Appendix M of the CEMP

Ecological Management Plan

NZ TRANSPORT AGENCY
WAKA KOTAHI

1 MacKays to Peka Peka Expressway

Revision History

Revision Nº	Prepared By	Description	Date
2	Matiu Park	First Draft for Review by Hugh Leersnyder, BECA	24 Aug 2011
3	Matiu Park	Draft for NZTA and Legal Review. Note: Highlighted sections still under review.	12 Oct 2011
4	Matiu Park	Changes following VE. Changes following KCDC, Legal and NZTA review.	22 Nov 2011
6	Matiu Park	Final draft following EPA review comments	16 Feb 2012
7	Matiu Park	Separation of landscape material	23 Mar 2012

Document Acceptance

Action	Name	Signed	Date
Prepared by	Matiu Park		23.03.2012
Reviewed by	Stephen Fuller		23.03.2012
Approved by	Matiu Park		23.03.2012
on behalf of	Boffa Miskell Limited		

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Executive Summary

This Ecological Management Plan (EMP) is one of several management plans comprising the overall Construction Environmental Management Plan (CEMP, Volume 4) for the MacKays to Peka Peka Expressway Project (the Project). This EMP covers ecological values and is integral to the Ecological Impact Assessment (Technical Report 26, Volume 3) as it outline methods and monitoring necessary for managing the adverse construction effects.

It is anticipated that this document will be a 'live' document and will be updated and revised as the construction methodology, regulatory environment and requirements for managing ecological effects change over time. This adaptive process reflects the fact that the construction methodology will not be finalised until a detailed design is completed, at which time the impacts will be understood more comprehensively.

1 Introduction

This Ecological Management Plan (EMP) forms part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (CEMP, Volume 4) for the construction phase of the MacKays to Peka Peka Expressway Project (the Project). This EMP addresses all aspects of the Project's ecological management and monitoring initiatives during the construction of the Expressway.

1.1 Purpose and Scope

The purpose of the EMP is to outline the ecological management programme to protect, reduce and remediate impacts on the environment during the construction phase of the Project. This EMP also documents the permanent mitigation measures, such as restoration planting.

The EMP outlines the necessary monitoring during the construction phase and the transition to the operational phase of the Expressway (refer to the CEMP, Volume 4). The monitoring includes qualitative and quantitative monitoring of the effects on the terrestrial and fresh water ecosystems within the wider Project area. The focus of the monitoring is to identify potential adverse environmental effects from the construction phase and to trigger implementation of appropriate systems and controls to avoid, remedy or mitigate these effects.

The EMP will be updated, throughout the course of the Project to reflect material changes associated with changes to construction techniques or the natural environment.

1.2 Performance Standards

1.2.1 Regional Consent Conditions and Designation Conditions

The relevant regional consent conditions and designation conditions are outlined in Volume 2 of the AEE.

1.2.2 NZTA's overall environmental goals

NZTA's Environmental Plan has the following Ecological objectives:

- E1 Promote biodiversity on the State highway network.
- E2 No net loss of native vegetation, wetlands, critical habitat or endangered species.
- E3 Limit the spread of plant pests.

1.2.3 Regional Pest Management Strategy – NZTA Responsibilities

The Greater Wellington Regional Council's Regional Pest Management Strategy (2009) requires active pest management from the NZTA within and along the road reserve. The road reserve includes the land on which the road lies and the verge area that extends to adjoining property boundaries.

Road reserves have the potential to be a source of pest infestations and can act as corridors allowing pests to spread throughout the region. The various pest plants have different levels of management control, as set out in the Regional Pest Management Strategy (RPMS). The Project team[1] will need to refer to Appendix M.H of this EMP for the summary table.

1.3 Environmental Plans and Maps

The EMP is one of 12 specialised management plans which sit under as "sub-plans" to the main CEMP (Volume 4) document and include the following:

- Construction Noise and Vibration Management Plan (Appendix F of the CEMP, Volume 4)
- Construction Air Quality Management Plan (Appendix G of the CEMP, Volume 4)
- Erosion and Sediment Control Plan (Appendix H of the CEMP, Volume 4)
- Groundwater (Level) Management Plan (Appendix I of the CEMP, Volume 4)
- Settlement Effects Management Plan (Appendix J of the CEMP, Volume 4)
- Contaminated Soils Management Plan (Appendix K of the CEMP, Volume 4)

[1] This Management Plan refers to the Project team as carrying out works on behalf of and as contracted by the NZTA. The NZTA is the requiring authority and the consent holder.

- Hazardous Substances Management Plan (Appendix L of the CEMP, Volume 4)
- Ecological Management Plan (Appendix M of the CEMP, Volume 4)
- Resource Efficiency and Waste Management Plan (Appendix N of the CEMP, Volume 4)
- Construction Traffic Management Plan (Appendix O of the CEMP, Volume 4)
- Stakeholder Communication Management Plan (Appendix S of the CEMP, Volume 4)
- Landscape Management Plan (Appendix T of the CEMP, Volume 4)

In addition to the CEMP and sub environmental plans (Volume 4), the Project will use Standard Operating Procedures which provide processes for the following situations and activities:

- Environmental complaints
- Archaeological finds
- Sediment discharge emergency
- Waste Concrete and Grout
- Dewatering Disposal
- Discovery of Contaminated Soils
- Dust Nuisance
- Works within a Watercourse

Refer to the CEMP and Appendices of the CEMP to access the above standards (Volume 4).

2 Environmental Values and Potential Effects

2.1 Introduction

Given the highly developed residential nature of much of the Kāpiti Coast together with the long-standing Western Link Road (WLR) designation, much of the Project area has been highly modified. Land not developed for residential use has long been modified by farming.

There is little remnant indigenous vegetation remaining and the ecological areas that currently exist are predominantly highly modified by historical land clearance, swamp drainage, farming and residential development. However, there are a large number of wetlands in close proximity to the Alignment, several of which have high ecological values.

Through the Project shaping phase, the majority of the high value ecological areas in close proximity to the Expressway Alignment have been avoided. In some locations only small areas of marginal vegetation will be lost. However, in other areas there will be some permanent loss of vegetation and habitat beneath the road footprint.

Construction activities have the potential to directly affect ecology through the loss, disturbance and displacement of terrestrial and aquatic habitats, species and wetlands. Construction activities can also generate indirect impacts on ecological values through sediment effects, and altered hydrological flows, a risk of discharge of construction contaminants (oil, cement, lubricants) from stores or vehicles and a risk of impact on terrestrial habitat and species loss through dust, fire and weed introduction caused by construction activities.

The ecological values are described and mapped in the separate Technical Reports within Volume 3 of the AEE and have been summarised and integrated in this report. The five technical reports are:

- Technical Report 27, Volume 3: Terrestrial Vegetation & Habitats (including wetlands): Description and Values
- Technical Report 28, Volume 3: Herpetofauna: Description and Values
- Technical Report 29, Volume 3: Avifauna: Description and Values
- Technical Report 30, Volume 3: Freshwater Habitat & Species: Description and Values.
- Technical Report 31, Volume 3: Estuarine Habitat & Species: Description and Values

The Ecological Impact Assessment (Technical Report 26, Volume 3) compiles the five technical reports (Technical Reports 27 to 31, Volume 3) assessing ecological values and evaluates the actual and potential effects, including construction effects on the ecological values of the MacKays to Peka Peka Expressway Alignment.

2.2 Summary of construction activities which have the potential to impact on ecology values

Through the sequence of construction phases there are different construction activities that have the potential to affect ecological values.

Table 1 Summary of construction activities which have the potential to impact on ecological values

Activity	Potential Effect	Ecological and Landscape Receptor
Site Establishment	Permanent loss of wetland and terrestrial vegetation and therefore loss of habitat.	▪ Terrestrial vegetation (ecological values) ▪ Wetlands
	Removal of vegetation, exposure of bare soil to erosion and invasion of weeds.	▪ Terrestrial vegetation ▪ Wetlands
	Importing fill material with potential noxious plant seeds and pods.	▪ Terrestrial vegetation ▪ Wetlands

Activity	Potential Effect	Ecological and Landscape Receptor
	Removal of habitats for lizards and birds.	▪ Birds and lizards
	Partial disturbance of vegetated area resulting in edge effects – pest invasion and instability of the canopy therefore subject to windthrow.	▪ Terrestrial vegetation ▪ Wetlands
	Discharge of sediment to aquatic receiving environments smothering freshwater and marine benthic ecology.	▪ Freshwater (water quality, habitats and fauna) ▪ Marine
Preloading peat and construction of embankments	The construction of pre-loading embankments, dewatering of excavations, disruption to groundwater creating hydrological impacts on wetlands: ▪ Excavation and replacement of peat with sand. ▪ Excavation of sand below wetland/flood storage areas and replacement with peat. ▪ Construction of embankments affecting areas of significant vegetation that has been identified to be retained.	▪ Wetlands ▪ Freshwater (water quality, habitats and fauna)
Culverts and temporary stream diversion	Disruption to fish movements. Potential changes to groundwater levels (lowering and raising).	▪ Freshwater (water quality, habitats and fauna)
Drainage wetlands and swale drains	Discharge of construction phase stormwater and contaminants to freshwater and ultimately marine environment decreasing water quality and habitat values.	▪ Freshwater (water quality, habitats and fauna) ▪ Wetlands ▪ Marine
Stream Realignments	Discharge of sediment when diverting the streams through their newly realigned sections, with potential smothering of invertebrate communities and loss of interstitial stream-bed habitat	▪ Freshwater (water quality, habitats and fauna) ▪ Marine
	Reduction in the extent of existing freshwater habitat as a result of shortened realignments	▪ Freshwater (water quality, habitats and fauna) ▪ Riparian Vegetation

Activity	Potential Effect	Ecological and Landscape Receptor
Operation of construction machinery	Vibration and noise generated by construction machinery causing disturbance to birds, lizards and other fauna.	▪ Birds and lizards
Land disturbance	Smothering of adjacent terrestrial habitat with dust.	▪ Birds and lizards
	Discharge of sediment to aquatic receiving environment smothering freshwater and marine benthic ecology.	▪ Freshwater (water quality, habitats and fauna)
	Disturbance of contaminated soil leading to the discharge of sediment-bound contaminants. In turn leading to a decrease in the water quality of freshwater and marine receiving environments.	▪ Freshwater (water quality, habitats and fauna) ▪ Marine
	Damage or disturbance to vegetation through excavation, undercutting, or encroachment into the dripline of desirable vegetation being retained for mitigation purposes.	▪ Existing vegetation to be retained
	Fragmentation of existing vegetation into unsustainable small pockets.	▪ Existing vegetation to be retained
	Exposure of sheltered vegetation that affects vegetation to be retained.	▪ Existing vegetation to be retained
	Exposure of sheltered vegetation to the elements (wind, salt) that has a debilitating effect over time to vegetation being retained.	▪ Existing vegetation to be retained
Accidental Spill of hazardous substances	Hazardous substances enter the stormwater system and contaminate water bodies causing both lethal and sub-lethal effects on aquatic organisms and vegetation. Hazardous substances poisoning or causing damage to desirable vegetation being retained.	▪ Freshwater (water quality, habitats and fauna) ▪ Remnant and regenerating native vegetation.
Concrete works	Potential decrease in water quality due to discharge of cement (resulting in an elevated pH) and sediment.	▪ Freshwater (water quality, habitats and fauna)

Activity	Potential Effect	Ecological and Landscape Receptor
	Physical damage/ destruction to vegetation	▪ Terrestrial vegetation trees identified to be retained
Bridge construction	Working adjacent to watercourses for bridge construction at: ▪ Waikanae River ▪ Wharemauku Stream ▪ Muaupoko Stream ▪ Waimeha Stream ▪ Kakariki Stream ▪ Paetawa Drain Discharge of sediment from piling in and near watercourses smothers freshwater ecology.	▪ Freshwater (water quality, habitats and fauna) ▪ Riparian vegetation
	Realignment and reinstatement of Muaupoko Stream to facilitate bridge construction: ▪ Loss of riparian vegetation and consequential effects on freshwater habitats. ▪ Loss of riparian vegetation planted by local environmental groups and residents	▪ Freshwater (water quality, habitats and fauna) ▪ Riparian native and exotic vegetation

2.3 Receiving environments by sector

Appendix M.B summarises the key construction activities occurring in each of the 4 Sectors, and lists the respective receiving environments and sensitive receptors that are important for the success of avoiding, mitigating and remedying adverse construction effects on ecological values. Appendix M.B is an important reference throughout this EMP document.

2.4 Terrestrial vegetation and habitats

2.4.1 Existing Environment

The vegetation communities along the length of the Expressway Alignment are highly varied and range from exotic trees within residential and rural areas, forestry and croplands through to regenerating broadleaved native forest and largely unmodified swamp wetlands.

Ecological Technical Report 1 (refer to Technical Report 27, Volume 3): Terrestrial Vegetation & Habitats (including wetlands) describes the terrestrial vegetation values. The areas of high and

medium ecological values which both fall beneath the Construction Footprint are identified on the Vegetation Maps Series 1 - 4 (refer to Appendix M.A) and are summarised by Sector in

. The Vegetation Map Series colour codes the ecological value vegetation, and it also differentiates between areas within the Project Footprint and the Construction Footprint.

Table 2 Valued Vegetation

Vegetation
Sector 1: South a) Poplar Avenue – Poplar Av Interchange b) Poplar Avenue-Raumati Road: Expressway
▪ Kanuka forest, gorse and mahoe areas south of Raumati Road
Sector 2: Paraparaumu a) Raumati Road – Wharemauku Stream/Ihakara Stream: Expressway b) Ihakara Street/Wharemauku Stream – Kāpiti Road c) Kāpiti Road – Mazengarb Road d) Mazengarb Road + 300m
▪ Mahoe vegetation along Drain 7
Sector 3: Waikanae a) Mazengarb Road + 300m – Otaihanga Road b) Otaihanga Road – Waikanae River c) Waikanae River – Te Moana Road d) Te Moana Road + 600m
▪ Dry vegetation in Otaihanga
▪ Kanuka remnant in Otaihanga
▪ Riparian vegetation
▪ Riverside plantings
▪ Waikanae River riparian vegetation
▪ Large area of regenerating broadleaved low forest of Tuku Rakau Village
Sector 4: North a) Te Moana Road + 600m – Ngarara Road b) Ngarara Road – Peka Peka:
▪ Large area of regenerating broadleaved low forest on Ngarara Farm between Te Moana Road and Smithfield Road
▪ Kakariki Stream and associated riparian vegetation.

2.4.2 Potential Effects

a. Permanent Loss of Terrestrial Vegetation

In most areas, the majority of the terrestrial vegetation within the Expressway (Project Footprint) will be lost as part of the construction works. As part of the overall mitigation package, areas of restoration and planting are proposed. Refer to the proposed mitigation detailed in the EcIA (Technical Report 26, Volume 3).

b. Site Clearance

While large areas of terrestrial vegetation will be lost within the Project Footprint, there are also opportunities to retain and protect areas of significant ecological and landscape valued vegetation within this area. Vegetation is most at risk during the site clearance phase of construction. The following areas are particularly vulnerable:

- Areas of vegetation which are on the edge of the permanent road Alignment; and
- Areas of vegetation which are severed by the permanent road Alignment.

Site clearance has the potential to generate adverse effects on these areas of vegetation by fragmenting it into small, less viable stands / groups, compaction around root zones, and physical damage to trunks and limbs. In addition, site clearance activities have the potential to generate adverse 'edge' effects to these areas creating through larger die-back areas, wind-throw and other edge effects such as the invasion of weeds.

Section 8.2.1 of the EcIA (Technical Report 26, Volume 3) describes the potential indirect construction effects and there are three main issues during the construction phase:

c. Dust

There is a small risk of adverse effects of airborne dust on indigenous vegetation and wetlands during the construction phase. Given the sensitivity of the wetlands in close proximity to the Project Footprint, appropriate management responses are recommended.

d. Fire

There is a risk of fire during the construction period caused by hot works, smoking, and vehicle exhausts. Given the frequent long dry summer periods on the Kāpiti Coast, appropriate management systems will be required to manage this risk.

e. Weeds

Given the propensity of invasive weed growth on the Kāpiti Coast, there is a real risk during construction of the liberation of weed species not currently present on site and increased invasion of weed species currently in the area (e.g. blackberry). This could be through the importation of

sand, topsoil, cleanfill, plant stock, or as seed on vehicles. This risk cannot be quantified but can be mitigated through appropriate management systems.

In general, retaining the greatest area of existing ground cover during the construction phases (including the hydroseeding of all areas disturbed by earthworks as soon as practicable) will reduce erosion and invasion of weeds.

2.5 Wetlands

2.5.1 Existing Environment

Wetlands are one of the dominant indigenous habitats along the Expressway Alignment, ranging from remnant primary lowland swamp forest dominated by kahikatea, manuka shrublands, purei sedgeland through to highly modified wet dune depressions dominated by Juncus and wet pasture species. TR 1: Terrestrial Vegetation & Habitats (including wetlands) describes the wetland values.

Key wetlands located in the Construction and Project Footprint are identified on the Vegetation Map Series (Appendix M.A) and identified by Sector inTable 3

Given their high ecological sensitivity, the Project team will need to be aware of these wetlands, including the potential for any indirect (i.e. downstream) impacts.

Table 3 Wetland by Sectors 1 - 4

Wetlands across Sectors 1 – 4
Sector 1: South a) Poplar Avenue – Poplar Av Interchange b) Poplar Avenue - Raumati Road: Expressway
▪ Raumati Manuka Wetland A small portion of the Raumati Manuka Wetland is located within the Project Footprint of the Expressway. In addition, a large area of excavation is proposed for flood storage capacity immediately surrounding this wetland and some potential long-term impacts are possible as a result of this construction and potential hydrological changes.
Sector 2: Paraparaumu a) Raumati Road – Wharemauku Stream/Ihakara Stream: Expressway b) Ihakara Street/Wharemauku Stream – Kāpiti Road c) Kāpiti Road – Mazengarb Road d) Mazengarb Road + 300m
▪ n/a
Sector 3: Waikanae a) Mazengarb Road + 300m – Otaihanga Road

Wetlands across Sectors 1 – 4
b) Otaihanga Road – Waikanae River c) Waikanae River – Te Moana Road d) Te Moana Road + 600m
▪ Northern and Southern Otaihanga Wetlands ▪ Otaihanga Central Wetland and associated Landfill Drain (contaminated by old landfill) ▪ New wetland created to mitigate permanent loss of wetlands The Otaihanga northern, southern and central wetlands are partially located within the Project Footprint. There is scope to retain large areas of wetland vegetation within each of these Otaihanga wetlands and the Ecology Team have worked with the Design Team to reduce as far as possible the Project Footprint and associated earthworks in these locations. Ultimately the areas of wetland outside the Project Footprint (and within the Designation) are to be retained and protected. Nonetheless, given the importance of wetlands, every effort should be taken to minimise wetland vegetation removal within the Project Footprint within the Otaihanga northern and southern wetlands. Ecological input should be sought before vegetation clearance in this location.
▪ El Rancho The El Rancho wetland is one of three wetlands in a larger wetland complex, and is valued as a regionally significant wetland. The Designation affects the southern edge of the El Rancho Wetland through vegetation loss and edge effects. The stormwater treatment and flood storage wetlands proposed adjacent to the El Rancho wetlands also have the potential to adversely impact on the El Rancho wetlands. Every effort needs to be made to limit encroachment (and loss of wetland vegetation) into the El Rancho wetland. Ecological input should be sought before vegetation clearance in this location. ▪ Tuku Rakau Village wetland and regenerating mahoe forest. The Tuku Rakau Village wetlands and the adjacent regenerating mahoe forest together comprise a larger area of ecological value. Every effort needs to be made to limit encroachment into the Tuku Rakau wetland and forest within the Project Footprint. Ecological input should be sought before vegetation clearance in this location.
Sector 4: North a) Te Moana Road + 600m – Ngarara Road b) Ngarara Road – Peka Peka:
▪ Te Harakeke / Kawakahia wetland ▪ Kawakahia swamp forest Te Harakeke / Kawakahia wetland is nationally recognised (QEII covenant) and is the main receiving environment for the northern end of the Expressway, including the Ngarara Drain, Ngarara

Wetlands across Sectors 1 – 4
Stream, Kakariki Stream, Paetawa Drain and associated farm drains through this large area of peat land. Historically, the Waikanae Oxidation ponds formed part of the Te Harakeke / Kawakahia wetland. As part of the mitigation for the loss of wetland vegetation within the Expressway Project Footprint, the partial infilling with peat and restoration of the former Waikanae Oxidation Ponds will be undertaken.
▪ Ti Kouka wetland The Ti Kouka wetland is avoided by the Project Footprint. However, as part of this regenerating wetland is located within the Designation, care needs to be taken to ensure there is no physical vegetation loss in this QEII covenanted wetland.
▪ Ngarara wetland The Designation is unlikely to physically impact on the core wetland, but the close proximity may reduce the future potential of the area to provide habitat for bird species. A small portion of the dryer buffering forest edge of the Ngarara wetland, principally comprising of scattered mahoe, will be lost beneath the Designation. Every effort needs to be made to limit encroachment into the Ngarara wetland given the high habitat values. Ecological input should be sought before vegetation clearance in this location to ensure habitat requirements of the North Island fernbird are taken into consideration.

