

23rd August 2016

Ecological Management and Restoration Plan Main Project Works

HAMILTON SECTION - WAIKATO EXPRESSWAY

Contract No. NZTA 2/09 – 015/602

[THIS PAGE IS INTENTIONALLY LEFT BLANK]

Table of Contents

1	Introduction	1
1.1	Background and Purpose	1
1.2	Scope	1
1.3	EMRP Process	2
1.4	DOC and TWWG Consultation	2
2	Summary of Ecological Values, Effects and Mitigation	3
2.1	Introduction	3
2.2	Terrestrial Vegetation	3
2.2.1	Mangaonua Gully	3
2.2.2	Mangaone / Mangaharakeke Gully	4
2.2.3	East/West Link Gully	5
2.2.4	Vegetation and Habitats outside gullies	5
2.3	Herpetofauna (Lizards)	6
2.4	Avifauna	6
2.5	Freshwater Fauna (Fish)	8
2.6	Long-Tailed Bats	9
3	Cultural Values and Ecological Resources	11
4	Designation and Consent Requirements.....	12
4.1	Ecological Requirements Summary	12
4.2	Seasonal Constraints	12
4.3	Gully Vegetation and Habitats Protocols	14
4.3.1	Culvert AG4 Wetland 10 outlet Vegetation Removal Mitigation	15
4.4	Herpetofauna (Lizard) Protocols	17
4.5	Avifauna Protocols	17
4.5.1	Preconstruction surveys	17
4.5.2	preconstruction Targeted Nesting Surveys	18
4.5.3	Gully wetland bioacoustic surveys	18
4.5.4	Incidental Kill and Harm minimisation protocols	18
4.5.5	Adaptive MANAGEMENT approach & ongoing monitoring	20
4.5.6	REPORTING	20
4.6	Freshwater Fish Protocols	21
4.7	Long-Tailed Bat Protocols	24
5	Pest Management Summary	25
6	Ecological Monitoring and Reporting	26
7	EMRP Reviews	27
8	Consent Condition Summary.....	28

List of Figures

Figure 1– Management Plan Framework	1
Figure 2: Mangaonua Gully Bridge Impact on Kahikatea	14
Figure 3 – Steps in Restoration of a Site	16
Figure 4: Indigenous Fish Survey, Recovery and Translocation Process.	22
Figure 5: Steps in Mudfish Survey, Recovery and Relocation	23

List of Tables

Table 1: Ecological Management Related Plans and Status	1
Table 2: Seasonal Constraints for Key Fauna Species and Habitat Enhancement Works	13
Table 2: Consent Conditions	26

Appendices

Appendix A – Bat Management Plan	
Appendix B – Indigenous Fish Management plan	
Appendix C – Lizard Management Plan	
Appendix D – Gully Restoration Implementation Plan (Southern Gullies)	
Appendix E – Mudfish Management Plan	
Appendix F – TWWG Feedback from Ecology Workshop	

Authorisation & Revision Record

Review and Approval

Status	Name	Date	Approval
Prepared by (Project Ecologist)	Jen Price	23/08/2016	
Reviewer (Environmental and Consents Manager)	Ross Winter	23/08/2016	
Approve for release (Project manager)	Matt Fairweather	23/08/2016	

Revision Record

Date	Rev	Details / Comments
13/05/2016	A	DRAFT document for consultation and review before ecology workshop
5/07/2016	B	Revised document reflecting comments raised at ecology workshop from DOC and WRC
11/08/2016	C	Revised documents reflecting comments received from DOC and WRC after second revision draft was submitted for review
7/09/2016	D	Updated to reflect final review comments from WRC
23/09/2016	E	Updated bird protocols with comments from WRC
28/03/18	F	Updated section 4.3.1 with culvert AG\$ mitigation requirements. Updated Section 8 with the specific conditions related to the consent.

1 Introduction

1.1 Background and Purpose

This Ecological Management and Restoration Plan (EMRP) forms part of a comprehensive suite of environmental controls within the broader, project-wide Construction Management Plan (CMP) for the Hamilton Section of the Waikato Expressway (the Project), programmed to commence October 2016.

The EMRP will be finalised and approved in accordance with the conditions of the Waikato Regional Council (WRC) resource consents. The consent conditions are contained in Section 8 of the EMRP for completeness.

The purpose of the EMRP is to provide a framework to avoid, remedy or mitigate adverse ecological effects associated with the Project. The ecological resources that may be affected include terrestrial, wetland and perennial stream habitats and nationally “Threatened” or “At-Risk” species associated with these habitats (including long-tailed bats, black mudfish, other indigenous fish, other indigenous lizards, little shag and any rare or uncommon plants).

The EMRP is closely linked to the Landscape Management Plan (LMP) and the Waikato Tainui Mitigation Plan (WTMP). The EMRP encompasses the following specific Ecological Management Plans or other documents (hereafter referred to as sub-plans):

- Bat Management Plan (BMP) (Appendix A);
- Indigenous Fish Management Plan (IFMP)(Appendix B);
- Lizard Management Plan (LMP) (Appendix C);
- Gully Restoration Implementation Plan (GRIP) (Appendix D); and,
- Mudfish Management Plan (Appendix E).

The status of these sub-plans is set out in Table 1.2. The format of the EMRP is arranged to include the sub-plans the sub-plans attached as appendices.

The EMRP aims to summarise and address:

- Ecological resources along the Expressway alignment;
- Restoration and habitat enhancement measures. The objective of the ecological programme for the project is to achieve no net loss of terrestrial, wetland and stream biodiversity values or natural habitat along the Expressway route (including all perennial waterways and wetlands, seepage zones and gully seeps);
- Include procedures to ensure that the gully wetlands lost during construction of the Mangaonua and Mangaone bridges are replaced by wetland habitat of an equivalent or greater area (via the GRIP);
- Inform the detailed design process for vegetation clearance, revegetation, habitat creation, species transfers, stream diversions, monitoring and mitigation (via the BMP, MMP, LMP and IFMP);
- Provide general guidance for development of those sections of the Project which have ecological value, but which are not covered by the sub-plans; and,
- Summarise monitoring, reporting and plan-review requirements and provisions.

The EMRP draws on the ecological impact assessment provided in support of the consent application and Assessment of Environmental Effects (AEE) as well experience from local ecologists. The AEE and associated technical reports provide detail of values, construction, and operational effects, and calculations of appropriate mitigation.

This EMRP will be reviewed and commented on by the Department of Conservation (DOC) and the Tangata Whenua Working Group (TWWG) during the drafting of the EMRP prior to submission to WRC.

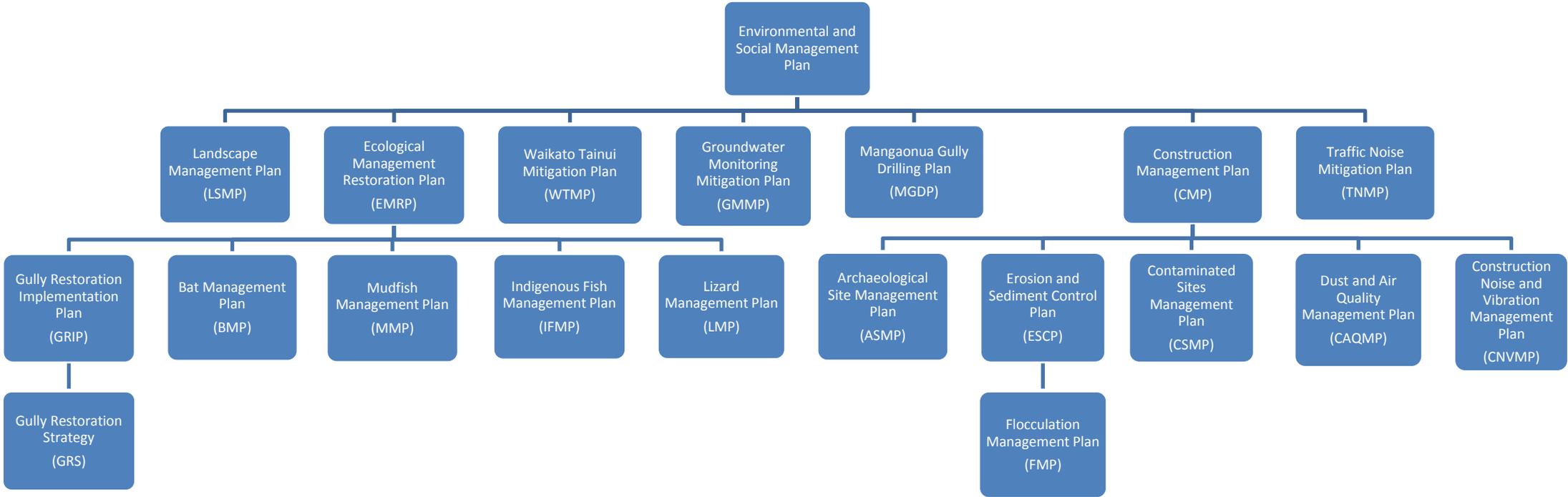


Figure 1– Management Plan Framework

1.2 Scope

The EMRP highlights the key elements in the sub-plans and provides guidance to the design and construction activities for areas where sub-plans may not apply, but where potential ecological effects may still occur. The status of the plans that contribute to the EMRP is outlined in Table 1.

Table 3: Ecological Management Related Plans and Status

Title		Description	Status
Ecological Management & Restoration Plan	EMRP	<p>Outlines how the ecological aspects will be addressed throughout the project. The EMRP provides a framework that includes or will include the following:</p> <ul style="list-style-type: none"> • Indigenous Fish Management plan; • Lizard Management Plan; • Bat Management Plan; • Mudfish Management Plan; • Gully Restoration Strategy; and • Gully Restoration Implementation Plan. <p>It will also reflect the Waikato Tainui Mitigation Plan and inform the Landscape Management Plan.</p>	Alliance Final
Landscape Management Plan	LSMP	Specifies the proposed landscaping measures along the alignment including constructed aspects as well as planting and maintenance requirements.	Alliance Final
Lizard Management Plan	LMP	Specifies indigenous lizard discovery and management protocols.	Alliance Final (Appendix C)
Indigenous Fish Management Plan	IFMP	Specifies indigenous fish discovery and management protocols.	Alliance Final (Appendix B)
Bat Management Plan	BMP	Identifies methods to manage effects on bats, including those associated with the modifications to the landform, from new structures, and from the removal of roost trees.	NZTA Final (Appendix A)
Mudfish Management Plan	MMP	Specifies the management tools for the recovery of mudfish in the Ruakura Road drain.	Alliance Final (Appendix E)
Gully Restoration Strategy	GRS	The GRS is a high level strategy to address the impacts of the Expressway construction and operation on cultural and ecological aspects in the Mangaone and Mangaharakeke and the Mangaonua Gullies. This plan does not require council approval but is to be provided to the TWWG on completion.	NZTA Final
Gully Restoration Implementation Plan(s)	GRIP(s)	In relation to the Mangaone and Mangaharakeke and the Mangaonua Gullies, these plans detail the methods to restore the vegetation and habitat of these gullies.	NZTA/ Alliance Final (Appendix D)
Waikato Tainui Mitigation Plan	WTMP	This is likely to set out the social and cultural values of Waikato Tainui as well as detailing the minimum requirements both in terms of process, works methodology and design specifically relating to the Project.	NZTA Final

1.3 EMRP Process

The EMRP has been developed and finalised in consultation with DOC regulatory staff and the TWWG. Any changes proposed to the EMRP need to be approved by WRC, prior to the implementation of any changes.

