Boffa Miskell

Palmerston North Regional Freight Hub

~~Assessment of Ecological Values and Effects~~Assessment of Ecological Values and Effects – section 92

Prepared for KiwiRail Holdings Ltd

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Prepared by:	Jeremy Garrett-Walker Ecologist Boffa Miskell Limited	
Reviewed by:	Dr Vaughan Keesing Senior Ecologist Boffa Miskell Limited	
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Cover photograph: Central section of the northern tributary of stream system 1

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1.0 Executive Summary

This assessment considers the potential ecological effects of the proposed KiwiRail Freight Hub (Freight Hub) between Palmerston North and Bunnythorpe, immediately west of Railway Road.

Project Description

The project will involve the construction and operation of a new Freight Hub, including associated infrastructure (e.g. marshalling yards, container terminal, and stormwater treatment devices). KiwiRail is seeking to enable works through a designation. A detailed design of the Freight Hub will follow this process, along with the process of obtaining any relevant regional resource consents.

The Designation Extent is currently comprised primarily of pasture grasses (Charlton & Stewart, 1999), with some small areas of exotic vegetation (e.g. pine shelterbelts), and includes two tributary systems of the Mangaone Stream catchment which pass through the Designation Extent.

Methods

- A range of desktop and field investigations were used to describe the terrestrial and freshwater environments present within the Designation Extent.
- Once described, the ecological values were assessed based on the EIANZ guidelines. An assessment of ecological effects was then conducted using these guidelines.
- The assessment of ecological effects considers the terrestrial and freshwater environments within the Freight Hub area.
- A range of measures to avoid, minimise, remedy and mitigate effects are described.

Existing Environment

The Site falls within the Manawatu Plains Ecological District (31.01), in the Manawatu Ecological Region (31) (McEwen, 1987). This district is characterised by low altitude, loess covered plains and alluvial terraces and has a range of soils including volcanic ash, loess, clay and peat soils. The vegetation was originally (pre-human) comprised of semi-swamp forest (kahikatea and pukatea) on low-lying land near rivers, totara forest in lower rainfall areas or stony soils, mixed podocarp on the plains east of the Manawatu River, as well as areas of black beech and flax swamp. However, the district is now highly modified from historic clearing for farming. It is currently dominated by pasture and other exotic vegetation (e.g. pine, orchards).

Significance

The aquatic environment within the Designation Extent is not considered to be in a natural state or a site of significance. No terrestrial sites of significance were identified.

Assessment of Value

The ecological habitat components present within the Designation Extent have ecological values ranging from Negligible to Low. Though no fish surveys occurred, and no freshwater fish database records exist, it is assumed Longfin eel may be present in the aquatic habitats within the Freight Hub extent which have (because of their threat classification) High ecological value.

Assessment of Effects

Potential operational effects of the Freight Hub have been considered in this assessment, including terrestrial vegetation loss, species habitat loss, stream loss, introduction of fish passage barriers, sediment discharge events, and stormwater discharges. These potential effects are considered to have Negligible to High Magnitudes of Effect on the Ecological Values present on site. Overall Levels of Effect range from Very Low to Low. With mitigation, correct culvert installation can result in a Positive Magnitude of Effect and an Overall Net Gain Ecological Effect.

Recommendations

- No vegetation clearance conditions, or requirements, are recommended at this stage.
- Undertake salvage efforts for all herpetofauna on Site prior to commencing any earthworks, irrespective of their threat classification (due to their protection under the Wildlife Act 1953).
- Undertake salvage efforts for all fish and kōura (freshwater crayfish) within the affected reaches of stream prior to any works within the stream environment(s).
- Where possible, recreate open stream channel(s), preferably around the northern margin for the Freight Hub rather than through it.
- Ensure best practice sediment management is undertaken.
- Install appropriate and sufficient stormwater treatment devices to ensure any discharged water is of ecologically acceptable quality.
- Where possible, treated stormwater should be discharged into the remaining and/or replaced reached of the affected stream system 1 and northern tributary of stream system 2.

2.0 Introduction

Boffa Miskell Ltd has been engaged by Stantec New Zealand (on behalf of KiwiRail Holdings Ltd.) to carry out an ecological assessment which forms part of the Assessment of Environmental Effects prepared in support of the Notice of Requirement (NoR), for a proposed rail and freight hub (Freight Hub) between Palmerston North and Bunnythorpe, immediately west of Railway Road (Designation Extent).

2.1 The Project

The project will involve the construction and operation of a new Freight Hub, including associated infrastructure (e.g. marshalling yards, container terminal, and stormwater treatment devices). KiwiRail is seeking to enable works through a designation. A detailed design of the Freight Hub will follow this process, along with the process of obtaining any relevant regional resource consents.

The Designation Extent includes 177.7 ha of primarily agricultural and lifestyle land and is situated immediately west of Railway Rd which runs from Bunnythorpe to Palmerston North (Figure 1). This Site is comprised primarily of pasture grasses (Charlton & Stewart, 1999), with some small areas of exotic vegetation (e.g. pine shelterbelts).

Two tributary systems of the Mangaone Stream catchment pass through the Designation Extent, hereon considered Stream system 1 in the north and then Stream system 2 in the south (Figure 2). Stream system 2 includes two tributaries which join downstream of the Designation Extent (they are therefore assessed independently). Stream system 1 runs south/south-west across the site over a length of approximately 2,352 m. The northern tributary of stream system 2 runs west from Railway Rd for a length of 835 m through the site. The southern tributary of stream system 2 briefly passes through the south-eastern corner of the Freight Hub location for approximately 590 m.

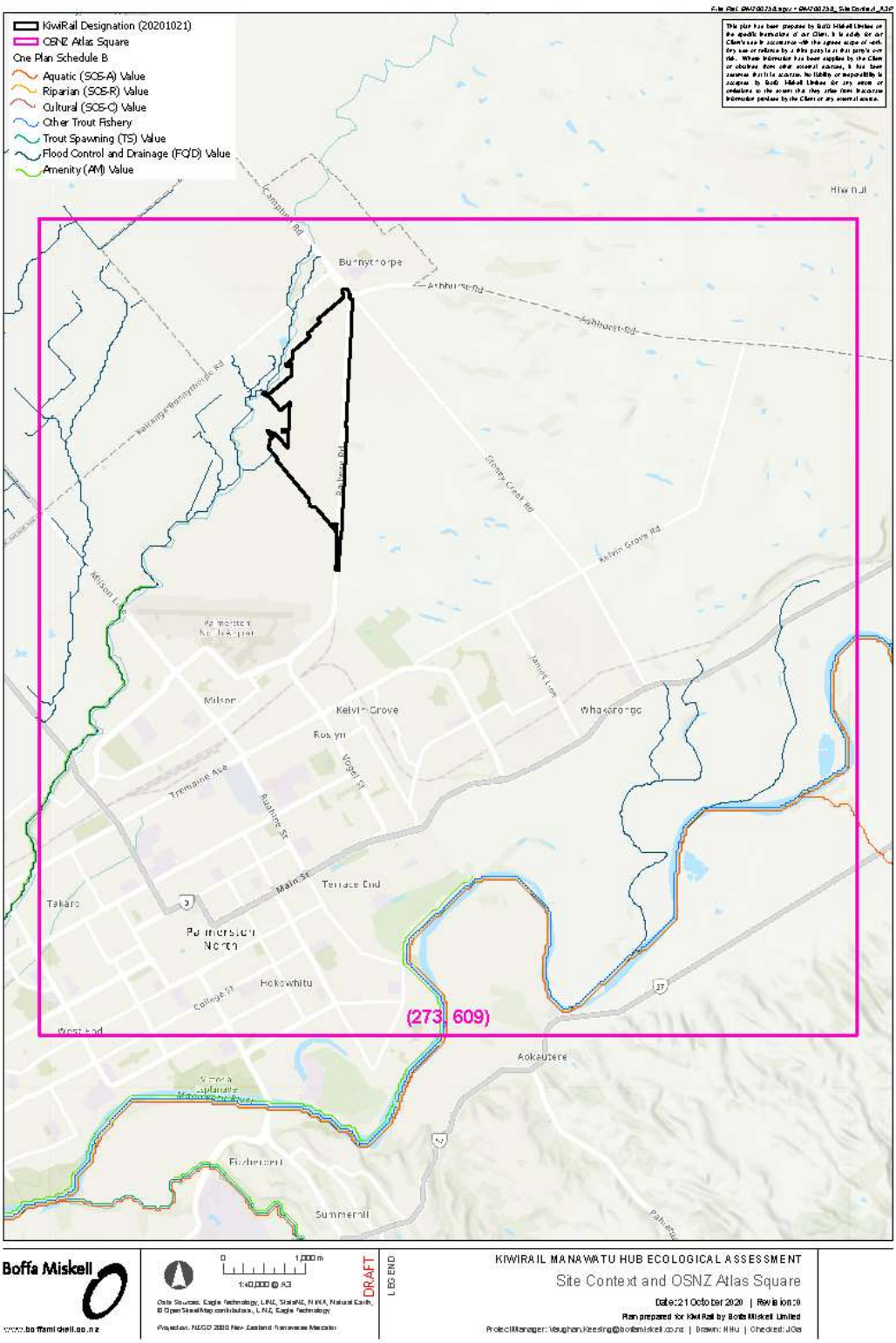

Figure 1: Location of the Freight Hub within the landscape. Included are sections of waterway identified as Sites of Significance in Schedule B of the One Plan and the OSNZ square used to compile a list of avifauna that may frequent the Freight Hub area.

