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AQUATIC AND TERRESTRIAL ECOLOGY ASSESSMENT

WHAKATU ARTERIAL LINK HASTINGS, HAWKE'S BAY

PROJECT NO. EAM361-REP-02-V2

PREPARED FOR
HASTINGS DISTRICT COUNCIL

PREPARED BY
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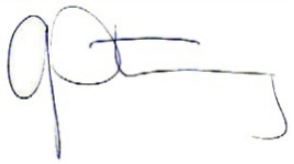

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EXECUTIVE SUMMARY

EAM NZ Limited (EAM) has been engaged by Environmental Management Services) Limited (EMS), on behalf of Hastings District Council (HDC), to provide an aquatic and terrestrial ecology assessment with regards to possible effects associated with the pre and post construction of the proposed Whakatu Arterial Link (WAL) road.

The WAL will provide an efficient heavy vehicle route for the movement of freight between the Whakatu industrial area and the Port of Napier and will run between State Highway 2 North and Pakowhai Road.

This report summarises the results of an ecological survey and habitat assessment undertaken during October-November 2013 along the proposed route of the WAL.

POTENTIAL EFFECTS

The WAL is to be a two lane carriageway of approximately 3.5 kilometres in length with a construction footprint width averaging 36 metres and up to eighty metres. The link road will run parallel to the Karamu Stream for much of its length.

Additionally the proposed WAL is to include the construction of a seventy two metre long prefabricated bridge that will span a section of the Karamu Stream. The bridge has been designed so that no pillars are required within the wet stream bed of the Karamu Stream.

Stormwater during construction and from the finished roadway will eventually drain to the Karamu Stream. Ultimately there are planned to be seven stormwater outlets to the Karamu Stream and another eight outlets to existing road side open drains.

Potential effects during the pre and post construction phases of the WAL were identified as the loss of important terrestrial habitat and existing flora and fauna through proposed significant earthworks as well as the possible reduction of water quality and associated effects to aquatic flora and fauna in the Karamu Stream due to stormwater/sediment runoff.

ASSESSMENTS UNDERTAKEN

A survey of the proposed WAL footprint was undertaken to establish existing biodiversity values of the area. This included the recording of dominant avifauna, herpetofauna, mammals, fish species and terrestrial and aquatic flora.

Aquatic macroinvertebrate and water quality sampling was not carried out as historical data supplied by the HBRC was deemed sufficient.

RESULTS OF ASSESSMENTS

From this assessment it is apparent that area within and surrounding the WAL route is highly modified and currently exhibits very little in relation to its pre human state with surrounding land use dominated by agricultural and horticultural activities.

Terrestrial vegetation is dominated by exotic trees and shrubs, and sprawling weedy vines while the riparian margins of the Karamu Stream in this area have been severely compromised by both biotic and abiotic factors. In particular the riparian areas are severely impacted through the continual grazing of livestock.

Indigenous plants are largely absent along the riparian margin with the dominant species being rank pasture grasses and ephemeral weeds. An exception to this is a relatively new area of riparian enhancement plantings carried out by the HBRC.

As the WAL does not specifically encroach on this area, the loss of terrestrial flora as a result of the proposed WAL is considered to be no more than minor.

The Karamu Stream is heavily dominated by introduced macrophytes and extensive growths of filamentous green algae and there were no important aquatic plant species noted during this assessment. As such effects on aquatic plant species as a result of the proposed WAL are considered to be no more than minor.

The potential effects on terrestrial ecological values will be most significant during the construction phase of the WAL with the two main impacts on terrestrial ecology considered to be:

1. The loss of habitat through clearance and earthworks; and

2. disturbance, displacement, injury and mortality.

Habitat loss will also result in a minor loss of connectivity or ecological functionality at a local level. However this habitat loss is considered to be minor given the similarity of nearby habitats, wide ecological tolerances and adaptability of identified bird species. Furthermore, lizards and frogs were not recorded during this assessment with lizards in particular unlikely to be present due to a lack of suitable habitat.

Displacement of resident bird populations is likely to lead to an increased amount of competition between displaced individuals and resident populations in adjoining areas. The effects of competition may lead to some low-scale mortality. This is considered to be of low-scale due to the large area of similar habitat that exists beyond the WAL footprint and wide habitat preferences of the identified species. Therefore the adaptability of the affected species is noted.

The on-going effects on terrestrial ecology from the operation phase of the WAL are relatively limited and considered to be minor. The potential and actual effects are likely to be limited to the direct impacts on terrestrial fauna from the road and vehicular traffic.

Pukeko and introduced mammals are most vulnerable to being injured or killed by vehicles using the WAL. Pukeko territories are generally restricted to within 50 metres of a water body or wetland. The presence of the nearby Karamu Stream therefore suggests that the potential risk to Pukeko is high as they may traverse the WAL in search of seasonally favoured areas of pasture. Proposed riparian plantings in areas where the WAL nears the Karamu Stream riparian boundary will help to deter their movements.

Aquatic macroinvertebrate data for the Karamu Stream is indicative of a soft bottomed system of poor habitat quality with moderate tolerances to organic enrichment.

Similarly water quality data highlights relatively poor water quality currently occurring in the Karamu Stream. With recorded concentration consistently above ANZECC (2000) default trigger values for both total phosphorus and soluble reactive phosphorus.

With no significant works occurring within the wetted area of the Karamu Stream the main potential effects to aquatic ecology and water quality as a result of construction and on-going operation of the WAL is considered to be largely through sedimentation and contamination via stormwater.

Stormwater runoff or accidental spills may also contain a range of contaminants including nutrients, heavy metals and hydrocarbons, which can also negatively impact the aquatic ecosystem. To mitigate sediments and other contaminants entering the Karamu Stream GHD has developed comprehensive Erosion and Sediment Control (GHD 2014h) and Stormwater Management (GHD 2014g) Plans. Within these plans are well set out environmental performance standards that must be met including:

- The concentration of suspended solids in any discharge from the site shall not exceed100 grams per cubic metre of water;
- The concentration of suspended solids in the Karamu Stream shall not increase by more than 10% as a result of any discharges from site. The point at which compliance with the standard is measured will not be more than 60 metres downstream from the point of discharge; and
- The stormwater discharge form the WAL shall not contain concentrations of hazardous substances that may cause significant adverse effects on aquatic life.

If the proposed treatment measures and performance standards are carried out as described to ensure that sediment and erosion and stormwater runoff is managed so as little as possible enters the Karamu Stream then significant contamination from this source is considered unlikely and effects to aquatic ecosystems and water quality are considered to be minor.

SUGGESTED APPROACH FOR EFFECTS IDENTIFIED

There is significant latitude for enhancement of the WAL site following development which could be achieved at minimal expense.

Due to the highly modified nature of the WAL corridor and the lack of suitable riparian cover there is significant potential for the roadway to offer an improvement in the habitat for both indigenous and desirable introduced species.