2.5.2 Potential effects

a. Loss of Wetlands

Every effort has been made during the Project design phase to avoid or minimise impacts on indigenous vegetation and wetland habitats. As a result most of the ecologically significant wetlands have been avoided by the Designation. However, there are some exceptions where wetlands are included both within the Designation and beneath the Project Footprint.

b. Site Establishment

Wetland vegetation is most at risk during the site clearance phase of construction, in particular the following areas are vulnerable:

- Areas which are on the edge of the permanent road Alignment; and
- Areas which are severed by the permanent road Alignment.

Similar to terrestrial vegetation, site clearance activities have the potential to generate adverse effects on the above wetland vegetation by fragmenting it into small, less viable stands / groups, compaction around root zones, and physical damage to trunks and limbs. In addition, site

clearance activities have the potential to generate adverse 'edge' effects to these areas created through larger die-back areas, windthrow and other edge effects such as the invasion of weeds.

c. Pre-loading and Peat Compaction - Changes to Water Table

The EcIA (Technical Report 26, Volume 3) discusses indirect construction effects on wetlands and concludes that maintaining existing hydrology is the most significant issue. Concerns relate to the potential adverse construction effects of preloading and peat compaction, 'de-watering' of wetlands or impeding water flows during both the construction phase and through the operational life of the Expressway. There is a risk that relatively small changes to the water table or disruptions to the 'east-west' hydraulic flows through these areas may lead to short-term or permanent adverse effects on some of these wetland systems, particularly the following wetlands which are located in close proximity to the Expressway Alignment:

- Raumati Manuka Wetland
- The residual areas of the Otaihanga wetland complex (Otaihanga Southern and Otaihanga Northern wetlands) west of the Designation
- El Rancho (Weggery) Wetland
- Ngarara Wetland

d. Receiving Environment

Given the ecological significance of the Te Harakeke / Kawakahia Wetland and its location as the downstream receiving environment of the Ngarara Creek, Ngarara Stream, Kakariki and Paetawa waterbodies (all of which are traversed by the Expressway), careful attention needs to be given to reducing potential contaminants and construction-related stormwater run-off into these areas.

2.6 Herpetofauna

2.6.1 Existing Environment

The Technical Report 28, Volume 3: Herpetofauna report describes the location of native lizards and skinks habitat. Much of the habitat within the southern two-thirds of the Alignment is considered to be highly suitable for terrestrial lizards, particularly the large areas of rank pasture. The majority of the Alignment represented low quality arboreal lizard habitat due to the absence of suitable tree species. However, a number of bush patches/wetlands were optimal due to their being composed of preferred tree species (e.g. kanuka). Common skinks were abundant and widespread across the site and probably occur in most or all areas of rank pasture.

2.6.2 Potential effects

a. Loss of habitat and land disturbance

There are relatively high populations of common skinks within the Expressway Alignment. While there are likely to be short-term impacts on residual populations within the Designation, the new habitat created within the Designation through landscaping is expected to provide suitable permanent habitat for this species.

2.7 Avifauna

2.7.1 Existing Environment

TR 3 Avifauna: Description and Values (Technical Report 29, Volume 3), describes and values the native and exotic bird species along the Expressway Alignment. The report discusses the presence, use and habitat of birds.

In terms of species use of the site, pipit, fernbird and bittern were recorded utilising the site.

Key habitats for introduced birds and the New Zealand pipit include:

- residential development among cleared forest; and
- converted farming landscape on modified dunelands.

Forest and freshwater habitats (particularly wetlands) are of greater value in their ability to provide feeding and nesting resources for a range of native species and include:

- the Te Harakeke wetland habitats; and
- the wider Ngarara / Nga Manu wetland areas.

Estuarine and coastal habitats, stream mouths, the Waikanae Estuary: eastern bar-tailed godwit, banded dotterel, wrybill, caspian tern, reef heron and variable oystercatchers. These species favour the coast and are concentrated in areas away from the Expressway Alignment.

2.7.2 Potential effects

Minimising the loss of terrestrial vegetation and wetlands within the Designation will ensure loss of physical habitat is reduced.

Close attention to reducing noise and disturbance in areas of identified habitat, most importantly adjacent to the identified wetlands, will ensure any impacts are minimised.

Ongoing attention to erosion control and sediment treatment devices through the construction phase will ensure that potential indirect effects on food supply by sediment deposition arising from construction earthworks are avoided.

2.8 Freshwater and marine habitat and species

2.8.1 Existing Environment

The TR 4: Freshwater Habitat & Species: Description and Values, describes the freshwater streams and drains within and traversed by the Expressway Alignment. The TR 5: Estuarine Habitat & Species: Description and Values, describes the ecological values of the estuaries traversed by the Expressway Alignment.

- The freshwater system (rivers, streams, drains) and marine receiving environments impacted and traversed by the Expressway are identified on the Terrestrial and Freshwater Ecological Mitigation Map Series (refer to Appendix M.C) and a summary by Sector is described in Table 4 below.

Table 4 Freshwater systems and Marine receiving Environments along Sectors 1 – 4

Sectors	Freshwater systems and Marine Receiving Environments
Sector 1: South a) Poplar Avenue – Poplar Av Interchange b) Poplar Avenue-Raumati Road: Expressway	The Whareroa watershed: ■ A number of smaller tributaries of the Whareroa Stream consisting of farm drains cut into the larger peatlands of the QE Regional Park ■ The Whareroa Estuary
Sector 2: Paraparaumu a) Raumati Road – Wharemauku Stream/Ihakara Stream: Expressway b) Ihakara Street/Wharemauku Stream – Kāpiti Road c) Kāpiti Road – Mazengarb Road d) Mazengarb Road + 300m	The Wharemauku watershed: ■ The main branch of the Wharemauku Stream ■ Drain 7, a large tributary The Wharemauku Estuary
Sector 3: Waikanae a) Mazengarb Road + 300m – Otaihanga Road b) Otaihanga Road – Waikanae River c) Waikanae River – Te Moana Road d) Te Moana Road + 600m	The Waikanae watershed: ■ The Waikanae River (regionally important) ■ The Waikanae Estuary (nationally important) ■ Smaller tributaries of the Waikanae River, upstream of the estuary: Mazengarb Stream, Waste Water Treatment Plant Drain (the main outlet for the Paraparaumu wastewater treatment plant); and the Muaupoko Stream.
Sector 4: North a) Te Moana Road + 600m – Ngarara	The Waimeha watershed: ■ Te Harakeke/Kawakahia Wetland (large sensitive

Road b) Ngarara Road – Peka Peka:	receiving environment) ■ The Ngarara Creek, Kakariki Stream, Ngarara Stream and Paetawa Drain (and associated farm drains) all discharge into Te Harakeke/Kawakahia Wetland. ■ Upper Waimeha Stream ■ Paetawa Streams and associated farm drains ■ Kakariki Streams and associated farm drains. ■ The Waimeha Stream mouth ■ The Hadfield Drain / Kowhai Stream watershed: discharges to Peka Peka beach via a small estuary

2.8.2 Potential Effects on freshwater and marine receiving environments

The following construction activities have the potential to impact freshwater receiving environments:

a. Site Establishment, Land Disturbance

Discharge of sediment to aquatic receiving environments smothering freshwater and marine benthic ecology during site establishment activities.

b. Installing culverts, realigning streams, temporary stream diversions

The permanent loss and modification of aquatic habitat, including changes to fish passage, through culverting and diversions of streams.

c. Drainage wetlands and swale drains

Discharge of stormwater contaminants to aquatic receiving environments smothering freshwater and marine benthic ecology.

d. Accidental Spill of hazardous substances

The risk of impact on streams, wetland and estuarine habitats through discharge of construction contaminants (oil, cement, lubricants) from stores or vehicles.

e. Concrete works

Discharge of sediment and changes in the pH level of receiving water.

f. Bridge construction

Bridge construction at the Waikanae River, Wharemauku Stream, Waimeha Stream, Kakariki Stream and Paetawa Drain has the potential to reduce riparian vegetation and change habitat for freshwater fauna.

The Waikanae River and the Muaupoko Stream that joins the Waikanae River at the proposed bridge location, is a particularly sensitive environment.

2.8.3 Potential Effects on estuarine and marine receiving environments

The Waikanae Estuary, Waimeha Estuary and the Wharemauku Estuary, all located downstream of the Expressway Alignment, are considered to have high ecological values.

The primary indirect effects on these areas are associated with disturbance of soil during the construction phase leading to the discharge of sediment-bound contaminants. In turn leading to a decrease in the water quality of freshwater and marine receiving environments.

3 Implementation and Operation

There are a number of proposed management measures designed to avoid, remedy, minimise and/or mitigate the potential adverse ecological effects associated with the construction phases of the MacKays to Peka Peka Expressway Project. The following section details the ecological management for wetlands, planting restoration and revegetation, freshwater and marine environments and fauna.

It is important to understand the roles and responsibilities for implementing this CTMP and also the necessary training Project teams must go through so the ecological values and principles are understood.

3.1 Roles and responsibility

Section 3.2 of the CEMP, Volume 4 details roles and responsibilities associated with managing environmental factors from construction of the Project. The Environmental Manager has the responsibility for supporting the implementation of all required ecological mitigation, monitoring, reporting and communicating any issues to the Project Management Team and the NZTA.

Suitably qualified ecological specialists will be nominated to monitor the effects of construction on the ecology. In some instances the specialists can train the environmental team to carry out the ecological monitoring. Specialists include:

- Botanist
- Freshwater ecologist
- Marine ecologist
- Ornithologist
- Herpetologist.

All personnel working on the Expressway Project, including Project team members and subcontractors, have a responsibility for following the requirements of this EMP and responsibilities pertaining to the management of erosion and sediment control outlined in the ESCP (Appendix H of the CEMP, Volume 4) are vital for managing effects on marine and freshwater ecology.

3.2 Training

Environmental training for all staff will be undertaken as part of the site induction programme as described in the CEMP (Volume 4). This requires all new staff to go through an induction training session when they commence work and then as part of annual refresher courses.

Environmental Induction will include information on the following aspects of this plan:

- Information about the activities and stages of construction that may cause impact to ecological values;
- Significant areas of vegetation and wetlands – explaining the what and why these areas are significant and how they are to be protected from direct and indirect construction activities;
- Freshwater network including main catchments within and surrounding the construction area, final receiving environments (Te Harakeke / Kawakahia wetland and the Waikanae Estuary);
- Freshwater fish and the importance of culvert design for fish passage;
- Consent requirements; and
- Ecological monitoring procedures.

Refer to the ESCP (Appendix H of the CEMP, Volume 4) for the induction and training requirements for management of erosion and sediment control which are vital for minimising the Project's impact on freshwater and marine ecology.

3.3 Vegetation and wetland management

3.3.1 Terrestrial Vegetation and Habitats

There is a level of planned vegetation and wetland removal within the Expressway Alignment (the Project Footprint) to enable the construction and operation of the Expressway. However, through good environmental management there are opportunities during the construction phases to protect and minimise the amount of vegetation removal required, within the Project Footprint, thus reducing ecological impacts.

The Project team shall be aware of the mapped vegetation and wetlands within each of the Sectors and carry out various construction activities in accordance with the following management measures.

a. Vegetation Removal

During the site establishment phase of construction, the Project team shall minimise permanent loss and damage to vegetation to the minimum required to undertake works. The following mitigation measures in Table 5 are established methods that can be implemented by the contractor.

Table 5. Management measures for vegetation removal

Activity	Recommended Management Measures
Site Establishment	■ Any medium-high value indigenous vegetation shown in the Vegetation Map Series (Appendix M.A) within the Project Footprint and on the boundary of the Designation will be confirmed with the Project Ecologist on site and fenced off (or appropriate measures to avoid these areas implemented). ■ Minimise damage to any terrestrial vegetation outside those areas to be cleared. ■ Vegetation clearance boundaries will be clearly defined with marker tape pegs or by marking perimeter trees. ■ Individual specimen/established trees will need to be clearly identified and fenced to avoid and prevent unnecessary disturbance or damage. ■ Wherever practical, trees within the actual Alignment area will be felled into Alignment areas that have been previously cleared or are about to be cleared for construction purposes (e.g. plantation pine, large specimen trees etc.). ■ Timbers that cannot be utilised, together with branches and leaves, shall be mulched for landscaping or temporary stabilisation on this Project in the first instance.
Land Disturbance	■ Careful selection of appropriate machinery to minimise disturbance. ■ Minimise exposed ground and re-stabilise earthworked areas as soon as possible using Erosion and Sediment Control Plan (Appendix H of the CEMP, Volume 4) methods. ■ Ensure no land disturbance within the dripline of trees or vegetation that is to be retained during construction works. ■ While working in close proximity to vegetation that is to be retained, ensure that machinery is kept well clear of the vegetation canopy and that any excavations do not undermine the vegetation stability or endanger its health. ■ Where there is a deviation from an approved route or outside the construction zone, any vegetation in the new construction area will be checked first by the Project Ecologist. Approval for removal will be

Activity	Recommended Management Measures
	required and areas to be retained are to be marked out on site by the Project Ecologist before proceeding further.
Activities near watercourses	▪ Avoid washing of organic material into watercourses, stockpile organic mulch away from waterways and overland flow paths. ▪ The output from chippers etc is not to be directed towards watercourses. ▪ Cleared vegetation on site will only be stockpiled short term and either mulched or disposed of offsite

b. Pest plant species management

Disturbed sites and soils often lead to weed invasion. During the site establishment phase of construction, ongoing land disturbance and major earthworks, the contractor shall implement the pest management controls set out in Table 6.

Table 6 Pest & Weed Management Controls

Activities	Management controls
Site establishment	Identify areas of persistent, difficult to control weeds within the disturbed area and determine a programme of early control prior to any site disturbance.
Land Disturbance and general earthworks	Control with herbicide any persistent, difficult to control weeds (blackberry, kikuyu, *convolvulus*, and creeping dock) that are in areas that will have the topsoil stripped and reused. Blackberry regrowth and gorse germination on disturbed areas is an issue for any areas to be planted and must be controlled. Early herbicide spraying of regrowth will reduce maintenance requirements once the areas are planted.
Vegetation removal	Close attention is required to ensure invasive weed species do not become established in areas of indigenous vegetation cleared as part of Expressway construction.

Activities	Management controls
Activities near watercourses or sensitive environments (residential)	The use of herbicides to control weeds have the potential to kill or harm non-target species of plant and, depending on the herbicide, cause a discharge of contaminants to water which in turn may impact upon aquatic ecology. As a minimum all weed controls and herbicide applications shall comply with Greater Wellington Regional Air Plan (refer to Appendix M.G for the relevant rules). Refer to Appendix M.H for the relevant Rules and permitted activity standards for contractors to be aware of when using hand or mechanical application of agrichemicals and herbicides, particularly in proximity to residential areas and waterbodies.
Restoration / interplanting	While traditionally considered to be a weed species, gorse has ecological benefits as a nitrogen-fixer and a nurse crop for promoting natural regeneration of broadleaved forest in the Wellington Region. There are areas of the Expressway Alignment where gorse can be retained and left to naturally regenerate to indigenous forest, and this process can be sped up by inter-planting with appropriate native trees. Ongoing maintenance to control invasive pest plants such as blackberry would be required within these areas. This process would speed up the natural regeneration by providing additional forest species as well as reduce the areas required to be improved and replanted.

c. Weed survey

In addition to the pest management controls outlined above, a weed survey should be undertaken to ensure new weed species, particularly invasive weeds, have not established as a result of construction earthworks. The purpose of a weed survey is to determine whether efforts to prevent spread of weeds over earthworked sites have been effective, and in particular to determine if any weeds have been:

- Introduced by vehicle arrivals from other sites; or
- Carried into the site within imported materials such as soils, gravels and hydro-mulch mixes; or
- Spread across the site through the presence of large open earthworked areas.

The survey focus should primarily be on invasive weed species not currently present or which are highly localised within the site. The types of weeds of particular concern are:

- Vines such as blackberry, Japanese honeysuckle, climbing asparagus, cathedral bells, various ivy, old man's beard, and convolvulus;

- Invasive shrub weeds such as inkweed, boneseed, tutsan, Himalayan honeysuckle, buddleia, and barberry; and
- Invasive weeds of wetlands, stream banks and wet places such as pampas grass, montbretia and *Tradescantia*.

A survey should be undertaken at a time when all bulk earthworks have been completed, and when all disposal sites are finished, and soil stabilisation has been well advanced. The survey will involve a walk-over-type reconnaissance. Because the works are to be undertaken in sections, each section, as it is finished and stabilised, should then receive an initial weed survey. This survey should be followed up by another in six months, then one year, and a final survey two years post earthworks stabilisation.

The survey should include all haul road and main road edges, all batter slopes, all spoil areas, all diversion reaches, all laid down and storage sites and all sediment control ponds and all stream riparian zones and diversion channels.

The survey should record species, GPS location and a measure of the abundance of the weed as well as any complicating management issues, e.g. growing amongst native regeneration, wetlands etc.

The survey should recommend control methods for weeds identified.

3.3.2 Wetlands

Similar to the terrestrial vegetation affected, there are a number of areas where wetlands will be modified within the Project Footprint. However, through good environmental management there are opportunities during the construction phases to minimise the amount of wetland removal within the Designation.

a. Minimising the extent of wetland loss

During the site establishment phase of construction, the contractor shall minimise activities that have the potential to result in the permanent loss or damage of wetlands outside of the Project Footprint. The mitigation measures in Table 5 are to be implemented by the Project team and include the Project Ecologist to agree on the physical extent of wetland vegetation to be demarcated for removal. This demarcated boundary shall be clearly identified by Project teams working in these areas.

Table 7 below lists all wetlands with site specific management approaches, in conjunction with the overall planting plan set out in Appendix M.D, which the Project team will need to be aware of during the construction within the various Sectors.

b. Pest management

Refer section 3.3.1 b of this EMP.

c. Stormwater treatment wetlands and flood storage areas

The planting and design of the stormwater treatment wetlands, wetland swales and the flood storage wetlands have been designed in conjunction with ecological principles. These new stormwater networks provide opportunities for wetland plant species and habitat for wildlife.

Table 7 Wetlands

High and Medium Value Wetlands	Specific Management (construction)
Sector 1: South	
▪ Raumati Manuka Wetland The Raumati Manuka Wetland is located outside the Project Footprint of the Expressway. However a large area of excavation is proposed for flood storage capacity immediately surrounding this wetland.	▪ Ecological involvement during the site establishment construction phase to define vegetation clearance boundaries within the Project Footprint to minimise the loss of wetland vegetation; ▪ Planting of wetland species within the proposed flood storage areas as well as new landscape planting between the Expressway, cycleway/walkway and the wetland as buffering during the construction process. ▪ Hydrological monitoring of water levels to ensure the long term ecological health of this wetland.
Sector 2: Paraparaumu	
▪ n/a	
Sector 3: Waikanae	
▪ Northern and Southern Otaihanga wetlands ▪ New wetland created to mitigate permanent loss of wetlands The Otaihanga northern, southern and central wetlands are partially located within the Project Footprint. There is scope to retain large areas within each of the Northern and Southern Otaihanga wetlands east and west of	▪ Ecological involvement during the site establishment construction phase to define vegetation clearance boundaries within the Project Footprint to minimise the loss of wetland vegetation across the two wetland areas (Northern and Southern and Otaihanga Wetlands). ▪ Hydrological monitoring of water levels to ensure the long term ecological health of this wetland through the contraction phase.

High and Medium Value Wetlands	Specific Management (construction)
the Expressway Alignment. Ultimately the areas of wetland outside the Project Footprint are to be retained and protected. The Otaihanga Central Wetland is identified as being contaminated.	▪ Retention of existing wetland sedges and rushes and temporary storage for transplanting into the new ecological wetlands in Otaihanga. ▪ Adhere to wetland restoration plan for transplanting of existing wetland species and design of new wetland in Otaihanga.
▪ El Rancho The El Rancho Wetland (Weggery) is one of three wetlands in a larger wetland complex, and is valued as a regionally significant wetland. The Expressway Designation affects the southern edge of the El Rancho Wetland (Weggery). This southern section of the wetland retains wetland values and has an important role in edge buffering the current land uses. Therefore every effort needs to be made to limit encroachment of the Expressway embankment into the El Rancho wetland.	▪ Ecological involvement during the site establishment construction phase to define vegetation clearance boundaries within the Project Footprint to minimise the loss of wetland vegetation at El Rancho Wetland (Weggery). ▪ Removal of blackberry and other weed control, as well as planting of edge buffering species as part of the landscape mitigation within the construction footprint. ▪ Hydrological monitoring of water levels to ensure the long term ecological health of this wetland through the construction phase. ▪ Long-term monitoring of wetland health, particularly during and immediately following construction.
▪ Tuku Rakau wetland and regenerating mahoe forest. This small wetland has ecological values as wetland habitat and for the adjacent terrestrial dryland vegetation.	▪ Minimising vegetation removal and earthworks during the site establishment construction phase. ▪ Long-term monitoring of wetland health, particularly during and immediately following construction.
Sector 4: North	
▪ Te Harakeke Kawakahia Wetland Te Harakeke / Kawakahia Wetland is nationally recognised and QEII	▪ Particular attention to any discharge of sediment to any waterbodies entering the Te Harakeke/Kawakahia Wetland.

