accounts for the relative abundances in relation to the invertebrate sensitivity scores and generally inferred similar water quality conclusions as the MCI-sb index scores. The overall similarities in more sensitive EPT[22] taxa (typically associated with better water quality and permanent flow) indicates ecological degradation across the sites. Table 3.6 presents how scores are interpreted to denote stream health.

[22] EPT are macroinvertebrates that are sensitive to water pollution. These are Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly).

Overall the macroinvertebrate communities in the surveyed impact reaches can be considered highly impacted with **Very Low** to **Low** ecological value.

Table 3.5 Macroinvertebrate sampling results, Kākā Hill Tributary impact reaches, 9 October 2023. Detailed results are presented in Appendix F.

Metric/index[a]	Site			
	KHT1	KHT2	KHT3	KHT4
Number of taxa (including rare taxa)	19	20	16	15
Number of rare taxa	6	8	3	6
Number of individuals	212	230	205	215
MCI-sb	104	82	107	93
QMCI-sb	3.77	2.63	4.36	4.03
%EPT taxa (excluding Hydroptilidae)	31.58	5.00	12.50	6.67
%EPT abundance (excluding Hydroptilidae)	2.83	0.43	2.44	0.47

[a] Refer NEMS Macroinvertebrates (2020), page xiii, for further details of listed indices.

Table 3.6 Interpretation of QMCI-sb, MCI-sb scores and percentage (%) EPT taxa to denote site-specific stream health.

% EPT taxa	QMCI-sb score	MCI-sb score	Quality class	Description
<25	<4.00	<80	Poor	Stream is in poor ecological condition. Indicative of probable severe pollution and/ or poor habitat conditions.
25-50	4.00-4.99	80 - 99	Fair	Stream is in fair ecological condition. Indicative of probable moderate pollution and/or habitat conditions.
51-70	5.00-5.99	100 - 119	Good	Stream is in good ecological condition. Indicative of possible mild pollution and/or habitat conditions.
>70	>5.99	>120	Excellent	Stream is in excellent ecological condition. Indicative of excellent water quality/ clean water and/or habitat conditions.

Fish Community

The NZFFD records for the wider Maitai River catchment[23] indicated the potential occurrence of 18 species, all of which are native. Potentially occurring species of conservation significance (TAR species) include:

- longfin eel (*Anguilla dieffenbachii*) — At Risk (Declining)
- īnanga (*Galaxias maculatus*) — At Risk (Declining)
- koaro (*Galaxias brevipinnis*) — At Risk (Declining)
- lamprey (*Geotria australis*) — Nationally Vulnerable

[23] NZFFD Catchment Number 578.000.

- torrentfish (*Cheimarrichthys fosteri*) — At Risk (Declining)

A total number of 23 fish were sampled during the 2023 electrofishing and spotlighting surveys at sites KHT1 and KHT4[24]. Four species were confirmed from surveys, representing four separate families and genera (Table 3.7). Shortfin eel, kōura, upland bully and īnanga were recorded during the fish survey at impact reach KHT1, with shortfin eel and kōura the only species found at site KHT4 (Table 3.7). Full results of the fish survey are included in Appendix G. Similar assemblages were recorded during a previous survey of the Upper Kākā Hill Tributary[25].

Table 3.7 Fish species recorded during the electric fishing and spotlight surveys on the 11th and 13th of December 2023. Refer to Appendix G for further detail. Conservation status assigned using Dunn et al. (2018).

Species	Conservation status	Site[a]			
		KHT1		KHT4	
		Abundance	Length	Abundance	Length
Shortfin eel	Not Threatened	3	120-300 mm	1	200 mm
kōura	Not Threatened	6	40-100 mm	6	50-110 mm
upland bully	Not Threatened	5	40-60 mm		
īnanga	At Risk (Declining)	2	70 mm		

[a] As shown in Figure 2.1.

Of the native freshwater fish species observed within the Kākā Hill Tributary, apart from the upland bully, all are diadromous, meaning they require access to both freshwater and marine environments to complete their life cycles. Therefore, maintaining access to both downstream and upstream habitats is crucial for these species to support healthy regional populations. Similarly, because fish are mobile and may move between habitats throughout the year, ensuring fish passage and connectivity within the Kākā Hill Tributary is essential for the sustainability of these observed species.

The ecological value of fish populations in the freshwater receiving environment is **Low** to **Moderate** based on the survey results, which confirmed a very low potential for Threatened species to occupy or utilise the Project Area. The moderate rating reflects the presence of At Risk species (īnanga). However, the absence of these species within the Project Area does not necessarily mean that they do not utilise available habitat within the broader catchment area. We note the current survey results reflect the existing state, and it is possible that native fish populations may occupy or utilise the Project Area in the future or during different seasons.

eDNA

Two eDNA samples also taken during an on-site survey on 7th March 2023 supported the findings of the fish survey, as the eDNA identified shortfin eel, īnanga and kōura as freshwater fish present (Appendix H). Interestingly, upland bully were not detected. Possible reasons for the failure to

[24] With similar hydrogeomorphic features, these sites were considered representative of fish communities that could potentially occupy the other impact reaches at sites KHT2 and KHT3.

[25] Tonkin & Taylor (2021) observed shortfin eel, unidentified eel (including elver), and an unidentified climbing Galaxiidae sp. in the upper Kākā Hill Tributary (i.e. upstream of the farmhouse culvert) on 12 and 13 December 2019.

detect upland bully in eDNA samples, despite their presence confirmed through manual sampling, could include their lower biomass in the sampled area, or the intermittent shedding of detectable DNA levels, which might not coincide with the timing of eDNA sampling.

Figure 3.5 presents the Taxon-Independent Community Index (TICI)[26] scores used to interpret stream ecological condition. The TICI results indicate 'poor' stream ecosystem health in the Lower Kākā Hill Tributary (Site A) and 'average' health further upstream at Site B. No TAR macroinvertebrate species were recorded in eDNA data.

The poor ecological health of the Lower Kākā Hill Tributary site is likely exacerbated by exposure to agricultural pollutants coupled with the site's intermittent flow. Many of the detected freshwater macroinvertebrates at Site A, including species such as *Physella acuta*, *Potamopyrgus antipodarum*, and *Gyraulus corinna*, are known for their adaptability and tolerance to varying environmental conditions, including stagnant and intermittently flowing waters. Their prevalence suggests that the habitat does not sustain more sensitive species that require consistently oxygenated, flowing waters, such as those found in healthier stream systems. The presence of these tolerant species alongside the absence of EPT taxa indicates ecological degradation. This situation is likely compounded by the intermittent flow regime of the tributary, which does not support a stable, diverse aquatic community, leading to reduced biodiversity and compromised ecological health.

The macroinvertebrates detected at Site B in the Upper Kākā Hill Tributary, including sensitive species like the caddisflies *Aoteapsyche colonica* and *Psilochorema bidens*, and the mayfly *Deleatidium* sp., suggest a diverse and healthy aquatic environment. This diversity, marked by the presence of sensitive taxa such as mayflies and caddisflies, indicates a more ecologically balanced and less disturbed habitat compared to the Lower Kākā Hill Tributary, which is dominated by pollution-tolerant species. This contrast supports better ecological health and higher water quality upstream at Site B, with reduced human impact.

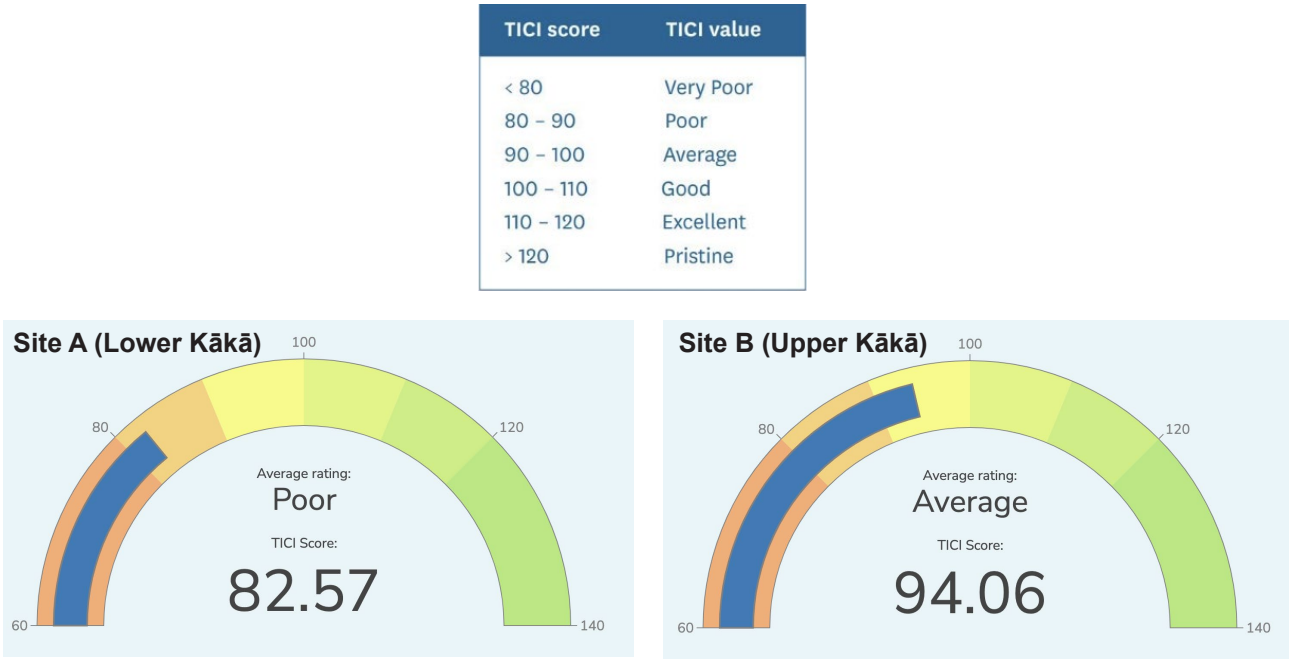

Figure 3.5. TICI results output of single-replicate samples collected from the surveyed reaches, 7 March 2023. Note the inset qualitative score ranking is on the same scale as the NZ MCI-sb.

[26] Wilkinson et al. (2024).

