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Glossary and Acronyms / terms

Acronym / Term	Description
Commencement of Construction Works	The time when Construction Works for the Project (excluding Enabling Works) commence.
Completion of Construction Works	The time when Construction Works for the Project (or the relevant part of the Project) is complete and is available for use.
Construction Works	Those works necessary to construct and establish the Project, including: <ul style="list-style-type: none"> • Bulk earthworks (including cut and fill activities). • Ground improvement works. • Establishment of bridges, culverts, drainage, stormwater treatment and disposal systems, noise mitigation features, and other structures. • Temporary construction yards, buildings, and laydown areas. • Temporary haul roads, access points, and traffic management. • Temporary drainage and erosion and sediment control measures. • Landscaping and planting. • Pavements and surfacing. • Road furniture and ancillary works. • Site reinstatement and rehabilitation activities.
Early Works	The Kaiapoi Bridge strengthening and quarry lakes partial reclamation authorised under CRC260612, CRC230304, CRC230305, CRC230306, CRC230307 and RC255072.
Operations and Maintenance Activities	Those activities needed to ensure the completed Construction Works function effectively and safely on an ongoing basis.

Acronym / Term	Description
ASPM	Average Score Per Metric
bgl	Below Ground Level
BML	Boffa Miskell Ltd, the contractor engaged by NZTA to undertake freshwater surveys and to prepare a stream survey assessment report.
BOAM	Biodiversity Offset and Accounting Models
CLWRP	Canterbury Land and Water Regional Plan (March 2025 version)
CEMP	Construction Environmental Management Plan
Construction Works	Those works necessary to construct and establish the Project.
CRPS	Canterbury Regional Policy Statement (July 2021 version)
Designation	As the context requires: <ul style="list-style-type: none"> • Existing: The designation for the Project and State Highway 1 in an operative version of the Waimakariri District Plan. • Proposed: The existing designation inclusive of the alterations sought by the NZTA shown in Volume 2C (conditions) and Volume 4D (boundaries) of the SAR.
DOC	Department of Conservation
ECan	Environment Canterbury (Canterbury Regional Council)
EclA	Ecological Impact Assessment

Acronym / Term	Description
EclAG	Ecological Impact Assessment Guidelines
ECR	Ecological Compensation Ratio
ED	Ecological District
eDNA	Environmental DNA
EMP	Ecological Management Plan
ESCMP	Erosion and Sediment Control Management Plan
EPT	Ephemeroptera, Plecoptera, Trichoptera
FPAT	Fish Passage Assessment Tool database– administered by NIWA
FTAA	Fast-track Approvals Act
GIS	Geographic Information System
g / m³	Gram per metre cubed
km	Kilometre
LMP	Lizard Management Plan
m	Metre
MCI	Macroinvertebrate Community Index
mm	Millimetre
NES-F	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NZFFG	New Zealand Fish Passage Guidelines 2024 (v2)
NZFFD	New Zealand Freshwater Fish Database – administered by NIWA
NPS-FM	National Policy Statement for Freshwater Management 2020 (Amended January 2024)
NPS-IB	National Policy Statement for Indigenous Biodiversity 2023 (Amended October 2024)
NTU	Nephelometric Turbidity Unit
NZTA	New Zealand Transport Agency Waka Kotahi
Project	State Highway 1 North Canterbury – Woodend Bypass Project (Belfast to Pegasus) (the construction, operation, and maintenance thereof)
Project Site (or Site)	The land contained within the area delineated as “Project Site” in Volume 4C of the SAR.
QMCI	Quantitative Macroinvertebrate Community Index
REM	Residual Effects Management
RMA	Resource Management Act 1991
SAR	Substantive Application Report
SH1	State Highway 1
SEAs	Significant Ecological Areas
SEV	Stream Ecological Valuation
WDC	Waimakariri District Council
Wildlands	Wildland Consultants Ltd, the contractor engaged by NZTA to undertake a lizard survey report.

Executive summary

The New Zealand Transport Agency Waka Kotahi (**NZTA**) proposes to construct, operate and maintain the State Highway 1 (**SH1**) Belfast to Pegasus Motorway and Woodend Bypass Project (the **Project**). The Project is an extension of the Christchurch Northern Motorway and will provide four lanes of grade-separated motorway over approximately 11 km.

This ecological impact assessment assesses the potential ecological effects from the following proposed Project activities, which NZTA are applying for consent under the Fast-Track Approvals Act 2024 (**FTAA**):

- Upgrades to Existing SH1 – Upgrade SH1 from approximately 600 m south of the Kaiapoi River Bridge to the Cam River / Ruataniwha (a total distance of approximately 4 km).
- Woodend Bypass – Construction of a new four-lane motorway, bypassing Woodend township, from the Cam River / Ruataniwha to approximately 700 m north of the Pegasus / Ravenwood intersection (a total distance of approximately 7 km).
- Project-wide features and activities applying at various locations along the entire length of the Project (a total distance of approximately 11 km) and may include a mixture of operations and maintenance activities.

The following ecological values and effects are within the scope of this EclA and are of relevance to the regional resource consents which are sought under the FTAA:

- Wetland and stream ecology within and in proximity to the Project Site.
- Terrestrial ecology within 10 metres of wetlands and streams, and within the areas of land sought to be added to the Project designation.

A desktop assessment and various terrestrial, wetland and stream field assessments were undertaken to determine the ecological values at the Project Site. An assessment of the potential ecological effects of the Project activities was undertaken in general accordance with EIANZ guidelines (Roper-Lindsay et al. 2018). The guidelines provide a standardised framework and matrix allowing a consistent and transparent assessment to assess ecological values and the magnitude of effects to reach an overall conclusion on ecological effects.

Key findings are as follows:

- Terrestrial ecological values range from negligible to very high; wetland ecological values range from low to high; and stream ecological values range from low to high.
- High and very high characteristics include 'At Risk' and 'Threatened' indigenous fauna (e.g., birds, lizards and fish), moderate diversity wetland mosaics, and stream habitat that provides potential spawning habitat for a 'Threatened' fish species.
- Potential and actual adverse effects on terrestrial ecology values include permanent of largely exotic vegetation, loss of indigenous lizard and bird habitat and, disturbance, injury or mortality of indigenous fauna during vegetation clearance and construction works. Overall effects can be avoided or minimised to a low to very low level, however there will be moderate residual adverse effects associated with the loss of indigenous lizard habitat. The EIANZ recommends compensation is provided for moderate adverse effects, and we therefore recommend compensation to address these residual adverse effects.
- Potential and actual adverse effects on wetland ecology values include the direct permanent loss of wetland habitat, modification to wetland hydrology, habitat fragmentation, and sedimentation effects during construction works. Overall effects can be avoided or minimised to a low to very low level for most wetlands, however, a moderate to high level of residual adverse effect remains for wetland habitat and values that will be permanently lost.

- Potential and actual adverse effects on stream ecology values include temporary construction related effects such as from sedimentation, injury and mortality to freshwater fauna, localised dewatering effects, modification of stream habitat, and fish passage and migration success. Overall effects can be avoided, minimised, or remediated to a low to very low level, however, a moderate to high level of residual adverse effect remains for stream habitat and values that will be permanently lost or modified.
- Where residual adverse effects remain for wetland and stream habitats and values, the EIANZ recommends offsetting is provided. It is recommended that these are offset through the implementation of restoration and habitat management actions at the McIntosh Drain and the South Lake remnant wetland respectively.

Project effects management will be implemented via a Project Ecological Management Plan (**EMP**) and a Construction Environmental Management Plan (**CEMP**). Erosion Sediment Control Management Plan (**ESCMP**), and proposed consent conditions.

The EMP shall include the following sections:

- Approaches to the management of vegetation clearance, and include establishment methods, programmes, and targets.
- Pest plant and animal management.
- Planting monitoring and maintenance approaches and timelines.
- Approaches to managing indigenous avifauna.
- Approaches to fish management.
- Residual Effects Management measures, which will include:
 - The offset and compensation measures, the outcome of any calculations that are to be completed via specific separate consent conditions.
 - Principles, methodologies, processes, targets, monitoring and reporting that will be used to achieve the offset and / or compensation measures.

Proposed consent conditions shall include:

- The preparation of an ESCMP.
- Approaches to fish passage through culvert design.
- The provision of stream realignment design measures.
- Inclusion of watercourse reinstatement measures when a temporary structure is required in a watercourse.
- Construction phase dewatering and stormwater discharge requirements.
- Requirements for operational stormwater design measures.
- Approaches to managing incidental discovery of 'Threatened' and 'At risk' indigenous flora and fauna species.
- The recalculation and re-evaluation of offset and compensation measures due to any revision of habitat area to be affected as a result of the Project.

The risk to indigenous lizards will be minimised through the implementation of a Lizard Management Plan (**LMP**), which is to be developed as a condition of the Wildlife Approval (see Volume 3J of the Substantive Application Report (**SAR**)).

Overall, it is considered that the actual and potential temporary and permanent adverse ecological effects due to the construction, and operation and maintenance of the Project can be adequately

managed through the proposed ecological effects management measures (including any required offset and compensation recommendations).

While this is not a matter before the Environment Court, the authors of this report have each read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023 ('Code'). The authors have each complied with the Code in the preparation of this report.

The data, information, facts and assumptions the authors have each considered as part of this report are set out in this report. The reasons for the conclusions of the report are also set out in this report. Unless stated otherwise, this report is within each of the authors' expertise and the authors have not omitted to consider material facts known to them that might alter or detract from the opinions expressed.

1 Introduction

The New Zealand Transport Agency Waka Kotahi (**NZTA**) proposes to construct, operate and maintain the State Highway 1 (**SH1**) Belfast to Pegasus Motorway and Woodend Bypass Project (the **Project**). The Project is an extension of the Christchurch Northern Motorway and will provide four lanes of grade-separated motorway over approximately 11 km. The purpose of the Project is to provide an efficient and reliable connection between Belfast and Pegasus, while delivering improved access, community safety and public health outcomes, and reduced severance.

The Project includes the following components:

- Upgrades to Existing SH1 – Upgrade SH1 from approximately 600 m south of the Kaiapoi River Bridge to the Cam River / Ruataniwha (a total distance of approximately 4 km).
- Woodend Bypass – Construction of a new four-lane motorway, bypassing Woodend township, from the Cam River / Ruataniwha to approximately 700 m north of the Pegasus / Ravenwood intersection (a total distance of approximately 7 km).
- Project-wide features and activities applying at various locations along the entire length of the Project (a total distance of approximately 11 km).

A more comprehensive background and description of the Project is contained in the Substantive Application Report (**SAR**).

An early works (**early works**) package has been submitted for resource consent separately, with works aiming to commence construction in the 2025 / 2026 construction season. The early works comprises the Kaiapoi Bridge strengthening and the Quarry Lakes partial reclamation. The potential ecological effects of early works are assessed in the early works Ecological Impact Assessment (**Ecia**) which has been prepared to inform the early works Assessment of Environmental Effects (**AEE**). The ecological effects of the early works are therefore not assessed in this EcIA.

1.1 Purpose and scope

The purpose of this report is to provide technical support to the SAR for applications made by NZTA under the Fast-Track Approvals Act 2024 (FTAA) for the construction, operation, and maintenance of the Project.

This EcIA includes:

- A description of the Project.
- An outline of assessment methods used.
- A description of relevant ecological values based on desktop review of publicly available information, information from Project-specific reports commissioned by NZTA, and site investigations.
- An assessment of the actual and potential ecological effects of the Project on the ecological values identified.
- Effects management recommendations to address adverse effects on the ecological values identified.

The following ecological values and effects are within the scope of this EcIA:

- Wetland ecology within and in proximity to the Project Site (of relevance to the regional resource consents which are sought under the FTAA).

- Stream ecology within and in proximity to the Project Site (of relevance to the regional resource consents and complex freshwater fisheries approvals which are sought under the FTAA).
- Terrestrial ecology within 10 metres of the wetlands and streams in clause (a) (of relevance to the regional resource consents which are sought under the FTAA).
- Terrestrial ecology within the areas of land sought to be added to the Project designation (of relevance to the notice of requirement to alter a designation sought under the FTAA). These areas of land are:
 - A 4.98 ha area located along the southern extent of the South Quarry Lake, with a small fragment located on the northern extent (hereafter referred to as the ‘quarry lakes designation alteration’).
 - A 0.29 ha area located along the western side of SH1 north of the existing Pegasus Roundabout (hereafter referred to as the ‘Pegasus designation alteration’).

Terrestrial ecology values within the above scope are described and effects on these values assessed within the main body of this report. Terrestrial ecology values relating to the full Project Site are presented for completeness within Appendix I. However, for the avoidance of doubt, this EclA does not assess terrestrial ecology values and effects which are not in the areas noted above, for the reasons set out in Volume 2A Part 1 of the SAR.

1.2 Report structure

This report is split into four main sections and seven sub-sections. These have been organised according to the type of proposed works, while grouping together sections of the alignment with similar vegetation and habitat character, and to characterise and assess values and effects of those groupings. A breakdown of the report structure is provided in Table 1.1.

Table 1.1: Structure of this EclA

Section	Description
Ecological characteristics and values of the Project Site	
Section 4: Upgrades to existing SH1	Includes areas within and alongside the existing SH1 alignment where SH1 widening works will be undertaken.
Sub section 4.1: Ohoka Road to Lineside Road	Comprises the section of SH1 from the Ohoka Road overpass to Lineside Road, including the Kaiapoi River Bridge.
Sub section 4.2: Lineside Road to south of the Cam River / Ruataniwha.	Comprises the section of SH1 from Lineside Road to south of the Cam River / Ruataniwha. This section includes Rossiter Drain and Wilsons Drain, located south of the Cam River / Ruataniwha, but excludes the southern bank of the Cam River / Ruataniwha.
Section 5: Woodend Bypass	Includes areas within, and within 100 m of ¹ the Project Site that comprise the new road alignment for the Woodend Bypass and rejoins SH1 at Pegasus.
Sub section 5.1: Cam River / Ruataniwha to Williams St interchange	Comprises the section from the Cam River / Ruataniwha up to, and including, the Williams St bridge and Williams St interchange. This section includes Project activities in, on and over Cam River / Ruataniwha.

¹ For wetlands and streams as per the NPS-FM 2020.

Section	Description
Sub section 5.2: Quarry Lakes to Woodend Beach Road	Comprises the section between the Williams St bridge up to, and including, the Woodend Beach Road bridge; this section includes Project activities in, on and over the Quarry Lakes and McIntosh Drain. This section includes an alteration to the existing designation.
Sub section 5.3: Woodend Beach Road to Gladstone Road bridge	Comprises the section between the Woodend Beach Road bridge up to, and including, the Gladstone Road bridge.
Sub section 5.4: Gladstone Road bridge to the existing SH1	Comprises the section between the Gladstone Road bridge up to the point where the alignment meets existing SH1 north of the proposed Waihora Stream culvert.
Sub section 5.5: Pegasus interchange	Comprises the section between the proposed Waihora Stream culvert to the end of the alignment and includes the Pegasus interchange and the Garlick Place connection. This section includes Project activities in, on and over the Taranaki Stream and its tributaries. This section includes an alteration to the existing designation.
Assessment of Ecological Effects	
Section 6: Assessment of Ecological effects	Provides an assessment of the actual and potential ecological effects of the Project within the entire Project Site and provides recommendations to avoid, minimise, remedy, or offset / compensate adverse effects.
Section 7: Approach to residual adverse ecological effects	Provides a recommended approach to address adverse residual effects comprising the permanent loss of natural inland wetland extent and habitat values, and the permanent loss and modification of stream extent and habitat values. An overall summary of the recommended residual adverse effects management is provided in Sections 7.4 to 7.5.

1.3 Ecological context

The Project is located within the Canterbury Plains Ecological Region and Low Plains Ecological District (ED). Historically (pre-human settlement), the Low Plains ED mainly comprised tussockland and floodplain forest, with extensive areas of swamp wetland areas along alluvial valleys. In the local Project area, the historic vegetation likely comprised a mosaic of flaxland, sedgeland, and cabbage tree swamp wetland habitats grading into back-dune forest and grass / sedgeland habitats towards the coast. Broadleaved-hardwood species forest would have been present along the riparian margins of major rivers.

The Low Plains ED has been highly modified for farming and urban expansion, which has resulted in < 1% native vegetation remaining. Remaining native areas are generally in small, scattered fragments. Current vegetation in the immediate vicinity of the Project is generally characterised by common native enhancement plantings, exotic trees (including as shelterbelts), rank exotic and pasture grasses, lawns and garden plantings. The native enhancement plantings that have occurred are starting to provide semi-contiguous native vegetated corridors within the local area. Small areas of wetland are also present within and adjacent to the Project, but these are generally restricted to small, moderately to highly degraded remnant features located primarily along stream systems.

Existing broad landcover class categories² within the Project and adjacent areas include 'Exotic Grassland' (including high and low producing exotic grassland), 'Cropland', with some small areas of 'Exotic forest'.

² Per the Land Cover Database Version 5 (LCDB5).

No ‘*Critical habitats*’ (as per the Canterbury Land and Water Regional Plan (**CLWRP**) or ‘*Significant habitats*’ (as per the Canterbury Regional Policy Statement (**CRPS**)) are located within the Project Site. Although, a distinct reach of critical habitat is located within Silverstream immediately upstream of its confluence with the Kaiapoi River (c. 1.2 km from the Project). In addition, inanga (*Galaxias maculatus*, Threatened – Nationally vulnerable (per Dunn et al, 2023)) spawning habitat has been identified and mapped in the CLWRP as being potentially present within the bed and banks of the Kaiapoi River in and around the Project designation.

1.4 Hydrogeological context

This summary outlines key hydrogeological characteristics from the Project’s hydrogeology assessment relevant to surface water and groundwater, and the relationship of these to stream and wetland systems. For full details on all hydrogeological assessments and relevant context, refer to the full hydrogeology assessment report in Volume 3K.

Most of the Project overlies a coastal confined aquifer system that comprises a sequence of gravel confined aquifers of increasing depth, deposited during glacial periods. The coastal confined aquifer system transitions into unconfined and semiconfined aquifer systems to the west.

Shallow groundwater levels across the Project alignment reflect the low elevation, topography, extensive surface water network, and proximity to the coast with groundwater levels progressively deepening inland. The depth to shallow groundwater across the Project area is typically <2 m below ground level (bgl), but ranges between 0.5 and 3 m bgl. Within the northern half of the project area, groundwater flows east towards the coast; south of the Cam River / Ruataniwha, the groundwater flow direction transitions to southeast (see Figure 4.3 of the hydrogeological report). Groundwater is hydraulically connected to surface water in many locations across the Project alignment.

Regionally, recharge to the aquifers occurs through leakage from the Ashley / Rakahuri River and the Waimakariri River, through infiltration of rainfall to the plains, and through leakage from deeper underlying aquifers. Discharge occurs by vertical flow between aquifers and east towards the coast, however discharge also occurs at spring-fed streams which are present along the margins of the coastal confined aquifer system.

1.5 Statutory context

The following statutory documents are relevant to this EclA:

- CRPS.
- CLWRP with particular emphasis on the definitions (Section 2.9) and objectives, policies and standards within:
 - Sections 4.86A, 5.137 and 5.141 as they relate to inanga spawning habitat.
 - Sections 2.A.2 and 4.8.1 to 4.8.5 as they relate to wetlands.
- National Policy Statement for Freshwater Management (**NPS-FM 2020**, as amended in October 2024) (Ministry for the Environment, 2024a) including the definition for ‘effects management hierarchy’ in relation to natural inland wetland and rivers.
- National Policy Statement for Indigenous Biodiversity (**NPS-IB 2023**, as amended in October 2024) (Ministry for the Environment, 2024b) including the definition for ‘effects management hierarchy’ in relation to indigenous biodiversity.
- Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (**NES-F**):
 - The NES-F includes specific provisions in respect of fish passage.

- The NES-F includes specific rules and provisions regarding development works within, or within 100 m of identified natural inland wetlands.

In addition to the national and regional documents above, the state highway network including the Project is designated within the operative and proposed Waimakariri District Plans for the purpose of construction, maintenance, operation, use and improvement of the state highway network and associated infrastructure. The Project designation is subject to conditions, several of which pertain to ecological matters. Where relevant these have been addressed within this EclA.

1.6 Cultural context

The Project Site traverses an area of high cultural values which includes Ngā Wai, a Ngā Tūranga Tūpuna and Wāhi Tapu (as defined in the Partially Operative Waimakariri District Plan). The locality is therefore recognised as a significant cultural landscape that is defined by geomorphological features such as waterways, wetlands and springs; and the presence of ecosystems and habitats that were historically abundant and a source of mahinga kai. NZTA has formally engaged with Ngāi Tūāhuriri Rūnanga through its mandated agency, Whitiōra. This has included the sharing of technical information on the biophysical effects of the Project on indigenous fauna and flora as well as changes to wetland systems, water quality and water quantity. It is understood that these biophysical effects will also have consequential effects on cultural values and the relationship of Ngāi Tūāhuriri Rūnanga to this locality and the practice of mahinga kai.

2 Project description

The Project context is summarised in the following sections. The Construction Methodology Statement (**CMS**) is provided in Volume 3A and the Design Statement is provided in Volume 3B. These provide details on the construction programme, construction strategy and general approach to construction activities, and further information around Project design. Where relevant to this EclA, specific information is provided in the Project component sections below. A Project environmental setting figure is provided in the SAR and Appendix A.

2.1 Proposed existing SH1 upgrades

Upgrade SH1 from approximately 600 m south of Kaiapoi River Bridge to the Cam River / Ruataniwha (a total distance of approximately 3.5 km), including:

- Additional southbound lane – Between approximately 600 m south of the Kaiapoi River Bridge to the bridge itself. Note: The southbound lane extends beyond the Project Site to approximately 200 m south of the Ohoka Road Overpass, but these works are beyond the scope of the Project. Kaiapoi River Bridge upgrades – seismic strengthening and widening to provide an additional southbound lane. Note: Strengthening works forms part of the early works consenting package.
- Four-lane upgrades – upgrade of the SH1 carriageway from two lanes to four lanes from Lineside Road Overpass to the Cam River / Ruataniwha.

2.2 Proposed Woodend Bypass

A new four-lane motorway, bypassing Woodend township, from the Cam River / Ruataniwha to approximately 700 m north of the Pegasus / Ravenwood intersection (a total distance of approximately 7 km), including:

- Cam River / Ruataniwha Bridge upgrades – a new bridge to the east of the current bridge (SH1 and southbound on ramp). Note: these works integrate with the Williams Street interchange.
- Williams Street interchange – A new interchange and SH1 overbridge at the existing intersection of Williams Street and SH1.
- Quarry lakes embankment and South Lake remnant infilling – a new tiered embankment through two artificial lakes (formed through quarrying), including dynamic compaction. The South Lake remnant created by the causeway will be partially filled, and a wetland constructed in this area. Note: The initial (partial) reclamation is part of the early works consenting package.
- Woodend Beach Road overbridge – a new local road bridge over SH1, including a realignment of and upgrades to Woodend Beach Road.
- Gladstone Road overbridge – a new local road bridge over SH1, including upgrades to Gladstone Road.
- Pegasus interchange – remove existing roundabout at the intersection of SH1 / Pegasus Boulevard / Bob Robertson Drive and replace with a new grade-separated diamond interchange overpass, including traffic signals and local road upgrades including connection of Garlick Street to SH1.

2.3 Project wide activities

Features and activities applying at various locations along the entire length of the Project (a total distance of approximately 11 km) may include a mixture of operations and maintenance activities, such as:

- **Ground improvement works** - may include stone columns, rammed aggregate piles, rigid inclusions, soil cement or deep soil mixing, and bored piles.
- **Stormwater infrastructure** – swales, drains, culverts, and stormwater detention and treatment facilities.
- **Watercourse and drainage works** – including the permanent realignment and culverting of portions of Waihora Stream, Taranaki Stream, and McIntosh Drain.
- **Landscaping and planting** – landscape features and planting.
- **Ecological offsetting and compensation** – this includes where additional management measures are recommended to mitigate residual adverse effects such as stream riparian vegetation enhancement or wetland creation and biodiversity enhancement.
- **Noise mitigation** – earth bunds and acoustic fences.
- **Utilities and services** – relocation of existing utilities and installation of new utilities.
- **Road features and furniture** – including but not limited to emergency bays, signage, and barriers.

3 Assessment methods

3.1 Desktop review of available information

3.1.1 Databases

Publicly available information and databases were reviewed in May and September 2025 to inform the methodology and approach to the ecological assessment and to establish the ecological context of the site. This included a review of the following available information:

- Canterbury Maps geographic information system (GIS) layers:
 - Significant Ecological Areas (SEAs).
 - Ecosystem type layers.
 - Aerial imagery assessment of the SEAs and wider landscape to assess habitat suitability for terrestrial fauna.
 - Overland flow paths.
 - Mapped wetlands.
 - Permanent rivers or streams.
 - Critical Habitats.
 - Ecology & Biodiversity layer.
 - Black Maps for historical landuse / landcover context.
- iNaturalist database (<https://iNaturalist.org>).
- Department of Conservation Herpetofauna Database.
- Department of Conservation Bat Database.
- New Zealand Threat Classification System.
- New Zealand Freshwater Fish Database (NZFFD).
- Fish Passage Assessment Tool (FPAT; <https://fishpassage.niwa.co.nz/>).
- Manaaki Whenua | Landcare Research: [Maps » Our Environment](#)
- Soils Map database (<https://smap.landcareresearch.co.nz/maps-and-tools/app>).
- Our Environment database (Habitats layer).
- Historic aerial imagery (Retrolens (<https://retrolens.co.nz/>) and Google Earth Pro historical imagery tool).

3.1.2 Reports commissioned by NZTA

3.1.2.1 Lizards

Detailed terrestrial, wetland and freshwater ecological assessments of the Project area have been undertaken by Tonkin & Taylor Ltd (T+T) and Wildlands Consultants Ltd. (Wildlands) to inform the SAR required under the FTAA.

Lizard surveys were undertaken by Wildlands between December 2024 and March 2025. GIS layers showing lizard habitat identified within the Project Site (including habitat within the relevant areas specified in Section 1.1) and a lizard survey report were provided by Wildlands (Wildlands, 2025; see Volume 3J of the SAR). No lizard surveys were undertaken by T+T.

An aerial survey of the Project Site was undertaken in June 2025, and images collected in this survey were used as the basemap for all figures in this report. Lizard habitat polygons provided by

Wildlands were mapped and adjusted by T+T to better align with vegetation types visible in the updated aerials. Lizard habitat polygons were also extended to incorporate all areas of contiguous habitat of the same type, regardless of whether lizards were detected during surveys or not. The absence of detections during the survey does not preclude occasional use of these habitats, and it has been conservatively assumed that lizards may be present within all contiguous habitat of the same type. During site visits in August 2025, areas of lizard habitat were further ground-truthed and refined by T+T.

3.1.2.2 Wetlands and waterways

Spring / summer freshwater field work to assess stream faunal communities and classify watercourses was undertaken by Boffa Miskell Ltd (**BML**) over the 2024 / 2025 period. The results were provided to T+T in the form of a report that included results of stream and wetland ecology field surveys and clean survey data in an Excel spreadsheet (BML, 2025). A draft report and survey information was provided on 15 April 2025 for comment and review, with a finalised version provided to T+T on 1 May 2025. Following review, the final data was used as the basis for further investigations to update and confirm ecological values.

The freshwater wetland information provided by BML comprised a summary of all potential wetlands identified through desktop analysis (30 wetlands) and a list of confirmed wetlands (12 wetlands) with brief descriptions following site investigations undertaken in summer 2024 / 2025. This information was used by T+T as the basis for further investigations to determine ecological values for each identified wetland, to complete investigations of sites for which access was not granted to BML, and to gather additional data to clarify the extent and classification of confirmed wetlands.

As the information in the BML 2025 report has been further developed and superseded, a copy is not appended to this report; it can be made available on request.

The additional wetland and stream field assessments undertaken by T+T are described in Sections 3.2.6 and 3.2.7.

3.2 Specific field and assessment methods

3.2.1 Vegetation surveys and habitat assessments within terrestrial riparian margins and alterations to the designation

Vegetation surveys of terrestrial habitats within the Project Site were conducted by T+T between 5 and 8 May 2025.

Aerial images show that the bulk of the broader Project Site comprises pasture, managed grassland, and shelterbelts. These vegetation types were assessed and described from photographs undertaken during geotechnical investigations and habitat descriptions provided by Wildlands following lizard surveys (Wildlands 2025). The terrestrial vegetation survey undertaken by T+T targeted areas of vegetation other than pasture, managed grassland, and shelterbelts. This included areas that consisted of native scrub, treeland, and riparian margins.

The following was undertaken at each survey location:

- Vascular plant species survey.
- Habitat descriptions and assessment of likely fauna presence / use.

Representative photographs were taken at each site and a list of plant species observed at all sites is provided in Appendix C and Appendix D.

3.2.1.1 Non-vascular plants and fungi

A desktop review of records of non-vascular plants (mosses, liverworts, and hornworts) and fungi from within 5 km of the Project Site was undertaken using iNaturalist observations, focussing on species with a national conservation status of 'At Risk' or 'Threatened'.

The iNaturalist database has a record of an indigenous liverwort species with a conservation status of 'At Risk – Declining' from a location approximately 1 km southwest of the Quarry Lakes. *Ricciocarpos natans* can be found in both terrestrial and aquatic environments, and it has a conservation status of At Risk – Declining (de Lange et al 2020). Although not directly observed, this species may be found within, and within the 10 m terrestrial riparian margin of streams. Approximately 170 m of potentially suitable stream habitat (within Waihora Stream and McIntosh Drain) is being impacted by the Project. The impacted areas will be reinstated, either fully through stream realignments (Waihora Stream) or partially via culverts (McIntosh Drain), following completion of works and there is similar contiguous habitat upstream and downstream of the impacted areas. As such, the species (if present) will be able to recolonise following completion of works and the temporary loss of this habitat will not have an impact on the species at a population level. As such, it is not considered further in this assessment.

3.2.2 Arthropods, Annelids, and Molluscs

A desktop review of arthropod, annelid, or mollusc records from within 5 km of the Project Site was undertaken using iNaturalist observations, focussing on species with a national conservation status of 'At Risk' or 'Threatened'. No records of 'At Risk' or 'Threatened' species are present within the 10 m terrestrial riparian margin or within aquatic environments in the Project Site were found.

3.2.3 Birds

All incidental bird observations (both visual and auditory) were recorded. These records, together with the results of the desktop assessment, are provided in Table Appendix C.2.

The potentially impacted wetlands within the Project Site do not provide suitable habitat for cryptic wetland bird species such as moho pererū (banded rail, *Hypotaenidia philippensis*), mātātā (fernbird; *Poodytes punctatus*), or pūweto (spotless crane, *Zapornia tabuensis*) and no callback surveys targeting these species were undertaken. The McIntosh Drain may be used on occasion by matuku hūrepo (Australasian bittern, *Botaurus poiciloptilus*); however, the habitat is of low quality and an acoustic survey was not considered necessary.

3.2.4 Lizards

Desktop records show four indigenous lizard species within a 10 km radius of the Project Site (Table 3.1). Of these, Canterbury grass skink (*Oligosoma* aff. *polychroma* Clade 4, At Risk-Declining; Hitchmough et al. 2021) were considered most likely to be present (Wildlands, 2025). The other three species are unlikely to be present based on distribution and / or habitat requirements.

Wildlands undertook an initial habitat assessment for lizards in October 2024, followed by targeted surveys for Canterbury grass skink across the broader Project Site. These included manual searches, tracking tunnels, funnel trapping and ACO surveys conducted between December 2024 and March 2025 (Wildlands, 2025).

In total, 134 Canterbury grass skinks were recorded across the broader Project Site (c.105 ha). Thirty-nine were captured and 95 were observed during surveys. Skinks were also detected in 41 out of 128 tracking tunnels (32%). Lizard survey results across the broader Project Site are presented in Wildlands (2025). Locations of skink detections (captures and observations) within the terrestrial riparian margins and areas of alteration to the designation are shown in Appendix A. In summary,

eight skinks were detected (captured or observed) within the terrestrial riparian margins across the Project Site, and one skink was detected (observed, not captured) within the Quarry Lakes designation alteration area.

Table 3.1: Lizard species recorded within a 10 km boundary of the Project Site (DOC Herpetofauna Atlas, updated August 2024)

Species name	Common name	Conservation Status (Hitchmough et al. 2021)	Presence
<i>Oligosoma polychroma</i> Clade 4	Canterbury grass skink	At Risk – Declining	Confirmed
<i>Oligosoma maccanni</i>	McCann’s skink	Not Threatened	Unlikely
<i>Oligosoma polychroma</i> Clade 5	Southern grass skink	At Risk – Declining	Highly unlikely
<i>Woodowrthia cf. brunnea</i>	Waitaha gecko	At Risk – Declining	Highly unlikely

3.2.5 Bats

A review of the DOC National Bat Database identified 32 acoustic bat surveys conducted within a 40 km radius of the site during the last 20 years. No bats were recorded during any of these surveys. The nearest detection of an indigenous bat consists of the long-tailed bat (*Chalinolobus tuberculatus*; Threatened – Nationally Critical (O’Donnell et al., 2023)) greater than 100 km from the Project Site.

Based on the paucity of nearby records and a general lack of forest connectivity or general habitat availability, it is considered highly unlikely that bats are utilising the site, and an acoustic survey for bats was not deemed warranted. Bats are therefore not considered further in this assessment.

3.2.6 Freshwater – Streams and lakes

As detailed in Section 3.1.2.2, spring / summer freshwater field work to assess and classify waterways was undertaken by BML and provided to T+T, which T+T has used to inform this EclA. Additional freshwater field work undertaken by T+T in the winter was completed to confirm and / or update the BML waterways classification and to undertake Stream Ecological Valuation (SEV) surveys.

3.2.6.1 Waterway classification

All watercourse classifications were completed using the definitions from the RMA and / or the CLWRP. These are:

- Artificial lake means a lake created by human action. It includes any lake created as a result of damming a river, constructing an impoundment on land, or excavating land, but excludes detention and retention basins for stormwater, for dewatering purposes, factory waste and washdown water and oxidation ponds and other artificial water bodies used to treat human or animal waste (CLWRP definition).
- Artificial watercourse means a watercourse that is created by human action. It includes an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal channel. It does not include artificial swales, kerb and channelling or other watercourses designed to convey stormwater (CLWRP definition).

- River means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal (RMA definition).

3.2.6.2 Macroinvertebrate community

The macroinvertebrate community was sampled at eight sites by BML during summer 2025 (Table 3.2). Sampling was conducted in accordance with protocol C1 (for hard bottomed streams) and C2 (for soft-bottomed streams),³ and laboratory processing was in accordance with protocol P1 of the New Zealand macroinvertebrate sampling protocols (Stark et al., 2001). Several community indices were calculated by BML to provide an indication of stream health and aid in determining ecological value at each of the sites. The results of these have been used for this EclA and includes the following metrics, which have been reported on:

- Taxonomic richness - the total number of macroinvertebrate taxa recorded at each site. Streams supporting high numbers of taxa generally indicate healthy communities, however, the pollution sensitivity / tolerance of each taxon needs to also be considered.
- Ephemeroptera, Plecoptera, Trichoptera (EPT) taxa richness and % EPT - the total number and percent abundance of EPT taxa excluding the Hydroptilidae⁴. A high %EPT richness suggests high water quality.
- The relevant Macroinvertebrate Community Index (MCI) and its quantitative variant (QMCI) - the MCI is based on tolerance scores for individual macroinvertebrate taxa found in hard or soft-bottomed streams (Stark and Maxted, 2007). These tolerance scores, which indicate a taxon's sensitivity to in-stream environmental conditions, are summed for the taxa present in a sample, and multiplied by 20 to give MCI values ranging from 0-200.
- The QMCI is a variant of the MCI, which uses abundance data. The QMCI provides information about the dominance of pollution-sensitive species in hard or soft bottomed streams. Table 3.3 provides a summary of how MCI and QMCI scores were used to evaluate stream quality.
- Average Score Per Metric (ASPM) – this index aggregates MCI, EPT richness (excl. hydroptilids), and %EPT abundance (excl. hydroptilids) and indicates the macroinvertebrate community's ecological integrity.

Where relevant and appropriate, the reported metrics are assessed against the relevant MCI, QMCI, and ASPM national bottom line and attribute states for wadeable rivers and streams in the NPS-FM (Appendix 2 B13)⁵.

Table 3.2: Macroinvertebrate sampling sites

Site name ¹	Site reference	Easting	Northing
Cam River Tributary (Rossiters Drain)	81 Lower Camside Road	1571679.094	5198331.417

³ Where a hard bottomed stream is a stream bed naturally dominated by > 50 % hard substrate types (gravels, cobbles, boulders etc) and a stream bed dominated by > 50 % fine sediments < 2 mm in size is a soft bottomed stream.

⁴ The Hydroptilidae family, namely *Oxyethira sp* and *Paroxyethira sp*, are algal piercing caddisflies considered more tolerant of degraded conditions than other EPT taxa. Excluding hydroptilid caddis from the EPT metric is a more conservative approach and more accurately represents the "clean-water" EPT taxa.

⁵ The MCI, QMCI, and ASPM NPS-FM Attribute State is determined by comparing the current state (calculated as a five-year median score). However, for the purpose of this EclA we have inferred the respective attribute states to the single sample collected for this EclA.

Cam River Tributary (Wilson's Drain)	155 Lower Camside Road	1571933.112	5199025.337
Waihora Stream (downstream of SH1)	160 Gladstone Road	1573887.993	5203754.704
Waihora Stream	1188 Main North Road	1573386.278	5204371.76
Waihora Stream	Upstream of SH1	1573347.536	5204482.502
Taranaki Stream	Behind Harvey Norman complex	1573418.329	5204677.869
Taranaki Stream	Upstream of SH1	1573607.557	5204856.199
Taranaki Stream Tributary	Tributary parallel to SH1	1573627.002	5204882.765

Note: 1 – Where T+T site name used within this EclA is provided brackets.

Table 3.3: Interpretation of MCI-type indices (per Stark & Maxted, 2007)

Quality class	MCI / MCI-sb	QMCI / QMCI-sb
Excellent	> 119	> 5.99
Good	100 - 119	5.00 – 5.90
Fair	80 – 99	4.00 – 4.99
Poor	< 80	< 4.00

Note: Both MCI and QMCI values are synonymous with their soft-bottomed variants (i.e., MCI-sb and QMCI-sb).

3.2.6.3 Freshwater fish community

The freshwater fish community was assessed at 12 sites by BML during summer 2025 using three methods, depending on site suitability. The assessment sites and the methods used by BML are presented in Table 3.4.

Table 3.4: Freshwater fish community assessment sites and methods used (BML, 2025)

Site name ¹	Site reference	Method	Easting	Northing
Kaiapoi River	Northern bank under SH1 Bridge	eDNA	1571272.311	5197214.344
Cam River Tributary (Rossiters Drain)	81 Lower Camside Road	eDNA	1571679.094	5198331.417
Cam River Tributary (Wilson's Drain)	155 Lower Camside Road	eDNA	1571933.112	5199025.337
Cam River / Ruataniwha	Northern bank, downstream of SH1 Bridge	eDNA	1572444.892	5199671.778
Quarry Lake	Eastern bank of southern lake	eDNA, trapping	1573231.237	5200070.447
McIntosh Drain	Downstream of Fullers Road	eDNA	1573858.976	5200699.84
Waihora Stream	Downstream of SH1 – 160 Gladstone Road	eDNA	1573887.993	5203754.704

Site name ¹	Site reference	Method	Easting	Northing
Waihora Stream	Downstream of SH1 – 1188 Main North Road	eDNA, EFM	1573386.278	5204371.76
Unnamed pond	Pond at 1188 Main North Road	eDNA, trapping	1573397.332	5204397.869
Waihora Stream	Upstream of SH1	EFM	1573347.536	5204482.502
Taranaki Stream	Behind Harvey Norman complex	eDNA	1573418.329	5204677.869
Taranaki Stream	Upstream of SH1	eDNA, EFM	1573607.557	5204856.199
Taranaki Stream Tributary	Tributary parallel to SH1	eDNA, EFM	1573627.002	5204882.765

Note: 1 – Where T+T site name used within this EclA is provided brackets.

Electric fishing

A single pass with a Kainga EFM 300 backpack-mounted electric fishing machine was undertaken at four sites by BML. Fish were captured in a downstream push net or hand net before being transferred to buckets where they were identified and measured to the nearest millimetre before being returned alive to the stream.

Trapping

Sites that were not suitable for electric fishing (unsafe, no flow) used trapping methods to survey the fish community. Surveys were completed by BML. At the Unnamed Pond two fine-meshed fyke nets (baited with tinned cat food) and five Gee's minnow traps (baited with marmite) were set in the afternoon and left overnight. At the Quarry Lake four fyke nets and six Gee's minnow traps were set due to the large size. The following morning all native fish captured were identified, measured to the nearest millimetre and returned to the waterbody alive. Exotic fish were humanely euthanised and disposed of off-site.

Environmental DNA

The freshwater fish community was also assessed through the collection of environmental DNA (eDNA) at 12 sites by BML. Six replicate syringe samples were collected from each site⁶, and then analysed using the basic multispecies assay by Wilderlab NZ Ltd. eDNA is considered a useful and suitable additional technique to increase the chances of establishing the presence of species with high conservation value, or species that are difficult to detect with standard fishing methods.

3.2.6.4 Stream Ecological Valuation

Stream ecological valuations (SEV) (Storey et al., 2011) were completed by T+T within the McIntosh Drain, Waihora Stream and Taranaki Stream reaches that are proposed to be either reclaimed or culverted. The SEV provides a semi-quantitative assessment of 14 ecological functions that are divided into four main categories:

- Hydraulic functions.
- Biogeochemical functions.

⁶ Only five samples were collected at McIntosh Drain due to one syringe head being broken.

- Habitat provision functions.
- Biodiversity provision functions.

In SEV, stream data are recorded at ten transects evenly delineated over a 100 m stream reach. The recorded data are used to calculate a score for each of the 14 functions, and the SEV calculator provides an overall score for the assessed reach. The final score is from zero to a maximum of one, where the higher the score, the higher the observed ecological value of the surveyed reach.

Project-specific fish sampling has not been undertaken for McIntosh Drain or Waihora Stream downstream of SH1 at 160 Gladstone Road. Project-specific macroinvertebrate sampling was not undertaken for McIntosh Drain, and while it was undertaken for Waihora Stream downstream of SH1 at 160 Gladstone Road, invertebrate fauna of intermittent streams is significantly different to that of perennial streams due mainly to the absence of many EPT (Storey, 2010). Therefore, Biotic indices (fish and macroinvertebrate data) have not been used in the calculation of the SEV values for McIntosh Drain and Waihora Stream downstream of SH1 at Gladstone Road.