High and Medium Value Wetlands	Specific Management (construction)
covenanted and is the main receiving environment for many of the waterbodies in the northern end of the Expressway. Historically, the Waikanae Oxidation ponds were part of the Te Harakeke / Kawakahia wetland, and as part of the mitigation for the loss of wetland vegetation within the Expressway Project Footprint, the infilling and restoration of the former Waikanae Oxidation Ponds is proposed.	▪ Avoid any disturbance to vegetation of the Ti Kouka Wetland.
▪ Kawakahia swamp forest This is a small QEII covenanted remnant of swamp forest adjacent to the main Te Harakeke / Kawakahia Wetland.	▪ Ecological involvement to define the extent of vegetation clearance and minimise adverse effects on the edge vegetation of the Ngarara Wetland. ▪ North Island fernbird territories within the Te Harakeke / Nga Manu area should be undertaken prior to any construction-related activities. ▪ Subject to the results of the fernbird territory surveys, no vegetation should be removed within the recognised breeding areas between August and February without input from a suitably qualified ecologist.
▪ Ti Kouka wetland This is a large QEII covenanted wetland that has regenerated into forest.	
▪ Ngarara Wetland This is a moderate sized wetland that provides habitat to a rare mistletoe and an At-risk bird species (North Island fernbird). A small portion, consisting of up to 6 scattered mahoe trees, of the drier buffering forest edge of this wetland, will be lost beneath the Designation.	

3.3.3 Planting plan along the Expressway Alignment

Mitigation planting is proposed throughout the Expressway Alignment. There are several types of mitigation planting, depending on the function and purpose (Refer to Landscape and Visual Assessment of Effects, Technical Report 7, Volume 3).

a. Planting Design

In particular, there are specific planting designs for riparian areas, ecological wetlands, stormwater treatment wetlands and swales, and flood storage areas. These are given more description below:

1 *Riparian planting* – where the Expressway crosses streams and waterways riparian planting using native species will be planted 10.0m on both sides of the waterway extending 50m upstream and downstream of the Expressway. This planting will be closely-spaced using eco-sourced species from the Foxton Ecological District species with the aim to create a dense band of planting that will overhang the stream to provide shade and habitat.

2 *Wetland planting* – forming wetlands and then planting with a range of proven species will be the most challenging type of planting, both in terms of plant establishment and ongoing maintenance. Aggressive exotic pest plants are well established and a problem in many of the existing wetlands on the Kāpiti Coast, including those along the Expressway route. Plant establishment will rely on ensuring the overall form and design of wetland areas provide suitable habitat for plant establishment, good site preparation prior to planting and then timely maintenance to ensure pest plants are controlled.

3 *Flood storage areas* –are extensive in several places along the route. Generally, these areas once formed, will be re-grassed and farmed grazing continued wherever possible. Often they will remain mostly damp and periodically they will become inundated with flood waters. In some locations, where flood storage areas are adjacent to stormwater treatment or ecological wetlands, they will be planted with appropriate local native species.

Two types of wetland areas are proposed – ecological wetlands and stormwater treatment wetlands. There are several existing wetlands along the route and most of these have been avoided and will be retained as key ecological features.

Stormwater treatment wetlands will in many instances have a similar appearance to ecological wetlands but their function will be different; they will collect and treat stormwater from the Expressway. They will also need to be cleaned periodically and so this will need to be taken into account in their design.

A similar range of eco-sourced native plants will be used in both types of wetland.

b. Ecological restoration and revegetation

As part of the overall planting strategy, there are specific areas of ecological restoration and revegetation along the Expressway Alignment and these are identified in Table 8 below. In the long-term, ecological restoration and revegetation along the Expressway Alignment will create corridors of wetlands, dry vegetation and riparian communities, improving existing and providing new bird and fish corridors along the route. In this regard, the Project Team shall be aware of the areas identified in Table 8, and arrange on-site inception meetings with the Project Ecologist to discuss the most effective and efficient way to implement respective planting plans.

Table 8 Site Specific Areas for Restoration and Revegetation Planting

Areas – Vegetation and Wetlands	Long term restoration concepts
Sector 1: South	
▪ Raumati Wetland ▪ Area of kanuka and mahoe south of Raumati Road	▪ Additional planting of the wetland surrounds to expand and buffer the current wetland to provide a range of long-term ecological benefits. ▪ The large area of gorse and mahoe shrubland surrounding Raumati wetland to be retained and interplanted to assist with the natural regeneration process. Weed control, particularly for blackberry.
Sector 2: Paraparaumu	
▪ Mahoe along Drain 7 of the Wharemauku Stream	▪ Protect and restore edge with new planting
Sector 3: Waikanae	
▪ Northern and Southern Otaihanga Wetlands ▪ Kanuka forest adjacent to the Northern Otaihanga Wetland ▪ New wetland created to mitigate permanent loss of wetlands ▪ Waikanae River riparian planting. ▪ Replacement riparian planting for the loss from Muaupoko Stream and the Kakariki Stream.	▪ Restoration of the low-lying dune depression just to the south of the Otaihanga wetlands (adjacent to the WWTP Drain) using transplanted wetland plants from the Otaihanga Southern and Northern wetlands.
▪ El Rancho ▪ Tuku Rakau Village wetland and regenerating mahoe forest	▪ The permanent protection of the adjacent Tuku Rakau Village wetland and regenerating mahoe forest. ▪ Restoration of the former Waikanae Oxidation Ponds as mitigation for the loss of wetland vegetation at El Rancho.

Sector 4: North	
■ Ngarara wetland ■ Area of mahoe surrounding Ngarara Wetland	■ Dense edge planting and landscape treatment to buffer the wetland core and weed control. ■ Planting in the existing area of blackberry along the length of the Expressway Alignment in this location.

3.3.4 Lizards (Herpetofauna)

Lizard habitats have been found within rank pasture across the Project Footprint. While no threatened species were found, prior to earthworks or vegetation clearance, the Project Ecologist will need to be involved to capture and transfer any lizards found to the nearest suitable lizard habitat.

a. Habitat enhancement

The objectives of habitat enhancement are to provide protected habitat for lizards by planting areas with appropriate densely spaced native plants, supplying additional lizard refuges, and undertaking appropriate weed and pest management operations. Terrestrial lizards prefer open environments with abundant refuges, and the edges of plantings are conducive to these characteristics because they are naturally open and promote the growth of a thick ground tier.

Optimal arboreal lizard habitat consists of native shrubs and trees, and particularly kanuka (*Kunzea ericoides*) which are incorporated into the planting plans.

3.3.5 Birds (avifauna)

Specific habitats areas of importance for birds are as follows:

- The wider area of farmland surrounding Te Harakeke /Kawakahia Wetland, Ngarara Wetland and Nga Manu Nature Reserve provide the best quality habitat for bird species (including the riparian vegetation along the Kakariki Stream).
- Although located outside of the Expressway Alignment, the estuaries downstream (including the Whareroa, Wharemauku, Waikanae, Waimeha, and Hadfield / Kowhai estuaries) provide habitat for estuarine and coastal bird species.
- An ‘at risk’ bird species, North Island fernbird, has been identified in the farmland and riparian vegetation between Nga Manu Nature Reserve and Ngarara Wetland. Fernbird habitat surveys must be undertaken prior to any construction-related vegetation clearance or activities in this area.

a. Management of Construction Effects

The protection of vegetation important to native birds is discussed in Section 3.3.1 above.

3.3.6 Freshwater habitat & species

A range of activities are proposed within watercourses that will have effects ranging from permanent to temporary. All perennial and intermittent streams where culverts, bridge crossings and stream diversions are proposed are mapped on the Terrestrial and Freshwater Ecological Mitigation Sites Map Series (Appendix M.C).

Culverts

A number of new culverts to allow for crossings over drains and streams, and extensions to existing culverts are proposed throughout the Expressway Alignment leading to the loss of aquatic habitat and potential problems for fish passage.

It is important to ensure the design of the culverts do not impair fish passage in those streams identified in Appendix M.C, both during construction and the permanent operation of road. Refer to Culvert Design in Section 3.3.6d below.

Diversions

There are a number of instances along the Expressway Alignment where existing waterbodies (drains and streams) are to be temporarily or permanently diverted during the construction phase. Where possible, works will be phased in the drier months of the year to minimise potential effects on freshwater fauna.

A number of permanent stream diversions are proposed, including the outlet of the Muaupoko Stream, the upper sections of the Smithfield Drain and a number of smaller tributaries of the Paetawa Stream. In all these locations, the existing waterbody is to be permanently diverted and realigned as part of the Expressway Alignment.

Maintaining fish passage within all the drains and streams traversed by the Expressway Alignment is important to retain existing aquatic habitat and connectivity. To achieve this result will require detailed design and considerable care during construction, and in some cases, ongoing monitoring and maintenance.

Riparian habitat

There is an expectation of best endeavours to avoid existing riparian vegetation and aquatic systems wherever possible outside the construction footprint. In locations where these areas can be avoided or effects minimised, fencing or other markers will be established in conjunction with the Project Ecologist to demarcate the Projects/Construction Footprint boundary. Members of the Project team working in these areas should be advised that the signage fence demarcates work boundaries that should not be breached.

Where riparian vegetation and habitat cannot be avoided, all practicable steps will be taken to minimise the areas of vegetation and the extent of in-stream habitat that is impacted.

a. Guidelines

The following guidelines and monitoring plans have been developed to assist in this work.

- Diversion Design Guide - requiring restoration as close as possible to the condition of the original stream bed.
- Culvert Design Guide with principles for maintaining habitat and fish passage.
- Monitoring plans to establish proof of the limit of adverse effects and to measure the success of the mitigation package proposed.
- Post Construction Fish Passage Monitoring Plan (culvert passage).

b. Design

A suitably qualified ecologist will be involved in the design and the key construction phase of all in-stream works in perennial and intermittent streams, including temporary and permanent culvert installations, temporary and permanent fords, diversions and weirs.

The design of all in-stream works will comply with guidelines presented in Section 3.3.6d. They will consider as a matter of course the following issues:

- Water velocity and flow rates
- Appropriate water course width and depth
- Habitat and geomorphological characteristics
- Substrate
- Fish passage
- Removal and remediation of temporary structures.
- Maintenance

c. Diversion channel design principles

Each diversion reach must both convey water as well as provide new and appropriate aquatic habitat. This means the velocities and flow paths must be of a similar nature (it cannot be a straight, plain, drain), the substrate must be similar, the depths also similar (hyporheic zone), the banks as stable and the array of physical water habitat types (run, pool etc) comparable. Correct diversion construction can mitigate, over time, for the diversion loss.

The overall ecological design principle for all stream diversions and new sections of stream is to achieve mitigation levels calculated by the SEV model of a form that raises the existing habitat values to at or near SEV reference levels. This is particularly the case in the Smithfield Drain diversion and the Paetawa Drain tributaries where the existing habitat is restricted to uniform straight channels with similar depth, substrate and velocity profiles over large linear distances.

Appendix M.E and Appendix M.F provide guidelines on the final design of diversion channels in each key catchment, in particular in setting the substrate, meander, habitat hypes, depths and velocity goals.

d. Culvert Design Principles

All culverts identified in the Terrestrial and Freshwater Ecological Mitigation Sites Map Series (Appendix M.C) must facilitate the passage of juvenile and adults of whitebait of several fish species that are relatively poor climbers including *Galaxias argenteus* (Giant kokopu) and *Galaxias maculatus* (Inanga).

While all of the culverts proposed along the Expressway Alignment have been designed to retain the low gradients currently, to ensure the movement of fish any culvert or stream diversion needs to apply the following design criteria:

- A velocity of or around 0.5m/s (but certainly less than 1m/s);
- A water depth of at least 0.1m but preferably 0.2m;
- The invert (both in and out) must be set below the stream invert and the structures conducive to gravel movement into and along the culvert.
- Where culvert length exceeds 60m, and water velocity is greater than 0.4m/s, rest areas will need to be installed.

e. Freshwater fish translocations

In a number of locations (primarily during culvert installation and stream diversions), sections of stream will be reclaimed. In these sections fish will need to be collected, housed and moved to safe locations.

Prior to and during the permanent diversion of streams, all practicable steps shall be taken to capture and relocate fish from the affected reaches of stream. All practicable steps include, but are not limited to netting with minnow traps and electric fishing.

Enabling works

The following actions are required to enable translocations:

- Permits to capture and move species will be required, specifically permits from the Ministry of Fisheries to release fish species within the same stream they are captured in and the DOC where species are proposed to be released in a different water body. Permits will require preparation of a Project plan.
- Confirmation of sites to be searched and timing of works;
- Confirming translocation sites;

- Catching the taxa, providing temporary storage, and release; and
- Monitoring success.

Temporary Diversion

Prior to stream diversion or culvert installation the upstream and downstream extents of the diversion should be block netted. The catch and transfer should have two stages.

- **Stage 1:** This involves an initial electric fish of the site just prior to final installation of the dam and dewatering of the reach. A downstream channel closing net should first be installed at the water reintroduction point. That process should involve a downstream to upstream electric fishing run with nets to trap and retain all fish. Three electric catch sweeps of the affected reach should be undertaken.
- **Stage 2:** As the dewatering occurs, a search should be made of the substrate and particularly the bank edges to retrieve stranded fish not caught by the electric fishing machine – this is typically eel that are "buried" in the banks. These fish should also then be moved.

Release sites

All fish will be released in the same stream they have been captured upstream of the site works.

Culverting

Where the stream is to be diverted to a bypass pipe or to a culvert the fish need to be transferred into a nearby main stem or tributaries. The decision on appropriate release site should take into account the quantity of aquatic habitat present and the species of fish that have been captured.

Diversion & Reclamation

Where the stream works involve diversion to a new channel the fish should be held in sufficiently large containers until water has been diverted to the new channel and it is running clear. Fish can then be reintroduced to the new channel.

Other

- All fish electric fishing, netting and relocation shall be completed by a suitably qualified ecologist.
- All fish collected shall be relocated upstream of the diversion.
- The Manager, Environmental Regulation, Wellington Regional Council shall be advised when the relocation of fish has been completed.
- An advisory note will be prepared and forwarded to The Manager, Environmental Regulation, Wellington Regional Council, when the relocation of fish has been completed.

Inspections and monitoring

Immediately following formation of diversions and prior to livening of the new channel an appropriately qualified ecologist will inspect and confirm that any structures within the diversion will provide fish passage for all native species currently known to occur or are reasonably likely to occur within this stream.

3.3.7 Aquatic and marine ecology and sedimentation

Controlling the impact of construction activities on marine ecological values is a function of minimising the amount of stream flushed sediments derived from road construction earthworks. Control measures within sub-plans have been developed for construction phase stormwater ESCP (Appendix H of the CEMP, Volume 4), contaminated soil, and management of bulk earthworks.

The current array of erosion and sediment control, stormwater treatment and other sediment management devices and systems minimises the discharge of the Expressway Project's earthworks derived sediment.

a. Monitoring and Adaptive Management

The primary opportunity for management of risk of sediment discharge to valued streams and the marine environment rests with monitoring and adaptive management of the site, systems for erosion control, the capture and treatment of sediment laden water, and its discharge.

Section 4.4 provides an indicative freshwater aquatic monitoring plan, which uses baseline data to establish triggers for changes to turbidity, sediment deposition and aquatic health and guidance for how the results of this monitoring will feed into an adaptive management processes.

Section 4.5 provides and indicative marine monitoring plan which uses baseline data to establish triggers for changes to sediment deposition and the health of the marine environment and guidance for how the results of this monitoring will feed into an adaptive management processes.

b. Early Warning Storm Plan

These plans are to be implemented consistent with the early warning storm plan as outlined in the Erosion and Sediment Control Plan (Appendix H of the CEMP, Volume 4).

3.4 Sector Specific Approach

Appendix M.B identifies the ecological values to be monitored in relation to construction activities, sensitive receiving environments and receptors along the extent of the Expressway Alignment.

4 Monitoring

4.1 Overall Approach

Where required, baseline information on ecological values potentially affected by the Project will be collected before works commence. Ecological monitoring of vegetation, wetlands, freshwater and marine ecology shall be undertaken before, during and after construction works are completed. Monitoring of each aspect is detailed in the following sub sections.

4.2 Response to Indicators of Significant Effects

4.2.1 Adaptive Management

Adaptive management requires monitoring, research and review. Once monitoring has occurred, the assessment of monitoring results will lead to ‘adapted’ development and operation, either to anticipate potential problems identified by the monitoring, or to ensure any effects of the existing activity are reduced to acceptable levels. Review conditions provide flexibility to either expand or cut back activity should the research suggest it is necessary.

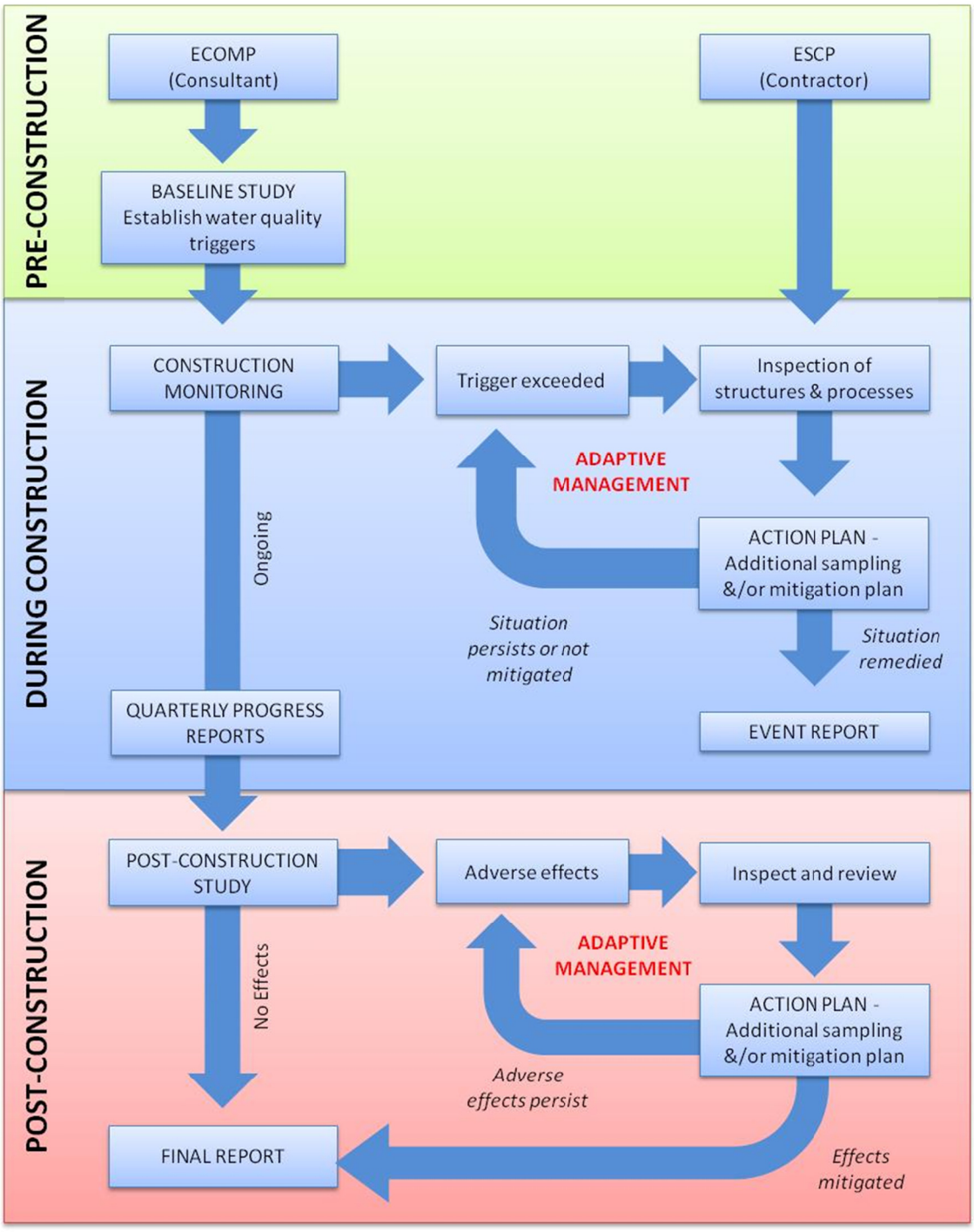


Figure 1 provides an indicative process for monitoring, management and reporting related to marine and aquatic habitat monitoring. A key component is the establishment of pre construction baseline conditions against which to measure change. Monitoring through construction provides continual feedback to the contractor on the effectiveness of environmental management methods. Monitoring post construction establishes processes for remediation and/or mitigation if effects could not be avoided.