2.2 Scope of assessment

This report assesses the ecological values present and the level of potential ecological effects of the proposed activities for which the NoR is sought. For the purposes of this assessment, we have assessed the ecological values of the Designation Extent and the likely ecological effects based on a conservative assessment of the proposed activities for which the NoR is sought.

This report outlines:

- The methods of assessment;
- The existing environment;
- The ecological values of the site;
- The potential ecological effects of the Freight Hub; and
- Recommendations to mitigate potential effects.

2.3 Definitions used in this report

The following definitions are applied to terms used throughout this report:

- **Designation Extent** - the proposed extent of land which KiwiRail is seeking to designate for the Freight Hub through the NoR.
- **Freight Hub** – KiwiRail's proposed rail and freight hub near Palmerston North.
- **EIANZ** – Environment Institute of Australia and New Zealand
- **One Plan** – The Consolidated Regional Policy Statement, Regional Plan and Regional Coastal Plan for the Manawatu-Wanganui Region (Horizons Regional Council)
- **NPS-FM (2020)** – the National Policy Statement of Freshwater Management 2020
- **NES-FW (2020)** – The Resource Management (National Environmental Standards for Freshwater) Regulations 2020
- **NoR** – The Notice of Requirement to which this assessment relates to.

3.0 Methods of Assessment

3.1 Assessing ecological values

The method used to undertake this assessment of effects is consistent with the Environment Institute Of Australia And New Zealand (EIANZ) guidelines for undertaking ecological impact assessments (Roper-Lindsay et al., 2018), whereby ecological values are assigned (refer to Table 1~~Table 1~~ for species and Table 2~~Table 2~~ for vegetation and habitat) and the magnitude of effects

identified (Table 3~~Table 3~~) in order to determine the overall level of effect of the proposal (Table 4~~Table 4~~).

Table 1: Criteria for assigning ecological value to species (Roper-Lindsay et al., 2018).

ECOLOGICAL VALUE	SPECIES CLASSIFICATION
Very High	*Nationally Threatened* (Nationally Critical, Nationally Endangered, Nationally Vulnerable) species found in the ZOI[1] either permanently or seasonally.
High	Species listed as *At Risk – Declining* found in the ZOI either permanently or seasonally.
Moderate	Species listed as any other category of *At Risk* (Recovering, Relict, Naturally Uncommon) found in the ZOI either permanently or seasonally; or Locally (ED) uncommon or distinctive species.
Low	Nationally and locally common indigenous species.
Negligible	Exotic species, including pests, species having recreational value.

Table 2: Assigning overall value to areas (refer to Appendix 1 for the four (terrestrial) or five (freshwater) matters to be considered) (Roper-Lindsay et al., 2018).

VALUE	DESCRIPTION
Very High	Area rates High for three or all of the four assessment matters listed in Appendix 1. Likely to be nationally important and recognised as such.
High	Area rates High for two of the assessment matters listed in Appendix 1, Moderate and Low for the remainder, or Area rates High for one of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter listed in Appendix 1, Moderate and Low for the remainder, or Area rates Moderate for two or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for three matters and Moderate, Low or Very Low for remainder.

[1] Roper-Lindsay et al. (2018) define the Zone of Influence (ZOI) as "*the areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities.*"

Table 3: Criteria for describing magnitude of effect (Roper-Lindsay et al., 2018).

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

Table 4: Criteria for describing the level of effect (Roper-Lindsay et al., 2018).

LEVEL OF EFFECT		ECOLOGICAL AND / OR CONSERVATION VALUE				
		Very High	**High**	**Moderate**	**Low**	**Negligible**
MAGNITUDE	**Very High**	Very High	Very High	High	Moderate	Low
	High	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net gain	Net gain	Net gain	Net gain	Net gain

To assess the existing ecological significance and values of the Designation Extent:

- Information was gathered from relevant published and unpublished sources through a desktop investigation.
- Field investigations were undertaken to provide further context in assessing onsite values.

3.2 Desktop investigation

The desktop investigation included a review of existing site inventories, national databases, management plans, and publicly available literature. Specific details of the material used for the desktop investigation are as follows:

i. **Terrestrial vegetation –** recent and historical aerials of the site were used (in combination with a literature search) to determine the vegetation currently present within the site, and the land use history.

ii. **Herpetofauna –** Records from the DOC administered BioWeb database were retrieved to determine the species present within the wider area. Aerials were also used to provide guidance on potential lizard habitats within the site, to be ground-truthed during field investigations.

iii. **Avifauna –** data from the Ornithological Society of New Zealand (OSNZ) bird atlas (C. J. R. Robertson et al., 2007) were used to determine the bird species recorded near the location of the Freight Hub. The OSNZ bird atlas sections New Zealand into a series of 10 km by 10 km squares, of which the Designation Extent falls within the BO74 square (see Figure 1 for extent of square). This square was used to compile a list of potential bird species that may frequent the Designation Extent and surrounds.

iv. **Freshwater environment (physical habitat, aquatic fauna) –** data from the NIWA freshwater fish database (NZFFD) and the NZ river environment classification (REC) provided information on the characteristics and potential fauna of the Mangaone Stream and its tributaries. Council data, from State of the Environment monitoring, any publicly available relevant resource consents, or other monitoring data was sought from Horizons Regional Council (but none was found). Current and historical aerials provided context regarding flow and channel paths and riparian condition over time.

3.3 Field surveys

A site walkover was undertaken on 27 and 28 July 2020 to confirm the terrestrial vegetation condition and to verify the streams and aquatic habitats (including wetlands) within, upstream, and downstream, of the Designation Extent. Terrestrial vegetation was investigated and recorded where aerials suggested some presence. The walkover allowed for the mapping and description of waterways and wetlands (as defined by the Resource Management Act 1991 (RMA)) within the Designation Extent. Not all properties in the Designation Extent were visited, as the intent was to get a general sense of the environment, and at the time of the field surveys, not all could be accessed and the full extent of the designation, including for stormwater treatment and other mitigation features, was still being developed. However, we believe the areas surveyed provide a good representation of the Designation Extent as a whole and we do not expect there to be any unseen/unvisited ecological features that would have a material effect on this ecological assessment. The following qualitative approaches were used to assist the describing and valuing of ecological aspects:

- Opportunistic recording and identification of ecological features (such as vegetation);
- Visual searches for suitable avifauna and herpetofauna habitats as a proxy for potential faunal habitation/use;
- Walking of watercourses (where accessible) and recording of typical morphological conditions/features;

- Visual identification of potential aquatic fauna habitat (such as undercut banks, substrate complexity).

For the purpose of this assessment no quantitative surveys were conducted. At the time of site visits, qualitative surveys were considered appropriate for describing and assessing the ecological value(s) of this highly modified landscape.

Terrestrial vegetation

The terrestrial vegetation and its condition were qualitatively described and recorded during the site visits. In some cases, it could only be described from afar due to access arrangements. The absence of notable and complex indigenous vegetation meant comprehensive and complete vegetation lists were not considered necessary and so not developed.

Avifauna

No specific avifauna field surveys were conducted due to a combination of lack of indigenous avifauna habitat for them and the highly modified nature of the farmland surveyed.