1.4 DOC and TWWG Consultation

Consultation with DOC and TWWG in relation to the Hamilton Section of the Waikato Expressway EMRP has been undertaken to discuss any areas of key concern to both groups, and to ensure that their issues and ideas are taken into account when finalising this EMRP.

Key ecological concerns have been focussed around the southern gullies as they provide habitat to the New Zealand Long-tail Bat, indigenous lizards, fish, birds and indigenous vegetation. Key cultural concerns in relation to the EMRP have also been focussed around the southern gullies network as this area was heavily used by Maori in pre-European times and is of a high cultural significance.

This EMRP will give effect to the WTMP as well as the Minimum Requirements (MR's). Kaitiaki Monitoring staff will have an opportunity to take part in the activities associated with the EMRP such as the Lizard Monitoring Programme, fish surveys and removal of indigenous vegetation.

Following the Ecology Workshop held by the Alliance, the TWWG have provided a summary of feedback on issues to be addressed in the finalisation of the EMRP and sub-plans. This feedback can be found in Appendix G.

2 Summary of Ecological Values, Effects and Mitigation

2.1 Introduction

This section highlights the key ecological resources that may be affected by the construction and operation of the Hamilton Section of the Waikato Expressway.

2.2 Terrestrial Vegetation

The main alignment of the Project traverses a landscape that is largely urban fringe and rural. As a result, the vegetation is dominated by pasture, plantation forest, and three major gully systems – the Mangaonua, Mangaone/Mangaharakeke and East/West Link gullies. These gully systems provide refuges for native flora and fauna, and each is a potential nucleus for restoration activity, and are consequently of high ecological value.

Although the gullies are dominated by exotic vegetation, indigenous plants are often a component of the sub-canopy through much of the Mangaonua Gully crossing and the northern part of the Mangaone/Mangaharakeke Gully. For the most part this vegetation is highly modified from its original state and does not reflect the vegetation that would have originally occurred in the gullies. However, the small area of bush on the southern slope of the Mangaonua Gully, which comprises mature kahikatea with regenerating sub-canopy, is much closer to the original vegetation that would have existed in the gully systems. Although it is a degraded example of this type of forest ecosystem, given the rarity of such stands of vegetation in the landscape around Hamilton, this area is considered to be significant indigenous vegetation.

Many small seep zones and wetlands are also present at the bottom of the gully systems. These comprise a variety of vegetation types, all characterised by a dominance of exotic trees, shrubs and grasses. Swamp sedge, rautahi and pukio are the few native species found, while the majority of the herbal wetlands and seeps are covered in exotic species, such as the leafless rush and isolepis, and grasses such as Yorkshire fog and *Glyceria maxima*. The major part of the wetland systems has a willow canopy. This dense woody vegetation is dominated by grey willow, but also has a high proportion of native species, such as cabbage tree, whekī, karamu, five finger, māhoe and tree fuchsia growing underneath.

The Project will result in the permanent loss of existing gully habitat, consisting mostly of modified shrubland, treeland and wetlands, largely dominated by exotic plants. Every effort will be undertaken to avoid or minimise effects on the ecological values within the gully systems and reduce the extent of the construction footprint wherever possible.

The consent requires that a minimum of 10.2 ha of gully restoration occurs to mitigate for this loss of habitat. This also requires minimum of 4ha of kahikatea dominated planting to be established on the gully slopes and gully floors. This planting has been reflected in the Southern Gullies GRIP (Appendix D).

The following vegetation descriptions are adapted from the AEE and the GRIP.

2.2.1 MANGAONUA GULLY

The Mangaonua Gully is approximately 270 m wide at the expressway crossing point with a relatively flat floor. The gully floor includes areas of wetland, ephemeral channels, and raised levees and the

vegetation is dominated by crack willow (*Salix fragilis*) which forms a canopy 6 - 10 m high. A range of indigenous and exotic species are present including ti kouka (*Cordyline australis*), *Carex spp.*, *Cyperus spp.*, wheki (*Dicksonia squarrosa*), mamaku (*Cyathea medularis*) and pate (*Shefflera digitata*).

Some areas are dominated by exotic species including Japanese honeysuckle (*Lonicera japonica*), periwinkle (*Vinca major*), tradescantia (*Tradescantia fluminensis*), blackberry, *Rubus fruticosus* agg.) and Chinese privet (*Ligustrum sinense*). Levees within the gully include areas of exotic grasses along with shrubs such as karamu (*Coprosma robusta*) and mahoe (*Melicactus ramiflorus*).

Towards the edge of the gully floor the vegetation grades into the slope communities and species such as kotukutuku (*Fuchsia excorticata*) and kahikatea (*Dacrydium dacrydioides*) become more common.

The northern gully slopes are relatively weedy with areas of gorse (*Ulex europaeus*), Japanese honeysuckle, periwinkle and blackberry. Pines (*Pinus sp.*) and *Eucalyptus sp.* occupy the upper slopes on the western end and there are scattered poplar (*Populus sp.*), privet (*Ligustrum lucidum*), kotukutuku, mahoe, and ti kouka. The understorey is largely exotic comprising Japanese honeysuckle, periwinkle etc. along with pampas (*Cortaderia selloana*) and woolly nightshade (*Solanum mauritianum*). Several mature kahikatea and totara (*Podocarpus totara*) occur in one area.

The southern slopes of the gully comprise predominantly gorse shrubland with scattered pampas and wilding pines. A patch of indigenous forest on the toe of the slope at the eastern end includes tawa (*Beilschmiedia tawa*), kahikatea, totara, and mahoe over a sub-canopy of mahoe, pate, mapou, wheki, ponga (*Cyathea dealbata*) and seedlings of canopy trees. Another patch of indigenous forest in the line of the road alignment and extending to the east comprises mature kahikatea over an understorey of mahoe, wheki, gorse pampas and ponga.

2.2.2 MANGAONE / MANGAHARAKEKE GULLY

The southern expressway gully crossing spans the confluence of the Mangaharakeke and Mangaone gullies. The gully floor here is dominated by crack willow along with weeping willow (*Salix babylonica*). Reed sweetgrass (*Glyceria maxima*) is common and forms dense patches. Pampas and arum lily (*Zantedeschia aethiopica*) are also present, along with bindweed (*Calystegia sp.*). Below the willow canopy the understorey includes a number of indigenous species including wheki, ti kouka, *Carex spp.*, ponga, putaputaweta (*Carpodetus serratus*) and drooping spleenwort (*Asplenium flaccidum*).

Further up the Mangaharakeke the gully floor is more natural and is dominated by kotukutuku, mahoe, wheki, and ponga. The understorey is also predominantly indigenous, comprising putaputaweta, mahoe, pate, *Carex spp.* and drooping spleenwort. Woolly nightshade and English ivy (*Hedera helix*) are present on the margins of this area.

The gully slopes on the northern and eastern sides are densely vegetated with a range of exotic and indigenous species including Tasmanian blackwood (*Acacia melanoxylon*), *Eucalyptus*, mahoe and poplars. Infestations of periwinkle, bindweed and Japanese honeysuckle are present on the margins. The toe of the slopes includes seepages and vegetation in these areas includes wheki, ponga, mahoe, and kotukutuku. A wide range of weed species are present in the understorey but regeneration of indigenous species such as kahikatea and mamaku, mahoe, and kotukutuku is also occurring.

The southern slopes of the gully are open pasture-dominated habitat with scattered infestations of pest plants such as gorse, blackberry, and periwinkle. Scattered patches of indigenous scrub comprising mahoe, wheki, mamaku, and pate also occur on the slopes.

2.2.3 EAST/WEST LINK GULLY

The site of the proposed road construction is located within a highly modified landscape of rural lifestyle blocks in the periphery of the Hamilton City area. The alignment crosses a gully that forms part of a major gully system which links to the Waikato River. There are no known threatened plants present within the proposed alignment; the majority of the area is highly modified and remnant features are degraded. A small group of mature kahikatea on the north-eastern slope of the gully is all that remains of the native kahikatea forest cover of the area.

A mixture of native and exotic species is found in the alignment area, with four general vegetation types present: pasture, gully slopes, sedge wetlands and willow wetland.

The slopes of the gully are covered by common exotic pasture species. These habitats are dominated by herbal weed species, such as scotch thistle, foxglove, Australian fireweed, inkweed, black nightshade, Himalayan honeysuckle, selfheal, white clover, broad-leaved flea-bane, cleavers, purple top and oxtongue. A number of common pastoral grasses are also present, e.g. cocksfoot and Yorkshire fog. Some areas are densely covered in Austral lady fern while some kiokio and bracken were observed as well.

Some whekī and a kātote border the seep at the northern slope. One large lemonwood, a māhoe and numerous mature hawthorn are also present at the upper end of the slopes. Some small native trees are emerging from the surrounding weeds at the southern slope and opposite of the pa site. Regenerating woody species along this slope are ponga, karamu, lemon wood, fuchsia and māhoe. Additional native ferns were also observed at this site such as bracken, rasp fern, round-leaved fern, hanging spleenwort and sickle spleenwort. The slope to the east, below a private property, is completely covered in Japanese honeysuckle.

The smaller southern arm of the gully mainly contains exotic species such as blackwood, Japanese honeysuckle, blackberry and gorse. No permanent stream is present here, but a willow wetland is present in the lower regions of the gully.

2.2.4 VEGETATION AND HABITATS OUTSIDE GULLIES

Outside the two main gully areas outlined above, and the gully that is intersected by the East-West Link, the vegetation is predominantly pasture with scattered large exotic trees such as poplar and pine, and patches of pine willow, and eucalyptus.

2.2.5 WETLAND 10 OUTLET TO UNNAMED TRIBUTARY OF THE MANGAONUA STREAM

A large storm water treatment wetland is being built to the south of the Ruakura interchange. As part of these works a culvert outlet pipe (culvert AG4) will be constructed to allow stormwater to discharge from Wetland 10 into a tributary of the Mangaonua Stream. Parts of the gully system are identified within a Significant Natural Area (SNA) as identified on the planning maps for the operative district plan. The area of works being undertaken is within 350m² of that total SNA area representing 1.4% of the total area of the SNA.

The top of the gully slope of dominated by low exotic scrub, herbaceous plants and pasture grasses. Tree privet (*Ligustrum lucidum*) and blackberry (*Rubus fruticosus*) are abundant, with gorse (*Ulex europaeus*) and Chinese privet (*Ligustrum sinense*) also present. Herbaceous species include ribwort (*Plantago lanceolata*) and creeping buttercup (*Ranunculus repens*) with the exotic grass cocksfoot (*Dactylis glomerata*) occurring frequently on the edge of the blackberry and scrub.

The vegetation on the gully slope consists of predominantly exotic scrub with abundant barberry (*Berberis vulgaris*) and blackberry. Native trees occur infrequently with small lemonwood (*Pittosporum eugenioides*) trees present on the slope and cabbage trees (*Cordyline australis*) at the toe of the slope.