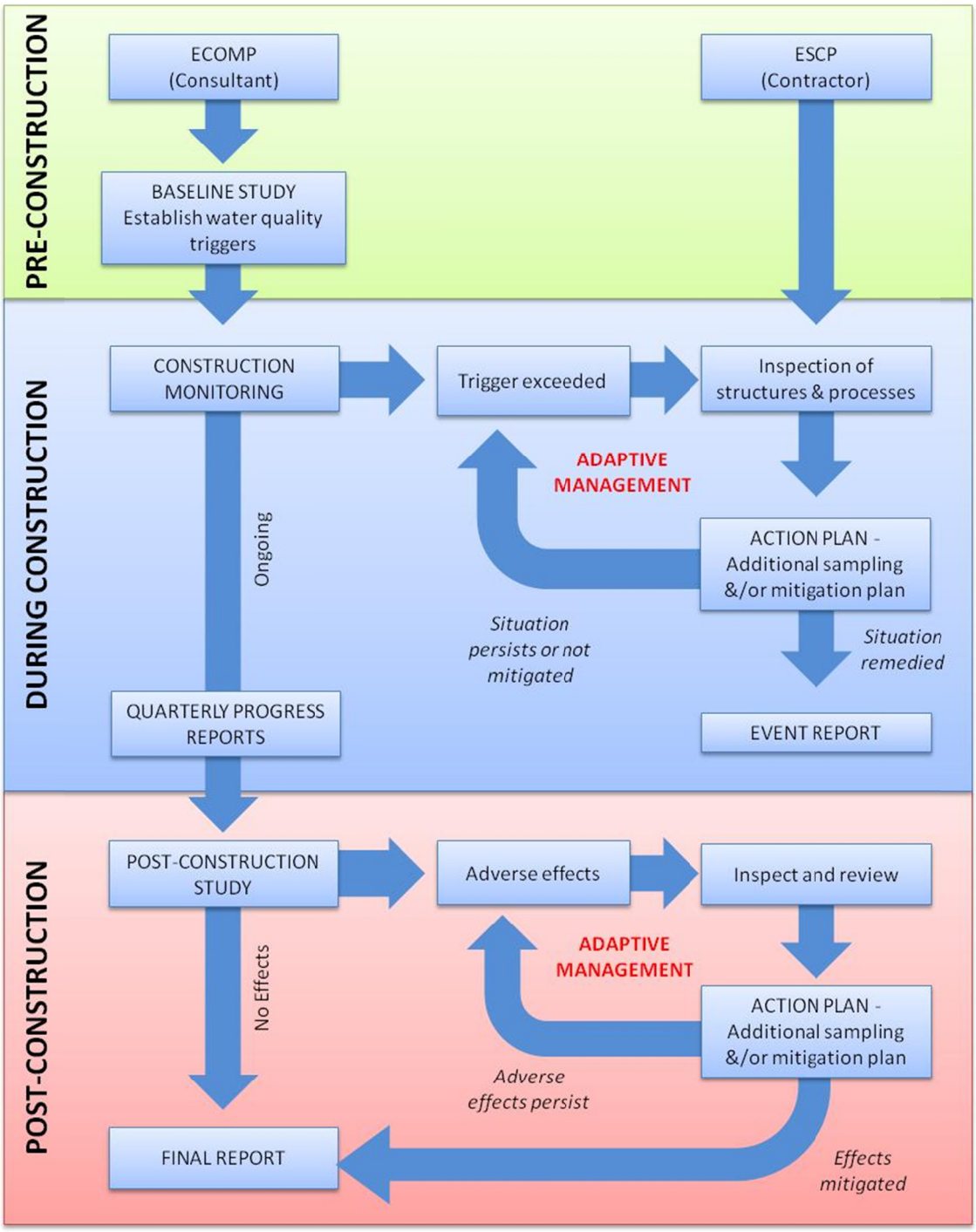


Figure 1 Adaptive Management Flow Chart

4.2.2 Response to observed effect

In the event that adverse impacts on terrestrial, wetland, in-stream or estuarine communities are detected by the monitoring programmes, a plausible (cause-effect) association with the Project will be investigated in the first instance. Should this prove to establish linkages between the adverse effect and on-site practices then alterations to the operational methods (including modifications to environmental devices) will be investigated as a first order response. The Regional Council will be

consulted on any proposed changes to the on-site practices. Further monitoring will then be used to assess the effectiveness of the alterations in operational methods to alleviate / avoid adverse effects on the environment.

Factors to be considered in the decision chain relating to the above would include:

- the assessed likely cause(s) of the effect,
- whether the effect is on-going,
- the magnitude of the event and effect,
- the sensitivity of the receiving environment,
- the need for, and nature of, any remedial action to the environment,
- the need for, and nature of, any remedial action to the discharge defences and process.

If any remedial action is deemed to be necessary by the breach of consent condition targets and / or the Regional Council then the Project team shall be responsible for the appropriate rectification or mitigation of the adverse effects detected. The Regional Council will be consulted within the process of identifying the appropriate rectification or mitigation.

However, should no such linkages be established between the Expressway Project work practices and the adverse environmental effects observed, then the Project team shall not be liable for any remediation or mitigation works over and above those already required by the conditions of consent and the Designation.

The most likely cause of a significant adverse effect would be the incorrect installation or operation of devices or sub-optimal performance of the measures designed to avoid or minimise adverse environmental effects. The Project Erosion and Sediment Control team are responsible for ensuring adequate provision for such devices (including correct installation), and the routine environmental inspections are aimed at minimising their failure and to ensure repair any observed damage occurs.

The ESCP (Appendix H of the CEMP, Volume 4) and the wider CEMP (Volume 4) outline a number of preventative measures (such as silt ponds, correct stockpiling, cut-off drains etc) that ideally prevent an adverse effect from occurring in the first instance. In addition to the route wide generic ESCP (Appendix H of the CEMP, Volume 4), the Project Team will be preparing site-specific Erosion and Sediment Control Plans which will be lodged with the Regional Council prior to construction activities, within each of the development sectors within the Project area.

Contingency measures (such as the requirement for spill kits to be present in re-fuelling areas) are also detailed in the CEMP (Volume 4). Responsibility for their implementation will be with the Project team.

4.3 Vegetation and Wetland Monitoring

4.3.1 Vegetation

Prior to works, an on-site inception meeting will be arranged with the Project Ecologist and Project team to agree the most effective way to establish the site and implement the planting and restoration plans (refer to Appendices M.A, M.B, M.C and M.D). They will agree on 'hold points', site visits and regularity of monitoring and reporting.

Prior to works commencing an assessment should be undertaken to give an updated condition of the vegetation identified in on the Vegetation Map Series (Refer to Appendix M.A).

This assessment will be used as a baseline data set to monitor any change in the condition of this vegetation throughout the construction process. A photographic record of each area of vegetation should be undertaken prior to works commencing and at the completion of works.

Monitoring reports should include dates of visits, condition of the vegetation, condition of protective fencing, works undertaken in the vicinity over the past fortnight and any action required. As part of this monitoring process the Project Ecologist can make recommendations to the Project team to improve the health or safety of the retained and newly planted vegetation.

Following the practical completion (pending defects liability requirements) a two year maintenance period is proposed for the wet and dry swales, and for riparian planting. A four year maintenance period is proposed for the ecological, stormwater treatment and planted flood storage wetlands.

4.3.2 Pest Plant Species

Monitoring of pest plant species is essential to trigger the planning and implementation of pest plant management.

a. During construction

During the construction phase of the Expressway, a reconnaissance walk-over will take place regularly to determine presence of invasive pest plants. The aim of this survey is to identify areas that have been recently colonised by pest plants, and areas that contain potential for infestation. The Project team will walk the site, note the location and type of pest plant species and identify appropriate control methods.

Monitoring of pest plants will focus on areas along riparian zones, ecological and stormwater wetlands, areas that were cleared / disturbed during the construction phase and the restoration and revegetated areas.

On completion of the construction of the Expressway, the area is to be inspected by the Project team for pest plants and appropriate controls implemented prior to inspections by the Greater Wellington Regional Council pest control officers and the Projects Environmental Manager.

b. General Landscaped Areas

Newly planted and established landscaped areas are particularly susceptible to weed invasion. It is important that these areas are monitored and all weeds, including pest plants, are managed.

Generally, the newly planted areas associated with the Expressway will fall under a defects liability period lasting 2 – 4 years. This timeframe would depend on the type of planting.

It is the responsibility of the Project team and ultimately the Project Environmental Manager to monitor and maintain these areas, including pest plant control. Regular inspections will take place to ensure plant establishment and weed control is appropriate as per the Planting Specifications. Inspections will involve identifying pest plant species and severity of weed infestation, as well as identification of appropriate controls and implementing these controls immediately.

c. Restoration and Revegetation Areas

Monitoring of the areas to be restored and revegetated will be required. It is anticipated that monitoring will in the first instance require inspections on a regular basis depending on the phase of activity by a suitably experienced and qualified ecologist. The monitoring effort will be tapered off once the planted areas become well established, with a 2 – 4 year limit on the extent of maintenance. Monitoring shall include the extent of increases in area coverage, the extent of die-back (where observed) and general observations of plant health. Photographic records will be taken on each visit.

4.4 Freshwater Ecology Monitoring

The freshwater monitoring programme has two primary components, being “devices” monitoring and habitat monitoring. Habitat monitoring is discussed in the following sections of this report. “Devices” monitoring is covered in the Project’s Erosion and Sediment Control Plan (Appendix H of the CEMP, Volume 4). The design, installation, monitoring and repair of these devices is the responsibility of the Project team’s Erosion and Sediment Control Team. There may be trigger events for device monitoring that require ecological monitoring to ascertain the magnitude of the effect. Device monitoring for trigger events is detailed in the ESCP (CEMP Appendix H, Volume 4) and ecological monitoring shall follow the methodology described in this document.

Hazardous substances have the potential to be released into waterways following a spill. Management of spills is covered in CEMP Appendix L, Volume 4.

4.4.1 Introduction

For reasons associated with the dominant substrate present (sand), the landforms that are predominant (flat and modified), the gradients governing velocities (low and slow) and on the aquatic communities current condition and tolerance (poor and tolerant), accidental sediment discharges from earthworks has not been assessed to be of particular aquatic habitat and community risk. That being the case, this monitoring programme does not need to be as detailed and as certain of all and every aspect in relation to that monitoring as other more challenging sites and projects.

Short-term construction impacts associated with the Expressway construction on aquatic habitats are likely to include the following:

- disturbance / displacement of fish and aquatic macro-invertebrates due to construction activities, in particular the construction and operation of new stream realignments (diversions) and culverts; and
- water quality effects as a result of discharge to waterbodies, i.e. potential spillages of contaminants (e.g. hydrocarbons), increased sediment loads associated with treated stormwater discharged from construction sites, and potentially increased contaminant loads in operational phase stormwater discharges.

The freshwater ecological monitoring programme is intended to:

- identify and quantify any adverse effects resulting from the Expressway Project (which potentially could include episodic contamination of receiving waters due to spills or the failure of management controls to contain effects); and if necessary -
- identify and evaluate corrective measures which may be required in the event of adverse ecological effects arising from the construction of the Expressway; and
- evaluate the success of any corrective measures that are subsequently implemented.

The freshwater habitats will be monitored by use of a Before-After Control-Impact (BACI) methodology. This refers to undertaking pre-construction (i.e. baseline) surveys at selected sampling sites within the watercourses associated with the Project and then at set periods re-surveying these same sites following the start of construction activities, and continuing for a set period after their completion and comparing the results. It also utilises fixed sampling sites stationed outside the zones of impact but in the same waterway (e.g. upstream of the treated storm water discharge points).

Freshwater ecological monitoring consists of four stages that include two levels of monitoring intensity:

- Baseline surveys (high intensity)

- Scheduled Operational Monitoring (routine monitoring, low intensity)
- Triggered Monitoring (greater monitoring intensity)
- Post Construction Monitoring (routine monitoring, low intensity (dependent on incidences))

The structure of the monitoring programme will involve three levels of monitoring, those being Baseline, Scheduled Bi-Annual Monitoring and Triggered Monitoring. The Baseline data will provide a bench-mark against which to measure the construction phase data sets and the post construction. The Scheduled Monitoring will involve routine (Calendar) studies of prescribed ecological parameters. The Triggered Monitoring will be in response to potential adverse effects having happened, as identified by pre-determined "triggers" having occurred. Those triggers originate first with the sediment management device monitoring and the team that will undertake that duty and as stipulated in the ESCP (Appendix H of the CEMP, Volume 4). Those devices must be therefore, be regularly inspected and accurately monitored at the discharge location in each waterway of each discharging device,

4.4.2 Methods

Monitoring of Macro-Invertebrate Communities

Monitoring of macro-invertebrate populations in the Wharemauku Stream, Mazengarb Stream, Muaupoko Stream, Waikanae River, Waimeha Stream, Ngarara Drain, Kakariki Stream, Paetawa Drain and Hadfield/Kowhai Stream will be undertaken on two occasions each year, one in summer and one in winter at sites upstream and downstream (beyond the mixing zone) of the works. The protocol for macro-invertebrate sampling shall be established by a suitably qualified and experienced freshwater ecologist, but will follow the national protocols established for wadable streams (Stark et al 2000) and include taking five replicated samples from each of the sampling sites and establishing full or semi-full taxa counts (not coded abundance). Each replicate will involve the sampling of the micro-habitats present (e.g. the bank, bed, and woody debris habitats) while being consistent with previous sampling efforts and only sampling repeatable type habitats (i.e. not ephemeral habitat types).

In addition to the macro-invertebrate surveys, there will be a one-off baseline (pre-construction) quantitative assessment of the substrate, bed and bank using the Hardy et al (2004) National protocol and will focus on establishing a fixed quadrate/location type assessment, especially with a focus on measuring substrate change.

Responsibility

Responsibility for undertaking macro-invertebrate monitoring rests with the Contractor's Environmental Manager who will nominate an appropriately qualified and experienced freshwater ecologist to undertake the monitoring and report on findings.

Data Interpretation

At least the following metrics will be applied to the data collected:

- Species Richness;
- Total Abundance;
- The Macro-Invertebrate Community Index;
- The quantitative Macro-Invertebrate Community Index;
- EPT taxa Richness and abundance ratios
- Comparison of community similarity measures (e.g. PERMANOVA).

Periodicity and Timing of Surveys

Monitoring will be undertaken twice per year, in Summer and winter. There will be four baseline (pre-construction) surveys (2 per summer and winter period), followed by the bi-annual routine monitoring programme commencing during the construction period and continuing until the Regional Council is satisfied that no adverse effects have or are likely to occur, but up to a maximum time of 3 years following the opening of the Expressway.

Additional "Event" Related Monitoring

"Events" which constitute triggers for additional monitoring and the indicators of what constitutes a potential "significant adverse aquatic effect" in receiving waters are specified in this EMP in Sections 4.5.1.3 and 4.5.1.4. If there is an "event" then discussions will be held with the Regional Council to determine if a further macro-invertebrate community assessment should be conducted based on initial habitat condition observations.

Macrophyte and Periphyton Communities

At the same locations as the macro-invertebrate samples, and in addition to the substrate quantification, a semi-quantitative periphyton and macrophyte baseline and monitoring protocol should be developed to establish and follow macrophyte taxa and abundance change and periphyton taxa and abundance change. Both aspects of the monitoring shall be developed by a suitably qualified freshwater ecologist and include identification of the species present and the relative abundances at fixed locations and presence (if any) of substrate periphyton and a visual cover measure (that measure should follow Briggs et al 2000, MfE guidelines).

Monitoring of Fish Communities

Monitoring native fish communities in any of the waterways open to works on a regular basis while works are present is unlikely to result in a "true" picture of effects. This is because of the mobility of the fish present. Non-lethal adverse effects, direct disturbance or changes to water quality are likely

to cause fish to reallocate themselves in the catchment. Sampling throughout the disturbance time is unlikely to give a clear account of an effect.

The test of an absence of adverse effect will be the comparison of sites that during baseline had repeated taxa presence, again having those taxa post construction. It is therefore not suggested to monitor fish during the construction period but to set a good baseline (at least 4 detailed study periods), and then to resample with the same effort 6 months or 1 year (after a migration period) post construction.

Responsibility

Responsibility for undertaking fish community monitoring rests with the Project team's Environmental Manager who will nominate an appropriately qualified and experienced freshwater ecologist to undertake the monitoring and report on findings.

Methods

Each survey shall include an assessment of relative abundance or similar measure of density expressed as number of fish per m^2 and a record of species and size classes of fish at each of the sample sites.

Number and Timing of Surveys

There will be four baseline (pre-construction) surveys, followed by another four surveys 6 months post construction (note that this will be a rolling period as construction may finish in some catchments well before it does in others), until the Regional Council is satisfied that no adverse effects have or are likely to occur, up to a maximum time of 3 years following the opening of the Expressway

The surveys will be carried out in spring-summer (October –December).

Sampling Techniques

In the baseline and post construction surveys the fishing methods shall employ electric fish sampling, fyke nets and collapsible Kilwell fish traps (baited). Sampling effort will be standardised for each sampling run. In addition, flow / habitat characteristics will be measured for each survey by measuring a cross sectional depth profile, wetted width and velocity at each sampling site at the time of survey.

Additional "Event" Related Monitoring

If there is an" event" then discussions will be held with the Regional Council to determine if a fish community assessment should be conducted, Given the high short term tolerance of fish to

suspended sediment (Rowe et al 2004), an infrequent and short duration event will only result in fish movement and not death and monitoring set positions downstream may not inform the authority of an "adverse effect" but rather an example of avoidance behaviour. If fish monitoring is to be undertaken then it should only be instigated several days to a week after clear water has again been running.

4.4.3 Freshwater Habitat Monitoring - ""Trigger Event" Event" Monitoring

As with the devices monitoring, there may be additional sampling required within the freshwater habitats in response to events. The trigger events for freshwater habitats will include:

- Marked change in any of the ecological or physical variables measured under the regular freshwater component of this EMP (e.g. sediment deposition, macro-invertebrate and Macrophyte communities);
- Any device monitoring by the earthworks contractors that detects a "trigger event" which requires additional ecological monitoring, or Alerts of potential issues through observations of oils and sheens in the control devices etc;
- Project related conspicuous change of water colour or condition (e.g. oily) at the downstream monitoring sites that is not evident at the upstream (control) sites;
- Turbidity significantly higher at the sampling site(s) than that of the baseline sediment monitoring and / or compared to the control sites;
- Obvious (visually detectable) degradation of the immediate receiving environment downstream of the sediment treatment ponds (or wider construction site), such as conspicuous oil or grease films, scum or foams, or floatable matter, which is not evident above the discharge point;
- Obvious accumulation of sediment in the vicinity of the treatment pond discharge points, or anywhere else within or in proximity to the active construction zones;
- Spillage / accident reports by construction workers;
- The occurrence of loadings outside of the design criteria for the silt control works.

4.4.4 Indicators of "Significant Effects" in Freshwater Habitats

Following "trigger event" monitoring, the next step is to establish whether a significant adverse effect has resulted from the event that triggered the additional (unscheduled) monitoring. Indicators of significant adverse effects having occurred include the following:

- continued presence of sensitive indicator species at upstream control sites and loss of those species down-stream where they would have been present ;
- Significant difference in species richness for macro-invertebrates at affected sites compared to the baseline and no corresponding changes in the control communities; and

Significant difference in the depth of fine sediments in pools and in any reach of the waterway monitored at potentially impacted downstream sites compared to that recorded in the upstream control sites, with additional reference to the results of the baseline surveys and previous construction-phase surveys at those same sites

4.5 Marine Ecology Monitoring

Short-term construction phase impacts on marine/estuarine ecological values associated with the Expressway Project may arise from the discharge of operational phase stormwater, device failures or accidental contaminant spills.

The marine ecological monitoring programme is intended to:

- identify and quantify any adverse effects resulting from the Expressway Project (which potentially could include episodic contamination of receiving waters due to spills or the failure of management controls to contain effects); and if necessary -
- identify and evaluate corrective measures which may be required in the event of adverse marine ecological effects arising from the construction of the Expressway
- evaluate the success of any corrective measures that are subsequently implemented.

The marine habitats will be monitored by use of a Before-After Control-Impact (BACI) methodology. This refers to undertaking pre-construction (i.e. baseline) surveys at selected sampling sites within the watercourses associated with the Expressway Project and then periodically re-surveying these same sites following the start of construction activities, and continuing for a set period after their completion and comparing the results. It also utilises fixed sampling sites stationed outside and within the likely zones of impact (e.g. upstream and downstream of the treated stormwater discharge points).

Marine ecological monitoring consists of four stages that include two levels of monitoring intensity:

- Baseline Monitoring (routine monitoring intensity)
- Scheduled Operational Monitoring (routine monitoring intensity)
- Triggered Monitoring (greater monitoring intensity)
- Post Construction Monitoring (routine monitoring intensity)

The structure of the monitoring will involve three levels of monitoring, being Baseline, Scheduled Annual Monitoring and Triggered Monitoring. The Baseline data will provide a bench-mark against which to measure the construction phase data sets. The Scheduled Monitoring will involve routine twice yearly studies of prescribed ecological parameters. The Triggered Monitoring will be in response to potential adverse effects having happened, as identified by pre-determined “triggers” having occurred.

The sections below detail monitoring of impacts on marine ecological values and habitats.