3.1.2.2 Ecological Value

All streams within the survey Project Area are modified from their original natural condition. Notably Lower Kākā Hill Tributary associated with the floodplain area has been realigned away from its original course, straightened in part and confined to a small macro-channel (connection to floodplain reduced due to incision, channelisation, or infilling) and, in some cases, the active channel has been widened, straightened or deepened. Additionally, sections of stream through the Project Area could not be assessed as they have been piped or culverted.

The NPS-FM directs the consideration of the potential value of any freshwater features being impacted if they were restored. Based on this, the assessed streams have the potential to have enhanced water quality, shading, and increased in-stream habitat heterogeneity. However, the water quality will still be affected by the highly modified, largely agricultural usage catchment. Based on the overall freshwater assessment (habitat and species), stream sites on the main Kākā Hill Tributary (sites Site A/KHT1 and Site B) were assessed to have **Moderate** ecological value, respectively, whilst the sites on the smaller hillslope tributaries (KHT2, KHT3) was **Low** (refer Table 3.8). The difference in ecological value between the reaches assessed may be attributed to a higher stream order, more permanent flows and more in-stream habitat availability for sites Site A/KHT1 and Site B, as well as observed presence of īnanga (At Risk — Declining) at sites Site A/KHT1. The ecological value attributed for freshwater habitat (in-stream and riparian) and freshwater fish species are comparable and as such are expressed as one value for the remainder of the report.

Table 3.8 Freshwater ecological features and overall ecological value.

Freshwater habitat/ species assessment	Lower Kākā Hill Tributary (Site A)	Lower Kākā Hill Tributary (KHT1)	Upper Kākā Hill Tributary (Site B)	Unnamed Tributary on Eastern Hillslope (KHT2)	Unnamed Tributary on Eastern Hillslope (KHT3)	Unnamed Tributary on Western Hillslope (KHT4)
Overall value	Moderate	Moderate	Moderate	Low	Low	Low

3.1.3 Natural Wetlands

3.1.3.1 Desktop Observations

A desktop assessment was made of potential wetlands within the Project Area to include any wetlands within the Project ZOI. This assessment considered wetlands mapped by Tonkin & Taylor (2021) for the wider Project Area to inform PPC28. The ZOI for the wetland assessment was based on 100 m distance from the proposed Project footprint in line with restrictions on activities such as earthworks, associated with the NES-F.

Potential wetlands in the floodplain area associated with the Lower Kākā Hill Tributary, which has undergone significant modifications in the past, were not considered in this report. Historical stream realignments and the addition of fill material and access way formation have substantially altered the original floodplain topography, resulting in only small artificial drainage lines and associated depressions (Figure 3.4) that are infrequently inundated during higher flow events. These modifications likely restrict natural drainage of localised areas, creating an environment that could support wetland plant species.

The Project Area is not included within the Pre-human Wetlands overlay, and the LENZ prediction by Landcare Research (2023) suggests that the historic land cover for this area was predominantly ‘Rimu-broadleaf-beech’ forest, indicating it was covered by lowland terrestrial forest rather than wetlands or wetland forest. Although the historical presence of wetlands in the floodplain area cannot be entirely discounted, such wetland features are typically situated in lower-lying areas more

prone to frequent flooding (Courtney et al. 2003). This geographical context reduces the likelihood of historical wetland presence at the relatively higher-lying land associated with the floodplain area.

3.1.3.2 Site Investigations (Wetland Delineation)

Two wetlands were identified within the Project Area, as depicted in Figure 3.3. Wetland plots were conducted during a site visit on 26 March 2024 and the results for the plots are provided below (Table 2.1). Locations and field sheets for all plots are provided in Appendix I.

Wetland 1 is located near the northern extent of the Project Area on the western side of Kākā Valley, while Wetland 2 is situated on the southeastern slopes of the lower valley (see overview photographs in Figure 3.6; Appendix I). Wetland 1 covers approximately 0.29 hectares and features hydrophytic plant species including rautahi (*Carex geminata*), pureī (*Carex virgata*), buttercup (*Ranunculus repens*), and exotic rushes (*Juncus effusus* and *J. articulata*). Wetland 2, slightly smaller at about 0.28 hectares, predominantly features pasture plant species and exotic rushes, with adjacent areas of gorse and mānuka/kānuka scrub. The wetlands lack any notable riparian (indigenous or otherwise) vegetation.

Both wetlands meet to the NPS-FM definition of a natural inland wetland and therefore a natural wetlands under the NES-F. The Project proposes to protect, restore, and enhance the ecological values of these identified wetland features. Earthworks are planned on the western hillslope, located within 100 m of Wetland 1.

No additional wetlands are known within the Project Area. There are wet/boggy areas within the pasture, including within floodplain area associated with the Lower Kākā Hill Tributary, which support occasional *Juncus* species but none of these appeared to reach the density of the NPS-FM definition of natural wetland, based on cursory observations made during site visits. The predominant long-term pastoral use of the land means it is exotic pasture dominated and any ecological values from the presence of hydrophytes is perceived as very low.

3.1.3.3 Ecological Value

The wetland habitats within the Project Area are predominantly dominated by exotic plant species and have been significantly degraded due to factors such as vegetation removal, livestock grazing, and pugging. Wetland 1, in particular, was heavily impacted by smothering effects from a nearby landslip caused by the August 2022 storm event. However, recent observations indicate that Wetland 1 is undergoing a natural restoration process, with native vegetation such as rautahi and pureī showing signs of regrowth. The condition of the two wetland areas that were mapped were assessed in addition to the wetland delineation process. The assessment involved giving a value based on four “Matters”: representativeness (low), rarity/distinctiveness (moderate), diversity and pattern (low), and ecological context (moderate). Although the exotic wetlands are highly modified and relatively small in size, their ecological value is considered to be **Moderate**. This is due to the overall reduction in freshwater wetland habitat across the Bryant Ecological District, which has seen a loss of c. 99% in area (Tasman District Council 2020). Additionally, the retained hydrogeomorphic features of these systems provide ecological functionality for stormwater attenuation and excess contaminant (e.g. sediment, nutrients) removal.

3.1.4 Terrestrial Ecology (Flora)

3.1.4.1 Desktop Observations

The present-day terrestrial habitats within the vicinity of the Project Area are predominantly heavily modified pasture grassland. Where natural habitats like native scrub/trees remain, within the

Figure 3.6 Wetland features identified within the Project Area. Wetland 1 is located near the northern extent of the Project Area on the western side of Kākā Valley, while Wetland 2 is situated on the southeastern slopes of the lower valley, as shown in Figure 3.3.

wider landscape, the Nelson City Council has largely mapped and classified habitats as Significant Natural Areas (SNA). No SNAs are located directly within the Project Area; however, SNA 166 is situated within some 500 meters (see Figure 3.3). This SNA is valued for its indigenous vegetation, hosting TAR species such as kānuka (*Kunzea ericoides*) and matagouri (*Discaria toumatou*)[27]. As noted, it is important to consider the potential impacts on areas beyond the immediate Project Area, including SNA 166. Highly mobile indigenous fauna may inhabit areas extending beyond SNA boundaries, and earthworks within the catchment could affect downstream environments, such as coastal wetlands.

In addition, Nelson Haven is located approximately 2 km away from the Project and is within the direct receiving environment of the Project Area, connected via the Kākā Hill Tributary and Maitai River. The intertidal mudflats and coastal wetlands particularly eelgrass beds associated with Nelson Haven[28] can be particularly sensitive to sedimentation runoff caused by construction works.

3.1.4.2 Site Investigations

A total of two (2) broad terrestrial habitat types were mapped (Figure 3.3; Table 3.1):

- Indigenous Vegetation[29];
  - » Regenerating kānuka shrubland with patchy canopy and highly degraded understorey.
  - » Regenerating mixed māhoe-exotic scrub with patchy canopy and highly degraded understorey.
- Non-indigenous vegetation or other;
  - » Predominantly exotic scrub/trees with highly degraded understorey.
  - » Pasture grasses with very occasional native-exotic shrubs/trees.
  - » Gorse with very occasional native-exotic shrubs.
  - » Recently cleared or sprayed vegetation.
  - » Accessways (no vegetation).

There was no Indigenous Forest[30] recorded within the Project Area. Representative field photographs of each identified habitat type are presented in Attachment X.

Regenerating kānuka shrubland and mixed māhoe-exotic scrub with patchy canopy and highly degraded understorey

Regenerating kānuka dominated shrubland was present in several areas of variable size on the eastern and western hillslopes, but was most prevalent to the eastern extent of the survey area (refer Figure 3.3). Two patches of māhoe dominant scrub were also recorded on the northwestern hillslope below the Bayview ridgeline where surrounding vegetation has recently been cleared or sprayed. These areas of native vegetation meet the definition of Indigenous Vegetation under the

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[27] Nelson City Council. (2009). Ecological Significance Assessment Report. Site No. 166. Technical report prepared by Micheal North.

[28] Stevens, L.M., Forrest, B.M. 2019. Broad scale intertidal habitat mapping of Nelson Haven. Salt Ecology Report 022 prepared for Nelson City Council. 42p.

29 As defined in the NRMP: '...*an area of naturally occurring vegetation where the area covered by plant species indigenous to the District is the same as or greater than the area covered by other plants*...'.

[30] Per NRMP definition: '...*an area of naturally occurring woody vegetation that:*
a) has a canopy predominantly formed by trees over 6 m high, and
b) has more than 80% closure of the canopy, and
c) comprises plant species indigenous to the District...".

NRMP.

Kānuka in these areas consisted largely of shrubs with occasional larger trees (>6 m tall) emerging from the thinning canopy. Māhoe (*Meticytus ramiflorus*) formed the sub-dominant canopy species. Several large wilding pines, which appear to have been poisoned, were recorded. Understorey growth (native or otherwise) was generally absent owing to the broken canopy (limiting suitable habitat for shade-tolerant species) and intensive grazing pressure by stock and other pest mammals (mostly wild goats).

Exotic species present hawthorn, gorse, barberry, old man's beard, convolvulus, foxglove and several introduced grasses. Pasture grasses and pasture weeds and gorse were often most abundant at the margins. Fragmentation and edge effects were also apparent. This habitat forms part of the naturally regenerating band of native kānuka shrubland occupying lowland hillslopes of the wider Kākā Hill Valley catchment.

Predominantly exotic scrub/trees with degraded understorey

Areas of mixed exotic vegetation occur in the Project Area, mostly bounding similar vegetation at the southwestern extent of the Project Area. Predominantly vegetation comprises scattered ash (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*) with occasional māhoe and kānuka (rare), above exotic grasses and hawthorn, gorse, barberry, and old man's beard.