Vegetation on the gully floor is characterised by a mixture of exotic and native flora that favour wetland conditions. Crack willow (*Salix fragilis*) along with grey willow (*Salix cinerea*) form a large broken canopy with wheki (*Dicksonia squarrosa*) and occasional cabbage trees. Closer to the stream native flora become more prevalent with wheki, pate (*Schefflera digitata*) and tree fuchsia (*Fuchsia exorticata*), cabbage trees and swamp astelia present although there are also willow and privet.

2.3 Herpetofauna (Lizards)

The lizard surveys carried out for this study only recorded one species, the indigenous common skink, out of five native species that could be present based on habitat availability. No species of conservation concern were found, however, if present they are most likely to occur in the gully systems.

The consent conditions require development of the Lizard Management Plan (Appendix C) that focuses on the preparation of a lizard capture and transfer plan in the event indigenous and “Threatened” or “At-Risk” lizards are found, including obtaining the necessary permit from the DOC. This permit is currently in the process of being applied for.

Construction of the Hamilton Section of the Waikato Expressway (the Project), which includes the Tamahere East-West Link and Ruakura Interchange, will commence late 2016. Prior to construction commencement vegetation and site clearance will to be undertaken which may affect habitats of indigenous lizards (skinks and potentially geckos). There is also the potential for accidental killing of lizards during these activities.

The Lizard Management Plan has the following objectives:

- Outline methods to be used to survey for the presence of indigenous lizard species in areas affected by the Project;
- Define protocols for capturing and relocating At Risk and Threatened indigenous lizards identified prior to site clearance works;
- Define methods for capturing and relocating At Risk and Threatened indigenous lizards accidentally discovered during construction works;
- Provide supporting documentation for Wildlife Act permits from the Department of Conservation; and,
- Recommend methods to remedy or mitigate any residual significant adverse effects on lizards and their habitats through inclusion of habitat features in landscape planting.

The Lizard Management Plan (Appendix C) provides further details on pre-construction monitoring, lizard capture and relocation, post relocation monitoring and sets out how this Project will comply with the associated resource consent conditions and the Wildlife Act.

2.4 Avifauna

Of the seventeen native species likely or possibly found within the alignment three species are ranked as nationally At Risk or Threatened by DOC (Robertson et al. 2012). Notably, relatively small numbers of pied stilts make occasional use of flooded paddocks to feed on invertebrates during the

wetter months. Falcon has been recorded recently around Cambridge and the outskirts of Hamilton, so may also roam the locality of the alignment from time to time. Spotless crane are an elusive wetland bird that is likely to be present in the gully systems, either seasonally or throughout the year.

There are also a range of other common native species recorded here or possibly found, which are listed as not At Risk or Threatened. However, several of these species, such as tui, kereru, little shag, and bellbird, are important species for the continued functionality of the regeneration of native forest and wetlands in the gully systems. Notably tui are often seen and heard and are an ‘icon’ and focus species for Hamilton City’s restoration endeavours. Thus, measures to minimise harm to these species is also appropriate. These species are listed in Table 2.

Table 4: Summary of indigenous bird species found or possibly found within the alignment

Species	Likelihood	Threat status
Tui	Probable	Not threatened
Bellbird	Possible	Not threatened
Morepork	Probable	Not threatened
Spotless Crane	Possible	At Risk
Pukeko	Probable	Not threatened
Spur-wing plover	Probable	Not threatened
Paradise shelduck	Probable	Not threatened
Grey warbler	Probable	Not threatened
Shining cuckoo	Probable	Not threatened
Fantail	Probable	Not threatened
Welcome swallow	Probable	Not threatened
Waxeye	Probable	Not threatened
Pied stilt	Probable – seasonal use only	Declining
Kereru	Possible – very low numbers	Not threatened
Australasian Harrier	Probable	Not threatened
NZ falcon	Possible – occasional use only if at all	Threatened
Little shag	Probable	Not threatened

Within flooded pasture areas small numbers of pied stilt have been observed at the northern area of the Project. Traditionally pied stilt have been found feeding and nesting in rougher pasture areas throughout the Waikato basin. However, since intensification of farming and the arrival of greater numbers of spur-winged plovers, stilts are far less common than they were twenty years ago (D Riddell pers comm). Stilts begin mating about August and nest from late winter until summer, so there is a small risk that nesting birds could be disturbed during the construction period.

The wetlands in the gully systems are utilised by wetland and game birds. Effects of the construction and operation of the road will be less than minor on most of these wetland specialist birds given the mobility of these ubiquitous wetland species. There is one possible exception – spotless crane. Although not found to date, it is highly likely that spotless crane occur within the gullies. Spotless crane is nationally defined by DOC as being an ‘At Risk – relict’. There is a risk that construction could disturb nesting crane and thus pre-construction surveys are required to confirm or otherwise the presence of this species.

There is a little shag colony located on the Mangaonua Stream which could be impacted by a proposed construction works in the area to construct a footbridge/cycleway and upgrade Cambridge Road, although presently these shags are not roosting directly in the footprint of the road or its associated construction infrastructure.

Given the low numbers of NZ falcon recorded in this locality, and the ease in which this species is detected if present, it is considered highly unlikely that falcon or their habitats will be significantly affected by the construction and operation of the road. Regardless, general pre-construction surveys will likely detect these birds if present, and then suitable measures can be developed to avoid effect if required.

Under the requirements of the Wildlife Act, pre-construction surveys are required to confirm or otherwise the present of all indigenous bird species and to minimise direct harm on individuals found. In this case there is a focus on the locally 'iconic', at risk and threatened species which could be directly impacted by the construction works. The methodology for these surveys is provided for in 4.5.1, 4.5.2 and 4.5.3. A set of protocols are provided for in section 4.5.4 to minimise direct potential effects on any indigenous birds present during the construction period.

A package of mitigation is proposed, including over 10 ha of gully enhancement restoration and an animal pest control programme over 20 ha of gully habitat for a period of 10 years. The details of this package are summarised in this report and detailed in the GRIPs. Implementation of these mitigation measures, when combined with the pre-construction surveys and harm minimisation protocols, will be sufficient to avoid significant direct adverse effects, as well as compensate for any direct, indirect and ongoing effects associated with the construction and operation of this roading project.

2.5 Freshwater Fauna (Fish)

The Hamilton Section corridor encompasses a highly modified and intensively farmed landscape, which for the most part supports no indigenous vegetation and little indigenous fauna. However there are a number of stream gullies that provide habitat for several threatened fish species (including longfin eels and black mudfish), and several farm drains that may also be providing habitat to indigenous species of fish. The three main gully systems (all located to the south of SH26) provide relatively high-quality stream habitat.

Historic fish records for the Mangaonua, Mangaharakeke and Mangaone streams held in the New Zealand Freshwater Fish Database (NZFFD) show that these streams support a variety of native fish species and also koura. 'Threatened' or 'At Risk' fish species known to inhabit the Mangaonua and Mangaharakeke/Mangaone Gully streams include longfin eel, inanga, torrentfish, and koura (all classified as 'At Risk – Declining'). Black mudfish ('At Risk – Declining') have been found upstream of the alignment in the Mangaone Stream.

Artificial farm or roadside drains are the most commonly encountered watercourse along the alignment. These drains generally offer very low ecological values, with many drying up during the summer period. Typically records from these waterways include shortfin and longfin eel, with the occasional downstream records of common bully, and closer to the Waikato River, records of giant kokopu exist. Inanga have also been found, although again well downstream of the alignment, in perennial flowing watercourses.

The Transport Agency has supplied an Indigenous Fish Management Plan (IFMP) (Appendix B) that has been prepared in accordance with the consent conditions to minimise any potential adverse effects on fish life within all waterways affected by the project.

Mudfish have been located in the Ruakura Rd drain as part of investigations for the AEE, and have also been found previously upstream of the alignment in the Mangaone Stream. The MMP has been

developed (Appendix F) to manage and mitigate for the potential effects on black mudfish during construction as a result of in-stream works.

It is recognised that there is a risk that there may be some level of mortality and injury as a result of the earthworks in the beds of streams. The objective of the fish recovery procedures that are described in the IFMP is to take all practical steps to minimise the direct loss of native freshwater fish as a consequence of stream diversion and culvert installation. With the implementation of the proposed avoidance, remediation and mitigation measures it is anticipated that the Expressway will result in no overall net loss of biodiversity values with respect to freshwater fish.

2.6 Long-Tailed Bats

As highlighted in the consent AEE ecological assessment, the Mangaonua and Mangaharakeke/Mangaone Stream Gullies provide critical habitat for long-tailed bats (classified 'Nationally Vulnerable', a sub-category of the 'Threatened' category) in the Hamilton-Cambridge landscape. Long-tailed bats are known to roost, forage and commute within the Waikato River corridor and connected gully systems at the south end of Hamilton City and selected stands of old, mature indigenous and exotic trees in the surrounding landscape. Bats make extensive preferential use of these gullies within Hamilton City.

Little detailed research has been undertaken on long-tailed bat/road interactions. Consequently, prediction of effects has to be extrapolated from the incomplete knowledge that exists concerning long-tailed bats and bat/road studies that have been undertaken on other similar species overseas, noting that individual species of bats can react to roads in radically different ways. A precautionary approach to the assessment of effects and corresponding avoidance, remediation and mitigation of effects has therefore been adopted. Regardless, the effects associated with the construction and operation of the Hamilton Section of the Waikato expressway are considered to be significant, with the greatest effect likely to result from the increased loss of habitat from the edge of the gully along the edge of the Southern Interchange.

The BMP outlines the following avoidance, remediation, mitigation and offset measures recommended to help minimise adverse effects on long-tailed bats:

- Adoption of protocols (tree removal protocols) for removal of mature trees where this is essential to permit construction;
- Refinement of the Project footprint to the extent practical to minimise the loss of mature exotic and native trees along sections of the alignment where bats have been shown to be present;
- Bridging gullies to reduce the effect of habitat fragmentation;
- Use of low-spill lighting to minimise the effect of lighting and bat friendly 'hop overs' and under pass flyways by design features and landscape planting ;
- Low noise road surfaces along sections of the road known to provide significant bat foraging and/or roosting habitat;
- Inclusion of a vegetation buffer along the alignment between the Mangaharakeke / Mangaone Gully and the Southern Interchange;
- Enhancement of the gully to the west of the Southern Interchange within the designation (East-West Link);
- Mitigate the loss of bat roosts as much as possible in the short and medium term by providing artificial bat roosts as far in advance of the construction as possible;

- Mitigate for the loss of bat foraging and commuting habitat, as well as long-term roost sites, by undertaking habitat enhancement through restoration of the Mangaone and Mangaonua gullies (already proposed as part of the mitigation for loss of significant indigenous vegetation and as offset for cultural impacts); and,
- Monitoring of the effects of the road construction during and after construction and evaluating the consequences of the operational roads on bats and their habitats to assess the effects of the Project, to focus any additional offset mitigation measures into areas where maximum benefit can be obtained, and apply learnings to future projects.

More detail surrounding the monitoring and mitigation measures surrounding long-tail bats can be found in the BMP (Appendix A).