A well developed riparian margin will not only provide good cover for instream life and habitat for terrestrial species it will also provide a valuable ecological corridor between the Pakowhai Country Park and the Havelock North Hills area.

The connectivity of habitats in the Heretaunga Plains is very poor and the development of this area with suitable native tree and shrub species will effectively extend the Pakowhai Country Park area and carrying capacity.

Where areas of concentrated stormwater runoff from the roadway are created which have the potential to enter the water these should be directed into thickly vegetated swales with species such as *Carex geminata*. This Carex forms dense swards which will provide invaluable interception and filtering of the run off before entering the water.

The creation of shallow scraps and swales is recommended. These areas could be planted with a range of low to medium tier species such as Purei, Carex secta, Toetoe (*Cortaderia toetoe*) and Harakeke/ Swamp Flax (*Phormium tenax*). These scrapes and swales will offer services in the form of water quality and increasing available habitat. All of the above mentioned species naturally occur in the Heretaunga Ecological District.

It is the opinion of the author(s) that there will be no significant ecological effects on the environment to the progressing of this proposal if best management practices and proposed mitigation measures are followed.

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1.0 INTRODUCTION

1.1 BACKGROUND TO PROPOSED WHAKATU ARTERIAL LINK ROAD.

The proposed Whakatu Arterial Link (WAL) road will provide an efficient heavy vehicle route for the movement of freight between the Whakatu industrial area and the Port of Napier and will run between State Highway 2 North and Pakowhai Road. It will also provide direct linkage to the Whakatu industrial area via Whakatu and Anderson Roads. Figure 1 illustrates the proposed WAL layout/route.

The WAL is to be a two lane carriageway of approximately 3.5 kilometres in length with a maximum width of 80 metres and an average width of approximately 36 metres . The link road will run parallel to the Karamu Stream for much of its length. The land traversed by the proposed WAL is predominately flat horticultural and agricultural land.

The proposed WAL also includes the construction of a seventy two metre long prefabricated bridge that will span a section of the Karamu Stream. The bridge has been designed so that no pillars are required within the wet stream bed of the Karamu Stream.

Stormwater during construction and from the finished roadway will eventually drain to the Karamu Stream. Ultimately there are planned to be seven stormwater outlets to the Karamu Stream and another eight outlets to existing road side open drains.

1.2 PURPOSE OF THIS REPORT

The purpose of this report is to describe the findings of an assessment of ecological effects with regards to pre and post construction activities associated with the proposed Whakatu Arterial Link (WAL) road.

This assessment considers the impacts that may occur as a result of the proposed WAL development to water quality, as well as flora and fauna (terrestrial and aquatic). Additionally this report provides recommendations for possible enhancement/mitigation options for the WAL area.

FIGURE 1: PREFERRED ROUTE OF PROPOSED WHAKATU ARTERIAL LINK.

2.0 DESCRIPTION OF STUDY SITE

2.1 GENERAL LOCATION OF WAL

The proposed route of the WAL runs in a northwest to southeast direction between State Highway 2 North and Pakowhai Road (refer Figure 1). Surrounding land use is dominated by agricultural, horticultural and industrial activities. Of particular significance to this assessment is the close proximity of the WAL to the Karamu Stream.

2.1.1 OVERVIEW OF KARAMU STREAM CATCHMENT

The Karamu catchment covers an area of some 490 square kilometres and drains the Poukawa basin, the Kohinurakau, Kaokaoroa and Raukawa ranges and a large part of the Heretaunga Plains (see Figure 2). Today the Karamu Stream catchment is a highly modified area that currently exhibits very little in relation to its pre-human state.

The catchment consists of a series of tributaries radiating about Pakipaki that drain the upland catchments, and further tributaries downstream that drain the Havelock hills to the east, and the plains to the west. The path of the tributaries across the plains is distinguished by very flat grades and associated flooding of large areas of surrounding land, particularly south of the Irongate Stream (HBRC 2004).

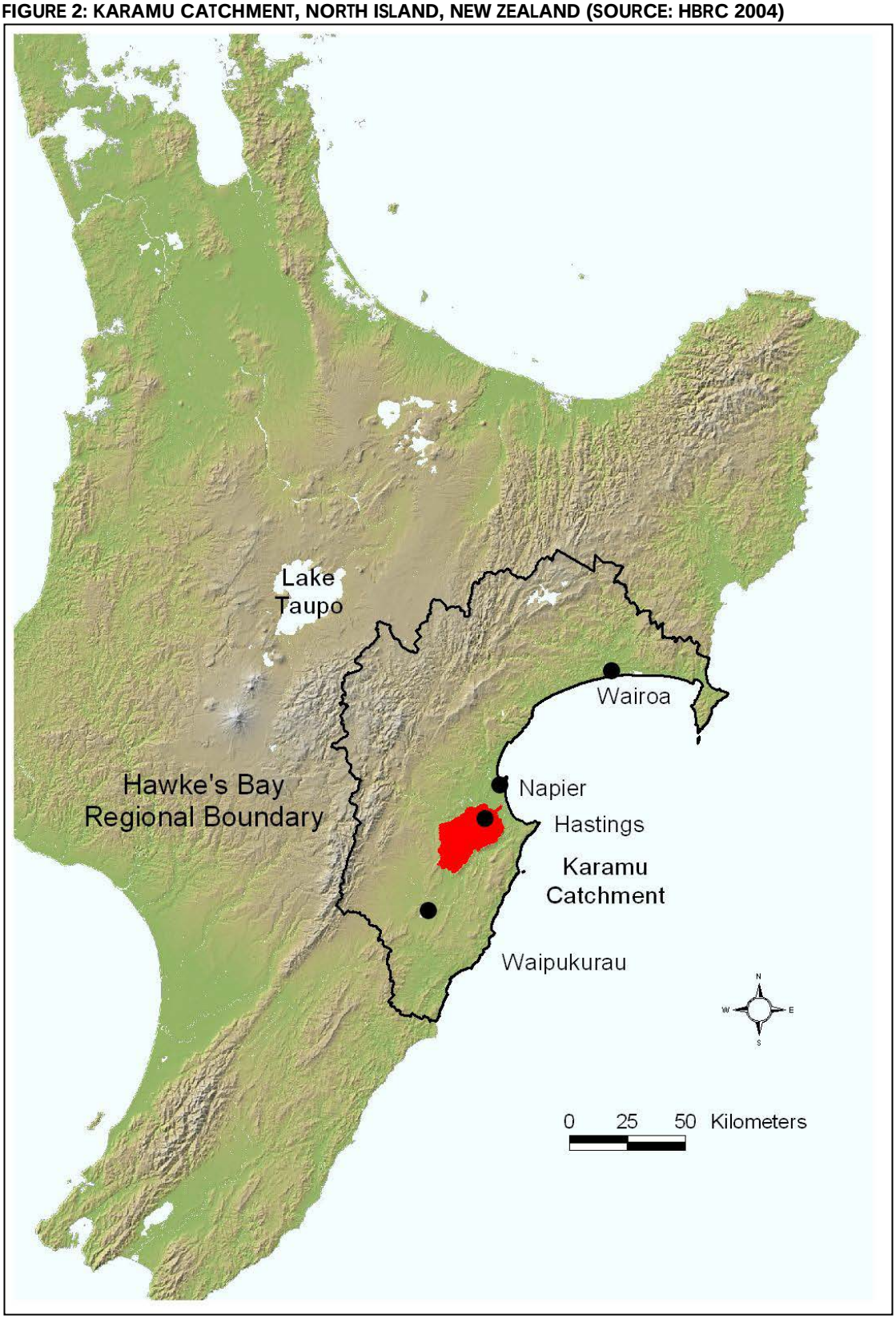
Water quality within the Karamu Stream is typically compromised by farm and urban run-off and, at times, other undetected and illegal discharges from septic tanks and the like (HBRC 2004).