Such vegetation characterises a roughly 270 m stretch of the riparian corridor some 200 m upstream of the farmhouse culvert, which will be retained and enhanced as part of the Project. Notably, the balance riparian corridors are generally highly modified comprising predominantly rank and pasture grass and herb species.

Pasture grasses and gorse with very occasional native shrubs/trees

A high proportion (>70%) of the terrestrial vegetation in the Project Area is characterised by pasture used for grazing sheep and cattle. Pasture is most common within the mapped valley floor, lower hillslopes and along the western ridgeline. Pasture comprises exotic grasses and herbs (e.g., narrow-leaved plantain (*Plantago lanceolata*), perennial ryegrass (*Lolium perenne*), Kentucky bluegrass (*Poa pratensis*), Cocksfoot (*Dactylis glomerata*), Yorkshire fog (*Holcus lanatus*), white clover (*Trifolium repens*), birdsfoot trefoil (*Lotus corniculatus*), dock (*Rumex* spp.), and buttercup (*Ranunculus* spp.). There are individual kānuka (shrubs and trees) and specimen trees (poplars, weeping willows and exotic conifers) highly sparsely distributed within pasture areas.

Recently cleared vegetation

Vegetation clearance has been undertaken at various locations across the Project Area (Figure 3.3). Prior to clearance the vegetation comprised a combination of predominantly exotic scrub and exotic grassland (LCDB5). These areas now comprise either dead vegetation, bare ground, or re-establishing pasture grasses and weeds.

3.1.4.3 Plant Species Observed

Plant species encountered during the surveys are listed in Appendix C. Indigenous species present within the Project Area included:

- kānuka (*Kunzea ericoides*) — Nationally Vulnerable.
- kōwhai (*Sophora microphylla*) — Not Threatened.
- māhoe, whitey wood (*Melicytus ramiflorus*) — Not Threatened.
- akeake (*Dodonaea viscosa*) — Not Threatened.
- patatē, seven-finger (*Schefflera digitata*) — Not Threatened.

- mamaku, black tree fern (*Cyathea medullaris*) — Not Threatened.
- taratara, lemonwood (*Pittosporum eugenioides*) — Not Threatened.
- mikimiki (*Coprosma linariifolia)* — Not Threatened.

In total, twenty-three (23) indigenous vascular taxa were recorded within vegetation and habitat types associated with the Project Area. Of the recorded taxa, most are relatively common and are typical of regenerating native vegetation in modified lowland hill country of the Bryant Ecological District. However, one species is included in the New Zealand Threat Classification Lists. Kānuka is classified 'Threatened - Nationally Vulnerable' (de Lange et al. 2018), acknowledging the threat it faces from disease (i.e., myrtle rust).

3.1.4.5 Ecological Value

Table 3.9 summarises and further justifies the terrestrial habitat values in accordance with EIANZ guidelines. The Project Area is not designated as SNA and currently lacks the ecological values required for such classification. Within the area, secondary native shrubland habitats are considered of **High** ecological value. In contrast, areas dominated by exotic scrub and trees are assessed as having **Low** to **Moderate** ecological value. Exotic (pasture) grasslands and areas of recently cleared or bare ground are evaluated as having **Low** and **Very Low** ecological values, respectively.

Table 3.9 Assignment of values within the terrestrial receiving environment to habitats and species (adapted from EIANZ, 2018).

Habitat/Species	Value	Comments
Regenerating kānuka shrubland and mixed māhoe-exotic scrub with patchy canopy and degraded understorey (RS)	High	This secondary native shrubland dominated area with the Project Area supports recognised biodiversity attributes (indigenous vegetation). The area is not listed as SNA (NRMP). The wider, albeit fragmented shrubland area contains Threatened plant species (kānuka) and is considered to act as a buffer and connect adjacent ecosystems. It may support TAR or locally uncommon or rare species (i.e., birds, lizards); however, the limited canopy diversity and lack of understorey vegetation, existing edge effects (as evidenced through the encroachment of exotic plants species) and exposure to a high degree of disturbance (grazing and to a lesser extent noise) likely significantly reduce the carrying capacity of this habitat for indigenous fauna. The overall High rating reflects kānuka's Threatened status, and the importance of native vegetation as habitat for indigenous fauna and for linking ecosystems within the Bryant Ecological District.
Predominantly exotic scrub/trees with highly degraded understorey (ES)	Low-Moderate	This area is dominated by exotic vegetation. It does not support any recognised high biodiversity attributes (e.g. indigenous vegetation/forest) or feature as SNA (NRMP). The wider area may support Nationally Threatened, At Risk or locally uncommon or rare species (i.e., birds, lizards); however, the area has been significantly modified and the exotic vegetation consists of a low diversity of species and is simple in structure. It is unlikely to provide habitat for TAR species.

Pasture grasses and gorse with occasional native shrubs/trees (EG)	Low	Highly modified area with little to no representation of indigenous vegetation and very low levels of diversity. This habitat type is not expected to support significant numbers of TAR species.
Recently cleared vegetation and accessways (CV)	Very Low	Highly modified and comprising either dead vegetation, bare ground, or re-establishing pasture grasses and weeds, these areas have no recognised ecological value.

3.1.5 Terrestrial Ecology (Fauna)

3.1.5.1 Bats

Desktop & On-site Observations

Department of Conservation's bat distribution database lists several records of pekapeka/long-tailed bat (*Chalinolobus tuberculatus*, Threatened – Nationally Critical) from various habitat types in the Bryant Ecological District over the past decade. According to Department of Conservation's bat distribution database records (accessed June 2023), this species has not been detected within 10 km of the Project Area, with the closest record some 13-14 km (Pelorus catchment) from the Project Area[31].

Pekapeka/long-tailed bats forage over farmland and urban areas favouring forest edge and riparian habitats where they feed on aquatic insects. Long-tailed bats can cover 50 km in a single night and have ranges extending up to 100 km^2. A study of pekapeka/long-tailed bats within the highly fragmented landscape of South Canterbury found they preferred roosting habitat that included indigenous forest, shrubland remnants and riparian zones (Sedgeley and O'Donnell 2004). Long-tailed bats usually find roosts in large old native canopy trees either beneath the bark or in cavities where they rest during the day and breed. They are also known to utilise mature exotic trees such as pine and macrocarpa.

No old growth and very limited large trees which supported cavities and/or epiphytes within which bats could roost were recorded within the Project Area. The area is unlikely to be important habitat for bats and although the Project Area may provide some intermittent habitat for bats these potential habitats were of relatively low value. On this basis formal bat surveys were not deemed necessary and were not conducted for the Project Area.

Ecological Value

There is limited habitat within the Project Area suitable for commuting, roosting, and foraging by pekapeka/long-tailed bats, with the closest known record located 13-14 km away to the east. While no targeted ABM surveys were conducted, their presence within or adjacent to the Project Area is considered unlikely. This assessment is based on a lack of positive records, the proximity of urban development, existing noise and light pollution, and limited adjacent foraging habitat and connectivity to known bat records/habitat.

3.1.5.2 Birds

Desktop Observations

All birds are protected under the Wildlife Act except those listed in Schedule 5 of the Act. The pres-

[31] Distance is approximated from the centre of the Project Area to the location of the DOC record.

ence of Threatened species would be considered significant if identified within the Project Area.

Records of native bird species identified within approximately 5 km of the Project Area were collated. Table 3.10 identifies the TAR species that may occupy or utilise the Project Area, detailing each species' habitat preferences and summarising their likelihood of presence within the area. As the Project Area is within 5 km of both coastal and native forest habitat, many of the species recorded in the area are highly unlikely to ever visit the Project Area, due to their specific habitat requirements. The modified habitats present within the Project Area are only likely to permanently support a range of common, Not Threatened native bird species.

The NPS-IB[32] classifies certain bird species as 'specified highly mobile fauna.' All of the native bird species listed in Table 3.10 are included in this classification.

Table 3.10 TAR bird species with potential to occupy or utilise the Project Area.

Species	Common/Maori name	Threat Status[a]	Preferred ecosystem type(s)[b]	Likelihood of presence	Justification
Porzana pusilla affinis	kotoreke / marsh crake	At Risk (Declining)	Wetland/ riverine	Possibly utilise wetland habitat	Require dense wetland vegetation for cover and foraging. As isolated wetlands exist, occasional presence is possible.
Larus bulleri	tarāpuka / black-billed gull	At Risk (Declining)	Coastal/riverine	Very Low, possible flyover	Typically breed and feed along riverbeds and lakeshores but may occasionally forage over farmland.
Anthus novaeseelandiae	pīhoihoi / New Zealand pipit	At Risk (Declining)	Forest/open	Low, possible in marginal areas	Prefer undisturbed native grasslands but may be found on road verges, fence lines, or open hill pasture.
Ardea modesta	kōtuku, white heron	Nationally Critical	Wetland/ riverine	Very Low, possible transient visitor	Reliant on rich wetland ecosystems but may use farm ponds, drains, or slow-moving streams if available.
Falco novaeseelandiae "southern"	kārearea / southern falcon	Nationally Endangered	Forest/open	Low, possible hunting visitor	Rare in intensive pasture, but known to hunt over open landscapes and may perch on fence posts or trees.
Anarhynchus frontalis	ngutu pare / wrybill	Nationally Increasing	Coastal/riverine	Very Low, transient migrant	Strictly nests on braided riverbeds but may use short-cropped paddocks near estuaries during migration.

[32] Appendix 2.

Anas superciliosa	pārera / grey duck	Nationally Vulnerable	Wetland/ riverine	Very Low, possible farm pond visitor	Requires vegetated wetlands and slow-moving rivers but may use farm ponds or drainage ditches.

[a] Dunn et al. (2018).
[b] NPS-IB; Appendix 2.

Site Observations

Formal bird surveys for wetland or forest birds were not completed within the Project Area, as limited habitat was present for TAR species. However, a roaming inventory of birds sighted or heard was taken during the field survey within the Project Area. Of those recorded (several silvereye and fantail), none were classified as TAR species. The bird life observed during survey within the Project Area area generally reflects the modified state of the local environment.

