

21 Terrestrial ecology

Overview

The Project traverses a highly modified landscape, which has mainly been converted to pasture with relatively few areas of indigenous vegetation remaining. Ecological field surveys undertaken have confirmed the variability of ecological conditions along the route, from highly modified urbanised and pastoral landscapes with limited ecological diversity and values, through to regionally rare, complex and ecologically significant ecosystems. While the choice of alignment has avoided the most significant ecosystems, the proposed Expressway will traverse some areas of ecological value.

Within this modified landscape, populations of indigenous fauna are typically small, and species of conservation concern are restricted to specific sites, typically associated with fragments of indigenous vegetation. These habitats have been identified and described.

The Project ecologists have worked closely with the design team to avoid potential adverse ecological effects, where practicable. Where avoidance is not practicable, ecological mitigation has been developed to mitigate any remaining adverse effects.

A conservative approach has been taken to quantifying the loss of vegetation and terrestrial habitats. The adverse effects of the Project on terrestrial ecology are most likely to arise as a result of vegetation clearance and disturbance and displacement of habitats and / or species.

Effects of construction on vegetation and the habitat of terrestrial fauna are considered to be short term, assessed as low to moderate, with the exception of effects on the North Island fernbird population and habitat. Mitigation will include ecological offsetting (re-establishment of areas of habitat lost consistent with existing values), replanting with indigenous vegetation in some areas, relocation and/or protection of fauna and careful construction management methods.

Effects of the operation of the proposed Expressway on terrestrial fauna are assessed as very low to low, with the exception of high potential adverse effects on the North Island fernbird population due to habitat disturbance and the risks of traffic mortality. Additional pre-construction research is proposed to better understand the existing population and tailor appropriate mitigation for discussion with DOC and other relevant stakeholder groups.

The ecological mitigation recommended for the loss of terrestrial habitat, combined with the methods of stormwater management for the Project, will also have a number of positive environmental outcomes.

21.1 Introduction

This Chapter presents the findings of investigations undertaken to determine the actual and potential effects of the Project on terrestrial ecology. Terrestrial ecology includes terrestrial vegetation and terrestrial fauna such as birds, bats, lizards and terrestrial invertebrates.

The terrestrial assessments commenced with an initial desktop study of ecological databases and previous relevant studies to provide information about the existing terrestrial ecology; this data informed the methodology used for field surveys undertaken within and adjacent to the Designation¹⁵². Once a baseline of terrestrial ecological values had been determined, the potential impacts of the construction and operation of the Project were assessed.

Liaising with the specialist ecologists on the Project team, the Project ecologist has worked closely with the design team to seek to avoid potential adverse ecological effects that had been identified, where practicable. Where avoidance was not practicable, ecological mitigation was then developed to mitigate any remaining adverse effects.

21.2 Existing terrestrial ecological values

21.2.1 Ecological investigations

The identification of effects on terrestrial ecology required the assessment of the composition and values of the existing terrestrial ecology of the study area. This relied on two complementary methods:

- Desktop studies of available relevant ecological information; and
- Field surveys.

The description of existing terrestrial ecology in this section includes a brief overview of the investigations undertaken. Further details on the methods used and findings of these investigations are contained in the following Technical Reports provided in Volume 3:

- Ecological impact assessment (Technical Report 26);
- Terrestrial vegetation and habitats (including wetlands) (Technical Report 27);
- Herpetofauna (Technical Report 28); and
- Avifauna studies: Description and values (Technical Report 29).

In addition, the following Technical Reports (Volume 3) and Management Plans (Volume 4) are cross referenced within this Chapter:

- Assessment of Landscape and Visual Effects (Technical Report 7);
- Assessment of Hydrology and Stormwater Effects (Technical Report 22);
- Ecological Management Plan (Appendix M of the CEMP)

¹⁵² Refers to the maximum extent of direct ecological effects within the proposed Expressway Designation. The Designation is approximately 316 ha and encloses all necessary construction activities, including the proposed Expressway itself and all subsidiary work such as sediment treatment and fill disposal.

- Landscape Management Plan (Appendix T of the CEMP); and
- Construction Air Quality Management Plan (Appendix G of the CEMP).

21.2.2 Terrestrial flora and habitats

21.2.2.1 Foxton ecological district

The entire Project is located within the Foxton Ecological District¹⁵³; which is defined by the dune topography and associated vegetation. Wind is a dominating feature of the climate, with northwesterly gales common, affecting the dune landscape, vegetation and land uses.

A great part of the Foxton Ecological District would have originally been swamp forest dominated by kahikatea and pukatea with rimu and swamp maire, with shrubs and trees dominating inland of the coast. These original forests are now reduced to several small remnants; today less than 5% of the surface area of the Foxton Ecological District consists of predominantly indigenous vegetation.

The Foxton Ecological District also contained extensive dune wetlands and lakes, and connecting waterways. Major drainage works for farming have resulted in the loss of most of these natural lakes and wetland systems throughout the area, and many streams have been channelised. Dune lakes and peat swamps now account for only a small part of the Foxton Ecological District.

21.2.2.2 Threatened plant species

Rare, threatened or locally uncommon plant species of the Kāpiti Coast were identified from a range of sources, and all key habitats within the Designation that were considered likely to contain any of these plants were identified.

Following detailed botanical surveys in these key habitats, the rare species *Korthalsella salicornioides* (dwarf mistletoe) was identified in a regenerating manuka wetland off Ngarara Road (an area not physically affected by the proposed alignment). This species has been classified with a status of 'At Risk'¹⁵⁴.

Korthalsella salicornioides is considered to be a naturally uncommon and biologically sparse species which can, on occasion, be locally abundant, but is more usually known in large parts of its likely range by only spot or scattered occurrences. The NZPCN website¹⁵⁵ notes that in some parts of its range it is

¹⁵³ An ecological district is an area of land where topographic, climatic, soils and biological features and broad cultural patterns produce a characteristic landscape of biological communities.

¹⁵⁴ 'At Risk' species are those that are naturally uncommon, with the qualifier of sparse distribution. All species are assessed against a standard set of criteria which is described in "Townsend, et.al (2007): New Zealand Threat Classification System Manual. Wellington: Department of Conservation". Refer to Technical Report 26, Volume 3 for further details.

¹⁵⁵ New Zealand Plant Conservation Network (NZPCN) website (www.nzpcn.org.nz)

seriously at risk due to the felling of its main host species (*Leptospermum* and *Kunzea*) for fire wood and also to clear land for farming or pine plantations.