3 Cultural Values and Ecological Resources

The TWWG have developed the WTMP which sets out key cultural aspects and concerns associated with the construction and operation of the Hamilton Section of the Waikato Expressway. In relation to ecological aspects, the TWWG have indicated the following items of significance:

- Gullies – waahi tapu;
- Vegetation – impacts on existing valued vegetation and choice of gully restoration and landscaping vegetation species;
- Peka-peka (bats);
- Tuna (eel);
- Streams/watercourses;
- Wetland establishment;
- Ecosourcing;
- Landscape planning; and,
- Gully restoration.

These elements are reflected in the final WTMP and are recognised and given effect to in the EMRP as well as the appended plans.

4 Designation and Consent Requirements

4.1 Ecological Requirements Summary

This section summarises the management measures and monitoring requirements for each ecological value identified by the consent conditions. It outlines the Project's obligations with regards to stream diversions, in-stream works, fish passage, bat roost and vegetation removal, sensitivity of receiving environments, protection of endangered species, wetland systems and significant indigenous vegetation and habitat where effects are to be minimised or avoided.

It is divided into the following sections based on the specialist ecological advice that will be required and where appropriate, contained within the various sub-plans:

- Gully vegetation and habitats (and GRIP);
- Herpetofauna (lizards);
- Little shags;
- Freshwater fauna (fish); and,
- Long-tailed bats.

Each of the following sections provides a summary of the specific management requirements pertaining to the affected ecological value. Detailed sub plans included at appendices have information including:

- Contains the results of pre-construction/baseline ecological studies and monitoring;
- Habitat restoration and enhancement measures;
- Describes in detail the construction and post construction management triggers and implementation requirements and the scientific methods that will be used;
- Provides an adaptive management framework specific to that ecological element; and,
- Provides monitoring requirements and any other information relevant to the Project.

4.2 Seasonal Constraints

Because construction will potentially impact a broad range of flora and fauna species and their habitats, management measures to minimise these effects and to monitor them vary from species to species, habitat to habitat through the seasons in any given year. Table 2 indicates the most suitable times of the year to undertake management and monitoring procedures for the fauna species and habitat affected by the construction works. For some species, and works timing is absolutely critical, and for others less so. In particular the following constraints need to be particularly noted when scheduling site preparation and construction works:

- Bat monitoring during winter months is not effective given that bats are less active and can even go into a state of semi-hibernation during winter months; and,
- Mudfish monitoring and translocation is generally ineffective during summer months as these fish burry themselves in to the mud and go into a state of hibernation (estivation).

Where there are significant constraints, further refinement of construction periods and ecosystems management procedures will need to be developed to allow for practical implementation of necessary works while minimizing adverse effects on species and their habitats as well maximising detection during survey and translocation events.

Table 1: Seasonal Constraints for Key Fauna Species and Habitat Enhancement Works

Activity	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Ecological constraints												
Bats ^[1]	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓
Mudfish relocation ^[2]	x	x	x	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓
Native fish relocation ^[3]	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓
Native fish migration	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓	x/✓
Lizard survey and translocation	x/✓	x/✓	x/✓	x/✓	x	x	x	x	x	x/✓	x/✓	x/✓
Planting and weed control constraints												
Planting	x	x	x	x	✓	✓	✓	✓	✓	x/✓	x	x
Weed control	✓	✓	✓	✓	x	x	x	x	✓	✓	✓	✓
Willow control	✓	✓	x	x	x	x	x	x	✓	✓	✓	✓

- KEY:**
- ✓ No work constraints for this activity at this time;
 - x Work constraints for this activity at this time;
 - x/✓ Some constraints may apply, check management plans, consult with ecologist.

^[1] Bats are most active when it is warm and are less in winter. The best time to check for roost trees is summertime. Dusk temperature needs to be above about 10°C for bat activity.

^[2] For sites where mudfish have been recorded, avoid works in dry waterways, timing should be assessed on a site by site basis and if sufficient flowing water is still present then exclusion does not need to apply. Details are provided in the separate Mudfish Management Plan

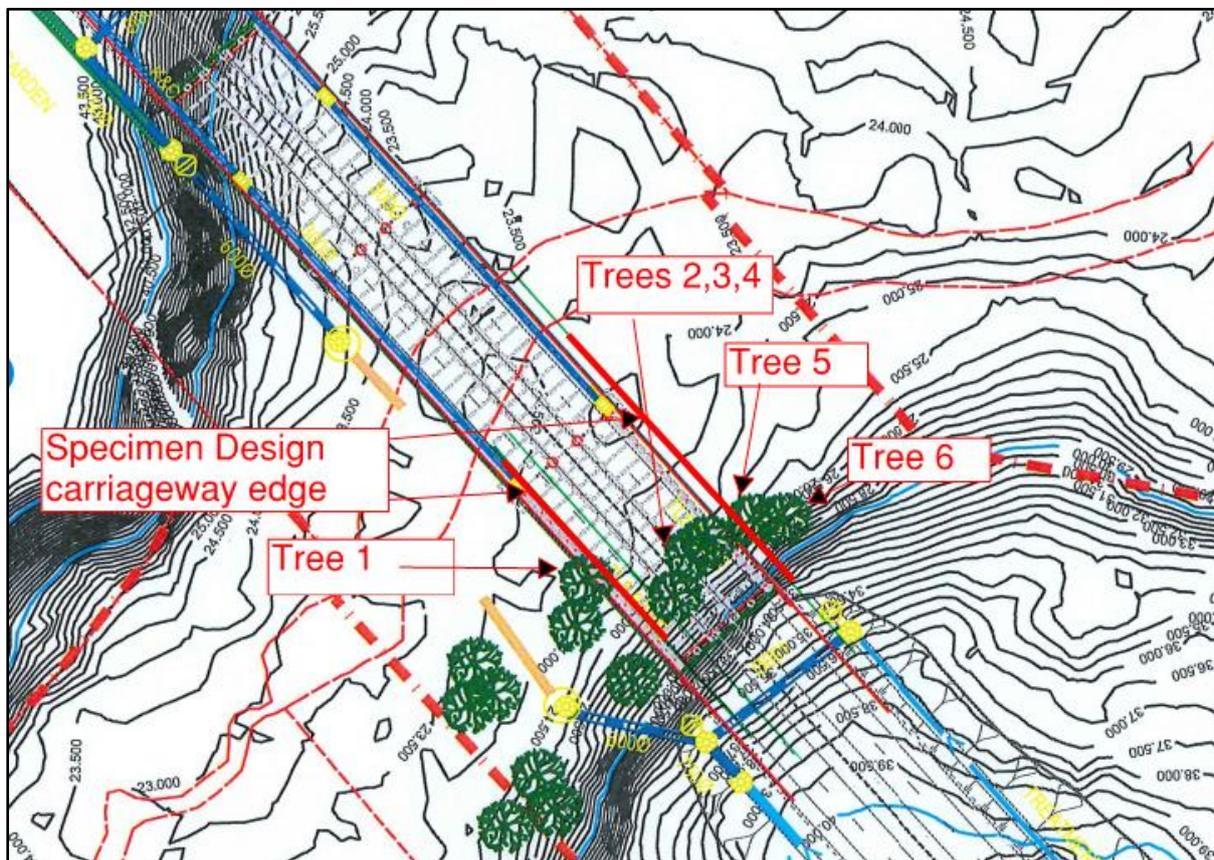
^[3] The best time to survey (and translocate) some indigenous fish such as giant kokopu is when in-stream water temp is above about 14°C. This is not a hard-and-fast rule but fish are generally less active in cold temperatures.

4.3 Gully Vegetation and Habitats Protocols

There will also be a need to remove most of the vegetation from within the designation to allow for construction across the Mangaonua and Mangaharakeke/Mangaone Stream Gullies and the gully traversed by the East West Link. While most of this will be exotic plants species, it will also include the native elements of the sub-canopy as well as a number of small seep and riverine wetlands. Some mature kahikatea trees and other native trees may also have to be removed. Mitigation for the loss of these mature trees will be achieved by replanting gullies and recreating wetlands with appropriate native gully species.

Impacts on vegetation in Mangaonua Gully have been reviewed to assess likely impacts on the significant kahikatea trees. On review (refer Figure 2), the proposed bridge alignment is unlikely to affect significant vegetation when compared to specimen design (in fact it offers an opportunity to be better).

Figure 2: Mangaonua Gully Bridge Impact on Kahikatea



- Trees 1, 2, 3 and 4 (refer Figure 2) would need to be removed under both designs;
- Tree 5 under the Alliance project alignment it may be able to be retained (it would be removed to construct specimen design); and
- Tree 6 – retained with both alignments.

It is proposed to replant the impacted gully areas with native plant species known to have typified gully environments prior to human settlement. An approach generally in accordance with the Gully Restoration Guide (Wall & Clarkson, 2006) is proposed with a minimum 5 year aftercare and maintenance period. Plants used for the restoration of the gullies will be eco-sourced. Draft GRIPs have been provided for the Mangaonua and Mangaone gully crossings.

The GRIPs have been finalised following discussion and consultation with TWWG, DOC and WRC before submitting to WRC for approval in accordance with the conditions of consent.

Replanting the designation within the gullies and also extending planting to the stormwater treatment areas associated with the gullies should in time achieve a higher quality gully vegetation environment than currently exists.

Ultimately, the key outcome sought is that the ecological restoration will provide a net ecological gain in the quantity and quality of the vegetation in the impacted sections of gully.

However, such areas will remain vulnerable to plant pests and it is critical that the aftercare and maintenance is undertaken until a closed canopy of native species is achieved. Therefore a minimum five year maintenance period will be essential. Monitoring impacts on the remaining kahikatea have been included in the final GRIP.

The following diagram (Figure 3) outlines the process and seasonal timing requirements to undertake restoration works within the gully systems.

4.3.1 CULVERT AG4 WETLAND 10 OUTLET VEGETATION REMOVAL MITIGATION

Vegetation Clearance

During vegetation removal in the gully for the construction of the wetland outlet, the following measures will be implemented to ensure that the effects of the vegetation clearance to minimise the effects on the ecology and comply with the DOC wildlife permits and with our current EMRP and associated appendices.

- An ecologist will provide advice during vegetation clearance to ensure removal of native vegetation is kept to a minimum.
- Removal of trees and shrubs above 15 cm DBH will follow the bat tree removal protocols required by the DOC wildlife permit
- Vegetation clearance will comply with conditions of DOC wildlife permits and applicable ecological management plans as these relate to birds and lizards

Improving the Aquatic Environment

During tree removal, effort will be made to keep some woody debris from the felling to improve the aquatic environment. Large woody debris will be placed along the water's edge, within the channel. These will be laid in bundles, in the water at the edge of the channel. Wood is the main source of stable habitat in the current stream, providing cover for fish and invertebrates.

Post Construction Vegetation Restoration

The gully slopes and the riparian margins of the new channel will be restored post construction with appropriate native species. A restoration ecologist will advise on species selection for the various planting zones. The approach to species planting and selection will be in general accordance with the current GRIP for the gullies. Taking into account site specific variables such as gully slope aspect. The species selection will include suitable tree species that will eventually form a canopy over the channel.