Ecological Value

Bird diversity in the Project Area is most likely low and dominated by introduced and Not Threatened species. These native birds are likely to breed throughout the remaining scrub, shrubland and planted vegetation within the Project Area. The vast majority of TAR birds identified in the desktop review are likely to be confined to the riverine/coastal margin of Maitai River and the Nelson Haven. The only TAR species with the potential to frequent the Project Area are those listed in Table 3.10, which could potentially use the Kākā Hill Tributary for foraging. Little to no breeding or roosting habitat for TAR species was identified.

Habitat suitability for TAR species is considered to be low and they are likely to be at most infrequent visitors to the Project Area rather than resident. The ecological value of bird habitat within the Project Area is therefore considered to be **Low** to **Moderate**. The moderate rating reflects the albeit very low potential for TAR species (pīhoihoi / New Zealand pipit and kārearea / southern falcon) to occupy or utilise the area. Again, these species are not restricted to these habitats within the Project Area and likely utilise available, higher quality habitat across the wider lowland valley floor and hill country environment and adjacent coastal area.

3.1.5.3 Macroinvertebrates

The overall diversity of ground active macroinvertebrates is expected to be very low within the pasture-dominated areas, but higher within the mapped indigenous vegetation (Attachment X).

Kānuka shrubland typically habours greater species richness and diversity than other forest types and land dominated by pasture or other monocultures. At the feeding guild level, present communities are likely to be dominated by detritivores and, to a lesser extent, scavengers, predators, parasitoids and phytophages given that on the day of the field survey organic aggregations of readily consumable leaf litter and woody debris (primary food source for detritivores) were present within native vegetated areas. Ecologically, detritivore-based communities are particularly important given their role in nutrient cycling by facilitating the decomposition of organic material.

Most native invertebrates are not legally protected under the Wildlife Act 1953. Protected invertebrates are listed in Schedule 7 of the Act and include a small number of large or threatened species, none of which are known to occur within the Project Area. Other likely present invertebrate species that are not listed as protected may nevertheless contribute to the identification of valuable habitats by their presence.

It is important to note that Nelson and Tasman Districts hold the most diverse range of giant *Powelliphanta* land snails nationally, with most species are classified as either At Risk or Threatened.

Powelliphanta snails are prone to dehydration and so they cannot survive in dry conditions. For this reason, they are more common in moist high-altitude forest than in drier forests at lower altitudes (as in the present case). No *Powelliphanta* snails or shells were encountered during the present survey, and it is considered unlikely that *Powelliphanta* snails will be inhabiting the habitats within the Project Area.

Ecological Value

The overall ecological value of inhabitant invertebrates is considered to be **Low** given the likely absence of TAR species.

3.1.5.4 Herpetofauna

Desktop Observations

Seven native lizard species are known to occur within 15 km of the Project Area, based on a review of the ARDS database, iNaturalist, Whitaker (2004), and van Winkle et al. (2018). These species and their habitat preferences are presented in Table 3.11.

Table 3.11 Herpetofauna records in the vicinity of the Project Area and their preferred habitat type.

Species	Common/ Maori name	Nearest record	Threat Status[a]	Preferred Habitat Type	Likelihood of Presence
Mokopirirakau granulatus	Forest gecko	6.8 km SE	At Risk - Declining	Primarily arboreal including within swamps, scrubland and mature forest.	Low
Naultinus stellatus	Starred gecko	1.6 km SE	Threatened - Nationally Vulnerable	Arboreal including within swamps, scrubland and mature forest.	Low
Oligosoma kokowai	Northern spotted skink	2.9 km NW	At Risk - Relict	Prefers open areas such as boulder beaches, sand dunes, open coastal forest/ scrub, as well as grassland and shrubland.	Very Low
Oligosoma polychroma	Northern grass skink	0.6 km SE	Not Threatened	Wide ranging including rock, grassland, flaxland, shrubland and modified habitat.	Confirmed
Oligosoma zelandicum	Glossy brown skink	13.4 km NE	At Risk - Declining	Coastal pebble banks, grassland, wetland, dense scrubland and mature forest.	Very Low
Woodworthia maculata	Raukawa gecko	3.4 km SW	Not Threatened	Wide ranging; saxicolous (rock dwelling) or arboreal.	Very Low
Woodworthia “Marlborough mini”	Marlborough mini gecko	3.4 km NW	At Risk - Declining	Saxicolous and terrestrial.	Very Low

[a] Hitchmough et al. (2021).

Most native lizards require indigenous habitat or surrogate habitat adjacent to contiguous forest habitat area. Based on the desktop habitat assessment, there is likely to be a predominant absence

of suitable habitat within the Project Area for most indigenous lizard species. The Not Threatened northern grass skink is however widespread and frequently recorded within highly modified habitats such as exotic scrub and rank grassland. The closest record is approximately 1 km from the Project Area[33]. It is therefore highly likely to occur within and adjacent to the Project Area.

It is highly unlikely that native frog species would occur within the Project Area. The only frog species recorded within the >5 km of the Project Area was the Southern bull frog (Introduced and Naturalised). Based on lack of suitable habitat available and lack of suitable source population, native frogs have not been considered further for the Project.

Site Investigations

A targeted lizard survey was undertaken by RMA Ecology Ltd across the Project Area between 26 January and 29 March 2023 (refer detailed report in Appendix D). Ten northern grass skinks and one unidentified skink (seen and not captured, but likely to also have been a northern grass skink) were detected during the survey. No other skink species and no gecko species were observed within the Project Area during the survey.

Northern grass skinks were found to be inhabiting sunny steep slopes that were unlikely to be grazed and which had rank grass and alternative refuge in the form of scrub or a thicket of blackberry and pōhuehue; and debris (such as scattered wood, disposed concrete and plywood) amongst rank grass. No skinks were found on the floodplain of the Maitai River or its tributary, within scrub, or amongst grazed pasture.

The findings of this survey indicate that northern grass skink is almost certainly the only species present within the Project Area and that the population that exists there is likely to be at low density and not significant in terms of the range and total population of this species.

Ecological Value

It is confirmed that the Not Threatened Northern grass skink are present throughout the Project Area, in a wide variety of dense exotic vegetation types such as areas of exotic scrub and rank grassland habitats. It is unlikely that any other native lizard species are present.

Northern grass skink are widespread and Not Threatened and the habitat value for native lizards is limited. As such, the ecological value of the habitat for lizards is considered to be **Low**.

3.1.6 Summary of Ecological Value

Table 3.12 summarises the ecological values of the ecological features (aquatic and terrestrial) present within the Maitahi Village Project Area.

Table 3.12 Summary of ecological values for aquatic and terrestrial habitat and species within the Project Area.

Ecological Feature	Assigned Ecological Value
Aquatic Habitat	
Kākā Hill Tributary (Site A, KHT1, Site B)	Moderate
Unnamed Tributaries on Eastern and Western Hillslope (KHT2, KHT3 and KHT4)	Low
Aquatic Fauna	

[33] Distance is approximated from the centre of the Project Area to the location of the DOC record.

Fish	Kākā Hill Tributary (Site A, KHT1, Site B)	Moderate
	Unnamed Tributaries on Eastern and Western Hillslope (KHT2, KHT3 and KHT4)	Low
Wetland Habitat		
Wetland 1 (western side of Kākā Valley)		Moderate
Wetland 2 (eastern side of Kākā Valley)		Moderate
Terrestrial Habitat		
Secondary native shrubland (NS)		High
Exotic scrub (ES)		Low-Moderate
Exotic grassland (EG)		Low
Cleared vegetation and accessways (CV)		Very Low
Terrestrial Fauna		
Bats		N/A
Native birds		Low-Moderate
Native Macroinvertebrates		Low
Native herpetofauna		Low

4 Project Features & Implementation

4.1 Project Key Features

Indicative key features of the complete construction of the Maitahi Village Project include the following and how they relate to ecological impacts:

- Realignment, protection, restoration and enhancement of modified watercourses to include pools, runs, riffles, woody debris, logs, and boulders to provide habitat variety where appropriate.
- Wetland and stream side riparian planting zones including shallow marsh, littoral edge, and terrestrial riparian planting.
- Connections over streams via bridges.
- Stormwater retention basins planted with native rushes and sedges.
- Overland flow paths with native planting and stone lined channels.
- Native parkland amenity planting and green connections planting.

Refer back to the main AEE report for a more detailed description of works to be authorised for the Project.

4.2 Project Implementation

The Maitahi Village development will be implemented in several stages with the following staging of project attributes:

- The proposed subdivision involves the creation of 182 residential allotments, one allotment for commercial use, along with roads to vest, reserve to vest, and also allotments to vest for utility / infrastructure purposes. The balance land (zoned rural) containing Kākā Hill will remain in one large title at the end of the subdivision and development process.
- Two of the allotments to be created are to be sold to Arvida for the development of a retirement village containing 192 residential units, a care facility containing 36 beds, and the full range of communal facilities such as a Residents Clubhouse and Pavillion.
- Development of the commercial site for the cultural base for Ngati Koata (Te Whare or Koata), containing offices, meeting rooms, function and event spaces, and a commercial kitchen.

There are a total of 11 subdivision stages (stages 1-11), with one additional stage (Stage 0) proposed as a part of undertaking an initial boundary adjustment between the applicant's title (NL11A/1012) and that adjoining title owned by Bayview Nelson Limited (RT 1039028). The planned ecological, cultural and recreational outcomes will be developed progressively at each stage. A comprehensive description of these fully integrated components of the development are provided in the Application and supporting technical reports and plans.

4.3 Description of Construction Works

Refer back to the main AEE report for a more detailed description of construction works to be authorised for the Project. Key aspects of relevance to ecology are outlined below.

The topography of the Project Area is low within the valley floor and steepens on the low to mid slopes associated with Kākā Hill to the east and Malvern Hill to the west. The Kākā Hill Tributary and several associated (unnamed) tributaries run north to south through the Project Area. The majority of the construction footprint occurs within farmland dominated by exotic pasture (EG). However, the there are small areas of regenerating native shrubland (NS), exotic scrub (ES) which will need to be partially cleared to accommodate the preliminary design. The proposed design formation for the residential lots requires a mixture of cut and fill areas, while the Lower Kākā Hill Tributary realignment requires additional cuts into the existing levels down to groundwater level.

Surface water during construction will be managed in accordance with Nelson Tasman Erosion and Sediment Control Guidelines 2019 or any subsequent version. An Erosion and Sediment Control Assessment Report has been prepared by Southern Skies Limited (SSL) and this will be further developed by the contractor and approved by Nelson City Council prior to site clearance works. At the preliminary design stage, sediment control measures include:

- Erosion controls, such as dirty and clean water diversions.
- Sediment controls, such as sediment retention ponds, decanting earth bunds, silt fences and super silt fences, chemical treatment, dewatering and pumping, and dust control.