Photo 21.1: *Korthalsella salicornioides*

In addition to *Korthalsella salicornioides*, there were a small number of other locally uncommon wetland plants identified within a number of the wetlands near the proposed Expressway alignment. The key species include:

- At the Raumati South Peatlands, *Nertera scapanoides*, an uncommon herb in the Wellington Conservancy of the Department of Conservation (DoC), is a dominant ground cover in large wet areas. *Baumea teretifolia* is also present, which is at its southern limit in the Conservancy. *Gleichenia dicarpa* / *G. microphylla* hybrid is also somewhat uncommon in the Conservancy;
- At the Raumati Manuka Wetland, *Nertera scapanoides* was found. It is a dominant ground cover in large wet areas, *Baumea teretifolia* and *Gleichenia microphylla* were also found at the site; and
- At the El Rancho Wetland (Weggery), an earlier site inventory (Cameron 1995) recorded the nationally critical *Ophioglossum petiolatum* (stalked adder's tongue fern) present in the wetland. Other botanical surveys since, including those undertaken for the Project, have not confirmed this species presence.

21.2.2.3 Ecologically significant areas

Within the Project area there are a number of areas of ecological significance. There are two types of these areas:

- 11 protected natural areas (PNA) that are formally protected; and
- 21 significant natural areas (SNA) that are not formally protected.

The SNA sites were derived from a number of sources, in particular, the Wildlands Kāpiti Coast District Council Ecological Sites Survey (2003) and the Wildlands Kāpiti Coast District Council Potential Ecological Sites Survey (2007), as well as the Project Ecologist's knowledge of the Kāpiti Coast.

The PNA sites include scenic reserve or conservation land protected under the Reserves Act (1977) including local purpose reserves and stewardship areas; a private or National Covenant (QEII) attached to the title of the property; or public land which has a management plan (i.e. Regional Parks).

Table 21.1 below lists those PNAs and SNAs that are immediately adjacent to or within the proposed alignment; these are shown on Vegetation Maps, Volume 5.

Table 21.1: Relevant protected natural areas and significant natural areas within the Project area

Name	Total Size (ha)	Description	In relation to the Project
Protected Natural Areas			
Terrestrial vegetation			
Ngarara Bush	2.59	An area of contiguous semi-coastal modified primary kohekohe and kahikatea forest. Protected by QE II covenant, KCDC Ecosite (K133).	Adjacent to Designation
Wetland Vegetation			
Queen Elizabeth Regional Park peatlands	N/A	A large Regional Park with a range of values, including areas of remnant swamp forest and wetland systems in the south and Poplar Ave wetlands in the north. The actual areas of peatlands have not been determined. Protected by Regional Park status, KCDC Ecosite (K184).	Partially falls beneath Project Footprint ¹⁵⁶
Andrews Pond Scientific Reserve.	1.3	A small manuka wetland located amongst large areas of pasture. Protected as a Scientific Reserve, RAP, KCDC Ecosite (K093).	Adjacent to Designation
Sovereign Way / Crown Hill Eco-site	0.6	Manuka transitional wetland. Protected by KCDC Recreation Reserve (E183), KCDC Ecosite (E92).	Adjacent to Designation

¹⁵⁶ "Project footprint" refers to the earthworks extent for the road including the road surface, associated cuts and fills and permanent stormwater treatment devices, but does not involve temporary works such as site offices, laydown and storage areas and construction sediment treatment devices. The MacKays to Peka Peka Project Footprint has an area of 164 ha.

Name	Total Size (ha)	Description	In relation to the Project
Waikanae Estuary Scientific Reserve	68.2	Nationally-significant estuarine wetland and rivermouth protects a natural mosaic of freshwater lakelets, saltwater lagoons and marshes, tidal sand flats and sandy beach at the mouth of the Waikanae River. Protected as a Scientific Reserve, KCDC Ecosite (K081).	Downstream of Designation
Waimanu Lagoons	8.0	A large saline lagoon system with linkages to Waikanae Estuary Scientific Reserve. Wetland habitat is nationally under-represented. KCDC Ecosite (K175).	Downstream of Designation
Osbornes Swamp	1.0	A modified flax/toetoe/raupo wetland with <i>Coprosma propinqua</i> shrubland. Protected by QEII Covenant, KCDC Ecosite (K068).	Adjacent to Designation
Te Harakeke Swamp / Kawakahia Wetland	58.2	The largest dune swale wetland remaining in a relatively natural state on the coastal plain of the Foxton Ecological District. Protected by QEII Covenants, KCDC Ecosite (K066), RAP (PNAP).	Downstream of Designation
Te Kouka Wetland	3.7	Regenerating kahikatea wetland, with scattered remnant kahikatea. Protected by QEII Covenant, KCDC Ecosite (K066).	All or part within Designation
Kawakahia Swamp Forest	0.8	A small area of kahikatea-dominated semi-coastal remnant swamp forest. Protected by QEII Covenant, KCDC Ecosite (K066).	Downstream of Designation
Nga Manu Nature Reserve	41.0	One of the largest and best examples of swamp forest within Foxton Ecological District. Protected by Private Trust, QEII Covenant, KCDC Ecosite (K133).	Adjacent to Designation
SIGNIFICANT (UNPROTECTED) NATURAL AREAS			
Terrestrial Vegetation			
Raumati Road Kanuka	0.4	A small area of kanuka forest and treeland with scattered mahoe on the raised dunes south of Raumati Road. Reference: BML, ¹⁵⁷ 2011.	Partially falls beneath Project Footprint
Otaihanga Mahoe Landfill	0.1	Small stand of indigenous bush with remnant matai tree. Reference: Wildlands, 2007; BML, 2011.	All or part within Designation

¹⁵⁷ BML refers to information sourced from Boffa Miskell.