The intermittent and permanent SEV Data Analysis spreadsheet (version 2.6) was used by T+T to calculate the SEV scores for the McIntosh Drain, Waihora and Taranaki Streams, and the Taranaki Stream Tributary.

3.2.6.5 Environmental Compensation Ratio

To assess the loss of stream values and whether these could be offset the Environmental Compensation Ratio (ECR) method has been applied.

The ECR is a standardised tool used to quantify the amount of stream bed area to be created or restored relative to the amount lost to maintain 'no net loss' in ecological function because of a project.

The ECR calculation formula requires an SEV score to be calculated at the impact and proposed mitigation (offset) sites. This provides a basis from which to quantify and scale the likely loss in values and functions at an impact site and the increase in stream value and functions at an offset site. The calculated SEV score excludes the biotic invertebrate fauna and fish fauna functions⁷ as their response to the stream loss cannot be accurately forecast.

Use of the SEV and ECR is a robust and internationally peer reviewed method (Neale et al. 2017), designed to quantify the ecological function of a watercourse and, where all measures to avoid, remedy and minimise effects have been exhausted, it provides a means to quantify offset requirements. The method has been applied in New Zealand for approximately 13 years to support resource consent applications, including applications that have been heard at Council Hearings, Boards of Inquiry, and the Environment Court. Furthermore, the ECR meets the principles outlined in Appendix 6 of the NPS-FM.

The standard ECR calculation (per Neale et al. 2017) uses the potential SEV value at the impact site (SEVi-P) to assess the quantum of offset required so that a no net loss in stream value and functions is realised (termed the '*Standard ECR approach*'). This is due to the stream functions lost at the impact site include not only those that are actually degraded as a consequence of the development, but also the potential for improvement in these functions that is forgone by development of the site. Failure to take this component into account is likely to result in a steady decline of stream values on a regional scale (Neale et al. 2017).

⁷ The exclusion of the biotic functions is recommended in Story, et al. (2011).

In many cases potential value is unlikely to be realised and the existing stream conditions and values will remain as they are in their current state.⁸ Therefore, for this EclA, the current SEV value at the impacted site (SEVi-C) has also been used to assess the quantum of offset required (termed the 'Current value ECR approach') to replace current function and value. The two ECR approaches provide a recommended range in the offset quantum, with the upper value being more conservative and more likely to result in a no net loss outcome.

The ECR approaches are calculated by:

$$\text{Standard ECR approach} = [(SEVi-P - SEVi-I) / (SEVm-P - SEVm-C)] \times 1.5$$

$$\text{Current value ECR approach} = [(SEVi-C - SEVi-I) / (SEVm-P - SEVm-C)] \times 1.5$$

Where:

- SEVi-P is the potential SEV value for the stream to be impacted.
- SEVi-C is the current SEV value for the stream to be impacted.
- SEVi-I is the predicted SEV value of the stream to be impacted after impact.
- SEVm-C is the current SEV value for the stream where environmental compensation is applied.
- SEVm-P is the potential SEV value for the stream where environmental compensation is applied.
- Restoration length recommended = (impact area × ECR) / restoration channel width.

3.2.7 Wetland assessments

All BML confirmed wetland sites were visited by T+T in May 2025 to validate wetland status and gather ecological values information. An additional ten potential wetland sites were also visited in either April, May or July 2025 by T+T. Four of these were identified as potential wetlands by BML but were unable to be assessed by BML due to access not being granted. The remaining six sites comprised additional wetland areas identified by T+T as either potential wetlands via inspection of aerial imagery, areas that are now within 100 m of the Proposed Designation boundaries, or wetland areas for which values needed to be assessed under the RMA, but not the NPS-FM (i.e. areas of vegetation and habitat that meet RMA and / or LWRP wetland definitions, but which do not meet the definition of a natural inland wetland under the NPS-FM).

3.2.7.1 Wetland delineation and habitat value assessments

Wetland delineation and habitat value assessments were undertaken over two key periods: April-May 2025, and July 2025.

April and May site visits

Twenty-one (21) wetland sites within, or within 100 m of the existing designation were visited by T+T on either 10 April 2025 or between 6-8 May 2025. For most of the sites, the site visit was for the purposes of confirming wetland boundaries, making detailed notes on vegetation and habitat types within each discrete wetland area, determining ecological values, making notes on hydrological influences, and noting actual or potential fauna values.

Additional information was collected in general accordance with the Wetland Delineation Protocols (WDP; Ministry for the Environment, 2022) at 19 sites to either confirm BML assessments, because the site was unable to be accessed by BML at the time of their assessment, or because the site had

⁸ i.e., where potential stream values cannot be attained due to requiring substantial land use change and restorative actions in the adjacent land areas or in the wider catchment.

not previously been identified as a potential wetland within 100 m of the existing designation by BML. For one site included within this report, a site visit has not been undertaken as access was not granted.

For sites where delineation information was collected, this involved walking through the wetland, splitting it into distinct vegetation types, and making notes on the percent cover for each plant species observed within each vegetation type. Notes were also made on hydrological indicators and landform features observed. For vegetation types that contained plant species composition that were considered likely to result in Prevalence Index (PI) values within the uncertain range (PI of 2.5-3.5) (Clarkson, 2013) a hole was dug to check for the presence of hydric soils and groundwater. The results of the wetland delineation assessments are presented in Appendix E.

Climate and rainfall considerations

The April and May T+T wetland assessments contained within this report have mainly relied on hydrophytic vegetation tests and indications of hydric soils presence. Hydrological indicators observed during the April and May T+T site visits are not considered to be reliable for making final wetland determinations due to the volume of rainfall received for the Christchurch area⁹ in the three months leading up to each site visit.

For the 10 April site visit, the preceding 3 monthly rainfall was approximately 14% greater than historical averages for the same month. For the 6-8 May site visits, the preceding 3 monthly rainfall was approximately 44 % greater than historical averages for the same months. Wetland boundaries identified in May are therefore considered to be conservative (i.e. represent a maximum wetland extent) and it is highly unlikely that any confirmed wetland areas have been mis-identified.

July site visit

Following confirmation that the South Lake remnant at the Quarry Lakes is proposed for use as an ecological offset site, the land within 100 m of the proposed designation boundary in the vicinity of the South Lake remnant was assessed for the presence of potential wetlands. This assessment was undertaken by a site walk-through within a 100 m radius of the proposed designation boundary at Kaiapoi to identify whether any hydrophytic plants were present. Following the walkthrough, two representative plots were established within one potential wetland area and vegetation data was collected in accordance with the WDP (Ministry for the Environment 2022) (see Section 3.2.6 for details). Vegetation and habitat type descriptions were also collected for an additional (1) wetland site but full delineation protocols were not implemented as the site was clearly wetland habitat (i.e. vegetation would have passed the Rapid Test (Step 1 of the WDP). These site assessments were undertaken on 25 July 2025. The results of the wetland delineation assessments are presented in Appendix E.

Climate and rainfall considerations

For wetland delineation assessments to be considered accurate, wetland delineation is recommended to be undertaken during the growing season. The growing season for the Christchurch area is from approximately 16 August to 11 June in any given year (MfE 2021). As the additional site visits were undertaken in July, the boundaries of the wetlands may need to be refined during the growing season when vegetation patterns and full species assemblages are more easily observed. Undertaking a reassessment during the growing season is important for assessing the botanical values of the wetland area, to more accurately define how much wetland area could be impacted by partial infilling of the South Lake remnant, and to accurately report on the area of potential additional wetland habitat available for restoration and enhancement, if required.

⁹ Rainfall volumes and historical averages have been calculated from the Kainga Yard Environment Canterbury rainfall station.

Although the July assessments were undertaken outside of the growing season, the hydrological indicators observed during the July site visit are considered to be a conservative reflection of normal hydrological conditions for the season. Although there were no major rainfall events in the two weeks prior to the site visit, the preceding average 3 monthly rainfall⁹ was approximately 31% greater than historical averages for the same months. Wetland boundaries identified in July are therefore considered to be conservative (i.e. represent a maximum wetland extent) and it is highly unlikely that any confirmed wetland areas have been mis-identified.

3.2.7.2 Offset modelling data collection

The wetland impact and proposed offset sites were revisited between 21 and 24 July 2025 to collect more detailed habitat metrics for inputting into the Biodiversity Offset and Accounting Models (BOAMs; Maseyk et al., 2015) for the Project. The data collected for this purpose included:

- Walkthrough of each entire wetland impacted to:
 - Identify a full plant species list.
 - Identify number, type, and quality of fauna habitat present.
- Measure and collect:
 - Maximum emergent tree height (m).
 - Average canopy tree height (m).
 - Canopy foliar cover (% cover)¹⁰.
 - Understorey cover (% cover).
 - Understorey average and maximum height (m).
 - Groundcover cover (% cover).
 - Groundcover cover average and maximum height (m).
- Establish a representative plot¹¹ within each wetland to measure canopy tree basal diameter.

3.3 Approach to Ecological Impact Assessment

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

The guidelines were used to establish the following (Refer to Appendix B for the criteria and tables used in this assessment):

- The ecological values of terrestrial and wetland areas within the sites (Appendix B Table 1 to Appendix B Table 4).
- The magnitude of effect (Appendix B Table 5) on ecological values from the proposed project works in the absence of any controls.
- The overall level of effects to determine whether avoidance, minimisation or remediation is required (Appendix B Table 7).
- The magnitude of effect and overall level of effect, taking into consideration any additional measures to avoid, minimise or remedy effects.

¹⁰ This had to be estimated for many canopy species due to these being deciduous trees.

¹¹ Plot size and shape was determined in-field based on vegetation pattern and wetland shape.

- Where an overall level of effect is moderate or higher, after applying proposed measures to avoid, minimise and remediate effects, then additional effects management in the form of offset and / or compensation is recommended to achieve a no net loss of biodiversity values. Section 3.3.1 details how these residual effects are approached within this EclA.

The EclAG states that practitioners may deviate from the guidelines framework where it is considered ecologically relevant and justifiable to do so.

While the assessment criteria for terrestrial values is fairly well defined in the EclAG (Appendix B Table 1 to Appendix B Table 3), the freshwater values are less so. For the purpose of this assessment, we have adapted freshwater values criteria based on the EclAG (Appendix B Table 4) which assigns ecological value based on biodiversity and ecological function values of the freshwater stream / water systems.

Note that the NPS-FM requires consideration of the loss of 'potential' value of freshwater systems. As such, an ecological impact assessment has been completed on the potential value of freshwater systems (rivers / streams and wetlands) within this EclA (Section 6.4.7.5). In addition, potential value of wetlands and streams was also considered within the recommended offset actions where residual adverse effect are identified.

3.3.1 Residual effects approach

The EclAG states that if, after all efforts to avoid, minimise, and remedy effects,¹² there remains an overall effect of **moderate** or higher, then consideration of further efforts to address these residual adverse effects in the form of offset and / or compensation is recommended so that no net loss of biodiversity value occurs. Within this EclA, the offsetting and compensation principles in the NPS-FM and NPS-IB have been used where there remains an overall effect of moderate or higher as outlined in the EclAG.

However, offsetting and compensation are only required in relation to particular ecological values, and only where residual adverse effects are more than minor. The determination of 'more than minor' under the RMA is an assessment made by a planner rather than an ecologist, where the planner makes an assessment drawing on the technical information presented alongside their own professional judgement. An assessment of the overall effects has been undertaken by the planner within the SAR.

Offsetting

Biodiversity offsetting within the NPS-FM and NPS-IB refers to a 'measurable conservation outcome'¹³ that adheres to key principles, balancing any more than minor residual adverse effects that cannot be reasonably avoided, minimised, remedied to achieve a "no net loss, and preferably a net gain" (NPS-FM) or "net gain" (NPS-IB) standard (Baber et al., 2021a, b, c).

For impacted streams, the SEV / ECR approach has been taken (Sections 3.2.6.4 and 3.2.6.5) and for wetlands a BOAM approach has been applied (Section 3.2.7.2). Details on how these approaches have been applied to the Project are provided in Section 7.

As stated above, biodiversity offsetting relies on quantifiable information to realise a measurable conservation outcome. This differs from biodiversity compensation, which typically requires that any compensatory actions result in positive effects that outweigh the adverse effects.

Compensation

¹² Effects management hierarchy from the NPS-FM and NPS-IB.

¹³ Demonstrated a by a like-for-like quantitative loss / gain calculation.

A moderate level of effect on indigenous lizard habitats was assessed for this Project. As discussed above, consideration of further efforts to address these residual effects in the form of offset or compensation is recommended in the EclAG so that residual adverse effects are adequately addressed.

For these residual effects, offsetting (typically utilising a Biodiversity Offset Accounting Model (BOAM) approach) was deemed unsuitable. Indigenous lizard habitat comprises complex micro-habitats and external factors such as pest mammal activity, micro-temperature changes, and resource availability further complicate predicting the suitability of lizard habitat and associated lizard responses to offset actions.

This makes collecting robust, quantitative data and monitoring offset outcomes challenging. Given these challenges, compensation has been considered more appropriate. Details of the approach to compensation are outlined in Section 7.1.

4 SH1 upgrades ecological characteristics and values

4.1 Ohoka Road overpass to Lineside Road (including the Kaiapoi River Bridge)

A map overview showing ecological features for this section of the Project Site is provided in Appendix A Sheet 2. No alterations to the Project designation are being sought within this section of the Project.

4.1.1 Terrestrial riparian margin

Terrestrial riparian margins present within this section of the Project have been addressed in the early works EclA and are not considered within the scope of this EclA.

4.1.2 Wetlands

No wetlands were identified within 100 m of this portion of the Project Site. Wetlands are therefore not considered further for this section of the Project.

4.1.3 Stream ecological characteristics and values

The Kaiapoi River is the only watercourse within this section of the Project. The following sections provide an assessment of the freshwater values of this watercourse.

4.1.3.1 Stream habitat

The Kaiapoi River is classed as a *'Spring-fed Plains-Urban'* river in the CLWRP¹⁴. At SH1 the Kaiapoi River is approximately 40 m wide and the stream bed is comprised of soft-bottomed substrate (Photograph 4.1 and Photograph 4.2). At this location the river is tidally influenced, being approximately 4 km upstream of the coastal marine area boundary. As a result, the Kaiapoi River both upstream and downstream of the SH1 Bridge is classified as *īnanga* spawning habitat on the Canterbury Maps Viewer Ecology & Biodiversity layer. *īnanga* spawning preference is generally associated with flatter lower gradient vegetated banks that are inundated by high spring tides. The riparian vegetation includes some areas consisting of tall fescue (*Lolium arundinaceum subsp. arundinaceum*) grasses, present on both banks, which may provide some suitable *īnanga* spawning habitat. However, overall *īnanga* spawning habitat within the vicinity of the Kaiapoi River bridge was of low quality. No barriers to fish passage have been recorded, so where *īnanga* spawning habitat is present these areas would be deemed to be potential *īnanga* spawning sites.

Spot water quality measurements collected¹⁵ showed that temperature and dissolved oxygen were at levels that would meet the CLWRP Freshwater Outcomes for Waimakariri Sub-region Rivers (table 8a, page 210, CLWRP) at the time of sampling.

Overall, the Kaiapoi River at the SH1 bridge has been assessed as having **high** current habitat value, based on Appendix B Table 4. This is due to the river providing habitat for a diverse fish community including nationally 'Threatened' and 'At Risk' species (refer to Section 4.2.3.1), no barriers to fish passage at or downstream of the site and providing *īnanga* spawning habitat.

¹⁴ Classification per the 'LWRP - Water Quality Management Units and Classes-Rivers' GIS layer in Canterbury Maps.

¹⁵ Separately by BML and T+T.



Photograph 4.1: Kaiapoi River looking downstream at true right bank (05 May 2025).



Photograph 4.2: Kaiapoi River looking upstream true right bank (05 May 2025).

4.1.3.2 Freshwater fauna

Eleven species of native freshwater fish have been recorded within the NZFFD in the Kaiapoi River over the last 20 years and via eDNA (per the BML field work outlined in Section 3.1.2.2). Of these species, several have a national conservation status of either 'Threatened' or 'At Risk' (per Dunn et al., 2023; Table 4.1).

Of the fish species detected via eDNA (BML, 2025), panoko (torrentfish, *Cheimarrichthys fosteri*) and bluegill bully (*Gobiomorphus hubbsi*) are unlikely to be resident species in the vicinity of the Kaiapoi River site. Panoko and bluegill bully generally inhabit riffle sections of larger rivers (particularly the braided and hill-fed rivers in the Canterbury region) with substrates primarily comprised of cobbles and boulders. This habitat type is not present within the Kaiapoi River Project Site and is also very rare within the wider Kaiapoi River catchment. Furthermore, both species are diadromous and must migrate to / from the sea to complete their lifecycle. Additionally, panoko and bluegill bully are known to undertake sex specific intra-catchment migration to spawning areas. Therefore, it is likely that the panoko and bluegill bully eDNA detected is an artefact of the eDNA being shed while these species are migrating, either through the Kaiapoi River Project Site or, the more likely scenario, that the tidal inundation of the site has resulted in the eDNA that was shed within the Waimakariri River being detected in the Kaiapoi River.¹⁶ For this EclA, there is only a very small likelihood that panoko and bluegill bully are present within the Kaiapoi River, and their presence as a resident fish species within the Project Site is exceedingly unlikely. Therefore, where 'Threatened' and 'At Risk' fish species are considered within this EclA at this site, it is restricted to īnanga, tuna (longfin eel, *Anguilla dieffenbachii*), paraki (common smelt, *Retropinna retropinna*), redfin bully (*Gobiomorphus huttoni*), koukoupara (upland bully; *Gobiomorphus breviceps*), and māruru (giant bully, *Gobiomorphus gobioides*).

¹⁶ Where the Kaiapoi River has its confluence with the Waimakariri River c. 3.5 km downstream of the early works site.

No direct macroinvertebrate sampling was completed for this EclA, however, eDNA detections (BML, 2025) of macroinvertebrate taxa showed that both ephemeroptera and trichoptera were identified. Trichoptera generally have a range of taxa indicator values from 'tolerant' through to 'sensitive', while ephemeroptera are more commonly attributed a sensitive indicator value (per Stark & Maxted, 2007). Notably, within the eDNA results, kākahi (freshwater mussel, *Echyridella menziesii*) were detected, this taxon is listed as a 'At risk – declining' species (Grainger et al., 2018; Table 4.1). While there were trace records of kēwai / freshwater crayfish (*Paranephrops zealandicus*) in a single eDNA replicate at this site, this is not considered a 'true detection'. Therefore, it has been assumed kēwai are not present at this site.

Table 4.1: NZFFD records of freshwater fauna within the Kaiapoi River, and BML 2025 eDNA results

Common name	Scientific name	National conservation status (Dunn et al., 2023)	Recorded in
Īnanga	<i>Galaxias maculatus</i>	Threatened – Nationally vulnerable	NZFFD & BML (2025)
Tuna / longfin eel	<i>Anguilla dieffenbachii</i>	At Risk – Declining	NZFFD & BML (2025)
Paraki / common smelt	<i>Retropinna retropinna</i>	At Risk – Declining	NZFFD
Māruru / giant bully	<i>Gobiomorphus gobioides</i>	At Risk – Naturally Uncommon	NZFFD & BML (2025)
Bluegill bully*	<i>Gobiomorphus hubbsi</i>	At Risk – Naturally Uncommon	BML (2025)
Redfin bully	<i>Gobiomorphus huttoni</i>	At Risk – Naturally Uncommon	BML (2025)
Panoko / torrentfish*	<i>Cheimarrichthys fosteri</i>	At Risk – Naturally Uncommon	BML (2025)
Koukoupara / upland bully	<i>Gobiomorphus breviceps</i>	At Risk – Naturally Uncommon	BML (2025)
Hao / shortfin eel	<i>Anguilla australis</i>	Not Threatened	NZFFD & BML (2025)
Toitoi / common bully	<i>Gobiomorphus cotidianus</i>	Not Threatened	NZFFD & BML (2025)
Pātiki mohoao / black flounder	<i>Rhombosolea retiaria</i>	Not Threatened	NZFFD
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	Introduced and naturalised	NZFFD
Brown trout	<i>Salmo trutta</i>	Introduced and naturalised	NZFFD & BML (2025)
Large macroinvertebrates			
Kākahi / freshwater mussel	<i>Echyridella menziesii</i>	At Risk – Declining ⁺	BML (2025)

Note: * not expected to be present within the Project site, + = conservation status per Grainger et al., 2018

The ecological value of freshwater fauna within the Kaiapoi River is considered **high** (Appendix B Table 4). This is based on the presence of nationally 'Threatened' and 'At Risk' species, in particular the presence of Īnanga and māruru.

4.2 Lineside Road to south of Cam River / Ruataniwha

A map overview showing ecological features for this section of the Project Site is provided in Appendix A Sheet 3 and Sheet 4. No alterations to the Project designation are being sought within this section of the Project.

4.2.1 Terrestrial riparian margin

Two watercourses are located within this section of the Project (see Section 4.2.3 below). The terrestrial riparian margins (10 m either side) of these watercourses consist of a mosaic of pasture, managed grass, and rank grass associated with the existing road and surrounding farming / land-use.

Managed grass and pasture are considered to have **negligible** ecological value, as these areas are unlikely to provide breeding habitat or important foraging habitat for any indigenous bird species due to regular disturbance. They also have very low plant diversity. Up to 0.41 ha of managed grass and pasture may be impacted within the terrestrial riparian margin.

The rank grass found within the terrestrial riparian margins provides suitable habitat for Canterbury grass skink (*Oligosoma* aff. *polychroma* Clade 4 At Risk – Declining; Hitchmough et al. 2021) (Photograph Appendix D.2). Presence of this species was confirmed within the rank grass along the terrestrial riparian margin of Wilsons Drain (Appendix A Sheet 3) (Wildlands, 2025). Rank grass is of **negligible** value botanically, however the provision of habitat for lizards results in an overall **low** ecological value (Roper-Lindsay et al., 2018). Up to 0.07 ha of rank grass may be impacted by the Project.

4.2.2 Wetlands

No wetlands were identified within 100 m of this section of the Project Site. Wetlands are therefore not considered further for this part of the Project assessment.

4.2.3 Stream ecological characteristics and values

Two watercourses were identified within this section of the Project Site, namely the Rossiters Drain and Wilsons Drain.¹⁷ The following sections provides an assessment of the stream values of these watercourses.

4.2.3.1 Stream habitat

Current and historical catchment information¹⁸ was reviewed for both the Rossiters and Wilsons drains to confirm whether these watercourses meet the definition of a river in the RMA. For Rossiters Drain, due to there being no areas of natural stream habitat within the upstream catchment and the drain being primarily constructed to direct farm drainage waters to the Cam River / Ruataniwha; this watercourse is defined as being artificial and does not meet the definition of a river in the RMA.

For Wilsons Drain, historical aerial imagery shows that within its upper catchment this watercourse connects to historic natural channels, that periodically become active during rain events and during times of high groundwater. It has also been noted that Wilsons Drain (North) connects to a primary drain for a historical swamp¹⁹ and the downstream portion from the SH1 to the

¹⁷ Naming convention per that used within the Waimakariri District Council Rural Drainage Maintenance Contracts GIS layer ([Rural Drainage Maintenance Contracts](#); accessed 26 June 2025).

¹⁸ Including aerial photography (historical), available district and regional council GIS hydrological layers, and BML and T+T site walkover information.

¹⁹ [Rural Drainage Maintenance Contracts](#) – see Keiths Drain “Asset Notes”.

Cam River / Ruataniwha is classed as a ‘*Spring-fed plains*’ river in the CLWRP.²⁰ Aerial imagery also shows a fenced off wetland area in the upper catchment, likely feeding the drain. Therefore, conservatively it is appropriate to classify this watercourse as a modified natural stream and therefore a river under the RMA.

For completeness, as both Rossiters and Wilsons drains provide current and potential habitat for freshwater fauna (refer to Section 4.2.3.2), information on the stream ecological values has been included.

The Rossiters and Wilsons drains both flow through a primarily agricultural catchment and are culverted below two roads (SH1 and Revells Road) before ultimately confluencing with the Cam River / Ruataniwha. Both drains are tidally influenced, with water present along the reach changing with tide levels (i.e., water was present upstream adjacent to SH1 at high tide but absent from this section on low tide (BML, 2025)). It should also be noted that flood gates are present at each drain’s outlet to the Cam River / Ruataniwha. Instream habitat primarily consisted of fine sediments (< 2 mm in size) and occasional macrophyte beds (both emergent and marginal sprawling), and low to no spring and summer water flow with only residual pools present in some locations in the vicinity of SH1. During winter, higher water flows were observed, however, this generally consisted of very slow shallow runs through to pools. Ongoing periodic maintenance of these drains does occur and generally consists of sediment and macrophyte removal.

Overall, both drains have been assessed as having low current habitat value, based on Appendix B Table 4. This is due to both drains being highly modified with degraded habitats due to their artificial (Rossiters Drain) and maintained (Rossiters and Wilsons drains) nature, which is providing low quality habitat diversity for aquatic fauna (refer to Section 4.2.3.2). In addition, the flood gates may present a barrier to fish passage into the reach downstream of SH1. Due to the highly modified and artificial nature of the drains continuing to occur, this limits the potential improvements within both the Rossiters and Wilsons drains.

4.2.3.2 Freshwater fauna

The macroinvertebrate community was surveyed in 2025 by BML, the results of this survey showed that both the Rossiters and Wilsons drains were indicative of poor quality (per Table 3.3) and a severe loss of ecological integrity. All calculated metrics did not meet the NPS-FM national bottom line for MCI, QMCI, and ASPM; nor the CLWRP QMCI freshwater outcomes for spring-fed plains rivers (i.e., a QMCI value of ≥ 5 ; Wilsons drain only) (Table 4.2).

Table 4.2: Summary of Rossiters and Wilsons drain macroinvertebrate community metrics. Surveyed in 2025 by BML

Site	Total richness	EPT richness	%EPT abundance	MCI-sb	QMCI-sb	ASPM
Rossiters Drain	14	0	0	53.9	1.65	0.14
Wilsons Drain	19	0	0	60.4	1.48	0.12

Note: Where values are in bold, these do not meet the relevant NPS-FM national bottom lines: MCI ≥ 90 ; QMCI ≥ 4.5 ; ASPM ≥ 0.3 .

Only hao (shortfin eel, *Anguilla australis*) and toitoi (common bully, *Gobiomorphus cotidianus*) have been identified (via eDNA (BML, 2025)) within the Rossiters and Wilsons drains. Both species are ‘Not Threatened’ (Dunn et al., 2023) and can be common within slow flowing agricultural watercourses like the Rossiters and Wilsons drains. The presence of these fish species results in an

²⁰ Classification per the ‘LWRP - Water Quality Management Units and Classes-Rivers’ GIS layer in Canterbury Maps.

ecological fauna value of **low**. However, hao is a mahinga kai / mahika kai²¹ species and therefore their value should be higher, and raising their respective values to **moderate** is justified in this instance. Therefore, the ecological value of freshwater fauna within these two drains ranges from **low** to **moderate** when referencing the value of freshwater fish species.

²¹ While ECan provides a mahinga kai species guide ([mahinga-kai; accessed July 2025](#)), this requires confirmation by Whitiara.

5 Woodend Bypass ecological characteristics and values

5.1 Cam River / Ruataniwha to Williams Street

An overview of sites characteristics for this section of the Project Site is provided in Appendix A Sheet 5. No alterations to the Project designation are being sought within this section of the Project.

5.1.1 Terrestrial riparian margin

One wetland and two freshwater features are located within the designation boundaries for this section of the Project Site; these include the Cam River / Ruataniwha, an Ephemeral Pond, and CR_W2_NPSFM (see Section 5.1.2 and Section 5.1.3 below). Site investigations to assess the terrestrial ecological characteristics and values of the riparian margins of these features within the Project designation were undertaken in May 2025.

The vegetation types present along the terrestrial riparian margin of the Cam River / Ruataniwha consists primarily of rank grass, pasture, and exotic treeland. The exotic treeland is dominated by a canopy of crack willow (*Salix x fragilis*) which line the banks of the river and a low diversity of understory vegetation containing species such as karamū (*Coprosma robusta*), rereti (*Blechnum chambersii*), and kiwakiwa / creek fern (*Cranfillia fluviatilis*) (Photograph Appendix D.4). The groundcover on the bank, including within the inundation zone of the river, comprises rank exotic grass and blackberry (*Rubus fruticosus agg.*) with scattered indigenous ferns including little hard fern (*Austroblechnum penna-marina*).

Exotic treeland is present within the terrestrial riparian margin of the Ephemeral Pond and CR_W2_NPSFM and is similarly dominated by crack willow with varied groundcover vegetation including rank grass, exotic herbfield, leaf litter, and blackberry (Photograph Appendix D.5). Hawthorn (*Crataegus monogyna*), spindle (*Euonymus europaeus*), gorse (*Ulex europaeus*), broom (*Cytisus scoparius*), and karamū are scattered through the understorey, particularly on edges. Areas of rank grass are also located within the terrestrial riparian margins of CR_W2_NPSFM.

No 'At Risk' or 'Threatened' plant species were observed and all indigenous plant species have been assigned an ecological value of **low**. Exotic treeland, rank grass and managed pasture are considered to have a **negligible** ecological value from a botanical perspective.

A single kāruhiruhi (pied shag, *Phalacrocorax varius*) was observed foraging in the Cam River / Ruataniwha on 6 March 2023 (Appendix C.2). Willow trees within the riparian margin provide potential nesting habitat for kāruhiruhi, however no sign of nesting was observed. Willows and shrubs provide foraging and potential nesting habitat for other common forest birds such as pīwakawaka (*Rhipidura fuliginosa*), riroriro (*Gerygone igata*), and tauhou (silveryeye, *Zosterops lateralis*), all of which were observed at the site. Pūkeko (*Porphyrio melanotus*) footprints were observed underneath the existing Cam River Bridge and this species may use rank grass and wetland vegetation habitats for foraging and nesting. Other than kāruhiruhi ('At Risk – Recovering', Robertson et al. (2021)), all indigenous species observed or likely to use habitats in this section have a conservation status of 'Not Threatened'. Kāruhiruhi have been assigned an ecological value of **high** due to their conservation status. All other 'Not Threatened' bird species have been assigned a **low** ecological value.

Rank grass and exotic treeland provide confirmed habitat for the Canterbury grass skink, which were recorded within these vegetation types (Wildlands, 2025). The low stature vegetation found within these vegetation classes is expected to provide lesser quality habitat for lizards and it is likely that the habitat is only used on occasion. As such, rank grass is considered to have **low** ecological value habitat for Canterbury grass skink. Canterbury grass skinks however have an ecological value of **High**

due to their threat status (At Risk -Declining), in accordance with the EclAG guidelines (Appendix B Table 1).

Exotic treeland provides **low** value habitat for 'Not Threatened' indigenous bird species as well as Canterbury grass skink. A total of 0.28 ha of exotic treeland, 0.16 ha of rank grass, and 0.08 ha of pasture is located within the terrestrial riparian margin of the Cam River / Ruataniwha.

5.1.2 Wetland habitat types

Two wetland areas have been identified either within, or within 100 m of the existing designation (refer to Sheet 5, Appendix A). These areas are described in detail in Table 5.1 below. Both of these wetlands are present on / within paleo river channels and substrates formed by the historic path of the Cam River / Ruataniwha prior to its realignment (see Figure 5.1 below).



Figure 5.1: Aerial photographs showing (a) the historic Cam River alignment, and (b) the alignment after construction of the Northern Motorway. Source: Retrolens, Accessed July 2025.

Table 5.1: Cam River / Ruataniwha wetland descriptions and current ecological values.

Wetland ID	Description	Ecological Value	Justification
CR_W1_NPSFM	<p>A very small (c.0.03 ha) area of wetland habitat comprising a small, shallow pond within a depression beneath a crack willow canopy, and with a few <i>Carex virgata</i> (see Photograph 5.3). The wetland is connected to the Cam River / Ruataniwha at high tide via a small side-channel that extends along its northeastern boundary.</p> <p>Based on hydrogeological modelling for this project²², this area does not appear to be permanently connected with groundwater. Rather it likely receives water from the Cam River / Ruataniwha at high tide, some input from wetland CR_W2, and a small amount via overland flow from the surrounding catchment.</p>	Low	<p><i>Representativeness</i> – Low Contains a few, minor elements of typical Canterbury wetland character and species composition but highly modified by exotic plant abundance and historical river diversion.</p> <p><i>Rarity and distinctiveness</i> – Moderate Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Low Contains one vegetation type and very low plant diversity.</p> <p><i>Ecological context</i> – Low A very small remnant of wetland habitat that does not provide any key buffering to other wetland or terrestrial habitats but provides a small amount of water quality connectivity and filtering for this section of the Cam River / Ruataniwha. Likely to provide some foraging and nesting habitat for common indigenous and exotic bird species.</p>
CR_W2_NPSFM	<p>A small (c.0.33 ha; Photograph 5.4 - Photograph 5.6) wetland located within a paleo-channel of the Cam River / Ruataniwha. Contains three key vegetation types:</p> <ul style="list-style-type: none"> • Mature crack willow trees form a canopy up to c.15 m tall over standing water and exotic species dominated grassland and herbfield. • Crack willow forms a patchy canopy up to c.12 m tall over dense <i>Carex</i> sedgeland. In places rautahi (<i>Carex geminata</i>) 	Moderate	<p><i>Representativeness</i> – Moderate Contains elements of typical Canterbury wetland character and species composition but degraded through disturbance and exotic plant abundance.</p> <p><i>Rarity and distinctiveness</i> – Moderate Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare. Native vegetation and habitats are also very rare in the</p>

²² See Appendix H of the hydrogeology assessment, which is Volume 3K of the SAR.

Wetland ID	Description	Ecological Value	Justification
	<p>is the main <i>Carex</i> species, whilst in other areas <i>Carex maorica</i> is dominant. Blackberry is present throughout.</p> <ul style="list-style-type: none"> Crack willow forms a patchy canopy up to c.12 m tall over a swamp forest subcanopy and understorey containing typical swamp forest species such as tī kōuka, kiokio (<i>Parablechnum novae-zelandiae</i>), and <i>Carex virgata</i>. <p>The wetland area comprises a transition from seasonally wet (crack willow forest) to permanently wet / damp (rautahi sedgeland and swamp forest) that receives water via overland flow from the surrounding catchment, diurnal inputs from the Cam River / Ruataniwha at high tide, and some groundwater recharge²³.</p> <p>Eels may occasionally use shallow standing water within this site. A wide range of aquatic invertebrates are likely to be present.</p>		<p>Low Plains ED, which makes any remaining native vegetation of high relative value.</p> <p><i>Diversity and pattern</i> – Moderate</p> <p>Contains two broad vegetation types that represent a transition between two slightly different hydrological states. Contains moderate native species richness.</p> <p><i>Ecological context</i> – Moderate</p> <p>A small remnant of wetland habitat that provides a buffer to the Cam River / Ruataniwha from surrounding landuse and provides fauna habitat along a river corridor in an otherwise relatively barren landscape. Likely to at least partially contribute to improved water quality within the Cam River / Ruataniwha.</p>

²³ See Appendix H of the hydrogeology technical assessment, which is Volume 3K of the SAR.



Photograph 5.3: CR_W1_NPSFM shallow open water, Carex virgata and crack willow within a small depression beside the Cam River / Ruataniwha. Taken 6 May 2025.



Photograph 5.4: CR_W2_NPSFM. Parts of this wetland contain a patchy crack willow canopy over shallow standing water and hydrophytic herbs and grasses.



Photograph 5.5: CR_W2_NPSFM. Rautahi dominated sedgeland on the western margin of crack willow forest within this wetland mosaic. Blackberry is locally common amongst the rautahi cover. Taken 10 April 2025.



*Photograph 5.6: CR_W2_NPSFM. Parts of this wetland mosaic contain swamp forest species associations including *Carex virgata*, kiokio, and tī kōuka. Blackberry is present at low cover throughout. Taken 6 May 2025.*

5.1.3 Stream ecological characteristics and values

5.1.3.1 Stream habitat

Cam River / Ruataniwha

The Cam River / Ruataniwha is classed as a ‘*Spring-fed Plains*’ river in the CLWRP²⁴. The Cam River / Ruataniwha at SH1 is approximately 12 m wide with a bed comprised of soft-bottomed substrate. Riparian vegetation is mature willow and eucalyptus species, *Carex* sp. and rank grass; with some native plantings occurring on the upper true right bank. A full description of the riparian vegetation is provided in Section 5.1.1. The site is approximately 3 km upstream for the confluence with the Kaiapoi River. The Cam River / Ruataniwha is tidal in its lower reaches, including within the Project Site but this is dependent on the floodgates control being open which regulates the quantity of fluctuation during high flow periods. The floodgate is located approximately 150 m upstream from the confluence with the Kaiapoi River. This structure is likely to create a complete barrier to fish passage when closed, but the presence of migratory fish species upstream of the structure (Section 5.1.3.2) indicates there is suitable passage when not in use. No other barriers to fish passage were noted between the confluence and the site on the NIWA fish passage assessment tool or the Biodiversity – Fish Barrier layer on Canterbury Maps. The Cam River / Ruataniwha also has high cultural value for its ability to provide mahinga kai resources.

Spot water quality measurements collected by BML and T+T showed that temperature and dissolved oxygen were at levels that meet the CLWRP Freshwater Outcomes for Canterbury Rivers at the time of sampling.

Overall, the Cam River / Ruataniwha at SH1 has been assessed as having **high** current stream habitat value due to providing suitable fish passage and habitat for a diverse fish community, including nationally ‘Threatened’ and ‘At Risk’ species (Section 5.1.3.2), and well-established riparian vegetation, but there being moderate degradation of the upstream catchment which is primarily agricultural with some urban areas (Appendix B Table 4).

Ephemeral Pond

A small (approximately 0.15 ha) ephemeral pond is present within this section of the Project Site. The pond is fed by an ephemeral spring that discharges water to the surface following heavy and / or prolonged rainfall events. It has no surface connection to any other waterbodies. At the time of the site inspection a shallow water body was present. Aerial imagery shows the pond is often vegetated with terrestrial grasses. The pond and surrounding vegetation is not considered to meet either RMA, CLWRP, or NPS-FM definitions of either a permanent or seasonal wetland as it did not support an assemblage of plant species adapted to wet conditions and did not contain any soil indicators that would suggest prolonged or seasonal periods of saturation.

5.1.3.2 Freshwater fauna

Cam River / Ruataniwha

Ten species of native freshwater fish have been recorded within the NZFFD in the Cam River / Ruataniwha over the last 20 years and via eDNA collected as part of the freshwater BML field work outlined in Section 3.1.2.2. Of these ten species, three have a national conservation status of ‘At Risk – Declining’ (per Dunn et al., 2018; Table 5.2).

No direct macroinvertebrate sampling was completed for this EclA, however, eDNA sampling (BML, 2025) identified ephemeroptera and trichoptera macroinvertebrate taxa. As described in Section

²⁴ Classification per the ‘LWRP - Water Quality Management Units and Classes-Rivers’ GIS layer in Canterbury Maps.

4.2.3.2., ephemeroptera are commonly attributed to sensitive indicator values while trichoptera have a range of values from ‘tolerant’ through to ‘sensitive’. Notably, within the eDNA results, kākahi were detected, listed as ‘At risk – declining’ species (Grainger et al., 2018) and having high conservation, ecological and cultural value. While there were trace records of kēwai in two of the six eDNA replicates at this site, this is not considered a ‘true detection’. Therefore, it has been assumed kēwai are not present at this site.

Of the fish species detected via eDNA (BML, 2025), bluegill bully is unlikely to be a resident species within this section of the Cam River / Ruataniwha due to the lack of suitable habitat (see Section 4.1.3.2). It is likely the bluegill bully eDNA detected is an artifact of the eDNA being shed during migration. Therefore, the only ‘At Risk’ and ‘Threatened’ fish species considered for this watercourse in relation to this EclA are tuna, paraki, koukoupara, and māruru; and īnanga, respectively.

Table 5.2: NZFFD records of freshwater fauna within the Cam River / Ruataniwha, and BML 2025 eDNA results

Common name	Scientific name	National conservation status (Dunn et al., 2023)	Recorded in
Īnanga	<i>Galaxias maculatus</i>	Threatened – Nationally vulnerable	NZFFD & BML (2025)
Tuna / longfin eel	<i>Anguilla dieffenbachii</i>	At Risk – Declining	NZFFD & BML (2025)
Paraki / common smelt	<i>Retropinna retropinna</i>	At Risk – Declining	NZFFD
Koukoupara / upland bully	<i>Gobiomorphus breviceps</i>	At Risk – Naturally Uncommon	BML (2025)
Māruru / giant bully	<i>Gobiomorphus gobioides</i>	At Risk – Naturally Uncommon	NZFFD
Bluegill bully*	<i>Gobiomorphus hubbsi</i>	At Risk – Naturally Uncommon	BML (2025)
Aua / yelloweye mullet	<i>Aldrichetta forsteri</i>	Not Threatened	NZFFD & BML (2025)
Hao / shortfin eel	<i>Anguilla australis</i>	Not Threatened	NZFFD & BML (2025)
Toitoi / common bully	<i>Gobiomorphus cotidianus</i>	Not Threatened	NZFFD & BML (2025)
Pātiki mohoao / black flounder	<i>Rhombosolea retiaria</i>	Not Threatened	NZFFD
Brown trout	<i>Salmo trutta</i>	Introduced and naturalised	NZFFD & BML (2025)
Large macroinvertebrates			
Kākahi / freshwater mussel	<i>Echyridella menziesii</i>	At Risk – Declining [†]	BML (2025)

Note: * not expected to be present within the Project site, † = conservation status per Grainger et al., 2018

The ecological value of freshwater fauna within the Cam River / Ruataniwha is considered high (Appendix B Table 4). This is based on the presence of nationally ‘Threatened’ and ‘At Risk’ species as well as several species that have a cultural value as mahinga kai²⁵ (Environment Canterbury, n.d.).

²⁵ While ECAN provides a mahinga kai species guide ([mahinga-kai; accessed July 2025](#)), this requires confirmation by Whitiara.

In the absence of the Project, the potential value for freshwater fauna within the watercourse would remain **high** due to upstream land use limiting the freshwater habitat.