Herpetofauna

As with the avifauna, specific herpetofauna field surveys were not conducted based on the absence of suitable habitat within the Designation Extent (e.g. lack of refugia, food sources, etc). Given the potential for only Not Threatened[2] skink species to be present (i.e. northern grass skink) survey work would not add to the values assessment. Salvage requirements at the resource consent stage would likely require trapping effort for all species in any case. The risk of not identifying a conservation special species on site is considered very small because of the nature of the highly modified and frequently disturbed environment.

Stream habitats and morphology

Habitat characteristics were noted and described including both instream (e.g. substrate, hydraulic components) and along the banks (e.g. erosion, riparian vegetation, buffer width).

Additionally, each tributary reach and/or branch was classified as either perennial, intermittent, or ephemeral, according to the following Auckland Unitary Plan definitions (Auckland Council 2016)[3]:

i. Ephemeral stream: Stream reaches with a bed above the water table at all times, with water only flowing during and after rain events. This category is defined as those stream reaches that do not meet the definition of permanent river or stream or intermittent stream.

ii. Permanent river or stream (Perennial): The continually flowing reaches of any river or stream.

Water quality

Water quality parameters were not measured as they are not relevant to this assessment at this stage.

[2] (Hitchmough et al., 2016)

Benthic substrates

The benthic substrates were noted and described, including visual estimation of the percentage cover of each substrate size/class. No specific deposited fine sediment measures (as described in Clapcott et al. (2011)) were made due to difficulties in distinguishing unnatural fine sediment loading from the prevailing soft-bottom nature of the waterways.

Periphyton/didymo/aquatic macrophytes

While the presence and species of macrophyte was noted, no detailed periphyton or macrophyte surveys were undertaken as a winter survey does not produce meaningful results related to warm season habitat provision and issues (when macrophyte and periphyton can be problematic).

Due to the timing of the NoR process, warm-weather survey was not achievable, although it is expected to be included as part of the regional resource consenting process.

Aquatic fauna

No macroinvertebrate community samples were collected at the time of the survey due to the streams being regularly unfenced from stock (i.e. stock access to waterways was permitted) and the prevailing soft-bottom nature (fine sediments) making it possible to estimate the macroinvertebrate community composition without sampling.

No fish surveys were conducted due to the relatively uniform habitat opportunities and existing predominantly unfenced nature of the watercourse. The fish fauna that are potentially present relies on the NIWA Freshwater Fish Database and the surveyor's experience.

4.0 Description of Existing Environment

4.1 Site context

The Site falls within the Manawatu Plains Ecological District (31.01), in the Manawatu Ecological Region (31) (McEwen, 1987). This district is characterised by low altitude, loess covered plains and alluvial terraces. It has a range of soils including volcanic ash, loess, clay and peat soils. The vegetation was originally comprised of semi-swamp forest (kahikatea and pukatea) on low-lying land near rivers, totara forest in lower rainfall areas or stony soils, mixed podocarp on the plains east of the Manawatu River, as well as areas of black beech and flax swamp.

The district is now highly modified, with the majority of indigenous vegetation cleared for farming. It is currently dominated by pasture and other exotic vegetation (e.g. pine, orchards), though there remain some small, isolated areas of flax swamp, totara forests, and black beech forests.

4.2 Terrestrial environment

The terrestrial environment has been considered in terms of:

- vegetation
- avifauna; and

- herpetofauna.

4.2.1 Terrestrial vegetation

There are no features within the Designation Extent recognised by Schedule F (*Indigenous Biological Diversity)* of the One Plan which identifies rare, threatened, and at-risk habitats in the Region.

During the site walkover, only stands/pockets of exotic vegetation (e.g. pines, eucalypts) and recently planted native amenity vegetation were observed that differed from standard farming pastures and vegetation (e.g. grasses, hedgerows). The vegetation communities are described accordingly.

Native amenity plantings

The presence of notable native vegetation patches/communities is limited to sporadic and small areas of recently planted native vegetation, typically surrounding dwellings. Typically, it appeared these plantings were for landscaping rather than ecological benefit. Lemonwood, cabbage tree, manuka were the dominant species used, with flax being the common shrub-layer species. Of the observed native planting areas, they were approximately 10 or less years old (i.e. no mature patches were observed).

Exotic plantations

Small patches of pine and eucalypt plantations (woodlots) were observed throughout the proposed hub location. These monoculture areas typically did not have any native or exotic undergrowth; however, occasional ferns were observed.

Agricultural vegetation communities

The most prominent vegetation throughout the Designation Extent was species and communities commonly associated with agricultural practices. This included pasture grasses for grazing purposes, hedgerows (most commonly barberry), and shelterbelts (typically cypress species).

4.2.2 Avifauna

The OSNZ Bird Atlas has records of 27 species of bird for the 10 km x 10 km grid within which the Designation Extent falls. Of these, eight species are classified as Threatened or At-Risk[4]; these are summarised below in Table 5.

[4] (H. A. Robertson et al., 2017)

Table 5: At-Risk or Threatened species potentially present in or around the site, according to the OSNZ bird atlas.

Common name	Species name	Conservation Status (H. A. Robertson et al., 2017)
Pied Shag	Phalacrocorax varius varius	Threatened - Nationally Vulnerable
Banded Dotterel ssp	Charadrius bicinctus bicinctus	Threatened - Nationally Vulnerable
Red-billed Gull	Larus novaehollandiae scopulinus	At Risk - Declining
Australasian Pied Stilt	Himantopus h. leucocephalus	At Risk - Recovering
Black Shag	Phalacrocorax carbo novaehollandiae	At Risk - Naturally Uncommon
Little Black Shag	Phalacrocorax sulcirostris	At Risk - Naturally Uncommon
Australian Coot	Fulica atra australis	At Risk - Naturally Uncommon
Black-fronted Dotterel	Charadrius melanops	At Risk - Naturally Uncommon

The Threatened and At Risk species are all associated with the larger rivers (Manawatu) or lake and other larger waterbodies and their edges (i.e. dotterel, coot, pied stilt, red-billed gull, and shags). Aerials of the Site do not show any suitable nesting or staging habitat for these species making it unlikely these species frequent the Bunnythorpe farmlands (although some might alight here occasionally).

The Not Threatened indigenous and Introduced and Naturalised exotic species[5] present or likely to be present (those common to highly modified agricultural landscapes in the Manawatu), include:

- Finches (gold, green, chaffinch)
- Red poll
- Magpie
- House sparrow
- Hedge sparrow/dunnock
- Paradise shelduck
- Australasian harrier
- Pukeko
- Spur-winged plover
- Welcome swallow
- Silvereye

[5] (H. A. Robertson et al., 2017)

- Feral turkey
- Yellowhammer
- Song thrush
- Black bird
- Starling
- Skylark
- Rook
- Myna

The only natives likely to use pastural habitats (though not necessarily as primary habitat) include silver eye, pukeko, harrier, plover, and kingfisher. Unusually, pipit (At Risk - Declining), which is known to frequent open pasture habitats, has not been recorded at the Site.

4.2.3 Herpetofauna

To capture any lizards that may be present within the surrounding landscape, herpetofauna records within a 30 km radius of the Designation Extent were retrieved from the DOC herpetofauna database (BioWeb). Eight species of native lizard have been recorded within this area and are described below in Table 6.

Table 6: Native lizards recorded within 30 km of the study area.

Common Name	Scientific Name	Conservation Status[6]	Habitat Preferences	Functional group
Northern grass skink	*Oligosoma polychroma*	Not Threatened	Dry open areas with low vegetation or debris such as logs or stones for cover.	Terrestrial skink
Glossy brown skink	Oligosoma zelandicum	At Risk - Declining	Forest, scrub, grassland and boulderfields.	Terrestrial skink
Ornate skink	Oligosoma ornatum	At Risk - Declining	Forest and shrublands with damp leaf litter or rocks/logs	Terrestrial skink
Raukawa gecko	*Woodworthia maculata*	Not Threatened	Forest, scrub, grassland, boulderfields and coastal areas.	Terrestrial/arboreal gecko
Pacific gecko	Dactylocnemis pacificus	At Risk - Relict	Forest, scrub, grassland, boulderfields and coastal areas.	Terrestrial/arboreal gecko
Forest gecko	Mokopirirakau granulatus	At Risk - Declining	Forest and scrub, especially kanuka / manuka, and creviced clay banks	Arboreal gecko

[6] (Hitchmough et al., 2016)

Common Name	Scientific Name	Conservation Status[6]	Habitat Preferences	Functional group
Ngahere gecko	*Mokopirirakau* "Southern North Island"	At Risk – Declining	Forest and scrub, especially kanuka / manuka, and creviced clay banks	Arboreal gecko
Barking Gecko	*Naultinus punctatus*	At Risk – Declining	Forest and scrub, especially kanuka / manuka.	Arboreal gecko

Five species of exotic/invasive herpetofauna were also recorded on the BioWeb database, including three species of frog and two species of lizard.