Name	Total Size (ha)	Description	In relation to the Project
Otaihanga Landfill Kanuka	0.5	Kanuka forest located on an elevated sand dune. Reference: Wildlands, 2007; BML, 2011.	Partially falls beneath Project Footprint
Waikanae River Riparian	0.13	Riparian planting on southern bank of the Waikanae River. Reference: Keesing, 2001; BML, 2011.	Partially falls beneath Project Footprint
Tuku Rakau Forest	0.9	Regenerating mahoe forest with remnant kohekohe tree. Adjacent to a small modified wetland. Reference: BML, 2011.	Partially falls beneath Project Footprint
Ngarara Farm Mahoe	4.2	A large area of advanced mahoe regenerating from gorse on the raised dunes of Ngarara Farm, in close proximity to Ti Kouka wetland.	Partially falls beneath Project Footprint
Wetlands			
131 Raumati South Peatlands	11.1	Large manuka-dominated wetland with a range of other wetland habitat types. Reference: KCDC; Wildlands, 2007; BML, 2011.	Adjacent to the Designation
Raumati Manuka Wetland	2.0	Manuka and Sphagnum wetland, with Carex and Baumea sedge-rushland and open water Reference: Wildlands, 2007; OPUS, 2007; BML, 2011.	All or part either within the Designation or Outside of Designation, but potentially connected via watertable
Kiwi Pond	1.8	A large area of seasonally wet pasture that provides occasional wildlife habitat. Reference: Wildlands, 2007; OPUS, 2007; BML, 2011.	Partially falls beneath Project Footprint
Meadows Trust Carex Wetland	0.2	Small area of induced <i>Juncus</i> and <i>Carex</i> wetland. Reference: Wildlands, 2007; BML, 2008; BML, 2011.	Adjacent to Designation
Southern wetland Otaihanga	1.4	Large area of purei sedgeland with areas of open water, Baumea rushland and scattered manuka. Reference: Wildlands, 2007; Opus, 2007; BML, 2011.	Partially falls beneath Project Footprint
Middle wetland Otaihanga	2.3	Modified manuka and Carex wetland dominated by weeds. Reference: Wildlands, 2007; BML, 2011.	Partially falls beneath Project Footprint
Northern wetland Otaihanga	1.0	Manuka and Carex wetland with Sphagnum. Reference: Wildlands, 2007; OPUS, 2007; BML, 2011.	Partially falls beneath Project Footprint
Open water and Juncus south of Waikanae River.	1.8	Stock water pond (formed) and large area of <i>Juncus</i> and pasture grasses. Reference: Wildlands, 2007; BML 2011.	Adjacent to Designation

Name	Total Size (ha)	Description	In relation to the Project
El Rancho Wetland (Weggery)	3.9	A large area of manuka dominated wetland with occasional kahikatea. Southern edge includes Baumea and Carex. Some open water and Sphagnum. Reference: KCDC, Cameron, 1995; Kessels, 1998; Keesing, 2001; BML, 2006; Wildlands, 2007; OPUS, 2007; BML, 2011.	Either falls beneath Project Footprint or Outside of Designation, but potentially connected via watertable
El Rancho Wetland (West)	0.7	Large area of manuka dominated wetland with some open water to the west. Reference: KCDC; Kessels, 1998; Keesing, 2001; Wildlands, 2007; BML, 2006; OPUS, 2007; BML, 2011.	Outside of Designation, but potentially connected via watertable
El Rancho Wetland (Takamore)	1.8	Large area of manuka dominated wetland with some open water to the north. Reference: KCDC; Kessels, 1998; Keesing, 2001; Wildlands, 2007; BML, 2006; OPUS, 2007; BML, 2011.	Outside of Designation, but potentially connected via watertable
Tuku Rakau Wetland	0.3	A small wetland with scattered manuka, cabbage tree and rushland.	All or part within Designation
Osbornes Swamp West	1.3	Large area of manuka dominated wetland with some open water. Reference: KCDC; Kessels, 1998; Keesing, 2001; Wildlands, 2007; BML, 2006; OPUS, 2007; BML, 2011.	Adjacent to Designation
Ngarara Wetland	2.7	A large area of manuka dominated wetland with areas of Carex sedgeland and regenerating kahikatea forest east of Ngarara Road. Contains <i>Korthalsella salicornoides</i> . Reference: KCDC; Wildlands, 2007; BML, 2008; BML, 2011.	Adjacent to Designation
Ngarara Dune Depressions	3.3	Three large wet dune depressions dominated by <i>Juncus</i> (induced from grazing) in the north of Ngarara Farm. Reference: Wildlands, 2007; BML, 2008; BML, 2011.	Partially falls beneath Project Footprint

21.2.3 Terrestrial fauna

Several areas of habitat for herpetofauna, avifauna and terrestrial invertebrates are present within the alignment.¹⁵⁸

As part of the Project ecological investigations, an assessment of herpetofauna and avifauna populations within the Project area was undertaken (discussed below).

21.2.4 Terrestrial invertebrates

A wide variety of common terrestrial invertebrates were detected during various ecological investigations, though none of conservation concern.

One specimen of *Peripatus novae-zelandiae* (velvet worm) was located in the compacted sand under a recently fallen pine tree within the Otaihangā Mountain Bike Area. While this species does not currently have a threat status, their taxonomy is under review.

21.2.5 Herpetofauna

21.2.5.1 Lizards

Much of the habitat within the southern two-thirds of the alignment is covered in dense grass and associated ground tier species, which are characteristics preferred by native terrestrial lizards due to the abundance of refuges and openness. In the northern end of the alignment, while the habitat is less desirable due to grazing, pockets of dense ground tier vegetation exist around the borders of bush patches, under fencelines and at roadside verges.

The majority of the proposed Expressway alignment contains low quality arboreal lizard habitat due to the absence of suitable tree species. However, a number of bush patches/wetlands along the alignment were considered to provide optimal habitat for arboreal lizards as a result of the presence of preferred tree species (for example, kanuka).

Desktop studies identified five species of endemic lizard that could potentially occur within the proposed Expressway alignment (refer to Table 21.2).

¹⁵⁸ Herpetofauna refers to amphibians and reptiles; avifauna refers to birds; and terrestrial invertebrates refer to species that are visible with the naked eye that do not have a backbone.

Table 21.2: Conservation status and habitat preferences of herpetofauna potentially occurring along the proposed Expressway alignment

Family	Common Name	Conservation Status ¹⁵⁹	Habitat Preferences
Skink	Copper skink	Not Threatened PD	Open and shaded areas where sufficient cover is available (e.g., rock piles, logs, dense vegetation, etc).
	Common skink	Not Threatened	Dry open areas with low vegetation or debris such as logs or stones for cover.
	Ornate skink	Declining CD,PD	Open and shaded areas where sufficient cover is available (e.g., rock piles, logs, dense vegetation, etc).
Gecko	Common gecko	Not Threatened PD	Forest, scrub, grassland and coastal areas.
	Wellington green gecko	Declining	Forest and scrub, especially kanuka / manuka.

In total, the herpetofauna survey found a minimum of 17 common skinks on 68 occasions, and unidentified skinks on 36 occasions. Skinks were observed at virtually all sites where long, thick grass was present, and were not recorded at any other site. No geckos were found during the survey and there was no record of any gecko skin sloughs.