In Addition to the Karamu Stream's important function as a flood channel, it also provides significant fish and wildlife habitat. In particular the Karamu Stream catchment is ultimately connected (after joining with the Raupere Stream and the Clive River) to the nationally significant Waitangi Estuary system.

The Waitangi Estuary, located 7.5 kilometres south of Napier, is a large tidal area (240 hectares) formed at the confluence of the Clive, Ngaruroro and Tutaekuri Rivers. Formed behind an unstable shingle bar this area includes large areas of intertidal mudflats, permanent open water, and ephemeral (temporary) wetlands, thus providing a wide range of habitat conditions and high biodiversity values (HBRC, 1999; Cheyne and Addenbrooke, 2002).

A gravel spit on the southern side of the estuary is a designated Wildlife Refuge under Department of Conservation control, and the lower estuary, is a gazetted Closed Game Area (Cheyne and Addenbrooke, 2002).

FIGURE 2: KARAMU CATCHMENT, NORTH ISLAND, NEW ZEALAND (SOURCE: HBRC 2004)



Important bird species recorded in the estuary habitats include; Black Fronted Dotterel *(Charadrius melanops)*, Banded dotterel *(Charadrius bicinctus)*, Pied Stilts *(Himantopus leucocephalus)*, White Fronted Terns *(Sterna striata)*, Black Fronted Dotteral *(Charadrius melanops*), Caspian Tern *(Hydroprogne caspia*), Little Shags (*Phalacrocorax melanoleucos)*, Bar-Tailed Godwit *(Limosa lapponica),* and Black Billed Gulls *(Larus bulleri)*.

Recognised as nationally significant fisheries habitat, the estuarine area is an important link for diadromous native freshwater fish, with the Clive River in particular being identified by Rook (1993) as the largest Inanga (*Galaxias maculatus*) spawning site in Hawke's Bay.

The Waitangi Estuary is gazetted as a Recommended Area for Protection (RAP) 10 in the Department of Conservation Heretaunga Ecological District Protected Natural Areas Report (Lee, 1994). The Hawke's Bay District generally has very little in terms of remnant indigenous habitats, with RAP10 being one of very few within the Heretaunga Plains.

3.0 GENERAL ASSESSMENT METHODOLOGY

3.1 GENERAL

A review of the following documents, all of which are included in the RMA application documentation, was undertaken to determine design details and the proposed approach to the management of water quality effects:

- Whakatu Arterial Project Description (GHD 2014a)
- Stormwater Management Plan (GHD 2014g)
- Erosion and Sediment Control Plan (GHD 2014h)

An ecological assessment of habitat along the proposed WAL route was carried out during October and November 2013. From this initial assessment three broad ecological zones were identified (refer Section 4) and were traversed to establish a species list of flora and fauna for each zone as well as general notes on the site's topography, ecology and functioning. Specific attention has been paid to indigenous species only in this highly modified landscape.

3.2 FLORA

Vegetation was surveyed with the aid of relevant texts along each stretch of the proposed WAL route and a general search of neighboring areas was performed to gain an overall picture of the habitat in the area. Any plants unable to be identified on site were collected for subsequent identification.

3.3 FAUNA

Species known to be present or possibly present have been included in the list for this site. Many species are cryptic and are therefore not typically encountered in a general survey.

3.3.1 AVIFAUNA

Birds were recorded during the site visit and this list augmented with prior knowledge of the site.

3.3.2 FISH

Aquatic fauna was searched for along the proposed WAL route using spotlights to ascertain the dominant species types. This was augmented with searches of the NZ Freshwater Fish Database as well as prior knowledge of the site.

3.3.3 AQUATIC MACROINVERTEBRATES

This is not specifically sampled for as data provided by the Hawke's Bay Regional Council (HBRC) was deemed sufficient.

3.3.4 HERPETOFAUNA

Herpetofauna and suitable habitat were assessed during site visits. This was a visual assessment only as are highly unlikely to be present in the WAL corridor.

3.3.5 TERRESTRIAL INVERTEBRATES

No specific survey of invertebrates was performed.