Ephemeral Pond

As the pond is ephemeral and has no connectivity to any other surface waterbodies, it does not provide habitat for any fish species. It likely provides very little habitat for macroinvertebrates due to only containing water following heavy rain, which is generally not long enough for macroinvertebrate nymphs to complete this part of their lifecycle. Similarly, as heavy and / or prolonged rain events generally occur during the late autumn through to early spring this is commonly outside of the aquatic invertebrate emergence and egg laying timings. Therefore, it is very unlikely that the ephemeral pond is being utilised as a habitat for aquatic invertebrate lifecycles.

The ephemeral pond has been assessed as having no current or potential freshwater value. It is not assessed further in this assessment.

5.2 Quarry Lakes to Woodend Beach Road

The baseline for assessing this area of the Project Site assumes that early works at the Quarry Lakes have been completed. Upon completion of the early works, all vegetation within the early works footprint (excluding a 15 m buffer from the northern boundary of wetland QP_W1) will have been removed and partial reclamation of the South Lake and East Lake will have been completed to form an embankment through these two lakes. The embankment through the South Lake will leave a small remnant (approximately 1.8 ha) of the South Lake (South Lake remnant).

A land area of approximately 4.98 ha is sought to be added to the Project designation (of relevance to the notice of requirement to alter a designation sought under the FTAA). This area (the 'quarry lakes designation alteration') primarily sits along the southern extent of the quarry lake, with a small fragment located on the northern extent.

A map overview showing ecological features for this section of the Project Site is provided in Appendix A Sheet 6, Sheet 7, and Sheet 8.

5.2.1 Terrestrial riparian margin ecological characteristics and values

Terrestrial riparian margins and terrestrial ecological characteristics within the Quarry Lakes designation alteration were assessed during site visits in April, May, and July 2025. Aerial images, Google Street View, photographs undertaken during site surveys and geotechnical assessments, and habitat descriptions provided by Wildlands (2025) were also relied upon for the assessment.

The vegetation in the riparian margin for the South Lake remnant and wetland QP_W1_NPSFM consists primarily of exotic grassland / scrub mosaic. A small area (298 m²) of this vegetation type remains on the eastern side of the Quarry Lakes within the terrestrial riparian margin of QP_W1_NPSFM due to a protective wetland buffer established during early works. This area is expected to be impacted during the main works and comprises a mosaic of exotic shrubs and grassland (Photograph Appendix D.9). Key species within this area include:

- Broom and lupin (*Lupinus arboreus*) shrubland with local blackberry and gorse and dense exotic grass cover beneath the shrub canopy. Pōhuehue (*Muehlenbeckia australis*) is locally common on shrubs within these areas.
- Cocksfoot (*Dactylis glomerata*), browntop (*Agrostis capillaris*) and tall fescue grassland.
- Marram (*Calamagrostis arenaria*) grassland.

- Patchy exotic herbfield with highly variable composition. Species noted include sheep's sorrel (*Rumex acetosella*), cutleaf burnweed (*Senecio glomeratus*), broad-leaved fleabane (*Erigeron bonariensis*), fireweed (*Senecio hispidulus*), yarrow (*Achillea millefolium*), and musky storksbill (*Erodium moschatum*).

In addition to exotic grassland / scrub mosaic, exotic shelterbelt vegetation is present along the southern extent of the South Lake remnant. This vegetation type primarily consists of mature pine (*Pinus* sp.). Rank understory vegetation is present and consists primarily of broom, gorse, and rank exotic grasses. The remainder of the Quarry Lakes designation alteration consists of managed exotic dominated grass.

No 'At Risk' or 'Threatened' indigenous plant species were observed and all indigenous plant species have been assigned an ecological value of **low**. Exotic shelterbelt, exotic grassland / scrub mosaic, and managed grass are considered to have a **negligible** ecological value from a botanical perspective, with due to low, exotic-species dominated species diversity. Up to 0.42 ha of exotic shelterbelt, 0.56 ha of exotic grassland / scrub mosaic, and 4 ha of managed grass are likely to be impacted by the Project.

Eight indigenous bird species were recorded on the South Lake during the site visit, including four with a conservation status of 'At Risk' or higher (Table 5.3). The baseline for this assessment assumes that all habitat within the early works footprint has been removed. The South Lake remnant and its margins provide potential foraging habitat for all the species listed in Table 5.3 and potential nesting habitat for pāpango (New Zealand scaup, *Aythya novaeseelandiae*) and pūtangitangi (paradise shelduck, *Tadorna variegata*).

Table 5.3: Indigenous bird species observed on and around the Quarry Lakes

Common name	Scientific name	Conservation status	Nesting habitat
Pūteketeke / great crested grebe	<i>Podiceps cristatus</i>	Threatened-Nationally Vulnerable	Floating nest of sticks and water weeds often attached to willow branches or reeds. No nests found during a survey of the South Lake in July 2025.
Australasian coot	<i>Fulica atra</i>	At Risk-Naturally Uncommon	Vegetated lake margins. No nests found during a survey of the South Lake in July 2025.
Kawaupaka / little shag	<i>Microcarbo melanoleucos</i>)	At Risk-Relict	Colonies in trees overhanging water. No nests observed.
Kāruhiruhi / pied shag	<i>Phalacrocorax varius</i>	At Risk-Recovering	Colonies in trees overhanging water. No nests observed.
Pāpango / New Zealand scaup	<i>Aythya novaeseelandiae</i>	Not Threatened	Lake margin vegetation. Suitable habitat present around both South and East Lakes.
Pūtangitangi / paradise shelduck	<i>Tadorna variegata</i>	Not Threatened	Nest in holes (trees, rock crevices, under buildings or debris piles) with overhead cover and a single entrance. Suitable habitat present around both South and East Lakes.

Common name	Scientific name	Conservation status	Nesting habitat
Spur-winged plover	<i>Vanellus miles</i>	Not Threatened	Ground nests in open habitat. Suitable habitat present around both South and East Lakes.
Warou / welcome swallow	<i>Hirundo neoxena</i>	Not Threatened	Cup nests on artificial structures. Sheds may provide nest habitat.

The terrestrial riparian margin of the McIntosh Drain (see Section 5.2.3 below) consists solely of rank exotic grass and managed pasture. A total of 0.11 ha of rank grass is expected to be impacted within the terrestrial riparian margin. Rank grass is of **negligible** ecological value from a botanical perspective, being dominated by a small number of exotic species.

Shelterbelts and exotic grassland / scrub mosaic provide foraging and nesting habitat for common forest birds such as riroriro and pīwakawaka and are considered to provide potential foraging and nesting habitat for other 'Not Threatened' indigenous birds such as tauhou or korimako (bellbird, *Anthornis melanura*). Rank grass and exotic grassland / scrub mosaic vegetation may provide breeding habitat for pīhoihoi (New Zealand pipit, *Anthus novaeseelandiae*, 'At Risk – Declining) and kahu (Australasian harrier, *Circus approximans*). Rank grass near the McIntosh Drain may provide occasional low-quality foraging habitat for matuku-hūrepo. Other than pīhoihoi and matuku-hūrepo, it is unlikely that any 'At Risk' or 'Threatened' native species use habitats outside of the Quarry Lakes area.

In accordance with EclA guidelines, 'Not Threatened' indigenous species have been assigned an ecological value of **low**, 'At Risk' species an ecological value of **high**, and 'Threatened' species an ecological value of **very high**. A full list of bird species observed within this section of the Project is provided in Appendix C.2.

Groundcover beneath the exotic shelterbelts may support Canterbury grass skink. However, shelterbelts are well-represented in the surrounding area and this vegetation type is not considered to provide significant habitat for indigenous fauna. As such, it has been assigned an ecological value of **low**.

Exotic grassland / scrub mosaic has a **negligible** botanical value due to it being dominated by exotic species. However, the vegetation provides confirmed habitat for Canterbury grass skink (Wildlands, 2025) and likely foraging and nesting habitat for indigenous birds. This vegetation type is expected to provide preferable habitat for Canterbury grass skink in the context of the wider environment, due to the provision of more complex foraging and basking habitat areas. As such, the ecological value of exotic grassland / scrub from a habitat provision perspective is considered **moderate**.

5.2.2 Wetland habitat types

Ten wetlands have been identified and delineated within this section of the Project Site (refer to Sheets 6 and 7, Appendix A):

- Eight wetland areas have been identified within 100 m of the proposed designation, including one which is located partially within the construction works area for the Project.
- Two wetland areas, which form a larger wetland complex, are located further than 100 m from the proposed designation boundaries but have the potential to be affected by the Project construction works.

Eight of these ten wetlands are described in detail in Table 5.4 below. All wetlands discussed in Table 5.4 meet the definition of a natural inland wetland under the NPS-FM.

Two of the ten wetland areas that were identified within 100 m of this section of the Project Site (QP_W2_LWRP, QP_W3_LWRP) have not been assessed for this application and are therefore not included within Table 5.4 below or within the remainder of this report. These two wetlands were considered in the resource consent application to ECan for partial reclamation of the Quarry Lakes as part of early works. It was determined that partial reclamation of the quarry lakes via progressive end tipping would not change the hydrological processes for these two wetlands and no direct effects were anticipated. They have not been considered again for the Project construction works and post-construction potential impacts because construction works within the lakes will also not affect hydrological processes.

Although wetland QP_W1_NPSFM has also been assessed for early works, it is also included here as Project construction works and post-construction state have the potential to impact on this area.

Table 5.4: Descriptions of wetland areas located between Williams Street and Woodend Beach Road bridge, and their current ecological value

Wetland ID	Description	Ecological Value	Justification
QP_W1_NPSFM	<p>A small (c.0.34 ha) area of wetland habitat situated adjacent to the access road into the Quarry Lakes site comprising a mosaic of willow scrub and <i>Juncus</i> and exotic grass rushland and grassland. Willow scrub areas contain a 5 m tall patchy canopy dominated by crack willow with scattered grey willow over exotic grasses and herbs such as creeping bent (<i>Agrostis stolonifera</i>), Yorkshire fog (<i>Holcus lanatus</i>), and cocksfoot. The grassland and rushland areas comprise variable proportions of <i>Juncus edgariae</i>, sweet vernal (<i>Anthoxanthum odoratum</i>), Yorkshire fog, and creeping bent with common rank grassland herbs. Pampas (<i>Cortaderia selloana</i>) and occasional tī kōuka are present on the margins. Shallow surface water was present during the May site assessment (see Photograph 5.7). Aquatic invertebrates are likely to be present.</p> <p>Top-soils within this area comprise fine loamy sand over a densely-packed damp, pale sand layer which is likely to slow down water movement following rainfall. The soil profile contained indications of periodic inundation and reducing conditions (redox mottles within the matrix and along rhizospheres), which supports assessment of this area as a seasonal wetland. Based on hydrogeological modelling for this project, this area does not appear to be permanently connected with groundwater²⁰. Rather it likely receives water through overland flow from the surrounding undulating remnant or modified dune systems and direct interception of rainfall.</p>	Moderate	<p><i>Representativeness</i> – Moderate Contains elements of typical Canterbury wetland character and species composition but degraded through repeated disturbance and exotic plant abundance.</p> <p><i>Rarity and distinctiveness</i> – Moderate Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare. Native vegetation and habitats are also very rare in the Low Plains ED, which makes any remaining native vegetation of high relative value.</p> <p><i>Diversity and pattern</i> – Moderate Contains two broad vegetation types that represent a transition between two slightly different hydrological states.</p> <p><i>Ecological context</i> – Moderate A small area of wetland habitat that is part of a network of wetland habitat in the local landscape.</p>
QP_W4_NPSFM	A small (c.0.13 ha) area of wetland habitat situated to the east of the South Lake. This area comprises a mosaic of	Moderate	<i>Representativeness</i> – Low

Wetland ID	Description	Ecological Value	Justification
	<p><i>Juncus edgariae</i> rushland and creeping bent dominated grassland within a slight depression adjacent the access track into the quarry. Shallow surface water was present during the site assessment. Aquatic invertebrates are likely to be present.</p> <p>Soil within this area comprised fine light to medium brown loamy sand over light grey clay soils indicative of prolonged / permanent soil saturation. Soils were moist at the time of the site visit, and groundwater rapidly infiltrated the soil hole to a final depth of 5 cm below ground level. Based on hydrogeological modelling for this project²⁶, the wetland is seasonally connected with groundwater, which sits at the existing Quarry Lake level (c.0.9-1.9 RL). Low soil permeability, fluctuating permanent groundwater levels, rainfall, and overland flow also likely contribute to the persistence of saturated soils within this area.</p>		<p>Contains few elements of typical Canterbury wetland character and species composition and has heavily degraded through repeated disturbance and exotic plant abundance.</p> <p><i>Rarity and distinctiveness</i> – Moderate</p> <p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare. Native vegetation and habitats are also very rare in the Low Plains ED, which makes any remaining native vegetation of high relative value.</p> <p><i>Diversity and pattern</i> – Low</p> <p>One vegetation type and low species diversity.</p> <p><i>Ecological context</i> – Moderate</p> <p>A small area of wetland habitat that is part of a network of wetland habitat in the local landscape.</p>
<p>Barkers Road wetlands:</p> <p>BR_W1_NPSFM, BR_W2_NPSFM, BR_W3_NPSFM, BR_W4_NPSFM</p>	<p>A medium-sized (c.2.74 ha) area of wetland habitat located within a shallow relict lagoon channel²⁷. The vegetation is generally dominated by crack willow, but comprises a mosaic of finer vegetation types:</p> <ul style="list-style-type: none"> • Dead standing crack willow trees over dense <i>Carex secta</i> sedgeland and scattered to locally common tī kōuka trees and shrubs. Areas of open water are also present (BR_W1 (Photograph 5.8) and BR_W2 (Photograph 5.9)). • Crack willow forest and treeland over a variable groundcover containing <i>Carex secta</i>, tī kōuka, harakeke, karamū, and exotic grasses. Areas of open water and mud are present (BR_W3). 	Moderate	<p><i>Representativeness</i> – Moderate</p> <p>Parts of this site are dominated by native wetland species following crack willow control. Remaining areas contains elements of typical Canterbury wetland character and species composition but are moderately to highly degraded by domestic stock and exotic plant abundance.</p> <p><i>Rarity and distinctiveness</i> – Moderate</p> <p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare. Native vegetation and habitats are also very rare in the Low Plains ED, which makes any remaining native vegetation of high relative value.</p> <p><i>Diversity and pattern</i> – Moderate</p>

²⁶ See Appendix H of the hydrogeology technical assessment, which is Volume 3K of the SAR.

²⁷ Environment Canterbury Blackmaps.

Wetland ID	Description	Ecological Value	Justification
	<ul style="list-style-type: none"> Crack willow forest and scrub over exotic grass (BR_W4). Crack willow treeland over open water (BR_W4 (Photograph 5.10)). <p>A wide range of aquatic invertebrates are likely to be present. The hydrology of this wetland is likely a combination of connection with shallow groundwater and overland flow from the surrounding land.</p>		<p>Contains four broad habitat types that reflect water levels and permanence and degree of management intervention.</p> <p><i>Ecological context</i> – High</p> <p>A medium-sized area of relict wetland habitat that is part of a network of wetland habitat in the local landscape.</p>
FA_W1_NPSFM	<p>A very small (c.0.15 ha) area of wetland habitat situated within a shallow depression in farmland northwest of Barkers Road. This area comprises exotic grassland dominated by creeping bent with perennial ryegrass (<i>Lolium perenne</i>), narrow-leaved plantain (<i>Plantago lanceolata</i>), and white clover (<i>Trifolium repens</i>) also present (see Photograph 5.11).</p> <p>Top-soils (0-30 cm) within this area comprise dense, saturated clay with high plasticity. Below 30 cm soil character is the same as top-soils but contained indications of periodic inundation and reducing conditions (redox mottles within the matrix), which supports assessment of this area as a seasonal wetland.</p> <p>Based on hydrogeological modelling for this project²⁸, this area does not appear to be permanently connected with groundwater. Rather it likely receives water primarily through rainfall, with some overland inputs; water is retained due to high clay content of the soil.</p>	Low	<p><i>Representativeness</i> – Very Low</p> <p>Does not contain any elements representative of typical Canterbury wetland character and species composition; dominated by exotic species and heavily modified.</p> <p><i>Rarity and distinctiveness</i> – Moderate</p> <p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Very Low</p> <p>Contains one vegetation type and few plant species.</p> <p><i>Ecological context</i> – Low</p> <p>A very small area of wetland habitat that does not provide any key buffering to other wetland or terrestrial habitats, does not provide any water quality connectivity or filtering for the McIntosh Drain and is unlikely to provide more than negligible foraging resource for common native and exotic bird species.</p>
FR_W1_NPSFM	<p>A medium-sized (c.3.4 ha; Photograph 5.12) wetland area that is part of a much larger wetland complex (c.6.1 ha) located along a very shallow valley system. This area was not inspected in detail, but comprises crack willow forest</p>	Moderate	<p><i>Representativeness</i> – Low</p> <p>Contains few native wetland species that are representative of historic Canterbury wetland character and species composition.</p>

²⁸ See Appendix H of the hydrogeology technical assessment, which is Volume 3K of the SAR.

Wetland ID	Description	Ecological Value	Justification
	<p>with varying understorey and groundcover density and diversity depending on the willow canopy height and density, and permanence of saturated soils. Aquatic invertebrates are likely to be present.</p> <p>This area appears to receive overland flow from a medium-sized catchment which, in combination with groundwater seepage²⁹, sustains water levels seen at the site. It is also connected to, and receives water from, other wetland areas to the north (FR_W2 to FR_W4).</p>		<p>Highly modified by exotic plant abundance and domestic stock grazing.</p> <p><i>Rarity and distinctiveness</i> – Moderate</p> <p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Low</p> <p>One vegetation type and low native plant species diversity.</p> <p><i>Ecological context</i> – Moderate</p> <p>A medium-sized part of a much larger wetland habitat remnant that extends to the north and south. Likely to be important for local surface and potentially ground water quality connectivity and filtering. Likely to provide regular foraging habitat for common native and exotic wetland bird species.</p>
FR_W2_NPSFM	<p>A small (c.0.4 ha; Photograph 5.13) wetland area that is part of a much larger wetland complex (c.6.1 ha) located along a very shallow valley system. This area comprises damp to seasonally wet grassland dominated by creeping bent, perennial ryegrass, and white clover with soft rush (<i>Juncus effusus</i>) scattered throughout.</p> <p>This area appears to receive overland flow from surrounding land and flood outflows from the main wetland areas (FR_W3 and FR_W4).</p>	Moderate	<p><i>Representativeness</i> – Low</p> <p>Does not contain any native wetland species that are representative of historic Canterbury wetland character and species composition. Highly modified by exotic plant abundance and domestic stock grazing.</p> <p><i>Rarity and distinctiveness</i> – Moderate</p> <p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Low</p> <p>One vegetation type and low native plant species diversity.</p> <p><i>Ecological context</i> – Moderate</p> <p>A small part of a much larger wetland habitat remnant that extends to the south. Likely to be important for local surface and potentially ground water quality connectivity and filtering. Likely</p>

²⁹ See Appendix H of the hydrogeology technical assessment, which is Volume 3K of the SAR.

Wetland ID	Description	Ecological Value	Justification
			to provide regular foraging habitat for common native and exotic wetland bird species. Willows may provide nesting habitat for common native and exotic terrestrial species.
FR_W3_NPSFM	<p>A medium-sized (c.1.56 ha; Photograph 5.14) wetland area that is part of a much larger wetland complex (c.6.1 ha) located along a very shallow valley system. This area contains two key vegetation types that vary by permanence of surface water:</p> <ul style="list-style-type: none"> • Most of the wetland comprises soft rush and creeping bent dominated rushland or grassland. Jointed rush (<i>Juncus articulatus</i>) is locally common in places. • Some areas that are regularly wet, and at times contain shallow water, support grassland dominated by blue sweetgrass (<i>Glyceria declinata</i>). <p>A wide range of aquatic invertebrates are likely to be present.</p> <p>This area appears to receive overland flow from a small catchment, which is unlikely to sustain water levels seen at the site. It is therefore likely that this area is maintained through connection to shallow groundwater³⁰ and / or a spring at the head of the shallow valley within FR_W4.</p>	Moderate	<p><i>Representativeness</i> – Low Does not contain any native wetland species that are representative of historic Canterbury wetland character and species composition. Highly modified by exotic plant abundance and domestic stock grazing.</p> <p><i>Rarity and distinctiveness</i> – Moderate Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Moderate Contains at least two different vegetation types that vary by water permanence. Whilst not containing any native plant species, the site has moderate exotic species diversity which is used as a proxy for historical native plant diversity.</p> <p><i>Ecological context</i> – Moderate A medium-sized part of a much larger wetland habitat remnant that extends to the north and south. Likely to be important for local surface and potentially ground water quality connectivity and filtering. Likely to provide regular foraging habitat for common native and exotic wetland bird species.</p>
FR_W4_NPSFM	A small (c.0.71 ha; Photograph 5.15) wetland area that is part of a much larger wetland complex (c.6.1 ha) located along a very shallow valley system. This area comprises two main vegetation types:	Moderate	<p><i>Representativeness</i> – Low Does not contain any native wetland species that are representative of historic Canterbury wetland character and species composition. Highly modified by exotic plant abundance and domestic stock grazing.</p>

³⁰ See Appendix H of the hydrogeology technical assessment, which is Volume 3K of the SAR.

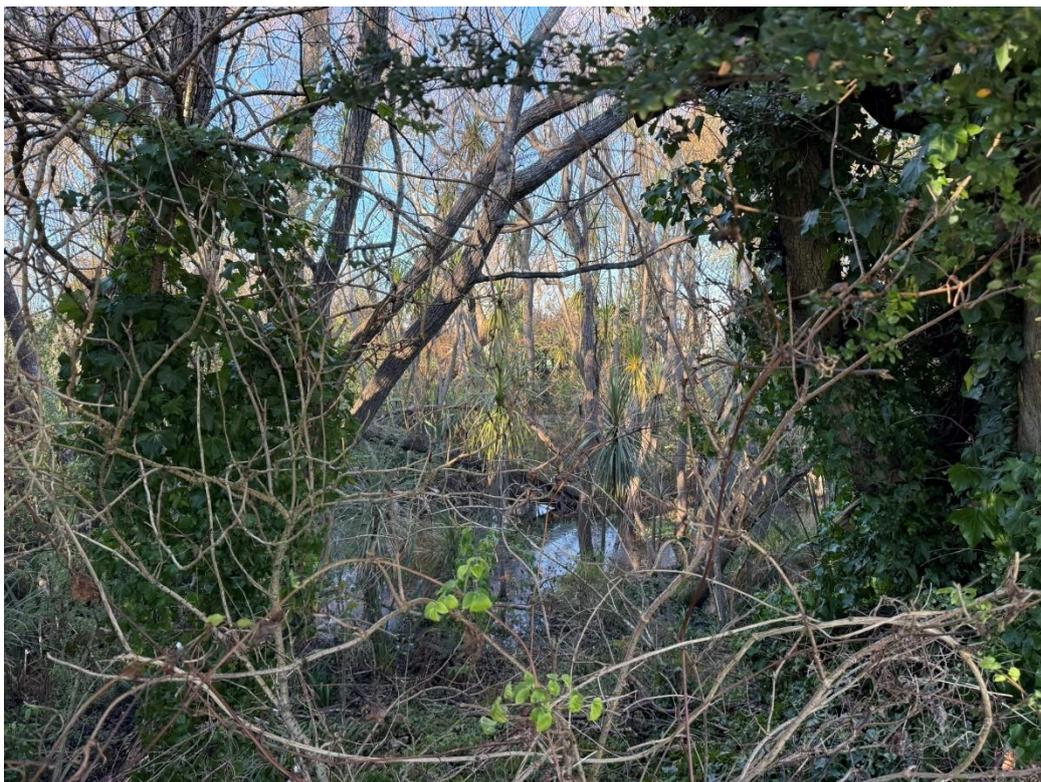
Wetland ID	Description	Ecological Value	Justification
	<ul style="list-style-type: none"> • Crack willow and grey willow scrub over open, shallow water with local coverage by duckweed (<i>Lemna disperma</i>). • Soft rush and creeping bent dominated rushland and grassland. <p>A wide range of aquatic invertebrates are likely to be present.</p> <p>This area appears to receive overland flow from a small catchment, which is unlikely to sustain water levels seen at the site. It is therefore likely that this area is maintained through connection to shallow groundwater²⁹ and / or a spring at the head of the shallow valley.</p>		<p><i>Rarity and distinctiveness</i> – Moderate</p> <p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Moderate</p> <p>Contains at least two different vegetation types that vary by water permanence. Whilst not containing any native plant species, the site has moderate exotic species diversity which is used as a proxy for historical native plant diversity.</p> <p><i>Ecological context</i> – Moderate</p> <p>A small part of a much larger wetland habitat remnant that extends to the south. Likely to be important for local surface and potentially ground water quality connectivity and filtering. Likely to provide regular foraging habitat for common native and exotic wetland bird species. Willows may provide nesting habitat for common native and exotic terrestrial species.</p>



Photograph 5.7: QP_W1_NPSFM willow scrub with standing water beneath canopy. Taken 7 May 2025.



Photograph 5.8: BR_W1_NPSFM dense Carex secta sedgeland with scattered emergent tī kōuka and patches of shallow open water / mud. Taken 24 July 2025.



Photograph 5.9: BR_W2_NPSFM moderate density crack willow canopy with a variable understorey and groundcover containing tī kōuka, Carex sp. and open water. Taken 24 July 2025.



Photograph 5.10: BR_W4_NPSFM crack willow trees over open water with other vegetation limited to the margins. Taken 24 July 2025.



Photograph 5.11: FA_W1_NPSFM pasture and hydrophytic grass and herb species within a slight depression in flat land adjacent the McIntosh Drain. Taken 8 May 2025.



Photograph 5.12: FR_W1_NPSFM crack willow forms a variable canopy above shallow open water at the northern end of this wetland. Taken 8 May 2025.



Photograph 5.13: FR_W2_NPSFM exotic hydrophytic grass and herb species with very shallow standing water on the eastern margin of crack willow forest (FR_W1_NPSFM). Taken 8 May 2025.



Photograph 5.14: FR_W3_NPSFM a mosaic of wetland rushland, grassland, open water and herbfield that extends between crack willow forest in FR_W1_NPSFM and FR_W4_NPSFM. Taken 8 May 2025.



Photograph 5.15: FR_W4_NPSFM shallow open water is present beneath a sparse crack willow canopy at the southern end of this wetland area. Taken 8 May 2025.

5.2.3 Freshwater ecological characteristics and values

5.2.3.1 Freshwater habitat (including streams and artificial lakes)

Quarry Lakes

For this EclA, the assessment of the Quarry Lakes habitat and fauna values has been completed on what is effectively a future environmental state, i.e., an environment where the early works construction activities have been completed (e.g., bulk fill and causeway reclamation of the South and East Lake). Therefore, the Project Site in this area includes artificial lakes which were formed through the extraction of gravel and sand, where the South Lake has been split into two through the early works construction activities. This has resulted in the South Lake remnant (c.2.5 ha) being formed and the remaining South Lake being retained, both will retain a maximum depth of approximately 10 m. Photograph 5.16 and Photograph 5.17 provide a contextual view of habitat characteristics which are currently present at the South Lake prior to any early works construction activities occurring.

Riparian vegetation is described in Section 5.2.1 above. The raupō (*Typha orientalis*) that was present on some of the margins would provide adequate habitat for fish. Once the early works have been completed, the South Lake will be split into two smaller lakes by the causeway reclamation. The freshwater habitat resulting from the early works will be comparable to pre-early works conditions, but there will be three lakes instead of two, with no surface water hydrological connection between the two South Lakes portions.

Historical aerial imagery shows that the South and East Lakes were previously separated, but more recent aerial imagery and onsite investigation shows these have since been amalgamated into a single system by a breach in the northern bank separating the two lakes in 2023. There is no

hydrological connection between the lakes and any natural waterbodies, with the exception of groundwater.

As detailed in Section 3.2.6.1, under the Canterbury LWRP, an artificial lake means a lake created because of excavating land by human action. Therefore, these waterbodies are classified as artificial.



Photograph 5.16: South Lake looking to the south bank of the South Lake prior to early works activities (06 May 2025).



Photograph 5.17: South Lake looking west from the east bank of the South Lake prior to early works activities (24 April 2025).

Overall, the three Quarry Lakes post-early works have been assessed as having **low** freshwater habitat value (Appendix B Table 4). This is due to their artificial nature with no connectivity to natural waterbodies, and poor native freshwater fauna species diversity (Section 5.2.3.2).

McIntosh Drain

McIntosh Drain is an intermittent modified natural watercourse that has historically been straightened to accommodate the agricultural land uses within the adjacent area (Photograph 5.18). However, within its upper catchment recent restoration measures have occurred. These have been generally tied into the consenting of new sub-divisions and have included riparian vegetation plantings and some increases in instream habitat and function.

Within the Project Site, McIntosh drain is characteristic of a low gradient agricultural watercourse within the Canterbury region. It consisted of slow shallow runs and pools, high deposited sediment and submergent macrophytes (Photograph 5.19); as well as having highly modified banks that have disconnected the stream from its natural flood plain and riparian area. This has restricted the natural movement and stream function of McIntosh Drain but has increased the hydrologic capacity and flow potential of the drain.

The confluence of McIntosh Drain with the Waimakariri River is approximately 5.4 km downstream of the Project Site. Approximately 210 m upstream of this confluence there is a tidal flap gate. The

presence of migratory fish species upstream of this structure (Section 5.2.3.2) indicates it is not a complete barrier to fish passage. No other barriers to fish passage have been identified on the McIntosh Drain within the FPAT database.

The overall SEV score for the 100 m reach (excluding biodiversity values) was 0.225. Function scores are presented in Table 5.5. This 'poor' score is reflective of the highly modified nature of the watercourse, with no riparian vegetation and poor aquatic habitat.

Overall, McIntosh Drain at the Project site has been assessed as having low current stream habitat value (Appendix B Table 4). This is due to the watercourse being highly modified with very high degradation and a low diversity fish community. Potential value of the McIntosh Drain is limited by its catchment land use.

Table 5.5: SEV function scores for McIntosh Drain

Function type	Function	Score
	Natural flow regime (NFR)	0.33
	Floodplain effectiveness (FLE)	0.00
	Connectivity for natural species migration (CSM)	0.30
	Natural connectivity to groundwater (CGW)	0.60
Hydraulic		0.31
	Water temperature control (WTC)	0.00
	Dissolved oxygen levels maintained (DOM)	0.40
	Organic matter input (OMI)	0.00
	Instream particle retention (IPR)	0.20
	Decontamination of pollutants (DOP)	0.80
Biogeochemical		0.28
	Fish spawning habitat (FSH)	0.05
	Habitat for aquatic fauna (HAF)	0.25
Habitat provision		0.15
	Fish fauna intact (FFI)	-
	Invertebrate fauna intact (IFI)	-
	Riparian vegetation intact (RVI)	0.00
Biodiversity		0.00
Overall SEV score		0.244



Photograph 5.18: McIntosh Drain looking downstream. Note the straightened and deepened nature (04 July 2025).



Photograph 5.19: McIntosh Drain stream bed dominated by macrophytes and silt (04 July 2025).

5.2.3.2 Freshwater fauna

Quarry Lakes

Five species of freshwater fish have been recorded within the South Lake on the NZFFD (Table 5.6). Of these five species, common bully (toitoi) is the only native species, which has a national conservation status of 'Not Threatened' (Dunn et al., 2023). The remaining four species are coarse fish, each with a conservation status of 'Introduced and naturalised' (Dunn et al., 2023), with rudd (*Scardinius erythrophthalmus*) additionally designated as a noxious pest fish species under the Freshwater Fisheries Regulations 1983.

A fish survey of the lake in early March 2025 using Gee's minnows, fyke nets, and eDNA captured toitoi, perch (*Perca fluviatilis*) and tench (*Tinca tinca*) (BML, 2025).

As there is no connection between the East and South Lakes with a natural waterbody, the four coarse fish species have likely been introduced into the artificial lake for recreational purposes. How common bully became established in the lakes is currently unknown. However, their presence is also likely the result of human relocation. Since the breach of the bank between the South and East Quarry Lakes in 2023, it can be expected the same species are within both lakes.

All species recorded are likely spawning within the two lakes where appropriate habitat is present, and therefore a self-sustaining fish community is present.

The ecological value for freshwater fauna in the East and South Lakes is considered **low** based on the presence of a single native freshwater fish species (toitoi) that is classified as 'Not Threatened' (Appendix B Table 1). The coarse fish that are present in the Quarry lakes are not included in this assessment of ecological value as they are introduced and have been released into the waterbody by human action for recreational purposes.

Table 5.6: NZFFD records of freshwater fauna, and Boffa Miskell 2025 fish survey and eDNA results from the Quarry Lake

Common name	Scientific name	National conservation status (Dunn et al., 2023)	Recorded in
Toitoi / common bully**	<i>Gobiomorphus cotidianus</i>	Not Threatened	BML (2025)
Goldfish	<i>Carassius auratus</i>	Introduced and naturalised	BML (2025)
Perch**	<i>Perca fluviatilis</i>	Introduced and naturalised	BML (2025)
Rudd	<i>Scardinius erythrophthalmus</i>	Introduced and naturalised, identified as a pest fish species	BML (2025)
Tench ⁺	<i>Tinca tinca</i>	Introduced and naturalised	BML (2025)

Note: *caught using trapping during 2025 fish survey. ⁺detected in eDNA sample.

McIntosh Drain

Eight species of freshwater fish have been recorded within the NZFFD in McIntosh Drain over the last 20 years and via eDNA collected as part of the freshwater BML fieldwork outlined in Section 3.1.2.2. Of these eight species, four have a national conservation status of either 'Threatened' or 'At Risk' (Dunn et al. 2023, Table 5.7). Three species present in the NZFFD records have only been detected downstream of the flap gate, but it can be assumed they are able to pass this structure due to the presence of other species upstream. The eDNA sampling (BML, 2025) only recorded īnanga and hao at the Project site.

No direct macroinvertebrate sampling was completed for this EclA, however eDNA detections (BML, 2025) of macroinvertebrate taxa did not detect the presence of EPT taxa, only *Chironomus* and *Culex*, which are commonly associated with poor-quality, soft bottomed habitat.

Table 5.7: NZFFD records of freshwater fauna within McIntosh Drain, and BML 2025 eDNA results

Common name	Scientific name	National conservation status (Dunn et al., 2023)	Recorded in
īnanga*	<i>Galaxias maculatus</i>	Threatened – Nationally vulnerable	NZFFD, BML (2025)
Māruru / giant bully	<i>Gobiomorphus gobioides</i>	At Risk – Naturally Uncommon	NZFFD
Tuna / longfin eel	<i>Anguilla dieffenbachii</i>	At Risk – Declining	NZFFD
Paraki / common smelt ⁺	<i>Retropinna retropinna</i>	At Risk – Declining	NZFFD
Aua / yelloweye mullet ⁺	<i>Aldrichetta forsteri</i>	Not Threatened	NZFFD
Hao / shortfin eel*	<i>Anguilla australis</i>	Not Threatened	NZFFD, BML (2025)
Toitoi / common bully	<i>Gobiomorphus cotidianus</i>	Not Threatened	NZFFD
Brown trout ⁺	<i>Salmo trutta</i>	Introduced and Naturalised	NZFFD

Note: *Detected in eDNA at the site. ⁺Only caught downstream of the flap gate.

The ecological value of freshwater fauna within McIntosh Drain at the Project site is considered **high** (Appendix B Table 4). This is based on the presence of a nationally 'Threatened' and 'At Risk' species.

5.3 Woodend Beach Road to Gladstone Road

An overview of sites characteristics for this section of the Project Site is provided in Appendix A Sheet 8 and Sheet 9. No alterations to the Project designation are being sought within this section of the Project.

5.3.1 Terrestrial riparian margin ecological characteristics and values

No terrestrial riparian margins are present within this section of the Project. Terrestrial ecological values are therefore not considered further for this section of the Project assessment.

5.3.2 Wetland habitat types

No wetlands were identified within this section of the Project Site. Wetlands are therefore not considered further for this section of the Project assessment.

5.3.3 Stream ecological characteristics and values

No stream habitats as defined in the RMA and the CLWRP were identified within this section of the Project. Stream values are therefore not considered further for this section of the Project assessment.

For clarity within this section of the Project Site the Waihora Stream consists entirely of sub-surface flows, when surface flows do occur these are commonly only during extended high rain fall periods (e.g., c. a 1 in 100-year event). Therefore, for the purpose of this EclA the Waihora Stream within this section of the Project Site is an ephemeral watercourse and is not a river under the RMA or the CLWRP.

5.4 Gladstone Road to SH1

A map overview showing ecological features for this section of the Project Site is provided in Appendix A Sheet 9 and Sheet 10. No alterations to the Project designation are being sought within this section of the Project.

5.4.1 Terrestrial riparian margin ecological characteristics and values

Terrestrial riparian margins of the Waihora Creek and associated wetland areas were assessed within the Project designation during site visits in April, May, and July 2025. A detailed ecological description of these features is outlined in Section 5.4.2 and 5.4.3 below. The terrestrial riparian margins consist primarily of exotic treeland, exotic grassland / scrub mosaic, rank exotic grass, and managed pasture (Appendix A Sheet 9 and Sheet 10).

The terrestrial riparian margin around the Waihora Stream comprises a relatively large area of exotic treeland. A range of exotic species are present including willows (*Salix* spp.), radiata pine, macrocarpa, and gum (*Eucalyptus* sp.). Understorey vegetation of this area consists primarily of gorse, broom, and occasional harakeke / flax (*Phormium tenax*) which is mainly associated with the adjoining wetland areas. Exotic treeland has a **negligible** ecological value from a botanical perspective.

Within the terrestrial riparian margin of the lower Waihora Creek, a small area of exotic grassland / scrub mosaic is present, however this is contiguous with a significantly larger area of this vegetation type within the wider designation. This area comprises broom with a dense infestation of old man's beard (*Clematis vitalba*) forming a canopy over the broom. Exotic grassland / scrub mosaic is considered to have a **negligible** ecological value from a botanical perspective. Rank grass is also considered to be of **negligible** value botanically.

Exotic treeland does however provide potential foraging and nesting habitat for ‘Not Threatened’ indigenous birds and confirmed habitat for ‘At Risk’ Canterbury grass skink. Similar habitat is well represented in the surrounding area and the exotic treeland is not considered to provide significant habitat for indigenous fauna. Areas of rank grass are also found between areas of exotic treeland. As such, both vegetation types are considered to be of **low** ecological value for habitat provision. Up to 0.22 ha of exotic treeland and 0.02 ha of rank grass within the terrestrial riparian margin may be impacted by the Project.

Exotic grassland / scrub vegetation provides confirmed habitat for Canterbury grass skink (Wildlands 2025) (Photograph Appendix D.8). As noted in section 5.2.1, this vegetation type is expected to provide preferential habitat for lizards and is also likely to provide potential foraging and breeding habitat for common indigenous birds including pīwakawaka, kahu, and riroriro. As such, a **moderate** ecological value has been assigned to this habitat type. Up to 0.07 ha of exotic grassland / scrub mosaic within the terrestrial riparian margin may be impacted by the Project.

Managed pasture has a **negligible** ecological value from both botanical and habitat provision perspectives because pasture is dominated by exotic plant species and high levels of disturbance mean it is unlikely to offer significant habitat for any indigenous fauna species. Small areas of buildings and gardens are located within the terrestrial riparian margins of WC_W1_NPSFM, and these areas are considered to have a **negligible** ecological value for fauna. Up to 0.22 ha pasture and 0.01 ha of buildings / gardens within the terrestrial riparian margins may be impacted by the Project.

5.4.2 Wetland habitat types

Seven wetland areas have been identified within 100 m of the existing designation, including two wetlands wholly and two wetlands partially within the designation and therefore potentially within the construction works footprint (see Sheets 9 and 10, Appendix A). The remaining three wetlands are located outside, but within 100 m of, the designation boundaries. The character and ecological value of these wetlands are outlined in Table 5.8 below.

All seven wetlands meet the definition of natural inland wetlands as per the NPS-FM.

Table 5.8: Descriptions of wetland areas located between Gladstone Road bridge and State Highway 1 and their current ecological value

Wetland ID	Description	Ecological Value	Justification
FA_W2_NPSFM	<p>A very small (c.0.05 ha) area of wetland habitat situated within an old river / stream valley and which retains some wetland hydrology and plant characteristics. This area is dominated by <i>Juncus edgariae</i> and Yorkshire fog, with cocksfoot also present (see Photograph 5.20). The presence of groundwater seepage at 35 cm below the ground surface, and redox mottling within soils indicates that this area is a seasonal wetland.</p> <p>The area is connected to shallow groundwater to the northeast and also receives water via rainfall and overland flow from the wider Waihora Stream catchment during flood events³¹.</p>	Low	<p><i>Representativeness</i> – Low Contains minor elements representative of typical Canterbury wetland character and species composition but exotic species are abundant. Heavily modified by agricultural practice.</p> <p><i>Rarity and distinctiveness</i> – Moderate Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Very Low Contains one vegetation type and few plant species.</p> <p><i>Ecological context</i> – Low A very small area of wetland habitat that does not provide any key buffering to other wetland or terrestrial habitats and is unlikely to provide more than negligible foraging resource for common native and exotic bird species.</p>
WC_W1_NPSFM	<p>A small (c.0.20 ha; Photograph 5.21) area of wetland habitat that is part of a larger wetland and stream complex (combined wetland area of c.1.1 ha) located along Waihora Stream.</p> <p>This area comprises crack willow forest and scrub over open, shallow water with common exotic grass and herb species (perennial rye grass, Yorkshire fog, hairy buttercup (<i>Ranunculus reflexus</i>)). Occasional tī kōuka are also present.</p> <p>This area receives water from Waihora Stream following heavy rain; the Waihora Stream terminates within this area and goes to ground.</p>	Moderate	<p><i>Representativeness</i> – Low Contains one native wetland species that is representative of historic wetland character and species composition. Highly modified by exotic plant abundance and domestic stock grazing.</p> <p><i>Rarity and distinctiveness</i> – Moderate Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Low One vegetation type and low species diversity.</p> <p><i>Ecological context</i> – Moderate A small part of a larger wetland and stream complex that extends to the north. Likely to be important for local surface and potentially ground water quality</p>

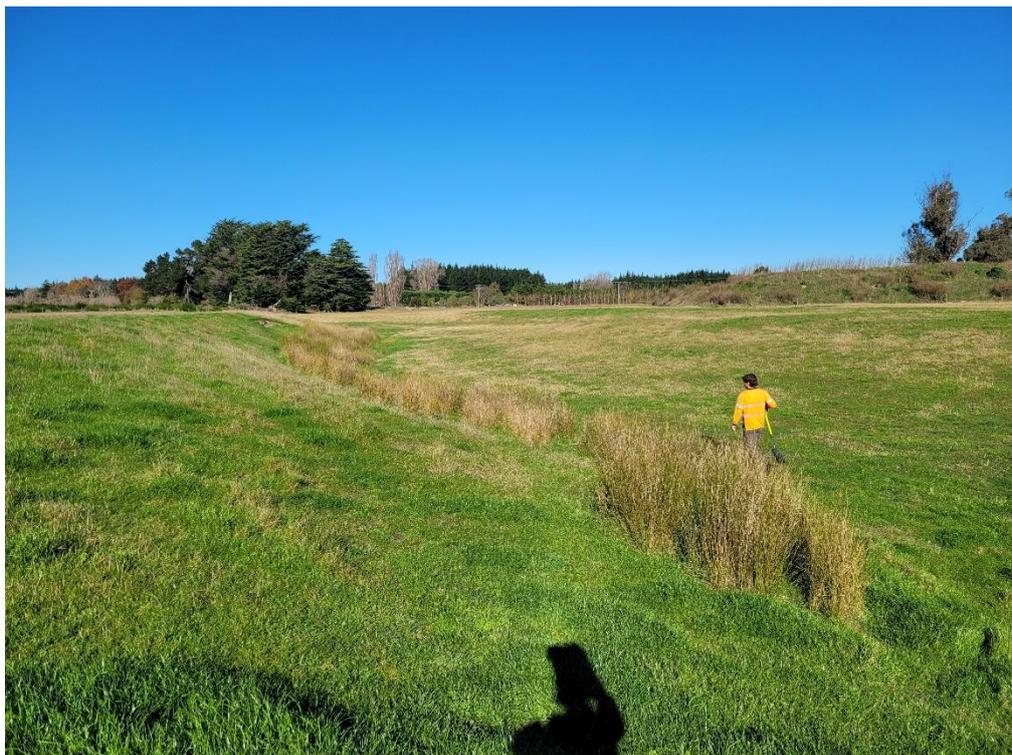
³¹ See Appendix H of the hydrogeology assessment, which is Volume 3K of the SAR.