No lizard species of conservation concern were located during the survey. Given the variety of potential habitats investigated, combined with the intensity of the surveys, if any species were missed they are unlikely to be present in any abundance.

Finding only one identifiable skink species within close proximity of the proposed Expressway alignment suggests both a lack of suitable habitat for other skink species together with high predation pressure from introduced mammals.

21.2.5.2 Frogs

Native frogs are considered extremely unlikely to occur and none were observed in the vicinity of the proposed Expressway alignment due to the absence of suitable habitat. A number of exotic frogs were observed during botanical and freshwater investigations.

21.2.6 Avifauna

Field surveys (involving point counts) recorded a total of 41 bird species (excluding dabchick) along the proposed Expressway alignment. Of the 22 native species recorded, 2 species are *Threatened* (Australasian bittern and pied shag) and 3 species are *At Risk* (pipit, black shag and North Island

¹⁵⁹ CD=Conservation Dependent; PD=Partial Decline; Sp=Sparse.

fernbird). Ecologists undertaking flora surveys also made an incidental observation¹⁶⁰ of dabchick. Dabchick is also *Threatened*.



Photo 21.2: North Island fernbird

While *Threatened* and *At Risk* species were present along the proposed Expressway alignment, they were recorded in very low numbers (0.8% of all observations). Overall, introduced species were found to make up the greatest proportion (62.2%) of all birds recorded during the point counts.

A comparison with Ornithological Society of New Zealand's atlas and DOC data confirms that species recorded during the avifauna field surveys were those that were expected to be found in the habitat types surveyed (i.e. those occurring along the proposed Expressway alignment and the wider area). The majority of species recorded in the OSNZ atlas and DOC data but not in the field survey work were those that primarily occur in the coastal/estuarine habitats (which are not adversely affected by the Project).

The avifauna along and adjacent to the proposed Expressway alignment were found to be dominated by introduced passerines¹⁶¹, which reflects the urban and open country habitats. These habitat types are considered to be of low ecological value.

¹⁶⁰ Incidental observations: In addition to the above mentioned counts, all incidental observations were recorded while travelling between survey stations. The objective of these observations was to record any significant observations that may have been made outside of the formally defined methods of data collection. They included observation of avifauna within or adjacent to the site, as well as unusually large numbers of a common or exotic species, or any unusual and noteworthy behaviour.

¹⁶¹ 'Passerines' are a large order of birds distinguished by having feet that are adapted for perching, including all songbirds; includes tui, blackbird, sparrows, thrushes, and starlings.

Native avifauna associated primarily with freshwater habitats (wetlands and waterways) were recorded in low numbers, though both *Threatened* (pied shag and bittern) and *At Risk* (black shag and fernbird) species were recorded along or adjacent to the proposed Expressway alignment. Shags were recorded traversing the site rather than utilising the waterbodies. However, the bittern and fernbird were associated with wetland habitats and are likely to be resident in the area. The incidental observation of dabchick (*Threatened*) adjacent to the proposed Expressway alignment was in open water within a modified wetland.

The wetlands in the less developed area of the proposed Expressway alignment, north of Te Moana Road (comprising Te Harakeke/Kawakahia Wetland, Ti Kouka Wetland, Ngarara Wetland and Nga Manu Nature Reserve), provide the best quality habitat for freshwater bird species due to the extent and diversity of habitat types present. This area is of particular importance to *Threatened* and *At Risk* avian species in the district.

The estuary and stream mouths downstream of the Project (including the Whareroa, Wharemauku, Waikanae, Waimeha, and Hadfield / Kowhai estuaries and stream mouths) provide habitat for a number of estuarine and coastal bird species.

The fragmented remnant native forest habitats along and adjacent to the proposed Expressway alignment provide an important habitat for a number of native avifauna species through the provision of feeding resources and nesting sites. These fragments also provide a series of forested areas that serve as a corridor to encourage the dispersal of avifauna across the wider area. Consequently, these forested areas are also considered to be of high ecological value for avifauna.

21.3 Assessment of effects on terrestrial ecology

21.3.1 Avoidance through design

As discussed earlier, in liaison with the specialist ecologists, the Project ecologist has worked closely with the design team to seek to avoid effects on terrestrial ecology (along with effects on freshwater and marine ecology).

Through this process, the most significant potential effects to indigenous vegetation were avoided. This included avoiding effects on statutorily recognised wetlands along the length of the proposed Expressway, including at Raumati South (Raumati South Peatlands), the wider El Rancho wetland complex (including Osbournes wetlands) and north of Te Moana Road (including Te Harakeke/Kawakahia Wetland, Ti Kouka Wetland and Ngarara Wetland).

Ongoing Project design has benefited from the more detailed ecological investigations with continued refinements of the proposed Expressway further reducing effects on indigenous wetlands, habitats and freshwater systems.

Ecological involvement also assisted with the design and location of stormwater treatment wetlands and flood storage areas, bridge and culvert locations, groundwater studies (in relation to wetland hydrology), stormwater sampling, contaminant modelling and sediment and erosion control structures.

21.3.2 Methodology

Assessment of potential indigenous vegetation and habitat loss has been based on the assumption that all indigenous vegetation and habitat within the Designation is at risk, focusing primarily on the loss of all indigenous vegetation and habitat within the Project footprint.

21.4 Assessment of effects on terrestrial ecology (including wetlands) during construction

Terrestrial ecological effects associated with proposed Expressway construction can be separated into “direct effects” and “indirect effects”.

The potential direct effects of construction on terrestrial ecology include:

- The loss of terrestrial habitat (including wetlands) and species through clearance and modification (i.e. earthworks and vegetation clearance) as part of construction activities; and
- Disturbance and displacement of terrestrial fauna through construction activities.

The potential indirect effects of construction on terrestrial ecology include:

- Impact on terrestrial habitat and species loss through dust, fire and weed introduction caused by construction activities.
- It is noted that Chapters 22 and 23 of this AEE address the potential effects of sediment discharge to streams, wetlands and the coast, the effects of groundwater take, effects on hydrology, and the risk of discharge of contaminants to waterways.

21.4.1 Potential direct effects of construction

21.4.1.1 Loss of terrestrial habitat (including wetlands)

The majority of the Designation lies in a highly modified pastoral landscape dominated by a mix of farming and rural lifestyle blocks and residential areas with approximately:

- 70% in pasture and grasslands;
- 16% in plantation forestry or other exotic forest and trees;
- 9% in pioneer shrublands, scrub and low forest; and
- 4% of the designation is classed as urban.