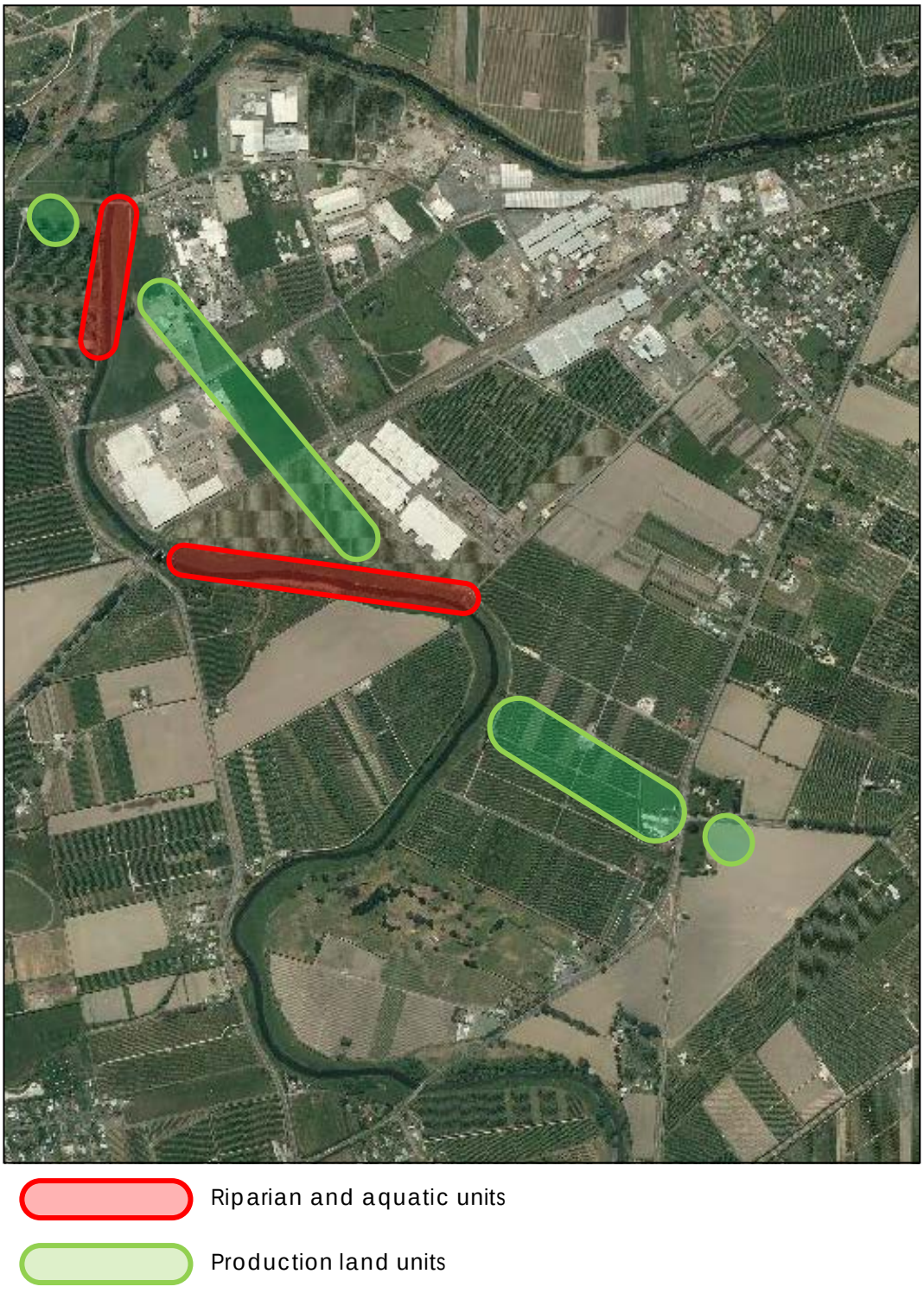
3.4 WATER QUALITY

Water quality data has been provided by the HBRC as a State of the Environment (SOE) monitoring site is located immediately downstream of the area identified for the WAL bridge crossing.

4.0 GENERAL SITE CHARACTERISTICS

Site visits were undertaken to evaluate the current ecological state of the area. From these visits the three main ecological units were identified: 1) Production land; 2) Riparian margins; and 3) Aquatic system. Figure 3 illustrates the main ecological units assessed.

FIGURE 3: MAIN ECOLOGICAL UNITS ASSESSED



4.1 PRODUCTION LAND

The production land is predominantly covered in fruit orchards (Figure 4) with the typically associated Sheoak (*Cassurina spp*) dominant shelter belts providing only a limited amount of habitat to typically cosmopolitan bird species including several native species such as Pukeko (*Porphyrio porphyria)* which are common in the area, Fantail (*Rhipidura fuliginosa*), Grey warbler (*Gerygone igata*) and Silver eye(*Zosterops lateralis)*.

These species are highly adaptable and well distributed in the Hawke's Bay landscape. Less common species such as Shining Cuckoo (*Chrysococcyx lucidu*) are also known to be occasional inhabitants on a seasonal and infrequent basis.

Exotic bird species are well represented in the area with larger species such as Pheasant (*Phasianus colchicus*) and Californian Quail (*Callipepla californica*) being notable but many other smaller introduced passerines are present.

Introduced mammalian pests are established in this area with larger species such as rabbits, and possums typically managed through trapping and shooting, but species such as rats, cats, hedgehogs and mustelids are generally not controlled.

FIGURE 4: TYPICAL ORCHARD LAND HABITAT

4.2 RIPARIAN MARGINS

The riparian margins are more diverse in the species mix as the ecotone between terrestrial and aquatic environments. The aforementioned bird species are all found in the riparian area but in addition Black Shag (*Phalacrocorax carbo novaezehollandiae)*, White Faced Heron (*Sterna striata)*, Pukeko (*Porphyrio porphyria*) and Australasian Harrier (*Cirus approximans*) are frequent users of this area. Tui (*Prosthemadera novaeseelandiae*) are occasionally present in isolated areas specifically where suitable food sources are present, namely Harakeke *(Phormium tenax).* Mallard ducks are common as well as Muscovy cross ducks and occasional feral geese.

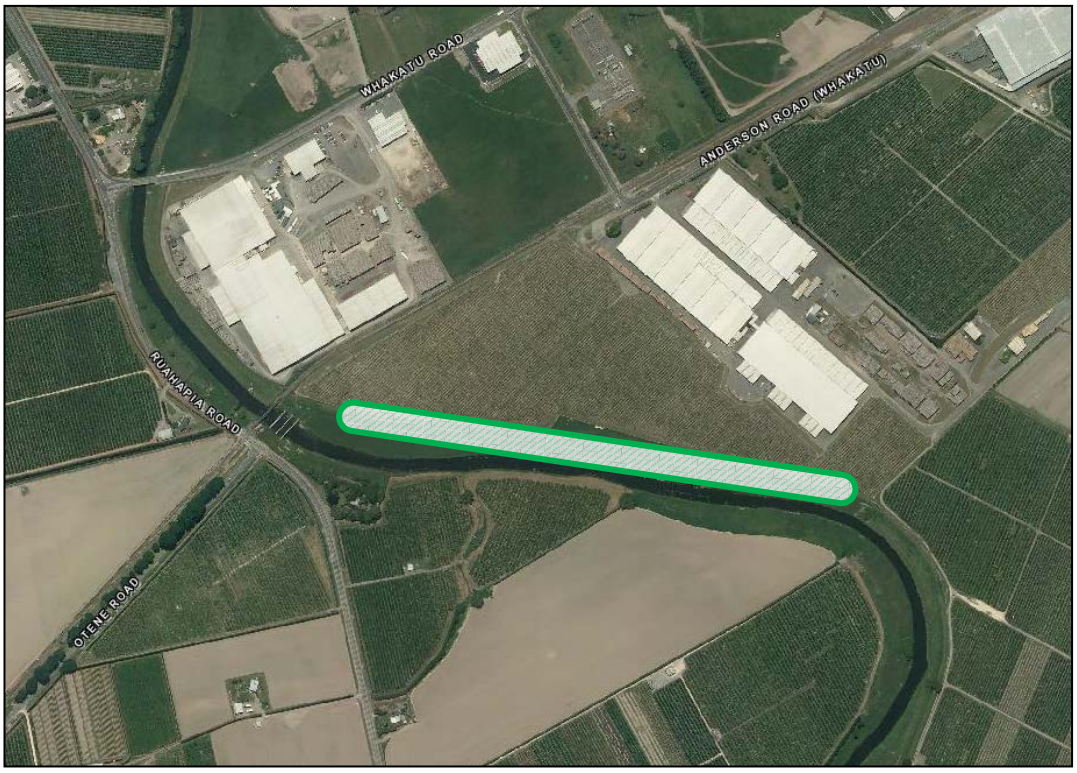
Indigenous plants are largely absent along the riparian margin with the dominant species type based around rank pasture grasses, primarily Tall Fescue and ephemeral weeds such as Hemlock, Fennel, Dock and a variety of thistles (Figure 5). An exception to this is a relatively new area of riparian enhancement plantings carried out by the HBRC (Figure 6). This enhancement is located immediately upstream of the Apollo site and is approximately 750 metres long and 15 metres wide (Figure 7).