4.5.1 Marine Invertebrate Community Composition, Sediment Grain Size and Sediment Quality

Sampling of the marine invertebrate community composition, surface sediment grain size and sediment quality is to be undertaken at sampling sites (based on random sampling within an established grid), to be located at two locations within the Waikanae Estuary as outlined in the Marine Values Report (Technical Report 31, Volume 3). The experimental design will be based on the Estuarine Environmental Assessment and Monitoring: A National Protocol (Cawthron, 2002).

Sampling will be undertaken routinely every 6-months with two baseline surveys to be undertaken prior to commencement of construction, monitoring continuing during the construction period and at least a further 36 months following completion of construction.

Benthic invertebrates will be sampled using a 13cm diameter PVC corer to a depth of approximately 15 cm. Cores will be sieved through a 0.5 mm mesh, and the retained material preserved in 60% ethanol, for later extraction and identification of the organisms.

Composite surface sediment (top 2 cm) samples will be collected using a plastic scoop. The material from the sampling sites will be placed in jars and held on ice until analysed by a suitably accredited laboratory for grain size and stormwater contaminants (copper, lead, zinc, TOC (Total Organic Carbon) and high molecular weight polycyclic aromatic hydrocarbons).

Responsibility for undertaking marine invertebrate community composition, sediment grain size and sediment quality monitoring rests with rests with the Project teams Environmental Manager who will nominate an appropriately qualified and experienced marine ecologist to undertake the monitoring and report on findings.

4.5.2 Marine habitat monitoring - “trigger event” monitoring

As with the devices monitoring, there may be additional sampling undertaken within the marine habitats in response to events. The trigger events for marine habitats would include such matters as:

- Marked change (>50%) in any of the ecological or physical variables measured under the marine component of this EMP (e.g. invertebrate community composition, sediment grain size and sediment quality);
- Any device monitoring that detects a “trigger event” which requires additional ecological monitoring;
- Turbidity significantly higher at the sampling site(s) immediately adjacent to the construction zone compared to further seaward, and which are at levels that may be harmful to aquatic biota;

- Obvious degradation of the immediate receiving environment downstream of the sediment treatment devices (or wider construction site), such as the visual presence of conspicuous oil or grease films, scum or foams, or floatable matter, which is not evident above the discharge point;
- Obvious accumulation of sediment in the vicinity of the treatment pond discharge points, or anywhere else in proximity to the active construction zones;
- Visual reports / evidence of changes to adjacent habitats;
- Spillage / accident reports by construction workers;
- The occurrence of loadings outside of the design criteria for the silt control works; and
- Appearance of an oily sheen on the surface of any sediment treatment pond. This will also indicate the need to investigate other parameters.

4.5.3 Indicators of "Significant Effects" in Marine Habitats

Following "trigger event" monitoring, the next step is to establish whether a significant adverse effect has resulted from the event that triggered the additional (unscheduled) monitoring. Indicators of significant effects (defined as a greater than 50% change) having occurred include the following:

- Significant difference in benthic invertebrate species richness composition, diversity or community composition compared to baseline surveys at the same time of year.
- Significant difference in surficial sediment grain size composition compared to baseline surveys.
- Significant difference in sediment quality i.e. concentration of common contaminants in stormwater contains (Cu, Pb, Zn, PAHs) surficial sediment compared to baseline surveys.

4.6 Reporting

Compliance reports will be forwarded to the Greater Wellington Regional Council by the Project team on an "as-required" basis. As-built specifications and plans for erosion and sediment controls will also be forwarded on to the Regional Council on an "as completed" basis.

Ecological Monitoring will typically be reported to the Regional Council to demonstrate compliance with the consent conditions according to the following schedule:

4.6.1 Devices Monitoring

Device monitoring is covered in the ESCP (Appendix H of the CEMP, Volume 4).

4.6.2 Ecological (Habitat) Monitoring

1 Terrestrial Habitat Monitoring: Within two months after completion of each survey

2 Freshwater Habitat Monitoring: Within two months after completion of each survey.

3 Estuarine Habitats Monitoring: Within two months after completion of each survey.

4.7 Complaints

Complaints will be managed through the process included in the Construction Environmental Management Plan (CEMP, Volume 4).

Any complaints received relating to ecology and landscape activities will be reported to the Project Ecologist for discussion on the appropriate response with the Environmental Manager.

5 Review of the Ecological Management Plan

This section describes how the Plan will be reviewed, including looking at the environmental controls and procedures to make sure that they are still applicable to the activities being carried out.

The EMP will be reviewed by the Project Ecologist and Project team after confirmation of the resource consent conditions and will be revised in accordance with those conditions. The EMP will be updated, with the necessary approval, throughout the course of the Project to reflect material changes associated with changes to construction techniques or the natural environment. Approval from the Greater Wellington Regional Council and/or the Department of Conservation will be required for any relevant revisions of a material nature to the EMP.

A management review of the EMP will be undertaken at least annually by the Project. The management review will be organised by the Project's Environmental Manager, the Project Ecologist and Project Team will be informed of any changes to this Plan through the regular Project communications processes. The review will take into consideration:

- any significant changes to construction activities or methods;
- any significant change in the related sub-plans (such as the ESCP, Appendix H of the CEMP, Volume 4);
- key changes to 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 public complaints.

Reasons for making changes to the EMP will be documented. A copy of the original EMP document and subsequent versions will be kept for the Project records, and marked as obsolete. Each new/updated version of the EMP documentation will be issued with a version number and date to eliminate obsolete EMP documentation being used.

6 References

Ecological Technical Report 1: Terrestrial Vegetation & Habitats (including wetlands), Technical Report 27, Volume 3 of the MacKays to Peka Peka AEE.

Ecological Technical Report 2: Herpetofauna, Technical Report 28, Volume 3 of the MacKays to Peka Peka AEE.

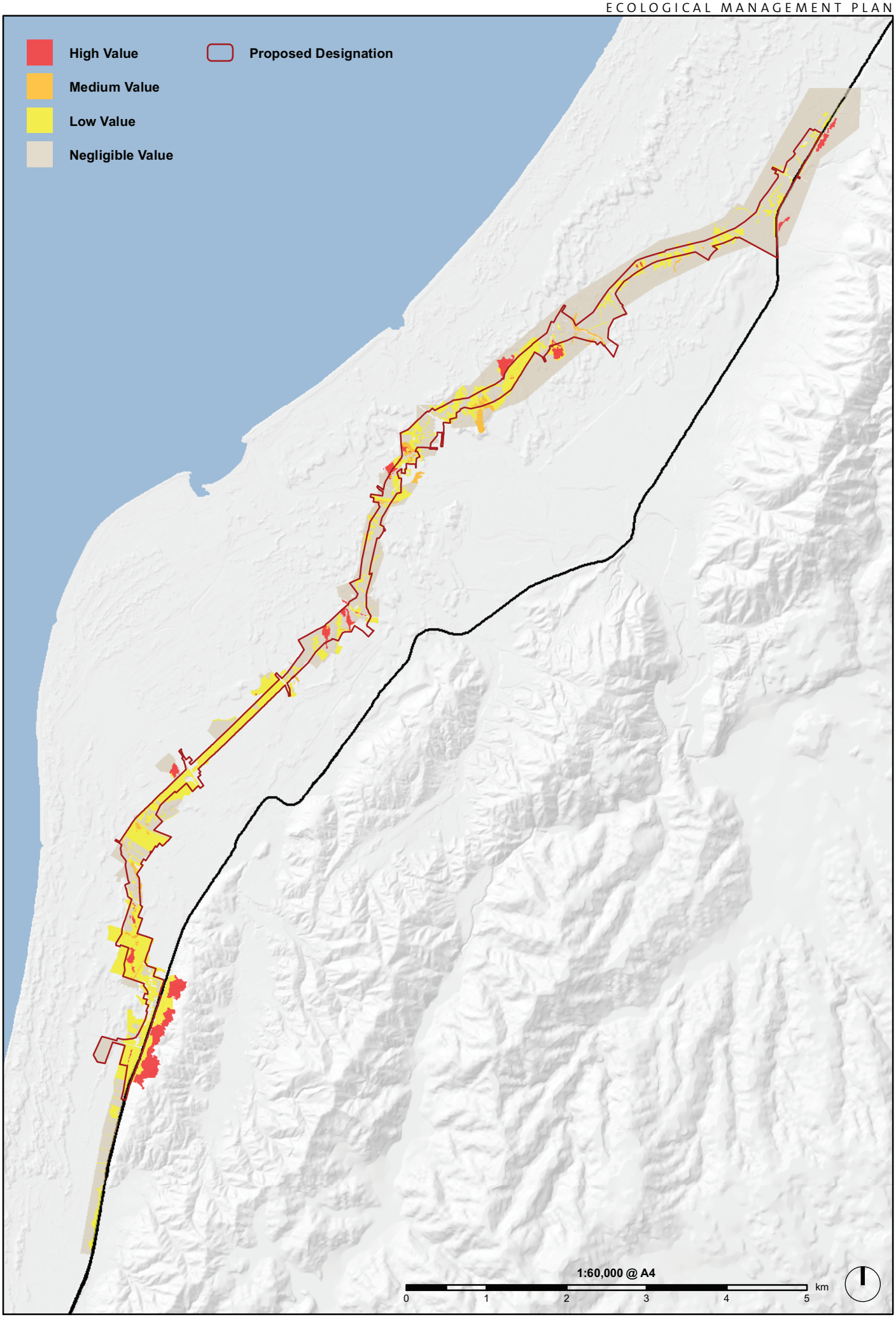
Ecological Technical Report 3: Avifauna Studies – Description and Values, Technical Report 29, Volume 3 of the MacKays to Peka Peka AEE.

Ecological Technical Report 4: Freshwater Habitat & Species Description and Values, Technical Report 30, Volume 3 of the MacKays to Peka Peka AEE.

Ecological Technical Report 5: Marine Habitat and Species – Description and Values, Technical Report 31, Volume 3 of the MacKays to Peka Peka AEE.

Appendix M.A

Vegetation Map Series - Areas of Medium – High Ecological Value



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Appendix M.B

Construction activities, receiving environments and sensitive receptors in each sector

Appendix M.B Construction activities, receiving environments and sensitive receptors in each sector

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
1- South	a) Poplar Avenue – Poplar Avenue Interchange **Culverts** ▪ Extension of existing culverts under the existing SH1 to the location of the new swale ▪ Culvert 7. ▪ Water diversion **Road Construction** ▪ Surface water drainage pipes and sumps will be installed. ▪ Erosion and sediment control and site drainage systems removed.	▪ Significant existing vegetation, particularly kanuka, and groups of pines ▪ Sediment discharge ▪ Fish passage	▪ Minimise vegetation clearance around the areas of regenerating kanuka. ▪ Erosion and sediment control ▪ Design and construction of culverts taking into account fish passage. ▪ Mass planting of indigenous vegetation at Poplar Avenue Interchange. ▪ Implement planting plan. ▪ Implement pest and weed management.	▪ Sediment discharge ▪ Fish passage at new culverts.
	b) Poplar Avenue-Raumati Road: Expressway **Culverts** ▪ To provide access across	▪ Kanuka forest, gorse and mahoe areas south of Raumati Road ▪ Raumati Wetland ▪ Wharemauku River mouth	▪ Where possible, protection and retention of mature kanuka. ▪ Where possible,	▪ Gorse and mahoe areas available for revegetation ▪ Established kanuka

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	Drain 7, Culvert 10 will be installed prior to preload: ▪ Drain diversion – Drain 7 diverted around worksite by blocking the drain at the upstream end and providing a temporary diversion. ▪ Culvert excavated through peat ▪ Drain 7 will pass through Culvert 10 and the temporary diversion removed. **Road Construction** ▪ Surface water drainage pipes and sumps will be installed. ▪ Erosion and sediment control and site drainage systems removed.	▪ Drain 7 is a tributary of Wharemauku Stream ▪ High grassed dunes ▪ Semi mature and established kanuka ▪ Gorse and mahoe areas available for restoration ▪ Water levels of Raumati wetland ▪ Wetland vegetation ▪ Sediment discharge ▪ Fish passage	protection and retention of mahoe areas south of Raumati Road ▪ Erosion and sediment control ▪ Design and construction of culverts taking into account fish passage. ▪ Implement stormwater wetland and flood storage pond planting design. ▪ Implement ecological wetland planting, including buffer planting. ▪ Implement hydrological monitoring of Raumati Wetland. ▪ Implement pest and weed management.	forest (ecological value) ▪ Water levels of Raumati Manuka Wetland ▪ Wetland vegetation ▪ Sediment discharge ▪ Fish passage at Drain 7
2 - Paraparaumu	a) Raumati Road – Wharemauku Stream/Ihakara Stream: Expressway	▪ Wharemauku Stream and Stream Mouth ▪ Mahoe vegetation along Drain 7	▪ Where possible, protection and retention of mahoe vegetation	▪ Ecological values of mahoe along Drain 7 ▪ Sediment discharge

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	Culverts ▪ To provide access across Drain 7, Culvert 11 will be installed prior to earthworks: ▪ Drain diversion – Drain 7 diverted around worksite by blocking the drain at the upstream end and providing a temporary diversion. ▪ Culvert excavated through peat ▪ Drain 7 will pass through Culvert 11 and the temporary diversion removed. **Swale & Wetlands** ▪ Swale on the west side (south embankment) of the Wharemauku Bridge will be formed and Wetland Ponds 2 and 3 excavated. **Road Construction**	▪ Bridge construction ▪ Sediment discharge ▪ Fish passage	along Drain 7 ▪ Erosion and sediment control ▪ Design and construction of culverts taking into account fish passage. ▪ Implement stormwater wetland and flood storage pond planting design. ▪ Implement pest and weed management.	▪ Fish passage through new culverts. ▪ Ecological functioning of stormwater treatment and flood storage wetlands.

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	▪ Surface water drainage pipes and sumps will be installed. ▪ Erosion and sediment control and site drainage systems removed.			
	b) Ihakara Street/Wharemauku Stream – Kāpiti Road **Swale & Wetlands** ▪ Swale on the east side (north embankment) of the Wharemauku Bridge will be formed and Wetland Pond 4 excavated. **Road Construction** ▪ Surface water drainage pipes and sumps will be installed. ▪ Erosion and sediment control and site drainage systems removed.			

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	c) Kāpiti Road – Mazengarb Road **Swale & Wetlands** ▪ Swales formed and Wetland Pond 5 excavated. **Road Construction** ▪ Surface water drainage pipes and sumps will be installed. ▪ Erosion and sediment control and site drainage systems removed and linked into swale drainage.	▪ Stormwater wetlanda	▪ Implement planting plan. ▪ Implement pest and weed management.	▪ Wetland vegetation
	d) Mazengarb Road + 300m **Culverts** ▪ To provide access across Mazengarb Drain, Culvert 14 will be installed prior to earthworks: ▪ Drain diversion – Mazengarb Drain diverted around worksite by blocking	▪ Mazengarb Stream (sensitive) ▪ Large 110m box culvert ▪ Sediment discharge ▪ Fish passage	▪ Erosion and sediment control ▪ Design and construction of culverts taking into account fish passage. ▪ Implement planting plan. ▪ Implement pest and weed management.	▪ Sediment discharge ▪ Fish passage through new culverts, particularly the large 110m box culvert proposed in the Mazengarb Stream.

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	the drain at the upstream end and providing a temporary diversion. ▪ Culvert excavated through peat ▪ Mazengarb Drain will pass through Culvert 14 and the temporary diversion removed. **Road Construction** ▪ Surface water drainage pipes and sumps will be installed. ▪ Erosion and sediment control and site drainage systems removed and linked into swale drainage.			
3 - Waikanae	a) Mazengarb Road + 300m – Otaihanga Road **Culverts** ▪ To provide access across the Otaihanga Landfill drains, Culverts 15, 16, 17	▪ WWTP Drain (sewage treatment plant) ▪ Large culvert for the WWTP Drain, sensitive receiving environment is Mazengarb Stream and river mouth. ▪ Otaihanga North and South	▪ Implement planting plan for stormwater swales, wetlands and flood storage areas. ▪ Key ecological and revegetation area. ▪ Vegetation (Carex etc)	▪ Monitoring of hydrology in existing Otaihanga Wetlands (northern, central and southern). ▪ Sediment discharge ▪ Fish passage through

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	and 18 will be installed prior to earthworks: ▪ Drain diversion – the Landfill drains diverted around worksite by blocking the drain at the upstream end and providing a temporary diversion. ▪ Culvert excavated through peat ▪ Upon completion of each culvert, its drain will be allowed to pass through and the temporary diversion removed. ▪ Swales and wetland ponds will be excavated. **Road Construction** ▪ Surface water drainage pipes and sumps will be installed. Erosion and sediment control and site drainage systems	wetlands. ▪ Otaihanga Central Wetland and Drain potentially contaminated ▪ Dry vegetation in Otaihanga ▪ Kanuka remnant in Otaihanga ▪ New wetland created to mitigate for loss of wetland vegetation ▪ Vegetation (Carex etc) in north, south wetlands to be transported to new wetland as part of restoration. ▪ Riparian vegetation ▪ Sediment discharge ▪ Fish passage ▪ Contaminants from WWTP Drain	from Otaihanga North and South wetlands to be transported to new wetland as part of restoration. ▪ Implement pest and weed management.	new culverts. ▪ Monitoring of establishment of vegetation through defects liability and maintenance period, particularly buffering vegetation around wetlands and new constructed ecological wetland.

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	removed and linked into swale drainage.			
	b) Otaihanga Road – Waikanae River **Road Construction** **Stormwater** Stormwater Wetlands and Flood storage area **Drainage** Realignment of Muaupoko Stream	▪ El Rancho wetlands ▪ Muaupoko Stream and Waikanae River sensitive receiving environment north of Otaihanga. ▪ Riparian vegetation ▪ Sediment discharge ▪ Fish passage ▪ Surface water diversion ▪ Bird corridor ▪ Areas of well established native riparian species	▪ Erosion and sediment control ▪ Implement planting plan, including the riparian planting for Muaupoko Stream diversion. ▪ Implement pest and weed management.	▪ Monitoring of establishment of new planted riparian vegetation ▪ Sediment discharge ▪ Fish passage through new culverts and stream diversions. ▪ Areas of established native riparian species.
	Waikanae River Bridge ▪ 190m bridge ▪ Scrapers moving material along the Alignment between Otaihanga Road and Waikanae River ▪ Piling operations. ▪ River widening for flood capacity. ▪ Loss of plantings under	▪ Waikanae River, Waikanae Scientific Reserve and Estuary are high value receiving environment (ecological) ▪ Waikanae River - areas of well established native riparian species. ▪ Sediment discharge ▪ Fish passage ▪ Surface water diversion ▪ Bird corridor	▪ Erosion and sediment control to minimise open earthworked areas and stormwater runoff entering Waikanae River. ▪ Restrictions on operations in bed of Waikanae River to coincide with low summer water levels	▪ High ecological values. ▪ Riparian vegetation ▪ Sediment discharge ▪ Fish passage ▪ Surface water diversion ▪ Bird corridor

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	bridge and in Construction Footprint. ▪ Bridge beams transported to site and placed in position ▪ Realignment of Muaupoko Stream ▪ Culverts 20, 21 and 22 will be installed.		and avoid critical periods of fish passage. ▪ Implement planting plan. ▪ Implement pest and weed management.	
	c) Waikanae River – Te Moana Road ▪ New access to El Rancho ▪ Construction of Alignment within the edge of El Rancho Wetland (Weggery) ▪ Scrapers moving material along the Alignment between Waikanae River and Te Moana Road. ▪ Importing fill north of Te Moana ▪ A temporary crossing (3 bridges and associated works) over the Waimeha	▪ El Rancho wetland is a high value receiving environment ▪ Tuku Rakau Village, vegetation and wetland. ▪ Urupa and associated planting. ▪ Waimeha Stream and river mouth are sensitive receiving environments. ▪ Waimeha Stream and estuary. ▪ Riparian vegetation ▪ Sediment discharge ▪ Fish passage ▪ Surface water diversion	▪ Erosion and sediment control ▪ Minimise earthworks in El Rancho Wetland (Weggery). ▪ Implement planting plan for stormwater swales, wetlands and flood storage areas. ▪ Implement planting plan. ▪ Implement pest and weed management.	▪ El Rancho Wetland (Weggery) hydrology monitoring. ▪ Riparian vegetation ▪ Sediment discharge ▪ Fish passage at new culverts and stream diversions