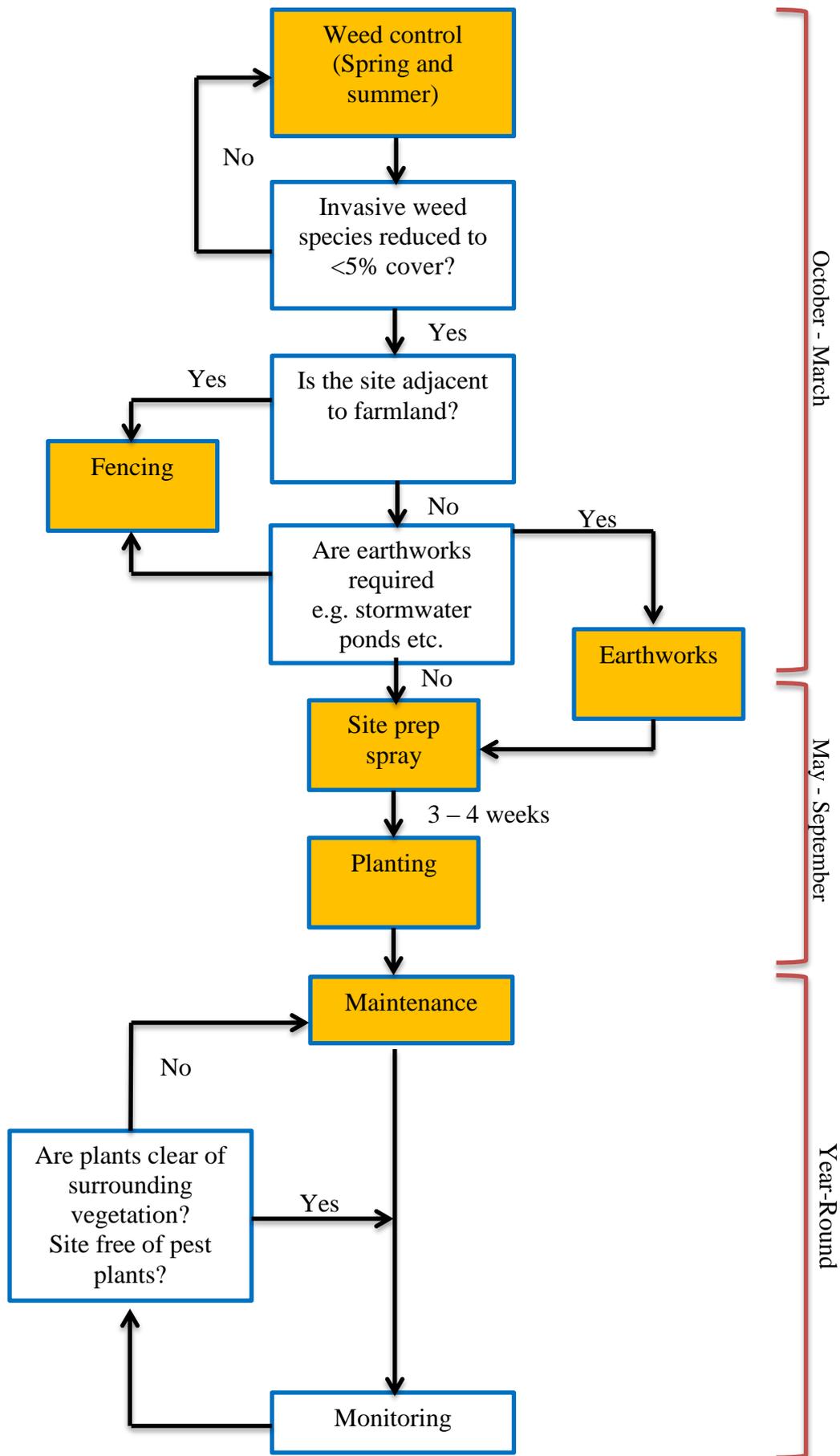


Figure 3 – Steps in Restoration of a Site

4.4 Herpetofauna (Lizard) Protocols

Lizard translocation protocols have been developed in consultation with the TWWG and DOC and can be found in the Lizard Management Plan (Appendix C). The risk of significant adverse effects occurring on indigenous lizards is considered to be generally less than minor. However, copper skinks could be harmed during the construction process. Key habitats for these skinks will be identified before construction commences, by deploying Artificial Capture Objects (ACOs) for at least 1 month before construction in these habitats. These ACOs will be deployed in August and will be checked for occupancy mid-September. Any indigenous lizards captured will be relocated to either of the two proposed lizard release sites. This will involve creating predator safe habitat, such as by using piles of rocks or woody debris as refuges, which cats and rats will struggle to enter.

Further detail on the location of these lizard release sites can be found in the GRIP.

4.5 Avifauna Protocols

The avifauna protocols consist of:

- Pre-construction surveys for target species (as identified in s2.4);
- Development and implementation of harm minimisation protocols on key bird species most vulnerable during the construction period;
- Monitoring requirements during and post construction; and
- Strategies for an Adaptive Management approach and general reporting requirements.

4.5.1 PRECONSTRUCTION SURVEYS

General Bird Survey methodology

A general informal, non-quantitative preconstruction bird survey will be sufficient to detect key target species and gain appreciation of abundance and distribution. In particular, this survey approach will be sufficient to detect NZ falcon, pied stilt, tui, bellbird, kereru, and little shag.

A walkover of the entire site shall be undertaken by an experienced ecologist familiar with birds and their habitats in the Waikato before construction commences on 1st October 2016. The walk over survey will involve a minimum of 4 hours survey time (excluding travel and set up time) per 'Critical Habitat', including dawn and dusk to detect species with crepuscular behaviour. All species encountered, including exotic species, will be recorded on a template observer sheet, noting, time, and weather, number of individuals seen, behaviour and habitat observed in. All detections will be logged by GPS and data supplied to the Project's Environmental Manager for distribution to the councils and key stakeholders.

'Critical habitat' for the purposes of this survey includes: all gully areas; waterways including drains; mature and dense stands of trees and hedgerows and wet pasture. Specific locations and delineations of critical habits will be refined and mapped using information gained from the general bird survey. All critical habitat maps will be supplied to the Project's Environmental Manager for distribution to the councils and key stakeholders.

4.5.2 PRECONSTRUCTION TARGETED NESTING SURVEYS

In addition to the general bird survey, two weeks before clearance of any critical habitats between the month of September and February in any calendar year an experienced ecologist will undertake targeted surveys of nesting and/or roosting habitat of the following species:

- Tui;
- Bellbird;
- Kereru;
- Pied stilt;
- Little Shag; and
- NZ falcon

4.5.3 GULLY WETLAND BIOACOUSTIC SURVEYS

Spotless crane and little shag may be within the gullies in the Project foot print. Before construction commences on the 1st of October 2016, a targeted bioacoustic survey, using DOC build static automated acoustic detectors, shall be undertaken at each gully crossing (excluding Simpsons Gully), to determine if crane and shag are present. These surveys shall be undertaken over 3 days (these do not have to be consecutive) in total with no more than 2.5mm of rain per day.

If crane or shag are detected, further approval will be sought from WRC prior to tree felling. A strategy to minimise harm on individuals that may be nesting within the project footprint is to be developed as part of the survey reporting requirements and in accordance with the adaptive management approach outlined in section 4.5.5.

Results of these bioacoustics surveys will be provided to WRC.

4.5.4 INCIDENTAL KILL AND HARM MINIMISATION PROTOCOLS

The following protocols shall be adhered to during the construction period of the Project in relation to indigenous birds and also in strict accordance with the conditions of DOC Wildlife Act Authority 50888-FAU.

Bird Protocol A:

An ecologist must be present during tree felling or vegetation removal within critical habitat areas. If indigenous birds are known or suspected to be nesting or roosting in a tree or locality, the tree or locality must be inspected and identified to the supervising engineer by the ecologist prior to felling.

At this point Protocols B and C shall apply.

Bird Protocol B:

If nesting or roosting indigenous birds other than those listed below are found during:

- The tree felling process;
- Pre-construction targeted nest surveys; or
- during any other occasion nesting indigenous bird species are discovered;

Best efforts must be made to retain the trees where nesting birds are found until the eggs have hatched and birds fledged before habitat is destroyed and/or occupied trees are felled. If this is not possible then Protocol C will apply.

For the following key species only:

- Pied stilt
- Little shag
- NZ falcon
- Spotless crane

If the retention of nests and associated nesting habitat, until the eggs have hatched and birds fledged, for the key species above is not possible or practical, WRC-and DOC will be notified with 24hrs of the issue being identified and a targeted approach to minimise harm to the birds is to be developed and implemented jointly. Until such time that a suitable approach is developed to minimise harm to the nesting or roosting bird(s), clearance and any other construction works shall be suspended in that specific locality.

Bird Protocol C:

Any injured or incidentally killed birds in the tree felling or clearance process shall be handled and/or disposed of in strict accordance with the Special Conditions of DOC Wildlife Act Authority 50888-FAU.

DOC shall immediately be notified of any indigenous birds taken into care as a consequence of the works during the construction period in accordance with the Special Conditions listed in Schedule 3 of DOC Wildlife Act Authority 50888-FAU.

The key steps the supervising ecologist shall undertake for dead birds classified as nationally Threatened, At Risk or Data Deficient under the Special Conditions listed in Schedule 3 of DOC Wildlife Act Authority 50888-FAU are:

- Ensure that the body is to be chilled if it can be delivered within 24 hours, or frozen if longer than 24 hours to delivery to the Te Rapa office of DOC.
- Ensure appropriate measures are taken to minimise further deaths.
- Inform DOC of the death and discuss if it is necessary to halt further handling until full investigations of death(s) have occurred.

For injured birds, the key steps the supervising ecologist shall take under the Special Conditions listed in Schedule 3 of DOC Wildlife Act Authority 50888-FAU are:

- Temporarily held and transported birds are to be taken to a veterinarian immediately.
- The veterinarian shall check the bird and direct whether it should be either rehabilitated, euthanized, or released.
- Any birds than are euthanized shall be returned to the Te Rapa office of DOC.

No indigenous birds shall be euthanised without first:

- Consulting with the DOC Captive Management Co-ordinator and obtaining the prior consent of DOC; or
- Obtaining the recommendation of a veterinarian where euthanasia is undertaken on animal welfare grounds; or

- Carries out the euthanasia under direction from DOC and in consultation with the DOC Captive Management Co-ordinator

Bird Protocol D:

DOC shall be notified within 24hrs of any nationally Threatened, At Risk or Data Deficient native bird species which should die as a consequence of the works during the construction period. DOC will provide directions as to how the body is to be disposed of. Until this direction is given, the supervising ecologist shall

- Ensure that the body is to be chilled if it can be delivered within 24 hours, or frozen if longer than 24 hours to delivery.
- Ensure appropriate measures are taken to minimise further deaths.
- Minimise all further handling until full investigations of death(s) occur.

Bird Protocol E:

Injured birds shall not be euthanized without first:

- Obtaining prior approval of DOC; and
- Obtaining the recommendation of a veterinarian

4.5.5 ADAPTIVE MANAGEMENT APPROACH & ONGOING MONITORING

In addition to the adaptive managements approaches outlined in the sections above, following discovery of nesting or roosting individuals of key species within the Project footprint, a post construction monitoring plan will be developed should one or more nesting pairs or roost sites of the following species be found to be directly impacted by the Project during the construction period:

- Pied stilt
- Little shag
- NZ falcon
- Spotless crane

In this event the methodology for any during and post-construction monitoring and for any avoidance, remediation and mitigation measures (if required), shall be developed in consultation with WRC, DOC and tangata whenua.