Trailing weeds such as wandering dew can be found, particularly under cover afforded by either the shelterbelts adjoining the riparian edges or willows *(Salix spp).* In the area nearer the cool stores (Apollo) and rail bridge the banks have had a long history of grazing and vegetation is typically low grasses.

FIGURE 5: TYPICAL RIPARIAN MARGIN ALONG KARAMU STREAM NEAR WHAKATU

FIGURE 6: EXAMPLE OF AREA OF RIPARIAN ENHANCEMENT BY HBRC ON TRUE RIGHT BANK

FIGURE 7: GENERAL AREA OF HBRC RIPARIAN ENHANCEMENT ON KARAMU STREAM TRUE RIGHT BANK NEAR WHAKATU



4.3 AQUATIC SYSTEM

The aquatic system is heavily dominated by introduced macrophytes and extensive growths of filamentous green algae (Figure 8). This species mix is typical of highly eutrophic streams and this limits the habitat availability for many species.

In spite of the degraded nature of the waterway the proximity to the coast allows for a wide variety of fish species, including those more typically of an estuarine environment such as Yellow eyed and Grey mullet, and Black Flounder. Inanga, Shortfin and Longfin eel are also relatively common, as are Koura. Common bullies are also present where macrophytes cover is diminished but these are generally sparse patches.

FIGURE 8: KARAMU STREAM SHOWING DENSE GROWTHS OF AQUATIC MACROPHYTES

5.0 RESULTS AND DISCUSSION

5.1 FLORA

5.1.1 TERRESTRIAL FLORA

The flora identified in the assessment area is very typical of highly modified agricultural/horticultural areas within the Heretaunga Plains. There is no remnant indigenous vegetation within the area and the WAL corridor itself is generally without any vegetation of ecological significance.

The area has been highly modified since pre European times and has few remnants of the Flax and Toetoe (*Cortaderia spp*) dominant swamps that were present in the time of William Colenso, (Grant, 1996). Grant also reported that stands of Kahikatea dominant Podocarp forest was within the vicinity but the exact location of this stand of trees is poorly defined.

There are also several species in this area that have been identified as pest plants in the Hawke's Bay Regional Council Pest Plant Strategy 2001. These plants are ubiquitous in waste areas in the Hawke's Bay and will most probably be eventually controlled during Hawke's Bay Regional Council maintenance associated with the management of the Karamu Stream enhancement works.

The only significant indigenous vegetation in the wider area is isolated to the Karamu Stream enhancement project and the Pakowhai Country Park. Plant species noted in the enhancement areas included Flax/Harakeke *(Phormium tenax and Phormium cookianum),* Manuka (*Leptospermum scoparium*), Totara (*Podocarpus totara)*, Rimu (*Dacrydium cupressinum*), Hebe (*spp*.), Cabbage Tree (*Cordyline australis*), ToeToe (*Cortaderia toetoe*) and Coprosma (*spp*.). The WAL will not affect these areas.

5.1.2 AQUATIC FLORA

Aquatic flora is dominated by a suite of submerged and emergent macrophytes with Water celery (*Apium nodoflorum)* being very conspicuous, as well as Canadian Pondweed (*Elodea canadiensis) (Figure 9),* Curled Pondweed *(Potamogeton crispus)* and Parrot's Feather (*Myriophyllum aquaticum) (*Figure 10*).* Duckweed *(Lemna minor)* is also dominant in the floating flora (Figure 9).

No aquatic flora of note was present and as such there is no concern with regard to impacts from the WAL activity on this vegetation type.

FIGURE 9: CANADIAN PONDWEED (*Elodea canadiensis*) AND DUCKWEED *(Lemna minor)*

FIGURE 10: PARROT'S FEATHER (*Myriophyllum aquaticum)*

5.1.3 PEST PLANTS

A Boundary Control Plant Pest is a plant pest that is abundant on some properties in the region where the long-term goal is to prevent the pest spreading to neighbouring properties. As these plant pests are widespread throughout the region, the cost of eradication is considered too great to justify any more rigorous methods of control.

To stop the plant pests spreading, the Strategy requires land occupiers to keep their property boundary free of the plant pest, if it is not present within a defined distance on their neighbour's property. Boundary Control Plant Pests are banned from sale, propagation and distribution under sections 52 and 53 of the Biosecurity Act.

5.1.4 NOTES ON IDENTIFIED PEST PLANTS

Blackberry (*Rubus fruticosus agg*) is classified as a Containment Control Plant Pest. It is a prickly scrambling perennial shrub with thorny stems up to 8 metres long. Blackberry grows to form thickets, which can harbour pests such as rabbits, hares, and possums. It can impede water flows, and thorns entangle sheep, and can also be a fire hazard. It was occasionally found in small growths in the riparian margin.

5.2 HERPETOFAUNA

Reptile populations on the mainland have been reduced or eliminated through the combined pressures of habitat loss and introduced predators.

Frogs and lizards were not recorded during field assessments. With regards to lizard species it is highly unlikely that they are present within the WAL corridor as suitable habitat was largely absent in both the production land and riparian zones.

5.3 AVIFAUNA

A complete list of bird species, such as identified during the site investigation and those recorded in previous studies throughout the Karamu system including the Waitangi Estuary, are shown in Table 1. The threat classifications are based upon Miskelly et al. 2008.

Of these species, the Australasian Bittern and Black Billed Gull are Nationally Endangered, whilst the Black Shag, Little Shag and Little Black Shag are all categorised as being 'at risk – uncommon'.

Efforts were made to determine the presence of any significant Black Shag perches in the general WAL area but none were noted.

Note: During the site assessments Pukeko were particularly prevalent both along the riparian margins as well as orchard/production land.