Wetland ID	Description	Ecological Value	Justification
			connectivity and filtering. Likely to provide regular foraging habitat for common native and exotic bird species.
WC_W2_NPSFM	<p>A small (c.0.38 ha; Photograph 5.22) wetland area that is part of a larger wetland and stream complex (combined wetland area of c.1.1 ha) located along the Waihora Stream. This area comprises a range of wetland vegetation types that are present on the margins of a small area of shallow water where the Waihora Stream expands in width and water velocity slows:</p> <ul style="list-style-type: none"> • Leafless rush (<i>Juncus australis</i>) and giant rush rushland with local gorse. • <i>Carex virgata</i> sedgeland. • Leafless rush, creeping bent, Yorkshire fog, and creeping buttercup (<i>Ranunculus repens</i>) rushland. • Creeping bent grassland with local common water milfoil (<i>Myriophyllum propinquum</i>) within very shallow water. <p>This area is sustained through flow within the Waihora Stream as well as overland flow from the local sub-catchment. Shallow groundwater connectivity has also been demonstrated within the Waihora catchment³². Eels are likely to regularly use open water areas within this site, and a wide range of aquatic invertebrates are likely to be present.</p>	Moderate	<p><i>Representativeness</i> – Moderate Contains several areas that, whilst degraded, contain representative elements of historic Canterbury wetland character and species composition. Modified by domestic stock grazing.</p> <p><i>Rarity and distinctiveness</i> – Moderate Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Moderate Contains at least four different habitat types, with moderate native plant species diversity.</p> <p><i>Ecological context</i> – Moderate A small part of a larger wetland and stream complex that extends to the north and south. Likely to be important for local surface and potentially ground water quality connectivity and filtering. Several wetland bird species noted using the habitat during the site visit.</p>
WC_W3_NPSFM	<p>A small (c.0.23 ha) wetland area that is part of a larger wetland and stream complex (combined wetland area of c.1.1 ha) located along the Waihora Stream. This area comprises two main vegetation types:</p>	Moderate	<p><i>Representativeness</i> – Moderate Retains some representative native wetland elements. Highly modified by exotic plant abundance and domestic stock grazing.</p> <p><i>Rarity and distinctiveness</i> – Moderate</p>

³² PDP (May 2025) Groundwater – Surface water interactions along proposed Belfast to Pegasus Woodend Bypass alignment. Prepared for NZTA / Waka Kotahi.

Wetland ID	Description	Ecological Value	Justification
	<ul style="list-style-type: none"> Crack willow forest on the riparian margins of the creek. Patches of harakeke, tī kōuka and blackberry are also present in the understorey. Scattered native shrubs (e.g. karamū) and groundferns (<i>Polystichum</i> sp. and piupiu (gully fern, <i>Pakau pennigera</i>)) are also present. <i>Carex virgata</i> sedgeland. <p>This area is sustained through flow within the Waihora Stream as well as overland flow from the local sub-catchment. Eels are likely to regularly use shallow water within this site, and a wide range of aquatic invertebrates are likely to be present.</p>		<p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Moderate</p> <p>Contains at least two different vegetation types and several native plant species.</p> <p><i>Ecological context</i> – Moderate</p> <p>A small part of a larger wetland habitat remnant that extends to the north and south. Likely to be important for local surface and potentially ground water quality connectivity and filtering. Likely to provide regular foraging habitat for common native and exotic bird wetland species. Willows likely to provide nesting habitat for common native and exotic terrestrial bird species.</p>
WC_W4_NPSFM	<p>A small (c.0.14 ha; Photograph 5.23) wetland area that is part of a larger wetland and stream complex (combined wetland area of c.1.1 ha) located along the Waihora Stream. This area comprises two main vegetation types:</p> <ul style="list-style-type: none"> Crack willow forest on the riparian margins of the creek. Patches of harakeke, tī kōuka and blackberry are also present in the understorey. Scattered native shrubs (e.g. karamū) and groundferns (<i>Polystichum</i> sp. and gully fern are also present. <i>Carex virgata</i> sedgeland. <p>This area is sustained through flow within the Waihora Stream as well as overland flow from the local sub-catchment. Eels are likely to regularly use shallow water within this site, and a wide range of aquatic invertebrates are likely to be present.</p>	Moderate	<p><i>Representativeness</i> – Moderate</p> <p>Retains some representative native wetland elements. Highly modified by exotic plant abundance and domestic stock grazing.</p> <p><i>Rarity and distinctiveness</i> – Moderate</p> <p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Moderate</p> <p>Contains at least two different vegetation types and several native plant species.</p> <p><i>Ecological context</i> – Moderate</p> <p>A small part of a larger wetland habitat remnant that extends to the north and south. Likely to be important for local surface and potentially ground water quality connectivity and filtering. Likely to provide regular foraging habitat for common native and exotic wetland bird species. Willows likely to provide nesting habitat for common native and exotic terrestrial bird species.</p>
WC_W5_NPSFM	<p>A very small (c.0.01 ha; Photograph 5.24) wetland area that is part of a larger wetland and stream complex (c.1.1 ha) located along the Waihora Stream. This area comprises a small area of <i>Juncus edgariae</i> rushland</p>	Low	<p><i>Representativeness</i> – Low</p>

Wetland ID	Description	Ecological Value	Justification
	<p>with browntop and white clover in a shallow hollow connected to the Waihora Stream. Standing water was present at the time of the site visit.</p> <p>This area is sustained through flood-flows from the Waihora Stream as well as overland flow from the local sub-catchment.</p>		<p>Contains minor elements representative of typical Canterbury wetland character and species composition but exotic species are abundant. Heavily modified by agricultural practice / landscaping.</p> <p><i>Rarity and distinctiveness</i> – Moderate</p> <p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Very Low</p> <p>Contains one vegetation type and few plant species.</p> <p><i>Ecological context</i> – Low</p> <p>A very small area of wetland habitat that does not provide any key buffering to other wetland or terrestrial habitats, does not provide any water quality connectivity or filtering for the Waihora Stream and is unlikely to provide more than negligible foraging resource for common native and exotic bird species.</p>
WC_W6_NPSFM	<p>A small (0.15 ha; Photograph 5.25) wetland area that is part of a larger wetland and stream complex (combined wetland area of c.1.1 ha) located along the Waihora Stream. This area comprises a mosaic of three key wetland vegetation types:</p> <ul style="list-style-type: none"> • Crack willow forest with dense <i>Carex virgata</i> groundcover. • Crack willow scrub over bare mud. • Yorkshire fog, sharp spike sedge (<i>Eleocharis acuta</i>), rautahi, cocksfoot, and creeping buttercup grassland and sedgeland. <p>This area is sustained through flood-flows from the Waihora Stream, overland flow from the local sub-catchment, and interception of shallow groundwater. Aquatic invertebrates are likely to be present.</p>	Moderate	<p><i>Representativeness</i> – Moderate</p> <p>Retains representative native wetland elements. Modified by exotic plant abundance and domestic stock grazing.</p> <p><i>Rarity and distinctiveness</i> – Moderate</p> <p>Although the site does not contain any rare or distinctive plants or vegetation types, wetlands are nationally rare and regionally very rare.</p> <p><i>Diversity and pattern</i> – Moderate</p> <p>Contains at least three different vegetation types and has moderate native plant species diversity.</p> <p><i>Ecological context</i> – Moderate</p> <p>A small part of a larger wetland habitat remnant that extends to the south. Likely to be important for local surface and potentially ground water quality connectivity and filtering. Likely to provide regular foraging habitat for common native and exotic wetland bird species. Willows likely to provide nesting habitat for common native and exotic terrestrial bird species.</p>



*Photograph 5.20: FA_W2_NPSFM comprises a long, narrow area of *Juncus edgariae* rushland at the base of a small slope formed as part of the relict Waihora Stream system. Taken 7 May 2025.*



Photograph 5.21: WC_W1_NPSFM contains a patchy crack willow canopy over exotic grasses and herbs adapted to seasonally wet conditions. Occasional tī kōuka are also present. Taken 7 May 2025.



Photograph 5.22: WC_W2_NPSFM contains a range of different wetland vegetation types as well as open water. Wetland grasses and turf species are present in a lobe that extends into grazed paddocks, whilst open water areas are fringed with either Carex or Juncus species. Taken 8 May 2025.



Photograph 5.23: WC_W4_NPSFM contains a range of wetland species beneath a crack willow canopy. Common species include Carex virgata, harakeke, and tī kōuka. Taken 6 May 2025.



Photograph 5.24: WC_W5_NPSFM comprises a small hollow with *Juncus edgariae*, leaf litter, and exotic grasses. A slight depression connects this area to the Waihora Stream. Taken 6 May 2025.



Photograph 5.25: WC_W6_NPSFM. Part of this area contains dense *Carex virgata* beneath a crack willow canopy (left) however a small area of sharp spike sedge and wetland grasses is also present (right). Taken 6 May 2025.

5.4.3 Stream ecological characteristics and values

5.4.3.1 Stream habitat

Waihora Stream downstream of SH1 is part of a wetland / stream complex. From the SH1 bridge to a farm track adjacent to the golf course the Waihora Stream has been classified as wetland.

Downstream of this to the 160 Gladstone Road property southeast of the golf course has been

classified as an intermittent stream. The intermittent section does not have a CLWRP river classification.³³

Beyond this intermittent section, the Waihora Stream becomes an ephemeral channel, where flows are only conveyed during substantial rain events (e.g., 1 in 100 year events). Due to this, the Waihora Stream eastwards of the buildings at 160 Gladstone Road through to approximately 91 Woodend Beach Road, is not classified as a river in the RMA nor the CLWRP. From 91 Woodend Beach Road, Waihora Stream is predominantly comprised of surface water flows and is again classified as river in the RMA and CLWRP. The ephemeral sections of Waihora Stream are not assessed any further in this EclA.

Riparian vegetation within the intermittent section of the Waihora Stream is primarily crack willow, rank grass, and areas of grazed grass (Photograph 5.26 & Photograph 5.27). A description of the riparian margin vegetation is provided in 5.4.1. Crack willow is also present within the flowing channel in some areas and was observed to be impounding flow. Silt is the dominant substrate, with submerged and surface reaching macrophytes present.

An embedded PVC pipe culvert funnels flow from a slow flowing ponded area upstream beneath the farm track near the golf course, likely creating a barrier to upstream fish passage in some flow conditions (Photograph 5.28). Similarly, as there is no downstream connection to the ocean, during dry periods habitat for freshwater fauna is only available via flood flows overtopping the banks near Taranaki Stream.

Spot water quality measurements collected by BML and T+T showed that temperature and dissolved oxygen were at levels that meet the CLWRP Freshwater Outcomes for Canterbury Rivers at the time of sampling.

It should be noted that the resource consent for the Ravenwood sub-division specifies that flows within the Waihora Stream are to be supplemented (at its upper extent) via the piping of base flows from a spring located within the sub-division.

The overall SEV score for the 100 m reach (excluding fish biodiversity values) was 0.380. Function scores are presented in Table 5.9. The highest function score was the hydraulic function, at 0.68. The remaining three functions scored poorly, ranging from 0.11 to 0.28.

Table 5.9: SEV function scores for Waihora Stream downstream of SH1 at 160 Gladstone Road

Function type	Function	Score
	Natural flow regime (NFR)	0.53
	Floodplain effectiveness (FLE)	0.35
	Connectivity for natural species migration (CSM)	1.00
	Natural connectivity to groundwater (CGW)	0.83
Hydraulic		0.68
	Water temperature control (WTC)	0.18
	Dissolved oxygen levels maintained (DOM)	0.34
	Organic matter input (OMI)	0.05
	Instream particle retention (IPR)	0.20
	Decontamination of pollutants (DOP)	0.58

³³ Classification per the 'LWRP - Water Quality Management Units and Classes-Rivers' GIS layer in Canterbury Maps

Function type	Function	Score
Biogeochemical		0.27
	Fish spawning habitat (FSH)	0.05
	Habitat for aquatic fauna (HAF)	0.16
Habitat provision		0.11
	Fish fauna intact (FFI)	-
	Invertebrate fauna intact (IFI)	-
	Riparian vegetation intact (RVI)	0.28
Biodiversity		0.28
Overall SEV score		0.380

Overall, Waihora Stream downstream of SH1 has been assessed as having a low current stream habitat value (Appendix B Table 4). This is due to the watercourse being modified with culverts, having poor diversity, high sedimentation and an SEV score less than 0.4. Any potential improvements to Waihora Stream are limited by the upstream catchment land use.



Photograph 5.26: Waihora Stream looking upstream from golf course (0.3 July 2025).



Photograph 5.27: Waihora Stream looking downstream from golf course. Note willows downstream (03 July 2025).



Photograph 5.28: Waihora Stream looking upstream at piped section near golf course (03 July 2025).

5.4.3.2 Freshwater fauna

Five species of freshwater fish have been detected in eDNA samples collected as part of the BML field work outlined in Section 3.1.2.2 (Table 5.10). Of these five species, only two species, hao and toitoi have been recorded in the Waihora Stream intermittent reach at 160 Gladstone Road. Both species have a national conservation status of 'Not Threatened' (Dunn et al., 2023). A fish survey by BML did not see or catch any fish.

As Waihora Stream is supplemented with flow from a spring within and / or adjacent to the Taranaki Stream, there is the potential for eDNA detections to be transferred downstream and detected within Waihora Stream. Given the intermittent nature of the watercourse, uncertainty of the eDNA results, and no detections from electric fishing, it has been assumed there are no or a very low likelihood of fish being present within the intermittent sections of Waihora Stream.

Table 5.10: BML 2025 eDNA results of Waihora Stream downstream of SH1

Common name	Scientific name	National conservation status (Dunn et al., 2023)	Recorded in
Īnanga*	<i>Galaxias maculatus</i>	Threatened – nationally vulnerable	BML (2025)
Tuna / longfin eel *	<i>Anguilla dieffenbachii</i>	At Risk – Declining	BML (2025)
Hao / shortfin eel	<i>Anguilla australis</i>	Not Threatened	BML (2025)
Toitoi / common bully	<i>Gobiomorphus cotidianus</i>	Not Threatened	BML (2025)
Brown trout*	<i>Salmo trutta</i>	Introduced and naturalised	BML (2025)

Note: *only detected in eDNA samples from 1188 Main North Road, immediately downstream of SH1.

The macroinvertebrate community was sampled from Waihora Stream at two locations downstream of SH1 by BML. Results are presented in Table 5.16. The number of EPT taxa was low at both sites. As mentioned in Section 3.2.6.4, this is expected of intermittent streams as EPT taxa are sensitive to dry periods. Three EPT taxa were identified within the watercourse. All three were of the order trichoptera. Two of the three were of the genera *Oxyethira* and *Paroxyethira*, which have low indicator scores (1.2 and 3.7, respectively) and are common in streams with low shading and abundant macrophyte or algal growth. The third genus, *Psilochorema*, has a high indicator score (7.8), but only a single individual was found. Over a quarter of the individuals within the Gladstone Road sample were *Oxyethira*, the most tolerant trichoptera genus. Most of the remaining taxa were tolerant taxa from the genus *Diptera*. The Main North Road sample was dominated by tolerant taxa from the mollusca and crustacea groups.

Table 5.11: Summary of Waihora Stream downstream of SH1 macroinvertebrate community metrics. Surveyed in 2025 by BML

Site	Total richness	EPT richness	%EPT abundance	MCI-sb	QMCI-sb	ASPM
Waihora Stream – 160 Gladstone Road	18	1	2.56	58.67	2.21	0.11
Waihora Stream – 1188 Main North Road	24	3	12.50	69.42	2.48	0.13

Note: Where values are in bold, these do not meet the relevant NPS-FM national bottom lines: MCI \geq 90; QMCI \geq 4.5; ASPM \geq 0.3.

Overall, the Waihora Stream downstream of SH1 has been assessed as having a low current freshwater fauna value (Appendix B Table 4). This is due to the existing habitat, limited fish passage and intermittent nature of the watercourse likely not supporting a fish community, and the benthic invertebrate community dominated by a few tolerant species.

5.5 Pegasus interchange

A map overview showing ecological features for this section of the Project Site is provided in Appendix A Sheet 10 and Sheet 11. A land area of approximately 0.29 ha is sought to be added to the Project designation (of relevance to the notice of requirement to alter a designation sought under the FTAA). This area (the 'Pegasus designation alteration') sits along the western side of SH1 after the existing Pegasus Roundabout.

5.5.1 Terrestrial riparian margin ecological characteristics and values

Terrestrial riparian margins located either side of the Taranaki and upper Waihora Creek have been planted with various indigenous species, largely comprising *Carex* sp., *Juncus* sp. and tī kōuka. Additional indigenous species are present in small numbers within the riparian margins of these streams and include kōhūhū and mānuka. The ecological value of the indigenous plantings from a botanical perspective is considered low. Small areas of exotic treeland and rank grass are located on the true left bank of the upper Waihora Creek. As per Section 5.4.1, exotic treeland and rank grass have an ecological value of low. Approximately 0.07 ha of exotic treeland, 0.35 ha of indigenous plantings, 0.78 ha of managed grass, and 0.03 ha of rank grass sit within the terrestrial riparian margins of this Project section.

Coprosma virescens has been planted with other indigenous species, such as flax, mingimingi (*Coprosma propinqua*), and small leaved kōwhai (*Sophora micrphylla*), adjacent to Taranaki Stream near Bob Robertson Drive. While most of the species within this area have a threat status of 'Not

Threatened', *Coprosma virescens* has a national conservation status of 'At Risk – Declining' (de Lange et al 2024) and is therefore considered to have an ecological value of **high** under the EclAG framework. However, as this species is planted within amenity plantings it is considered to have an ecological value of **low**, alongside the other 'Not Threatened' indigenous plants present within this area.

The Pegasus designation alteration consists of numerous vegetation types comprising relatively small areas totalling 0.29 ha. This includes managed grass, pasture, rank grass, buildings and gardens, and exotic shelterbelts. All of these vegetation types are considered to be of **negligible** ecological value from a botanical perspective.

Rank grass, buildings and gardens, and exotic shelterbelt provide limited **low** value habitat for 'Not Threatened' indigenous bird species and Canterbury grass skink. The total area of each vegetation type within the designation alteration includes:

- 46 m² of rank grass.
- 925 m² of buildings and gardens.
- 226 m² of exotic shelterbelts.

The remainder of the vegetated area consists of pasture or managed grass.

Seven indigenous and three exotic bird species were recorded in this section. All indigenous bird species recorded have a conservation status of 'Not Threatened' and have been assigned an ecological value of **low**.

Canterbury grass skink was detected in adjoining habitat / vegetation types to the Pegasus designation alteration. It is likely that Canterbury grass skink is present in planted indigenous vegetation within the terrestrial riparian margins of the Taranaki Stream; however, potential lizard habitat within this section was not surveyed in the 2024 / 2025 lizard survey (Wildlands 2025). Lizards have been assumed present within these areas for the purpose of this effects assessment.

5.5.2 Stream ecological characteristics and values

A variety of riparian and in-stream habitat parameters were recorded at two locations (upstream of Bob Robertson Drive (BML) and downstream of Bob Robertson Drive (T+T)) on the Taranaki Stream. Sample sites were approximately 300 m apart. The Taranaki Stream is classed as a 'Spring-fed Plains' river in the CLWRP.³⁴

Habitat information for the Taranaki Stream Tributary and the Waihora Stream has relied on historical reports and SEV results collected for the purpose of this EclA.

5.5.2.1 Stream habitat

Taranaki Stream upstream of Bob Robertson Drive

Taranaki Stream upstream of Bob Robertson Drive, is soft bottomed with an average wetted width of 3.3 m and an average depth of 0.4 m. Areas of gravel, pebble and large cobble with fine sediment cover (<2 mm) were recorded amongst the soft substrates. The average submergent and emergent macrophyte cover is approximately 40 %.

Riparian vegetation includes *Carex* sp., *Juncus* sp., tī kōuka, gorse, grey willow, rank grass and mown grass (Photograph 5.29). No active erosion of the banks is evident. The reach was last realigned in 2017 to accommodate a development. The site scored 51 of 100 on the rapid habitat assessment (RHA) (Clapcott, 2015), indicating 'good' habitat availability for macroinvertebrates and fish. A

³⁴ Classification per the 'LWRP - Water Quality Management Units and Classes-Rivers' GIS layer in Canterbury Maps.

review of fish barriers on the FPAT database showed no obstructions to fish passage between the site and the ocean, but a site visit identified a cascade feature downstream of the Garlick Street Bridge culvert (Photograph 5.30). This cascade is likely a barrier to swimming species, but navigable by climbing or jumping species such as eel or trout.



Photograph 5.29: Taranaki Stream looking upstream from Bob Robertson Drive.



Photograph 5.30: Cascade feature on Taranaki Stream downstream of the Garlick Road Bridge, likely a barrier to swimming species.

Taranaki Stream downstream of Bob Robertson Drive

Taranaki Stream downstream of Bob Robertson Drive is primarily soft bottomed with patches of gravels and cobbles (Photograph 5.31 and Photograph 5.32). Within the 100 m SEV reach a single boulder riffle from previous realignment works in 2017 was observed. The reach had an average width of 2.9 m and an average depth of 0.31 m which was representative of this section of the Taranaki Stream.

Flow was comprised of slow run throughout. Invasive submerged and emergent macrophytes are present across most of the channel, with monkey musk (*Erythranthe moschata*), Canadian pondweed (*Elodea canadensis*) and curly-leaf pondweed (*Potamogeton crispus*) dominating the macrophyte community. Riparian vegetation is predominantly *Carex* sp. and *Juncus* sp., with tī kōuka, gorse, grey willow, rank grass and mown grass also present. This riparian vegetation provides low shading to the watercourse. A review of fish barriers on the FPAT database showed no obstructions to fish passage between the site and the ocean.

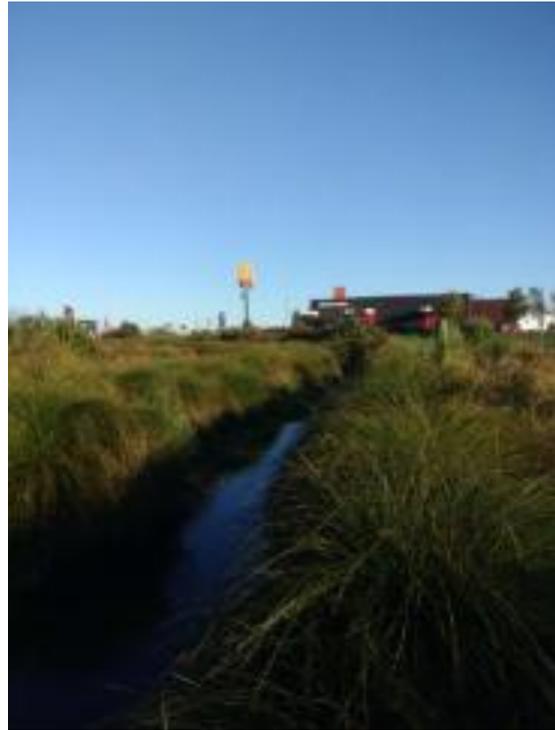
The overall SEV score for the 100 m stream reach of Taranaki Stream upstream of the confluence with the Taranaki Stream Tributary was 0.466. Function scores are presented in Table 5.12. The hydraulic function score was the highest of the four at 0.64, with habitat and biodiversity the lowest, both at 0.37.

Table 5.12: SEV function scores for Taranaki Stream downstream of Bob Robertson Drive

Function type	Function	Score
	Natural flow regime (NFR)	0.55
	Floodplain effectiveness (FLE)	0.20
	Connectivity for natural species migration (CSM)	1.00
	Natural connectivity to groundwater (CGW)	0.81
Hydraulic		0.64
	Water temperature control (WTC)	0.22
	Dissolved oxygen levels maintained (DOM)	0.68
	Organic matter input (OMI)	0.10
	Instream particle retention (IPR)	0.32
	Decontamination of pollutants (DOP)	0.81
Biogeochemical		0.43
	Fish spawning habitat (FSH)	0.40
	Habitat for aquatic fauna (HAF)	0.34
Habitat provision		0.37
	Fish fauna intact (FFI)	0.47
	Invertebrate fauna intact (IFI)	0.51
	Riparian vegetation intact (RVI)	0.12
Biodiversity		0.37
Overall SEV score		0.466



Photograph 5.31: Taranaki Stream looking downstream, downstream from Bob Robertson Drive (06 May 2025).



Photograph 5.32: Taranaki Stream looking upstream, downstream from Bob Robertson Drive (06 May 2025).

Overall, Taranaki Stream has been assessed as having **moderate** current ecological value for stream habitat, based on Appendix B Table 4. This is due to the watercourse being modified from natural conditions, characterised by a benthic invertebrate community dominated by taxa tolerant of organic enrichment, a moderate diversity fish community (Section 5.5.2.2) and comparable moderate SEV score (0.466) and good RHA (0.51) scores. The potential ecological value is restricted by the agricultural and urban land use catchment upstream and is unlikely to reach a value of high without catchment wide improvements.

Taranaki Stream Tributary

The Taranaki Stream Tributary is an engineered channel that has its confluence with the Taranaki Stream upstream of SH1. Historical aerial imagery shows the tributary was originally a drainage channel flowing into Taranaki Stream, but in 2017 was realigned and now the upstream sections flow into a stormwater detention wetland before being culverted beneath Kesteven Place and joining Taranaki Stream approximately 20 m upstream from SH1. Due to the stream deriving its surface water flow from natural portions in its upper catchment it has conservatively been defined as a modified natural watercourse.

Instream habitats primarily consisted of soft substrates, with small amounts of gravels and cobbles are present. The average depth is approximately 0.12 m, with an average width of approximately 1.5 m. Flow was slow run. Like Taranaki Stream, the macrophyte community is primarily monkey musk, Canadian pondweed and curly-leaf pondweed, but growth is not as excessive within this channel. Riparian vegetation is primarily *Carex* sp., providing moderate shading to the watercourse due to its incised nature (Photograph 5.33 and Photograph 5.34). There is little to no connection to the floodplain.

The overall SEV score for the 100 m stream reach for the Taranaki Stream Tributary was 0.342. Function scores are presented in Table 5.13. The hydraulic function score was the highest at 0.49, with biogeochemical, habitat provision and biodiversity functions all scoring poorly.

Table 5.13: SEV function scores for the Taranaki Stream Tributary

Function type	Function	Score
	Natural flow regime (NFR)	0.33
	Floodplain effectiveness (FLE)	0.02
	Connectivity for natural species migration (CSM)	1.00
	Natural connectivity to groundwater (CGW)	0.60
Hydraulic		0.49
	Water temperature control (WTC)	0.52
	Dissolved oxygen levels maintained (DOM)	0.68
	Organic matter input (OMI)	0.00
	Instream particle retention (IPR)	0.20
	Decontamination of pollutants (DOP)	0.51
Biogeochemical		0.38
	Fish spawning habitat (FSH)	0.10
	Habitat for aquatic fauna (HAF)	0.31
Habitat provision		0.21
	Fish fauna intact (FFI)	0.33
	Invertebrate fauna intact (IFI)	0.15
	Riparian vegetation intact (RVI)	0.04
Biodiversity		0.17
Overall SEV score		0.342

Overall, the Taranaki Stream Tributary has been assessed as having a low current ecological value for stream habitat (Appendix B Table 4). This is based on the watercourse having unnatural fine sediment loading and being disconnected from the flood plain due to incising, a macroinvertebrate community dominated by a few taxa tolerant of organic enrichment and low MCI-sb and QMCI-sb scores, a low diversity fish community, and an SEV score less than 0.4. The potential ecological value is restricted by the agricultural and urban land use catchment upstream. A stormwater detention wetland has been constructed in the upstream catchment which likely improves the water quality of runoff entering the watercourse, but fine sediment is still an issue. An improvement is unlikely without catchment wide improvements.



Photograph 5.33: Tributary of Taranaki Stream looking downstream to confluence with Taranaki Stream. Note incised channel and uniform riparian vegetation (01 July 2025).



Photograph 5.34: Tributary of Taranaki Stream looking upstream. Note incised channel and uniform riparian vegetation (01 July 2025).

Waihora Stream

As mentioned in Section 5.4.3.1, flows within Waihora Stream (at its upper extent) are supplemented via the piping of base flows from a spring located within the Ravenswood sub-division. As a result, flow from Taranaki Stream catchment enters the upstream end of Waihora Stream via a subsurface plastic pipe culvert, approximately 40 m downstream of the Garlick Street Bridge.

Overall, the channel is comprised of silt, sand and small gravels (Photograph 5.36). The stream at this site has been observed to have excessive macrophyte growth upstream of the SH1 culvert year round (Photograph 5.35, Photograph 5.37 and Photograph 5.38). This excessive growth was evident during site visits in both April and July 2025, with the invasive macrophyte monkey musk dominating the watercourse. Flow is slow run, with sections of very little flow due to the excessive macrophyte growth. Riparian vegetation is predominantly rank grass which provides very little effective shading to the channel. There is evidence the channel is mechanically cleared.

The status of the culvert connecting to Taranaki Stream is not on the NIWA fish passage assessment tool or ECan fish barrier layer, and the inlet could not be found during a site visit, so it is unknown the extent of this as a barrier to fish passage. The box culvert beneath SH1 is classified as not obstructing fish passage on the ECan fish barrier layer.

Spot water quality sampling by BML and T+T showed that temperature and dissolved oxygen were at levels that meet the CLWRP Freshwater Outcomes for Canterbury Rivers at the time of sampling.

The overall SEV score for the 100 m stream reach upstream of the SH1 bridge was 0.360. Function scores are presented in Table 5.14. The reach scored well in hydraulic function with a score of 0.73, but low in the remaining three functions.

Table 5.14: SEV function scores for Waihora Stream upstream of SH1

Function type	Function	Score
	Natural flow regime (NFR)	0.56
	Floodplain effectiveness (FLE)	0.49
	Connectivity for natural species migration (CSM)	1.00
	Natural connectivity to groundwater (CGW)	0.89
Hydraulic		0.73
	Water temperature control (WTC)	0.08
	Dissolved oxygen levels maintained (DOM)	0.34
	Organic matter input (OMI)	0.09
	Instream particle retention (IPR)	0.05
	Decontamination of pollutants (DOP)	0.64
Biogeochemical		0.24
	Fish spawning habitat (FSH)	0.05
	Habitat for aquatic fauna (HAF)	0.16
Habitat provision		0.10
	Fish fauna intact (FFI)	0.00
	Invertebrate fauna intact (IFI)	0.45
	Riparian vegetation intact (RVI)	0.25
Biodiversity		0.35
Overall SEV score		0.360

Overall, the stream habitat within Waihora Stream has been assessed as having a current ecological value of low (Appendix B Table 4). This is based on the channel being modified from natural conditions, a benthic invertebrate community with low diversity, dominated by taxa tolerant of organic enrichment and settled sediments, minimal riparian vegetation, a single flow type, and an SEV score less than 0.4.



Photograph 5.35: Waihora Stream - Midreach between culvert to Taranaki Stream and SH1 bridge, looking upstream (15 April 2025).



Photograph 5.36: Waihora Stream looking upstream to SH1 bridge (15 April 2025).



Photograph 5.37: Waihora Stream looking upstream midreach (01 July 2025).



Photograph 5.38: Waihora Stream looking downstream midreach (01 July 2025).

5.5.2.2 Freshwater fauna

Taranaki Stream

Several species of native freshwater fish have been recorded in the Taranaki Stream, upstream of State Highway 1 in the NZFFD in the last 20 years, or by Boffa Miskell ecologists during a fish survey and eDNA sampling on 12 February 2025 (Table 5.15). This includes one nationally 'Threatened' and one 'At Risk' species (Dunn et al., 2023), īnanga and tuna, respectively.

Table 5.15: NZFFD records of freshwater fauna within Taranaki Stream upstream of State Highway 1 from the last 20 years, and BML 2025 fish survey and eDNA results

Common name	Scientific name	National conservation status (Dunn et al., 2023)	Recorded in
Īnanga*	<i>Galaxias maculatus</i>	Threatened – Nationally vulnerable	BML (2025)
Tuna / longfin eel **	<i>Anguilla dieffenbachii</i>	At Risk – Declining	NZFFD, BML (2025)
Hao / shortfin eel **	<i>Anguilla australis</i>	Not Threatened	BML (2025)
Toitoi / common bully **	<i>Gobiomorphus cotidianus</i>	Not Threatened	NZFFD, BML (2025)
Unidentified eel (elver)*	<i>Anguilla</i> sp.	-	NZFFD, BML (2025)
Brown trout**	<i>Salmo trutta</i>	Introduced and naturalised	NZFFD, BML (2025)

Note: *recorded during 2025 EFM survey. †detected in eDNA sample

Macroinvertebrate community structure, abundance and diversity are standard indicators of long-term health of streams. Different taxa have various tolerance of pollutants and habitat modification, so their presence or absence gives an indication of stream condition. Two macroinvertebrate samples were collected from the Taranaki Stream, one upstream and one downstream of Bob Robertson Drive. Results are presented in Table 5.16. The macroinvertebrate samples were both largely comprised of taxa tolerant to organic enrichment, with the most dominant taxa being *Potamopyrgus*, a widespread genus of native snail. Both sites had soft bottom MCI-sb and QMCI-sb quality classes of 'Poor'.

Table 5.16: Summary of Taranaki Stream macroinvertebrate community metrics. Surveyed in 2025 by BML

Site	Total richness	EPT richness	%EPT abundance	MCI-sb	QMCI-sb	ASPM
Taranaki Stream upstream of Bob Robertson Drive	26	7	26.92	72.00	2.17	0.26
Taranaki Stream downstream of Bob Robertson Drive	27	7	25.93	68.07	1.83	0.19

Note: Where values are in bold, these do not meet the relevant NPS-FM national bottom lines: MCI ≥ 90; QMCI ≥ 4.5; ASPM ≥ 0.3.

While the macroinvertebrate community sampled within Taranaki Stream is dominated by species tolerant of organic enrichment, the ecological value of freshwater fauna in the Taranaki Stream is considered high based on the presence of two nationally 'At Risk – Declining' species (Appendix B Table 4).

Taranaki Stream Tributary

Three species of freshwater fish have been identified in the Taranaki Stream Tributary from fieldwork undertaken by BML (Section 3.1.2.2) (Table 5.17). This includes one 'Threatened' species (Dunn et al., 2023), īnanga. Unidentified eels are likely both shortfin eel (Not Threatened) and tuna (At Risk – Declining) as both are present in Taranaki Stream.

Table 5.17: BML fish survey and eDNA results from Taranaki Stream Tributary

Common name	Scientific name	National conservation status (Dunn et al., 2023)	Recorded in
īnanga	<i>Galaxias maculatus</i>	Threatened – Nationally vulnerable	BML (2025)
Hao / Shortfin eel	<i>Anguilla australis</i>	Not Threatened	BML (2025)
Unidentified eel (elver)	<i>Anguilla</i> sp.	-	BML (2025)
Brown trout	<i>Salmo trutta</i>	Introduced and naturalised	BML (2025)

Note: +Unidentified eels could be longfin eel or shortfin eel, both of which are found in Taranaki Stream.

The macroinvertebrate results for Taranaki Stream Tributary are comparable to Taranaki Stream, with low EPT richness, and MCI-sb and QMCI-sb scores (Table 5.18). The macroinvertebrate community is dominated by taxa tolerant of organic enrichment, from the oligochaeta, crustacea, and mollusca groups.

Table 5.18: Summary of Taranaki Stream Tributary macroinvertebrate metrics. Surveyed in 2025 by BML

Site	Total richness	EPT richness	%EPT abundance	MCI-sb	QMCI-sb	ASPM
Taranaki Stream Tributary	27	3	11.11	53.33	2.45	0.12

Note: Where values are in bold, these do not meet the relevant NPS-FM national bottom lines: MCI ≥ 90; QMCI ≥ 4.5; ASPM ≥ 0.3.

Overall, the Tributary of Taranaki Stream has been assessed as having a current freshwater fauna value of high, based on Appendix B Table 4. While the macroinvertebrate community is dominated by tolerant taxa, there are likely both 'Threatened' and 'At Risk' freshwater fish species within the watercourse at times (īnanga and tuna, respectively).

Waihora Stream upstream of SH1

No freshwater fish species have been identified within Waihora Stream. A fish survey by BML did not record any fish seen or caught, and no records are available on the NZFFD. In total, five species of freshwater fish have been recorded in Waihora Stream from eDNA sampling (BML, 2025) (Table 5.19). As Waihora Stream is fed by Taranaki Stream via a below ground culvert, the eDNA results cannot be relied on as eDNA shed in Taranaki Stream can enter the Waihora Stream without fish

having to enter Waihora Stream. While there is suitable habitat for freshwater fish within Waihora Stream, there is no suitable passage out of the watercourse due to the culvert. Any migratory fish that were to enter Waihora Stream are unlikely to be able to leave and spawn, except for eels which would be able to travel over land the short distance to Taranaki Stream.

Table 5.19: eDNA results from Waihora Stream (BML, 2025)

Common name	Scientific name	National conservation status (Dunn et al., 2023)	Recorded in
Īnanga	<i>Galaxias maculatus</i>	Threatened - Nationally vulnerable	BML (2025)
Tuna / Longfin eel	<i>Anguilla dieffenbachii</i>	At Risk – Declining	BML (2025)
Hao / Shortfin eel	<i>Anguilla australis</i>	Not Threatened	BML (2025)
Toitoi / common bully	<i>Gobiomorphus cotidianus</i>	Not Threatened	BML (2025)
Brown trout	<i>Salmo trutta</i>	Introduced and naturalised	BML (2025)

The macroinvertebrate results from Waihora Stream upstream of SH1 were comparable to the Taranaki Stream samples (Table 5.20). This is not unexpected due to the proximity between watercourses and similarities between habitats, that being primarily soft bottomed substrates, excessive macrophyte growth and low shading. The macroinvertebrate sample was largely comprised of taxa tolerant to organic enrichment, being dominated by crustacean and mollusc taxa. Both MCI-sb and QMCI-sb quality classes were 'Poor'.

Table 5.20: Summary of Waihora Stream upstream of SH1 macroinvertebrate metrics. Surveyed in 2025 by BML

Site	Total richness	EPT richness	%EPT abundance	MCI-sb	QMCI-sb	ASPM
Waihora Stream upstream of SH1	25	6	24	66.64	2.18	0.18

Note: Where values are in bold, these do not meet the relevant NPS-FM national bottom lines: MCI \geq 90; QMCI \geq 4.5; ASPM \geq 0.3.

Overall, the Waihora Stream upstream of SH1 has conservatively been assessed as having a low current freshwater fauna value (Appendix B Table 4). This is due to the lack of fish presence in the electric fishing survey, indicating no fish are present, and if they are they are unlikely to be able to migrate from the watercourse to spawn. The potential freshwater fauna value has also been assessed as low due to fish passage improvements being unlikely.

5.5.3 Wetland habitat types

Three wetland areas have been identified within 100 m of the existing designation (see Sheet 11, Appendix A). The character and ecological value of these wetlands are outlined in Table 5.21 below. Two of the wetlands are constructed (GS_W1_RMA and GC_W1_LWRP), and one is assumed to be constructed (GC_W2).

Wetlands GC_W1 and GC_W2 do not meet the definition of a natural inland wetland under the NPS-FM because they comprise wetland vegetation that has naturally established around the margin of a constructed pond / lake, since construction of the pond / lake.

Wetland GS_W1 does not meet the definition of a natural inland wetland because it has been constructed for the purposes of stormwater treatment.

Table 5.21: Descriptions of wetland areas located within 100 m of Project construction works adjacent to State Highway 1 at Pegasus and the northern end of the Project designation, and their current ecological values.