All site drainage, from impermeable surfaces during operation will be diverted via several stormwater wetlands (located on the eastern and western side of the realigned Lower Kākā Hill Tributary stream reach) which will provide stormwater retention and treatment before discharging directly (via add structure type, once confirmed) into Kākā Hill Tributary. The construction methodology for all bridge and culvert features will be confirmed at detailed design.

The proposed realignment of the lower reach of the Kākā Hill Tributary (KHT1) involves redirecting the existing channel westward to its original alignment within a newly constructed, enhanced stream corridor. This will require the infilling of approximately 630 m^2 of the existing channel (~400 metres of intermittent stream and ~230 metres of permanent stream) and the creation of approximately 920 m^2 of new watercourse with increased sinuosity. The new channel will incorporate natural stream features, including widened and deepened sections, meanders, rock riffles, and pool habitats. Structural elements such as embedded boulders, riprap, and pinned logs will enhance habitat complexity and stabilise the channel. Riparian restoration will include native plantings supported by coco matting or similar to promote vegetation establishment and long-term bank stability. The realignment will be constructed in stages, offline from the existing stream, ensuring hydrological continuity until the new channel is stabilised, at which point the flow will be diverted into its new alignment. The former stream channel will then be decommissioned as part of the broader earthworks programme. Refer to the SSL Stage 1 Site Specific Erosion and Sediment Control Implementation (SSESCP) for further information.

An additional 300 m of intermittent stream will be reclaimed along the entire length of the Unnamed Tributary on Eastern Hillslope (KHT2) stream. The ESC measures for the works are detailed in the corresponding SSESCP prepared by SSL.

Other minor channel (intermittent reaches of KHT3 and KHT4), overland flow path works and temporary culverts will be required that will also adopt the off-line methodology. These aspects will be detailed in the relevant SSESCPs prepared by SSL.

5 Assessment of Effects on Ecological Values

5.1 Positive Effects

As outlined above in Section 4, the proposed concept design provides for the realignment (including widening and deepening), protection, restoration and enhancement of several existing stream reaches. This includes the proposal to realign of Lower Kākā Hill Tributary back to its original course. Additionally, the plan encompasses the protection, restoration, and enhancement of two existing wetlands and two intermittent streams, both of which are currently degraded and dominated by exotic vegetation. These initiatives are designed to improve the ecological integrity and functionality of the aquatic and wetland habitats within the project area, aligning with relevant Schedule X provisions of the NRMP and the NES-F/NPS-FM.

Schedule X[34] requires the development and implementation of an Ecological Restoration Plan (ERP) for the Project Area. The ERP will outline appropriate ecological restoration and enhancement of terrestrial, in-stream, wetland and riparian habitats, and management interventions required to achieve the anticipated net gain of biodiversity values within the Project Area, including for stream features and wetlands, in the medium term.

With the development (during detailed design) and implementation of the ERP, the operation of the Project is expected to result in significant net positive ecological effects, including improved water quality within the Kākā Hill Tributary and corresponding benefits to recreational values within the Maitai River catchment downstream of the site. Anticipated positive effects include:

In-Stream & Riparian Habitat

- Naturalised channel and substratum heterogeneity via channel reshaping and substrata addition using natural materials and 'alternatives' that provide further ecological benefit (e.g. improve bank stability through planting).
- Increased quantity and quality of in-stream and riparian habitat available to aquatic (and riparian) flora and fauna.
- Enhanced riparian margins with no animal stock access to improve and maintain connectivity and provide stream shade, with improved biodiversity.
- Limited water flow velocities for protection against erosion and habitat flushing.
- Improved fish passage along the Kākā Hill Tributary stream length.

Wetland Habitat

- Promoting the settling and retention of suspended solids.
- Dispersing flow to minimise short-circuiting.
- Providing surfaces for the development of microbial biofilms.
- Transporting oxygen into their root-zone to enhance nitrification and other aerobic microbial processes.
- Assimilating nutrients and returning them in slowly-available organic forms, a portion of which are retained in accreted sediments.
- Producing litter as a source of organic carbon for denitrification and other microbial processes;
- Enhancing biodiversity and aesthetic values.

Further positive ecological outcomes and enhancement opportunities should be developed during detailed design. If implemented, these could include:

- Opportunities for a net increase in green infrastructure and habitats within the Project Area.

[34] REr.6.4.iii.

For example, planting native street trees, and planting native vegetation rather than grass, on roadsides and around stormwater wetlands. The Assessment of Landscape and Visual Effects report by RMM outlines recommendations to ensure ecological enhancement opportunities are capitalised upon at these locations.

- Landscape planting that enhances existing retained habitat (e.g. under-plant retained native and exotic shrubs and trees with native understorey vegetation and replace exotic vegetation with native species).
- Include the design of stormwater wetland features that adhere to best practice ecological outcomes, aiming to improve water quality, enhance habitat connectivity, and increase biodiversity.
- Connect stream profiling and landscape planting with adjacent stream reaches[35].

5.2 Assessment of Construction Effects

The proposed construction activities have the potential to cause temporary impacts on ecological features within and adjacent to the Project Area, without impact management.

Appendix A includes full details of the justification for the ecological values assessment and the magnitude of effect assessment that have resulted in the level of effect as per the EIANZ Guidelines.

Construction phase ecological effects include loss and modification of in-stream habitat; loss of existing vegetation cover, potential injury and/or mortality of native freshwater species; reduction in stream ecological function from possible sediment discharge and stream bed disturbance; temporary disturbance to avifauna; potential injury and/or mortality of lizards.

The effects assessment is based on the following embedded mitigation being delivered during construction of the Project:

- A provisional Erosion and Sediment Control Plan has been prepared for the Project which describes how the effects of sedimentation from construction earthworks will be managed. As such, it is assumed that issues related to sediment generation are adequately mitigated and will not lead to adverse ecological effects. This includes the potential effects on the downstream receiving environment (Maitai River and Nelson Haven) as it has been assumed that it can be acceptably managed as part of project delivery.
- Stormwater generated from the construction area will be treated through industry standard best practice measures, to remove or reduce contaminants to acceptable levels prior to discharge into any waterway within or adjacent to the proposed works area.

The Project will restore the lower intermittent reaches of the Kākā Hill Tributary, allowing it to flow through its original channel along the western edge of the historic floodplain. In terms of terrestrial ecology, no high-value habitats are known to exist within the area designated for this realignment on the Project plan. Accordingly, potential effects of the realignment on terrestrial ecology are not addressed further in this report.

Requirements for proposed activities to preclude injury/mortality of native animals under the Wildlife Act (1953) is considered separately to this assessment and is addressed as part of Impact Management (Section 6).

5.2.1 Aquatic Ecology

Table 5.1 integrates specific ecological values described in Section 3 above, and lists the potential effects (direct and indirect) to the **aquatic habitats** and **fish** within the Project Area and their magnitude of effect. This is then used to calculate an overall level of effect to each ecological feature, prior to mitigation.

[35] Noting the proposed rehabilitation of ecological (riparian and freshwater) values within the area of Kākā Hill Tributary immediately above the confluence with the Maitai River.

Table 5.1 Magnitude of effects and subsequent level of effect (without mitigation) of the Project on the aquatic ecology features present within the Project Area during the construction phase.

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation
Lower Kākā Hill Tributary (KHT1) - Freshwater in-stream and riparian habitat	Moderate	Termorary loss and modification of in-stream and riparian habitat. In the short term, existing riparian vegetation (exotic grassland) along ~630 m of stream will be removed for the realignment of the Lower Kākā Hill Tributary. Flow diversion during construction may affect downstream hydrology, habitat, and species. Earthworks pose risks of erosion, sedimentation, and potential chemical spills, impacting in-stream habitat and fauna.	Moderate	Short-term construction effects, including earthworks and temporary flow diversion, will be localised and confined to a few days during flow diversion. No ecological disturbance to the down stream environment (i.e. Maitai River/Nelson Haven) or the broader catchment expected. Flow diversion will only occur once the new channel is stabilised and vegetation established, ensuring localised and short-term impacts. Seasonal timing will avoid critical fish migration and spawning periods, while erosion and sediment controls will minimise potential contaminant impacts.	Moderate
Lower Kākā Hill Tributary (KHT1) - Native fish	Moderate	In-stream disturbance during construction (e.g. bridge installation, culvert removal, vegetation clearance, channel infilling), may impact on native fish within the subject impact reach. This activity may result in fish injury or death. The removal of existing culverts (C1) may lead to improved fish passage within the Project Area.	Very High	Death/injury of native fish species is considered to be an unacceptable effect that is highly likely to occur during in-stream works.	Moderate

Unnamed Tributary on Eastern Hillslope (KHT2) - Freshwater habitat in-stream & riparian	Low	Reclamation (infilling) during construction of c. 300 m of the associated stream reach and the removal of riparian margin vegetation (exotic grassland) as part of the Project works. Reclamation of this stream reach may require the diversion of current flow. Management of the flows from this reach during construction may pose a risk to downstream hydrology and may impact downstream habitat and species.	Moderate	Permanent loss of highly modified intermittent stream habitat over a relatively large extent. This reach lacks in-stream/riparian values and does not appear to support TAR species. Downstream flow modification may occur but is likely to be temporary and intermittent. The magnitude of effects assessment assumes a seasonal constraint on in-stream works or flow diversions during construction.	Moderate
Unnamed Tributaries on Eastern and Western Hillslope (KHT3 and KHT4) - Freshwater habitat in-stream & riparian	Low	Existing riparian vegetation (exotic grassland) will be temporarily removed along approximately 140 m (KHT3) and 340 m (KHT4) of stream for minor realignment work, impacting in-stream and riparian habitats. Post realignment, the stream, floodplain, and riparian margins will be restored and replanted with native habitats. Flow diversion during construction could affect downstream hydrology and habitats. Additionally, earthworks may lead to erosion, sedimentation, or chemical spills, impacting downstream habitats and species.	Low	Construction may cause short-term negative effects, but medium-term outcomes of the streambed restoration are expected to be positive as newly planted areas mature, enhancing in-stream habitat and filtration. Downstream flow modifications could be temporary and intermittent, with construction activities and flow diversions constrained seasonally to minimise impact. Although sediment and chemical contaminants could affect areas beyond the Project Area, effectively implementing erosion and sediment controls can significantly mitigate their frequency, duration, and likelihood.	Very Low
Unnamed Tributaries on Eastern and Western Hillslope (KHT2, KHT3 and KHT4) - Native Fish	Low	In-stream disturbance during construction (e.g. bridge installation, culvert removal, vegetation clearance, channel infilling), may impact on native fish within the subject impact reach. This activity may result in fish injury or death. The removal of existing culverts (C4,5) may lead to improved fish passage within the Project Area.	Low	Death/injury of native fish species is considered to be an unacceptable effect that is highly likely to occur during in-stream works.	Very Low