TABLE 1: BIRD SPECIES OF THE KARAMU STREAM SYSTEM IDENTIFIED DURING THIS SURVEY, AUTHORS KNOWLEDGE AND PREVIOUS REPORTS

Common name	Taxonomic name	Threat Classification
Australasian Harrier	*Cirus approximans*	*Not threatened*
Black Shag	*Phalacrocorax carbo novaezehollandiae*	*At risk - uncommon*
Little Shags	*Phalacrocorax melanoleucos*	*At risk - uncommon*
Little Black Shags	*Phalacrocorax sulcirostris*	*At risk - uncommon*
Australasian Bittern	*Botaurus poiciloptilus*	*Nationally endangered*
Pukeko	*Porphyrio porphyrio*	*Not threatened*
White Fronted Terns	*Sterna striata striata*	*At risk - declining*
Caspian Tern	*Hydroprogne caspia*	*Nationally vulnerable*
Gannet	*Morus serrator*	*Not threatened*
Black Fronted Dotterel	*Charadrius melanops*	*Migrant*
Banded Dotterel	*Charadrius bicinctus*	*Nationally vulnerable*
Pied Stilts	*Himantopus leucocephalus*	*At risk - declining*
Bar-Tailed Godwit	*Limosa lapponica*	*Migrant*
Grey Duck	*Anas superciliosa superciliosa*	*Nationally critical*
NZ Shoveler	*Anas rhynchotis*	*Not threatened*
Paradise Shelduck	*Tadorna variegata*	*Not threatened*
Grey Teal	*Anas gracilis*	*Not threatened*
Pied Stilt	*Himantopus himantopus*	*At risk - declining*
Pacific Golden Plover	*Pluvialis fulva*	*Migrant*
Variable Oystercatcher	*Haematopus unicolor*	*Recovering*
Kotuku (White Heron)	*Egretta alba modesta*	*Nationally critical*
White-Faced Heron	*Ardea novaehollandiae novaehollandiae*	*Not threatened*
Black Billed Gull	*Larus bulleri*	*Nationally endangered*
Black-Backed Gull	*Larus dominicanus dominicanus*	*Not threatened*
Spur Winged Plover	*Vanellus miles novaehollandiae*	*Not threatened*
Sacred Kingfisher, Kotare	*Todiramphus sanctus vagans*	*Not threatened*
Welcome Swallow	*Hirundo tahitica*	*Not threatened*
Silvereye	*Zosterops lateralis*	*Not threatened*
Pipit	*Anthus novaeseelandiae*	*At risk - declining*
Tui	*Prosthemadera novaeseelandiae*	*Not threatened*
Grey Warbler	*Gerygone igata*	*Not threatened*
Shining Cuckoo	*Chrysococcyx lucidus lucidus*	*Not threatened*
Fantail	*Rhipidura fuliginosa placabilis*	*Not threatened*
Black Swan	*Cygnus atratus*	*Not threatened*
Skylark	*Alauda arvenis*	*Not threatened*
Pheasant	*Phasianus colchicus*	*Not threatened*
Mynah	*Acridotheres tristis*	*Not threatened*
Magpie	*Gymnorhina tibicen*	*Not threatened*
Dunnock	*Prunella modularis*	*Not threatened*
House Sparrow	*Passer domesticus*	*Not threatened*
Yellowhammer	*Emberiza citrinella*	*Not threatened*
Blackbird	*Turdus merula*	*Not threatened*
Chaffinch	*Fringilla coelebs*	*Not threatened*
Goldfinch	*Carduelis carduelis*	*Not threatened*
Greenfinch	*Carduelis chloris*	*Not threatened*
Redpoll	*Carduelis flammea*	*Not threatened*
Thrush	*Turdus philomelos*	*Not threatened*
Starling	*Sturnus vulgaris*	*Not threatened*
Australian Magpie	*Gymnorhina tibicen*	*Not threatened*
Californian Quail	Callipepla californica	*Not threatened*
Ring Necked Pheasant	*Phasianus colchicus*	*Not threatened*

5.4 MAMMALS

Domestic stock (predominantly sheep) is present throughout the survey area and is considered to be of considerable consequence in terms of the general ecology. Grazing (in particular cattle) of the riparian fringe has a significant impact on this environment. A greater level of riparian protection is required to negate this damage.

Stock access to the water's edge also tends to increase both the nutrient and sediment load in the waterway which further reduces the habitat quality for indigenous aquatic species.

Other identified mammalian species were limited to introduced pests such as rabbits, possums, rats, cats, hedgehogs and mustelids.

5.5 FISH

The Karamu Stream system supports an important fishery and plays an important role in the migratory pathway of many fish species, including whitebait, eels and trout (HBRC 2005). It also provides access to suitable spawning and rearing streams, such as the Mangateretere and Karewarewa. However the in-stream values of the Karamu itself decline over summer due to deoxygenation as a result of factors such as intense aquatic weed growth and high temperatures (HBRC 2005).

Eel numbers during this assessment were regarded as high. It is thought that these high numbers are likely to be a direct result of the extensive weed beds present in the area as they likely provide good cover.

A complete list of fish species, such as identified during the site investigation and those recorded in previous studies (including New Zealand Freshwater Fish Database), are shown in Table 2. The threat classifications (where available) are based upon Hitchmough, 2005.

TABLE 2: FISH SPECIES OF THE KARAMU STREAM SYSTEM IDENTIFIED DURING THIS ASSESSMENT AND OTHER CITED LITERATURE.

Common name	Taxonomic name	Threat Classification
Longfin Eel	*Anguilla dieffenbachii*	*Gradual decline*
Shortfin Eel	*Anguilla australis*	-
Inanga	*Galaxias maculates*	-
Lamprey	*Geotria australis*	*Sparse*
Common Smelt	*Retropinna retropinna*	-
Torrent Fish (Juvenile)	*Cheimarrichthys fosteri*	-
Common Bully	*Gobiomorphus cotidianus*	-
Redfin Bully	*Gobiomorphus huttoni*	-
Giant Bully	*Gobiomorphus gobioides*	-
Black Flounder	*Rhombosolea retiaria*	-
Kahawai	*Arripus trutta*	-
Yellow Bellied Flounder	*Rhombosolea leporina*	-
Yellow Eyed Mullet	*Aldrichetta forsteri*	-
Goldfish – Common Carp	*Carassius auratus*	-
Rainbow Trout	Oncorhynchus mykiss	-
Mosquito fish	*Gambusia affinis*	*Introduced*

5.6 AQUATIC MACROINVERTEBRATES

Routine macroinvertebrate monitoring has not been carried out by the HBRC in the Karamu Stream and therefore records are sparse.

A recent sample has been collected by the HBRC does however provide a snapshot as to typical habitat quality with in the Karamu Stream relative to the area of the WAL route. The recent macroinvertebrate sample was collected during February 2013 in the Clive River upstream of the rail bridge and downstream of the Raupare Stream.

The data from this sample illustrates that dominant taxa were the caddisflies *Oxyethira* and *Paroxyethira*, the crustaceans *Cladocera* and *Paracalliope*, and the mollusc *Potamopyrgus*. All of these taxa are considered to be indicative of a system of poor habitat quality with moderate tolerances to organic enrichment and is reflected in the calculated soft-bottomed MCI and SQMCI score of 63 and 3.56 respectively (refer Table 3).

TABLE 3: INTERPRETATION OF MCI-TYPE BIOTIC INDICES (STARK AND MAXTED, 2007)

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

5.7 WATER QUALITY

There is only sparse available water quality data for the Karamu Stream in the immediate vicinity of the WAL development. Of the available dataset a summary of selected water quality parameters recorded by the HBRC at the floodgates of the Karamu Stream, immediately downstream of the WAL proposed bridge site, is provided in Table 4.