Otherwise no post construction monitoring of birds is considered necessary for the Project.

4.5.6 REPORTING

Reports for all bird surveys (as detailed in sections 4.5.1, 4.5.2 and 4.5.3) shall be prepared and presented to WRC and DOC within two weeks of completion of each survey event for review.

In addition, six monthly reports shall be prepared during the construction period outlining any bird survey results and consequential action requirements, as well as a detailed description of events activating the native bird harm minimisation protocols.

All survey and bi-monthly reports shall be presented to Council, DOC and tangata whenua at the time they are finalised.

4.6 Freshwater Fish Protocols

The specific requirements for fish survey, recovery, translocation and habitat restoration procedures are outlined in the IFMP (Appendix B) and MMP (Appendix E). The following flow charts (Figures 4 and 5) outlines a summary for the key steps required in the management plans.

Timing of works is particularly important and any construction works affecting aquatic habitats *must* be carefully scheduled so as to fit in with the survey and translocation requirements for either of these plans. For example, as mudfish go in a state of semi-hibernation in the summer (estivation), and thus recovery/translocation needs to be undertaken outside of the summer months. Scheduling requirements are detailed in both fish plans.

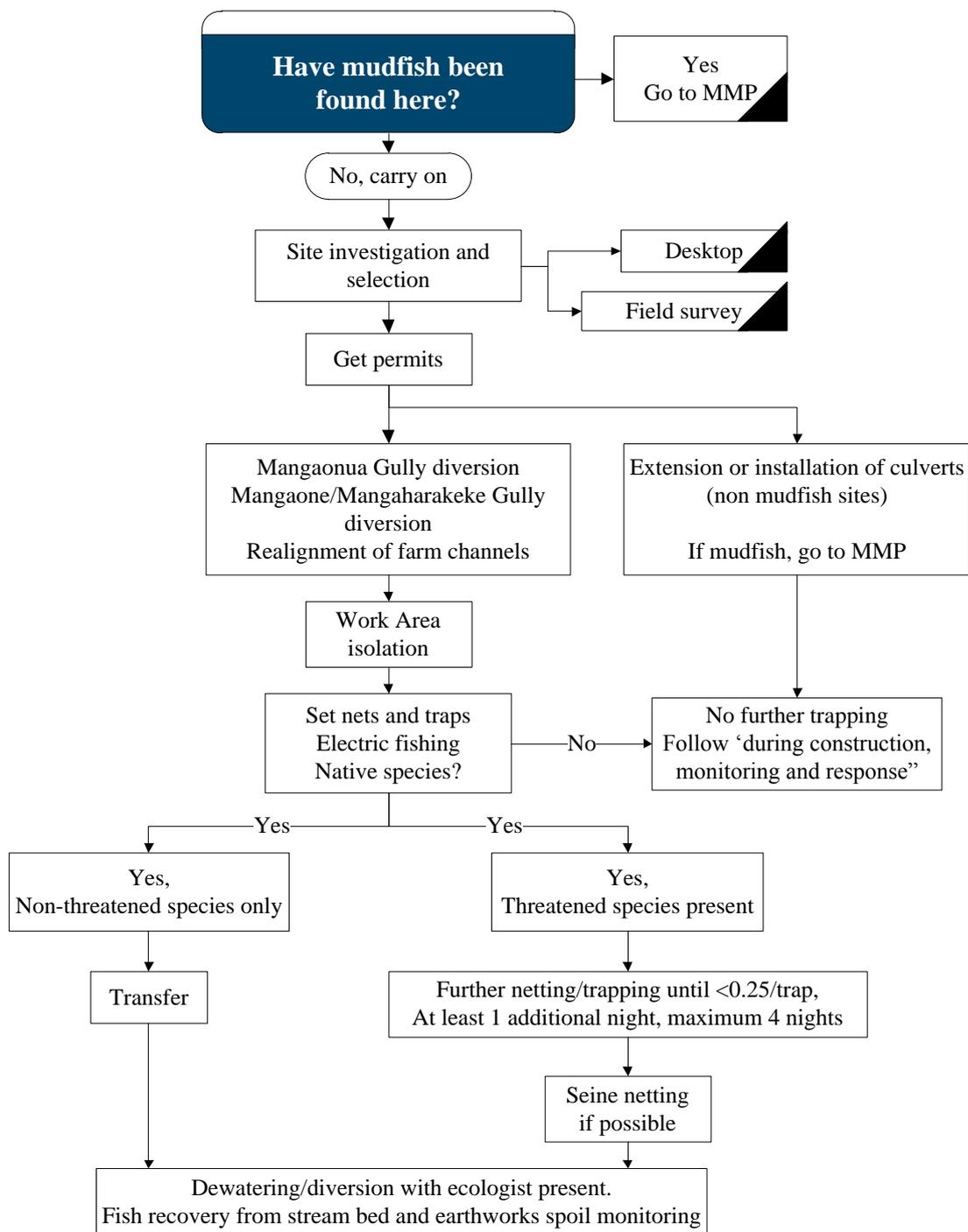


Figure 4: Indigenous Fish Survey, Recovery and Translocation Process.

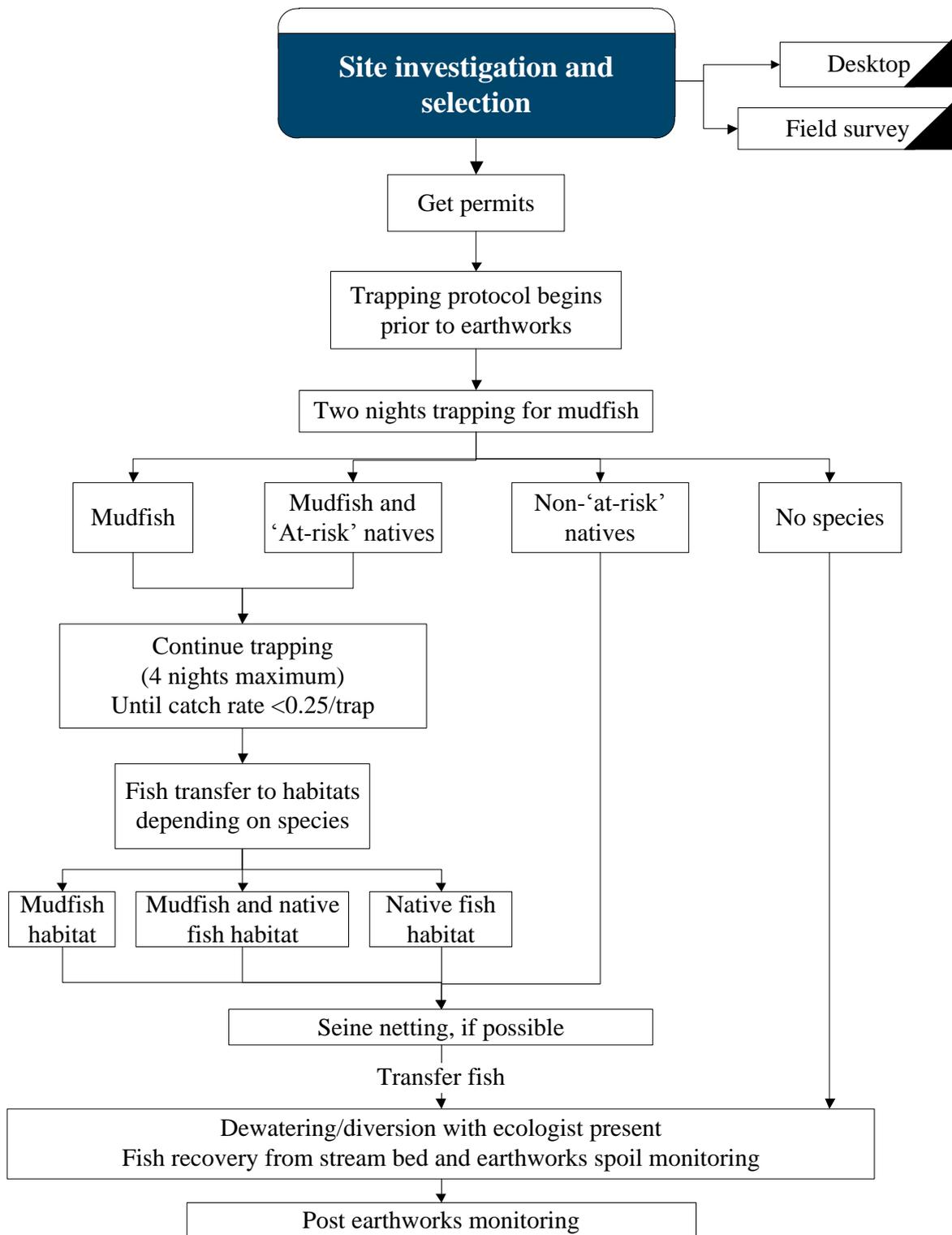


Figure 5: Steps in Mudfish Survey, Recovery and Relocation

4.7 Long-Tailed Bat Protocols

The key aspects which have been addressed in devising management and monitoring protocols for minimising, monitoring and mitigating effects on long-tailed bats have accounted for the following matters:

- Extensive monitoring during spring and summer months to determine locations of existing roosts (if any);
- Further refinement of structure design and measures to maintain bat behaviours and flying patterns and possible construction impacts on them;
- Development of tree removal protocols and seeking approval/permitting of these protocols from DOC;
- Consideration of bat-friendly structures including lighting regimes, minimum bridge heights and hop-overs in the detailed design – potentially both on-structure and adjacent to structures;
- Protocols to ensure protection of, and minimise disturbance on, existing habitat during construction;
- Refinement and implementation of pre and post monitoring as per the BMP; and
- Maximisation of restoration of bat habitat and roost trees through ecologist input into the Landscape Management Plan and GRIPs.

All of these processes and mitigation strategies have been developed, implemented and refined for other roading projects associated with Waikato Expressway one way or another. However, it is vital that the complexity and seasonality of the protocols are understood by the wider team.

The BMP (Appendix A) explains in detail the processes surrounding the tree removal protocol and any bat monitoring and mitigation measures.

5 Pest Management Summary

An animal pest control programme as a mitigation method for potential adverse effects on long-tailed bats and indigenous lizards affected by the construction and operation of the Hamilton Section of the Waikato Expressway has been proposed for the Southern Gullies.

Control of animal pests, particularly introduced mammals, is the best means of facilitating the recovery of indigenous animals that are threatened by predation or competition from these invasive species. Recovery of a number of indigenous species through control of mammalian pests not only mitigates for loss of habitat but also improves overall health and integrity of ecosystem processes (e.g. increasing pollination and seed dispersal processes by increasing the number of tui and kereru, or increasing seedling/sapling survival by reducing browsing pressure).

Target species for pest management of forests and wetlands are typically feral ungulates (goats and pigs), possums, mustelids (stoats and likely weasels and ferrets), ship rats, Norway rats, feral cats, and hedgehogs. Collectively, these species are a key threat to indigenous flora and fauna through consumption/ predation, habitat degradation, and competition for food.

An integrated animal pest control programme in forest, wetland, riparian, and aquatic habitats is likely to facilitate the recovery of biodiversity, including threatened or at risk species such as long-tailed bats. This increase in productivity in relation to pest control can overcome losses or modification of habitat.