Lower Kākā Hill Tributary (KHT1) and Unnamed Tributaries on Eastern and Western Hillslope (KHT3 and KHT4) - In-stream Habitat Enhancement	Low-Moderate	Enhancement of in-stream habitat within the realigned stream and reserve design is expected to provide multiple benefits, namely ecological, amenity, and stormwater management.	Positive	Increased sinuosity and in-stream habitat heterogeneity through the inclusion of boulders to create riffles. Improved water quality and habitat for freshwater fauna through temperature control, organic nutrient inputs, and increased habitat diversity.	Net Gain
Lower Kākā Hill Tributary (KHT1) and Unnamed Tributaries on Eastern and Western Hillslope (KHT3 and KHT4) – Riparian Habitat Enhancement	Low-Moderate	Enhancement of riparian habitat through native plantings along the realigned stream KHT1 and the existing KHT3 and KHT4 stream channels.	Positive	Riparian planting will enhance in-stream water quality and habitat by providing shading, organic inputs, and bank stabilisation, reducing erosion and supporting TAR species, including īnanga (At Risk – Declining). The realigned KHT1 channel will have c. 15–30 m or more of planted riparian margin on both banks, while KHT3 and KHT4 will have c. 5–15 m.	Net Gain

5.2.2 Wetland Habitat

Table 5.2 integrates specific ecological values described in Section 3 above, and lists the potential effects (direct and indirect) to the **wetland habitats** within the Project Area and their magnitude of effect. This is then used to calculate an overall level of effect to each ecological feature, prior to mitigation.

Table 5.2 Magnitude of effects and subsequent level of effect (without mitigation) of the Project on the wetland features present within the Project Area during the construction phase.

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation
Wetland Habitats - Wetland 1 (Western Side of Kākā Valley)	Moderate	Upslope earthworks within a 100 m setback may cause erosion and sedimentation entering the wetland during construction.	Low	The assessment assumes effective implementation of erosion and sediment controls, minimising frequency, duration, and likelihood of sedimentation.	Low
Wetland Habitats - Wetland 1 (Western Side of Kākā Valley)	Moderate	Upslope earthworks within a 100 m setback may cause hydrological modification during construction, with potential long-term impacts on wetland function due to topographical changes.	Moderate	The effect is reduced by the location and limited scale of earthworks relative to the wetland and its catchment size, though periodic impacts are still possible. Hydrological assessment will be necessary to confirm no adverse changes to wetland hydrology.	Moderate
Wetland Habitats - Wetland 2 (Eastern Side of Kākā Valley)	Moderate	Earthworks within 100 m may cause erosion and sedimentation entering the wetland during construction.	No Effect	Wetland 2 is hydrologically independent of the proposed earthworks area, eliminating potential sedimentation impacts. No earthworks are proposed upslope.	N/A
Wetland Habitats - Wetland 2 (Eastern Side of Kākā Valley)	Moderate	Earthworks may cause hydrological modification of Wetland 2 during construction, with potential long-term impacts on hydrological function.	No Effect	Wetland 2 does not receive surface or subsurface flows from the proposed earthworks area, confirming no potential hydrological impact.	N/A

5.2.3 Terrestrial Ecology

Table 5.3 integrates specific ecological values described in Section 3 above, and lists the potential effects (direct and indirect) to the **terrestrial habitats** and **fauna** within the Project Area and their magnitude of effect. This is then used to calculate an overall level of effect to each ecological feature, prior to mitigation.

Table 5.3 Magnitude of effects and subsequent level of effect (without mitigation) of the Project on the terrestrial ecology features present within the Project Area during the construction phase.

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation
Terrestrial Habitats - Secondary native shrubland (NS), Exotic scrub (ES), Exotic grassland (EG) and cleared vegetation (CV)	Very Low to High[a]	Temporary loss of habitat/ecosystem and edge effects.	Negligible	The overall extent of (highly modified) habitat loss is limited at both a site and catchment scale. The vast majority of taller native shrubs/ trees, including kānuka, will be retained by the Project. Post-construction native replanting of the Project Area (where practicable) will reestablish/enhance native habitat values and sequences within the Project Area and surrounds.	Very Low
Birds	Low to Moderate	Loss of foraging and breeding habitat through vegetation removal. Fragmentation of habitat.	Negligible	Retained habitat (native vegetation) within the Project Area and surrounding area will continue to provide habitat for native birds. Post-construction habitat creation and restoration (e.g. through native planting and stabilisation) efforts will enhance ecological value, increasing biodiversity, species richness, and an increased potential to support TAR bird species.	Low
Lizards	Low	Temporary loss of foraging and breeding habitat through vegetation removal. Fragmentation of habitat.	Negligible	Retained habitat (native vegetation) within the Project Area and surrounding area will continue to provide habitat for native lizards, including northern grass skink. Post-construction habitat creation and restoration (e.g. through native planting and stabilisation) efforts will enhance ecological value, increasing biodiversity, species richness, and an increased potential to support TAR lizard species.	Low

5.3 Assessment of Operational Effects

Operational phase ecological effects include in-stream enhancement, wetland enhancement, and enhancement via riparian and terrestrial plantings.

The Project Area is already highly disturbed and fragmented due to existing land use. While the proposed residential subdivision development could potentially exacerbate these issues—such as reducing habitat availability, increasing edge effects, and introducing additional human activity (e.g., noise, lighting, and domestic pets)—these impacts are expected to be minimal. The species likely to be present are generally adapted to human-modified environments, and the magnitude of these changes is assessed as Low.

The overall operational effects on terrestrial, aquatic, and wetland habitats and associated fauna have been assessed as **Low** to **Very Low**. Consequently, they have not been considered further in this assessment.

Importantly, significant positive ecological outcomes are expected in the medium to long term as a result of the proposed development. The establishment of stormwater wetlands, outlined in Section 5.1, will enhance water quality and provide new habitat opportunities for aquatic and wetland species. Furthermore, the restoration and enhancement of terrestrial, wetland, in-stream, and riparian habitats are anticipated to deliver a ***Net Gain*** in biodiversity values. These measures are designed to contribute to the long-term ecological health and resilience of the area, transforming the currently degraded landscape into a more diverse and functional ecological system.

6 Proposed Impact Management

The key ecological effects requiring management occur during the construction phase of the Project. Ecological input into design and proposed activities have sought to raise issues early to assist where possible to avoid, remedy and minimise adverse effects and maximise ecological benefits. The potential adverse ecological effects detailed in Section 5 can be minimised or managed through best practice environmental management as outlined below.

In accordance with the EIANZ guidelines, measures to avoid, remedy, or mitigate effects are focused on aquatic ecological features where the level of effect has been assessed as **Moderate**, **High**, or **Very High**, or where regulatory requirements (e.g., Wildlife Act) necessitate specific management actions.

6.1 Aquatic Ecology

6.1.1 Recommendations for Avoiding or Minimising Potential Adverse Effects

6.1.1.1 Avoidance

Due to historic degradation, aquatic ecological features and values are of low ecological value with the exception of native fish, and did not necessitate complete avoidance in context of the potential benefits of the Project, in particular with respect to the restoration potential of the site.

Schedule X and the initial assessment for the proposed Maitahi Village development highlighted the importance of preserving, restoring and enhancing major stream corridors within the Project Area. A key priority was set on restoring the original alignment of the Lower Kākā Hill Tributary (KHT1) and minimising further impacts on both the tributary and its floodplain. The Project further prioritises the restoration and enhancement of the intermittent stream reaches associated with KHT3 and KHT4. All three watercourses have undergone historical modifications, largely lack riparian vegetation and include the installation of existing culverts. Due to the constraints on site design and topographical confinement, completely avoiding impacts on these streams was not possible. To achieve this, temporary impacts on KHT1, KHT3 and KHT4 during realignment and enhancement works are unavoidable but necessary to deliver the overall ecological restoration goals for the Site.

6.1.1.2 Minimisation

Where avoidance was not achievable, mitigation measures have been applied to aquatic attributes assessed with a Moderate or higher level of effect, as detailed in Table 6.1.

Table 6.1 Aquatic ecology features requiring mitigation.

Ecological feature	Effects Description	Level of Effect, Without Mitigation	Mitigation Reference
Lower Kākā Hill Tributary (KHT1) and Unnamed Tributaries on Eastern and Western Hillslope (KHT2, KHT3 and KHT4) - Freshwater instream and riparian habitat	The diversion of an approximately 630 m of the existing KHT1 channel (~400 metres of intermittent stream and ~230 metres of permanent stream) and intermittent KHT3 (c. 140 m) and KHT4 (c. 340 m) reaches, whilst degraded, has the potential to negatively impact the overall ecological value of the site.	Moderate	a)

Unnamed Tributary on Eastern Hillslope (KHT2) - Freshwater habitat in-stream & riparian	Permanent loss of 300 m of Low value intermittent stream habitat associated with KHT2 on the eastern hillslope. This will include the removal of associated riparian margin vegetation (exotic grassland).	Moderate	b)
Lower Kākā Hill Tributary (KHT1) and Unnamed Tributaries on Eastern and Western Hillslope (KHT2, KHT3 and KHT4) - Native fish	In-stream disturbance during construction (e.g. bridge installation, culvert removal, vegetation clearance, channel infilling), may impact on native fish within the subject impact reach. This activity may result in fish injury or death.	Moderate	c)

a) Temporary loss of 1,110 m of permanent and intermittent stream

Diversion of parts of KHT1 (~630 m), KHT3 (~140 m) and KHT4 (~340 m) is required for realignment and cannot be mitigated 'at the point of impact'; therefore the remaining level of effect remains as **Moderate** and is further considered within the Residual Effects Section 6.1.2.

b) Loss of 300 m of intermittent stream

The reclamation of the entire length of the Unnamed Tributary on Eastern Hillslope (KHT2) stream (300 m) cannot be mitigated 'at the point of impact'; therefore the remaining level of effect remains as **Moderate** and is further considered within the Residual Effects Section 6.1.2.

c) Fish injury or death

In-stream works during construction i.e. bridge installation, culvert removal, channel infilling, may impact on native fish within stream reaches KHT1, KHT2, KHT3 and KHT4. This activity may result in fish injury or death. To prevent this, mitigation measures are outlined below:

- In-stream works restricted to low flow, summer period and also to avoid native fish migration periods (November to May).
- Include a Native Fish Salvage and Management Plan as a condition of consent.