During the site walkover on 27 and 28 July, no suitable habitat for geckoes or forest floor-dwelling skinks was observed. It is considered unlikely any species other than the Not Threatened northern grass skink reside within the Designation Extent.

4.3 Aquatic environment

The aquatic environment has been considered in terms of:

- Wetland environments; and
- Stream environments

4.3.1 Wetland environments

No wetland habitats were observed in areas that could be accessed during the site walkover. This includes wetlands as defined in Schedule F of the One Plan, or as defined in the RMA and the recently operative National Policy Statement for Freshwater Management 2020 (NPS-FM (2020)).

4.3.2 Stream environments

The Mangaone Stream is recognised in the One Plan's schedule B (Surface water management values) (denoted on Figure 1). It is divided into two sections/reaches, including the Upper Mangaone (from Milson's Line upwards) and the lower Mangaone (from the Manawatu to Milsons line). Schedule B does not highlight them as holding ecological values (i.e. no sites of significance for aquatic or riparian, no inanga spawning, and significance for trout). However, it retains capacity to assimilate pollution, and its life supporting capacity is that of a lowland mixed.

The Mangaone Stream originates north of Bunnythorpe and discharges into the Manawatu River main stem just south of the Palmerston North landfill. Much of its lower reaches are in urban landscapes and most of its upper reaches are in hill country agriculture. The rest is in lowland farmland.

There are two unnamed stream systems that flow through the Designation Extent (Figure 2). The stream systems typically flow in an east-west direction before draining into the Mangaone Stream. The stream systems are described below.

Stream system 1

Stream system 1 includes three branches of the system that merge into a single central channel near Te Ngaio Road (Figure 2). In total, there is approximately 2,352 linear m of stream channel in Stream system 1 that falls within the Designation Extent. In locations where the branches could be accessed, they all resembled ephemeral flow paths with no active beds and no defined channels and/or banks. Best access was gained along the branch that runs near parallel with Te Ngaio Road.

The stream was a shallow "u"-shaped channel with terrestrial/pasture grasses common throughout the channel. There was no discernible flow at the time of survey on 27 and 28 July 2020. Historical stock access was evident with no defined bank and it was pugging throughout. However, some sections have a newly installed (<2 years) fence set back from the stream approximately 1 m on each side and that may improve aspects into the future (Figure 2). The occasional open-water pools which had established near small farm culverts and crossings were typically free of macrophytes suggesting these frequently dry out.

Access was not granted to the other branches of the stream system (Figure 2) meaning observations could only be made from afar. There were no obvious features present which suggested these branches would be materially different to the surveyed branch.

The single, central channel downstream of Te Ngaio Road could not be accessed for survey. This channel was noted to be a modified channel, with oxbows that were apparent on aerial photographs as having been straightened.

Image 1: Ephemeral flow path within stream system 1 near Te Ngaio Road. Note the fencing either side of the stream has been in place <2 years.

Image 2: Ephemeral flow path immediately upstream of Clevely Line. Note the ponding upstream of the small culvert.

Stream system 2

Northern tributary

The northern tributary (Figure 2) of the Mangaone Stream catchment comprises a single channel which is approximately 835 m long that flows through the central portion of the Designation Extent. It is soft-bottomed throughout and typically comprises slow run habitat. Some incision was evident in the lower reaches (>0.5 m in places) which was also fenced to exclude stock. The middle and upper portions of the stream was unfenced meaning shallow, pugged banks dominated. Macrophytes (predominantly water pepper (*Persicaria hydropiper*)) were mostly found in the lower reaches which also had some riparian vegetation. That vegetation was predominantly flax (*Phormium tenax*) and has been planted throughout the lower reaches. However, where present, the riparian vegetation lacked the complexity needed to provide material benefits to the stream (other than serve as a barrier to stock). The stream typically varied between 0.5-1 m wide in the lower reaches before becoming more homogenous in the middle and upper reaches (typically 0.5 m wide). Depth varied between 30 cm and 60 cm throughout the surveyed and accessible reach(es).

Image 3: Downstream extent of the northern tributary within stream system 2 which may be impacted. Note it is largely unfenced and unvegetated, though some small, isolated patches of vegetation do exist.

Image 4: Typical upper reach of the northern tributary of stream system 2. Note the absence of riparian vegetation and fencing.

Northern tributary - upstream habitat

Upstream of the Designation Extent, where visited (Figure 2), the northern tributary of stream system 2 resembles an incised (> 1m high banks) and straightened channel which was fenced (fence typically 1 m from bank edge) to exclude stock. Riparian trees were limited to planted pine groves; however, rank vegetation (primarily rank pasture grasses with scattered juncus and sedge) along the banks did provide some fish cover, and slumping banks added further cover and

complexity. Where vantage was gained, water depth appeared to vary between 30 cm and 50 cm, and the wetted width ranged between 0.5-1 m. At the time of survey on 27 and 28 July 2020, there was no discernible flow.

Image 5: Northern tributary of stream system 2, upstream of the Designation Extent. Note the artificially incised and straightened nature of the channel. However, the incision provides some shading and the stream is largely fenced throughout.

Image 6: Open channel section of the Northern tributary, upstream of the Designation Extent, with negligible flows.

Southern tributary

The southern tributary of stream system 2 (Figure 2) is a shallow, ephemeral flow path that was dry at the time of survey on 27 and 28 July 2020. Approximately 590 linear meters of this stream channel is within the Designation Extent. This watercourse better resembled a roadside drainage system that had pasture grasses planted throughout. The absence of any aquatic habitat or features meant no physical habitat assessment was completed for the potentially affected reach.