Further detail on the Pest Control Proposal be found in Appendix E of the Southern Gullies GRIP.

6 Ecological Monitoring and Reporting

A number of monitoring methods have been developed and included in the EMRP and sub-plans. Monitoring will be undertaken according to the following plans and consent requirements to assess impacts on the local ecological resources:

- Gully vegetation and habitats (GRIPs);
- Herpetofauna (lizards);
- Little shags;
- Freshwater fauna (fish); and,
- Long-tailed bats.

A detailed monitoring schedule, setting out all ecological-related monitoring requirements will be developed and will be attached to the EMRP. This will include the monitoring as set out in the EMRP sub-plans and be used as a resource when undertaking work planning tasks. Monitoring locations will also be reflected in the Social and Environmental Mitigation drawings appended to the project Social and Environmental Management Plan.

Results of monitoring undertaken during the project have been outlined in the relevant sub-plans.

7 EMRP Reviews

A management review of the EMRP may be undertaken as required by the Project's Construction Environmental Manager and Project Ecologist. If completed, the review will take into consideration:

- Any significant changes to construction activities or methods;
- Any significant change in the related sub-plans;
- Key changes to key roles and responsibilities within the Project;
- Changes in industry best practice standards or recommended pollution controls;
- Changes in legal or other requirements (social and environmental legal requirements, the NZTA objectives and relevant policies, plans, standards, specifications and guidelines);
- Results of inspection and maintenance programmes, and logs of incidents, corrective actions, internal or external assessments; and ,
- Any relevant public complaints.

The EMRP sub-plans and monitoring schedule are expected to be updated from time to time throughout the course of the Project to reflect material changes associated with construction techniques, changes to the project footprint or to reflect ecological monitoring. In consultation with DOC and TWWG, approval from WRC will be required for any amendments to the EMRP (as outlined in the conditions of consent).

8 Consent Condition Summary

The following conditions set out the requirement to prepare an Ecological Management and Restoration Plan (EMRP) which is to include a Mudfish Management Plan (MMP). These conditions are from Schedule 1 which apply to all resource consent applications granted for the Waikato Expressway Hamilton section.

Table 5 Consent Conditions

Condition	Description	Reference in EMRP	Council Authority
WRC Project Consents Schedule One Condition 48	<p>The consent holder shall develop an Ecological Management and Restoration Plan (EMRP). This EMRP shall be prepared by an appropriately qualified and experienced ecologist/s and the Plan’s purpose shall be to avoid, remedy, or mitigate adverse ecological effects associated with the Project on terrestrial, wetland and perennial stream habitats and nationally “Threatened” or “At Risk” species associated with these habitat types, including long-tailed bats, Black Mudfish, other indigenous fish, other indigenous lizards, Little Shag and any rare or uncommon plants. The EMRP shall be submitted to the Waikato Regional Council for approval in a technical certification capacity that it addresses condition 48 (a) to (g), at least 40 working days prior to the commencement of works. Any subsequent changes proposed to the EMRP shall be confirmed in writing by the consent holder and certified in writing by the Waikato Regional Council acting in a technical certification capacity, prior to the implementation of any changes proposed. The EMRP shall include, but not be limited to, the following matters:</p>	Noted	WRC
48(a)	<p>Measures to be undertaken by the consent holder to minimise potential adverse effects on the stand of kahikatea trees in the Mangaonua gully including: measures to identify and minimise the trees that are to be removed; measures to protect the trees that are to remain, including delineation and protection of root zones, avoidance of fill placement in root zones, avoidance of foot traffic and machinery use in root zones, avoidance of bark and branch damage; and, monitoring of the kahikatea for a minimum of three years following completion of the bridge construction works in the gully to determine whether the works have adversely affected their health, and if so, the remedial measures to be adopted.</p>	Section 2.2.1 and the GRIP (Appendix D section 8.5)	WRC

Condition	Description	Reference in EMRP	Council Authority
48(b)	<p>The consent holder shall use an appropriately qualified and experienced ecologist(s) to design, implement and undertake a pre-construction survey and salvage programme targeting “Threatened” and “At Risk” birds and lizards, and “Threatened”, “At Risk” or locally uncommon plants, which may be found within the locality, as residents or seasonally in the case of fauna. “Threatened” and “At Risk” species are listed in the Department of Conservation New Zealand Threat Classification System (Townsend et al. 20081, Robertson et al. 20122, & Hitchmough et al. 20103, de Lange et al. 20134) and any subsequent published updates. At least 40 working days prior to the commencement of works, the consent holder shall provide to Waikato Regional Council a report detailing the results of the pre-construction survey(s). This report is to include but not be limited to;</p> <ul style="list-style-type: none"> i. The habitat requirements of the species identified in clause b) above likely to be found within the locality; ii. The location and relative abundance of the species identified in clause b) above found during the survey; iii. Methods to avoid, remedy or mitigate adverse effects on any species identified in clause b) above and their habitats; and iv. Timing for any further surveys and translocation options (if required). 	Noted	WRC
48(c)	<p>The EMRP shall include a Mudfish Management Plan (MMP). The objective of the MMP shall be to ensure that any resident black mudfish are removed from the impacted area of the Ruakura Drain and to retain and enhance habitat suitable for black mudfish. In this respect the MMP shall include, but may not be limited to, the following:</p> <ul style="list-style-type: none"> a) Methods for capture and transfer of resident mudfish including the timing and duration of trapping/monitoring periods and identification of suitable habitat for release of captured mudfish; b) Methods to ensure that mudfish do not re-enter the construction zone over the duration of construction activities; c) Details of the ecological enhancement planting which will occur over a length of 300m of the Ruakura Drain between 352 Ruakura Road and 410 Ruakura Road. The planting will be up to a width of 2m on both sides of the drain, allowing for the 	Appendix E and Section 4.6	WRC

Condition	Description	Reference in EMRP	Council Authority
	<p>constraints imposed by drainage and road reserve management activities. A minimum of 0.5m of planting on the road side of the drain, and 1m on the farm side of the drain is required;</p> <p>d) Details of the management regime for the drain where the mitigation is taking place (in consultation with Waikato District Council as the Road Controlling Authority) which will provide for the long-term management of the black mudfish population;</p> <p>e) Details of the internal habitat and riparian buffer planting including details of measures to be implemented, including fencing specifications, planting suites, eco-sourcing of indigenous plants, timing of works, monitoring for the presence of black mudfish, and all other relevant matters; and</p> <p>f) Details of how planted areas will be maintained for a period of five years following the initial planting.</p> <p>Advice Note: The consent holder and the Waikato District Council shall enter into a Memorandum of Understanding in relation to the long term management of the Ruakura Road drain between 352 Ruakura Road and 410 Ruakura Road. The Memorandum shall set out measures to ensure that the MMP is successfully implemented and the enhancements maintained and retained in this location.</p>		
<p>East West Link Schedule One</p> <p>Condition 42</p>	<p>The consent holder shall develop an Ecological Management and Restoration Plan (EMRP). This EMRP shall be prepared by an appropriately qualified and experienced ecologist/s. The EMRP's purpose shall be to avoid, remedy or mitigate adverse ecological effects associated with the construction and operation of the Tamahere east west link road on terrestrial, wetland and perennial stream habitats and nationally "threatened" or "at risk" species associated with these habitat types, including long-tailed bats, Black Mudfish, and other indigenous fish and indigenous lizards. The EMRP shall be submitted to the WRC for approval in a technical certification capacity that it addresses condition 42(a) – (h). at least 40 working days prior to the commencement of works – exclusive of the stage one works located between Chainage 400m and Birchwood lane. Any subsequent changes proposed to the EMRP shall be</p>	<p>Noted</p>	<p>WRC</p>

Condition	Description	Reference in EMRP	Council Authority
	confirmed in writing by the consent holder and certified in WRC acting in a technical certification capacity, prior to the implementation of any changes proposed. The EMRP shall include, but not be limited to, the following matters:		
Condition 42a	Details of restoration and habitat enhancement measures that will aim to achieve no net loss of terrestrial, wetland and stream biodiversity values or natural habitat (including all perennial waterways and wetlands), as a result of the construction and operation of the Tamahere East/West Link Road, including impacts on in-stream habitat resulting from culvert and road construction of the link road are replaced by wetland habitat of an equivalent or greater area. These details shall be provided in implementation plans and shall include, but not be limited to the following:	GRIP (appendix D)	WRC
Condition 42a.i	Ecological restoration of 1.33 ha of wetland	GRIP (appendix D)	WRC
Condition 42a.ii	Ecological restoration of 1.27 ha of gully slopes	GRIP (appendix D)	WRC
Condition 42a.iii	Ecological restoration of the road batter slopes totalling 7,785m ² , with tall, fast-growing trees planted along the road	This detail will be included in the landscape planting for the area. The design of this area will be included in the detailed design for section 7 which has not been completed as of yet	WRC
Condition 42a.iv	Ecological restoration of the riparian margins of the entire length of any diverted streams;	Shown in the GRIP (Appendix D) as SBOS planting along the length of the stream banks	WRC
Condition 42a.v	Details of the restoration and habitat enhancement measures involving indigenous re-vegetation to be provided in implementation plans, and where relevant, shall generally align with Wall, K and B.D. Clarkson 2006: Gully Restoration Guide: a guide to assist in the ecological restoration of Hamilton's gully system. Third Revised Edition. Hamilton City Council (or an updated version) and include, but may not be limited to the following:	GRIP (appendix D)	WRC

Condition 42a.v.A	The use of eco-sourced indigenous plant species, to be matched to the habitats and the site conditions where planting is to be undertaken	GRIP (Appendix D section 8.3)	WRC
Condition 42a.v.B	The nature of any restorative planting to be undertaken, including details of timing, species, source of planting material, extent, percentage of cover provided by canopy, and location	GRIP (Appendix D)	WRC
Condition 42a.v.C	The use of Kahikatea in plantings, in suitable sites, noting that kahikatea takes many years to provide canopy cover in re-vegetation plantings, and other species will need to be planted with the Kahikatea to provide additional canopy cover and closure	GRIP (appendix D section 8.5)	WRC
Condition 42a.v.D	Monitoring and maintenance programmes for all indigenous planting until 90% indigenous canopy cover is achieved on the north facing slopes on pumice soils, and 90% indigenous canopy cover on the gully floor and gully terraces, except where mature exotic trees are retained for bat habitat roosting	GRIP (appendix D section 9)	WRC
Condition 42a.v.E	The nature of any weed and/or pest control considered appropriate (timing, extent and location)	Weed control mentioned throughout the GRIP in each planting section. Pest control programme included as appendix to GRIP.	WRC
Condition 42a.v.F	The nature and extent of stock proof fencing that is to be established along the margins of restoration areas	GRIP (Appendix D section 6.1)	WRC
Condition 42a.b	A finalised Fish Recovery Protocol shall be developed in accordance with draft fish recovery protocol attached in Attachment A to these conditions. The finalised fish recovery protocol shall include details of the actions that will be taken during culvert installation and earthworks to minimise the direct loss of native freshwater fish.	IFMP (Appendix B)	WRC
Condition 42a.c	A lizard management protocol shall be prepared following consultation with the DOC. The purpose of the protocol shall be to minimise injury or mortality of indigenous lizards present within the construction footprint of the gully through salvage and relocation efforts by qualified and experienced ecologists.	Lizard Management Plan (Appendix C)	WRC
Condition 42a.d	Procedures for implementing, monitoring and review of the EMRP.	Section 7	WRC
Condition 42a.ei-eix	The consent holder shall engage an appropriately qualified and experienced bat ecologist to develop a Bat Management Plan. This plan shall address mitigation to be undertaken within, and	BMP (Appendix A)	WRC