6.1.1.2.1 Timing of Works

Instream works

In-stream works should be undertaken during low stream flow conditions over the dry summer period. March – April would be the best time of year for the stream diversion to be put in place and would simultaneously avoid adverse effects on birds during the nesting season.

The new channel(s) should be constructed before diverting flows. If the stream realignment and enhancement is to be staged due to construction necessity and the full required length is unable to be achieved immediately, a combined offset (via new stream realignment and enhancement) and compensation (riparian planting) approach may be used.

Fish

Stream dewatering should be undertaken during months when the intermittent section of the streams is expected to be dry to reduce potential adverse effects on fish. Freshwater fauna sal-

vage work should ideally be completed within one summer/autumn season, preferably between December and May which is the optimum time for capturing native freshwater fish (Joy et al., 2013).

6.1.2 Recommendations for Addressing Adverse Residual Effects that cannot be Avoided or Minimised

Stream realignment and enhancement works of will lead to the temporary loss of 1,110 m of highly degraded riparian and in-stream habitat along the Lower Kākā Hill Tributary (KHT1) and intermittent reaches associated with KHT3 and KHT4. The Project will have a **Moderate** level of effect on the habitat values of this stream even after measures to avoid, remedy or mitigate have been considered.

The Unnamed Tributary on Eastern Hillslope (KHT2) reach will be reclaimed leading to the complete loss of 300 m of highly modified riparian and in-stream stream habitat. The Project will have a **Moderate** level of effect on the habitat values of this stream even after measures to avoid, remedy or mitigate have been considered.

The permanent and intermittent flowing reaches of KHT1, KHT2, KHT3 and KHT4 meet the NPS-FM definition of a river and therefore the constraints on complying activities outlined within the NES-F[36] apply to the streams and surrounding area. Because potential impacts on the streams are inconsistent with the NPS-FM[37], it will be necessary to conduct further assessment and carry out biodiversity offsetting to compensate for the loss of river extent and values[38]. Associated information requirements and the proposed approach are outlined in Section 6.1.3 below.

6.1.3 Residual Effects Management Approach

The proposed residual effects management approach seeks to achieve No Net Loss or preferably Net Gain standard (Maseyk et al. 2018; Baber et al.2021) outcomes for the **Moderate** residual adverse effect on streams KHT1, KHT2, KHT3 and KHT4. This will be achieved through stream restoration.

As mentioned above in Section 2.5.1 Site Investigations, the Auckland Council SEV: a method for assessing the ecological functions of Auckland streams (Storey et al. 2011)[39] provides guidelines for calculating an Environmental Compensation Ratio (ECR) to offset the adverse effects of stream loss. The calculation of an ECR will guide the type and magnitude of proposed stream restoration measures required during the detailed design phase, as further outlined below. The application of the ECR provides transparency, process and justification for the proposed stream offset.

6.1.3.1 Proposed Stream Offsetting Approach

Lower Kākā Hill Tributary (KHT1) and KHT3 and KHT4 Offset

The realignment of KHT1 (~630 m), KHT3 (~140 m), and KHT4 (~340 m) will result in the diversion of degraded stream reaches but may still have residual ecological impacts on the freshwater envi-

[36] Reclamation of the bed of any river is a discretionary activity, per Section 57 of the NES-F.

[37] Policy 3.24 outlines that the loss of river extent and values is avoided.

[38] In accordance with the effects management hierarchy as defined in Policy 3.21 of the NPS-FM.

[39] The Stream Ecological Valuation (SEV) method (Storey et al. 2011) assesses how well the main ecological functions of a stream reach are being performed. The ecological functions assessed are: (1) Hydraulic function – processes associated with water storage, movement and transport; (2) Biogeochemical function – related to the processing of minerals, particulates and water chemistry; (3) Habitat provision functions – the types, amount and quality of habitats that the stream reach provides for native flora and fauna; and (4) [Native] biodiversity function – the occurrence of diverse populations of indigenous native plants and animals that would normally be associated with the stream reach. It incorporates a broad range of physical and biological measures derived from field and desktop assessment.

ronment. To offset these impacts, the realigned channels will incorporate enhanced in-stream and riparian habitat features, improving ecological function, habitat diversity, and connectivity (refer to RMM Concept Landscape Plan for design details). Key offsetting measures include:

- Creation of new habitat features to support aquatic recolonisation and improve fish passage.
- Enhanced riparian buffers to stabilise banks, provide shading, and contribute organic inputs.
- Reconfigured flow paths to maintain water transport capacity while optimising ecological value.

Unnamed Eastern Tributary (KHT2) Offset

The proposed offset for KHT2 will likely be achieved through restoration and enhancement of the non-realigned sections of Eastern KHT3 and Western KHT4 that are not required to offset losses associated with their own realignment.

Eastern KHT3 (285 m) and Western KHT4 (200 m) provide a total of 485 m of available intermittent stream for offsetting. If further offsetting is required, an additional 180 m of intermittent stream associated with Wetland 1 and 500 m of permanent stream from the Upper Kākā Hill Tributary are available within the Project Area.

These offset locations overlaid with the RMM concept landscape plan are shown in Figure 6.1, which depicts the realigned (impact) and offset reaches in relation to the Project Area and proposed restoration measures.

Preliminary Environmental Compensation Ratio (ECR) Estimate

While a detailed ECR assessment will be conducted during the final design phase, an interim tiered ECR approach has been applied, recognising the lower ecological value and higher restoration potential of intermittent streams:

- 1.5:1 for permanent streams (KHT1)
- 1.2:1 for intermittent streams (KHT3, KHT4, KHT2)

Stream Reach	Reclamation Impact (m)	Channel Width (m)	Existing Ecological Value	ECR Applied	Justification for ECR	Required Offset (m²)
KHT1 (Permanent)	630	2.0	Highly modified but retains some permanent flow and limited aquatic habitat.	1.5:1	Retains some permanent flow and aquatic habitat; higher compensation required to ensure habitat functionality.	945
KHT3 (Intermittent)	140	1.0	Highly degraded intermittent stream with poor riparian cover and reduced ecological function.	1.2:1	Heavily degraded intermittent stream; moderate restoration potential, lower ECR applied.	168

KHT4 (Intermittent)	340	1.0	Highly degraded intermittent stream with significant past modification and poor habitat quality.	1.2:1	Intermittent stream with significant modification; functional uplift expected through restoration, lower ECR applied.	408
KHT2 (Intermittent)	300	1.0	Highly modified intermittent stream with limited riparian cover and altered hydrology.	1.2:1	Highly modified with limited riparian cover; restoration will provide significant ecological improvement, lower ECR applied.	360
Total Required Offset						**1,881 m²**

Offset Location	Channel Width (m)	Available Offset within Project Area (m²)
Lower Kākā Hill Tributary (KHT1) Realignment (460m × 2m channel width)	2.0	920
Eastern KHT3 Realignment	1.0	285
Western KHT4 Realignment	1.0	200
Wetland 1 (Intermittent Stream)	1.0	180
Upper Kākā Hill Tributary (Permanent Stream)	1.0	500
Total Available Offset within Project Area		**2,085 m²**

- Total Required Offset (Tiered ECR): 1,881 m²
- Total Available Offset within Project Area: 2,085 m²
- Net Surplus: +204 m²

The available offsets exceed the compensation requirements, demonstrating a Net Gain outcome while still allowing for potential refinements during detailed design. Additionally, this available offset calculation assumes a 1 m channel width for non-KHT1 reaches. If wider channels are constructed during realignment, the total offset area will increase proportionally, further ensuring a *Net Gain* outcome.

Riparian Planting

Riparian planting using a heterogenous mix of native species typical of the Bryant Ecological District should be undertaken along the all stream channels to restore the riparian margins of these streams. Riparian revegetation has the potential to create more diverse and stable stream, food

webs, enhance habitat diversity, improve temperature regulation for in-stream biota, provide organic matter inputs, improve soil infiltration capacity, reduce long-term bank erosion, and reduce sediment and nutrient concentrations (Davies-Colley et al., 2009; McKergow et al., 2016). Where practicable, a minimum riparian buffer width of 10 metres from the stream edge is recommended to meet restorative functions (Collins et al., 2013).

Stream Restoration Plan

Upon finalising the realignment design, a Stream Restoration Plan (SRP) will be developed and implemented as a condition of consent. The SRP will ensure offsetting measures are robust, measurable, and adaptive, aligning with ecological and biodiversity compensation principles.

The SRP will include:

- Hydraulic assessment of KHT1, KHT3, and KHT4 to confirm flow regime maintenance.
- SEV assessment for KHT1, KHT2, KHT3, and KHT4 to inform ECR calculations, ensuring No Net Loss or Net Gain.
- Details of offset measures, including methodology, scope, and implementation timeline.
- Long-term maintenance actions, such as planting, pest control, and erosion management for at least five years.
- Monitoring objectives, performance targets, and adaptive management triggers to track success.
- A review and modification process for refining the SRP and monitoring programme as needed.
- Reporting requirements for compliance, monitoring results, and restoration progress.

The final Environmental Compensation Ratio (ECR) calculation will be confirmed during detailed design to ensure it reflects site-specific hydrological and ecological conditions. A Stream Ecological Valuation (SEV) assessment will be conducted at this stage to quantify functional gains, ensuring the ECR aligns with the Net Gain outcomes sought by the Project. This approach allows flexibility to optimise offsetting measures based on final channel design, stormwater conveyance needs, and ecological uplift.

Given the interdependence of the SRP with the broader Ecological Restoration Plan (ERP) for the wider Project Area, the SRP will be integrated into the ERP. This coordinated approach will ensure efficient implementation and maximise ecological benefits across the site.