Wetland ID	Description	Ecological Value	Justification
GS_CW1_RMA	A small (c.0.26 ha; Photograph 5.39) area of stormwater wetland constructed in association with the Pegasus residential development. Contains a kidney-shaped area of shallow open water fringed by giant rush, with naturally establishing floating sweetgrass. Aquatic invertebrates are likely to be present.	Low	<p><i>Representativeness</i> – Low Contains minor elements representative of typical Canterbury wetland character. Constructed.</p> <p><i>Rarity and distinctiveness</i> – N / A Constructed</p> <p><i>Diversity and pattern</i> – Very Low Contains one vegetation type and few plant species.</p> <p><i>Ecological context</i> – Low A very small area of wetland habitat that does not provide any key buffering to other wetland or terrestrial habitats but provides water quality treatment for the Waihora Stream and Taranaki Stream.</p>
GC_W1_LWRP	A small (c.0.86 ha; Photograph 5.40) area of open water constructed for amenity purposes within the Pegasus Golf Course ³⁵ . Natural wetland vegetation (raupō, <i>Juncus</i> sp. rushland) has established around the margins. A wide range of aquatic invertebrates are likely to be present within open water at the site, and waterfowl were noted to be present during site inspections.	Moderate	<p><i>Representativeness</i> – Moderate Contains small elements representative of typical Canterbury wetland character. Constructed.</p> <p><i>Rarity and distinctiveness</i> – N / A Constructed</p> <p><i>Diversity and pattern</i> – Low Contains two vegetation type and few plant species.</p> <p><i>Ecological context</i> – Moderate A small area of wetland habitat that does not provide any key buffering to other wetland or terrestrial habitats but provides water quality treatment to Taranaki Stream. Provides local waterbird habitat.</p>

³⁵ Access was not granted to inspect the Pegasus Golf Course sites. The assessment of GC_W1 was made from vantage-point survey from the road. The assessment for GC_W2 has been undertaken from aerial photographs only.

Wetland ID	Description	Ecological Value	Justification
GC_W2	A small area of shallow open water within the Pegasus Golf Course. Natural wetland vegetation appears ³⁶ to have established around the margins.	Unknown	<p><i>Representativeness</i> – Unknown Unknown.</p> <p><i>Rarity and distinctiveness</i> – N / A Constructed</p> <p><i>Diversity and pattern</i> – Unknown Unknown.</p> <p><i>Ecological context</i> – Moderate</p> <p>A small area of wetland habitat that is likely to provide water quality treatment to Taranaki Stream as part of the network of ponds within the Golf Course. Likely to provide local waterbird habitat.</p>

Note: Potential ecological value is not required to be assessed for wetlands that do not meet the definition of natural inland wetlands within the NPSFM.

³⁶ Access was not granted to inspect the Pegasus Golf Course sites. The assessment of GC_W1 was made from vantage-point survey from the road. The assessment for GC_W2 has been undertaken from aerial photographs only. Wetland GC_W2 has not been mapped.



Photograph 5.39: GS_CW1_RMA contains open shallow water fringed with giant rush.



Photograph 5.40: GC_W1_LWRP natural wetland vegetation comprising raupō, Juncus species, and Carex species has established on the margins of an area of open water. Taken 6 May 2025.

5.6 Pest organisms

Four species declared as pest organisms under the Canterbury Regional Pest Management Plan³⁷ were observed during site assessments:

- Common broom
- Feral rabbit
- Gorse
- Old man's beard

These species are all managed under the "Sustained Control" programme. Gorse and old man's beard are also included in Site led control programmes. No part of the Project is within a Site led control programme area for these species.

5.7 Summary of ecological values within the Project

A summary of ecological values identified throughout the Project is provided in Table 5.22 below.

Table 5.22: Summary of ecological values

Ecological feature		Ecological value
Ohoka Road overpass and Lineside Road (Section 4.1)		
Terrestrial - No riparian terrestrial habitats relevant to this stage of the Project works are present		
Wetlands - No wetland habitats present		
Stream	Stream habitat: Kaiapoi River	High
	Freshwater fauna: Kaiapoi River	High
Lineside Road and south of Cam River / Ruataniwha (Section 4.2)		
Terrestrial	Canterbury grass skink	High
	'Not Threatened' indigenous bird species	Low
	Rank grass (skink habitat)	Low
Wetlands - No wetland habitats present		
Stream	Stream habitat	Rossiters Drain: Low Wilson's Drain: Low
	Freshwater fauna	Rossiters Drain: Low – moderate (for fish) Wilson's Drain: Low – moderate (for fish)
Cam River / Ruataniwha and Williams Street (Section 5.1)		
Terrestrial	'Not Threatened' indigenous birds	Low
	Kāruhiruhi / pied shag	High
	Canterbury grass skink	High
	Exotic treeland (skink and bird habitat)	Low
	Rank grass (skink habitat)	Low
	Exotic shelterbelt (skink and bird habitat)	Low
	Indigenous planting (bird habitat)	Low

³⁷ <https://www.ecan.govt.nz/your-region/plans-strategies-and-bylaws/canterbury-regional-pest-management-plan/pest-management-plan>

Ecological feature		Ecological value	
Wetlands	CR_W1_NPSFM	Low	
	CR_W2_NPSFM	Moderate	
Stream	Stream habitat: Cam River / Ruataniwha	High	
	Freshwater fauna: Cam River / Ruataniwha	High	
Quarry Lakes and Woodend Beach Road (Section 5.2)			
Terrestrial	'Not Threatened' indigenous birds	Low	
	'At Risk' indigenous birds	High	
	'Threatened' indigenous birds	Very High	
	Canterbury grass skink	High	
	Exotic shelterbelts / Lake margin / Rank grassland (skink and / or bird habitat)	Low	
	Exotic grassland / scrub mosaic (skink and bird habitat)	Moderate	
	Buildings and gardens	Negligible	
Wetland	QP_W1_NPSFM	Moderate	
	QP_W4_NPSFM	Moderate	
	BR_W1_NPSFM BR_W2_NPSFM BR_W3_NPSFM BR_W4_NPSFM	Moderate	
	FA_W1_NPSFM	Low	
	FR_W1_NPSFM	Moderate	
	FR_W2_NPSFM	Moderate	
	FR_W3_NPSFM	Moderate	
	FR_W4_NPSFM	Moderate	
	Stream	Stream habitat	Quarry lakes: Low McIntosh Drain: Low
		Freshwater fauna	Quarry lakes: Low McIntosh Drain: High
Woodend Beach Road and Gladstone Road (Section 5.3)			
Terrestrial	Canterbury grass skink	High	
	Rank grassland (skink habitat)	Low	
	Exotic grassland / scrub mosaic (skink and bird habitat)	Low	
	Exotic treeland and exotic shelterbelts (skink and bird habitat)	Low	
Wetlands - No wetland habitats present			
Stream - No stream habitats present			
Gladstone Road and SH1 (Section 5.4)			
Terrestrial	'Not Threatened' indigenous bird species	Low	
	Canterbury grass skink	High	

Ecological feature		Ecological value
	Rank grassland (skink habitat)	Low
	Exotic scrub / grassland mosaic (skink and bird habitat)	Moderate
	Exotic treeland and exotic shelterbelts (skink and bird habitat)	Low
Wetland	FA_W2_NPSFM	Low
	WC_W1_NPSFM	Moderate
	WC_W2_NPSFM	Moderate
	WC_W3_NPSFM	Moderate
	WC_W4_NPSFM	Moderate
	WC_W5_NPSFM	Low
	WC_W6_NPSFM	Moderate
Stream	Stream habitat: Waihora Stream	Low
	Freshwater fauna: Waihora Stream	Low
Pegasus Interchange (Section 5.5)		
Terrestrial	'Not Threatened' indigenous bird species	Low
	Canterbury grass skink (if present)	High
	Indigenous plantings (potential Canterbury grass skink habitat)	Low
Wetland	GS_CW1_RMA	Low
	GC_W1_LWRP	Moderate
	GC_W2	Unknown
Stream	Stream habitat	Taranaki Stream: Moderate Taranaki Stream Tributary: Low Waihora Stream upstream of SH1: Low
	Freshwater fauna	Taranaki Stream: High Taranaki Stream Tributary: High Waihora Stream upstream of SH1: Low

6 Assessment of Ecological Effects

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

A summary of the potential effects on terrestrial, wetland and stream environs is provided in a summary table at the end of each respective section (see Table 6.3, Table 6.7, and Table 6.13).

For the purposes of this assessment, it is assumed that all vegetation and habitat within the designation, including terrestrial riparian margin, as well as areas where designation alterations are proposed, will be removed.

6.1 Proposed works and summary of actual and potential ecological effects

6.1.1 Construction works and construction-related ecological effects

The following activities will be required to complete construct works within the Project Site. A full list and description of the works that will be required for the Project is included in the SAR. However, in summary, the works include (but are not limited to) the following:

- Bulk earthworks (including cut and fill activities).
- Ground improvement works such as rammed aggregate piers, rigid inclusions, soil cement mixing, and bored piles.
- Erecting / constructing / placing structures such as bridges, culverts, drainage channels, noise mitigation features, and other structures.
- Dewatering during culvert installations.
- Gradual tipping of gravel / river-run material into the south Quarry Lake remnant to create substrate for wetland creation.
- Installation and construction of stormwater conveyance channels, treatment and disposal systems.
- Establishing and operating:
 - Temporary construction yards, buildings, and laydown areas;
 - Temporary haul roads, access points, and traffic management;
 - Temporary drainage and erosion and sediment control measures;
- Undertaking landscaping and planting.
- Laying pavements and surfacing.
- Road furniture and ancillary works.
- Site reinstatement and rehabilitation activities.

The above activities have the potential to result in the following adverse ecological effects:

- Terrestrial:
 - Permanent loss of terrestrial riparian vegetation (with low botanical value) from terrestrial riparian margins of streams and wetland features, around the South Lake remnant and areas of alteration to the designation around Quarry Lakes and Pegasus Interchange.

- Permanent loss of low-moderate habitat for indigenous fauna.
- Injury or mortality of indigenous fauna during vegetation clearance.
- Disturbance and displacement effects on indigenous fauna.
- Wetlands:
 - Permanent loss of wetland vegetation and habitat.
 - Temporary modification of wetland hydrology.
 - Permanent modification of wetland hydrology.
 - Fragmentation of wetland habitat.
 - Temporary construction effects – sedimentation effects on wetlands.
- Stream:
 - Temporary construction effects – sedimentation effects on stream habitat and freshwater fauna.
 - Temporary construction effects – modification of stream habitat.
 - Temporary construction effects – localised dewatering effects on stream flow.
 - Temporary construction effects – modification of fish passage and migration.
 - Permanent modification and / or loss of fish passage.
 - Permanent modification and / or loss of stream habitat (including the loss of potential value to streams).

These effects and measures to manage these effects are outlined in more detail below.

6.1.2 Post-construction operational effects

The following actual or potential ecological effects following construction of the Project have been identified in this assessment:

- Vehicle strike of indigenous terrestrial fauna.
- Lighting effects on indigenous and native terrestrial and freshwater fauna due to the operation of the road.
- Permanent changes in receiving water quality due to ongoing use of the road.

As addressed further in the SAR (Volume 2A), effects in the first two bullet points above (vehicle strike and lighting effects) are already authorised by the designation and / or permitted activities. As such, they are not considered further in this assessment. The post-construction operational effect to water quality is expected to be addressed through resource consents for stormwater discharges, which will have conditions managing the discharge water quality (in accordance with accepted standards and practice). This operational effect is addressed further in this EclA (Section 6.4.8) and in the SAR.

6.2 Terrestrial

6.2.1 Permanent loss of vegetation

Up to 3.48 ha of predominantly exotic vegetation may be removed within the Project site from terrestrial riparian margins of streams and wetland features. Up to 5.27 ha of additional, predominantly exotic vegetation may also be removed from alterations to the designation around the Quarry Lakes and the Pegasus Interchange. This comprises a total of up to 8.75 ha of predominantly exotic permanent vegetation loss. A conservative approach has been applied when

calculating the quantum of vegetation loss across the Project Site. Maximum areas are summarised in Table 6.1.

The removal of vegetation within these areas will alter the baseline conditions and the environment post-construction will be fundamentally changed. Therefore, the magnitude of effect of vegetation loss is considered to be **high**. The magnitude of effect will decrease during the detailed design phase as opportunities to minimise vegetation clearance are identified.

Pasture, managed grassland, buildings / gardens and amenity plantings are considered to be of **negligible** ecological value. As per the EclA guidelines, a high magnitude of effect combined with a negligible ecological value results in an overall level of effect of **very low**.

Rank grass, exotic shelterbelts and exotic treeland have been assigned a **negligible** ecological value botanically. Combined with a **high** magnitude of effect, the overall level of effect of removing these vegetation types is **very low**. However, these vegetation types do provide suitable habitat of low to moderate value for indigenous birds and lizards; this loss of habitat is considered in Section 6.2.2 below.

A small area (0.35 ha) of indigenous plantings of **low** value will also be removed. However, although no effects management is required due to the low ecological value, it is understood that the loss of indigenous plantings within the terrestrial riparian margin of the Taranaki Stream will be replaced following Project completion with indigenous landscape planting.

Table 6.1: Summary of terrestrial vegetation types, area of impact, ecological value and overall level of effect

Vegetation type	Area of impact (ha)	Ecological (botanical) value	Overall level of effect
Indigenous planting	0.35	Low	Low
Exotic grassland / scrub mosaic	0.66	Negligible	Very low
Pasture	0.81	Negligible	Very low
Managed grassland	5.01	Negligible	Very low
Rank grass	0.42	Negligible	Very low
Exotic shelterbelts	0.45	Negligible	Very low
Buildings and gardens	0.10	Negligible	Very low
Exotic treeland	0.95	Negligible	Very low
Total	8.75 ha		

6.2.2 Permanent loss of habitat for indigenous fauna

The vegetation within the Quarry Lakes and Pegasus designation alteration areas primarily comprises managed exotic grass, which does not provide habitat for indigenous birds and lizards and is therefore not considered further.

Much of the vegetation within terrestrial riparian margins of streams and wetland features and the vegetated margins of the South Lake remnant does however provide potential habitat for indigenous birds and lizards. Across the Project Site, up to 5.43 ha indigenous fauna habitat of low-moderate value will be lost. This is an estimate of the maximum quantum of habitat loss and this figure will be reduced through detailed design. Maximum areas of habitat loss comprise:

Woody vegetation:

- Exotic grassland / scrub mosaic (0.66 ha)
- Exotic treeland (0.95 ha)
- Exotic shelterbelts (0.45 ha)
- Indigenous plantings (0.35 ha)

Grassland habitat:

- Rank grass (0.42 ha)

Open water habitat:

- Up to 2.6 ha of open water within the South Lake remnant provides foraging habitat for indigenous bird species (see Section 5.2)

6.2.2.1 Loss of woody vegetation habitat (2.41 ha)

Woody vegetation provides potential feeding and breeding habitat for common ‘Not Threatened’ forest bird species, including riroriro, pīwakawaka, and korimako. It also provides potential breeding and foraging habitat for other ‘Not Threatened’ forest bird species that were recorded in database searches but not observed, such as pīpīwharau (shining cuckoo; *Chrysococcyx lucidus*). Exotic grassland / scrub mosaic vegetation provides potential breeding habitat for ground nesting birds such as pīhoihoi and kahu.

Canterbury grass skink was detected in exotic grassland / scrub mosaic vegetation, exotic treeland, and in rank grass and weeds beneath exotic shelterbelts (Wildlands, 2025); largely within the Quarry Lakes to Woodend Beach Road section of the Project (Appendix A Sheet 5). Limited published information is available regarding Canterbury grass skink, however exotic grassland / scrub mosaic vegetation is considered preferential habitat for Canterbury grass skink. It is likely that Canterbury grass skink is present in planted indigenous vegetation within the terrestrial riparian margins of the Taranaki Stream (Appendix A Sheet 9); however, potential lizard habitat within this section was not surveyed in the 2024 / 2025 lizard survey (Wildlands 2025). Lizards have been assumed present within these areas for the purpose of this effects assessment.

For birds, there is similar or higher-quality woody vegetation available within the surrounding area that is readily accessible. As such, the magnitude of effect of removing woody vegetation is considered **low** for birds. Lizards are less able to disperse to new habitat and therefore the magnitude of effects of habitat loss is considered **moderate**.

The ecological value of woody vegetation for indigenous birds and lizards ranges from **low** (exotic treeland and exotic shelterbelts) to **moderate** (exotic grassland / scrub mosaic) (see section 5). Under the EclAG framework, the overall level of effect of woody vegetation habitat loss ranges from **very low** to **moderate**. The EclAG recommends that moderate adverse effect associated with the loss of 0.66 ha exotic grassland / scrub mosaic habitat for lizards, residual effects management is required and compensation measures such as “lizard friendly” planting and habitat enhancement are proposed (see Section 7).

6.2.2.2 Loss of grassland habitat (0.42 ha)

Pockets of rank grass provide foraging and potential breeding habitat for pīhoihoi and kahu (‘Not Threatened’). In both cases, higher-quality breeding habitat exists in scrub and duneland habitats outside of the Project Site, however the presence of these species within the terrestrial riparian margins cannot be ruled out. Rank grassland near the McIntosh Drain (Appendix A Sheet 7) and rank grassland and wetland habitats on the northern bank of the Cam River / Ruataniwha (Appendix A Sheet 5) are likely to provide feeding and breeding habitat for pūkeko (‘Not Threatened’). The

McIntosh Drain also provides potential low-quality foraging habitat for matuku-hūrepo ('Threatened-Nationally Critical'). Although there is higher-quality wetland and stream habitat nearby, their occasional presence cannot be ruled out. Due to sub-optimal / marginal habitat and higher quality breeding habitat in the surrounding areas, the magnitude of effect of removing rank grassland on indigenous birds is considered **low**.

Low detections of Canterbury grass skink were recorded in areas of rank grass within riparian margins within the Lineside Road to south of Cam River / Ruataniwha section of the Project (Appendix A Sheet 4, Wildlands 2025). All rank grassland within the terrestrial riparian margin and areas of alteration to the designation provides low value lizard habitat. However, as lizards are less able to disperse to new habitats, the effects of habitat loss are greater than for birds. As such, the magnitude of effect of the loss of rank grassland on lizards is considered **moderate**.

The ecological value of rank grassland for indigenous birds and lizards is considered **low**. In accordance with the EclAG framework, the overall level of effect of loss of rank grassland habitat is considered **very low** for indigenous birds and **low** for Canterbury grass skink.

6.2.2.3 Loss of open water habitat (2.6 ha)

The South remnant lake, located in the Quarry Lakes to Woodend Beach Road section of the Project Site (Appendix A Sheet 6) provides approximately 2.6 ha of open water that provides foraging habitat for indigenous bird species, with seven species observed using this habitat during site assessments (Table 5.3). The ecological value of this habitat is considered **moderate**. Infilling of the South Lake remnant is proposed to create a wetland with approximately 30% open water remaining. The magnitude of effect of reducing the area of open water habitat from 2.6 ha to around 0.8 ha is considered **moderate** because it will result in a noticeable change from the baseline. According to the EclAG framework, a moderate ecological value and a moderate magnitude of effect results in an overall ecological effect of **moderate**.

However, the South Lake remnant currently provides very little value to indigenous bird species beyond foraging habitat, and there is over 20 ha of similar open water habitat in close proximity to the lake. Open water within an extensive indigenous wetland habitat is considered to have higher ecological value long-term due to the provision of nesting and roosting habitat on the margins as well as foraging habitat. The magnitude of effect of partially infilling the South Lake remnant to create an indigenous wetland is considered **positive**, leading to an overall **net gain** in ecological value in the long-term. However, it is acknowledged that there will be a loss in value in the short-term while the lake is filled and the wetland becomes established. The short-term effects are considered to be **low** in magnitude as it is likely any foraging birds will disperse to nearby suitable habitat, leading to a **low** overall level of effect. Ecological biodiversity gains associated with infilling the South Lake remnant and creation of wetland habitat are accounted for in the wetland BOAM (Section 7.2 below).

Table 6.2: Summary of habitat types for indigenous lizards and birds, area of impact, ecological value and overall level of effect

Habitat type	Area of impact (ha)	Ecological value	Magnitude of effect		Overall level of effect	
			Birds	Lizards	Birds	Lizards
Exotic grassland / scrub mosaic	0.66	Moderate	Low	Moderate	Low	Moderate
Exotic treeland	0.95	Low	Low	Moderate	Very low	Low

Habitat type		Area of impact (ha)	Ecological value	Magnitude of effect		Overall level of effect	
				Birds	Lizards	Birds	Lizards
Woody vegetation	Exotic shelterbelts	0.45	Low	Low	Moderate	Very low	Low
	Indigenous plantings	0.35	Low	Low	Moderate	Low	Low
Grassland habitat	Rank Grass	0.42	Low	Low	Moderate	Very low	Low
Open Water habitat		2.60	Moderate	Moderate	N / A	Low*	N / A

* Note: Refer to text above.

6.2.3 Injury or mortality of indigenous fauna during vegetation clearance

Vegetation clearance activities and earthworks have the potential to cause accidental injury and mortality to indigenous 'Not Threatened' and 'At Risk' lizards and birds. All indigenous birds and lizards, regardless of conservation status are protected under the Wildlife Act 1953, administered by Department of Conservation (DOC), and therefore measures to avoid injury / mortality immediately prior to and during construction are required.

As described in Section 6.2.2, potential habitat for indigenous birds and lizards is present within terrestrial riparian margins, vegetated margins of the South Lake remnant and alterations to the designation at the Quarry Lakes and Pegasus Interchange. Up to 2.83 ha of vegetation habitat for indigenous birds and lizards will be removed. Without effects management measures, the potential for lizard and bird injury or mortality during vegetation clearance is considered to have a moderate magnitude of effect.

6.2.3.1 Lizards

Canterbury grass skink may not be able to disperse during site preparation and vegetation clearance works and will therefore be susceptible to injury and mortality. Vegetation clearance in areas of suitable habitat will result in permanent displacement, and may cause stress, injury or incidental mortality of individuals.

Determining population sizes of lizards at an impact site is challenging due to low detectability rates, cryptic behaviour, and variable capture rates. Based on the survey methodology, results and site observations (Wildlands, 2025), it is not possible to accurately estimate the population size of Canterbury grass skink that will be impacted within the Project Site. Current data only allow for confirmation of presence / absence rather than density or abundance. Due to the fragmented nature of the lizard habitats, lizard populations are likely to be restricted by habitat size, habitat quality, localised pest animal activity, and the level of ongoing disturbance. While the habitat quality is mostly of low-moderate value, there may be "hotspots" of discrete habitat where lizards may be locally abundant.

The risk of injuring or killing indigenous fauna can be minimised through reducing the spatial extent of vegetation clearance required to complete the works. Up to 2.83 ha of low-to-moderate value lizard habitat could be removed from the Project Footprint. The risk can be further minimised through the implementation of a Lizard Management Plan (LMP) to be developed as a condition of the Wildlife Approval (see Volume 3J of the SAR). The LMP will detail measures to salvage lizards from the works area and relocate them to a release site in accordance with best-practice methodologies from DOC's Inventory and Monitoring Toolbox: Herpetofauna (Hare 2012a,b,c;

Lettink 2012), sampling techniques for New Zealand lizards (Lettink and Hare (2016)) and DOC's key principles for lizard salvage and transfer in New Zealand (DOC 2019). The LMP will also include details of habitat enhancement measures at the lizard release site / s, including pest plant management, enhancement planting, addition of habitat features such as logs / refugia, and pest animal control, to increase lizard carrying capacity and population persistence. Ongoing post-release monitoring and reporting requirements will also be detailed in the LMP.

6.2.3.2 Birds

Up to 5.43 ha of low-to-moderate bird habitat (of which 2.6 ha is moderate value open water habitat) could be removed from within the Project Footprint. Habitat removal during the peak bird breeding season (September to January inclusive) can result in direct harm to nests, eggs and nestlings. Best practice avifauna management measures will be included in the Project Ecological Management Plan (EMP) as a condition of consent (Condition MP.12). As adult birds are mobile, the plan will focus on minimising the risk of killing or injuring eggs and chicks in nests. Potential adverse effects can largely be minimised by undertaking vegetation clearance outside of peak breeding season (September to February, inclusive). If it is not possible to avoid peak breeding season, the risk of damaging an occupied nest can be minimised through undertaking nest surveys no more than 48 hours prior to vegetation clearance.

Implementation of best-practice measures for lizard and bird management will reduce the magnitude of effect of incidental injury and mortality to **low**. The overall level of effect in accordance with the ECIAG framework therefore ranges from **very low** ('Not Threatened' species) to **low** ('At Risk' species, including Canterbury grass skink).

6.2.4 Disturbance effects on indigenous fauna during vegetation clearance and construction

Increased noise and disturbance during vegetation clearance and construction works may have adverse impacts on indigenous fauna.

6.2.4.1 Lizards

Disturbance from noise, dust and vibrations may cause lizards to disperse into adjacent habitats that may be unsuitable for lizards, or may already be at carrying capacity. In both cases, displaced lizards may be at risk of lower survival and breeding success through lower food availability, absence of protective cover, and / or competition with resident lizards. The potential adverse effect of disturbance during vegetation clearance and construction is considered to be **moderate**.

The ecological value of Canterbury grass skink is **high**, resulting in an overall level of effect according to the ECIAG framework without effects management of **moderate**. Implementation of lizard salvage and relocation measures prior to and during vegetation clearance detailed in the Wildlife Approval report (see Volume 3J of the SAR) and proposed LMP will reduce the magnitude of effect to **low** and minimise the number of lizards that are displaced into surrounding habitats.

Proposed landscape planting adjacent to the road corridor will benefit lizard populations through enhancement of up to 6 ha of low-stature habitat planting (including "lizard friendly" species) that lizards from outside of the Project Site can utilise following completion of works. Additional compensation measures such as enrichment planting and habitat enhancement are proposed, as detailed in Section 7.1. Following proposed effects management, the overall effect of disturbance on lizards is considered to be **low**.

6.2.4.2 Birds

Project activities will lead to increased levels of disturbance and may lead to birds abandoning feeding areas in habitats within and adjacent to the project area, and in rare cases could result in nest abandonment. The land surrounding the Project Site is already subject to disturbance from existing roads, residential dwellings, and farming activities and it is considered that the local bird population has adapted to the existing disturbance regime. This disturbance will happen over a short time frame, and it is considered unlikely that construction activities will have a high level of adverse effect.

Overall, the magnitude of effect of disturbance on birds is considered **low**. The ecological value of indigenous bird species that may be impacted ranges from **low to very high**, resulting in an overall level of effect according to the ECIAG framework ranging from **very low to low**.

6.2.5 Summary of terrestrial effects

Terrestrial values of the Project area range from negligible to very high. A range of effects management measures are proposed to address potential adverse effects on these values. Table 6.3 summarises the ecological values of the Project, potential adverse effects, magnitude and overall level of effect following recommended effects management measures. These measures will be detailed in a project Ecological Management Plan (**EMP**), which if fully implemented, will reduce the overall level of effects on ecological values to very low to low.

Table 6.3: Summary of actual and potential effects on terrestrial ecology values, magnitude of effect, and overall level of effect following recommended measures to avoid, minimise, or remedy effects

Effect	Feature		Ecological value	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)	Comment
Permanent loss of terrestrial vegetation	Vegetation class	Area (ha)	Negligible	High	<ul style="list-style-type: none"> Minimise vegetation clearance through detailed design process. While not intended as effects management, landscape planting will replace a portion of the lost exotic vegetation with indigenous species in key locations throughout the Project Site. 	Very low	<p>The vegetation loss estimates are a maximum amount and assumes the loss of all vegetation within the Project Site.</p> <p>The actual quantum of vegetation loss is likely to be reduced through design refinement.</p> <p>These vegetation types provide habitat for indigenous birds and lizards and the effects of this vegetation loss is addressed with the loss of fauna habitat.</p>
	Exotic grassland / scrub mosaic	0.66					
	Exotic treeland	0.95					
	Pasture	0.83					
	Managed grassland	4.96					
	Rank grass	0.42					
	Exotic shelterbelts	0.45					
	Buildings and gardens	0.1					
	Indigenous planting	0.35	Low	High	As above	Low	As above
Permanent loss of habitat for indigenous lizards	Exotic grassland / scrub mosaic	0.66	Moderate	Moderate	<ul style="list-style-type: none"> Minimise vegetation clearance through detailed design process. 	Moderate	<p>This vegetation provides moderate value habitat for Canterbury grass skink and residual effects will remain following the loss of this habitat. Compensation “lizard friendly” planting and habitat enhancement are proposed. This is addressed in Section 7.1.</p>
	Exotic treeland	0.95	Low	Moderate		Low	

Effect	Feature		Ecological value	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)	Comment
	Exotic shelterbelts	0.45	Low	Moderate		Low	Low quality habitat for birds and lizards will be lost.
	Indigenous plantings	0.35	Low	Moderate		Low	
	Rank Grass	0.42	Low	Moderate		Low	
Permanent loss of habitat for indigenous birds	Exotic grassland / scrub mosaic	0.66	Moderate	Low	<ul style="list-style-type: none"> Minimise vegetation clearance through detailed design process. While not intended as effects management, landscape planting will replace a portion of the lost exotic shelterbelt and treeland habitats with indigenous species in key locations throughout the Project Site. Wetland creation and habitat enhancement of the McIntosh Drain will benefit matuku-hūrepo. 	Low	Low quality habitat for birds will be lost.
	Exotic treeland	0.95	Low	Low		Very low	
	Exotic shelterbelts	0.45	Low	Low		Very low	
	Indigenous plantings	0.35	Low	Low		Low	
	Rank Grass	0.42	Low	Low		Very low	

Effect	Feature	Ecological value	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)	Comment
Permanent loss of habitat for indigenous birds	Open water (c. 2.6 ha)	Moderate (due to habitat provision for birds)	Moderate	<ul style="list-style-type: none"> It is not possible to avoid the loss of open water habitat; however, removal will enable construction of an indigenous wetland complex, which will include approximately 0.8 ha of open water. This will result in the remediation of the South Lake remnant, which will eventually lead to better-quality foraging and nesting habitat for water birds, including 'At Risk' and 'Threatened' species. This is considered to provide a net gain in ecological value over the long-term. 	Short term construction period to < 5 years: Low Long term > 5 years: Net gain	It is acknowledged that there will be a loss in value in the short term (i.e., during the construction period and while the lake is filled and the wetland becomes established). Over the long term positive ecological outcomes are expected to result in a net gain in ecological value. Any ecological gains are accounted for in the wetland BOAM.
Injury or mortality of native fauna	'At Risk' bird (including pihoihoi) and Canterbury grass skink	High	Moderate	<ul style="list-style-type: none"> Minimise vegetation clearance through detailed design process, taking opportunities to avoid fauna habitat where possible. Implement bird management measures (as detailed in the Project EMP) to minimise the risk of killing or injuring birds, particularly in nesting birds during peak bird breeding season (September to January). Prepare and implement a Lizard Management Plan 	Low	
Disturbance effects on indigenous fauna during construction	'Not Threatened' bird species	Low	Moderate		Very low	

Effect	Feature	Ecological value	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)	Comment
				detailing lizard salvage and relocation methods, lizard release site habitat enhancement and post-release monitoring.		

6.3 Wetlands

6.3.1 Wetlands overview

6.3.1.1 Overview of wetlands not affected or potentially affected by the Project

Ten wetlands are located within, or within 100 m of the construction works footprint or Project Site boundaries, but are located beyond 10 m from any proposed construction works and are also considered unlikely to be impacted by any project works and have therefore not been assessed further with respect to effects. A summary of the reasons why these wetlands are not considered to be impacted is provided in Table 6.4 below.

Table 6.4: Identified wetland areas within, or within 100 m of the Project footprint or Proposed designation that are unlikely to be impacted by the works

Wetland name	Location relative to project works	Justification for non-inclusion in effects assessment
QP_W2_LWRP	c.81 m northwest of the southern quarry lake causeway Refer to Sheet 6, Appendix A	<ul style="list-style-type: none"> Connected directly to the shallow unconfined aquifer. Highly unlikely to be impacted by construction or operation of the quarry lake embankment.
QP_W3_LWRP	c.67 m north of the southern quarry lake causeway within the east quarry lake Refer to Sheet 6, Appendix A	<ul style="list-style-type: none"> Hydrology sustained by water levels within the East quarry lake, which is directly connected to the shallow unconfined aquifer. Highly unlikely to be impacted by construction or operation of the quarry lake embankment. Potential for sedimentation effects assessed as part of the early works package and found to be very low potential for effects.
Barkers Road wetlands: BR_W1_NPSFM BR_W2_NPSFM, BR_W3_NPSFM, BR_W4_NPSFM	Located east of the South Lake remnant. Refer to Sheets 6 and 7, Appendix A	<ul style="list-style-type: none"> The historic presence of a lagoon channel in this location (ECan Blackmaps) suggests that this area is directly connected to shallow groundwater that is independent from the south quarry lakes. Considered highly unlikely to be impacted by construction, compaction, or operation of the quarry lake embankment or any enabling works. Considered highly unlikely to be impacted by partial filling of the South Lake remnant.
FA_W1_NPSFM	c.98 m west of the proposed McIntosh drain culvert below the Quarry Lakes to Woodend Beach Road section. Refer to Sheet 7, Appendix A	<ul style="list-style-type: none"> Soil characteristics, landscape context, and hydrological catchment modelling indicate that the primary hydrological input sustaining this wetland is rainfall. Consequently the wetland catchment is considered equal to the wetland boundaries.

Wetland name	Location relative to project works	Justification for non-inclusion in effects assessment
		<ul style="list-style-type: none"> As the wetland will not be directly impacted by construction of the road and associated infrastructure, any impact to this wetland is considered highly unlikely.
GS_W1_RMA	Immediately west of the Garlick St connection Refer to Sheet 10, Appendix A	<ul style="list-style-type: none"> Wetland hydrology is maintained by stormwater inputs from the Ravenswood subdivision. Road construction works in the area are highly unlikely to have any impacts on this area.
GC_W1_LWRP	Immediately east of the Pegasus Interchange Refer to Sheet 10, Appendix A	<ul style="list-style-type: none"> Connected directly to the shallow coastal aquifer. Road construction works and dewatering for culvert installation are highly unlikely to have any impacts on this area.
GC_W2	c.90 m east of the eastern designation boundary along existing SH1 north of the Pegasus interchange Refer to Sheet 11, Appendix A	<ul style="list-style-type: none"> Wetland hydrological connections are unknown. Minor road widening works are highly unlikely to have any impacts on this area.

Note: Access was not granted to assess ecological values for Wetland GC_W2.

6.3.1.2 Overview of wetlands impacted or potentially impacted by the Project

Fifteen (15) wetlands are located within, or within 100 m of, the Project Site or are located further than 100 m from the Project Site but could be impacted by the Project. Table 6.5 below provides a summary of which wetlands, and within which project section, adverse impacts will or could be seen and provides cross-references to the relevant effects assessment subsection where the impacts are discussed.

Our assessment of direct and indirect effects on wetland habitat and values that follows assumes that:

- a All vegetation and habitat within the designation boundaries will be removed during the construction phase of the project.
- b All soil disturbance changes to wetland catchments that are not beneath the road or part of stormwater infrastructure will be reinstated to pre-disturbance state and contours as far as is reasonably possible.

The assessment therefore outlines a worst-case scenario in terms of potential vegetation and habitat loss, the overall effects of which could be reduced in some areas through construction-phase controls.

A summary of the overall level of effects assessment for each wetland listed in Table 6.5 is provided in Section 6.3.6, Table 6.7.

Table 6.5: Summary of wetlands within or within 100 m of the Project designation that have been assessed for direct and / or indirect adverse impacts as a result of construction works

Project Section	Wetland name	Direct effect	Indirect effect
Cam River / Ruataniwha and Williams Street	CR_W1_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.2 Sedimentation – Section 6.3.5
	CR_W2_NPSFM	<ul style="list-style-type: none"> Partial loss of extent – Section 6.3.2 	<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.2 Habitat fragmentation – Section 6.3.4 Sedimentation – Section 6.3.5
Quarry Lakes-Woodend Beach Road	QP_W1_NPSFM	<ul style="list-style-type: none"> Partial loss of extent – Section 6.3.2 	<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.2 Habitat fragmentation – Section 6.3.4 Sedimentation – Section 6.3.5
	QP_W4_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.3
	FR_W1_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.1
	FR_W2_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.1
	FR_W3_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.1
	FR_W4_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.2 Sedimentation – Section 6.3.5
Gladstone Road-SH1	FA_W2_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.2 Sedimentation – Section 6.3.5
	WC_W1_NPSFM	<ul style="list-style-type: none"> Complete loss of extent – Section 6.3.2 	
	WC_W2_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.2
	WC_W3_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.2
	WC_W4_NPSFM		<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.2 Sedimentation – Section 6.3.5

Project Section	Wetland name	Direct effect	Indirect effect
	WC_W5_NPSFM	<ul style="list-style-type: none"> Partial loss of extent – Section 6.3.2 	<ul style="list-style-type: none"> Hydrological modification – Section 6.3.3.1.2 Habitat fragmentation – Section 6.3.4 Sedimentation – Section 6.3.5
	WC_W6_NPSFM	<ul style="list-style-type: none"> Complete loss of extent – Section 6.3.2 	

6.3.2 Permanent loss of wetland vegetation and habitat

Five wetlands³⁸ are located directly beneath the proposed road alignment and / or within the Project Site. Construction works will result in complete or partial loss of wetland vegetation and habitat within these five wetlands, which will result in a combined direct wetland habitat loss of 6,206 m²:

- CR_W2_LWRP – partial loss of 2,492 m² (77%).
- QP_W1_NPSFM – partial loss of 105 m² (2%).
- WC_W1_NPSFM – total loss of habitat (2,022 m² lost).
- WC_W5_NPSFM – partial loss of 105 m² (79%).
- WC_W6_NPSFM – total loss of habitat (1,482 m² lost).

Wetlands CR_W2, WC_W1, and WC_W6 mainly comprise crack willow dominated forest and scrub habitat but have variable understorey and groundcover diversity. Wetland WC_W5 is a very small area of *Juncus* and pasture grass habitat, with very low diversity. The area of Wetland QP_W1 potentially affected comprises *Juncus* and exotic grasses, which is part of a mosaic of wetland vegetation types.

The loss of 77% of the wetland vegetation and soils within wetland CR_W2 and 79% loss within WC_W5 represents a substantial proportion of the total wetland area that is likely to completely alter the character and function of these wetlands. As loss of the wetland cannot be avoided, this results in a very high magnitude of effect. Complete loss of wetland vegetation and habitat within wetlands WC_W1 and WC_W6 also comprises a very high magnitude of effect.

A very high magnitude of effect combined with moderate ecological values for wetlands CR_W2, WC_W1, and WC_W6 results in an overall high level of effect. A very high magnitude of effect combined with low ecological value for wetland WC_W5 results in an overall moderate level of effect.

Due to the location of wetlands CR_W2, WC_W1, and WC_W6 relative to the proposed road alignment and designation boundaries and the road design and structural requirements, avoiding impacts on these wetlands is not feasible. A high level of effect on wetland extent and values will therefore remain post-construction (i.e. a residual effect). This high level of residual effect should be offset as per guidance within the NPS-FM (see Section 7.1 below).

For wetland WC_W5, impacts to wetland habitat could be avoided by not undertaking earthworks within or in close proximity to the wetland boundaries. If works within, or within 10 m of wetland WC_W5 can be avoided, the potential overall level of effect on this wetland could be reduced to negligible.

³⁸ A very small area (25 m²) of wetland WC_W4 NPSFM is also within the Project designation. This area of wetland is so small that it has not been considered in any further assessments of potential direct wetland habitat loss.

The small area of wetland QP_W1 potentially impacted by vegetation disturbance and loss of soils represents a very small proportion of the total wetland area. If impacts to the wetland cannot be avoided, then there would be a small and permanent loss in wetland extent, although values and function of the remaining wetland area are likely to be un-changed, which equates to a **low** magnitude of effect. A **low** magnitude of effect combined with a **moderate** ecological value results in an overall **low** level of effect. This represents a minor change to the baseline condition with the post-construction environment in this area being similar to pre-development character.

The overall level of effect to wetland QP_W1 could be reduced to very low, or negligible by creating a buffer around the wetland extent so that vegetation clearance and habitat removal during construction works avoids these wetlands.

6.3.3 Modification of wetland hydrology

Construction and operation of the new road has the potential to change hydrological functioning within wetlands both temporarily during construction and / or permanently following construction. The mechanisms through which wetland hydrology could be altered include:

- Altered catchment size and function via:
 - Increase in impermeable surfaces resulting in reduced rainfall interception and infiltration directly to ground at the point of contact.
 - Changes to substrate and therefore below-ground water movement as a result of compaction or other ground improvement works to create a structurally and seismically sound platform for road creation.
 - Interception of rainfall into stormwater conveyance infrastructure and therefore modification of entry points to the catchment.
 - Installation of new culverts to convey stream flow.
- Reduced groundwater or surface water inputs via:
 - Dewatering activities during culvert installation.
 - Cutting off connectivity to waterways.
 - Cut-off drains intercepting groundwater.
- Increased water inputs via:
 - Hydrostatic pressure increase resulting in lateral and / or vertical dissipation of groundwater.
 - Discharge of drains / conveyance structures directly into wetlands.

During construction

Surface and groundwater hydrological connections are likely to be disrupted for the duration of construction works within each wetland / wetland catchment. Construction of the Project is anticipated to take approximately four years. Disruptions to wetland hydrology are unlikely to span the entire construction duration, however the length of time where hydrological connections and catchments may be impacted will not be determined until detailed design and construction programme timetabling. Conservatively, the period for hydrological interruption during construction has therefore been defined as two years / 24 months for the purposes of this assessment.

Post-construction / operational phase

The potential for hydrological modification to freshwater features, including wetlands, within the Project alignment has been minimised through the stormwater design process. The stormwater

design aims to achieve net hydrological neutrality within each catchment upon completion³⁹ so that the water flow and infiltration to the catchment is the same, or very similar to pre-construction. Net hydrological neutrality will primarily be achieved by using grassed or planted⁴⁰ swales to direct road runoff towards stormwater treatment infrastructure. The design of the swales will allow for complete infiltration of small rainfall events to ground and therefore back into each catchment through which the swales pass. In larger events, partial infiltration across the catchment will be achieved, with the remaining water flow being discharged to outflow points along the alignment. The outflow points along the alignment have been placed to maintain stream base flow and / or exit into natural catchment flow-paths.

Stormwater treatment infrastructure will primarily be in the form of bioretention basins and bioinfiltration basins and swales at various collection points along the alignment. Proprietary treatment devices are not currently proposed for the Project, but may be installed if required to treat small areas where additional treatment is needed.