Indigenous forest makes up less than 0.5% of the vegetation communities potentially affected by the Designation. Indigenous wetlands comprise approximately 1.2% of the Project footprint.

The protection from land development provided by the long history of designations over much of the proposed Expressway corridor has resulted in a number of areas of indigenous vegetation and habitat

being maintained and in some cases improved. However, a number of these areas will be lost or modified by the proposed Expressway.

Table 21.3 provides a summary of the magnitude of impact to vegetation within the Designation as a percentage of the total vegetation of this type found within the study area¹⁶². As a guide the following scale is used for this assessment <1%= negligible, 1-5% = low, 5-20% = moderate, 20-50% = high, >50% = very high.

The direct effects of construction on terrestrial vegetation will include:

- Permanent loss of approximately 5.6 ha of vegetation (dominated by indigenous species) beneath the Project footprint, comprising 1.8 ha of wetlands habitat, 3.8 ha of regenerating shrublands, scrub and low forest including 0.01 ha of mature or maturing forest (primarily scattered cabbage trees); and
- Potential loss or modification of a further 7.4 ha of indigenous vegetation within the Project footprint, due to earthworks and construction activities within the proposed Expressway designation.

While any permanent loss of wetland vegetation is considered significant in terms of the general loss of wetlands in the Wellington Region, the wetlands physically affected by the proposed Expressway are not known to provide core habitat for rare or threatened flora or fauna. There is evidence that all the wetlands present are modified from their former extent as a result of historical swamp drainage and vegetation clearance, and the vegetation present reflects varying stages of successional vegetation to swamp forest.

Vegetation clearance on the margins of two kanuka stands will have a very high adverse effect on these stands, in one case leading to loss of a majority of the stand. Mitigation is considered necessary for this loss and will be provided.

There will be a high effect of earthworks and vegetation loss within the Northern Otaihangā Wetland and a moderate effect on the Southern Otaihangā Wetland. There will also be a moderate effect of vegetation clearance of the Ngarara Mahoe Forest.

The Project is assessed as having low, very low or negligible effects on all other sites or vegetation communities.

¹⁶² "Study Area" refers to all land, water bodies and receiving environments that could be potentially affected by the Project including all downstream receiving environments. To provide consistency between this and the ecology Technical Reports within Volume 3, the study area includes all catchments that are crossed by the main Alignment. It has a total area of 10,808 ha. The study area is shown in Figure 1 of Technical Report 26, Volume 3.

Table 21.3: Magnitude of terrestrial vegetation loss (including wetlands) and modification (without mitigation)

DESCRIPTION (listed South to North)	Ecological value	Area of loss (ha)	Study area (ha)	Loss as % of study area	Assessment of impact magnitude	Assessment of impact significance
Wetlands						
Wetlands of low value –(wet pasture and Juncus)	Low	13.90	n/a	n/a	Negligible	Very Low
Raumati Manuka Wetland	Medium	0.03	2.0	15%	Moderate	Low
Southern Otaihangā Wetland	Medium	0.55	1.4	39%	High	Moderate
Northern Otaihangā Wetland	Medium	0.53	1.0	53%	Very High	High
El Rancho Wetland (Weggery)	Medium	0.38	3.9	10%	Moderate	Low
Pioneer shrublands and low forest						
Shrublands of low value (gorse and blackberry)	Low	21.9	n/a	n/a	Neutral or minor positive	Neutral
Ngarara mahoe forest	Medium	0.86	4.2	20%	High	Moderate
Waikanae river riparian vegetation (planted)	Low	0.13	2.0	7%	Moderate	Very Low
Tuku Rakau Forest	Low	0.25	0.9	28%	High	Low
Kakariki Stream riparian vegetation (planted)	Low	0.18	1.6	11%	Low	Very Low
Kanuka Forest						
Otaihangā Kanuka Forest	High	0.17	0.5	34%	High	Very High
Raumati Road Kanuka	High	0.35	0.4	88%	Very High	Very High
Other sites						
Scattered remnant cabbage trees in weedland	Low	0.01	n/a	n/a	Low	Very Low

21.4.1.2 Terrestrial fauna disturbance and displacement

a. Threatened Plant Species

As discussed, only one rare plant species was recorded during this study; the parasitic dwarf mistletoe (*Korthalsella salicornioides*) which was found within manuka scrub in close proximity to the proposed Expressway alignment.

Up to a dozen trees, on the margins of the wider wetland where mistletoe is located, may be lost during construction of the proposed Expressway. However, the core area where mistletoe is located is considered to be a sufficient distance from construction that adverse effects on that core area can be avoided. This can be achieved by marking the locations to be avoided prior to vegetation clearance, and educating contractors (as outlined within Appendix M of the CEMP, Volume 4). No additional management or mitigation is considered necessary.

It should also be noted that substantial landscape and buffer planting is proposed in the vicinity of these remnants, which should assist with the long-term maintenance of the vegetation and wetland habitat upon which this species relies.

b. Herpetofauna

The common skink was widespread in areas of dense grass along the proposed Expressway alignment and is likely to be present at similar densities throughout the district where this type of habitat is present. Large areas of this habitat will be lost beneath the Project footprint and any lizards that are resident in that habitat are at risk if not removed prior to earthworks.

In the short term, this habitat loss will have large effects on populations within the Designation, but it is considered unlikely that this loss will impact on populations of this common species within the district generally. Recovery of habitat will be rapid and in the short to medium term large areas of equivalent or improved habitat will be created on the margins of the proposed Expressway through landscaping and hydro seeding of exposed earthworks.

Construction effects on these residual lizard populations within the Designation could be reduced by trapping and relocation of lizards prior to construction. As outlined in Technical Report 28, Volume 3, while there are insufficient ecological grounds and some risks associated with capture and relocation of common lizards, provision for potentially undertaking such relocation is included in Appendix M of the CEMP, Volume 4.

c. Terrestrial Invertebrates

A wide variety of common terrestrial invertebrates were detected during various ecological investigations, though none of conservation concern. One specimen of *Peripatus novae-zelandiae* was located in the compacted sand under a recently fallen pine tree within the Otaihangā Mountain Bike Area. This species does not currently have a threat status.

The new habitat created within the alignment through landscaping, combined with increased areas of rank grassland, is expected to provide equivalent areas of suitable habitat for this species in the short to medium term. Landscaping mitigation is outlined within Chapter 17 of the AEE.

d. Avifauna

Construction of the Project has the potential to impact on mobile species of birds through the loss of habitat within the Designation, including that used for breeding, feeding and roosting.