6.2 Wetland Ecology

6.2.1 Recommendations for Avoiding or Minimising Potential Adverse Effects

In accordance with the EIANZ guidelines measures to avoid, remedy or mitigate effects is focused on wetland features where the level of effect was assessed to be **Moderate**, **High** or **Very High**.

Schedule X and the initial assessment for the proposed Maitahi Village development highlighted the importance of preserving wetlands within the Project Area. A key priority is to protect, restore, and enhance wetland habitats to improve their hydrological function, biodiversity values, and overall ecological integrity. As described in Section 5.1 Positive Effects, the Project will protect, restore and enhance all wetlands mapped within the Project Area. Measures to minimise impacts on the associated catchments included alterations to the lot boundaries and access arrangement footprint to prevent loss of wetland values and extent by incorporating those present within sufficient riparian margin buffer.

Due to the constraints on site design and topographical confinement, completely avoiding potential impacts on wetland features was not possible.

Where avoidance was not achievable, mitigation measures have been applied to wetland habitats assessed with a Moderate or higher level of effect, as detailed in Table 6.2.

Table 6.2 Wetland features requiring mitigation.

Ecological feature	Effects Description	Level of Effect, Without Mitigation	Mitigation Reference
Wetland 1	Upslope earthworks within a 100 m setback have the potential to result in hydrological modification of Wetland 1 during construction. Catchment level changes (e.g. through topographical modification) have potential to impact hydrological functioning over the long term, which may result in loss of wetland values and extent.	Moderate	a)

6.2.2 Mitigation Measures to Address Potential Wetland Loss

Wetland Restoration Plan

As part of the proposed ERP, a Wetland Restoration Plan will be developed and implemented. This plan will focus on the restoration and enhancement of both Wetland 1 and Wetland 2 to improve their ecological function, hydrological stability, and habitat value. These measures aim to achieve long-term ecological resilience, ensuring both wetlands provide improved biodiversity support and water quality benefits.

Wetland 1

- Wetland 1 is a degraded wetland impacted by historical land use activities. The restoration plan will focus on:
- Hydrological Protection – Incorporating a Wetland Hydrology Assessment as a condition of consent to identify measures to protect existing hydrological inputs and minimise alterations from earthworks. This assessment will directly address mitigation reference **a)** in Table 6.2, ensuring that potential hydrological modifications are effectively managed to maintain wetland function and prevent loss of ecological values[40].
- Revegetation – Native wetland plantings will be introduced within a 10-20 m buffer, using species that promote hydrological retention and improve habitat complexity.
- Sediment and Nutrient Management – Erosion control measures will be implemented to prevent sedimentation and nutrient loading from upslope land use.

Wetland 2

Wetland 2 will not be impacted by proposed works but has been historically modified and degraded. Restoration measures will include:

- Enhancing Buffer Vegetation – Expanding the riparian buffer using locally sourced indigenous species to increase habitat value and stabilise wetland edges.
- Managing Hydrological Inputs – Protecting existing water flow pathways and ensuring any surface water redirection does not adversely affect wetland function.

[40] As required by 51(1)(a) of the NES-F given the proposed earthworks within a 100 m setback from Wetland 1.

- Invasive Species Control – Managing exotic vegetation encroachment to promote native wetland plant dominance.

By implementing these restoration measures, both Wetland 1 and 2 are expected to maintain theit-ecological function and provide long-term improvements to wetland habitat quality.

6.3 Terrestrial Ecology

6.3.1 Recommendations for Avoiding or Minimising Potential Adverse Effects

There were no terrestrial ecological features identified where the level of effect (construction and operation) was assessed to be Moderate or higher. As such, and in accordance with the EIANZ guidelines, specific efforts to avoid, remedy or mitigate effects on these features is not required. Ecological restoration and enhancement will occur within the Project Area. This planting is also anticipated to benefit bats, birds and lizards and the provision of appropriate habitat for these species should form part of any restoration plan objectives to be outlined in the Project ERP.

Notwithstanding, we suggest the following measures be implemented prior to and during the construction phase of the Project:

- Avoid direct effects to the habitat immediately outside of the Project Area. This should include careful selection of appropriate machinery to minimise disturbance.
- Where the proposed works remove indigenous vegetation it is recommended that care is taken to ensure stabilisation of exposed earthworks as soon as possible along the exposed edge, with suitable native tree and shrub species. In this regard, invasive weeds need to be managed along these edges. Avoid washing of organic material into watercourses, stockpile organic mulch away from watercourses, the output from chippers etc should not to be directed towards watercourses, and cleared vegetation on-site should only be stockpiled short-term and either mulched or disposed of off-site.
- Avoid removal of larger shrubs/trees where practicable.

The Wildlife Act 1953 must be complied with, as such management measures must still be implemented to ensure that Project activities do not injure or kill native wildlife. These are outlined below.

6.3.1.1 Lizard management

On-site lizard surveys have confirmed the presence of native lizard species. Accordingly, a specific Lizard Management Plan (LMP) should be prepared by an appropriately qualified and experienced herpetologist. The LMP will outline measures required to ensure native lizards are protected.

6.3.1.2 Bird management

To effectively manage the potential direct injury/mortality threats on native birds and their eggs, mitigation is recommended by means of seasonal constraints for vegetation clearance activities across the higher quality native dominant areas. The removal of native woody trees and large shrubs should be carried out outside of the peak bird breeding season (August to February inclusive).

6.4 Overall Level of Effects

Table 6.3 Overall level of ecological effects with effect management implemented.

Impact	Ecological component	Ecological value (habitat or species)	Effects management	Revised Magnitude of Effect	Revised Level of Effect
Loss and modification of in-stream habitat	Impact Reaches (KHT1, KHT2, KHT3, KHT4)	Low to Moderate	Stream offsetting, riparian planting	Low	**Low** to **Very Low**
Loss of existing vegetation cover	Vegetation	Very Low to High	N/A	Negligible	**Very Low**
Potential injury and/or mortality of native freshwater species	KHT1, KHT2, KHT3, KHT4	Low	Native Fish Salvage and Management Plan	Low	**Very Low**
Reduction in stream ecological function from possible sediment discharge and stream bed disturbance	Kākā Hill Tributary	Low	Erosion and Sediment Control Plan	Low	**Very Low**
Temporary disturbance to birds	Birds	Low to Moderate	Bird management	Negligible	**Very Low**
Potential injury and/or mortality of lizards	Lizards	Low	Lizard managment	Negligible	**Very Low**
In-stream and riparian enhancement of Kākā Hill Tributary	Kākā Hill Tributary and intermittent tributaries	Low to Moderate	N/A	Positive	**Net Gain**
Wetland restoration and enhancement	Wetland 1 and Wetland 2	Moderate	N/A	Positive	**Net Gain**

Figure 6.1. Proposed offset stream locations overlaid with the RMM concept landscape plan.

PROJECT: MAITAHI VILLAGE, KĀKĀ VALLEY

Proposed Offset Streams

| Date: 29 Jan 2024 | Revision: A | Aerial: UAV May 24, LINZ 0.075m (22)
Plan map prepared for CCKV by Robertson Environmental Limited

Project Manager: Ben.Robertson@robertsonenviro.co.nz

7 Cumulative Effects

As per EIANZ guidelines, assessment of ecological effects of a project should consider cumulative impacts on the environment and not just the direct effects of the single project application. For the purposes of the Project it is considered that the proposed Project Area and the downstream receiving environment associated with Kākā Hill Tributary, Maitai River and Nelson Haven are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native birds and fish.

As the existing environment has been extensively modified, the specific impacts of the Project discussed in this report have been minimal, and adverse effects have largely been avoided. The proposed ecological mitigation and offset measures include enhancing freshwater systems (streams) where appropriate. It is anticipated that the Project will contribute meaningfully to local ecological connectivity. Additionally, the buffering effect of terrestrial and freshwater habitat protection, restoration and enhancement is expected to improve ecological values both within the Project area and in adjacent areas. This Project also recognises the opportunity to reverse historical impacts caused by land conversion to agriculture, thereby addressing associated cumulative effects in the long term. Consequently, cumulative adverse effects are not anticipated.

8 Summary & Conclusions

An estimate of habitat change resulting from the Project can be undertaken by importing the preliminary site design into a GIS environment. This allows a semi-quantitative estimate to be made of the habitat likely to be impacted. The areal footprint of the Project Area overlaid on a map of habitat types is shown above in Figure 3.3 with spatial proportions summarised in Table 3.1.

The Project Area is highly modified and consists of poor-quality freshwater and terrestrial habitat. Regardless, some effects of the redevelopment works, particularly in the watercourses, need to be managed. Fauna management and habitat replacement considerations will need to be addressed to develop the site as proposed. Many potential effects occur during the construction phase which can be minimised by timing and the staging of the development.

Through the proposed effects management outlined in this report, the overall effects of the proposed works are considered to be Very Low. No permanent loss of freshwater (in-stream or riparian) or terrestrial values is expected to occur.

Overall, it is considered that any effects resulting from the proposed activity will be relatively localised and limited to the construction phase (short term). With the volunteered integration of impact mitigation and development (during detailed design) and implementation of appropriate ecological restoration and enhancement of terrestrial, in-stream, wetland and riparian habitats, operation of the Project is anticipated to have significant ***Net Gain*** outcomes for local ecology in the medium to long term.

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10 Limitations & Applicability

As with all one-off field ecological assessments, seasonal or temporal variation in the presence of mobile fauna means that the presence or absence of such fauna cannot be ascertained with great accuracy. The condition of habitat often becomes the surrogate for the presence or absence of fauna rather than observed condition on the day of the survey.

This assessment has been carried out in line with the proposal given to the Client by Robertson Environmental Limited. This is assumed in this assessment to be the development area being sought by this application. We note that this design may not be final. Depending on the scope of any future development and detailed design changes, further ecological assessments, including further quantitative assessments may be required.

Robertson Environmental's professional opinions are based on its professional judgement, experience, and training. These opinions are also based upon data derived from the field survey and analysis described in this document, with the support of relevant guidelines (EIANZ, 2018). It is possible that additional surveying, testing and analyses might produce different results and/or different opinions. Should additional information become available, this report should be updated accordingly. Robertson Environmental Limited has relied upon information provided by the Client to inform parts of this document, some of which has not been fully verified by Robertson Environmental Limited. This document may be transmitted, reproduced or disseminated only in its entirety.

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