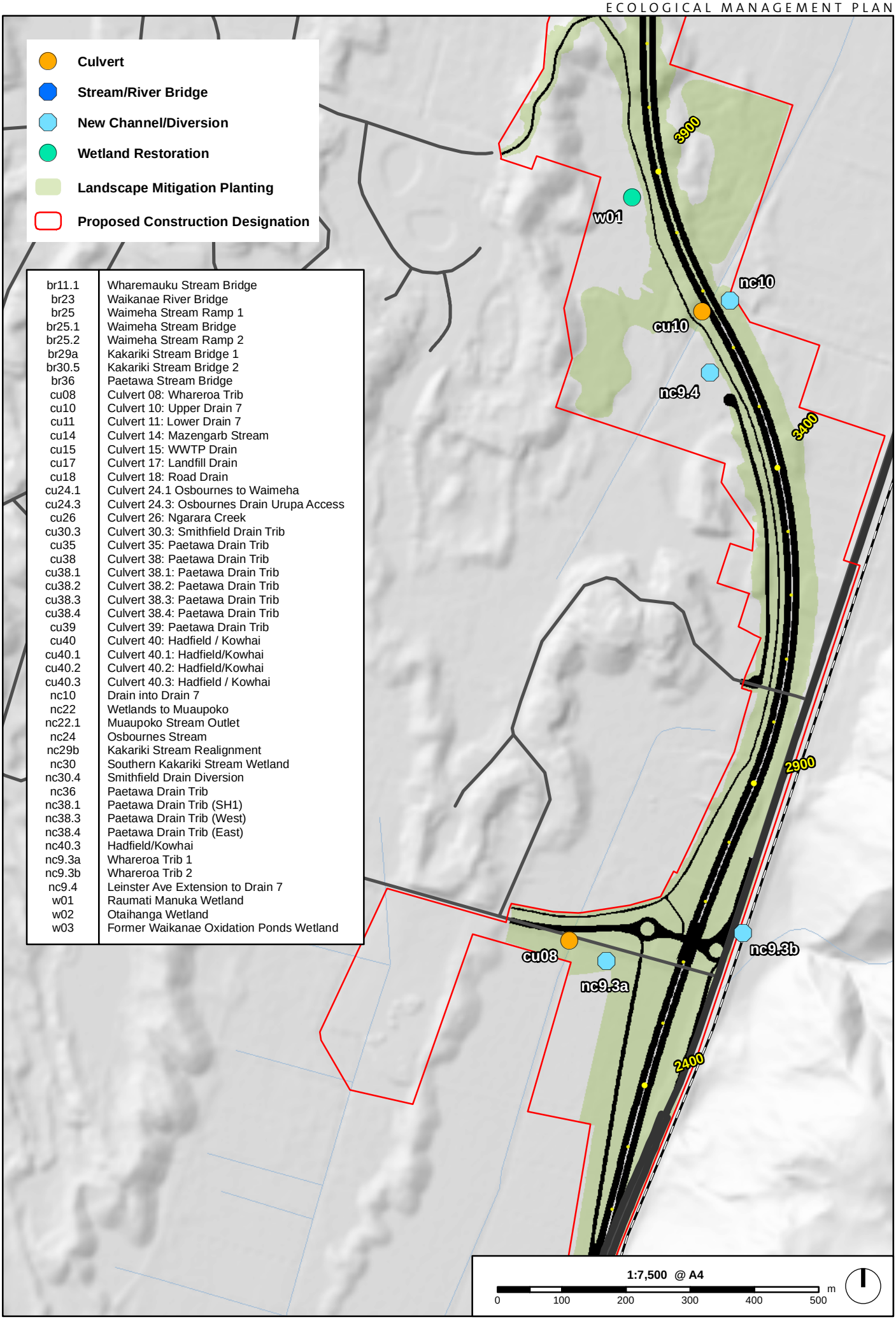
Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	Stream. ▪ Culverts and stream diversions within market garden south of Te Moana Road. d) Te Moana Road + 600m ▪ Scrapers moving material along the Alignment			
4 North	a) Te Moana Road + 600m – Ngarara Road **Culverts** ▪ Water from the Ngarara Drain will be diverted around worksite by blocking the drain at the upstream end and providing a temporary diversion. Flows through culvert 27 are expected to be much lower and so water will be pumped around the worksite in this location. ▪ Box culvert 26	▪ Areas of established mahoe. ▪ Kakariki Stream and associated vegetation. ▪ Te Harakeke Kawakahia wetland (main end receiving environment) ▪ Kawakahia swamp forest ▪ Ti Kouka wetland ▪ Waimeha Stream. ▪ Te Harakeke / Kawakahia Wetland downstream receiving environment for Ngarara Drain, Ngarara Stream, Kakariki Stream and Paetawa Drain. ▪ Riparian vegetation ▪ Sediment discharge	▪ Minimise the clearance of the Ngarara Mahoe Forest within Project Footprint. ▪ Implement planting plan including: mass planting at interchange; stormwater wetlands and swales, noise bunds; riparian planting. ▪ Implement erosion and sediment control. ▪ Culvert design incorporating fish passage.	▪ Riparian vegetation ▪ Sediment discharge ▪ Fish passage through new culverts.

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	▪ Swales drains, stormwater wetlands **Road Construction** ▪ Surface water drainage pipes and sumps will be installed. ▪ Interchange at Te Moana Road **Bridges** ▪ Over Te Moana Road, and ▪ Waimeha Stream	▪ Fish passage ▪ Bird corridor ▪ Nga Manu Nature Reserve	▪ Implement pest and weed management. ▪ Implement hydrological monitoring of Te Harakeke Wetland.	
	b) Ngarara Road – Peka Peka: ▪ New Smithfield Road and drainage system ▪ Bridges to cross Nga Manu Stream, Kakariki and Paetawa ▪ Stream realignments of Smithfield Drain, smaller tributaries of the Paetawa ▪ Culvert installation over Ngarara Drain, Kowhai	▪ Remnant lowland native forest, semi mature manuka/kanuka, wetlands, pine/macrocarpa shelterbelts woodlots and individual trees. ▪ Ngarara Stream ▪ Ngarara Drain ▪ Ngarara wetland ▪ Waimeha stream. ▪ Kowhai / Hadfield Stream and river mouth ▪ Bird flight corridors	▪ Minimise loss of remnant lowland native forest, semi mature manuka/kanuka, wetlands during site establishment phase. ▪ Implement planting plan. ▪ Implement pest and weed management. ▪ Erosion and sediment control	▪ Riparian vegetation, particularly Kakariki Stream. ▪ Sediment discharge ▪ Fish passage though new culverts and stream diversions. ▪ Bird populations, particularly the North Island fernbird population. ▪ Establishment of

Sector	Construction Phase/Activity	Potentially Impacted Values / Sensitive Receptor	Management & Mitigation	Monitored Values
	Hadfield Drain ▪ Formation of swales ▪ Wetland ponds.	▪ Te Harakeke / Kawakahia Wetland downstream receiving environment for Ngarara Drain, Ngarara Stream, Kakariki Stream and Paetawa Drain. ▪ Nga Manu Nature Reserve ▪ Riparian vegetation ▪ Sediment discharge ▪ Fish passage	▪ Culvert design to incorporate fish passage.	vegetation in new stormwater treatment and flood storage wetlands. ▪ Constructed wetland monitoring plan.

Appendix M.C

Terrestrial and Freshwater Ecological Mitigation Sites (6 pages)



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nc22.1	Muaupoko Stream Outlet
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nc9.3b	Whareroa Trib 2
nc9.4	Leinster Ave Extension to Drain 7
w01	Raumati Manuka Wetland
w02	Otaihanga Wetland
w03	Former Waikanae Oxidation Ponds Wetland

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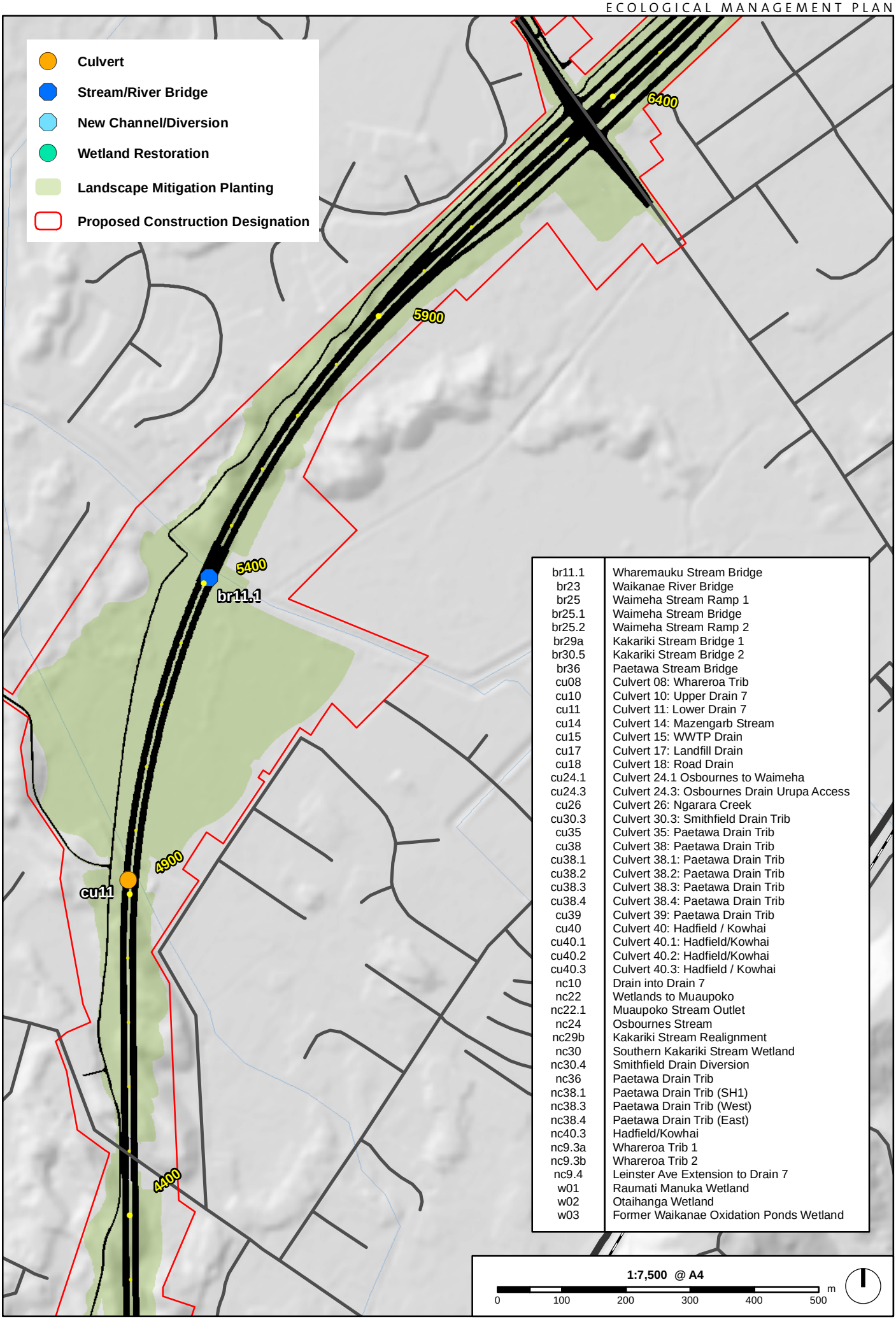

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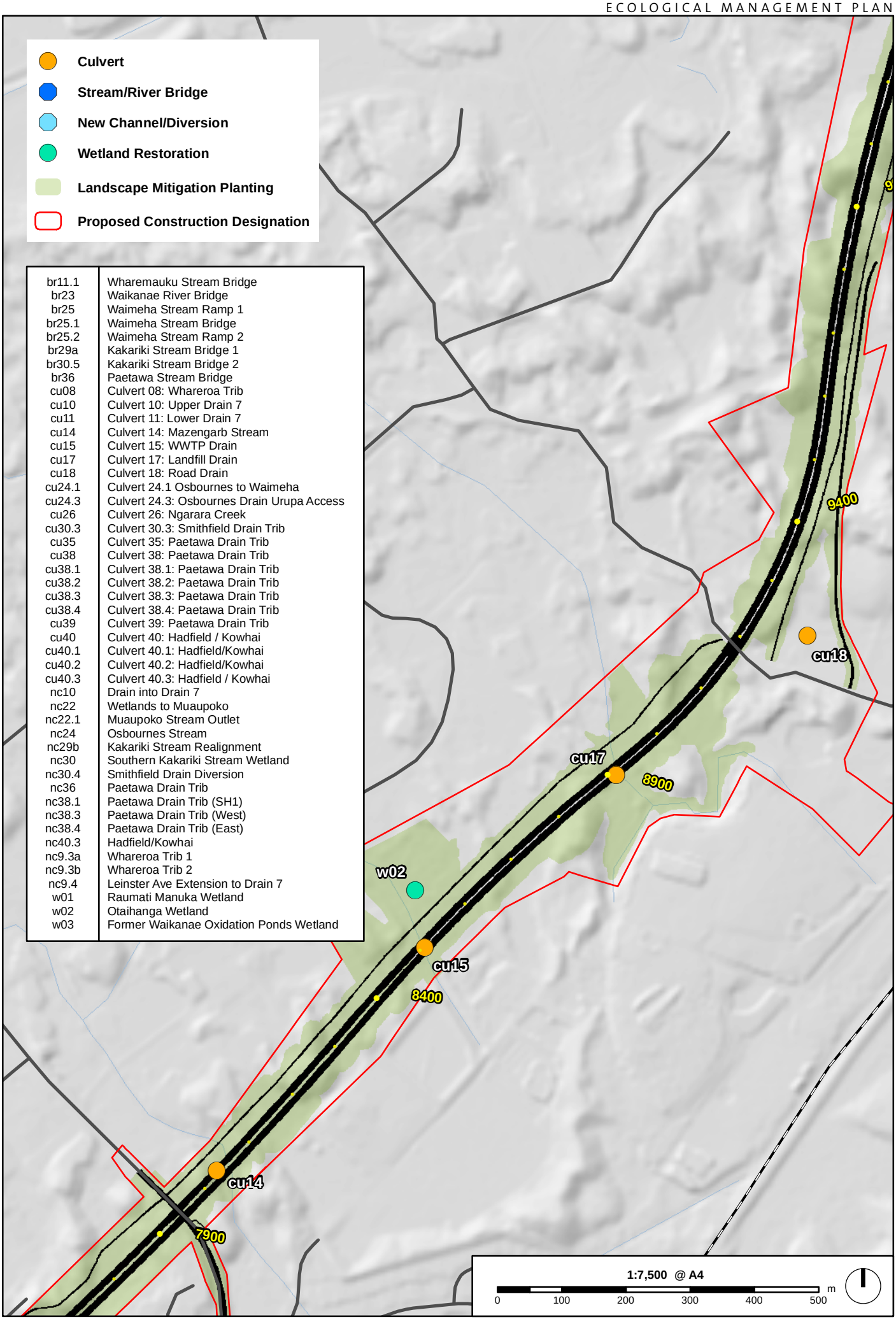

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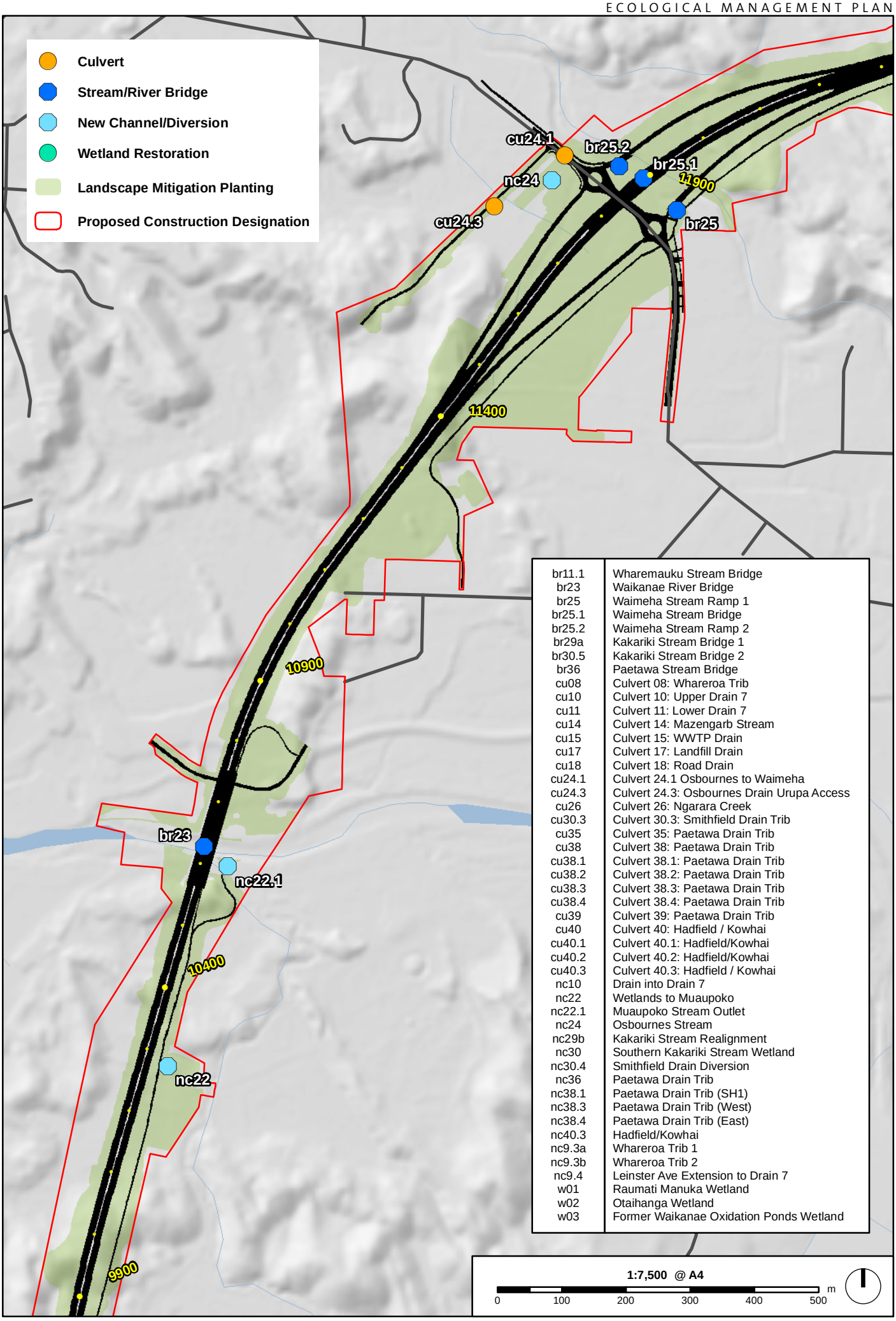

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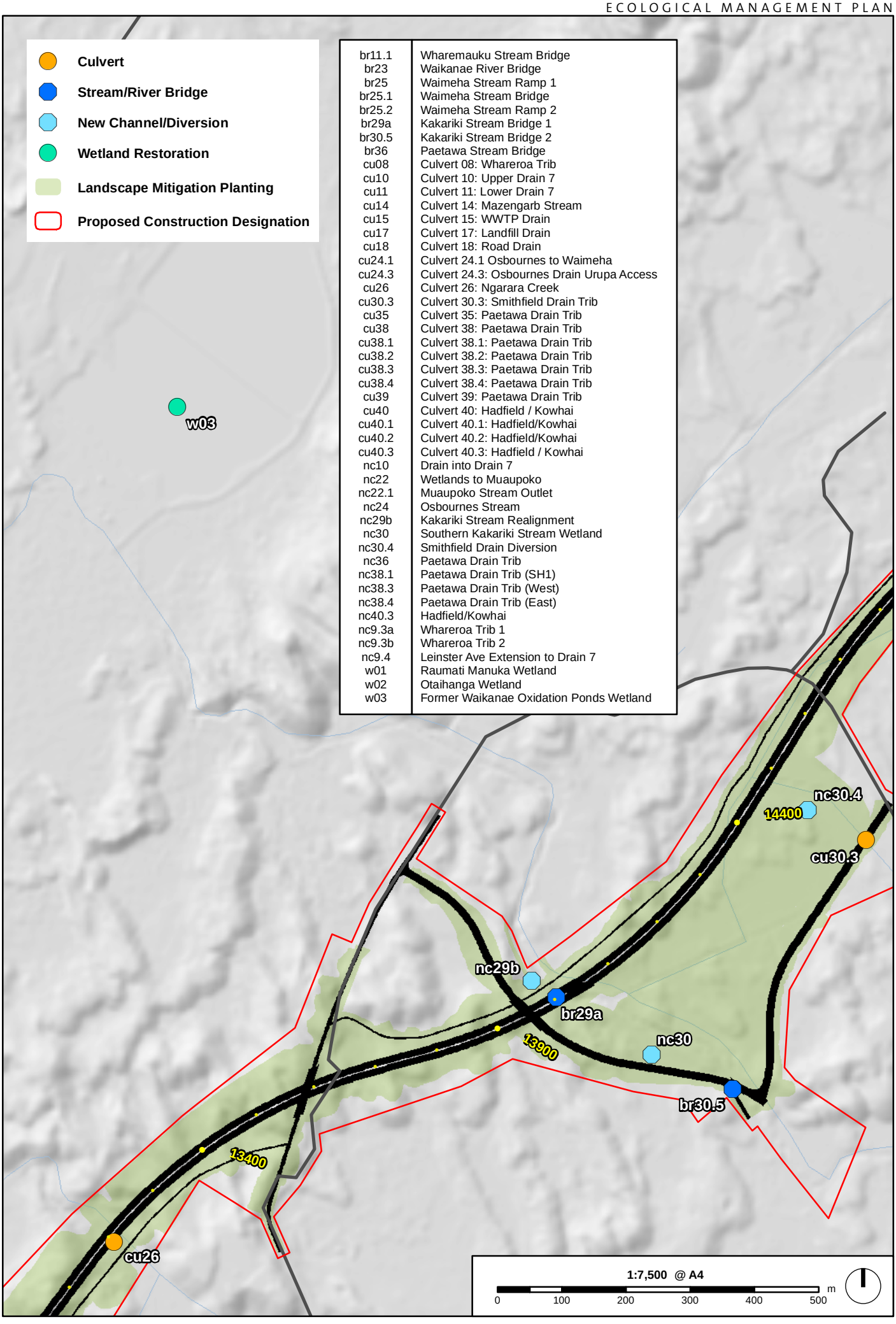