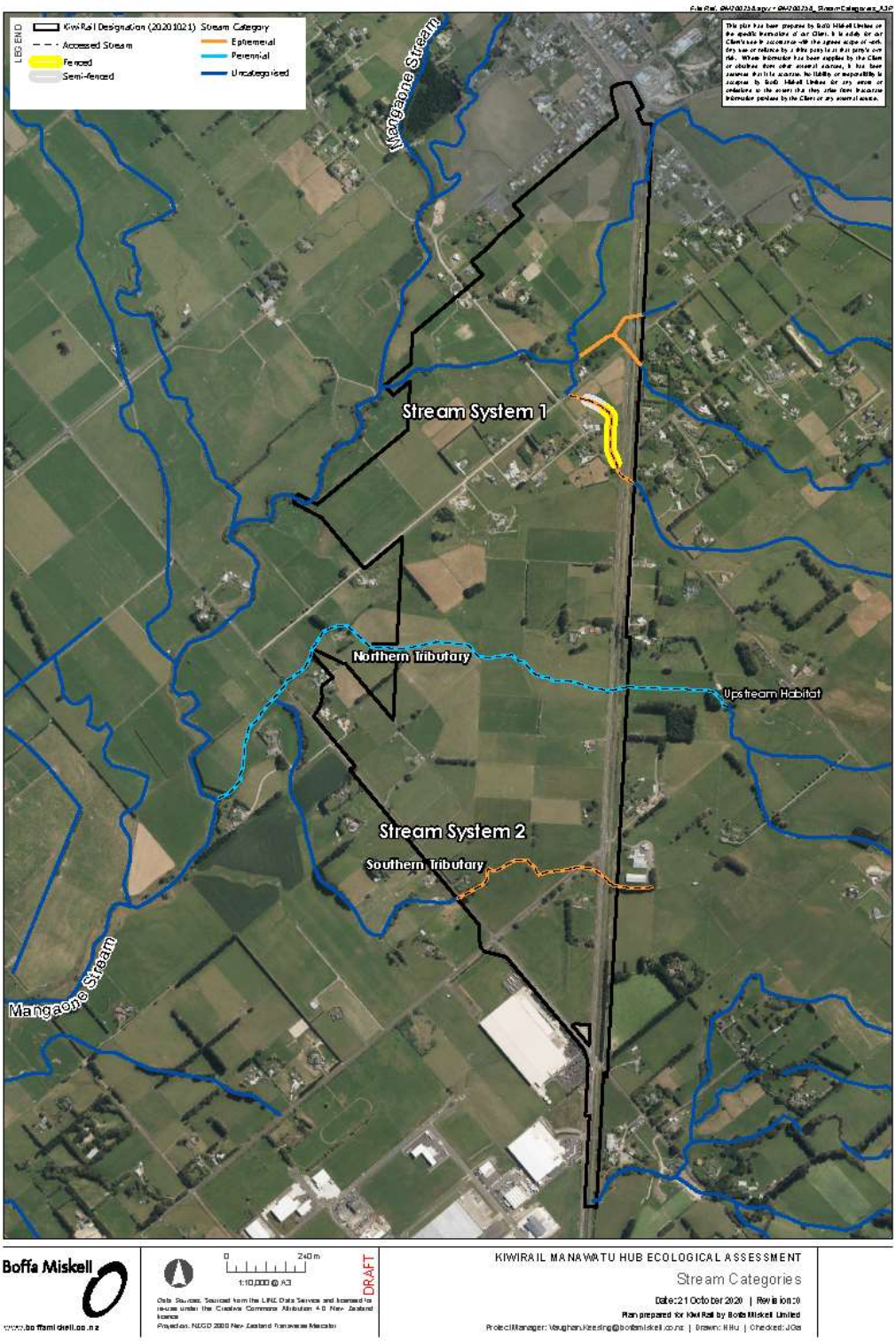

Figure 2: Map showing the location and the nature of flows within each stream system. The dotted lines denote stretches of stream which were accessible at the time of visit.

4.4 Aquatic fauna

The NIWA administered New Zealand Freshwater Fish Database (NZFFD; accessed 27/08/2020) shows 10 species of freshwater fish have been recorded in the Mangaone Stream catchment, including six indigenous species and four introduced species (Table 7). Additionally, the NZFFD allows for records of freshwater crayfish, mussel, and shrimp observations, of which all have been recorded in the catchment.

The ephemeral nature of Stream 1 and the southern tributary of Stream system 2 make it unlikely any of the recorded species in the Mangaone Stream catchment reside in these streams. However, there is the potential that eels may utilize Stream 1 during wet periods for foraging purposes.

The lower third of Stream 2 contained suitable fish cover. However, the habitat quality meant it is likely only eels and possibly common bully reside within it. Conversely, the upper two thirds did not provide much, if any, fish cover due to the absence of fencing, lack of stream shading, pugged and homogenous banks, and absence of instream complexity. This section of the stream is likely only used as a passageway to better habitat upstream (although that too is in a similar land use), whilst providing no respite for fish as they migrate. As such, this section is unlikely to contain a stable fish community. Furthermore, the prevalence of stock access is likely to preclude the establishment of a freshwater mussel community.

Fish habitat and cover is provided upstream of the Freight Hub in the northern tributary of Stream 2. The nature and condition of Stream 2 at this location makes it suitable for eels, common bully, and potentially inanga (assuming there are no downstream barriers). Though banded kokopu have not been recorded in the Mangaone Stream, the stretch of the northern tributary of Stream system 2, upstream of the proposed hub also provides suitable habitat for them should they be within the catchment.

Table 7: New Zealand Freshwater Fish Database records for the Mangaone Stream catchment (database accessed 27/08/2020). Fish conservation status from (Dunn et al., 2018). Invertebrate conservation status from (Grainger et al., 2018).

Common name	Scientific name	Conservation status	Number of records	Potentially present
Shortfin eel	*Anguilla australis*	Not Threatened	8	√
Longfin eel	*Anguilla dieffenbachii*	At Risk - Declining	3	√
Inanga	*Galaxias maculatus*	At risk - Declining	2	√
Upland bully	*Gobiomorphus breviceps*	Not Threatened	1	√
Common bully	*Gobiomorphus catidianus*	Not Threatened	6	
Common smelt	*Retropinna retropinna*	Not Threatened	1	
Freshwater mussel	*Echyridella menziesii*	At Risk - Declining	2	
Koura (freshwater crayfish)	*Paranephrops spp.*	Not Threatened[7]	4	√

[7] Based on geographical context, it is highly likely any crayfish within the catchment are the Not Threatened *Paranephrops planifrons*, rather than the At Risk – Declining *Paranephrops zealandicus*.

Common name	Scientific name	Conservation status	Number of records	Potentially present
Freshwater shrimp	*Paratya curvirostris*	Not Threatened	3	
Gambusia	*Gambusia affinis*	Introduced and naturalised	1	
Goldfish	*Carassius auratus*	Introduced and naturalised	4	
Perch	*Perca fluviatilis*	Introduced and naturalised	1	
Brown trout	*Salmo trutta*	Introduced and naturalised	3	

4.5 Macroinvertebrate community

The dominance of fine sediments, sporadic macrophytes, prevalence of stock access, and limited flows with long, slow runs strongly supports the presence of a tolerant (i.e. non sensitive) macroinvertebrate community. Therefore, community is expected to be mainly comprised of snails, true fly larvae, copepods, amphipods, worms and mites, and hemiptera. These types of slow, soft bottomed, agricultural-based streams typically have an MCI around 70-90 and a QMCI 3-4. These indices values are indicative of poor-fair water quality and/or polluted systems (Stark & Maxted, 2007). Potamopyrgus and Physa snails are usually numerically dominant along with Chironomus species, black fly (Austrosimulium), Tanypodinae, Culex, water beetles (Rhantus, Dytisicade) damselfly's (Xanthocnemis), and true bugs (Microvelis, Sigara). There will be very limited sensitive EPT (Ephemeroptera, Trichoptera, Plecoptera) species, with likely no stonefly and one or two caddisfly (most likely Aoteapsyche and Pycnocentrodes). It will be a pollution-tolerant, soft bottomed, depauperate, drying-resilient community of "low" representative value.

5.0 Ecological values

5.1 Terrestrial environment

The ecological value of each terrestrial unit or feature is assessed and determined according to the EIANZ 2018 (Roper-Lindsay et al., 2018) guidelines (described in Section 3.1 above) and presented individually below.

5.1.1 Terrestrial vegetation communities

Vegetation community	Description	Attribute values	Overall value
Native amenity plantings	**Representativeness** – The planted vegetation is not representative of historic vegetation communities. **Rarity and distinctiveness** – There are no rare or distinct species or communities. While the LENZ (Landcare Research Ltd, 2012) layer shows that there is less than 10% indigenous habitat remaining on this land class and indigenous vegetarian on this land system can be considered "rare", the planting is not representative of a natural early succession and cannot, as yet, be considered in this way. **Diversity and pattern** – These communities had low diversity and limited pattern. **Ecological context** – The amenity plantings are small and sporadic across the landscape and typically associated with a dwelling. Because these communities are induced, they are expected to be tolerant and resilient but do not provide a material ecological benefit to the landscape.	**Representativeness** – Negligible **Rarity and distinctiveness** – Negligible **Diversity and pattern** – Low **Ecological context** – Negligible	Negligible
Exotic plantations	**Representativeness** – These are not representative. **Rarity and distinctiveness** – They are not rare or distinct communities. **Diversity and pattern** – These are monoculture communities. **Ecological context** – These areas are often the only patches of dense, tall, mature vegetation within the landscape and may provide shelter and stepping-stones for some fauna.	**Representativeness** – Negligible **Rarity and distinctiveness** – Negligible **Diversity and pattern** – Negligible **Ecological context** – Moderate	Negligible

Vegetation community	Description	Attribute values	Overall value
Agricultural vegetation	**Representativeness** – These are not representative. **Rarity and distinctiveness** – They are not rare or distinct communities. **Diversity and pattern** – These communities had low diversity and limited pattern beyond what is expected for agricultural pasture mixes and little ecological value in the 'pattern' that is present. **Ecological context** – These communities are designed to support agricultural/farming practices; therefore, they do not add to the wider ecological context across the landscape.	**Representativeness** – Negligible **Rarity and distinctiveness** – Negligible **Diversity and pattern** – Low **Ecological context** – Negligible	Negligible

5.1.2 Avifauna

No specific conservation-valued species appear in records or were observed during the site visit and it is unlikely that there are any values associated with indigenous avifauna on site. Therefore, overall, the avifauna community and all species within it are considered to have, at most, **low** ~~**negligible**~~ **ecological value**.

5.1.3 Herpetofauna

It is highly unlikely that any Threatened or At Risk lizard species are present within the Designation Extent. However, there may be some (but in very low numbers if so) Not Threatened species. Therefore, overall, the herpetofauna community and all species within it are considered to ~~have~~ have **low**~~**negligible**~~ **ecological value**.