Fernbird (at risk – declining)

North Island fernbird was observed on two occasions in the vicinity of Ngarara Wetland and the Kakariki Stream in the vicinity of Nga Manu Nature Reserve. It is likely, given the habitat available, that the observed fernbird(s) are resident in the areas they were recorded.

These may be the most southern observations of fernbird in the North Island. This makes this population of scientific interest and regionally significant.

Part of the alignment is located within the riparian area where these sightings occurred. It is likely that some fernbird habitat may be lost and there may also be some adverse effects on resident birds relating to disturbance caused by construction activities, noise, movement, and dust.

Bittern (Nationally endangered)

A solitary Australasian bittern was the only cryptic marshbird recorded during the avi-fauna study¹⁶³. This species was recorded in the extensive areas of raupo reedland and flaxlands of Te Harakeke/Kawakahia Wetland, confirming earlier reports of a resident population of this bird.

No breeding or foraging habitat for bittern will be lost beneath the construction footprint, and it is considered unlikely that construction activity will displace these birds from their habitat, given the distance of Te Harakeke/Kawakahia Wetland from the proposed Expressway alignment.

No management or mitigation is considered necessary for bittern.

Dabchick (Nationally Vulnerable)

One incidental observation of dabchick was made during terrestrial flora surveys.

Dabchick are known to utilise freshwater wetlands as well as man-made water features such as farm ponds and sewage oxidation ponds and ample habitat is available in the wider area, with large areas of stormwater treatment wetlands and flood storage areas proposed as part of this Project.

No management or mitigation for dabchick is considered necessary.

¹⁶³ 'Cryptic marshbird' refers to wetland birds that are well camouflaged

Pipit (at risk – declining)

NZ Pipit was observed in at a number of locations along the Designation.

It is likely there will be some temporary effects on resident birds associated with construction of the proposed Expressway; however, this will be limited to the construction phase and revegetation is likely to replace lost habitat.

No further management or mitigation for pipit is considered necessary.

Black shag (at risk -naturally uncommon) & pied shag (Nationally vulnerable)

Black shag and pied shag were recorded traversing the proposed Expressway alignment, although not utilising the waterbodies. Both species are unlikely to utilise habitat along the alignment, and the risk of displacement during construction activities associated with waterbodies is considered to be low.

No management or mitigation for black and pied shags is considered necessary.

Other Avifauna

Overall, the lack of native forest habitats along the proposed Expressway alignment limits the range of abundance of native bird species present along the Designation. With the exception of a small number of cabbage trees adjacent to El Rancho Wetland (Weggery) no remnant native forest will be affected by the proposed Expressway. Native avi-fauna associated primarily with freshwater habitats (i.e. wetlands and waterways) were recorded in low numbers.

No management or mitigation is considered necessary.

21.4.2 Summary of direct construction effects

The direct construction effects on terrestrial ecology are:

- Permanent loss of approximately 5.6 ha of indigenous vegetation and habitat beneath the proposed Expressway (comprising 1.8 ha of wetlands, 3.8 ha of regenerating shrublands, scrub and low forest and 0.01 ha of mature or maturing forest);
- Potential loss or modification to a further 7.4 ha of indigenous vegetation due to earthworks and construction activities within the proposed Expressway designation;
- Potential loss of sedentary species (e.g. lizards) when their habitat is removed; and
- Disturbance and displacement of mobile species (e.g. birds) by construction activity.

Table 21.4 combines the assessment of ecological value with magnitude of effect to assess impact significance.

Table 21.4: Assessment of Impact Significance of Direct Construction Impacts (without mitigation)

DESCRIPTION	Ecological Value	Assessment of Impact Magnitude	Assessment of Impact Significance
FLORA & FAUNA			
Terrestrial Flora			
Dwarf Mistletoe	High	Negligible	Low
Terrestrial Fauna			
Common Lizards	Low	Moderate	Very Low
Peripatus novae-zelandiae	Low	Low	Very Low
Avifauna			
Australasian bittern	Very High	Negligible	Low
North Island fernbird	High	High	Very High
Black Shag	High	Negligible	Low
Pied Shag	Very High	Negligible	Low
Dabchick	Very High	Negligible	Low
Pipit	High	Negligible	Low

There is a risk of very high adverse effects on fernbird without mitigation. No other species of terrestrial flora or fauna are considered to be at risk of adverse effects to the extent that mitigation is proposed. However, attention to the protection of habitat during detailed design and construction are necessary to ensure this occurs.

21.4.3 Potential indirect effects of construction

In addition to the direct impacts, construction of the Project has the potential to cause indirect adverse effects on terrestrial ecology, in terms of the potential effects of dust and fire and the potential for the introduction of weeds to the area.

21.4.3.1 Dust

Significant amounts of airborne dust may be created during the period of construction with the potential for adverse ecological effects.

Given the nature of the sand and peat dominated substrates across the study area, dust is not considered to be a threat to indigenous flora fauna or habitats.

Extensive dust management (refer to Appendix G of the CEMP, Volume 4) will be carried out to protect residential areas, and it is considered that the levels of suppression needed to meet amenity and public health requirements will also protect indigenous flora and fauna. On this basis, no further mitigation or monitoring is proposed.

21.4.3.2 Fire

Given the frequent long dry summer periods on the Kāpiti Coast, the risk of fire during the construction period has been assessed. Fire may be caused by a range of activities including hot works, smoking, and vehicle exhausts.

This issue will be covered in the CEMP (Volume 4) which will include appropriate training, rules around hot works, and liaison with local fire services. Given this, additional mitigation or monitoring is not proposed.

21.4.3.3 Weeds

Given the propensity of invasive weed growth on the Kāpiti Coast, there is a high risk during construction of the introduction of weed species not currently present on site, or the spread of weeds which currently have limited distribution on site or locally.

This could occur through the importation of sand, topsoil, clean fill, plant stock, or as seed carried in mud on vehicles and equipment. This risk cannot be quantified but can be mitigated through appropriate management systems.

Controls will be included in the Appendix 4 of the CEMP, Volume 4, which include timely monitoring and a weed response plan.

21.4.4 Summary of indirect construction effects

The potential indirect adverse effects of construction on terrestrial ecology are limited to those related to dust, fire and weed invasion. The potential for these effects has been sufficiently mitigated through the inclusion of measures to manage those potential effects in the CEMP and its associated management plans (Volume 4).