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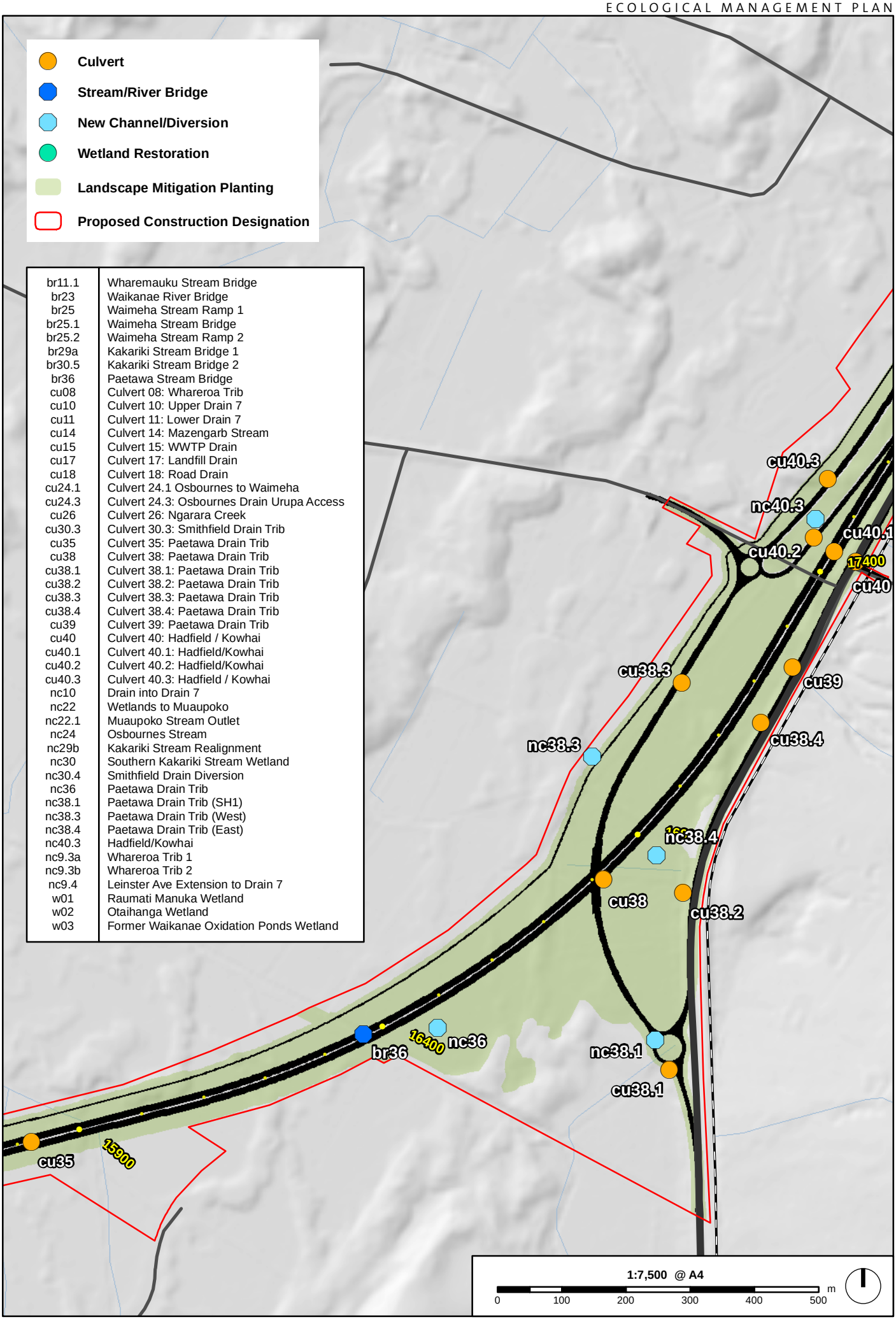

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Appendix M.D

Planting Plan Map Series (Figures 3-6 from Landscape and Visual Effects Assessment)

Refer to Volume 5, Appendix M.D

Appendix M.E

Stream Diversion Design Guidelines

Appendix M.E Stream Diversion Design Guidelines

Introduction

An indicative stream diversion design and cross-section has been developed by the Project team with ecological input. The information for these diversion design guidelines has been developed from the freshwater sampling carried out by Boffa Miskell as part of the ecological investigations undertaken for the MacKays to Peka Peka Expressway and the reference material provided by published works such as Richardson Jowett (1996) on fish species requirements.

Objectives

The design objective for all stream diversions and new stream sections is to form new channels which have the ecological components necessary to achieve the mitigation levels required by the SEV models ecological compensation ratios. This means creating channels that have values at or near those of a reference or pristine stream.

This will require the design to consider the stream and floodplain form, the stream bed and bank substrate, flow dynamics and riparian cover.

Current Situation

With the exception of the Muaupoko Stream diversion, all existing streams consist of long uniform run situations with similar depth, substrate and velocity profiles over large linear distances. Furthermore, most stream diversions are proposed in areas of open grassed channel characterised by dense beds of aquatic weeds and riparian weeds such as blackberry. In all these waterbodies there are good opportunities for diversion and new lengths to enhance the local stream function and habitat value.

These Guidelines

The purpose of these stream diversion design guidelines is to guide the establishment of the final design of the diversion channels, focusing in particular on setting the meander, habitat hypes, depths and maintaining current velocity. These guidelines have been developed to improve the stream corridor so that small meanders and flood plains can be installed that will reduce the total stream length lost and create a greater diversity of stream habitat.

Because of the relatively uniform and homogenous characteristics of the streams proposed to be diverted, we consider that a set of guiding principles and indicative stream plans and cross-sections is more practical than developing specific stream diversion design guidelines. The objective of ecological involvement during construction of the stream diversions will ensure these principles are met.

The following design standards for diversions and new sections of stream are based on the results of the SEV sampling and analysis. Matching these parameters as closely as possible will ensure that all new diversions improve the diversity of morphology, hydrology, substrate, and habitats of the current channels:

Channel length:

- While most waterbodies diverted consist of flat, uniform sections, in order to minimise the loss of channel length through diversions, the development of meandering sections within the floodplain is essential.
- Creating meanders in all stream diversions is vital for improving current values and providing habitat diversity, channel complexity, and velocity reduction. In some locations such as the Muaupoko Stream realignment the meanders will require rock rip rap and armouring, but if properly installed this form of armouring can provide good habitat for small native fish and macro-invertebrates.
- The meander should be planned on detailed drawings.

Width of wetted bed and water depth

- To match existing stream widths and depths, but designed to provide irregular widths to improve habitat values and provide habitat diversity.
- The width and depth of the wetted bed should be planned and pegged out on site in conjunction with the Project Ecologist.

Velocity

- To match existing low velocities and long runs consistent with these low-lying streams in sand country.

Bed material

- To match as closely as possible current substrates which are dominated by fine sands, muds and silts with small gravels in some sections.
- The placement of these different sized bed materials needs to be monitored and size will be determined by velocity and desired habitat. Consent conditions need to require ecological instruction and guidance during this process.

Hyporheic Zone

- Where the new diversion channel is to be formed in peat or sands, the bed is to be cut down 0.5m below final bed depth and filled with coarse material to form a deep gravel / cobble bed and functioning Hyporheic zone. If the excavation falls in river gravels this will not be necessary.

Channel complexity

- To match as closely as possible current low gradient runs and pools.
  - 90% runs / slow glides
  - 10% pool

Channel Habitat Diversity

- This is expected to increase over time from 3 to 6 types including
  - Cobble riffle
  - Run – Pool
  - Boulder - bedrock Cascade
  - Root mat (from riparian vegetation)
  - Undercut (bank)
  - Boulder

Shading

- Currently low shading based on predominantly grazed pasture to stream edges with some overhanging banks, blackberry weedlands, and weedy aquatic macrophyte.
- To attain a minimum (with revegetation) of 80% shading based on riparian canopy of small trees, and sedgelands.

Spawning Habitat

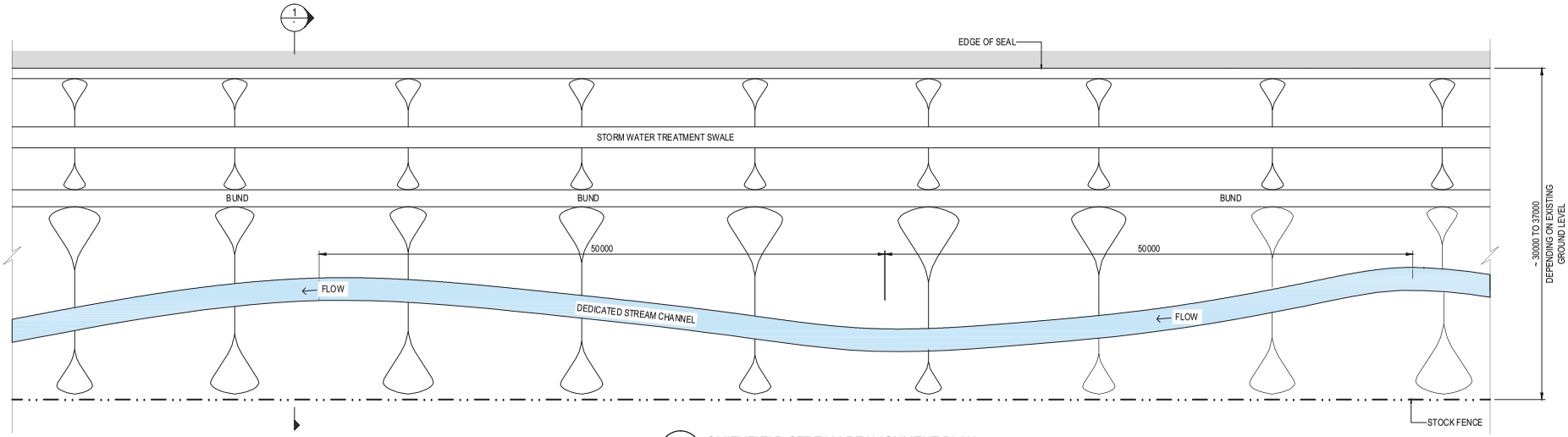
- Currently limited to small areas not subject to regular stock grazing or mowing.
- Intention is to increase spawning habitat with landscaping to a minimum of 40% of stream margin (subject to substrate strength) and extending into riparian planting.

Planting

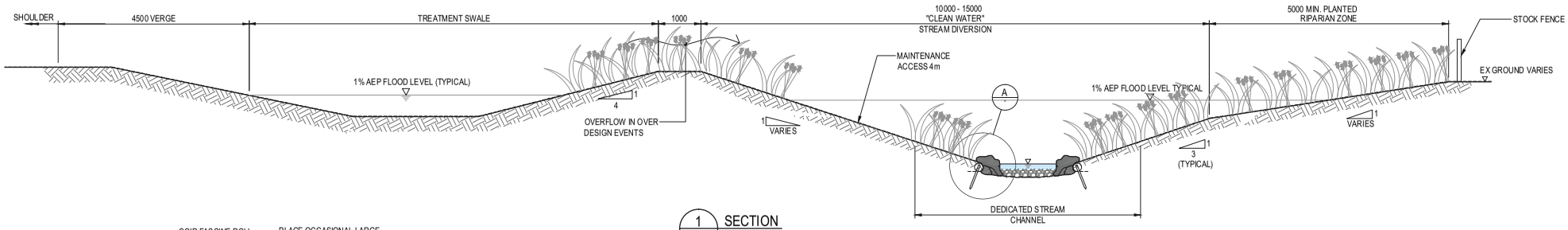
- Species and planting to be carried out as described in the effects assessment
- A focus on species tolerant of wet conditions and that exhibit rapid growth and robust root structure.
- Planting to achieve the following
  - Erosion control immediately following earthworks – hydro-seed with inter-planting
  - Riparian cover and stream shading
  - Weed control - elimination

Appendix M.F

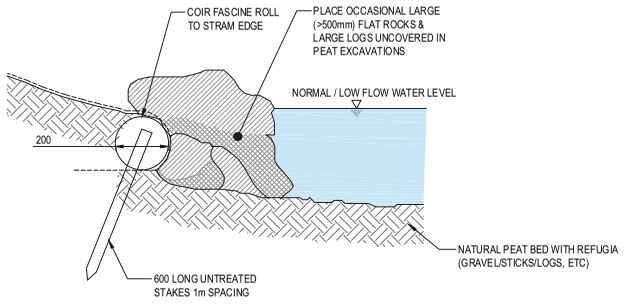
Indicative Stream Diversion Plan



A - SMITHFIELD STREAM REALIGNMENT PLAN
NTS



1 - SECTION
1:200



A - STREAM EDGE DETAIL
1:20

NOTES:

Original Scale (A3)

As Shown

Revision.	Amendment.	Approved.	Date.
A	FOR REVIEW	ICS	18.11.11

NZ TRANSPORT AGENCY WAKA KOTAHI

Project: MACKAYS TO PEKA PEKA EXPRESSWAY

Title: SMITHFIELD STREAM REALIGNMENT

UNDER REVISION

Status: -

Document ID: M2PP-AEE -DWG

Drawing No: CV-SW-231

Rev: A

Document No.: M2PP-AEE-DWG-CV-SW-231.DWG

Appendix M.G

GWRC Herbicide Application Rules

Regional Air Quality Management Plan for the Wellington Region

Publication No. WRC/RP-G-00/6
ISBN 0909016747

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Photography by Robin Blake

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in accordance with the relevant provisions of the Act. However, an application for a resource consent **need not** be notified if written approval has been obtained from every person who, in the opinion of the Council, may be adversely affected by the granting of the resource consent (unless, in the Council's opinion, it is unreasonable in the circumstances to require the obtaining of every such approval).

In addition, for applications for discretionary resource consents only, the Council will need to be satisfied that the adverse effects on the environment of the activity for which the consent is sought will be minor.

5.1.3 Block discharge consents

In some cases, such as sewage reticulation networks, there may be a multitude of discharge points where contaminants are discharged to air, or where there is the potential for them to be discharged.

In these instances the Council will consider processing consents for a "system" or "area", as long as **all** the actual or potential discharge points are clearly shown in the application for resource consent. One resource consent would apply, with the possibility of different provisions applying to different discharges.

5.1.4 Regional resource consents

Some activities which result in discharges to air are of a mobile nature (e.g., commercial fumigation, abrasive blasting, asphalt manufacture). For these types of operations, the Council will consider granting "regional" resource consents which will allow an operator to work throughout the Region, subject to some conditions.

This approach is intended to give resource users undertaking processes which are moveable and which discharge contaminants to air the freedom to conduct their activities relatively unhindered, but within the bounds of their resource consent.

5.2 Regional Rules for the Discharge of Contaminants into Air

Rule 1 Land-based agrichemical spray and powder application

The discharge of contaminants into air in connection with land-based application of agrichemical spray and powder:

(1) where agrichemical sprays are applied with a hand operated, and manually pumped, sprayer with a capacity of 20 litres or less; or where agrichemical powders are applied by hand;

(2) where agrichemical sprays or powders are applied by any means other than that described in (1); **and** the area to be sprayed or dusted with agrichemical

powder is **not located within** 50 metres of adjacent properties or places of common public assembly;

(3) where agrichemical sprays or powders are applied by any means other than that described in (1); **and** the area to be sprayed or dusted with agrichemical powder is **located within** 50 metres of adjacent properties and places of common public assembly; and

(4) in public areas and alongside public roadways using any method of application.

is a **Permitted Activity**, provided it complies with the relevant conditions below**.**

Conditions

Activity	Conditions
(1)	(i) - (vi)
(2)	(i) - (vi)
(3)	(i) - (viii)
(4)	(i) - (vi), (ix) - (xi)

The persons responsible for the activity shall ensure that:

(i) No agrichemicals are sprayed, or applied as powders, on or above surface water bodies, artificial watercourses, a bore, or spring unless they are registered for use over water bodies[2].

(ii) Where agrichemical sprays or powders are applied to the dry beds of any surface water bodies or artificial watercourses:

- only those products registered for use in dry watercourses may be applied; and
- all practical steps shall be taken to ensure that the appropriate re-entry time is allowed to elapse before water re-enters the watercourse.

(iii) Spray solutions are diluted, and sprays and powders are applied, strictly in accordance with the manufacturers' instructions and at concentrations not exceeding the manufacturers' label recommendations.

(iv) No mixing or diluting of chemicals takes place within 20 metres of a surface water body, a bore, spring, tile drain or the coastal marine area, unless the mixing or diluting takes place on an impervious surface which is bunded to contain washdown water or spillages.

(v) Sprays and powders are applied in a manner which does not cause or is not

[2] ***Note:*** *if the discharge is directly into water, a Resource Consent may be required under the Regional Freshwater Plan.*

likely to cause adverse effects beyond the boundary of the property.

(vi) The Wellington Regional Council is notified immediately in the case of accidental discharge into a water body.

Conditions (vii) and (viii) are additional to conditions (i) - (vi) for activity (3)

(vii) Written notice (either direct notification to individual properties or public notification) is given to all adjacent properties or places of common public assembly (e.g., schools, kindergartens, offices, etc.) located within 50 metres of the area to be sprayed or dusted with agrichemical powder.

Such notification is to take place prior to the spraying, not less than once a year, at the beginning of the year or spray season.

Such notification is unnecessary if owners or occupiers of adjacent properties or places of public assembly agree in writing that notification **is not** required;

Notice must be in the form of a property spray plan and include details of:

(a) the property, or part of property, to be sprayed or dusted with powder;

(b) the periods (likely day(s), date(s) and time(s)) when the agrichemical sprays or powders will be applied;

(c) the crops or vegetation to be sprayed and a list of chemicals (with brand names) to be used;

(d) any safety precautions for third parties, as noted in the most recent edition of the New Zealand Agrichemical and Plant Protection Manual (WHAM Chemsafe Ltd.);

(e) a list of immediate neighbours, and their contact phone numbers;

(f) identification of sensitive areas (e.g., residential buildings, school buildings, amenity areas, public water supply catchments, water bodies, sensitive crops or farming systems, wetlands, public roads) and the strategies employed to avoid contamination of those areas;

(g) the name and contact phone number of those carrying out the agrichemical application; and

(h) the equipment and method of application to be used.

(viii) A spray diary showing how the spray plan was implemented, is maintained, and available for inspection, containing:

- date and time of spray/powder application;
- concentration and volume of spray/powder used;
- weather conditions (including wind speed and direction);
- how notification requirements have been met; and

- details of any abnormal situation or incident, and any action taken, including any variations to the spray plan.

Conditions (ix) - (xi) are additional to conditions (i) - (vi) for activity (4)

(ix) The Principal Contractor shall hold a current **[**Advanced GROWSAFE Certificate**]**, and employees shall hold a Standard GROWSAFE Certificate issued by the New Zealand Agrichemical Education Trust.

(x) Where spraying or the application of powders occurs in a public area other than roads, signs clearly advising that spraying is in progress are placed within the immediate vicinity of the activity immediately prior to commencing spraying, and maintained in place until the re-entry period for that particular chemical, has expired.

(xi) Where spraying or the application of powders occurs alongside public roads and other public thoroughfares, vehicles associated with the spraying shall display prominent signs (front and back) advising that spraying is in progress.

In condition (ix) of Rule 1, the words in square brackets were for the original wording by Plan change 1 to the Regional Air Quality Management Plan 2003

Explanation: *Rule 1 relates to the spray and powder application of agrichemicals using land-based equipment. The term "agrichemical" is defined in the Definitions. It includes all pesticides, insecticides, herbicides, and fungicides, but does not include fertilisers. This rule only applies to the application of agrichemicals by methods involving* ***spraying or dusting with powders.*** *The application of agrichemicals by wipers, which do not produce spray droplets and therefore do not affect air quality, are not restricted in this Plan. Application of agrichemicals to land as solids or pastes (e.g., by baits), the aerial release of bait for the control of vertebrates and the application of agrichemicals in a granule or pellet form is addressed in the Regional Plan for Discharges to Land for the Wellington Region. Direct application of agrichemicals into water (e.g., by injection) is addressed in the Council's Regional Freshwater Plan. Application of agrichemical sprays or powders in the coastal marine area is addressed in the Regional Coastal Plan.*

Rule 1 relates to all instances where agrichemicals are sprayed or dusted in powder form, including the application of agrichemicals on domestic properties, trade and industrial premises, and in public and rural areas. The rule is primarily aimed at avoiding or mitigating the adverse effects of agrichemical spray drift on human health and safety and on surface water bodies and their ecosystems. A core set of conditions applies to all circumstances in which agrichemicals are applied, with additional conditions for application when using the larger methods of application specified and close to other properties, and in public areas.

The application of agrichemical sprays and powders using small scale application methods, other than in public areas is a permitted activity, as long as the stated conditions are complied with. Any method of application in a public area is in activity (4). All other applications are in activity (1), (2) or (3). Activity (4) excludes application on road frontage areas where sprays or powders are applied by the residents or owners (or their representatives) of an adjoining property, when using the methods described in (1).