6.3.3.1 Catchment modification

Catchment modification to wetlands that will be completely lost through project construction works (WC_W6 and WC_W1) have not been considered as changes to their catchments are irrelevant if no wetland habitat remains. Twelve wetlands across the Project alignment have catchments that will be impacted by construction of the road and associated infrastructure (for illustrations of wetland catchments and modelling of catchment impacts refer to the hydrogeological assessments for each wetland area in Appendix H of the hydrogeology assessment):

- Cam River / Ruataniwha wetlands (CR_W1_NPSFM and CR_W2_NPSFM).
- QP_W1_NPSFM.
- The Fuller's Road wetland complex (FR_W1_NPSFM, FR_W2_NPSFM, FR_W3_NPSFM and FR_W4_NPSFM).
- FA_W2_NPSFM.
- Remaining areas⁴¹ of the Waihora Stream wetland complex (WC_W2_NPSFM, WC_W3_NPSFM, WC_W4_NPSFM, and WC_W5_NPSFM).

Table 6.29 below summarises the modelled changes to the ground and surface water catchment area of each wetland listed above both during and post-construction. Where post-construction catchment areas are different than during construction catchment areas, this is based on:

- a The areas of the catchment not under road or roading-related infrastructure being rehabilitated / reinstated once construction has been completed.
- b Captured surface flow being discharged back into the catchment once construction is completed either via treated stormwater outflow points or reinstatement of stream hydrological connectivity via new culverts.

Any residual adverse effects to wetlands will be confirmed during detailed design and the offsetting requirements for these will be detailed in the residual effects management plan (see Section 7).

There are no clear guidelines to assess the likely degree of change to a wetland or thresholds for impacts to wetland function based on a percentage change in wetland hydrological catchment area. This is because the potential for, and degree of, wetland change is influenced by a complex

³⁹ Refer to the stormwater and flooding technical assessment for this Project which is Volume 3L of the SAR.

⁴⁰ The planting / surface restoration treatment will be dependent on land parcel existing and proposed future use, and has been determined in consultation with affected landowners.

⁴¹ The catchments for WC_W1 and WC_W6 have not been assessed in this section as the entirety of the wetlands are considered to be lost during construction therefore changes to catchments are irrelevant for these wetlands.

interaction between wetland size, current ecological condition, soil, wetland type (e.g. swamp, marsh, fen, bog, mire), dominant hydrological input, and current and historic disturbance. Determining accurate potential change to any given wetland area would therefore require site-specific metrics to be collected and analysed over time. However, as wetlands rely on water for their persistence in the landscape, any change in water input has the potential to change the base water level required for wetland persistence.

For the purposes of this project, a conservative approach has been taken where it has been assumed that, for example, a catchment loss of 20% is likely to result in an at least proportional decrease in wetland hydrological function and therefore likely loss of wetland extent over time. A 10% catchment loss threshold has been defined as the threshold above which moderate or higher magnitudes of ecological impacts may be observed. Table 6.6 below provides a summary of changes to the modelled wetland catchment area both during and post-construction, with values in red text representing catchment change scenarios that could result in a moderate or higher magnitude of adverse ecological impact.

Table 6.6: Modelled wetland catchment areas⁴², construction phase and post-construction phase changes to wetland catchments as a result of construction works associated with the Project

Wetland name	Existing catchment area (m ²)	Construction phase		Post-construction phase	
		Modified catchment area (m ²)	% change from existing	Modified catchment area (m ²)	% change from existing
CR_W1_NPSFM	95,900	50,400	-47%	50,400	-47%
CR_W2_NPSFM	95,900	50,400	-47%	50,400	-47%
QP_W1_NPSFM	19,600	16,310	-17%	19,600	0%
FR_W1_NPSFM	355,100	332,000	-7%	339,600	-4%
FR_W2_NPSFM	311,200	288,100	-8%	303,600	-5%
FR_W3_NPSFM	276,100	253,000	-8%	260,500	-6%
FR_W4_NPSFM	143,500	120,300	-16%	127,900	-11%
FA_W2_NPSFM	48,858	11,370	-77%	21,180	-57%
WC_W2_NPSFM	160,500	118,544	-26%	131,900	-18%
WC_W3_NPSFM	73,100	37,746	-48%	46,900	-36%
WC_W4_NPSFM	40,500	10,300	-75%	16,800	-59%
WC_W5_NPSFM	970	738	-24%	970	0%

Note:

- Values provided in red text indicate a scenario where catchment change could result in moderate or higher magnitude of ecological effect.
- Changes to catchment areas for wetlands that will be lost through construction works have not been considered in this table.

6.3.3.1.1 Wetlands with <10 % catchment change

Based on hydrogeological catchment modelling, the likely change in catchment area for three wetlands (FR_W1, FR_W2, and FR_W3) will be <10 % during construction and ≤5% post-

⁴² For details on wetland catchment modelling, calculations and mapping refer to Appendix H of the hydrogeological assessment for the Project, which is Volume 3K of the SAR.

construction. A <10% change in catchment area is considered unlikely to change the water budget for each wetland to a point where effects on wetland vegetation and function is observable. The magnitude of potential adverse effects for these wetlands is therefore considered to be **Low**.

6.3.3.1.2 Wetlands with >10 % catchment change

Based on hydrogeological catchment modelling, the likely change in catchment area for eight wetlands (CR_W1_NPSFM, CR_W2_NPSFM, FR_W4_NPSFM, FA_W2_NPSFM, WC_W2_NPSFM, WC_W3_NPSFM, WC_W4_NPSFM, WC_W5_NPSFM) will be >10 % during construction. Post-construction, the likely change in catchment area will continue to be >10 % for six wetlands (CR_W1_NPSFM, CR_W2_NPSFM, FA_W2_NPSFM, WC_W2_NPSFM, WC_W3_NPSFM, WC_W4_NPSFM). Discussion of the actual and potential impacts to each wetland area is provided below with wetlands grouped by geographical location and ecological connectivity.

Cam River / Ruataniwha wetlands

In addition to the direct loss of wetland vegetation and habitat within CR_W2, construction of the road and associated stormwater infrastructure will impact c.47 % (c.45,500 m²) of the total catchment area (c.95,900 m²) for both wetland CR_W1 and the remaining area of wetland CR_W2 (see Figure 3.1 in the hydrogeological wetland assessment report).

Water sources sustaining these wetlands are considered to be a combination of overland flow, interception of shallow groundwater, and diurnal inputs from the Cam River / Ruataniwha at high tide. The loss of c.47% of the wetland catchment, has the potential to substantially alter the hydrological dynamics of both wetlands.

For the area of wetland CR_W2 remaining post-construction (746 m²), the main groundwater interception points to the wetland are likely to be lost by earthworks and compaction associated with road formation, and the placement of the road is likely to reduce overland flow from the surrounding catchment by 47%. Tidal inputs from the Cam River / Ruataniwha will continue to replenish the southern end of the remaining wetland area, but the inputs from the river are unlikely to travel far into the remaining wetland extent. This loss of catchment area, in combination with loss of extent, is likely to result in transition of the remaining vegetation towards a dryland system. It is therefore likely that only very small, marginal areas of wetland plants would remain at the southern end of this wetland close to the Cam River / Ruataniwha. This is therefore considered to comprise a **Very High** magnitude of effect that is highly likely to result in total loss of post-construction wetland extent and function for wetland CR_W2 as a result of the Project.

For the remaining area of wetland CR_W2, a **Very High** magnitude of effect combined with a **moderate** ecological value results in an overall **high** level of effect representing a major change to the baseline condition. Potential for mitigating impacts to water flow within the remaining CR_W2 catchment post-construction is limited due to the shape of the designation in this area, and the width of the final road footprint and abutments. From a practical perspective, it is unlikely that treated stormwater can be diverted into the remaining CR_W2 wetland area to recharge lost hydrological connectivity. The post-construction overall level of effect to wetland CR_W2 is therefore considered to be high and, in conjunction with the direct loss of wetland extent, will need to be offset (see Section 7.1).

The hydrological inputs for wetland CR_W1 primarily appear to be interception of some water passing through wetland CR_W2 as well as diurnal and flood inputs of water from the Cam River / Ruataniwha. A 47% reduction in catchment to wetland CR_W2 is therefore inferred to influence the catchment inputs to wetland CR_W1, however the extent to which CR_W1 is reliant upon upgradient water flow is uncertain. Consequently, the 47% reduction in the modelled CR_W2

catchment is likely to result in some change to hydrological character of this area, but the magnitude of this is uncertain. Conservatively this has been assessed as a **moderate** magnitude of effect.

For wetland CR_W1, a **moderate** magnitude of effect combined with a **low** ecological value results in an overall **low** level of effect representing a noticeable, but minor shift away from baseline conditions. From a practical perspective, it is unlikely that treated stormwater can be diverted into the remaining CR_W2 wetland area to recharge lost hydrological connectivity and by association wetland CR_W1. However, as the post-construction overall level of effect is considered to be low, no further effects management has been proposed.

Quarry Lakes wetland

Water sources sustaining wetland QP_W1 are considered to be a combination of rainfall and overland flow interception rather than direct connection to groundwater. The potential loss of c.17% of the wetland catchment during construction, will result in a reduction in water input to the system that could result in changes to wetland character and function, if prolonged. However, if the wetland catchment is reinstated post-construction, the likelihood of a discernible change in wetland character occurring is relatively low. In the absence of any management measures, and based on the above, the magnitude for potential effects due to changes in wetland hydrology is considered to be **low**. A **low** magnitude of effect combined with a **moderate** ecological value results in an overall **low** level of effect.

If the wetland catchment is not reinstated post-construction, the post-construction impact will need to be reassessed. Any residual adverse effects to wetlands will be confirmed during detailed design and the offsetting requirements for these will be detailed in the residual effects management plan (see Section 7).

Fuller's Road catchment

Within the Fuller's Road wetland catchment, the wetlands are considered to be fed by a combination of surface water flows from the surrounding land and interception of shallow groundwater. A spring may also be present at the northern end of the wetland complex but this has not been able to be confirmed. During construction, the modelled catchment reduction for FR_W4 is 16%. Although the reduction of 16% of the catchment has the potential to alter the hydrological budget of the wetland to the point where changes to wetland vegetation character are observable, the temporary nature of the catchment change is potentially within the natural water budget variability experienced by this wetland over different climatic cycles. It is therefore considered unlikely that a short-term change in hydrology will be sufficient to alter the wetland to the extent that it is substantially different from the existing baseline condition.

Once construction is completed, the proposed stormwater conveyance structure design shows a combination of cut-off drains discharging road runoff to McIntosh's Drain to the south of the wetland complex, and grassed / planted swales directing runoff to the north and south. During small rainfall events, the swales should result in infiltration direct to ground and recharge to groundwater that will result in a low degree of change to catchment hydrological budgets for the Fuller's Road wetland complex. However, based on the proposed outflow points of the cut-off drain and swales it is possible that surface water flow and groundwater recharge following heavy rainfall events may not result in a net neutral hydrological budget for these wetlands compared to pre-development state.

The stormwater modelling indicates that the risk of substantially altered water inputs to the Fuller's Road wetland features is low, therefore the magnitude of potential adverse effects to this wetland complex is also considered to be **Low**. A **low** magnitude effect combined with a **moderate** ecological value results in an overall **low** level of effect. A degree of uncertainty remains regarding the relative importance of flood flow inputs to the Fuller's Road system due to the locations of proposed

stormwater outlets within the catchment. This uncertainty could be factored into the proposed wetland offsetting programme, which will be confirmed within the residual effects management plan (see Section 7.2 below).

Waihora Stream catchment

Within the Waihora Stream catchment, wetlands WC_W2, WC_W3, and WC_W4 are considered to be fed by a combination of spring and surface water flows within the Waihora Stream, and interception of shallow groundwater⁴³. Wetland WC_W5 is considered to be fed by surface water flow from the surrounding land as well as flood flows from the Waihora Stream.

During construction

During construction the modelled change in catchment size for wetlands WC_W2 and WC_W5 are around 25% (26% and 24% respectively). For wetlands WC_W3 and WC_W4 the modelled change is 48% and 74% respectively.

For wetlands WC_W2 and WC_W5 an approximately 25% change in hydrological inputs, even over a temporary timeframe, has the potential to result in a moderate level of impact so that by the time the construction period has ended, the impact to the wetlands may be discernible. Obligate wetland species like common water milfoil in WC_W2 may disappear from the wetland, and / or facultative wetland species may begin to show signs of ill-health.

For wetlands WC_W3 and WC_W4 a 48% and 74% change in hydrological inputs even temporarily has the potential to result in wetland plant dieback or ill-health health and changes to nutrient cycling. This may also allow for establishment of dryland plant species.

During construction catchment modification may therefore result in a **moderate**, though temporary magnitude of effect for wetlands WC_W2, WC_W3, WC_W4, and WC_W5.

Post-construction

One bioretention pond is proposed for the northern end of the catchment, the outflow of which is proposed to connect to the un-modified portion of the Waihora Stream. The base flows within the stream are therefore likely to be maintained. In combination with the infiltration capacity of the swales, the stormwater modelling indicates that the risk of substantially altered water inputs to the remaining wetland features is low. Based on the stormwater modelling and design, the magnitude of potential adverse effects to wetlands WC_W2, WC_W3, WC_W4 post-construction is therefore considered to be **Low**.

For wetland WC_W5, although the stormwater design objective is for net neutrality to the Waihora Stream system, complete disturbance of ground within the designation has the potential to cut off the connection of this wetland to the Waihora Stream. Consequently, if no remedial or mitigation measures are undertaken it is likely that a large proportion of the hydrological connectivity for this wetland will be lost post-construction. The potential magnitude of effect without management is therefore considered to be **High**.

Also, within the Waihora Stream catchment, wetland FA_W2 is considered to be fed by a combination of surface water flows from the surrounding land, very high flood flows extending southeast from the terminal end of the Waihora Stream, and interception of shallow groundwater from the northeast. The works within the road corridor and designation will not modify the groundwater catchment for this wetland, but have the potential to alter surface water and flood

⁴³ PDP (May 2025) Groundwater – Surface water interactions along proposed Belfast to Pegasus Woodend Bypass alignment. Prepared for NZTA / Waka Kotahi.

flows by cutting across the relict Waihora Stream channel along which flood flows are conveyed and reducing the surface runoff catchment from the surrounding land.

Post construction, the proposed stormwater infrastructure design shows construction of a diversion channel that extends from the terminal end of the Waihora Stream to a point within the relict Waihora Stream channel c.50 m northwest of the wetland. The intention of this discharge point is that the natural overland flowpath will convey any remaining water flow towards Gladstone Road. On the basis that the diversion channel will be sized to convey all flood flows from the Waihora Stream to the southeast, the potential change in flooding recharge of this area is considered to be low. The magnitude of effects for potential permanent changes to the catchment of wetland FA_W2 is therefore considered to be **Low**.

6.3.3.1.3 Summary

During construction

During construction impacts to the catchments of wetlands QP_W1, FR_W4, WC_W2 and WC_W5 are considered to have a Low level of effect due to the temporary nature of the disturbance / catchment change and therefore no effects management during construction is recommended.

During construction impacts to wetlands CR_W1, WC_W3 and WC_W4 may have a Moderate level of effect in spite of the temporary nature of the disturbance / catchment change. However, once hydrology is restored, the wetlands are likely to recover and the overall effect will likely be low. Due to the uncertainty around degree of impact to wetlands CR_W1, WC_W3 and WC_W4 during construction and response of the wetlands once hydrological connections have been restored post-construction, the following options could be considered:

- a A monitoring programme could be developed to determine whether greater than low adverse impacts are occurring as a result of the Project. If the monitoring programme shows a notable decrease in wetland condition and / or extent, either a remediation package should be developed or additional wetland offset should be undertaken.
- b A contingency offset could be included in the proposed offsetting package to account for any uncertainty. The final offsetting requirements for the project will be detailed in the residual effects management plan (see Section 7).

During construction impacts to the remaining area of wetland CR_W2 is likely to have a High level of effect despite the temporary nature of the disturbance / catchment change, due to the type and duration of catchment impact in conjunction with the direct wetland loss. See more on this wetland in the post-construction section below.

Post-construction

Based on the stormwater infrastructure design being able to achieve net hydrological neutrality within both the Waihora Stream and Fuller's Road wetland catchments and the assumed remediation of wetland catchment topography post-construction, the magnitude of potential adverse effects for wetlands FR_W1, FR_W2, FR_W3, FR_W4, FA_W2, WC_W2, WC_W3, and WC_W4 following construction being completed is considered to be Low. A low magnitude of effect combined with a Moderate ecological value comprises an overall **Low** level of ecological effect. Note however the uncertainty described for the Fuller's Road catchment in the previous subsection.

For wetland WC_W5, the magnitude of potential adverse effects, in the absence of mitigation or remediation, is considered to be High. A High magnitude of effect combined with a Low ecological value comprises an overall **Low** level of ecological effect. Adverse effects to wetland WC_W5 could be reduced to Very Low or Negligible by:

- Constructing a buffer around the wetland and retaining the connection to the Waihora Stream to avoid impacts.
- OR
- Reinstating the connection to the Waihora Stream post-construction to remediate any impacts that could occur during construction.

For wetland CR_W2, changes to the wetland catchment in conjunction with loss of wetland extent is highly likely to result in a permanent change to the remaining wetland character so that there is total loss, or major alteration to the wetland resulting in the post-construction character and features being fundamentally changed. This is considered to be an overall **high** level of effect that, in conjunction with loss of wetland extent, is recommended to be offset as per guidance within the NPS-FM (refer to Section 7).

6.3.3.2 Dewatering for culvert installation

In order to install a 70 m long culvert beneath the new SH1 alignment at the northern end of the Waihora Stream, dewatering of shallow groundwater is likely to be required. Dewatering within this part of the Waihora Stream system has the potential to alter the groundwater and surface water hydrological budgets for wetland WC_W6 and result in temporarily reduced stream inputs into wetlands WC_W5 and WC_W4.

The proposed dewatering approach would result in 20-30 days of local drawdown, however the abstracted groundwater is proposed to be discharged back into the surface waters of the stream following sediment removal. The temporary impacts of dewatering on wetlands along the Waihora Stream system is therefore considered to be **negligible**.

6.3.3.3 Modified groundwater levels

Based on the presence of a dense clay layer beneath wetland QP_W4, the presence of very shallow groundwater at the time of the wetland delineation, and the existing knowledge of the soils profile around the Quarry Lakes, it cannot be ruled out that wetland QP_W4 is connected to the Quarry Lake levels. As a conservative assessment, it is therefore considered that infilling of the southern Quarry Lake remnant has the potential to modify groundwater levels within QP_W4 through increased hydrostatic pressure resulting in lateral dispersal of water within the lake east towards the wetland.

Based on a lake infill rate of 2,000 m³ per day, any change in groundwater levels is likely to be very slight. However, due to the surrounding gravel soils permeability, and capacity of clays to retain any water inputs, the groundwater levels beneath the wetland may be slightly elevated whilst the groundwater disperses into the wider landscape. It is unlikely, however, that any slightly elevated groundwater levels will be prolonged beyond one growing season, and therefore changes to wetland character and composition are unlikely. The magnitude of impact is therefore considered to be Low. A **low** magnitude of impact combined with a **moderate** ecological value results in an overall **low** level of effect.

An assessment of changes water levels sustaining wetlands QP_W1, QP_W3, and QP_W4 as a result of surface and groundwater drawdown in the Quarry Lakes for dust suppression activities has also been undertaken in the hydrogeology report (see Volume 3K of the SAR). The hydrogeology assessment determined a Low to Negligible magnitude of likely effect to these wetlands from this activity and this is not further assessed in this report.

6.3.4 Permanent post-construction effects – wetland habitat fragmentation

Vegetation removal, soil disturbance, and infilling of wetland areas within the road footprint and wider designation that are required for construction of the road has the potential to result in fragmentation impacts to three wetlands (WC_W5, QP_W1 and CR_W2) that are additional to the effects described above. Habitat fragmentation occurs when the loss of vegetation and / or habitat separates formerly contiguous areas from each other. This can reduce habitat suitability for fauna, interrupt dispersal or intra-habitat movement, and can result in changes to vegetation composition and character by substantially altering physiochemical parameters such as exposure to wind, increased temperature, and reduced humidity.

For wetland WC_W5, permanent loss of 79% of the wetland extent will result in only 30 m² of wetland habitat remaining post-construction if no remediation or mitigation measures are undertaken. Due to the existing sparse vegetation cover within this wetland, fragmentation of wetland habitat is unlikely to significantly alter the character of the remaining wetland area. The potential magnitude of this potential effect is therefore considered to be **negligible**. No further management measures are therefore proposed, noting that the potential for avoiding permanent wetland loss has been discussed in Section 6.3.2 above.

For wetland QP_W1, there is the potential for loss of a small area of this wetland (c.105 m²) during construction. The area of potential vegetation loss is located on the northern boundary of the wetland, which while it will slightly reduce wetland extent, is not considered to result in direct fragmentation effects within the remaining wetland area. The magnitude for this potential effect is therefore considered to be **negligible**. No management measures are therefore proposed.

For wetland CR_W2, the complete loss of c.77% of the wetland vegetation will result in increased exposure of the remaining vegetation to edge effects by modifying the shape so that the remaining vegetation is long and narrow (vegetation width ranging from c.10 m to c.30 m wide and c.68 m long compared to average pre-construction width of c.35 m (range 15-45 m) by 110 m long). This change in shape and removal of buffering vegetation is likely to result in a reduction in the proportion of wetland plant species and lower plant species diversity, which will be dominated by species suited to regular disturbance. The magnitude for this likely effect is considered to be **moderate**. A moderate magnitude of effect combined with a **moderate** ecological value results in an overall **moderate** level of effect representing a discernible at least partial post-development change to the remaining wetland character. Because a large proportion of the wetland will be directly impacted by road construction, and 47% of the catchment area for the remaining wetland will also be permanently lost, it has been assumed that total loss of wetland CR_W2 will occur as a result of the project. This total loss has been accounted for within wetland biodiversity offset calculations (see Section 7.1), and therefore no further effects management measures have been proposed for this potential post-construction effect.

6.3.5 Temporary construction effects – sedimentation of wetlands

Increased sediment discharge into wetlands can result in smothering of wetland vegetation, increased ground level height, altered hydrological patterns, and providing avenues for pest plant establishment.

Earthworks are proposed for within or in close proximity to wetlands CR_W1, CR_W2, QP_W1, FR_W4, FA_W2, WC_W4, and WC_W5. Sedimentation effects within wetlands that will be completely lost during construction works have not been considered.

The proposed construction activities, with no management measures in place, will disturb vegetation and habitat immediately on the margins of the remaining area of wetland CR_W2, and potentially result in uncontrolled release of sediment to wetlands CR_W1 and CR_W2. These

wetlands are considered the most at risk of sediment discharge due to their proximity to the proposed works, and their location slightly downgradient of proposed cut / fill activities.

For wetland CR_W2 it will be very difficult to avoid any sedimentation effects to the remaining area of the wetland due to fill activities needing to be undertaken within the wetland. Additionally, if sediment control structures such as silt fences were constructed, this would need to be undertaken within the wetland thereby also creating disturbance. The potential magnitude of impact for sedimentation of this wetland is therefore considered to be **moderate**. Potential adverse impacts to wetland CR_W2 are considered to be unavoidable, therefore the overall level of potential effect is considered to be **moderate**. However, because a large proportion of this wetland will be directly impacted by road construction, and 47% of the catchment area for the remaining wetland will also be lost, it has been assumed that total loss of wetland CR_W2 will occur as a result of the project. This total loss has been accounted for within wetland biodiversity offset calculations (see Section 7.1), and therefore no further effects management measures have been proposed for this potential construction effect.

For wetland CR_W1, the potential for sediment to enter the wetland will be mitigated by the remaining vegetation with wetland CR_W2. Sediment may still enter the wetland via connected waterways between the two wetlands. The likely potential magnitude of impact for sedimentation of this wetland is considered to be **low**. Potential adverse impacts to wetland CR_W1 could be reduced to **very low** by construction of appropriate sediment retention devices upstream of, or adjacent to, waterways to limit the dispersal of any sediment into receiving watercourses and connected wetlands.

The remaining wetland areas listed above (QP_W1, FR_W4, FA_W2, WC_W4, and WC_W5) are less likely to be affected by uncontrolled discharge of sediment due to the distance of cut and fill activities relative to their location and their location within a very flat area of the project alignment. Additionally, the Project proposes to use best-practice erosion and sediment control measures to limit sediment impacts to the receiving environment through implementation of site- and activity-specific erosion and sediment control plans. These will be documented in the Erosion and Sediment Control Management Plan (ESCMP). The concepts and approaches to successful erosion and sediment control are presented in the Construction Methodology Statement (**CMS**; Volume 3A). These will be developed and expanded upon prior to construction via preparation and certification of the ESCMP.

Key management measures that will be implemented as part of the erosion and sediment control for the Project include:

- Minimise disturbance.
- Do the tasks (i.e., construction) in stages.
- Protect waterways.
- Stabilise exposed areas quickly.
- Consider the weather.
- Install perimeter controls and diversions.
- Use sediment control tools, including mixing and matching tools as necessary.
- Adjust the plan as needed.
- Implement a monitoring plan for E&SC devices and modify approach if required.
- Training and developing experience.

The implementation of the Project ESCMP will therefore result in a **low** potential magnitude of effect and **very low** to **low** overall level of effect for wetlands QP_W1, FR_W4, FA_W2, WC_W4, and WC_W5. No further effects management measures have therefore been proposed.

6.3.6 Summary of wetland effects

Wetland values within the Project Site range from Low to Moderate. Actual and potential adverse impacts on those values range from Negligible to Very High. Measures are proposed to address greater than moderate overall impacts on these values. These measures (to be detailed in a project EMP), if fully implemented, will reduce the overall level of effects on ecological values to very low to low.

Table 6.7 summarises the wetland ecological values within the Project Site, actual and potential adverse effects, magnitude and overall level of effect following the recommended effects management measures.

Table 6.7: Summary of actual and potential ecological effects on wetland values, magnitude of effects, and overall level of effects following recommended measures to avoid, minimise, or remedy effects

Wetland name	Location	Ecological value	Effect / potential effect	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)	Comments
CR_W1_NPSFM	Cam River / Ruataniwha to Williams Street	Low	Modification to wetland hydrology	Moderate	No effects management proposed. Reinstatement of hydrological connection considered to be impractical.	Low	
			Temporary construction effects – sedimentation	Low	Adhere to best practice sediment and erosion control practices.	Very Low	
CR_W2_NPSFM	Cam River / Ruataniwha to Williams Street	Moderate	Permanent loss of wetland habitat	Very High	No effects management proposed. Impacts cannot be avoided.	High	Biodiversity offset is recommended to align with guidance within the NPS-FM. Permanent loss of wetland habitat and substantial modification to hydrology are unavoidable and will significantly alter any wetland habitat that might remain. Therefore, the loss of the entire wetland extent has been included in the residual effects management calculations (Section 7.2). As a consequence, consideration of other effects management options for fragmentation and sedimentation effects has not been considered.
			Modification to wetland hydrology	Very High	No effects management proposed. Impacts cannot be avoided.	High	
			Permanent fragmentation of wetland habitat	Moderate	No effects management proposed.	Moderate	
			Temporary construction effects – sedimentation	Moderate	No effects management proposed.	Moderate	
QP_W1_NPSFM	Quarry Lakes to Woodend Beach Road	Moderate	Permanent loss of wetland habitat	Low	Retain the fence constructed during early works to avoid wetland vegetation and soils being impacted.	Negligible	<ul style="list-style-type: none"> Not included in offset modelling assuming that the early works buffer can be retained. If the early works buffer zone is not reinstated, offset modelling will need to be updated.
			Modification to wetland hydrology	Moderate	Retain the fence constructed during early works to limit the area of wetland catchment impacted to <10%.	Low	
			Permanent fragmentation of wetland habitat	Negligible	Retain the fence constructed during early works to avoid wetland vegetation and soils being impacted.	Very Low	
QP_W4_NPSFM	Quarry Lakes	Moderate	Modified groundwater levels	Low	None	Low	
Fuller's Road wetland complex: FR_W1_NPSFM FR_W2_NPSFM FR_W3_NPSFM FR_W4_NPSFM	Quarry Lakes to Woodend Beach Road	Low (FR_W2) Moderate (FR_W1, FR_W3, FR_W4)	Modification to wetland hydrology	<i>During construction:</i> Low (FR_W1, FR_W2, FR_W3, FR_W4) <i>Post-construction:</i> Negligible (FR_W1, FR_W2, FR_W3) Low (FR_W4)	<ul style="list-style-type: none"> Stormwater infiltration designed to result in net neutral hydrological change. Limit during construction earthworks within the wetland catchment as much as practically possible. Determine if a spring is present within the northern wetland extent. If present, establish a buffer around the spring to avoid any construction impacts. 	Low (FR_W1, FR_W3, FR_W4) Very Low (FR_W2)	<ul style="list-style-type: none"> Some uncertainty around net hydrological neutrality of the Fuller's Road wetland complex catchment during high rainfall events. This uncertainty could be factored into the wetland offset proposal.
FA_W2_NPSFM	Gladstone Road to SH1	Moderate	Modification to wetland hydrology	Low	<ul style="list-style-type: none"> Stormwater infrastructure designed to result in net neutral hydrological change and release of conveyed stormwater 	Low	

Wetland name	Location	Ecological value	Effect / potential effect	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)	Comments
					back to the relict Waihora Stream channel for infiltration to ground.		
WC_W1_NPSFM	Gladstone Road to SH1	Moderate	Permanent loss of wetland habitat	Very High	No effects management proposed. Impacts cannot be avoided.	High	Biodiversity offset is recommended to align with guidance within the NPS-FM.
WC_W2_NPSFM	Gladstone Road to SH1	Moderate	Modification to wetland hydrology	<i>During construction:</i> Moderate (temporary) <i>Post-construction:</i> Low	<ul style="list-style-type: none"> Stormwater infrastructure designed to result in net neutral hydrological change within the Waihora Stream catchment. During and post-construction monitoring of wetland extent and condition. Remediation of wetland extent and condition if monitoring shows moderate or higher Project effects. 	<i>During construction:</i> Low <i>Post-construction:</i> Low	
WC_W3_NPSFM	Gladstone Road to SH1	Moderate	Modification to wetland hydrology	<i>During construction:</i> Moderate (temporary) <i>Post-construction:</i> Low	<ul style="list-style-type: none"> Stormwater infrastructure designed to result in net neutral hydrological change within the Waihora Stream catchment. During and post-construction monitoring of wetland extent and condition. Remediation of wetland extent and condition if monitoring shows moderate or higher Project effects. 	<i>During construction:</i> Moderate <i>Post-construction:</i> Low	
WC_W4_NPSFM	Gladstone Road to SH1	Moderate	Modification to wetland hydrology	<i>During construction:</i> Moderate (temporary) <i>Post-construction:</i> Low	Stormwater infrastructure designed to result in net neutral hydrological change within the Waihora Stream catchment. During and post-construction monitoring of wetland extent and condition. Remediation of wetland extent and condition if monitoring shows moderate or higher Project effects.	<i>During construction:</i> Moderate <i>Post-construction:</i> Low	
WC_W5_NPSFM	Gladstone Road to SH1	Low	Permanent loss of wetland habitat	Very High	Establish a buffer around the wetland margin to prevent wetland habitat loss.	Negligible	<ul style="list-style-type: none"> Not included in offset modelling assuming that a buffer can be erected. If a buffer zone is not created, offset modelling should be updated.
			Modification to wetland hydrology	High	Establish a buffer around the wetland margin and connection channel to Waihora Stream to minimise hydrological impacts. OR Reinstate the Waihora Stream connection post-construction.	Very Low	
			Permanent fragmentation of wetland habitat	Negligible	None proposed.	Very Low	
WC_W6_NPSFM	Gladstone Road to SH1	Moderate	Permanent loss of wetland habitat	Very High	No effects management proposed. Impacts cannot be avoided.	High	Biodiversity offset is recommended to align with guidance within the NPS-FM.

6.4 Streams

6.4.1 Temporary construction effects – sedimentation

Increased sediment levels can be directly harmful to native freshwater fauna. Furthermore, external sources of sediment entering waterbodies can negatively impact habitats and fauna through changes in water clarity and via increased sediment deposition. This can reduce interstitial spaces, cover fish spawning and macroinvertebrate habitats, or reducing the quality of food sources and feeding ability of fish and macroinvertebrates (Reid and Quinn, 2011).

6.4.1.1 Streams

A visual inspection of the streams within the Project Site showed that they have good water clarity, indicating low suspended sediment. Similarly, turbidity and total suspended solid results from watercourses across the Project Site have also shown good water clarity. Turbidity results range between 0.52 NTU and 5.1 NTU, except for a single result of 24 NTU for the Kaiapoi River. Total suspended solid results are largely below the detection limit of $<3 \text{ g / m}^3$, with a reading of 89 g / m^3 at the Kaiapoi River the highest recorded result. However, of note is that most sites did have moderate to high deposited sediments (50 – 100% fine sediment deposition).

The proposed construction activities, with no management measures in place, will disturb both instream sediment and potentially result in an uncontrolled release of sediment from any bankside works areas. This will result in elevated turbidity levels within the proximity of the works site and a potential increase in surface fine sediment cover of the stream bed downstream of the active work sites.

Most of the fish community within the Project Site are tolerant of elevated suspended sediments for a short period of time. This includes the 'Threatened' and 'At Risk' species īnanga, kōkōupara and tuna. Rowe et al. (2009) undertook a meta-analysis of publications relating to New Zealand native fish and suspended sediment effects, before completing laboratory experiments on three species identified to be most likely susceptible to increased suspended sediment concentrations (i.e., redfin bully, kōaro and toitoi). Results from the Rowe et al. (2009) meta-analysis indicated species expected to be present in the Project watercourses, e.g. toitoi, tuna, hao and īnanga, are unlikely to be adversely affected by temporary increases in suspended sediment.

In terms of construction derived sediment effects on native fish spawning, the Taranaki Stream is likely the only stream where spawning is to occur during construction within the Project Site. This is due to the habitat types, e.g., permanent flow, and areas of small and large gravel, and large cobble with fine sediment cover, and the fish species that are present. Within the Taranaki Stream both toitoi and kōkōupara could spawn on any large cobbles or boulders that are present within the Project Site of Taranaki Stream. Both species have a wide potential spawning range, which is typically between August to February, with kōkōupara peak spawning occurring through October and December. Therefore, any construction activities that can disturb both instream sediment and potentially result in an uncontrolled release of bankside sediment may occur when these species are spawning.

Note, as no instream works are proposed to occur within the Cam River / Ruataniwha and the Kaiapoi River effects from sedimentation on fish spawning are not assessed in this section.

The macroinvertebrate community within the watercourses are dominated by taxa adapted to soft bottomed streams and tolerant of organic enrichment. This includes oligochaete worms, crustaceans, dipterans and molluscs.

Ecological values for freshwater fauna within watercourses in the Project Site have been assessed as ranging from **low** to **high**. Based on existing knowledge of the freshwater fish species present and macroinvertebrate communities, the temporary increase of sediment inputs to streams derived from construction activities is unlikely to have a significant effect on freshwater fauna. There is also the consideration that works are not likely to take place during the night, so there will be little to no sediment inputs outside of construction hours, allowing freshwater fauna time without potentially increased suspended sediment levels.

However, with no management in place, the magnitude of effect from the uncontrolled discharge of construction derived sediments on freshwater fauna has been assessed as a temporary **moderate** effect. This is based on the potential for a moderate proportion of the known fish population or its range (including during spawning) to be affected by increased sediment. Once construction activities are completed, it is recognised that the underlying character and attributes of the present freshwater faunal community will be similar to pre-development circumstances. A temporary **moderate** magnitude of effect on ecological values ranging from **low** to **high** equates to **low** to **high** overall levels of effects.

While there is potential for some temporary sedimentation effects on freshwater fauna, stream habitat must also be considered. There is limited hard substrate habitat throughout the Project Site for utilisation by freshwater fauna. Macrophytes provide the majority of stream habitat. Elevated suspended sediment from construction can smother plants and extended suspended sediment levels can reduce water clarity to a level that existing macrophytes are unable to photosynthesise, leading to mortality. Dead vegetation is broken down by natural processes which demand oxygen, removing the amount of biologically available oxygen used by freshwater fauna from the watercourse. With excessive macrophyte growth within most of the Project watercourses, sediment dropping out of suspension will be trapped by macrophytes, leading to an increase in sediment retention. This can exacerbate sediment issues by increasing fine sediment depths.

Ecological values for stream habitat throughout the Project Site have been assessed as ranging from **low** to **high**. With no management in place, temporary construction effects of sedimentation on stream habitat has been assessed as a temporary **high** magnitude of effect, based on a major loss or alteration of macrophytes which are the dominant stream habitat within the Project watercourses, and the small amount of hard substrate (i.e. gravels, cobbles) present. A temporary **high** magnitude of effect on ecological values ranging from **low** to **high** for stream habitat equates to **low** to **very high** overall level of effects.

Any potential adverse effects from sedimentation on stream habitat and fauna (including spawning) will be minimised through the implementation of site and activity specific erosion and sediment control plans. These will be documented in the Erosion and Sediment Control Management Plan (**ESCMP**). The concepts and approaches to successful erosion and sediment control are presented in the Construction Environmental Management Plan (**CEMP**; Volume 3A). These will be developed and expanded upon prior to construction via preparation and certification of the ESCMP. Key management measures that will be implemented as part of the erosion and sediment control for the Project include:

- Minimise disturbance.
- Do the tasks (i.e., construction) in stages. Including the potential to stage any construction activities to minimise effects on toitoi and koukoupapa spawning season.
- Protect waterways. Including avoiding any unnecessary works in waterways or their banks.
- Stabilise exposed areas quickly.
- Consider the weather.
- Install perimeter controls and diversions.

- Use sediment control tools, including mixing and matching tools as necessary.
- Adjust the plan as needed.
- Monitoring and adjust tools.
- Training and developing experience.

The implementation of the Project ESCMP will result in a **low** magnitude of effect, and **very low to low** overall levels of effect on stream habitat.

6.4.1.2 Quarry lakes

As mentioned in Section 2.2, a new tiered embankment through two of the artificial lakes will be created for the road. This will involve dynamic compaction of material.⁴⁴ This could resuspend sediment as well as potentially deposit new sediment into the lake.

Toitoi (common bully) are the only native fish species within the South and East Lakes and have a conservation status of 'Not Threatened'. Toitoi are known to be tolerant of elevated suspended sediment (Cavanagh et al., 2014) and inhabit natural lakes with permanent elevated levels of suspended sediment. Adult toitoi are a mobile primarily benthic species (bottom-dwelling), while their larval stages are often pelagic (open-water dwelling especially in lakes) (Ember et al., 2024). Therefore, it is likely that adult and juvenile toitoi will move within the lakes away from the embankment construction site to areas of lower suspended sediment levels.

In addition to the dynamic compaction works, the reclamation of the South Lake remnant for wetland creation (see Section 7.2) has the potential to impact toitoi spawning. In lakes habitats, toitoi spawning generally occurs in spring through summer within the littoral zone (edge habitats) and is dependent on lake habitat and resource conditions (e.g., water temperature, food availability). Spawning involves egg clusters being attached to hard surfaces (cobble and boulder substrates; woody debris etc) on the lake bottom within the littoral zone. Larval common bully are planktonic and then become benthic at around 18 mm. Common bully > 18 mm are generally a littoral zone species, especially during the spring and summer where they feed and eventually spawn.

Littoral zone habitat during reclamation works is expected to be present in some locations within the South Lake remnant. However, it should be noted that the littoral zone is close to vertical along the southern edge of the South Lake remnant, which provides less favourable spawning habitat for toitoi. More favourable spawning habitat, e.g., a lower gradient littoral zone composed of gravels and cobble substrate, is available on the eastern portion of South Lake remnant and along the eastern edge of the newly constructed tiered embankment. These areas will largely be unimpacted by the reclamation works (tiered embankment) or can potentially be staged to minimise effects on the toitoi spawning season (eastern edge littoral habitats).

With no additional management measures in place (other than the construction methods outlined in the CEMP and the ESCMP), there could be temporary elevated sediment levels within the South Remnant Lake and East Lake throughout the construction period. Given the tolerance of toitoi to elevated suspended sediment levels, mobility of the species, the population being 'Not Threatened', and that lake littoral habitat can still be utilised for spawning during reclamation activities there would conservatively be a temporary **low** magnitude of effect on toitoi (Appendix B Table 5). This is due to any change to the toitoi population arising from the temporary increase in sediment and any reclamation works being a temporary discernible change. However, it is expected the underlying

⁴⁴ Includes pit run gravel, cobble, boulder material that was bulk filled in to the Quarry lakes through the early works construction program.

baseline characteristics (size and age range of common bully within the South Remnant and East Lake) of the common bully population being similar to pre-development circumstances.

A **low** magnitude of effect and **low** ecological value for stream habitat and fauna would result in a **very low** overall level of effect for both. No further management measures are proposed or required.

6.4.2 Temporary construction effect – Injury or mortality of freshwater fauna

Works within a waterbody have the potential to cause injury or mortality to native freshwater fauna (where fauna solely relates to fish and Kēwai). The magnitude of potential effect on native freshwater fauna is driven by the nature of the activity, the area of disturbance, density of fish present in each area, the ability of fish to escape disturbance and the controls applied. The conservation status of fish species is also relevant when assessing the potential overall level of effect.

6.4.2.1 Streams

The freshwater fauna community within the Project watercourses has been assessed via eDNA, trapping, electric fishing (Section 3.2.6.3), and a review of the NZFFD. These watercourses have been identified as having low to moderate diversity, but nearly all contain at least one ‘Threatened’ or ‘At Risk’ species. In addition, īnanga, tuna and hao also have value as mahinga kai species.

Note the Cam River / Ruataniwha and the Kaiapoi River have been assessed as having high freshwater fauna diversity, but instream works are not proposed for these watercourses, so they have not been assessed in this section.

In the absence of controls there is potential for freshwater fauna to be injured or killed during Project activities like dewatering, construction of culverts, stream realignments and bringing offline culverts and realignments online. This has been assessed as having a **moderate** magnitude of effect based on the loss of a moderate proportion of the known population within each watercourse (Appendix B Table 5). With freshwater fauna values ranging from **low** to **high**, this equates to overall levels of effect ranging from **low** to **high**.