5.2 Aquatic environment

The following sections assess and determine the ecological values of each surveyed stream system using the criteria outlined in the EIANZ guidelines (Roper-Lindsay et al., 2018) (as outlined at Section 3.1 above). The values assessments are provided in table format to align with the criteria in the EIANZ guidelines and allow for corresponding dialogue.

Stream system 1

Criteria	Assessment	Value
Representativeness	This system, where observed, was indicative of a highly modified, ephemeral flow path.	Negligible
Rarity and distinctiveness	There were no rare or distinct features of this stream and it is unlikely to support threatened or at risk fish species.	Low
Diversity and pattern	When flowing, the stream system is likely dominated by run habitats with no instream or bankside diversity/complexity. There are limited habitat opportunities for macroinvertebrates and less so for fish due to it being ephemeral.	Low
Ecological context	Historic land clearance surrounding the reach to facilitate ongoing farming practices. Stock can access the stream in large parts and any fencing is resent (<2 years). Any riparian tree vegetation is sporadic and does not provide any functional benefit to the stream system. Terrestrial/pasture grasses frequently grew within the stream channel.	Low
Ecological integrity	Nativeness – expected depauperate macroinvertebrate community, which is indicative of ephemeral conditions, no resident stable fish populations expected (though some eels may forage in system when wet) - Low Pristineness – heavily farmed and modified – Very low Diversity – lack of diversity – Very low Resilience – extensive stock access and land clearance, with corresponding effects on the stream – Very low	Negligible
OVERALL ECOLOGICAL VALUE		**Low**

Stream system 2

Northern tributary – within Designation Extent

Criteria	Assessment	Value
Representativeness	This system, where observed, was indicative of a highly modified, stream which is heavily impacted by surrounding farming practices. In places, it has also been straightened.	Low
Rarity and distinctiveness	There were no rare or distinct features of this stream, though it may support a small population of the At Risk longfin eel (as well as shortfin eel and common bully) in the lower reaches. There are not expected to be any resident stable fish populations throughout the middle and upper reaches.	Low
Diversity and pattern	The stream system is dominated by slow run habitats with a predominantly homogenous bank and benthos. The macroinvertebrate community is expected to resemble, and be tolerant of, a degraded, soft-bottom system. Habitat opportunities for fish are limited to the downstream portion.	Low
Ecological context	Historic land clearance surrounding the reach to facilitate ongoing farming practices. Stock can access the stream in large parts and any fencing is limited to the downstream reach. Riparian vegetation is absent throughout the middle and upper reaches, and largely limited to flax-dominated vegetation in the lower reaches. The middle and upper reaches are expected to provide passage to better upstream opportunities rather than encourage fish to reside within these areas.	Moderate

Criteria	Assessment	Value
Ecological integrity	Nativeness – expected depauperate macroinvertebrate community, which is indicative of degraded and soft-bottom conditions, no resident stable fish populations expected (though some eels and common bully may reside in the lower portion) - Low Pristineness – heavily farmed and modified – Very low Diversity – lack of diversity – Low Resilience – extensive stock access and land clearance, with corresponding effects on the stream, through flows are permanent – Low	Low
OVERALL ECOLOGICAL VALUE		**Low**

Northern tributary – upstream of Designation Extent

Criteria	Assessment	Value
Representative ness	This system, where observed, was indicative of a highly modified, stream system which was artificially incised and straightened.	Low
Rarity and distinctiveness	There were no rare or distinct features of this stream; however, it may support threatened or at risk fish species.	Low
Diversity and pattern	Typically, the stream is a slow-flowing run habitat with some bank slumping and overhanging vegetation providing complexity and fish cover. There is some opportunity for fish habitation (more so than the aquatic environments within the proposed hub location) but limited habitat opportunities for sensitive macroinvertebrates.	Low
Ecological context	Historic land clearance surrounding the reach to facilitate ongoing farming practices and artificial incising and straightening. No stock access within observed locations. Riparian vegetation limited to rank grasses and shrubs which main benefit would be shade and cover provision. However, this reach provides the only permanent habitat for fish.	Moderate
Ecological integrity	Nativeness – expected depauperate macroinvertebrate community, but likely resident stable fish populations – Low Pristineness – heavily farmed and modified – Very low Diversity – lack of diversity – Low Resilience – extensive land clearance, with corresponding effects on the stream, though stock are excluded – Moderate	Low
OVERALL ECOLOGICAL VALUE		**Low**

Southern tributary

As stream 3 was a dry, ephemeral flow path at the time of survey it does not warrant a full assessment of aquatic ecological values. The absence of aquatic habitat means its only aquatic value is as a contributing hydrological flow path to downstream aquatic environments. As such, it has **Negligible aquatic ecological value**.

Aquatic fauna

The aquatic habitats present hold little capacity for indigenous flora and fauna and are not representative of naturally occurring indigenous systems; however, they are likely to contain eel and koura (longfin eel is technically an *At Risk- Declining* species). The values and conditions of the

existing aquatic systems do not suggest that there is a strong requirement to protect or retain any, or all, of the tributaries present.

5.3 National and Regional Policy Documents

National and regional policy documents should be considered when assessing the ecological effects of a proposal as these documents provide the criteria and definitions that, in part, determine what effects may be appropriate, or otherwise, for any given region. These are considered and commented on below.

National Policy Statement for Freshwater Management 2020 (NPS-FM (2020))

The NPS-FM (2020) places new emphasis on aquatic ecosystems and on the importance of freshwater. Of particular relevance, Policy 7 directs that the loss of extent of river and values is avoided to the extent practicable, and Policy 9 directs that the habitat of indigenous freshwater species are protected. The NPS-FM (2020) will be particularly relevant to consider as part of the regional resource consenting process.

National Environmental Standards for Freshwater 2020 (NES-FW (2020))

The NES-FW (2020) describes (among other things) what is expected when dealing with the potential fish passage effects/impediments from the placement of certain structures in, on, over, or under the bed of waterways and connected areas. It includes conditions for the placement of certain structures which, when followed, become permitted activities. If these conditions are met, then there are not expected to be any fish passage issues once the Freight Hub is operational.

Regional Policy Statement – The One Plan

The One Plan (Chapter 5, Policy 5-23) requires that if natural states[8] and sites of significance (including cultural or aquatic) are present / found then an activity should avoid adverse effects to those values or features. The aquatic environment within the Designation Extent is not considered to be in a natural state or a site of significance.

5.4 Summary of ecological values on site

- Terrestrial environment
    - Vegetation – **Negligible**
    - Avifauna habitat – **Negligible**
    - Avifauna species (indigenous) – ~~**Negligible**~~ **Low**
    - Avifauna species (introduced) - **Negligible**
    - Herpetofauna habitat – **Negligible**

[8] Natural state is defined in the One Plan as being *All sections of rivers and their beds that have sources in, and flow within, the Public Conservation Land (land held under the Conservation Act 1987 or administered by the Department of Conservation), with the exception of those where damming or diversion have significantly affected the natural state of the water.*

- Herpetofauna species - ~~Negligible~~Low

- Aquatic environment
  - Wetlands – None ~~present~~ identified
  - Aquatic habitat
    - Stream system 1 – **Low**
    - Stream system 2 (Northern tributary) – **Low**
    - Stream system 2 (Southern tributary - **Negligible**
  - Aquatic fauna
    - Longfin eel (small possibility and in low numbers) – **High** (due to At Risk – Declining conservation status)
    - All other potential indigenous fauna ~~– **Negligible**~~ – **Low** (due to Not Threatened conservation status)
    - All other potential introduced fauna – **Negligible**

6.0 Assessment of potential ecological effects

This section provides an assessment of the ecological effects of the NoR to inform an overall assessment of the Freight Hub's potential effects. KiwiRail is currently seeking an NoR to designate land for the Freight Hub. As such, detailed design of the Freight Hub has not yet been undertaken and required regional resource consents will be sought at a later stage.

The type (and magnitude) of effects may change with refinements and further detail guiding the final design of the Freight Hub and proposed construction methods. For the purposes of this assessment, we have assessed the likely ecological effects based on a conservative assessment of the Freight Hub from the concept design for the NoR.

Activities and ecological effects associated with the operation of the proposed Freight Hub, within or adjacent to the Site, are likely to include:

- Vegetation clearance/loss;
- Loss of avifauna and herpetofauna habitat;
- Stream loss;
- Introduction of barriers to fish passage;
- Earthworks sediment related discharges to water; and
- Discharge of stormwater (operational).