Activity (1) includes road frontage areas where sprays or powders are applied by the residents or owners (or their representatives) of an adjoining property using the above methods, but excludes any other application in public areas or alongside public roadways as addressed in activity (4).

Public areas include areas to which the public generally have unrestricted access, such as:

- *roadsides and other access ways;*
- *public areas administered by local authorities, including car parks, parks, forest reserves, reserves and recreation areas;*
- *public areas administered by government departments, including car parks, parks, reserves and recreation areas, and other Crown estate;*
- *areas administered by sports clubs (sports fields, golf clubs etc.) or educational institutes (kohanga reo, kindergartens, schools, tertiary education facilities etc.); and*
- *areas associated with industrial or trade premises to which the public has unrestricted access.*

The application of agrichemical sprays and powders in public areas is permitted, subject to compliance with the stated conditions. The most important of these conditions is that the Principal Contractor responsible for the activity must hold a Registered Chemical Applicators' GROWSAFE Certificate and all employees spraying in these areas must hold a current Standard GROWSAFE Certificate, issued by the New Zealand Agrichemical Education Trust. Spraying without the required certificate requires a discretionary resource consent (Rule 23).

Activities (2) and (3) of Rule 1 relate to larger methods of spray application. This would normally relate to production land and trade and industrial premises (where the public have restricted access) and include the application of agrichemical sprays and powders on agricultural, horticultural, silvicultural, native forest lands and alongside railway tracks.

Rule 1 includes a series of conditions which must be complied with in order for the respective spraying or application of powders to be considered as permitted activities. This includes the condition that no agrichemical sprays

or powders are applied on or above a surface water body or any artificial watercourse unless the agrichemical is registered for use over water bodies. The rule permits spraying along the banks of water bodies and on the beds of dry water bodies, provided that only agrichemicals registered for that purpose are used, and subject to due regard being taken of the re-entry time for introducing water into channels, as specified by the manufacturer or in the most recent edition of the New Zealand Agrichemical and Plant Protection Manual. "Re-entry period" is defined in the definitions.

Rule 1 also requires that spray solutions are diluted and sprays and powders are applied strictly in accordance with the manufacturers' instructions and at concentrations not exceeding the manufacturers' label recommendations, and that sprays and powders are applied in a manner which does not cause or is not likely to cause adverse effects beyond the boundary of the property.

The rule also requires that the dilution or mixing of agrichemical sprays ***only*** *takes place at a distance of more than 20 metres from a surface water body, a bore, spring, tile drain or the coastal marine area. Mixing any closer than 20 metres is permitted so long as it is carried on an impermeable surface which is bunded to contain spillages or washwater, otherwise it is a discretionary activity and requires a discretionary resource consent.*

Notification to the Council in the event of the accidental discharge of agrichemical solutions or sprays to water will enable the Council to act quickly to mitigate or remedy the adverse effects caused by such an event.

A significant aspect of the rule is the requirement for public notification when agrichemical sprays and powders are applied using larger scale methods of application close to other properties (condition vii) This condition requires that ***written*** *notice be given to all adjacent properties or place of common public assembly (schools, halls, sports fields etc.), which is within 50 metres of the area to be sprayed or dusted with powder. Public notification can either be via direct notice to neighbouring properties as described above, or through public notification in a community, district or national newspaper. Notification must be given at least once a year, at the start of the year or at the beginning of the spray season.*

Public notification is not required when the written agreement of the owner or occupier of an adjacent property has been obtained that states that notification is not required. In such instances, spraying can be carried out without notification to the adjacent property owner/occupier until such time as the ownership or occupation of the neighbouring property changes, or the notice stating that public notification is not required is rescinded. It should be noted that notification is not required when the agrichemical spray application takes place with a manually pumped sprayer with a capacity of 20 litres or less, or when agrichemical powders are applied by hand.

The information required with the notification is outlined in the condition. The period when the sprays or powders are applied means the general time frame which can be reasonably predicted. For example, if a horticulturalist wishes to apply agrichemicals within 50 metres of a neighbour's property then the notice to the neighbouring property owner could state that "spraying will be undertaken between 6-10 am on Tuesday 9th, Wednesday 10th, or Thursday 11th of February, depending on weather conditions". It should be noted that the requirement for notification does not mean that approval is required from those people to whom notification is given. Failure to provide adequate notification, where required, makes spraying relating to the use of these larger scale methods a discretionary activity.

Condition (viii) calls for the use of spray diaries, regardless of the type of chemicals being applied in the same situations as spray plans are required. The relevant data must be entered into the spray diary on each occasion that agrichemicals are sprayed or dusted. The spray diary may be required for inspection by Council compliance officers.

Conditions (ix)-(xi) require the provision of signage where agrichemical spraying has occurred or is in progress in public areas. Signs must be placed in the immediate vicinity of the spraying. This requirement does not apply to the application of agrichemical sprays and powders on or beside public roads.

Where signs are required they must clearly indicate that spraying is in progress. The signs must be maintained in place until the re-entry period for the particular chemical has passed. The re-entry period is the time elapsed until it is safe for humans to enter a sprayed or dusted area with little possibility of suffering any adverse affects from the spraying. The re-entry times for chemicals are those specified on the product label or in the most recent edition of the New Zealand Agrichemical and Plant Protection Manual.

Where agrichemical spray or powder application occurs alongside public roads and other public thoroughfares, condition (xi) requires that vehicles associated with the spraying must display prominent signs (front and back) clearly indicating that spraying is in progress.

Rule 2 Aerial agrichemical spray and powder application

The discharge of contaminants into air in connection with:

(1) the aerial application of agrichemical sprays or powders;

is a **Permitted Activity**, provided it complies with the conditions below.

Conditions

The persons responsible for the activity shall ensure that:

(i) The pilot holds a current agrichemical rating (issued by the NZ Agrichemical Education Trust), and loaders and ground crew shall hold the Standard GROWSAFE Certificate (issued by the NZ Agrichemical Education Trust), endorsed "Aerial Application Ground Crew".

(ii) Spray solutions are diluted, and sprays and powders are applied, strictly in accordance with the manufacturers' instructions and at concentrations not exceeding the manufacturers' label recommendations.

(iii) No mixing or diluting of chemicals takes place within 20 metres of a surface water body, a bore, spring, tile drain or the coastal marine area, unless the mixing or diluting takes place on an impervious surface which is bunded to contain washdown water or spillages.

(iv) No agrichemical sprays or powders are discharged over a catchment with surface water that is managed for water supply purposes as identified in any regional plan or proposed regional plan.

(v) All practicable steps are taken to avoid release of agrichemical over other open surface water (see Definitions) or wetland of one hectare or more unless the agrichemical is registered for use over water bodies.

(vi) Written notice (either direct notification to individual properties or public notification) is given to all adjacent properties, and places of common public assembly (e.g., schools, kindergartens, offices, etc.) located within 300 metres of the area to be sprayed or dusted with agrichemical powder.

Such notification is to take place prior to the spraying, not less than once a year, at the beginning of the year or spray season.

Such notification is unnecessary if owners or occupiers of adjacent properties or places of public assembly agree in writing that notification **is not** required.

Notice must be in the form of a property spray plan and include details of:

(a) the property or part of property to be sprayed or dusted with powder;

(b) the periods (likely day(s), date(s) and time(s)) when the agrichemical sprays or powders will be applied;

(c) the crops or vegetation to be sprayed and a list of chemicals (with brand names) to be used;

(d) any safety precautions for third parties, as noted in the most recent edition of the New Zealand Agrichemical and Plant Protection Manual;

(e) a list of immediate neighbours, and their contact phone numbers;

(f) identification of sensitive areas (e.g., residential buildings, school buildings, amenity areas, public water supply catchments, water bodies, sensitive crops or farming systems, wetlands, public roads) and the strategies employed to avoid contamination of those areas;

(g) the name and contact phone number of those carrying out the agrichemical application; and

(h) the equipment and method of application to be used.

(vii) A spray diary showing how the spray plan was implemented is maintained, and available for inspection, containing:

(a) date and time of spray/powder application;

(b) name and type of agrichemicals applied (including any additives);

(c) concentration and volume of spray/powder used ;

(d) weather conditions (including wind speed and direction);

(e) how notification requirements have been met; and

(f) details of any abnormal situation or incident, and any action taken, including any variations to the spray plan.

(viii) The Wellington Regional Council is notified immediately in the case of any emergency release, or accidental discharge.

(ix) Sprays and powders are applied in a manner which does not cause or is not likely to cause adverse effects beyond the boundary of the property.

Explanation: *Aerial application of agrichemicals (as defined in the Definitions section of this plan) is permitted provided the conditions are complied with. If the conditions cannot be met, the activity is discretionary and covered by Rule 23.*

Condition (i) requires that personnel involved in carrying out an aerial operation hold the appropriate qualifications.

Conditions (ii) and (iii) are also included in Rule 1 and address best practice in terms of following the label recommendations and preventing contamination of the environment.

If agrichemicals are to be aerially applied over public water catchments, a consent is required under Rule 23. The water bodies referred to in condition (v) are those which are readily visible from the air and can be avoided by the pilot.

A significant aspect of the rule is the requirement for public notification when agrichemical sprays and powders are applied close to other properties

*(condition vi). This condition requires that **written** notice be given to all adjacent properties or place of common public assembly (schools, halls, sports fields etc.), which is within 300 metres of the area to be sprayed or dusted with powder. Public notification can either be via direct notice to neighbouring properties as described above, or through public notification in a community, district or national newspaper. Notification must be given at least once a year, at the start of the year or at the beginning of the spray season.*

Public notification is not required when the written agreement of the owner or occupier of an adjacent property has been obtained that states that notification is not required. In such instances, spraying can be carried out without notification to the adjacent property owner/occupier until such time as the ownership or occupation of the neighbouring property changes, or the notice stating that public notification is not required is rescinded.

The information required with the notification is outlined in the condition. The period when the sprays or powders are applied means the general time frame which can be reasonably predicted. For example, if a horticulturalist wishes to apply agrichemicals aerially within 300 metres of a neighbour's property then the notice to the neighbouring property owner could state that "spraying will be undertaken between 6-10 am on Tuesday 9th, Wednesday 10th, or Thursday 11th of February, depending on weather conditions". It should be noted that the requirement for notification does not mean that approval is required from those people to whom notification is given. Failure to provide adequate notification, where required, makes spraying a discretionary activity.

Condition (vii) calls for the use of spray diaries, regardless of the type of chemicals being applied in the same situations as spray plans are required. The relevant data must be entered into the spray diary on each occasion that agrichemicals are sprayed or dusted. The spray diary may be required for inspection by Regional Council compliance officers.

The Council must be notified (condition (viii)) in the event of any accidental discharge or emergency load release to enable any necessary remedial measures to be undertaken.

Rule 3 Fumigation

The discharge of contaminants into air in connection with any process involving:

(1) the use of fumigants;

is a **Permitted Activity**, provided it complies with the conditions below**.**

Appendix M.H

Regional Pest Management Strategy Summary

Pest animals (kararehe nanakia) included in the RPMS and their management – table 2

Common name	*Scientific name*	Regional Surveillance	Total Control	Containment	Suppression			Site-Led Management				
			Service Delivery	Service Delivery	Service Delivery	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Argentine ant	*Linepithema humile*	✓									✓	
Australian subterranean termite	*Coptotermes acinacoformis*	✓									✓	
Brown bullhead catfish	*Ameiurensis nebulosus*										✓	
Darwin's ant	*Doleromyrma darwinia*	✓									✓	
European hedgehog	*Erinacues europaeus occidentalis*										✓	
Feral cat	*Felis catus*									✓	✓	
Feral deer	*Cervus elaphus, C. nippon, Dama dama*									✓	✓	
Feral goat	*Capra hircus*									✓	✓	
Feral pig	*Sus scrofa*									✓	✓	
Feral rabbit	*Oryctolagus cuniculus*				✓	✓	✓				✓	✓
Ferret	*Mustela furo*										✓	
Gambusia	*Gambusia affinis*									✓	✓	
Goldfish	*Carassius auratus*										✓	
Hare	*Lepus europaeus occidentalis*										✓	

Pest animals (kararehe nanakia) included in the RPMS and their management – table 2 (continued)

Common name	*Scientific name*	Regional Surveillance	Total Control	Containment	Suppression			Site-Led Management				
			Service Delivery	Service Delivery	Service Delivery	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
House mouse	*Mus musculus*										✓	
Koi carp	*Cyprinus carpio*									✓	✓	
Magpie	*Gymnorhina tibicen tibicen, Gymnorhina tibicen hypoleuca*								✓		✓	
Norway rat	*Rattus norvegicus*										✓	
Possum	*Trichosurus vulpecula*									✓	✓	
Rainbow lorikeet	*Trichoglossus haematodus*	✓									✓	
Rainbow skink	*Lampropholis delicata*	✓									✓	
Red-eared slider turtle	*Trachemys scripta elegans*	✓									✓	
Rook	*Corvus frugilegus*		✓								✓	
Rudd	*Scardinius erythropthalmus*										✓	
Ship rat	*Rattus rattus*										✓	
Stoat	*Mustela erminea*										✓	
Sulphur crested cockatoo	*Cacatua galerita*										✓	
Tench	*Tinca tinca*										✓	
Wasp	*Vulpecula germanica; V. vulgaris*								✓		✓	
Weasel	*Mustela nivalis*										✓	

Pest plants (taru) included in the RPMS and their management – table 3

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Alligator weed	*Alternanthera philoxeroides*	✓											✓	
African club moss	*Selaginella kraussiana*												✓	
African feather grass	*Pennisetum macrourum*		✓										✓	
African fountain grass	*Pennisetum setaceum*	✓											✓	
Apple of Sodom	*Solanum linneanum*	✓											✓	
Artemisia	*Artemisia spp.*												✓	
Artillery plant	*Galeobdolon luteum*												✓	
Arum lily	*Zantedeschia aethiopica*												✓	
Asiatic knotweed	*Reynoutria japonica*	✓											✓	
Australian sedge	*Carex longebraciata*	✓											✓	
Banana passionfruit	*Passiflora mixta; P. mollisima, P. tripartita*									✓			✓	
Barberry	*Berberis glaucocarpa*												✓	
Bathurst bur	*Xanthium spinosum*		✓										✓	
Blackberry	*Rubus spp.barbed cultivars*									✓	✓		✓	

Pest plants (taru) included in the RPMS and their management – table 3 (continued)

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Blue morning glory	*Ipomoea indica*												✓	
Blue passion flower	*Passiflora caerulea*		✓										✓	
Boneseed	*Chrysanthemoides monilifera*			✓	✓		✓						✓	
Bomarea	*Bomarea caldasii, B. multiflora*	✓											✓	
Boxthorn	*Lycium ferocissimum*												✓	
Broom	*Cytisus scoparius*												✓	✓
Brush wattle	*Paraserianthes lophantha*												✓	
Buddleia	*Buddleja davidii*												✓	
Californian arrowhead	*Sagittaria montevidensis*	✓											✓	
Californian bulrush	*Schoenoploectus californicus*	✓											✓	
Cape honey flower	*Melianthus major*												✓	
Cape ivy	*Senecio angulatus*												✓	
Cape tulip	*Moraea flaccida (syn.Homeria collina)*	✓											✓	
Cathedral bells	*Cobaea scandens*									✓			✓	
Chilean flame creeper	*Tropaeolum speciosum*	✓											✓	

Pest plants (taru) included in the RPMS and their management – table 3 (continued)

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Chilean needle grass	*Nassella neesiana*	✓											✓	
Chinese pennisetum	*Pennisetum alopecuroides*	✓											✓	
Chocolate vine	*Akebia quinata*	✓											✓	
Climbing dock	*Rumex sagittatus*												✓	
Climbing asparagus	*Asparagus scandens*												✓	
Climbing spindleberry	*Celastrus orbiculatus*		✓										✓	
Cotoneaster	*Cotoneaster franchetti; C. horizontalis*												✓	
Crack and pussy willow	*Salix fragili, S.cinerea*												✓	
Darwin's barberry	*Berberis darwinii*												✓	
Delta arrowhead	*Sagittaria platyphylla*	✓											✓	
Didymo	*Didymosphenia geminata*	✓											✓	
Eelgrass	*Vallisneria spiralis, V. gigantea*		✓										✓	
Elaeagnus	*Elaeagnus x reflexa*												✓	
Evergreen buckthorn	*Rhamnus alaternus*			✓			✓						✓	
German ivy	*Senecio mikanioides*												✓	

Pest plants (taru) included in the RPMS and their management – table 3 (continued)

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Giant knotweed	*Reynoutria sachalinensis and hybrids*	✓											✓	
Gorse	*Ulex europaeus*									✓	✓		✓	✓
Great bindweed	*Calystegia silvatica*												✓	
Gunnera	*Gunnera tinctoria*												✓	
Hawaiian arrowhead	*Sagittaria sagittifolia*	✓											✓	
Hawthorn	*Crataegus monogyna*												✓	
Hemlock	*Conium maculatum*									✓	✓		✓	
Himalayan honeysuckle	*Leycesteria formosa*												✓	
Hornwort	*Ceratophyllum demersum*	✓		✓			✓						✓	
Houttuynia	*Houttuynia cordata*	✓											✓	
Hydrilla	*Hydrilla verticillata*	✓											✓	
Japanese honeysuckle	*Lonicera japonica*												✓	
Japanese spindletree	*Euonymus japonicus*												✓	
Johnson grass	*Sorghum halepense*	✓											✓	
Lagarosiphon	*Lagarosiphon major*												✓	

Hornwort's inclusion is subject to successful control trials using the herbicide Aquathol K ® and Aquathol Super K ®

Pest plants (taru) included in the RPMS and their management – table 3 (continued)

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Madeira vine	*Anredera cordifolia*		✓										✓	
Manchurian wild rice	*Zizania latifolia*	✓	✓										✓	
Marram grass	*Ammophila arenaria*												✓	
Mexican daisy	*Erigeron karvinskianus*												✓	
Mile-a-minute	*Dipogon lignosus*												✓	
Mist flower	*Ageratina riparia*							✓					✓	
Monkey apple	*Acmena smithii*												✓	
Montbretia	*Crocosmia x crocosmifolia*												✓	
Moth plant	*Araujia sericifera*		✓										✓	
Nassella tussock	*Nassella trichotoma*	✓											✓	
Nasturtium	*Nasturtium officinalis*												✓	
Nodding thistle	*Carduus nutans*									✓			✓	✓
Noogoora bur	*Xanthium occidentale*	✓											✓	
Old man's beard	*Clematis vitalba*									✓			✓	
Pampas grass	*Cortaderia jubata; C. selloana*												✓	
Parrot's feather	*Myriophyllum aquaticum*												✓	

Pest plants (taru) included in the RPMS and their management – table 3 (continued)

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Perennial nettle	*Urtica dioica (sub spp)*		✓										✓	
Periwinkle	*Vinca major*												✓	
Phragmites	*Phragmites australis*	✓											✓	
Plectranthus	*Plectranthus ciliatus*												✓	
Polypodium (Common polypody)	*Polypodium vulgare*	✓											✓	
Purple loosestrife	*Lythrum salicaria*	✓											✓	
Purple ragwort	*Senecio glastifolius*												✓	
Pyp grass	*Ehrharta villosa*	✓											✓	
Ragwort	*Senecio jacobaea*									✓			✓	✓
Saffron thistle	*Carthamus lanatus*		✓										✓	
Salvinia	*Salvinia molesta*	✓											✓	
Senegal tea	*Gymnocoronis spilanthoides*	✓											✓	
Silver poplar	*Populus alba*												✓	
Smilax	*Asparagus asparagoides*												✓	✓
Spanish heath	*Erica lusitanica*												✓	
Spartina	*Spartina spp.*	✓											✓	

Pest plants (taru) included in the RPMS and their management – table 3 (continued)

Common Name	Scientific Name	Regional Surveillance	Total Control	Containment				Suppression		Site-Led Management				
			Service Delivery	Service Delivery	Biological Control	Boundary Control	Occupier Responsibility	Biological Control	Occupier Responsibility	Boundary Control	Human Health	Biodiversity	KNE Service Delivery	Biological Control
Stinking iris	*Iris foetidissima*												✓	
Sweet pea shrub	*Polygala myrtifolia*			✓			✓						✓	
Sycamore	*Acer pseudoplatanus*												✓	
Tradescantia	*Tradescantia fluminensis*												✓	
Tuber ladder fern	*Nephrolepis cordifolia*												✓	
Variegated thistle	*Silybum marianum*							✓		✓			✓	
Velvet groundsel	*Senecio petasitis*												✓	
Water Hyacinth	*Eichhornia crassipes*	✓											✓	
Wild ginger	*Hedychium; gardnerianum; H. flavescens*									✓			✓	
Wild onion	*Allium vineale*												✓	
Wilding pines	*Pinus spp*												✓	
White bryony	*Bryonia cretica subsp dioica*	✓											✓	
White edged nightshade	*Solanum marginatum*	✓											✓	
Woolly nightshade	*Solanum mauritianum*		✓										✓	

Bolded plants = MAF Led Surveilliance.