TABLE 4: WATER QUALITY DATA FOR THE KARAMU STREAM AT FLOODGATES (SOURCE HBRC)

Date	NH_3 (mg/L)	SRP (mg/L)	TP (mg/L)
17/12/2009	0.014	0.150	0.240
21/01/2010	0.020	0.180	0.200
11/02/2010	0.049	0.300	0.390
18/03/2010	0.044	0.093	0.170
06/05/2010	0.096	0.069	0.162
20/05/2010	0.070	0.084	0.132
27-Feb-13	< 0.010	0.100	0.135
27-Feb-13	< 0.010	0.089	0.112
ANZECC (2000) Default Trigger value for slightly disturbed	**0.9***	**0.010**	**0.033**

*ANZECC (2000) 95% protection toxicant trigger value for freshwater species

For the purpose of this assessment the default trigger values in the ANZECC (2000) guidelines (physical and chemical stressors) are used as target values for nutrient concentrations. The default trigger levels for physical and chemical stressors provide a broad national basis for assessing the impact of a particular activity, on the environment. These are applicable to slightly disturbed ecosystems and include a trigger value for New Zealand upland and lowland rivers.

Default trigger values for dissolved reactive phosphorus (SRP) and total phosphorus (TP) concentrations for lowland streams and rivers in New Zealand are 0.010 mg/L and 0.033 mg/L respectively.

The Default trigger value for ammonia concentrations for lowland rivers is 0.021 mg/L. The relevant guideline for free ammonia (unionised ammonia) for 95% species protection is 0.9 mg/L.

From the available data it can be seen that the Karamu Stream (for the assessed parameters) is consistently above default trigger values for both total phosphorus and soluble reactive phosphorus. Recorded data suggests that unionised ammonia concentrations are typically well below the 95% species protection trigger value of 0.9 mg/L.

This limited dataset is consistent with other data collected by the HBRC (HBRC 2005) in the system and highlights the relatively poor water quality currently occurring in the Karamu Stream.

It should be noted that these 'trigger values' are only a guide and in any situation where the values identified are exceeded the ANZECC (2000) guideline process recommends environmental/ecological investigations be undertaken to assess consequences of increased nutrient concentrations. ANZECC (2000) then recommend that site specific nutrient values be determined to account for local conditions.

6.0 POTENTIAL EFFECTS

6.1 TERRESTRIAL FLORA

The WAL traverses a highly modified landscape characterised by agricultural, horticultural and industrial land with the only area of indigenous vegetation identified being the area of riparian enhancement carried out by the HBRC. As the WAL does not specifically encroach on this area the loss of terrestrial flora as a result of the proposed WAL is considered to be no more than minor.

6.2 TERRESTRIAL FAUNA

The potential effects on terrestrial ecological values will be most significant during the construction phase of the WAL.

The two direct impacts on terrestrial ecology are considered to be:

1. The loss of habitat through clearance and earthworks; and

2. disturbance, displacement, injury and mortality of birds.

Sections of shelterbelt, hedgerows, stands of trees (orchards), areas of pasture and rank grassland cover occurring within the WAL footprint will be removed to accommodate construction. In particular this will result in a loss of habitat for resident bird populations.

The loss of habitat for common native and introduced passerines will be more pronounced for species such as fantails and grey warbler that have small territories and home ranges.

The overall adverse effects of the construction activities and associated habitat loss is considered minor for indigenous and visitor bird populations.

Habitat loss will also result in a minor loss of connectivity or ecological functionality at a local level. However this habitat loss is considered to be minor given the similarity of nearby habitats, wide ecological tolerances and adaptability of identified bird species. Additionally, proposed plantings discussed further in this report will provide new areas of habitat for the terrestrial ecosystem.

Loss of habitat in conjunction with disturbances arising from construction activities will lead to displacement of the affected bird populations into the surrounding countryside. It could also lead to mortality and injury to lizards due to their sedentary nature. Native and introduced insects will be similarly affected.

Displacement of resident bird populations is likely to lead to an increased amount of competition between displaced individuals and resident populations in adjoining areas. The effects of competition may lead to some low-scale mortality. This is considered to be of low-scale due to the large area of similar habitat that exists beyond the WAL footprint and wide habitat preferences of the species. Therefore the adaptability of the affected species is noted.

The on-going effects on terrestrial ecology from the operation phase of the WAL are relatively limited and considered to be minor. The potential and actual effects are likely to be limited to the direct impacts on terrestrial fauna from the road and vehicular traffic.

Pukeko and introduced mammals that naturally forage over a wide area are most vulnerable to being injured or killed by vehicles using the WAL. Other birds at risk of mortality or injury from motorway traffic are the Australasian Harrier and Black-Backed Gull as these birds regularly scavenge road killed animals.

Pukeko territories are generally restricted to within 50 metres of a water body or wetland. The presence of the nearby Karamu Stream therefore suggests that the potential risk to Pukeko is high as they may traverse the WAL in search of seasonally favoured areas of pasture. Pukeko may also be attracted to the wide stormwater swales and detention ponds established as part of the WAL, however it is noted that the stormwater detention ponds are temporary measures and will be removed following the completion of construction. It is hoped that proposed riparian plantings in areas where the WAL nears the Karamu Stream riparian boundary will help to deter their movements.

Construction activities and particularly, heavy machinery, present an opportunity for problem weed species not currently present in the area to become established. Seeds of problem weed species can be introduced inadvertently when machinery has been previously working in locations where these plants exist. These species could potentially pose a threat to the indigenous plantings proposed and present along the Karamu riparian zone.

6.3 WATER QUALITY AND AQUATIC FLORA AND FAUNA

As discussed earlier water quality in the Karamu Stream is relatively poor. As such it is important that the construction and operation of the WAL does not adversely impact water quality any further.

With no significant works occurring within the wetted area of the Karamu Stream the main potential effects to aquatic ecology and water quality as a result of construction and on-going operation of the WAL is considered to be largely through sedimentation and contamination via stormwater.

Stormwater runoff or accidental spills may also contain a range of contaminants including nutrients, heavy metals and hydrocarbons, which can also negatively impact the aquatic ecosystem.

To mitigate sediments and other contaminants entering the Karamu Stream GHD has developed comprehensive Erosion and Sediment Control (GHD 2014h) and Stormwater Management (GHD 2014g) Plans. The following should be read in conjunction with these two documents.

The main objectives of the Erosion and Sediment Control Plan are given as:

- Provide for the efficient conveyance of runoff from the WAL during construction activities, to ensure health and safety of road users and to protect surrounding properties;
- Avoid or minimise any potential effects on water quality and aquatic ecosystems from site drainage from the WAL during construction and associated earth disturbance activities;
- Protect and enhance the natural character and amenity values of the Karamu Stream; and
- Minimise any potential adverse effects from flooding and erosion of land and/or watercourses from site drainage from the WAL during construction and associated earth disturbance activities.