21.5 Assessment of operational effects on terrestrial ecology

The on-going effects on terrestrial ecology resulting from the operation of the Project are relatively limited. The potential adverse effects on terrestrial fauna relate to mortality or displacement as a result of the road and vehicular traffic.

21.5.1 Disturbance to terrestrial fauna

21.5.1.1 Avifauna

North Island fernbird (At Risk – Declining)

The proposed Expressway operation has the potential to effect the North Island fernbird populations. The North Island fernbird was observed in the wider area between Ngarara Wetland, Kakariki Stream and Nga Manu Nature Reserve. A population is known historically within the Te Harakeke / Kawakahia Wetland.

There are two potential effects that could occur; displacement from habitat by proposed Expressway activity and mortality from vehicle strikes. Given the apparent rarity of this species locally, a small number of mortalities caused by vehicles could have a disproportionately large effect on the population. Similarly, displacement of birds from current habitat due to traffic noise and activity would potentially diminish the range of this species locally.

Australasian bittern (Nationally Endangered)

Australasian bittern are present in the Te Harakeke/Kawakahia Wetland, which is located approximately 170 m from the proposed Expressway alignment.

Playback¹⁶⁴ and observations during this study and historical information suggest that this species is not present in the many smaller fragmented wetlands to the east that lie adjacent to the proposed Expressway alignment. This suggests that there is unlikely to be regular movement of bittern across the Alignment to these wetlands which would put these birds at risk.

Overall, it is considered that the risk of adverse effects on Australasian bittern from operation of the proposed Expressway is negligible and no additional mitigation or monitoring is proposed.

Dabchick (Nationally Vulnerable)

Large areas of stormwater treatment wetlands and flood storage areas proposed as part of this Project will provide additional habitat for dabchick.

Overall, it is considered that the effect on dabchick from the operation of the proposed Expressway will be negligible and additional mitigation or monitoring is not proposed.

Pipit (At Risk – Declining)

The extent of habitat modification along the Kāpiti Coast suggests that pipit are present only as a result of their opportunistic ability to adapt to such modified landscapes. All pipit observations were in areas of grazed pasture.

Overall, it is considered that the effect on pipit from operation of the proposed Expressway to be low and no additional mitigation or monitoring is proposed.

Black shag (At Risk – Naturally Uncommon) & pied shag (Nationally Vulnerable)

No habitat required by black and pied shag for roosting, nesting and feeding will be lost in the long term as a result of the proposed Expressway and the revegetation of the stream margins will provide additional roosting habitat.

¹⁶⁴ Playback calls act as “lures” to entice resident birds to appear from cover or vocally respond.

Overall, the risk of adverse effects on these two shag species from the operation of the proposed Expressway will be negligible. No additional mitigation or monitoring is proposed.

21.5.1.2 Herpetofauna

The new habitat created within the Designation through landscaping, combined with increased areas of rank pasture, is expected to provide suitable permanent habitat for the relatively high populations of common skinks within the proposed Expressway alignment.

Overall, the effect on lizards from operation of the proposed Expressway will be negligible.

21.5.2 Summary of operational effects

The potential adverse effects of proposed Expressway operation are limited to those relating to mortality and displacement, particularly in regard to the North Island fernbird. The significance of those potential adverse operational effects is outlined within Table 21.5.

Table 21.5: Assessment of Impact Significance of Operational Impacts (without mitigation)

DESCRIPTION	Ecological Value	Assessment of Impact Magnitude	Assessment of Impact Significance
FLORA & FAUNA			
Terrestrial Flora			
Dwarf Mistletoe	Medium	Negligible	Very Low
Terrestrial Fauna			
Common Lizards	Low	Negligible	Very Low
Peripatus novae-zelandiae	Low	Negligible	Very Low
Avifauna			
Australasian bittern	Very High	Negligible	Low
North Island fernbird	Very High	High	Very High
Black Shag	Low	Negligible	Very Low
Pied Shag	Very High	Negligible	Low
Dabchick	Very High	Negligible	Low
Pipit	Medium	Negligible	Very Low

In all cases, with the exception of fernbird, the potential adverse effects from the operation of the proposed Expressway will be very low or low. There is a risk of very high adverse effects on fernbird due to displacement from habitat and traffic mortality.

21.6 Positive ecological effects resulting from the Project

The ecological mitigation recommended for the loss of terrestrial habitat, combined with methods of stormwater management (as described in Technical Report 22, Volume 3), will have a number of additional positive environmental outcomes. These include:

- New stormwater treatment wetlands, while having the primary purpose of managing stormwater, will also provide additional habitat benefit for native flora and fauna;
- A number of new flood storage areas will be subject to mass planting of indigenous wetland species and will provide additional benefit for native flora and fauna – some of which have connections with adjacent waterbodies;
- Through retirement, restoration and revegetation along sections of the Designation (as part of a combination of ecological, hydrological, landscape, amenity and acoustic mitigation), there is an opportunity to connect existing vegetation fragments and wetland areas and provide a series of habitat "stepping stones" along the proposed Expressway alignment. This will have long-term ecological benefits for both terrestrial fauna and native birdlife, as well as providing landscape and amenity benefits; and
- As was demonstrated by the finding of the North Island fernbird population near Ngarara Wetland as a result of investigations undertaken in relation to the Project, this Project will result in a range of ecological investigations that will provide public good in terms of increasing local conservation knowledge. This knowledge and science could be fed directly into management of adjoining areas under control of other agencies.

21.7 Measures to avoid, remedy or mitigate actual or potential adverse effects on terrestrial ecology

The previous sections of this Chapter identify that mitigation, which may include management and monitoring, is required for the following operation and construction effects:

Direct impacts of construction

- Loss of terrestrial vegetation (including wetlands), in particular kanuka and mahoe forest; and
- Loss of fernbird habitat during construction, and disturbance caused by construction activities.

In addition, while the potential adverse effects are considered low, lizard mortality will result from construction vegetation clearance.

Impacts of operation

- Displacement from habitat or mortality of fernbird during operation.

21.7.1 Loss of indigenous terrestrial vegetation and habitat (excluding wetlands)

The extent of planting required to mitigate the loss of indigenous terrestrial vegetation and habitat has been calculated in Table 21.6.