The magnitude of fauna injury and mortality effects depends on the proportion of the population at risk, their conservation, ecological and cultural value; and the proportion of instream habitat where works are occurring. Although the overall length of instream works is low (c. 100 -200 m of instream works at any one time) and the native fish community is of low to moderate diversity, there are fish species present which have conservation and cultural value. Of which some may be at localised high densities within the Project watercourses. Therefore, fauna salvage and relocation should be required immediately prior to any instream works as a condition of consent. Any fish salvage and relocation will need to be undertaken by a suitably qualified freshwater ecologist working under Project specific fish salvage and relocation management measures developed via the EMP. In summary the measures will include:

- The methodology for fish capture prior to instream works (i.e. electric fishing, netting).
- Relocation area.
- The storage and transport measures to be utilised, including measures to prevent predation and death during capture / relocation.
- Methods to manage the incidental discovery of ‘Threatened’ and ‘At risk’ freshwater fauna.
- Method to prevent fish impingement or entrainment on any pump used to dewater.
- Euthanasia methods for any noticeably diseased individuals or pest species captured (e.g., rudd).

- Reporting requirements, inclusive of any mortality monitoring.

No occurrences of Canterbury mudfish (kōwaro; *Neochanna burrowsius*), a ‘Threatened - Nationally Critical’ species, were evident through the desktop assessment and the completed field surveys. However, the inclusion of an incidental discovery protocol within the fish salvage and relocation management measures should include procedures to implement if, in the unlikely event, this species is encountered during the Project construction works.

As outlined above (Section 6.4.1.1), construction activities may impact spawning of toitoi and koukoupara. The anticipated construction works within the Taranaki Stream are related to the extension of the Bob Robertson Drive culvert (10 m in length) and the construction of the SH1 culvert (90 m in length). These areas do provide favourable spawning habitat for toitoi and koukoupara. The CEMP will include measures to avoid and minimise construction effects on spawning habitat and success. This will include measures to avoid and minimise the disturbance of waterways (e.g., avoiding any unnecessary effects on favourable spawning habitat both upstream and downstream of the culvert sites by minimising the construction area) and include potential measures to stage construction to minimise effects on the spawning season. In addition, the implementation of fish salvage and relocation prior to any construction activities will relocate any toitoi and koukoupara to appropriate spawning habitat within the Taranaki Stream. Therefore, the loss of any potential spawning success due to the construction of these culverts will be discernible but will be temporary and will only have a low magnitude of effect on the known spawning range and success of toitoi and koukoupara within the Taranaki Stream.

With the implementation of the fish salvage and relocation measures by a suitably qualified freshwater ecologist and the avoidance and minimisation measures in the CEMP, the magnitude of effect of Project construction on freshwater fauna will be **low**, based on a minor effect on the known population within the Project watercourses. A **low** magnitude of effect on freshwater ecological values ranging from **low to high** equates to overall levels of effect ranging from **very low to low** on freshwater fauna in accordance with Appendix B Table 7.

6.4.2.2 Quarry Lakes

The only native freshwater fish species within the Quarry Lakes are toitoi which has a conservation status of ‘Not Threatened’. The remaining species are coarse fish with conservation statuses of ‘Introduced and naturalised’, therefore having no conservation value. Although coarse fish do have recreational value. All species recorded within the lakes are known to be benthivores as adults and feed from the bottom of the lakes. The fish community has likely been introduced to the artificial lakes and is isolated from naturally occurring populations as there is no surface water connection between the lakes and a natural waterbody.

Effects from Project construction activities on toitoi spawning within the Quarry Lakes have been covered in Section 6.4.1.2 and are not covered in this section.

The Project will involve dynamic compaction of the embankment (formed during early works) within the Quarry Lakes, the overall road construction on the embankment, and the creation of the South Lake remnant as a wetland offset site. During these construction phases, works in water will only occur during the construction of the South Lake remnant wetland.

It is understood that within the design of the South Lake remnant wetland there will be a small open water section (c 30 % of the available area) and the remaining water depth will be approximately < 1 m in depth. This is a substantial shift in freshwater habitat than what is currently present and what will be present once the early works has been completed. Due to the presence of several species of coarse fish (Section 5.2.3.2), this shift in habitat type may increase the predation pressure and resource competition on toitoi which are also likely present in the South Lake remnant. To minimise

the effect of an increased predation risk and resource competition to toitoi it is recommended that, once the South Lake remnant wetland construction is stabilised, coarse fish should be removed via the implementation of the fish salvage and relocation measures (Section 6.4.2.1). Furthermore, due to rudd being designated as a noxious pest fish species, measures must be taken to impede any movement of this species beyond its current locality within the Quarry Lake.

With the implementation of the fish salvage and relocation measures to target the removal of coarse fish from the South Lake remnant, it is expected that there will be a **low** magnitude of effect on the remnant toitoi fish population of the Quarry Lakes the construction works construction activities.

A **low** magnitude of effect and a **low** ecological value will result in a **very low** overall level of effect on freshwater fauna within the Quarry Lakes. No further management measures are proposed or required.

6.4.3 Temporary construction effects - localised dewatering effects on stream flow

During the culvert installation works, excavation could occur within 1 m of the groundwater surface and where groundwater is encountered temporary dewatering is likely to be required to allow placement of the culvert. The effects of dewatering include the lowering of the local groundwater level which could have an effect on nearby surface waters.

The hydrogeology assessment (Volume 3K) has completed dewatering assessments for a selected range of excavation dimensions (i.e., culvert sizes) to assess the effects of dewatering on streams within the Project. These assessments have been applied to determine the level of temporary hydrogeological effects to surface water bodies potentially affected by the Project.

The hydrogeology assessment concludes that:

- Dewatering will result in direct stream depletion effect on Rossiters and Wilsons Drains during the culvert installations as culvert installation works will be completed online. The abstracted groundwater will be discharged back into the drains after water treatment to removed sediment and any depletion effects will be negligible.
- Dewatering that will occur for the construction of culverts on the Taranaki Stream and Waihora Stream will have a moderate, high, or a direct depletion effect on those streams. However, any groundwater will be discharged back into the respective surface waters after water treatment to removed sediment. Stream flows in the Taranaki Stream and Waihora Stream will be managed in a way that negate any the depletion effects and effects will be negligible.
- The radial drawdown effects of the dewatering are likely to be limited to a very local distance from the excavation due to the low permeability of the shallow sediments. The effects on other surface water features will be negligible.
- The volume and rate of discharge will be determined by the Contractor (via the CEMP). Due to low flows in these surface waters, the discharge rate could be greater than the stream flows and this will be managed to ensure that there are no fish passage effect or flooding at downstream locations. It is expected that discharge to Waihora Creek will ultimately go the ground.

On review of the hydrogeology dewatering assessments and the localised temporary effects that these may have on surface water bodies within the Project, it is considered that the temporary magnitude of effects will be **low**. This is due to any effects on the existing baseline conditions being minor and temporary. Any change arising from the alteration of stream flow will be discernible, but the underlying stream flow attributes will be similar to the pre-development circumstances once culvert construction is completed. A **low** magnitude of effect on freshwater fauna values ranging

from **low** to **high** equates to overall levels of effect ranging from **very low** to **low** on freshwater fauna in accordance with Appendix B Table 7.

6.4.4 Temporary construction effects - modification of stream habitat

Over-pumping and dewatering will be required within Rossiters and Wilsons drains, and Taranaki Stream at the Bob Robertson Drive culvert and the SH1 culvert to enable online culvert construction. This will temporarily remove stream habitat from these watercourses for the duration of the works.

While the stream habitat within the culverts has not been visually assessed, it has been assumed, based on upstream and downstream habitats, that the habitat within the culverts is soft-bottomed substrate with no macrophytes, and limited stream function. Overall, the habitats within the culverts has been assessed as having **low** ecological value based on providing little suitable habitat for fish, and limited habitat for macroinvertebrates. Although, as outlined in Section 6.4.1.1 and 6.4.2.1, Taranki Stream may provide spawning habitat for toitoi and koukoupā.

The amount of habitat within the culverts is only a small amount of habitat relative to the upstream and downstream catchments of each watercourse. The timescale of any modification will be the length of the works required to install the culvert, which is anticipated to be approximately one month for Rossiter and Wilsons drains, and less for Taranaki Stream. Therefore, there will be a temporary **low** magnitude of effect based on a minor shift away from existing baseline conditions, which will result in a discernible change on the known range of habitat types present. This equates to a **very low** overall level of effect on stream habitat.

6.4.5 Temporary construction effects - modification of fish passage and migration success

Many New Zealand native freshwater fish are diadromous, meaning they must migrate between freshwater and the sea as part of their lifecycles. All fish species identified within the Project Site are migratory to some degree.⁴⁵ In addition, most fish species identified within the Project Site will move between habitats within the same stream catchment (i.e., intra-migration) to search for food, as refuge from predators, or to seek new habitats. Therefore, the adverse effect of instream works on fish passage are important to consider when assessing Project effects on freshwater fauna.

6.4.5.1 Culverts

The Project works requires the construction of six culverts within five watercourses that have been identified to provide suitable habitat for freshwater fauna. These watercourses are:

- Rossiters Drain⁴⁶
- Wilsons Drain
- McIntosh Drain
- Waihora Stream
- Taranaki Stream

Of the six culverts, McIntosh Drain and Waihora Stream culverts are proposed to be constructed offline to the existing stream flow, therefore having no effect on fish passage and are not considered further in this assessment. Rossiter and Wilsons drains, and Taranaki Stream at Bob Robertson Drive will require online construction. Taranaki Stream at SH1 will be constructed largely offline but will

⁴⁵ Common bully can form landlocked populations that do not require access to the ocean to complete their lifecycle. Such as the population in the Quarry lakes.

⁴⁶ Rossiters Drain is classified as an artificial watercourse under the RMA, it still provides habitat suitable for freshwater fauna and needs to be considered in an effects assessment.

require online construction for the outlet as it is largely fixed to the existing outlet location. Online construction within the stream will require dewatering and over-pumping, or diversion.

As outlined within this EclA, the freshwater fauna values within the Project Site watercourses range from low to high. Several of the identified species are of conservation and biodiversity value (e.g., 'Threatened' or At-Risk' species), and cultural value (as mahinga kai species). The diadromous fish species most likely to have the highest effect from a temporary modification to fish passage are hao and longfin eel, and īnanga. While access within each stream catchment will have a lesser effect on the majority of species identified.

The peak upstream migration of juvenile hao and longfin eel is between December and March and the peak downstream migration for adult hao and longfin eel occurs between February / March and May. Īnanga juveniles generally migrate upstream between August and November, with adults migrating downstream between March and July. Therefore, any instream works where these fish species are present will likely occur during a migration period.

In respect of fish movement within each stream catchment, it is anticipated that this will occur year-round in permanent streams. While in intermittent streams, i.e., the McIntosh Drain, Rossiter and Wilsons Drain, movement will be restricted to periods of the year when adequate wetted habitat and water flow is present.

Where culvert works are to occur online to the existing stream flow, it is anticipated to take approximately two weeks (Taranaki Stream at Bob Robertson Drive) to one month (per culvert at the Rossiter and Wilsons Drains). Even though online culvert works cannot avoid the migration period of each species, construction works programmes will be sequenced to minimise the disruption to fish migrations (for example working in dry periods in intermittent streams). The details around these avoidance and minimisation measures will be included in the CEMP. This will result in only a temporary minor effect on the diadromous migration of species known within each stream. Furthermore, to minimise any direct impacts to migrating fish during the construction of the culverts, management should be implemented via the Project EMP and specifically the fish salvage and relocation measures (Section 6.4.2.1).

In-stream habitats within the Taranaki Stream are generally uniform, with occasional boulders and cobble riffles, undercut banks, woody debris, and overhanging riparian vegetation being widespread throughout and adjacent to the Project area. While the smaller upstream catchments of the Rossiters and Wilsons Drain, are of low value and access is likely restricted to periods when adequate wetted habitat and water flow is present. When water levels in the Rossiters and Wilsons drains are low any fish are expected to either seek refuge in residual pools or move to where water is more permanent nearer to the confluence with the Cam / Ruataniwha River.

Any temporary loss of fish passage into these habitats due to culvert construction is likely to have only a very slight change from the existing baseline condition, so the underlying fish community composition (e.g., population size and age range, and density) will be similar to that of the baseline conditions once works are completed. This will approximate a 'no change' condition. This is due to there being continual access to habitat within the stream reaches upstream and downstream of the proposed works area (Taranaki Stream) or fish access already being restricted (Rossiters and Wilsons drains).

The magnitude of effect from the construction of culverts online to the existing stream flow is expected to be **low**. This is due to only a minor effect on the known population range of fish species and that their underlying composition (size and age range, and density) will be similar to that of the baseline conditions once works are completed. However, as freshwater fauna within the Project have conservation and cultural value, it is expected that to further minimise any effects to fish

during the construction of the culverts a series of the fish salvage and relocation management measures should be included within the Project EMP (Section 6.4.2.1). This may include:

- Removing any diadromous fish to their respective migration direction; e.g., elvers⁴⁷ should be relocated upstream of any instream works, depending on timing īnanga can be relocated either up or downstream of the instream works area.
- Continual observations, surveys, and potentially trap and transfer of any congregating diadromous fish.
- The installation of temporary fish passage between upstream and downstream habitats.
- Relocating fish from the within the works site.

The overall temporary level of effect has been assessed as **very low to low** and no further management measures are required.

6.4.5.2 Stream realignments

Realignments are proposed for Taranaki Stream, Taranaki Stream Tributary and Waihora Stream downstream of SH1. These will be constructed offline and livened when complete. These disruptions to fish passage will be minimal and approximate a 'no change' condition. This results in a **negligible** magnitude of effects, and therefore **very low** overall levels of effect.

As outlined in Section 6.4.2, fish salvage and relocation is to be undertaken within any of the decommissioned stream channels.

6.4.6 Permanent modification and / or loss of fish passage

As stated in Section 6.4.5, many New Zealand native freshwater fish migrate both via diadromy and within the local stream catchment. Therefore, the permanent adverse effects of instream structures or channel realignments on fish passage are important to consider when assessing Project effects on freshwater fauna.

With no consideration of fish passage within the Project watercourses proposed for permanent modification, there is the potential for a permanent **high** magnitude of effect. This is due to instream structures or realignments creating high water velocities that fish are unable to swim against or insufficient water depth which may inhibit fish movement, or culverts as a whole creating barriers to fish passage. This high magnitude of effect is based on the loss of a high proportion of the known fish populations range which can lead to fragmentation of fish populations and eventually localised species loss within a stream's catchment (Appendix B Table 5). The freshwater fauna values ranging from **low to high** within the Project, due to the high magnitude for effect this equates to an overall level of effect ranging from **low to very high** (Appendix B Table 7). Therefore, fish passage designs are to be incorporated into culverts and the stream realignments so that fish movement up and downstream of the culverts / stream reaches is maintained. Details of these are expanded on in the following section.

6.4.6.1 Culverts

Instream structures (culverts) that require fish passage are proposed within the following watercourses:

- Rossiters Drain
- Wilsons Drain

⁴⁷ Juvenile hao or longfin eel, generally to a size of 100 – 120 mm.

- McIntosh Drain
- Waihora Stream
- Taranaki Stream

Īnanga have been identified within McIntosh Drain, Taranaki Stream and Taranaki Stream Tributary. Īnanga are the weakest swimming species of the identified fish communities, so will be used as the benchmark species for evaluating culvert water velocities within these streams. Īnanga swimming performance is provided in Appendix A of the New Zealand Fish Passage Guidelines (**NZFPG**; Franklin et al., 2024). This refers to the relationship between maximum allowable water speed, culvert length, and the fish passage success rate of Īnanga.

The design for culverts requiring fish passage will be based on the principles of good fish passage design within the NZFPG, and Fish Passage Guidelines for State Highways (NZTA, 2013). These principles include:

- Maintaining continuity of instream habitat.
- Minimising alterations to natural stream alignment.
- Minimising alterations to natural stream gradient.
- Maintaining water velocities that allow for the upstream passage of native fish.
- Ensuring minimum water depths that allow for the upstream passage of native fish.
- Avoiding constraints on bank-full channel capacity resulting from the structure.
- Avoiding vertical drops.
- Providing an uninterrupted pathway along the bed of the structure.

Culvert designs should also aim to meet the fish passage requirements, where practical, of the permitted activity status for culverts defined in the NES-F (Clause 70). These conditions are:

- The culvert must provide the same passage for fish both upstream and downstream as would exist without the culvert.
- The culvert must be laid parallel to the slope of the bed of the river.
- The mean cross-sectional water velocity in the culvert must be no greater than that in all immediately joining river reaches.
- The culvert width must be $\geq 1.3 \times$ the width of the bed of the river for river widths ≤ 3 , or, $\geq 1.2 \times$ the width of the bed of the river + 0.6 for river widths > 3 .
- The culvert must be open-bottomed, or its invert placed so that at least 25% of the culvert diameter is below the bed.
- The bed substrate must be present over the full length of the culvert and stable at the flow rate at or below which the water flows for 80% of the time.
- The culvert provides for continuity of geomorphic processes (such as the movement of sediment and debris).

Despite flap gates at the confluence of Rossiters and Wilsons drains and the Cam River / Ruataniwha, there is favourable habitat for Īnanga within these watercourses. Therefore, a conservative approach to fish passage within these watercourses has been taken, and designs should cater for Īnanga passage anticipating they may utilise these watercourses in the future if the flap gates are removed or modified to allow for suitable fish passage. A similar assumption has been made for Waihora Stream. While Īnanga are not expected within this watercourse currently, culvert design should future-proof improvements in fish passage that may allow Īnanga access.

Rossiters and Wilsons drains

The proposed culvert design for these watercourses is a like for like replacement of the existing 45 m culverts. These watercourses are slow flowing intermittent watercourses that regularly only have residual pools present in the vicinity of SH1 that fluctuate in size with the tidal encroachment. Under normal flow conditions, it is expected that the current culverts are not creating barriers to fish passage at the SH1 culvert locations. A like for like replacement of these two culverts will result in a **negligible** magnitude of effect as the designs will be barely distinguishable from the 'no change' situation. A **negligible** magnitude of effect and **low** values for freshwater fauna equates to a **very low** overall level of effect. When considering the future potential presence of īnanga within these drains, as this species has a **high** ecological value and is considered a weak swimming species. It is anticipated that there will be a no change in the current habitat types within these drains, therefore the negligible magnitude of effect remains. This results in a **very low** overall level of effect.

McIntosh Drain

The proposed design for McIntosh Drain is a new 6 m wide x 2 m high box culvert, 50 m in length. This watercourse is currently straightened, deepened, slow flowing intermittent stream. Recorded average velocities were less than 0.1 m s^{-1} , with an average depth of 0.37 m and an average width of 2.28 m during a field survey in July 2025. This sluggish flow cannot be accurately used to inform īnanga swimming performance using the NZFPG swimming performance graph as it is too low. It can be assumed that īnanga will be able to pass the culvert, regardless of life stage. The proposed culvert will not increase flow velocities or create shallow depths that are impassable to īnanga. It will meet the fish passage requirements within Clause 70 of the NES-F. However, due to the ongoing and historical management of McIntosh Drain for flood conveyance purposes the stream bed width⁴⁸ is unnaturally wide, and the culvert width requirements may not meet Clause 70 (d). Even though this clause may not be met, fish passage will still be achieved at the McIntosh Drain culvert.

The magnitude of effect from these designs will have a **negligible** magnitude of effect based on a change barely distinguishable from the 'no change' situation. A **negligible** magnitude of effect and a **high** value for freshwater fauna equates to a **very low** overall level of effect.

Waihora Stream

The proposed design for Waihora Stream at SH1 is a 4 m wide x 1.5 m high box culvert, 70 m in length. This will replace an existing approximately 12 m box culvert that conveys flow beneath SH1. Recorded average velocities within Waihora Stream were less than 0.1 m s^{-1} , with an average depth of 0.27 m and an average width of 2.58 m during a field survey in July 2025. Like McIntosh Drain, this low velocity flow cannot be accurately used to inform īnanga swimming performance using the NZFPG swimming performance graph as it is too low. It can be assumed that īnanga will be able to pass the culvert, regardless of life stage. The proposed culvert will not increase flow velocities or create shallow depths that are impassable to īnanga. It will meet the fish passage requirements within Clause 70 of the NES-F. However, due to the ongoing and historical management of Waihora Stream the stream width⁴⁹ is unnaturally wide, and the culvert width requirements may not meet Clause 70 (d) will not be met. Even though this clause may not be met, fish passage will still be achieved at the Waihora Stream culvert

The magnitude of effect from these designs will be **negligible** based on a change barely distinguishable from the 'no change' situation. A **negligible** magnitude of effect and a **low** value for freshwater fauna equates to a **very low** overall level of effect.

Taranaki Stream

⁴⁸ Bankfull width is approximately 7.0 – 8.5 m.

⁴⁹ Bankfull width is approximately 5.0 m.

Taranaki Stream has two sections with proposed new culverts. One is an extension of the inlet to the Bob Robertson Drive culvert and the other is the replacement of the existing SH1 culvert.

Bob Robertson Drive

The Bob Robertson culvert extension design proposes two 1.8 m high x 1 m wide extensions up to 10 metres in length are added upstream of the two existing side by side 25 m box culverts, creating an up to 35 m length culverts. Average flow within the Taranaki Stream during July 2025 was 0.31 m s⁻¹, with an average width of 2.91 m. Plotted against the NZFPG swimming performance graph, this provides passage for greater than 50% of īnanga individuals, but less than 70%. While modelled individual īnanga passage will be lower because of the extension, the successful passage of individuals will still sit between 50% and 70%. The width requirements in Clause 70 of the NES-F will not be met. To meet the culvert width condition the culverts would need to total 3.8 m wide. Even though this clause may not be met, fish passage will still be achieved at the Bob Robertson Drive culvert.

However, as the remaining permitted activity conditions are expected to be met, the magnitude of effect is anticipated to be **low** based on a minor shift from baseline conditions as the design is extensions to what is existing. A **low** magnitude of effect on a **high** value for freshwater fauna equates to a **low** overall level of effect.

SH1

Taranaki Stream is currently conveyed beneath SH1 in a box culvert, approximately 21 m in length. The proposed culvert is a 2.7 m x 1.5 m box culvert, 90 m in length. Due to the length of this culvert the design will not be able to comply with the water velocity criteria set out in the NZFPG. To minimize potential adverse effects on fish passage due to the length of this culvert, void-filled rock rip rap will be used in the culvert bed to emulate natural rock riffles. Void filled rock rip rap within the bed of the culvert will consist of a mix of hard substrates such as boulders, cobbles and gravels that will provide complex and non-uniform velocities with roughness elements. It is expected that the specifications for void filled rip rap within the NZFPG should be followed, if practical and appropriate for the designs, when constructing this culvert.

The use of natural hard substrates within a culvert have been shown to produce a highly variable velocity profile (i.e., a complex flow), which small-bodied fish (such as īnanga) can utilize to assist in upstream fish passage (Johnson *et al*, 2019). With the addition of void filled rock rip rap the bed of the culvert will create areas that break up the flow, providing lower velocity resting areas for fish, which improves fish passage. The NZFPG doesn't specifically address the fact that small fish have been observed to exploit small-scale (i.e., less than the size of the fish) turbulent eddies and wake zones (micro velocity zones) to hold station and conserve energy, nor does it address the active utilization of boundary layers to facilitate upstream movement (Franklin & Baker, 2025). However, by providing stable substrates within the culvert the Project aims to meet the requirements of providing complex flows from the provision of stable substrate, and utilise the ability of fish to exploit micro velocity zones to move upstream within the culvert.

With the addition of void filled rock rip rap within the design to create complex flows and areas fish can exploit while moving through the culvert, the magnitude of effect on fish passage within the culvert will be **low**. This is based on the changes to fish passage arising from the alteration being discernible, but like those observed pre-development. This will result in an overall **low** level of effect on fish passage within Taranaki Stream.

6.4.6.2 Channel realignment

Channel realignments are proposed for Taranaki Stream, Taranaki Stream Tributary and Waihora Stream. The proposed designs are similar to existing conditions, with no potential barriers to fish passage in the designs, such as increased velocities or structures.

The realignments of Taranaki Stream and Taranaki Stream Tributary will be slightly wider than existing conditions to allow for increased flood conveyance, preventing flooding of the roadway. Depths will be suitable for native fish passage and are to be set to be greater than 150 mm deep. Substrates within the realigned streams will consist of a void-filled rock rip rap which will be used to emulate a natural rock lined stream bed. It is expected that the specifications for void-filled rock rip rap within the NZFPG will be followed, if practical and appropriate for the designs, when constructing the Taranaki Stream and Taranaki Stream Tributary realignments. As outlined in the above section the addition of this feature will aid in maintaining fish passage.

The realignment of Waihora Stream downstream of SH1 is proposed. This will result in the existing channel being realigning towards the north-east where the proposed road intersects the watercourse. This will leave the upstream section within the designation mostly untouched, except for some potential bankside works. The realignment will be a grass-lined swale. Approximately 160 m into this realignment the existing watercourse becomes ephemeral and fish passage is not considered beyond this point.

With 'like for like' designs and the addition of void filled rock rip rap within the Taranaki Stream and Taranaki Stream Tributary, the permanent channel modifications will have a **negligible** magnitude of effect on fish passage. While the design for Waihora Stream will not restrict fish passage to any potential wetted habitat if water is present. Overall, this equates to a **very low** overall level of effect for Taranaki Stream, Taranaki Stream Tributary and Waihora Stream.

6.4.7 Permanent modification and / or loss of stream habitat

6.4.7.1 Avoidance, minimisation, or remediation of effects through Project design

Where practical within the Project, efforts have been undertaken to avoid, minimise and / or remediate the loss of stream value and extent where stream realignment and / or culverts are required. A summary of these measures is provided in Table 6.8.

Table 6.8: Measures to avoid, minimise, or remediate the loss of stream value and extent

Measure	Stream realignment
Avoid	Stream realignment has been avoided to the extent practical within the designation.
Minimise	The stream realignment has been designed to allow the shortest realignment reach possible.

Measure	Stream realignment
Remediate	<p>Any final stream realignment design and composition of habitat features will be collaboratively developed for each stream realignment through a Project stream realignment design plan. This will include iwi, landscape designers, ecologists, and engineers.</p> <p>The following high-level design principles should be applied within the Project:</p> <ul style="list-style-type: none"> • Realignments will be designed to consider the existing stream geometry (plan form and section) and natural geomorphology of the stream where practicable. • Scour protection, such as rock rip rap, may be considered where hydraulic conditions could result in significant, non-desirable scour that could impact the road embankment or other infrastructure. • Natural bank scour will be allowed where possible. • A low flow channel to maintain water depth during low flows. • Creation of pool, riffle and run sequences where achievable (i.e. enough length of stream diversion lies within the designation and sufficient gradient to tie in to existing stream channel and culvert inlets / outlets). • Incorporating instream woody habitat features. <p>Utilising existing natural materials such as rocks, woody debris from the existing stream where present.</p> <p>Incorporating a planted flood plain terrace.</p>
Measure	Stream culverting
Avoid	Stream culverts and crossings has been avoided to the extent practical within the designation.
Minimise	The stream culverts have been designed to allow the shortest culvert reach possible. Where possible, culverts designs will aim to meet the fish passage requirements in the NES-F (Clause 70).
Remediate	Where specific conditions within the NES-F (Clause 70) cannot be met, the NZFPG will be used to inform design so that fish passage can be achieved for species within the catchment.

6.4.7.2 Fast Track Approval Act – standard and complex freshwater fisheries activity assessment

The FTAA sets out specific requirements that are to be met if a Project includes standard and / or complex freshwater fisheries activities. The definition of a standard and complex freshwater fisheries activity and the information required to meet Schedule 5 9, and Schedule 9 Clause 3 of the FTAA is provided in Table 6.9.

The Project involves standard freshwater fisheries activity including disturbance of a waterbody for less than three months (see Standard freshwater fisheries activity clause (c) i.) and disturbance of a waterbody used for spawning of native fish, outside the relevant spawning season clause (c) iii.).

A complex freshwater fisheries activity is also being applied for, due to the conservative approach of this EclA. In this instance a complex activity approval is sought as the stream realignments may be defined as a permanent diversion structure and therefore the diversion will be in place for greater than three months (see Complex freshwater fisheries activity clause (b) and (c)i.). In addition, works in water may occur during native fish spawning season; species that are likely spawning in the Project waterways (especially Taranaki Stream) may include toitoi and koukoupapa if present during construction works (Complex freshwater fisheries activity clause (c) iii.).

Table 6.9: Standard and complex freshwater fisheries activity and the information required to meet Schedule 5 clause 9 and Schedule 9 Clause 3

Freshwater fisheries activity	Activity present in project
Standard freshwater fisheries activity	
<u>Schedule 5 Clause 4A</u>	
The information required to be provided under section 13(4)(y)(vi) is the following:	
(a) whether an in-stream structure is proposed (including formal notification of any dam or diversion structure) and the extent to which the proposed structure may impeded fish passage; and	Yes - Project in-stream structures (culverts) and diversions (e.g., stream realignments) are included in the Project designs. Designs of both culverts and stream realignments will not impede fish passage. See Section 6.4.5 and 6.4.6, and below in this table.
(b) whether any fish salvage activities are proposed	Yes – fish salvage and relocation activities are proposed to manage effects on fish species present in waterways during in-stream construction works. See Section 6.4.2.
<u>Schedule 5 Clause 9</u>	
Standard freshwater fisheries activity means an activity that includes construction of any of the following:	
a) a culvert or ford that could impede but not permanently block fish passage	No
(b) weirs that comply with the conditions of regulation 72 of the Resource Management (National Environmental Standards for Freshwater) Regulations 2020:	No
(c) works— i. that require active disturbance to a water body, including diversions, in-stream operations, and removal of gravel, that does not persist for more than 3 months; or ii. that require disturbance of any duration outside the whitebaiting season to a water body within 500 m of the coast; or iii. that require disturbance of any duration outside the relevant spawning season to a water body that is known for the spawning of trout, salmon, or native fish; or iv. that require repeated disturbance to a water body and are temporary works for which there is a period of more than 6 months between each period of work	Yes – permanent realignment of three streams and culvert replacement or extension works at three streams. In addition, reclamation of the South Lake remnant will occur, as well as dynamic compaction of the causeway embankment will be completed. No Yes – native fish spawning may occur in waterways within the Project (e.g., Taranaki Stream). No
Complex freshwater fisheries activity – Schedule 9 Clause 3	

Freshwater fisheries activity	Activity present in project
Complex freshwater fisheries activity means an activity that includes construction of any of the following:	
(a) a culvert or ford that permanently blocks fish passage	No
(b) a permanent dam or diversion structure	May apply – permanent stream realignments are proposed but no diversion structures.
<p>(c) works—</p> <ul style="list-style-type: none"> i. that require disturbance to a water body, including diversions, in-stream operations, and removal of gravel, that persists for more than 3 months; or ii. that require disturbance of any duration during the whitebaiting season to a water body within 500 m of the coast; or iii. that require disturbance of any duration during the relevant spawning season to a water body that is known for the spawning of trout, salmon, or native fish; or iv. that require repeated disturbance to a water body and are temporary works for which there is a period of 6 months or less between each period of work 	<p>Yes – permanent stream realignments are proposed but no diversion structures. In addition, reclamation of the South Lake remnant as well as dynamic compaction of the causeway embankment will be completed. Although these activities are not intended to exceed 3 months, a precautionary approach is taken in assign this as a complex activity.</p> <p>No</p> <p>Yes - native fish spawning may occur in waterways within the Project (e.g., Taranaki Stream).</p> <p>No</p>
Information required for activity approval (per Schedule 5 clause 9 and Schedule 9 Clause 3)	Information provided
<p><i>For the purpose of section 43(3)(j), section 43(3)(a) - (d), an application for a complex standard freshwater fisheries activity approval must include the following information:</i></p>	<p>Note: although the Project structures (culverts) and diversions (stream realignments) are not impeding fish passage or specifically defined as diversion structures a summary and location of where information has been provided for each structure is outlined below.</p> <p>Similarly, works that are occurring in a waterbody for less than three months will occur at several locations to complete the above Project structures.</p>
<p>a) <i>in relation to the structure and any fish facility:</i></p> <ul style="list-style-type: none"> i. a description of the type of structure or fish facility: 	<p>Construction of three new box culverts, the extension of one existing culvert, and the like for like replacement of two existing culverts. In addition, stream realignments will occur at three</p>

Information required for activity approval (per Schedule 5 clause 9 and Schedule 9 Clause 3)	Information provided
<i>(c) the water quality and quantity in the surrounding habitat (at the proposed structure location, upstream and downstream):</i>	Please refer to Table 5.22 and Volume 3L Stormwater and Flooding Assessment.
<i>(d) how the passage of fish will be provided for or impeded.</i>	As noted above culvert designs either meet fish passage requirements in clause 70 in the NES-F or designs are informed by the NZFPG (2024) to provide fish passage. Stream realignments will match the current fish passage requirements at each stream and be informed by the NZFPG.

6.4.7.3 Permanent stream habitat loss – realignment

The proposed works will involve constructing new road lanes, requiring the realignment of Taranaki Stream between Bob Robertson Drive and SH1, the Taranaki Stream Tributary and Waihora Stream to accommodate the new lanes. The proposed total realignment will impact approximately 30 m of Taranaki Stream, 115 m of Taranaki Stream Tributary, and 120 m of Waihora Stream downstream of SH1. All realigned stream channels will be within the Project Site. The stream channel extent post construction of the Project will result in a c. 60 m channel reinstated at the Taranaki Stream, a 75 m channel reinstated at the Taranaki Stream Tributary, and a 120 m channel reinstated at the Waihora.

For the Taranaki Stream and Taranaki Stream Tributary remediation of habitat will occur via the implementation of the measures outlined in Table 6.10. This is likely to result in stream habitat and function similar, if not at a higher quality, than is already present. In terms of stream extent, the Taranaki Stream will not lose any extent overall as the 30 m length is effectively being replaced by a 60 m channel. However, in terms of the Taranaki Stream Tributary there will be a loss of approximately 40 m of stream channel once the Project construction works are completed.

The Waihora Stream section downstream of the realignment reach has been classified as ephemeral and therefore not a river under the RMA. As this ephemeral reach is not a river, Policy 7 of the NPS-FM⁵⁰ does not apply. It should also be noted that the applicability of the SEV to Waihora Stream downstream of SH1 is limited in comparison to the other watercourses due to Waihora Stream being a stream / wetland complex. However, for consistency in determining stream value, the SEV has been applied to the site, in a reach that has predominantly stream-like characteristics. Once the realignment of the Waihora Stream is completed, it will consist of a grassed channel that can accommodate the intermittent base flows and any high flow events. The stream habitat that will be present (post Project construction works) will be a reduction in quality and function from what is currently present

After efforts to avoid, minimise, remedy, effects (Table 6.10), the magnitude of effect associated with the permanent realignment of stream habitat will be:

- **Negligible** at Taranaki Stream due to remediation efforts within the realigned channel resulting in there being no permanent loss of stream habitat value and extent at Taranaki Stream.
- **Very high** at Taranaki Stream Tributary due to the loss of c. 20 m of stream extent which results in the permanent loss of stream habitat extent at the Taranaki Stream Tributary.

⁵⁰ NPS-FM Policy 7: the loss of river extent and values is avoided to the extent practicable.

- **Very high** at Waihora Stream due to the permanent loss of habitat quality and function, which will reduce the stream value of Waihora Stream (Appendix B Table 5). Stream values and overall level of effects for each site are presented in Table 6.10.

Therefore, and according to the EclAG approach residual effects remain which would require further management measures to result in a no net loss of stream value and function outcome. This is discussed in Section 7.

Table 6.10: Stream values, magnitude of effect and overall level of effect for watercourses with proposed reclamation

Watercourse	Current stream habitat value	Magnitude of effect	Overall level of effect
Taranaki Stream	Moderate	Negligible	Very low
Taranaki Stream Tributary	Low	Very high	Moderate
Waihora Stream downstream	Low		Moderate

6.4.7.4 Permanent stream habitat modification – culverting

The proposed works will require 17 culverts to be constructed. Of these 17 culverts, nine are new culverts within dry channels, two are replacement culverts within dry channels, and two are replacement culverts of the same lengths (Rossiters Drain and Wilsons Drain). None of these 13 culverts will result in direct stream habitat loss. Therefore, they are not considered within this assessment.

The remaining four culverts will have varying amounts of stream habitat modification associated with them. These culverts and the associated stream habitat modification are shown in Table 6.11. Under Policy 7 of the NPS-FM the loss of river values must be avoided to the extent practicable.

Table 6.11: New culverts with associated stream habitat modification

Location	Existing culvert type	Existing culvert length (m)	New culvert type	New culvert length (m)	Stream bed modification (m)
McIntosh Drain	-	-	4 m x 2 m box culvert	50	50
Waihora Stream	Box culvert	12	4 m x 2 m box culvert	70	58
Taranaki Stream (Bob Robertson Drive)	Box	25	Two 1.8 m x 1 m extensions	Up to 10 m extension; up to 35 m total length.	Up to 10 m
Taranaki Stream (SH1)	Box culvert	25	2 m x 2 m box culvert	90	50
Total					168

Where practical culvert designs should aim to meet the fish passage permitted activity status for culverts defined in the NES-F. Where this is not practical the Project culvert designs will be informed by the NZFPG. Regardless of the culvert designs, the magnitude of effect associated with the

permanent modification of stream habitat will be a **very high** effect due to a major alteration to the natural stream channel (Appendix B Table 5). The overall level of effect for each watercourse is detailed in Table 6.12 and range from **moderate** to **high**. Therefore, and according to the EclAG, residual effects remain which require further management measures to result in a no net loss of stream value and function outcome. This is discussed in Section 7.

Table 6.12: Current ecological value, magnitude of effect and overall level of effect for each affected watercourse

Location	Current ecological value	Magnitude of effect	Overall level of effect
McIntosh Drain	Low	Very high	Moderate
Waihora Stream	Low		Moderate
Taranaki Stream	Moderate		High

6.4.7.5 Loss of potential value to streams

The NPS-FM (clauses 3.21 and 3.24) directs that the loss of potential value of streams must be considered.

Within the Proposed Site, the predominant existing land use is the current motorway, residential housing, and various agricultural activities. A change in land use is unlikely to occur within the current motorway and residential areas. However, land use change may occur where agricultural land is changed to residential or rural residential (which itself would likely require a resource consent). Without substantial land use change and restorative actions, the existing stream conditions and values will remain as they are in their current state.

Restorative actions are recommended within the McIntosh Drain (Section 7.3) to offset residual effects from the loss and modification of stream values, and high quality stormwater infrastructure is being included across the Project to avoid and minimise impacts of the ongoing use of the motorway. Therefore, it is unlikely that the Project will have an adverse effect on the potential value of streams within the Project.

6.4.7.6 Permanent modification of freshwater habitat in Quarry Lakes

The South Lake remnant is artificial due to its original construction via excavating land for quarrying purposes. Therefore, in an RMA sense there is no requirement to consider the modification of habitat value or extent due to the southern remnant lake being utilised as a proposed offset site (Section 7.2). Therefore, no assessment of ecological effects on the loss of extent and value of the South Lake remnant has been completed and is not considered further in this EclA.

6.4.8 Changes in receiving water quality due to ongoing use of the road

Runoff from roads can be contaminated by several toxicants, including hydrocarbons from fuels and engine additives, and metals such as copper and zinc from brakes and tyres. These toxicants enter stormwater attached to sediment or directly in stormwater runoff. Although copper and zinc are essential trace elements, when they are present in high concentrations, they can become toxic to freshwater flora and fauna. Excessive copper and zinc can disrupt normal biological functions, affecting growth, reproduction and survival (Gadd et al., 2024). As well as posing a risk to the freshwater community, this can also pose a risk to humans when traditional mahinga kai sources, such as hao, are gathered for consumption as toxicants can bioaccumulate.

The existing roadway stormwater management is limited. While there are some areas of grassed roadside channels, other areas have stormwater discharging directly to surface water (Stormwater and Flooding Assessment (Volume 3L)). With no management measures in place, there will be an increase in potentially contaminated runoff washing off the impermeable road surface of the proposed road during rainfall, flowing to surface water via drainage. This can lead to the accumulation of contaminated sediments in the receiving environment as well as direct and indirect negative impacts on local flora and fauna (via bioaccumulation). Therefore, there would be a permanent **moderate** magnitude of effect based on an alteration to key features of the existing baseline. The current ecological value for both stream habitat and freshwater fauna range from **low** to **high**. This would result in overall levels of effect ranging from **low** to **high**.

As mentioned in Section 2.3, Project wide activities include the construction of stormwater infrastructure. These consist of:

- Cut-off drains – where external catchments cross proposed motorway alignments, cut-off drains are proposed to intercept offsite inflow, keeping it separated from roadway runoff and conveying it to a discharge location.
- Treatment swales – intended to improve stormwater quality through sediment filtering within wide, grass bottom channels. Effective at removing suspended sediment, with removal efficiencies often exceeding 80%. Limited ability to remove dissolved heavy metals and nutrients.
- Bioinfiltration swales – intended to improve stormwater quality via bioremediation and phytoremediation processes within the soil layers at the base of the swale, before infiltrating the ground via high infiltration subsoils. Check dams are utilised within the swales to impound water, allowing for infiltration through an engineered base material. These swales exhibit high suspended sediment removal efficiencies and enhanced removal efficiencies of dissolved heavy metals and nutrients due to biological treatment processes. During high inflows that exceed the swale capacity, flows cascade downstream through the swale, ultimately discharging to surface water.
- Bioretention swale – like bioinfiltration swales, however they do not rely on infiltration to achieve treatment. These are planted swales with permeable check dams that retain water within vegetated segments. Treatment is achieved through settlement of suspended solids and, partially, soil treatment within the vegetated topsoil layers. They are designed to provide impoundment volume for a first flush of up to 25 mm of runoff to ensure treatment outcomes. They exhibit high suspended sediment and attached heavy metal removal rates, however have potentially limited dissolved heavy metal and nutrient treatment capabilities.
- Bioinfiltration basin – basins intended to improve stormwater quality via bioremediation and phytoremediation processes within the soil layers at the bottom of the basin, before infiltrating the ground via high infiltration subsoils. Designed to impound the first flush of up to 25 mm of runoff, allowing for slow infiltration and treatment through their vegetated, engineered base material. Inflows that exceed the basin capacity is discharged via overflow weir to nearby surface water.
- Bioretention basin – like bioinfiltration basins, these basins are intended to capture the first flush of up to 25 mm of runoff, providing treatment through a combination of settlement and soil-based bioremediation and phytoremediation processes.

A more detailed explanation of this infrastructure as well as the proposed stormwater drainage design for each catchment within the Project can be found in the Stormwater and Flooding Assessment (Volume 3L).