Erosion control measures to be carried out prior and during the construction phase includes the installation of two swales (one to convey dirty construction affected water to sediment detention ponds and one to convey clean surface runoff to the Karamu Stream) and the provision of waterway entries that act as an interface between the drainage system and the Karamu Stream to dissipate stormwater velocity.

Proposed sediment control measures include eight retention ponds designed to comply with the Hawke's Bay Waterway Guideline – Erosion and sediment Control. Six of these ponds will discharge surplus water to the new WAL drainage system and two will discharge into existing road side drains on Pilcher Road. Additionally twelve earth decanting bunds and thirty five rock dams are to be constructed within the dirty water swale network to reduce velocity and erosion within the swales.

The main objectives of the Stormwater Management Plan are given as:

- Provide for the efficient conveyance of stormwater from the WAL, to ensure health and safety of road users and to protect surrounding properties;
- Avoid or minimise any potential effects on water quality and aquatic ecosystems from stormwater discharges from the WAL following the completion of construction activities;
- Protect and enhance the natural character and amenity values of the Karamu Stream; and
- Minimise any potential adverse effects from flooding and erosion of land and/or water courses from stormwater discharges from the WAL.

To achieve this the stormwater system will incorporate the following elements:

- A network of swales designed to pass the 10% Annual Exceedance Probability (AEP) event;
- A piped network for efficient conveyance of stormwater, designed to pass the 10% Annual Exceedance Probability (AEP) event;
- Weirs and scruffy domes to improve treatment;
- WaStop (or similar) valves to provide reverse flow protection to the swales and pipework; and
- A design that avoids collecting existing surface flows as much as possible to minimize volumes conveyed by the stormwater system and reduces the potential for increased peaking events.

The proposed permanent stormwater system will consist of thirty four swales, a piped network, seven discharge outlets along the Karamu Stream and eight discharge outlets to existing road side drains.

The seven outlet points to the Karamu Stream will be velocity controlled and will have active design measures to reduce scour at the stream interface. WaStop (or similar) valves will be fitted to provide reverse flow protection to the swales and pipework from potential high levels in the Karamu Stream.

At the eight outlet points to the existing road side drainage network, small weirs will be installed. Low flows will be retained in the swale, and will exit through the subsurface drain. High flow will be allowed to decant over the weir into the existing road side drainage network.

The following environmental performance standards have been provided for both the Erosion and Sediment Control Plan and Stormwater Management Plan:

- The concentration of suspended solids in any discharge from the site shall not exceed100 grams per cubic metre of water;
- The concentration of suspended solids in the Karamu Stream shall not increase by more than 10% as a result of any discharges from site. The point at which compliance with the standard is measured will not be more than 60m downstream from the point of discharge;
- All exposed areas of soil shall be stabilised against erosion by vegetation cover or other methods as soon as practical;
- There shall be no adverse increase in water levels downstream of the stormwater discharge points, e.g. additional flooding of downstream properties;
- The stormwater discharge form WAL shall not contain concentrations of hazardous substances that may cause significant adverse effects on aquatic life; and

- Any stream erosion occurring as a result of the stormwater discharge/s from the WAL shall be remediated as soon as practicable.

In addition to these performance standards the stormwater system will have ongoing monitoring to ensure it is operating effectively and environmental performance standards are being met.

Regular weekly visual inspections of the complete length of the Karamu Stream will be conducted over the complete construction period to look for environmental issues.

If the above treatment measures and performance standards are carried out as described to ensure that sediment and erosion and stormwater runoff is managed so as little as possible enters the Karamu Stream then significant contamination from this source is considered unlikely and effects to aquatic ecosystems and water quality are considered to be minor.

Note: Sediment removal will not only prevent further siltation of an already silt choked system but will also reduce the likelihood of chemical and metal contaminants reaching the waterway as many of these have a strong affinity to particulate material.

7.0 FURTHER MITIGATION OPTIONS

Due to the highly modified nature of the WAL corridor and the lack of suitable riparian cover there is significant potential for the project to offer an improvement in the habitat for both indigenous and desirable introduced species (both terrestrial and aquatic). As such further enhancement plantings along the Karamu Stream riparian margin to extend and compliment the areas already planted by the HBRC would greatly offset any minor effects identified as a result of the WAL construction and operation.

A well developed riparian margin will not only provide good cover for instream life and habitat for terrestrial species it will also provide a valuable ecological corridor between the Pakowhai Country Park and the Havelock North Hills area. The connectivity of habitats in the Heretaunga Plains is very poor and the development of this section with suitable native tree and shrub species will effectively extend the Pakowhai Country Park area and carrying capacity.

Where areas of concentrated stormwater runoff from the roadway are created which have the potential to enter the water these should be directed into thickly vegetated swales with species such as *Carex geminata*. This *Carex* forms dense swards which will provide invaluable interception and filtering of the run off before entering the water.

The proposed sediment management areas will essentially provide shallow scrapes and swales which is desirable. These scrapes and swales will offer services in the form of water quality and increasing available habitat. These areas could be planted with a range of low to medium tier species such as Purei, *Carex secta*, Toetoe and Swamp Flax. All of the above mentioned species naturally occur in the Heretaunga Ecological District.

With suitable riparian buffers and the use of well vegetated swales the impact of the WAL on the freshwater fish population can be minimised and with subsequent growth of the overhanging riparian cover the habitat will be improved. Overall once the proposed plantings have become established the project should provide a net benefit to what is currently a highly modified and degraded habitat.

8.0 REFERENCES

ANZECC (2000). Nationalwater quality management strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council and Agricultural Resource Management Council of Australia and New Zealand, Canberra, Australia.

Cheyne and Addenbrooke, 2002: Waitangi Estuary Management Plan. Hawke's Bay Regional Council Technical Report. ISSN 1174-3077; 38pp.

Hawke's Bay Regional Council (HBRC), Napier., 1999: Regional Coastal Plan. ISBN 1-877174-16-5. 249pp.

Hawke's Bay Regional Council 2004, *Te Karamu - Catchment Review and Options forEnhancement*, Environmental Management Group Technical Report.

Hitchmough, R.; Bull, L.; Cromarty, P. (compilers) 2007. New Zealand threat classification system lists 2005. Wellington, Department of Conservation. 194 p.

Miskelly, C.M.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Powlesland, R.G.; Robertson, H.A.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2008. Conservation status of New Zealand birds, 2008. Notornis 55: 117-135.

Rook, H., 1993: Inanga Spawning Survey to 1993. File note held on ANI 283, Department of Conservation, Napier, New Zealand.

Lee, A. (1994) Heretaunga Ecological District Survey Report for the Protected Natural Areas Programme, Department of Conservation.

APPENDIX 1

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