Table 21.6: Mitigation for indigenous terrestrial vegetation loss

Habitat Type	Vegetation Loss (ha)	Mitigation Ratio ¹⁶⁵	Mitigation (ha)	Area
Kanuka forest	0.8	x 2	1.6	
Regenerating broadleaf scrub and low forest (including riparian margins)	3.0	x 2	6.0	
Mature indigenous forest	0.01	x 3	0.03	
TOTALS	3.8	-	7.6	

Accordingly a minimum of 7.6ha of mass planting along the proposed Expressway alignment (refer to Chapter 17 for a description of mass planting) is required as mitigation for the loss of terrestrial vegetation (kanuka forest, regenerating mahoe and mature indigenous forest) within the Project footprint.

As part of the Project the NZTA is proposing to undertake revegetation at a number of locations along the proposed Expressway as follows:

- Loss of the 3.8 ha of kanuka forest and regenerating broadleaved forest along the Alignment will be mitigated in part by the replanting of a minimum of 7.6 ha of broadleaved forest and kanuka within the wider area of mass planting and mass planting with tree enrichment within the Designation; and
- The approximately 0.01 ha of loss of scattered mature indigenous forest trees along the Alignment will also be mitigated as part of this larger area of mass planting with tree enrichment within the Designation.

For pioneer shrublands, which are typically dominated by gorse, no mitigation is proposed for their loss or modification. However, there is the potential for these areas to act as nursery crops and as noted in Appendix M of the CEMP, Volume 4. In some locations, this process will be facilitated through interplanting with native trees.

Overall, the quantities of revegetation proposed will fully mitigate for the small areas of vegetation that will be lost.

21.7.2 Loss of indigenous wetland vegetation and habitat

A number of options to avoid or minimise loss of wetland habitat have been explored through the Project design and the selected alignment avoids the most highly valued areas of wetland habitat. Given that full avoidance was not practicable, a minimum of 5.4 ha of wetland restoration will be created as mitigation for the loss of 1.8 ha of wetland of moderate value as outlined in Table 21.7.

¹⁶⁵ Refer to section 11.1.2 of Technical Report 26, Volume 3, for information on mitigation ratios.

Table 21.7: Mitigation for indigenous wetland vegetation loss

Habitat Type	Loss (Project Footprint) (ha)	Mitigation Ratio ¹⁶⁶	Mitigation Area (ha)
Wetlands	1.8	x 3	5.4

The key wetlands requiring mitigation were identified through this assessment as:

- El Rancho Wetland (Weggery); and
- The Southern and Northern Otaihanga wetlands and the Otaihanga Kanuka Forest.

Discussions with KCDC, GWRC biodiversity staff and DOC confirmed a preference to focus any mitigation for wetland loss and modification on existing wetlands within the study area that currently lack formal protection. This has resulted in agreement to wetland restoration work at the following selected sites adjacent to the proposed Expressway:

- Raumati Manuka Wetland;
- Otaihanga Wetlands;
- El Rancho (Weggery) Wetland; and
- Ngarara Wetland.

However, this has not always been possible. It is noted that there is little opportunity to mitigate for wetland loss within the El Rancho (Weggery) wetland as it is outside the Designation and a recognised wāhi tapu area. In response to this, restoration of the former Waikanae Oxidation Ponds, part of the Pharazyn Reserve, is proposed to mitigate for wetland loss in this location¹⁶⁷. This alternative option has subsequently been discussed with KCDC, DOC and GWRC.

The 5.4ha of mitigation proposed is to be achieved through works along the Project footprint where existing wetlands or wet depressions provide opportunities for restoration, in combination with restoration work within the decommissioned Waikanae Oxidation Ponds (refer to Technical Report 26, Volume 3 for full details).

¹⁶⁶ Ecological mitigation ratios were derived to determine the value of the habitat being affected and quantity of mitigation that would be required for loss. Mitigation ratios are further explained within Technical Report 26, Volume 3.

¹⁶⁷ This option has been discussed with KCDC, DOC and GWRC. The restoration of the decommissioned Waikanae Oxidation Ponds will involve importing of approximately 76,000 m³ and 114,000 m³ of peat from the construction earthworks along the proposed Expressway alignment to raise the bed of the ponds (currently 2-3m deep) and create islands and shallows which will then be planted as wetland habitat.

The mitigation will include the following:

- Mass planting of approximately 1.1 ha of indigenous vegetation surrounding the Raumati Manuka Wetland, including interplanting within existing gorse vegetation;
 - Restoration of a new (approximately 1.2 ha) wetland north of the Waste Water Treatment Plant Drain at Otaihanga and the restoration of 0.4 ha of the Otaihanga Central Wetland to provide for the relocation of established wetland plants from the Otaihanga Southern and Northern wetlands, including larger specimens of *Carex secta*, *Carex virgata* and *Baumea teretifolia*; and
 - Restoration of a minimum of 3.8 ha of the former Waikanae Oxidation Ponds consistent with the approved Pharazyn Reserve Landscape and Ecological Plan¹⁶⁸.

In addition to this, stormwater treatment wetlands and flood storage areas will be formed along the route and will subsequently provide additional wetland benefits (refer to section 21.7 of this Chapter).

Overall, it is considered that the revegetation and restoration proposed will fully mitigate for the loss of wetlands, and will in the long term provide ecological benefit.

21.7.3 Loss of the North Island fernbird population and their habitat

Given the presence of this high value bird species in close proximity to the proposed Expressway, additional pre-construction research will be required. This research will determine the distribution and utilisation of the North Island fernbird within the Designation, between the Waikanae River and Kakariki Stream, where the proposed Expressway alignment would intercept potential fernbird habitat.

In addition to this, a research programme will commence at a motorway within known fernbird habitat, to determine the operational effects on the ability of a fernbird population to continue to utilise adjacent habitat.

Once the results of this research are collated, the range of mitigation measures available will be discussed with DOC and other relevant stakeholders.

21.7.4 Loss of lizards and their habitat

No further mitigation is considered necessary, given the affected skinks are relatively common. However, it is noted that the proposed landscape and amenity planting will result in the creation of habitat suitable for lizards in a number of locations (refer to Chapter 17 of this report and Technical Report 7, Volume 3), including a number of open environments with abundant refuges on the edge of plantings and the incorporation of ground tier species appropriate for lizard species. Large areas of rank pasture will also be retained as part of the landscape planting.

¹⁶⁸ Wildlands (2011)

21.7.5 Further considerations

There may be opportunities during detailed design to further review and mitigate effects on a number of high value areas of wetland vegetation, advanced regenerating forest and mature or maturing forest that fall both within the proposed Project footprint and Designation. In addition, site management will incorporate appropriate environmental management planning to seek to ensure that the areas where effects are to be avoided or mitigated are identified and protected during construction. These opportunities form an important component of Appendix M of the CEMP, Volume 4.