Specific construction effects have not been included as part of this assessment (e.g. effects from the construction of a haul road(s), laydown areas, and other associated infrastructure or specific sites), other than to mention that there are likely to be earthworks and sediment related discharges to water. These effects will be considered at the regional resource consenting stage.

The following subsections first present the relevant overall ecological effect by way of highlighting i. the ecological value (as summarised in Section 5.0), ii. the expected magnitude of effect (i.e. the scale), and iii. the expected overall level of ecological effect. A justification for the corresponding assessment is then provided.

6.1 Vegetation clearance & Loss of avifauna and herpetofauna habitat

i. The terrestrial vegetation and fauna all have, at most, ~~**negligible**~~ **low** **ecological value**.

ii. The effects on these features are expected to have a **low magnitude of effect**.

iii. Therefore, the proposed Freight Hub is expected to have an **overall very low level of ecological effect** on these features.

Given the largely exotic nature of the vegetation, the absence of indigenous habitat or particularly functional riparian vegetation, and, where there are some areas of indigenous vegetation, the simple species richness and young age of that indigenous planting, (notwithstanding the general absence of indigenous species), the overall values are, as a whole, Negligible. The magnitude of the proposed clearance, even if the entire site platform was cleared, would be at most **Low**. This is because any changes that are expected result in a no more than minor shift from the existing baseline within the wider landscape. The change will be discernible at the local level but will not change the underlying character, nature or the resource base of the local fauna and will not affect local populations of lizards, birds, insects.

A Negligible value and a low magnitude of effect results in a Very Low level of ecological effect on the terrestrial vegetation and fauna which typically does not require any form of mitigation response.

6.2 Stream loss

We assess the magnitude of stream loss in relation to the linear length of mapped stream within each tributary catchment they are associated with, and then as part of the wider Mangaone Stream catchment. The following summarises these losses and the magnitude of the loss:

Stream system 1

i. Stream system 1 has **low ecological value**.

ii. The effect of stream loss on the stream system 1 catchment is considered to be a **low magnitude of effect**.

iii. Therefore, the proposed Freight Hub is expected to have an **overall very low level of ecological effect** on stream system 1.

Approximately 2,352 linear meters of ephemeral stream is expected to be lost within stream system 1. Using GIS, the stream system 1 catchment contains approximately 20,180 linear meters of stream (much of which is expected to be ephemeral). This equates to a linear loss of approximately 12% of stream length. This is considered a **Low Magnitude of Effect** (very slight change from the existing baseline condition).

Stream system 2

Northern tributary:

i. The northern tributary of stream system 2 has **low ecological value**.

ii. The effect of stream loss on the stream system 1 catchment is considered to be a **low magnitude of effect**.

iii. Therefore, the Freight Hub is expected to have an **overall very low level of ecological effect** on the northern tributary of stream system 2.

Southern tributary:

i. The southern tributary of stream system 2 has **negligible ecological value**.

ii. The effect of stream loss on the stream system 1 catchment is considered to be a **low magnitude of effect**.

iii. Therefore, the Freight Hub is expected to have an **overall very low level of ecological effect** on the southern tributary of stream system 2.

Northern tributary – Approximately 835 linear meters of the perennial northern tributary is expected to be lost within stream system 2. Using GIS, the stream system 2 catchment contains approximately 21,390 linear meters of stream (some of which is expected to be ephemeral). This equates to a linear loss of approximately 4% of stream length. This is considered a **Low Magnitude of Effect** (very slight change from the existing baseline condition).

Southern tributary - Approximately 590 linear meters of the ephemeral/watershed northern tributary is expected to be lost within stream system 2. Using GIS, the stream system 2 catchment contains approximately 21,390 linear meters of stream (some of which is expected to be ephemeral). This equates to a linear loss of approximately 3% of stream length. This is considered a **Low Magnitude of Effect** (very slight change from the existing baseline condition).

Overall - approximately 1,425 linear meters of stream system 2 is expected to be lost. Using GIS, the stream system 2 catchment contains approximately 21,390 linear meters of stream (some of which is expected to be ephemeral). This equates to a linear loss of approximately 7% of stream length. This is considered a **Low Magnitude of Effect** (very slight change from the existing baseline condition).

Mangaone Stream catchment

i. In combination, the streams within the Freight Hub are considered to have **low ecological value**.

ii. The effect of stream loss on the wider Mangaone Stream catchment is considered to be a **negligible magnitude of effect**.

iii. Therefore, the Freight Hub is expected to have an **overall very low level of ecological effect** on the wider Mangaone Stream catchment.

The overall loss of approximately 3,777 linear m of stream habitat equates to <1% of GIS mapped linear stream length in the wider Mangaone Stream catchment (approximately 456,100 linear meters of stream). This is considered a **Negligible Magnitude of Effect** (negligible change from the existing baseline condition).

Stream	Stream system/catchment	Magnitude	Value	Overall level of effect
1	1	Low	Low	**Very Low**
2 – Northern tributary	2	Low	Low	**Very Low**
2 – Southern tributary	2	Low	Negligible	**Very Low**
Combined	Mangaone Stream	Negligible	Low	**Very Low**

6.2.1 Fish passage impediment

Correct culvert installation:

i. The northern tributary of stream system 2 is the only section with upstream perennial fish habitat – this tributary has **low ecological value**.

ii. Correct installation of culverts will have a **positive magnitude of effect**.

iii. Therefore, correct installation of culverts in the northern tributary of stream system 2 will have an **overall net gain ecological effect** for upstream fish populations.

Incorrect culvert installation:

i. The northern tributary of stream system 2 is the only section with upstream perennial fish habitat – this tributary has **low ecological value**.

ii. Incorrect installation of culverts will have a **high magnitude of effect**.

iii. Therefore, correct installation of culverts in the northern tributary of stream system 2 will have an **overall low level of ecological effect** for upstream fish populations.

Culverts can impede migrating fish if installed incorrectly, potentially rendering upstream habitats inaccessible, with a corresponding eventual decline in the pre-existing upstream fish population. This is only of concern where a culvert is installed in a perennial section of stream which has upstream fish habitat, and/or where fish passage is already provided for through an existing culvert that will be upgraded as part of this project. This is of particular concern where the upstream habitats are more suited to fish habitation than the sections of stream that will be lost. Furthermore, if installed correctly, the piping of the streams may actually improve fish passage as

the pipe could provide a less stressful route than currently exists within the unshaded, unfenced, homogenous Stream 2.

If installed incorrectly, the impediment to migrating fish will have a high magnitude of effect in the long term. A high magnitude of effect on the low value Stream 2 system results in a **Low level** of effect.

If installed correctly (which is realistic given the location and terrain), the improvement in conditions for fish migrating to the better upstream habitat will have a positive magnitude of effect (acknowledging the section being lost does not provide suitable fish habitat or cover in and of itself). A positive magnitude of effect, regardless of the value of a system, results in a **Net Gain** level of effect when considering the upstream stream environment.

6.2.2 Erosion and sedimentation

i. The stream systems have **negligible of low ecological value**.

ii. The effect on the stream systems is expected to have a **low magnitude of effect**.

iii. Therefore, any erosion and/or sedimentation resulting from the Freight Hub is expected to have an **overall very low level of ecological effect** on the stream systems.

Earthworks over the site have the potential to temporarily reduce the water quality of the surrounding waterways, including the Mangaone Stream through erosion and sediment runoff. At this stage, erosion and sediment control measures have not been developed, and further detail will be provided as the project progresses. However, it is assumed the streams under the proposed Freight Hub will be piped prior to substantial earthworks occurring. In our experience, the magnitude of effect on aquatic ecological values from erosion and sedimentation is likely to be low against the background soft-bottom condition of the watercourses, even in a worst-case scenario where a substantial amount of sediment may be discharged. A low magnitude of effect on these negligible and/or low value systems will result in an overall **Very Low level of effect**.

6.2.3 Stormwater discharge

i. The stream systems have **negligible or low ecological value**.

ii. The effect on the stream systems is expected to have a **negligible magnitude of effect**.

iii. Therefore, stormwater discharged from the Freight Hub is expected to have an **overall very low level of ecological effect** on the stream systems.

Stormwater entering the waterways from the completed development (operational phase effect) has the potential to reduce the water quality of the watercourses across the Site through the input of impermeable roading and rail contaminants (e.g. copper, lead, zinc, hydrocarbons). This effect is still speculative (as detailed design has not yet been undertaken), as the surface area delivering potential contaminants is relatively small, and treatment methods that eventually get developed will likely alter this assessment.