With no mitigation measures in place there is the potential for discharges of contaminated stormwater into the receiving environment, leading to the accumulation of contaminated sediment and the bioaccumulation of heavy metals in freshwater flora and fauna. The stormwater infrastructure proposed for the Project will be suitable to treat stormwater runoff potentially contaminated with toxicants such as hydrocarbons and heavy metals from operational use of the road before it is discharged to surface water. Furthermore, it will be an improvement over the existing roadway stormwater network where roads already exist. With this management in place, the magnitude of effect will be reduced to **low**. A **low** magnitude of effect and **low to high** values for stream habitat and freshwater fauna results in **very low to low** overall levels of effect (Appendix B Table 7).

6.4.9 Summary of stream effects

Stream values of the Project area range from low to high. The actual and potential magnitude of adverse effects on those values range from negligible to high. Measures are proposed to address effects on these values. These measures (to be detailed in a project EMP), if fully implemented, will reduce the overall level of effects on ecological values to very low to low.

Table 6.13 summarises the ecological values of the Project, potential adverse effects, magnitude and overall level of effect following the recommended effects management measures.

Table 6.13: Summary of actual and potential ecological effects on stream values, magnitude of effects and overall level of effects following recommended measures to avoid, minimise, or remedy effects

Effect	Location	Ecological value	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)	Comments
Temporary construction effects – sedimentation	<ul style="list-style-type: none"> Kaiapoi River Rossiter and Wilsons Drains Cam River / Ruataniwha Quarry Lakes McIntosh Drain Waihora Stream Taranaki Stream and tributary 	Habitat: Low to high Fauna: Low to high	Streams: Moderate Lakes: Low	Implementation of site and activity ESCMP to avoid and minimise any potential effects from construction derived sediment.	Very low to low	
Temporary construction effects – injury or mortality of freshwater fauna	<ul style="list-style-type: none"> Rossiter and Wilsons Drains Quarry lakes McIntosh Drain Waihora Stream Taranaki Stream and tributary 	Fauna: Low to high	Streams: Moderate Lakes: Low	Implementation of a freshwater fauna management plan to avoid and minimise effects on freshwater fauna due to construction.	Very low to low	
Temporary construction effects – localised dewatering effects on stream flow	<ul style="list-style-type: none"> Kaiapoi River Rossiter and Wilsons Drains Cam River / Ruataniwha McIntosh Drain Waihora Stream Taranaki Stream and tributary 	Fauna: Low to high		N / A; except for those outlined in the CEMP.	Very low to low	It is expected that the Contractor will control the volume and rate of discharge to local streams.
Temporary Construction effect – modification of stream habitat	<ul style="list-style-type: none"> Rossiter and Wilsons Drains Taranaki Stream and tributary 	Habitat: Low to moderate		N / A; except for those outlined in the CEMP.	Very low to low	Reinstatement of stream habitat within the realigned Taranaki Stream and its tributary is expected to result in similar attributes to those that have been modified.
Temporary Construction effect - modification of fish passage and migration success	<p>Culverts:</p> <ul style="list-style-type: none"> Rossiter and Wilsons Drains Taranaki Stream and tributary <p>Realignments:</p> <ul style="list-style-type: none"> Waihora Stream Taranaki Stream and tributary 	Fauna: Low to high	Culverts: Low Realignments: Negligible	Implementation of the Project fish salvage and relocation plan to minimise effects on migrating fish species. Any further management measures will be detailed within the CEMP.	Very low to low	Reinstatement of stream habitat within the realigned Taranaki Stream and its tributary is expected to result in similar attributes to those that have been modified.
Permanent modification and / or loss of fish passage	<ul style="list-style-type: none"> Rossiter and Wilsons Drains (culverts only) McIntosh Drain (culverts only) Waihora Stream (culverts only) Taranaki Stream and tributary 	Fauna: Low to high	High	<p>Avoid: Where practical meet permitted activity status for culverts per the NES-F or like for like culvert designs (Rossiter and Wilsons Drains only),</p> <p>Minimise: Culvert / stream realignment designs will be informed by the NZFPG (2024).</p> <p>Remedy: Inclusion of specific fish passage design criteria to manage any potential effects of fish passage (e.g., installation of void filled rock rip rap into the culvert base)</p>	Very low to low	

Effect	Location	Ecological value	Magnitude of effect (unmitigated)	Proposed effects management (avoid, remedy, minimise)	Overall level of effect (mitigated)	Comments
Permanent modification and / or loss of stream habitat	<ul style="list-style-type: none"> McIntosh Drain (culverts only) Waihora Stream Taranaki Stream and tributary 	Habitat: Low to moderate	Very low - moderate	<p>Avoid: Stream realignment and culverting has been avoided to the extent practical within the designation.</p> <p>Minimise: Stream realignment and culverting has been designed to affect the shortest stream reach possible. Culverts designs will meet the permitted activity status for culverts defined in the NES-F (Clause 70)</p> <p>Remedy: Stream realignment design and composition of habitat features will be collaboratively developed and follow Project design principles to remediate loss of value for each stream realignment. Inclusion of specific fish passage design criteria to manage any potential effects of fish passage (e.g., installation of void filled rock rip rap into the culvert base).</p>	Very low – high Residual effects remain at some locations. This is due to the permanent total loss of stream extent at Taranaki Stream Tributary and the permanent modification of stream habitat for the Taranaki Stream, McIntosh Drain, and the Waihora Stream (stream realignment and culverting).	Implementation of offset measures is recommended to address the loss of stream extent and value. It is recommended that these actions are completed within the McIntosh Drain. Reinstatement of stream habitat within the realigned Taranaki Stream and its tributary is expected to result in similar attributes to those that have been modified.
	<ul style="list-style-type: none"> Quarry Lakes 	Habitat: Low	N / A	N / A	N / A	Is an artificial lake, therefore does not require consideration.
Changes in receiving water quality due to ongoing use of the road	<ul style="list-style-type: none"> Kaiapoi River Rossiter and Wilsons Drains Cam River / Ruataniwha Quarry lakes McIntosh Drain Waihora Stream Taranaki Stream and tributaries 	Habitat: Low to high Fauna: Low to high	Moderate	Implementation of Project wide stormwater infrastructure.	Very low to low	

7 Approach to residual adverse ecological effects

As outlined in the previous section, the Project is expected to have adverse residual effects of 'moderate' and 'high' (after measures to avoid, minimise, or remedy effects) on the following:

- Permanent loss of 0.66 ha of moderate value indigenous lizard habitat.
- Permanent loss of 0.67 ha of natural inland wetland extent and habitat values.
- Permanent loss of, or modification to 428 linear metres of stream extent and habitat values due to stream realignment (Section 6.4.7.3) and culvert designs (Section 6.4.7.4).

As a result, further measures are recommended to offset and compensate for these residual effects. There is also the potential for currently unquantifiable changes to wetland function and character because of changes to surface water flow paths in some parts of the alignment depending on final design. These currently unquantifiable changes may therefore modify the quantum of residual adverse effects to wetlands. It is expected that any modification to offset or compensation quantum will be confirmed through the preparation of the EMP (see below).

As noted in Section 3.3.1, under the NPS-FM and NPS-IB effects management hierarchy, offsetting and compensation are only considered required where residual adverse effects remain that are more than minor. The determination of 'more than minor' under the RMA is an assessment made by a planner rather than an ecologist, where the planner makes an assessment drawing on the technical information presented alongside their own professional judgement. An assessment of the overall effects has been undertaken by the planner within the SAR for this application. However, for clarity, this EclA broadly follows the EclAG framework. The EclAG identifies that where a moderate or higher overall level of effect remains after efforts to avoid, minimise and remedy effects, then further efforts to address these residual adverse effects in the form of offset and / or compensation should occur so that a no net loss of biodiversity value is realised. Therefore, these additional recommended measures are presented in the following sections.

Offsetting and compensation activities are only required in relation to particular ecological values, and only where residual adverse effects are more than minor. It is recommended that the residual adverse effects for the Project are addressed through offsetting and compensation measures, these are discussed below. The Project EMP will include specific chapters outlining the recommended Residual Effects Management (**REM**) measures. The EMP will be prepared as a condition of consent. These measures will confirm and specify the required quantum of offset or compensation, the offset or compensation actions to be undertaken, the location of the offset or compensation actions, and any monitoring measures required to show that offset or compensation actions have been achieved. For the purpose of this EclA, the proposed offset and compensation measures generally meet the principles for offsetting and compensation as outlined in the NPS-IB and the NPS-FM. By implementing the following residual effects management recommendations, residual adverse effects are considered to be adequately addressed.

7.1 Loss of indigenous fauna habitat

Compensation measures are recommended to adequately address the residual adverse effects associated with the loss of moderate value lizard habitat. The proposed approach involves enrichment planting and habitat enhancement of already proposed low-stature planting along the alignment. Compensation has been informed by professional judgement based on the scale of impact (up to 0.66 ha), type of habitat being impacted (exotic grassland / scrub mosaic), and the available opportunity to utilise and enhance proposed natural features (low-stature landscape planting) to improve its ecological value to indigenous lizards.

Based on a conservative assumption of all 0.66 ha of moderate value lizard habitat (exotic grassland / scrub mosaic) being lost, this is recommended to be compensated through the implementation of enrichment planting and habitat enhancement within up to 5.94 ha (approx. 6 ha) of low-stature landscape planting. However, following final design, and in the event the area of habitat loss is reduced, a lesser area of enhancement would apply.

The recommended compensation approach is considered to meet the ‘additionality’ principle as outlined in Appendix 4 of the NPS-IB, as the enrichment planting and habitat enhancement will provide additional ecological value beyond what is already proposed within the low-stature landscape planting. The principles of compensation detailed in the NPS-IB have been addressed in Appendix H. Enrichment planting and habitat enhancement for lizards will include:

- **Enrichment planting:** planting of ‘lizard friendly’ species across up to a 6 ha area is recommended to increase the complexity of the habitat, provide a variety of food resources and retreats for lizards. The planting will also increase lizard carrying capacity in the medium-long term. Example plant species are shown in Table 7.1.
- **Woody debris / log deployment:** To increase suitable lizard habitat, provide additional shelter and protection from predators, habitat enhancement will be undertaken through the deposition of woody debris and logs. The placement of woody debris / wood piles will be supervised by the Project Herpetologist to ensure they are placed correctly and ensure that disturbance to the site is minimised.
 - A minimum of 12 m / ha of manageable portions of stockpiled logs will be deployed into landscape planting areas (i.e. minimum total amount of 72 m across the 6 ha). Log material will be placed in locations where it is unable to be dislodged into streams. Logs are to be a minimum of 40 cm diameter and cut into 0.5 to 1.5 m lengths. Logs shall be of suitable species that do not pose biosecurity risks.

Table 7.1: Example enrichment “lizard friendly” plant species (Wildlands, 2025b)

Species	Common name	Benefits to lizards
<i>Austroderia richardii</i>	Toetoe	C, R, I
<i>Carex buchananii</i>	Cutty grass	C, I
<i>Carex secta</i>	Pūrei	C, I
<i>Carex virgata</i>	Swamp sedge	C, I
<i>Carmichaelia australis</i>	Native broom	C, I
<i>Coprosma crassifolia</i>	Thick-leaved coprosma	C, N, F, I
<i>Coprosma propinqua</i>	Mingimingi	C, N, F, I
<i>Cordyline australis</i>	Cabbage tree	R, F
<i>Festuca novae-zelandiae</i>	Fescue tussock	C, I
<i>Muehlenbeckia astonii</i>	Shrubby tororaro	C, R, N, F
<i>Muehlenbeckia australis</i>	Large-leaved pōhuehue	C, R, N, F
<i>Muehlenbeckia complexa</i>	Scrub pōhuehue	C, R, N, F
<i>Phormium tenax</i>	Flax	C, R, N
<i>Poa cita</i>	Silver tussock	C, I

Note: Key to known benefits of lizards: C = Cover, R = Retreats, N = Nectar, F = Fruit, I = Invertebrates.

7.2 Permanent loss of wetland extent and values

The permanent loss of wetland habitat beside the Cam River / Ruataniwha (CR_W2) and at two wetlands (WC_W1 and WC_W6) along the Waihora Stream system cannot be avoided, minimised, remedied or mitigated. There is therefore a high level of residual adverse effect that is recommended to be offset as per guidance within the NPS-FM.

Potential permanent loss of wetland habitat within wetlands QP_W1 and WC_W5 could be avoided through establishment of buffer zones prior to construction commencing. These areas have therefore not been included in permanent wetland loss calculations. If no buffer zones are established, the wetland loss and consequent offset areas will need to be included in the updated offset calculations contained within the REM measures in the EMP.

There will be direct permanent loss of 5,995 m² of wetland habitat and associated values across three wetlands, and a high likelihood of post-construction loss of remaining wetland habitat totalling 746 m² at the Cam River / Ruataniwha as a result of changes to wetland hydrology and habitat fragmentation. Offsetting is therefore recommended to address the residual adverse effects of a combined wetland loss of 6,742 m².

The proposed approach to offsetting these residual effects would comprise creation of wetland habitat within the South Lake remnant. If this approach is applied, it would offset the permanent loss and modification of wetland extent and habitat values resulting from the Project construction works.

A Biodiversity Offset and Accounting Model (BOAM) has been prepared for each impacted wetland to determine the required quantum of wetland habitat creation and enhancement to achieve both no net loss, and net gain outcomes for wetland biodiversity and habitat provision values. Each BOAM compares loss of values at the impacted wetlands with the predicted constructed wetland values able to be achieved through restoration planting and maintenance following enhancement measures being completed (see Appendix G).

The BOAM model used for calculating offset area values accounts for the following habitat metrics at both the impact sites and proposed offset site:

- Canopy height (m)
- Canopy foliar cover (%)
- Canopy tree basal diameter (m² per ha)
- Groundcover foliar cover (%)
- Groundcover height (m)
- Native plant species diversity
- Fauna habitat and food provision richness
- Emergent trees (count per ha)

Based on BOAM modelling, a total area of 1.35 ha would be required to offset the loss of wetland extent and values across the entire Project to achieve a net gain outcome. To achieve no net loss only, an area of 0.74 ha would be required. Details on the BOAM model outputs, rationale for the target reference habitat type, and justification tables for end point offset values are provided in Appendix G.

The South Lake remnant within the Quarry Lakes area that will result from the creation of the embankment through the South Lake has been proposed as the site for wetland creation and offset due to:

- Its proximity to the impact sites.
- The offset site is NZTA owned land, which allows any offset outcomes to be secured for as long as the impacts occur.
- Groundwater connectivity and therefore water supply permanence is assured.
- The available area within and around the South Lake remnant (c.2.6 ha) is greater than the quantum of offset required, which provides the opportunity to achieve a net gain in biodiversity values lost. The large area available for offset actions also provides ample opportunity to account for additional potential adverse impacts to wetlands CR_W1, FR_W4, WC_W2, WC_W3, and WC_W5 that are currently uncertain.
- Allows the offset actions to be completed at a single site, which results in the best ecological outcome as opposed to several smaller fragmented areas throughout the Project designation.

The recommended offsetting would be delivered through the following:

- Production and implementation of a wetland creation and restoration plan to guide successful restoration and therefore offsetting outcomes.
- Infilling of the South Lake remnant to a suitable depth for wetland planting success. Approximately 30% of the lake remnant will be retained as open water.
- The infill material will be manipulated to create a range of water depths that will allow a variety of wetland habitat types to be established. Proposed water depths will range from c.0.1-1.0 m.
- Wetland restoration planting will be undertaken with a range of species suited to establishment on constructed wetland substrate. The aim is to create 4-6 different habitat types across the wetland planting area. Topsoil will be added, if required, in parts of the proposed wetland to improve planting success of the target habitat types.
- Nominal dominant plants and therefore habitat types for initial establishment⁵¹ could include:
 - Raupō (*Typha orientalis*) reedland.
 - Harakeke and tī kōuka flaxland.
 - Kāpūngāwhā (*Schoenoplectus tabernaemontani*) sedgeland.
 - *Juncus pallidus* rushland.
 - *Carex virgata* / *Carex secta* sedgeland.
- Wetland habitat planting maintenance for 10-15 years.
- Protection in perpetuity⁵².

The design and delivery of the wetland habitat restoration can be undertaken in partnership with mana whenua.

7.2.1 Conclusion

Permanent loss of wetland habitat will occur at three wetlands across the project alignment. There is also potential for indirect impacts to five other wetlands depending on catchment reinstatement

⁵¹ Final proposed habitat types and relative planting ratios will be determined during production of the detailed restoration plan. This will also be undertaken in consultation with mana whenua.

⁵² The most suitable protection mechanism will be determined in conjunction with relevant stakeholders and interested parties.

and / or uptake of buffering recommendations; some uncertainty around total wetland impacts as a result of the project therefore remains.

The creation of wetland habitat within the South Lake remnant at the Quarry Lakes provides an excellent opportunity for achieving a net gain ecological outcome for wetlands impacted by the Project. Because the area available for wetland creation exceeds the area required for offset from known impacts, it has the potential to absorb any potential additional effects and represents a scenario where a trade-up on biodiversity values and functionality is also possible.

Additionally, the offset site is located in close proximity to some of the impacted wetlands, and connections between stream offset (see Section 7.3 below) and other potential ecological offset and remediation actions are also present in the local area. Taking all of these considerations into account, and the high level of certainty of being able to achieve target ecosystem types and values, the wetland offset site represents a cohesive and achievable option that will meet, with potential to exceed, good practice biodiversity offsetting outcomes.

7.3 Permanent stream habitat loss and modification

The overall level of effect due to permanent habitat loss and modification ranges from very low to high. Therefore, residual effects due to the permanent loss and modification of stream extent and habitat within Taranaki Stream, Taranaki Stream Tributary, Waihora Stream, and McIntosh Drain remain after measures to avoid, minimise, and remedy effects have been considered (see Table 6.8). This results in the permanent loss or modification of up to 368 linear metres of stream habitat extent and value due to stream realignment (Section 6.4.7.3) and culvert designs (Section 6.4.7.4). Therefore, measures to offset these residual effects are proposed.

The approach to offsetting these residual effects will include the enhancement of existing degraded stream habitat located on land within and immediately adjacent to the Project Site that is owned by NZTA. This approach will offset the permanent loss and modification of stream habitat values resulting from the proposed stream realignments and culvert works.

To determine the quantum of stream enhancement to replace stream habitat loss and modification, and to achieve a no net loss in stream ecological values outcome, both Standard and Current Value ECR have been calculated using, where appropriate, the current and modelled potential SEV scores (detailed in Section 3.2.6.5). Although the ECR is not explicitly designed to offset the loss of stream extent (i.e. it focusses on value and function), for the purpose of this EclA it provides a consistent approach to determine an appropriate action to address any residual effects at the Taranaki Stream Tributary.⁵³

The proposed quantum of offset required for Taranaki Stream and Taranaki Stream Tributary takes into account the future potential remediated stream habitat condition of those realigned sections. Where there remains a residual effect, this is to be offset within the McIntosh Drain within and adjacent to the Project Site. Likewise, the offset site for Waihora Stream is also the McIntosh Drain.

McIntosh Drain has been selected as the stream offset site due to:

- Its proximity to the impact sites.
- The offset site is on NZTA owned land, which allows any offset outcomes to be secured for as long as the impacts occur.
- The available area within the NZTA land adjacent to the McIntosh Drain are greater than the quantum of offset required allowing for a single offset site. This achieves the offset gains beyond those that would have occurred in the absence of the offset.

⁵³ As long as the offset is at least at a 1:1 scale of the extent lost.

- Restricts the offset actions to be completed on a single highly modified and degraded stream section (see Section 5.2.3). This results in the best ecological outcome as opposed to several smaller fragmented reaches throughout the Project Site.

Offset site availability is partially restricted with only the downstream true right bank being available along the eastern property boundary. However, where McIntosh Drain deviates from this property boundary both the true left and true right banks are available for use as an offset site, as this is NZTA owned land. This partial restriction has been accounted for by increasing the quantum of offset actions that will occur on the true right bank portion of the McIntosh Drain (Volume 4e Figure 1). Section 5.2.3 of this EclA describes the habitat, stream ecological function and freshwater fauna currently present at McIntosh Drain. In summary, the watercourse is currently of low ecological value due it being highly modified with very high degradation and a low diversity fish community. However, it is important to note that inanga were detected via eDNA in summer 2025.

Table 7.2 presents the summary SEV scores for the current and potential values (excluding biological functions) for the impact reaches (SEVi-C and SEVi-P) and the offset reaches (SEV-mC and SEV-mP). SEVi-I is the predicted SEV value for the streams to be impacted, after impact. These are set to 0 for the Taranaki Stream Tributary to account for the permanent stream loss. The proposed design for Waihora Stream is for the channel to be realigned to a grass swale, with an estimated SEV score of 0.300. An SEV value of 0.200 is assigned to culverts within this Project as it reflects the heavily modified and poorly functioning stream habitat within the culvert itself. This culvert SEV value is considered conservative for culverts that meet the permitted activity status in the NES-F or where designs are informed by the NZFPG. It is therefore considered an appropriate value to reflect the stream habitat loss and modification within culvert designs.

Potential scores (SEVi-P and SEVm-P) for the impact sites and offsetting site have been calculated assuming a period of 10 years post-restoration and a 10 m riparian buffer on both sides of the stream. Potential scores have been calculated based on what is achievable at the site, given the constraints of the upstream catchments. Assumptions made when calculating the potential SEV scores are provided in Appendix F Table 2.

Table 7.2: Current, potential and predicted (excluding biological functions) SEV values of impact and offset reaches used to determine the ECR

Stream	Effect	SEVi-C	SEVi-P	SEVi-I	SEV-mC	SEV-mP
Taranaki Stream Tributary	Realigned	0.359	0.412	0	0	0.412
Waihora Stream downstream of SH1	Realigned	0.380	0.535	0.300	-	-
McIntosh Drain	Culvert	0.244	0.392	0.200	-	-
Waihora Stream	Culvert	0.382	0.547	0.200	-	-
Taranaki Stream	Culvert	0.462	0.512	0.200	-	-
McIntosh Drain	Offset site	-	-	-	0.244	0.510

Stream realignment

The ECR for the permanent loss of stream habitat due to the realignment of the two impact sites has been calculated following the methods in Section 3.2.6.5. These are shown in Table 7.3. An area of 777 m² of stream bed will be impacted by the Project.

Based on SEV values in Table 7.2, ECR values ranging from 0.45 – 1.50 have been calculated (Table 7.3 and Table 7.4). However, where ECR calculations produce an ECR value of less than 1.00, then the ECR is to be defaulted to 1.00 (Neal et al, 2011). This is the recommended approach outlined by Neal et al (2011) and provides that at a minimum a no net loss of stream habitat is achieved.

Depending on the ECR calculation used (standard or current value), this results in a range of 826 to 1,081 m² of stream bed habitat enhancement being required to achieve no net loss of ecological function because of the proposed permanent stream habitat loss. Approximately, 1,937 m² of stream bed is available across McIntosh Drain and the realigned channels. Therefore, stream loss can be adequately offset through the enhancement actions at the McIntosh Drain offset site and via the remediation undertaken at the point of stream realignment, thus achieving a no net loss of stream habitat.

Table 7.3: Standard ECR calculations for the realignment Taranaki Stream Tributary and Waihora Stream downstream of SH1

Impact						Offset					ECR	
Stream	SEVI-P	SEVI-I	Length (m)	Average width (m)	Streambed area (m ²)	Stream	SEV _m -P	SEV _m -C	Average width (m)	Length (m)	ECR	Streambed area compensation required (m ²)
Taranaki Stream Tributary	0.412	0	40	1.51	60	Taranaki Stream Tributary realignment	0.412	0	1.51	75	1.5	91
Waihora Stream	0.535	0.3	160	4.67	747	McIntosh Drain	0.510	0.244	4.67	800	1.33	990
Total stream bed area lost					993	Total stream bed area offset required					1,081	

Table 7.4: Current Value ECR calculations for the realignment Taranaki Stream Tributary and Waihora Stream downstream of SH1

Impact						Offset					ECR	
Stream	SEVI-C	SEVI-I	Length (m)	Average width (m)	Streambed area (m ²)	Stream	SEV _m -P	SEV _m -C	Average width (m)	Length (m)	ECR	Streambed area compensation required (m ²)
Taranaki Stream Tributary	0.359	0	40	1.51	60	Taranaki Stream Tributary realignment	0.412	0	1.51	75	1.31	79
Waihora Stream	0.38	0.3	160	4.67	747	McIntosh Drain	0.510	0.244	4.67	800	0.45 (1.0)	747
Total stream bed area lost					993	Total stream bed area offset required					826	

Culverts

The construction of culverts within the Project will result in residual adverse effects as no further management measures can be practically achieved (Table 6.8). This results in the permanent modification of stream value within up to 168 m of stream. Similarly to the recommended stream realignment actions outlined above, habitat enhancement of existing degraded stream habitat within the McIntosh Drain is recommended to offset these residual effects. A Standard and Current Value ECR (detailed in Section 3.2.6.5) has been calculated using the SEV scores (Table 7.2) to define the quantum of stream offset required to achieve no net loss of stream habitat value.

The ECR calculations (Table 7.5 and Table 7.6) show that an area of 424 m² of stream bed will be modified by the proposed culvert construction works. Based on SEV values in Table 7.2, ECR values ranging from 0.25 – 1.96 have been calculated (Table 7.5 and Table 7.6). As stated above, where ECR calculations produce an ECR value of less than 1.00, then the ECR is to be defaulted to 1.00.

Depending on the ECR calculation used (standard or current value), this results in a range of 527 - 723 m² of stream bed habitat being required for enhancement to achieve no net loss of ecological function due to the proposed permanent modification of stream habitat. Approximately, 856 – 1,111 m² of stream bed is available for offsetting in McIntosh Drain after the offsetting of permanent loss of stream habitat from the stream realignment (see above).

Based on the SEV and ECR completed in this EclA, there is sufficient stream offset area to address the residual effects due to the modification of and the loss of stream value through riparian enhancement at McIntosh Drain.

Table 7.5: Standard ECR calculations for streams impacted by culverting

Impact						Offset					ECR	
Stream	SEV-I-P	SEV-I	Length (m)	Average width (m)	Streambed area (m ²)	Stream	SEV-m-P	SEV-m-C	Average width (m)	Length (m)	ECR	Streambed area compensation required (m ²)
McIntosh Drain	0.428	0.2	50	2.28	114	McIntosh Drain	0.510	0.244	2.28	800	1.08	123
Waihora Stream	0.547	0.2	58	2.58	150						1.96	293
Taranaki Stream (Bob Robertson Drive)	0.512	0.2	10	2.91	15						1.76	51
Taranaki Stream (SH1)	0.512	0.2	50	2.91	146						1.76	256
Total stream bed area modified					424	Total stream bed area offset required					723	

Table 7.6: Current Value ECR calculations for streams impacted by culverting

Impact						Offset					ECR	
Stream	SEVi-P	SEVi-I	Length (m)	Average width (m)	Streambed area (m ²)	Stream	SEVm-P	SEVm-C	Average width (m)	Length (m)	ECR	Streambed area compensation required (m ²)
McIntosh Drain	0.244	0.2	50	2.28	114	McIntosh Drain	0.510	0.244	2.28	800	0.25 (1.0)	114
Waihora Stream	0.382	0.2	58	2.58	150						1.03	154
Taranaki Stream (Bob Robertson Drive)	0.462	0.2	10	2.91	15						1.48	43
Taranaki Stream (SH1)	0.462	0.2	50	2.91	146						1.48	215
Total stream bed area modified					424	Total stream bed area offset required					527	

7.4 Summary of residual adverse effects management

7.4.1 Measures to address residual adverse effects to native lizards (loss of fauna habitat)

Residual adverse effects on native lizards associated with the loss of habitat is recommended to be compensated for through the implementation of enhancement planting and habitat enhancement within the proposed baseline low-stature landscape planting (6 ha available). These compensation measures are considered to adequately address the loss of moderate value habitat (exotic grassland / scrub) mosaic and provide ecological benefit to native lizards.

7.4.2 Measures to address residual adverse wetland effects

The proposed wetland offset scenario for the Project comprises creation of new wetland habitat within the South Lake remnant. This site has approximately 2.5 ha of area available for wetland creation (see Ecological Offset maps, Appendix A). Based on BOAM modelling, a total area of 1.35 ha of wetland creation is recommended to offset the loss of wetland extent and values across the entire Project to achieve a net gain outcome. To achieve no net loss, an area of 0.74 ha of wetland creation would be required.

If undertaken, creation of wetland habitat at the proposed offset site will therefore address all residual project effects on wetlands due to Project activities and has the capacity to absorb additional uncertainty around wetland impacts that have not been able to be quantified with

sufficient certainty. It is highly likely that there will be a net positive / net gain outcome due to the project offset actions.

7.4.3 Measures to address residual adverse stream effects

Residual adverse effects remain in the Project due to the permanent loss or modification of 428 lineal metres of stream habitat. This equates to a total of 1,201 m² of stream bed requiring offsetting. Recommended offsetting actions include the enhancement of existing degraded stream habitat at McIntosh Drain.

Based on the SEV values for the relevant impact and offset sites, calculated ECRs range from 0.25 – 1.96, however as outlined above, where ECRs are less than 1.00, and ECR value of 1.00 is used. Therefore, the ECR range used to calculate the recommended offset quantum for this EclA is 1.00 – 1.96. Depending on the ECR calculation used (standard or current value), this results in a range of 1,353 – 1,804 m² (0.135 - 0.180 ha) of stream bed enhancement being required to achieve no net loss of stream habitat extent and value across the Project. With 113 m² of stream bed available for remediation within the realigned channels, and 1,824 m² available for offset actions within McIntosh Drain, this equates to 1,937 m² (0.19 ha) total remediation and offset area available. Therefore, residual effects due to permanent loss and modification of stream habitat extent and value resulting from the Project can be adequately addressed. It is recommended that the higher end of this range (i.e., 1,804 m² (0.180 ha) of stream bed) is progressed so that there is a higher level of certainty that the offset actions will achieve a no-net loss in stream values and extent due to the Project.

Table 7.7: Summary of offset or compensation actions within the Project

Offset or compensation actions	Offset / compensation site locality	Offset / compensation area required (ha)	Potential offset / compensation area available (ha)
Lizard habitat enhancement	Low-stature landscape plantings (project-wide)	5.94	6
Wetland creation	South Lake remnant	1.35	2.60
Stream enhancement	McIntosh Drain	0.135 – 0.180*	0.19*

Note:

* For this summary table stream offset has been calculated as ha not m².

7.5 Summary of Project benefits following residual effects management

The vegetation and indigenous fauna habitats, and wetlands and streams identified within the Project Site, whilst containing elements of representative naturally occurring native habitat and stream composition and function, are moderately to highly degraded. The indigenous species diversity and habitat complexity ranges from low (bird habitat, wetland) to moderate (native lizard habitat, wetlands and streams), with these values being impacted by agricultural activities (e.g., stock grazing), the existing roading network, urban developments (both historical and current / ongoing), high cover of exotic species, and through other anthropogenic activities (e.g., quarrying, small scale landfill activities, flooding infrastructure).

The proposed offset and compensation actions include:

- Fencing off and restricting stock access to the wetland and stream offset sites.
- Planting appropriate native species within the constructed wetland and immediate stream riparian habitats.
- Establishing a native planted terrestrial buffer around the planted stream habitats.

- An improvement to native biodiversity, wetland and stream function.
- The persistence of higher ecological value features in the area within and immediately adjacent to the Project Site.
- Enrichment planting of indigenous species that are expected to provide preferable habitat for indigenous lizards, as well as habitat enhancement through the placement of log / woody debris features throughout up to 5.94 ha of proposed low-stature landscape planting.

It is recommended that the net gain wetland (1.35 ha) and standard ECR stream (0.180 ha) offset actions, that have been identified in the above sections, are undertaken to offset the residual adverse effects to wetlands and streams. This will result in a substantial increase of native plantings which will result in an improved semi-contiguous native vegetation corridor between the wetland offset area (in the south) and the stream offset area (in the east and north) within the Quarry Lakes to Woodend Beach Road section of the Project. This increased area of indigenous biodiversity will improve the potential for wetland avifauna to use these areas on a regular basis, as well as providing important habitat resources for other indigenous species (e.g., indigenous lizards, forest birds and invertebrates, and native freshwater fish and macroinvertebrates).

Taking these considerations into account, and the high level of certainty of being able to target offset and compensation actions to ecosystem types and values, the terrestrial compensation, and wetland and stream offset sites represent a cohesive and easily achievable option. Which will meet, with potential to exceed, good practice biodiversity offsetting and compensation principles in the NES-F and NES-IB. In addition, as offset actions are restricted to a single wetland and stream site, the gains in positive ecological outcomes will be higher compared with using several smaller fragmented reaches / areas throughout the Project Site.

Additional to the ecological benefits outlined above, the creation of wetland habitat within the South Lake remnant will increase the amenity and visual values of the Quarry Lakes to Woodend Beach Road section of the Project. This will primarily be through the increased density of indigenous plantings and the inclusion of natural habitat characteristics (e.g., the combination of open water and wetland habitat). If the proposed wetland offset was not actioned in this area, the Project would result in the South Lake remnant becoming isolated (hydrologically and landscape-wise) from the wider Quarry Lakes. This would result in potential water quality degradation effects developing over the operational timeframe of the Project. For example, algal blooms may develop during warmer months when conditions are favourable resulting in ongoing visual / amenity effects and potential biodiversity effects. Establishing a wetland within the South Lake remnant, will regulate any water quality effects that develop through natural wetland processes such as the uptake of nutrients by wetland plants, shading of wetted areas, and sediment retention.

The Project EMP will include REM measures that will be developed following completion of detailed design to ensure a cohesive approach to management of this area. This REM measures will include:

- Descriptions of the proposed ecological outcomes and benefits from any offset / compensation actions.
- Indigenous revegetation planting and habitat enhancement specifications.
- Water level management and constructed wetland substrate establishment plan.
- Wetland and stream restoration planting plans including planting schedules and staging.
- Restoration maintenance plan including frequency of monitoring and details of pest plant control.
- Confirmation of offset and compensation areas and quantum, including finalising any ECR and BOAM calculations.

- Monitoring measures to show how and when offset and compensation actions have resulted in a no net loss and preferably a net gain in ecological function, biodiversity values, and potential for habitat provision for native fauna.

Overall, if implemented, the recommended offset actions within the South Lake remnant and McIntosh Drain have the potential to result in a minimum of **no net loss** for both wetlands and streams, and have the potential to result in a **net gain** for wetlands. The terrestrial compensation actions would result in a **positive effect** to indigenous lizards through increasing habitat provision for indigenous lizards. Additionally, the creation of terrestrial, wetland and enhancement of stream habitat will result in good quality, achievable ecological outcomes that will offset the residual ecological effects that will have occurred by the completion of the Project.

8 Summary and conclusion

NZTA proposes to construct, operate and maintain a four-lane grade-separated motorway as an extension of the Christchurch Northern Motorway. Overall, the Project will result in 11 km of new or upgraded roading infrastructure. A desktop review of publicly available information, information from Project-specific reports commissioned by NZTA, and site investigations were completed to inform this EclA.

A conservative approach has been taken for this EclA by assuming complete disturbance of all vegetation and habitats within the proposed designation boundaries. This approach has been used to allow for flexibility as the design progresses, and to allow construction methodology to vary.

Key findings are as follows:

- Terrestrial ecological values within the riparian margins of streams and alterations to the designation range from negligible to very high; wetland ecological values range from low to high; and stream ecological values range from low to high. High and very high characteristics include 'At Risk' and 'Threatened' indigenous fauna (e.g., birds, lizards and fish), moderate diversity wetland mosaics, and stream habitat that provides potential spawning habitat for a 'Threatened' fish species.
- Potential and actual adverse effects on terrestrial ecology values include permanent loss (up to 8.75 ha) of largely exotic vegetation, loss of lizard and bird habitat (up to 5.43 ha, of which 2.6 ha is open water), disturbance, and injury or mortality of indigenous fauna during construction. Overall effects can be avoided or minimised to a low to very low level, however due to residual moderate effects associated with the loss of 0.66 ha of indigenous lizard habitat, compensation in the form of "lizard friendly" enrichment planting and habitat enhancement within the designation is recommended.
- Potential and actual adverse effects on wetland ecology values include the direct permanent loss of wetland habitat, modification to wetland hydrology, habitat fragmentation, and sedimentation effects during construction works. Overall effects can be avoided or minimised to a low to very low level for most wetlands, however a moderate to high level of residual adverse effects on wetland habitat and values through permanent loss and / or modification remains. Offsetting is recommended to account for these high residual adverse effects.
- Potential and actual adverse effects on stream ecology values include temporary construction related effects such as from sedimentation, injury and mortality to freshwater fauna, localised dewatering effects, and the modification of stream habitat, fish passage and migration success. Permanent effects include the modification and loss of fish passage and stream habitat, and operational effects associated with changes in receiving water quality. Overall effects can be avoided or minimised to a low to very low level, however, due to a moderate to high effect on stream habitat and values offsetting measures are recommended.
- Where wetland and stream residual adverse effects remain, it is recommended that these are addressed through the implementation of offset actions at the McIntosh Drain and South Lake remnant wetland.
- McIntosh Drain is the recommended stream offset site due to its proximity to the impact sites and is on land owned by NZTA, while the offset area is on a single highly modified and degraded stream section which provides an area greater than the quantum of offset required allowing for a single offset site. Overall, the stream offset actions achieve stream biodiversity and function gains beyond those that would have occurred in the absence of the offset, and results in an improved ecological outcome as opposed to several smaller fragmented reaches throughout the Project Site.

- Project effects management will be implemented via a Project Ecological Management Plan (EMP), Construction Environmental Management Plan (CEMP), Erosion Sediment Control Management Plan (ESCMP), and proposed consent conditions.
- The EMP shall include the following chapters, where measures to avoid, minimise, remedy, offset or compensate adverse effects will be detailed:
 - Indigenous biodiversity management measures, which will include:
 - o Approaches to the management of vegetation clearance, and include establishment methods, programmes, and targets.
 - o Pest plant and animal management.
 - o Planting monitoring and maintenance approaches and timelines
 - o Approaches to managing indigenous avifauna, including:
 - Pre-construction avifauna surveys and bird nest checks during bird breeding season (September to January).
 - Responses to accidental harm.
 - Deterrent, exclusion zone, and supervision methods.
 - Fish management measures, which will include:
 - o Fish salvage and relocation measures, including methods to manage the incidental discovery of 'Threatened' and 'At risk' freshwater fauna species and the management of any noxious pest species.
 - o Measures to prevent fish impingement and / or entrainment in any pump used during stream dewatering.
 - o Site-specific guidance on fish migration and spawning timeframes.
 - o Approaches to on-line stream works, including provisions for temporary fish passage and avoidance of peak migration and spawning seasons.
 - Residual Effects Management measures, which will include:
 - o The offset and compensation measures, and relevant calculations that are required. This will include, via specified consent conditions, the recalculation of wetland and stream offset, and terrestrial compensation areas.
 - o Principles, methodologies, processes, targets, monitoring and reporting that will be used to achieve the offset and / or compensation measures. This may include provisions to report:
 - Success of offset or compensation actions.
 - Any changes to indigenous biodiversity following implementation of offset and / or compensation actions.
 - Against the offset and / or compensation targets.
 - Ongoing restoration, maintenance and monitoring of offset actions to show that a no net loss or net gain in indigenous biodiversity or function are generated.
- Further to the effects management via the EMP, several proposed consent conditions will also include measures to avoid, minimise, and remedy effects. These include:
 - The preparation of an ESCMP.
 - Approaches to fish passage through culvert design.
 - The provision of stream realignment design measures.
 - Inclusion of watercourse reinstatement measures when a temporary structure is required in a watercourse.

- Construction phase dewatering and stormwater discharge requirements.
 - Requirements for operational stormwater design measures.
 - Approaches to managing incidental discovery of 'Threatened' and 'At risk' indigenous flora and fauna species.
 - The recalculation and re-evaluation of offset and compensation measures outlined in Section 7 in this EclA due to any revision of the area of habitats to be affected as a result of the Project.
- The risk to indigenous lizards will be minimised through the implementation of a Lizard Management Plan (LMP), which is to be developed as a condition of the Wildlife Approval (see Volume 3J of the SAR).

Overall, it is considered that the actual and potential temporary and permanent adverse ecological effects due to the construction, operation and maintenance of the Project can be adequately managed through proposed ecological effects management measures (including any required offset or compensation recommendations).

9 Applicability

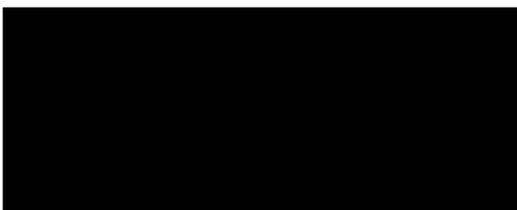
This report has been prepared for the exclusive use of our client Aurecon New Zealand Ltd and New Zealand Transport Agency Waka Kotahi, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that Aurecon New Zealand Ltd and New Zealand Transport Agency Waka Kotahi will submit this report as part of an application under the Fast-Track Approvals Act 2024 and the appointed panel will use this report for the purpose of assessing that application.

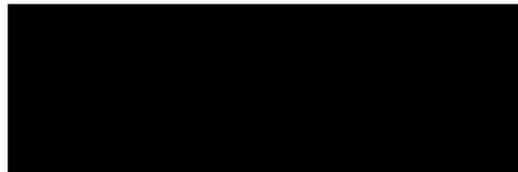
Tonkin & Taylor Ltd (T+T) has been engaged to prepare this EclA to accompany the applications under the FTAA. This EclA has been prepared in accordance with our sub consultancy agreement “Belfast to Pegasus Motorway & Woodend Bypass pre-implementation & MSQA Professional services contract number 11320”, dated 20 May 2025.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

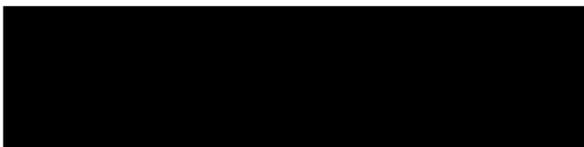
Report prepared by:



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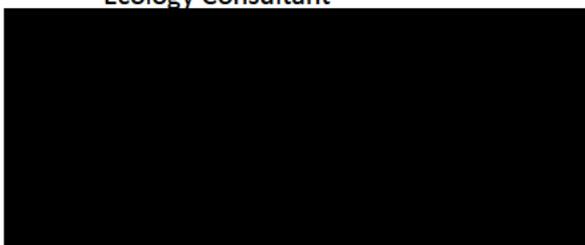


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Project Director

JAWM

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