	near the road footprint to avoid, remedy or mitigate any adverse effects from the construction and operation of the road on long-tailed bats		
Condition 42.a.f	The consent holder shall provide a draft of the EMRP, or any proposed changes to the EMRP to the DOC for comment at least 20 working days prior to it being submitted to the WRC for certification. The consent holder shall consider for incorporation into the final version of the EMRP or any final version of proposed changes into to the MRP any comments/suggested amendments provided by the DOC. If those comments/amendments are not incorporated into the final EMRP or final version of proposed changes, the consent holder shall forward copies of the comments/amendments to WRC. The WRC may consider any suggested amendments from the DOC and may require the consent holder to further amend the EMRP, or any proposed changes to it, before certifying the EMRP, or proposed changes.	Noted	
Condition 42.a.g	The consent holder shall undertake all activities authorised by this consent in accordance with the approved EMRP.	Noted	WRC
Condition 42.a.h	The consent holder shall ensure that a copy of the certified EMRP, including any certified amendments, is kept onsite and this copy is updated within 5 working days of any amendments being certified.	Noted	WRC
NOR East/West Link Condition 7.1	The requiring authority shall submit and Ecological Management and Restoration Plan (EMRP) prior to the commencement of works. The EMRP shall be approved in writing by WDC acting in a technical certification capacity prior to any works commencing and the requiring authority shall undertake all activities authorised by this designation in accordance with the approved EMRP. <i>(this EMRP shall be aligned with and be developed, as required for the particular circumstance of this designation, in concert with the EMRP as required by regional resource consents associated with the Hamilton Section Expressway alterations)</i>	Noted	WDC
Condition 7.2	The EMRP shall be prepared by an appropriately qualified and experienced person.	Noted	WDC
Condition 7.3	The purpose of the EMRP is to provide a management framework to ensure that any adverse ecological effects associated with either the construction or the operation of the Tamahere East-West Link Road are avoided,	Noted	WDC

	remedied or mitigated to the greatest extent practicable.		
Condition 7.4a	Detail of mitigation measures to be undertaken (in relation to the protection of indigenous flora and fauna including fish, wetland, and gully habitats) developed to ensure the avoidance, mitigation and remediation of adverse effects to existing ecosystems to the greatest extent practical.	IFMP (Appendix B), GRIP (Appendix D) LMP (Appendix C)	WDC
Condition 7.4b	<p>Details of measures to restore stream, wetland and gully habitats and areas affected by road construction and road operation in accordance with the Kessels Ecology dated September 2013 and attached as Appendix 9 to the AEE 2013, being not less than:</p> <ul style="list-style-type: none"> i. Ecological Restoration of 1.33 ha of wetland ii. Ecological Restoration of 1.27ha of gully slopes iii. Ecological restoration of the road batter slopes totalling 7,785m², with tall, fast-growing trees planted alongside the road and, iv. Ecological Restoration of riparian margins of the entire length of any diverted streams. 	<p>GRIP (Appendix D)</p> <p>GRIP</p> <p>GRIP</p> <p>This detail will be included in landscape planting detail</p> <p>GRIP</p>	WDC
Condition 7.4c	<p>Detailed plans of mitigation planting to be undertaken on the roadside embankments. The purpose of the mitigation planting is to:</p> <ul style="list-style-type: none"> I. Mitigate the loss of gully slope habitat as a result of road construction by: II. Protecting biodiversity values associated with the gully area; III. Establishing vegetation suited to providing long term erosion and slope stability; and, IV. Mitigating the barrier effect of the road on bat movement. 	<p>This detail will be included in landscape planting detail. This design comes through with the detailed design for sector 7.</p>	WDC
Condition 7.4d	<p>Details of vegetation removal including but not limited to:</p> <ul style="list-style-type: none"> i. The timing of any vegetation removal; and, ii. Proposed disposal methods 	<p>Large scale vegetation removal to occur during the summer construction season</p>	WDC
Condition 7.4e	Detailed design and details of installation methods for the arch culvert in the main gully including rock design in the archway.	The detailed design for the arch culvert has not yet been completed. When the	WDC

		detailed design is complete this will be provided to council for review	
Condition 7.4f	A finalised fish recovery protocol developed in accordance with draft fish recovery protocol included as attachment A to these conditions. The finalised fish recovery protocol shall include details of the actions that will be taken during culvert installation and earthworks to minimise the direct loss of native freshwater fish.	IFMP (Appendix B)	WDC
Condition 7.4g	A maintenance programme detailing how all the rehabilitated areas will be maintained. Details will include (but not be limited to): <ul style="list-style-type: none"> i. Proposed fencing; ii. Areas and methods of weed and pest control; and, iii. Areas and methods of planting protection and replacement to ensure the vegetation and mitigation works are successful 	GRIP (Appendix D) Section 6.1 of GRIP Pest management plan Section 9 of the GRIP	WDC
Condition 7.4h	Sediment and stormwater management plans.	These are prepared as SDESCPs for each works area and are prepared closer to the time.	WDC
Condition 7.4i	A Long-Tailed Bat Management and Monitoring Plan (LTBMMP) which shall be prepared by an appropriately qualified and experienced bat ecologist following consultation with the Department of Conservation. The purpose of the LTBMMP shall be to minimize impacts on bats and their habitat during construction and operation of the Tamahere East West Link Road using best practice techniques and mitigate and compensate for the direct loss of foraging, roosting and flyway habitat using best practice techniques. The LTBMMP shall include but not necessarily be limited to the following: <ul style="list-style-type: none"> i. Details of how the bats will be protected from light generated by road construction and operation. ii. Details of the proposed methods of installation of metal bands around the trunks of potential roost trees maintained within the restoration area, including but not limited to the three kahikatea trees next to the embankment; 	BMP (Appendix A)	WDC

	<ul style="list-style-type: none"> iii. Details of measures to reduce the barrier effect of the road embankment and reduce mortality from bats colliding with cars as they cross the embankment. Possible mitigation methods are creating “hop overs” for bats with planting and, or earthworks; and using downward pointing street lights to discourage bats from flying low across the road. iv. Details of the proposed methods for developing, testing the effectiveness of and deploying artificial roost houses to replace potential roost trees that will be felled; v. Details of proposed on-going monitoring of bat activity within the gully to assess and quantify any negative or positive effects of the road and the gully restoration project. vi. Adaptive monitoring and evaluation approaches shall be integrated into the Long-tailed Bat Management and Monitoring Plan to ensure regular feedback and allow management to adapt to changing conditions found during monitoring. 		
Condition 7.4j	A finalised pre-tree felling protocol shall be prepared following consultation with the Department of Conservation. The purpose of the finalised pre-tree felling protocol shall be to avoid the injury or mortality of roosting long-tailed bats. A draft set of pre- tree felling protocols is included as Attachment B to these conditions. These protocols shall be adopted unless new best-practice protocols are developed and approved by Waikato District Council.	BMP (Appendix A)	WDC
Condition 7.4k	A lizard management protocol shall be prepared following consultation with the Department of Conservation. The purpose of the protocol shall be to minimize injury or mortality of indigenous lizards present within the construction footprint of the gully through salvage and relocation efforts by qualified and experienced ecologist(s).	LMP (Appendix C)	WDC
Condition 7.4l	Timeframes for implementation, review and reporting requirements and the nature of proposed review and reporting requirements.	Section 7	WDC
Condition 7.4m	Identification of appropriate methodologies and monitoring procedures to ensure all mitigation measures undertaken are effective.	Section 4 and detail included in each ecological sub plan prepared	WDC
Condition 7.4n	Details of consultation undertaken with the Department of Conservation regarding the development of the EMRP. The Requiring	Submitted to council along with the	WDC

	<p>Authority shall seek written feedback from DoC regarding a draft EMRP and details of this consultation shall be included within the final EMRP to be provided to Waikato District Council. Details of consultation to be included in the EMRP include (but is not limited to):</p> <ul style="list-style-type: none"> i. How feedback from DoC has been incorporated into the EMRP; and ii. Where feedback has not been incorporated into the EMRP, the reasons why not. 	submission of these plans	
Condition 7.5	Any changes proposed to the EMRP must be confirmed in writing by the Requiring Authority and approved in writing by the Waikato District Council.	Noted	WDC
Wetland 10 culvert AG4 outlet 9	The Consent Holder shall provide a revised Ecological Management Restoration Plan (EMRP) to include measures to avoid, remedy and mitigate adverse ecological effects associated with this project, in accordance with conditions 48 to 50 of Schedule 1 and in accordance with the application.	<p>Section 4.3.1 addresses the specific mitigation requirements.</p> <p>All work associated with the tree felling and stream works need for the culvert installation will be in accordance with the current project BMP, LMP, IFMP, MMP and GRIP.</p>	WRC

9 References

- de Winton, M.; Bodmin, K.; Champion, P. (2010). Review of weed transfer risk associated with mudfish sampling and mitigation strategies. NIWA Client Report: HAM2010-68, prepared for the Department of Conservation.
- Connolly, T. and Turner, J. (2013) Waikato Expressway: Hamilton Section. Assessment of Environmental Effects. Terrestrial and Aquatic Ecology. Opus International Consultants Ltd, Hamilton.
- Hicks, B. J.; Barrier, R. F. G. (1996). Habitat requirements of black mudfish (*Neochanna diversus*) in the Waikato region, North Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 30: 135–151.
- Joy, M. et al. (2013). *New Zealand Freshwater Fish Sampling Protocols – Part 1 Wadeable Rivers and Streams*. Palmerston North, New Zealand: Massey University.
- Large, S. (2015). *Gully Restoration Implementation Plan: Mangaonua Gully*. Opus International Consultants Ltd, Hamilton.
- Ling, N. et al. (2013). A revised methodology to survey and monitor New Zealand mudfish. Department of Conservation, Wellington (unpublished).
- O’Brien, L. K. and Dunn, N. R. (2007). Mudfish (*Neochanna Galaxiidae*) literature review. *Science for Conservation* 277. Department of Conservation, Wellington.
- NZ Transport Agency. (2013) *Fish Passage Guidance for State Highways*. NZ Transport Agency, Wellington.
- Opus (2015) *Waikato Expressway: Hamilton Section. Erosion and sediment control plan*. Opus International Consultants Ltd, Hamilton.
- Opus (2015) *Waikato Expressway: Hamilton Section. Indigenous fish management plan*. Opus International Consultants Ltd, Hamilton.
- Waikato Regional Council (2014) *Waikato Regional Pest Management Plan 2014-2024*. Waikato Regional Council, Hamilton.

Appendix A – Bat Management Plan



Appendix B – Indigenous Fish Management Plan



Appendix C – Lizard Management Plan



Appendix D – Gully Restoration Implementation Plan
(Southern Gullies)



Appendix E – Mudfish Management Plan



Appendix F – TWWG Feedback from Ecology Workshop