At this stage, and as set out in further detail in the Stormwater Assessment, the stormwater treatment measures have not been detail-designed (but rather an assessment has been

undertaken to determine the area of 'land' needed to treat the expected stormwater run-off quantums). Further detail will be provided as the project progresses. However, we have assumed, stormwater from the final Freight Hub development will be treated using a combination of bio-retention devices such as treatment wetlands and swales before being discharged into adjacent waterways. There is reasonable evidence that these systems supply a treatment effect of around 70% (Birch *et al*. 2005; Maine *et al*. 2006). We also note, the development of the Freight Hub may reduce the amount of nutrients (that are commonly associated with farming practices) currently entering waterways across the Site.

The magnitude of effect on aquatic ecological values from stormwater discharge is predicted to be negligible, provided the stormwater treatment systems are designed to treat stormwater to the relevant rules and standards outlined in the Horizons One Plan. A negligible magnitude of effect on a negligible or low value system will have a **Very Low** overall level of effect.

6.3 Summary of overall level of effects

- Terrestrial environment
    - Vegetation clearance/loss – **Negligible**
    - Avifauna habitat loss – **Negligible**
    - Herpetofauna habitat loss – **Negligible**
- Aquatic environment
    - Wetlands – None identified~~present~~
    - Stream loss – **Very Low**
    - Fish passage impediment (if structures poorly installed) – **Low**
    - Erosion and sediment discharges – **Very Low**
    - Stormwater discharges (assuming appropriate management) – **Very Low**

7.0 Recommendations

The terrestrial and aquatic ecological values present and potentially affected are negligible and/or low, with minimal indigenous representative value and little functional value in the wider landscape (which is largely devoid of these values). However, recommendations are provided below to help minimise and mitigate for the losses, nonetheless. If these recommendations are implemented, all ecological effects are expected to be negligible (i.e. no more than a very slight shift from the baseline/current condition).

7.1 Terrestrial environment

- The clearance of vegetation (irrespective of the type) has little functional consequence and the level of effect does not suggest any requirement to avoid any vegetation areas or necessitate remediation or offsetting.
- Lizards will require salvage (as required under the Wildlife Act 1953) irrespective of which species are present. This process ensures all practicable steps are taken to minimise lizard mortality. Appropriate permits (DoC) are required to handle/salvage and relocate lizards.
- Pre-clearance checks should be undertaken for nesting indigenous avifauna in vegetation, irrespective of their threat classification (due to their protection under the Wildlife Act 1953). If found, measures will be put in place to ensure the nest is not disturbed with exclusion zones established, and clearance delayed within that zone.

7.2 Potential natural wetland environment

- Confirm the presence or absence of natural inland wetlands in sites within the designation extent that have not been able to be accessed, so that the potential effects can be assessed at the regional consenting stage.
- Manage any potential ecological effects so that Policy 6 of the NPS-FM is achieved by utilising the 'effects management hierarchy' as defined in the NES-FW.

~~7.2~~7.3 Stream environment

- To minimise the effects on any resident fish, efforts should be made to salvage and relocate fish to areas of suitable refugia outside of the affected areas prior to any works occurring within the stream environment(s).
- Aquatic habitat loss, given the values present and the magnitude of the effect, in and of itself does not warrant avoidance. The replacement of equal or better value/quality open-channel aquatic habitats is not required (by effect level One Plan policy, or NPS-FW policy) to offset the loss (assumed by piping) of 3,777 m of negligible to low value/quality aquatic habitat. However, the continuing loss of waterways in catchments are what leads to increased flood and water quality issues as well as the wider diminishing of aquatic habitat availability. That said, we recommend that alternative replacement aquatic habitat, even of a simple form, be dug around the Freight Hub, where possible and practicable, to collect and convey stormwater and provide replacement aquatic habitat. This may not be possible for the Northern tributary of stream system 2; however, the proposed provision of an open stream channel along the northern edge of the Freight Hub will reduce the overall quantum of lost open stream habitat.
- To ensure fish passage/access to upstream habitats is retained, we recommend that any pipes and culverts installed in the northern tributary of stream system 2 allow for unimpeded fish passage/access to upstream habitats (in essence, according to Part 3 (*Standards for other activities that relate to freshwater*) - Subpart 3 (*Passage of fish affected by structures*) of the NES-FW). Therefore, the entrance and exit detailing, width,

depth, and gradient of any culverts should be carefully considered so that swimming fish can readily pass through.

- Where best practice sediment management is undertaken, earthwork-generated discharges to the waterways should be minor. That said, the systems present (being already soft bottomed and well experienced to sediment inputs) are sufficiently robust that some discharge would have an unmeasurable effect and likely not constitute an adverse effect. This extends to accidental discharges (assuming they are minor) during the earthworks phase. Other than appropriate sediment and erosion defences and management there are no ecological recommendations for this aspect.
- Stormwater, if treated via suitable devices such as vegetated swales, wetlands, detention devices, etc., will result in acceptable stormwater quality (as per Schedule E of the One Plan) being discharged into the highly tolerant receiving aquatic habitats. We recommend such stormwater treatment devices be installed and maintained throughout the construction and operation of the Freight Hub.

~~7.3~~7.4 Summary of recommendations

1. No vegetation clearance conditions, or requirements, are recommended at this stage.
2. Undertake salvage efforts for all herpetofauna on Site prior to commencing any earthworks, irrespective of their threat classification (due to their protection under the Wildlife Act 1953).
3. Conduct pre-clearance checks for nesting indigenous avifauna in vegetation, irrespective of their threat classification (due to their protection under the Wildlife Act 1953). If found, measures will be put in place to ensure the nest is not disturbed (i.e. exclusion zones established, and clearance delayed within that zone).

~~2.~~4. Confirm the presence or absence of natural inland wetlands in sites within the designation extent that have not been able to be accessed, and manage any potential ecological effects utilising the 'effects management hierarchy' as defined in the NES-FW at the regional consent stage.

~~3.~~5. Undertake salvage efforts for all fish and kōura (freshwater crayfish) within the affected reaches of stream prior to any works within the stream environment(s).

~~4.~~6. Where possible, recreate open stream channel(s), preferably around the northern margin for the proposed Freight Hub rather than through it.

~~5.~~7. Ensure best practice sediment management is undertaken.

~~6.~~8. Install appropriate and sufficient stormwater treatment devices to ensure any discharged water is of ecologically acceptable quality.

~~7.~~9. Where possible, treated stormwater should be discharged into the remaining and/or replaced reached of the affected stream system 1 and northern tributary of stream system 2.

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Appendix 1: Attributes considered when assigning ecological value

Terrestrial:

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

Freshwater:

Matter:	Attributes to be Considered:
Representativeness	• Extent to which site/catchment is typical or characteristic

Matter:	Attributes to be Considered:
	• Stream order • Permanent, intermittent or ephemeral waterway • Catchment size • Standing water characteristics
Rarity/Distinctiveness	• Supporting nationally or locally Threatened, At Risk or uncommon species • National distribution limits • Endemism • Distinctive ecological features • Type of lake/pond/wetland/spring
Diversity and Pattern	• Level of natural diversity • Diversity metrics • Complexity of community • Biogeographical considerations - pattern, complexity, size, shape
Ecological Context	• Stream order • Instream habitat • Riparian habitat • Local environmental conditions and influences, site history and development • Intactness, health and resilience of populations and communities • Contribution to ecological networks, linkages, pathways • Role in ecosystem functioning – high level, proxies
Ecological Integrity[9]	• Nativeness – the degree to which an ecosystem's structural composition is dominated by the indigenous biota characteristics of the particular region • Pristineness – relates to a wide array of structural, functional and physico-chemical elements (including connectivity), but is not necessarily dependent on indigenous biota constituting structural and functional elements • Diversity – richness (the number of taxa) and evenness (the distribution of individuals amongst taxa); link to a possible reference condition; the use abundance weighting; and geographical scale • Resilience (or adaptability) – quantifying the probability of maintaining an ecosystem's structural and functional characteristics under varying degrees of human pressure or stressors such as climate change.

[9] In addition to the measures prescribed for terrestrial valuation, an additional matter is considered when assigning ecological value to freshwater environments as described in (Roper-Lindsay et al., 2018). Ecological Integrity is considered as a way of integrating structural and functional components of freshwater systems into the ecological values matrix. The 'nativeness', 'pristineness', diversity', and 'resilience' are all considered when determining ecological integrity.