Chapter 20

Part G

VOLUME 2

Aquatic Ecology

Overview

The Expressway will cross numerous catchments in the Project area. Three bridges and numerous culverts are to be constructed at waterway crossings (streams, drains and rivers). In addition, a depression containing the "Railway Wetland" near Ōtaki is to be mostly filled to accommodate the Expressway.

Expert assessments have identified the following five categories of potential adverse effects of the Project on waterways, and developed the following detailed mitigation measures to address each of those categories of effect.

First, construction activities may cause temporary adverse effects on freshwater quality and habitat. Best practice erosion and sediment control measures will be adopted in constructing the Project as specified in the draft CEMP and, in particular, in the ESCP and the Ecological Management Plan (EMP). On this basis the ecological effect of the Project from sediment run-off from earthworks on fresh water quality and habitat is considered to be less than minor.

Second, the use of culverts in watercourses may impair fish and invertebrate migration. Appropriate measure to provide for fish passage will be incorporated into the design of all culverts where streams have the potential to carry migratory native fish. On this basis, the affect of the Project on fish and invertebrate migration from the use of culverts is considered to be less than minor.

Third, road runoff has the potential to affect water quality and cause channel erosion. The existing SH1 lacks an attenuation system to intercept runoff. Attenuation swales and basins designed to retain and remove contaminants will intercept most runoff from the Expressway. Therefore, the Project will have a net-positive effect on road runoff contamination.

Fourth, the use of culverts may result in a loss of, or alteration to, habitat in waterways (streams, drains and rivers). In addition to the culvert design to provide for fish passage, a minimum of 2601 metres of enhanced waterway length (in the form of riparian buffers) will be established to off-set any residual effects on waterways. The overall effect of the Project on waterways is less than minor.

Fifth, 0.5 hectares of the Railway Wetland (0.8 hectares in total) will be lost to the Project. That loss will be off-set by the construction of two wetlands (1.1 hectares in total), as detailed in Technical Report 11 (Terrestrial Ecology). Aquatic ecological conditions will be monitored at these sites for 3 years following completion of construction of the Expressway. On the basis of the proposed riparian planting mitigation and culvert design, and establishment of the 1.1 hectares of new wetlands and monitoring, the effect of the Project on wetland habitat is considered to be less than minor.

20 Aquatic Ecology

20.1 Introduction

This Chapter summarises the potential effects of the Project on aquatic ecology.

The report that describes the effects that the Expressway construction and operation will have on freshwater ecosystems in the Project area, and provides recommendations for mitigating adverse effects, is:

- Peka Peka to Ōtaki Expressway: Aquatic Ecology (Technical Report 12).

This technical report is included in Volume 3 of this AEE report.

The following methods and sources were used to identify the existing environment and the potential effects of the Project on freshwater ecosystems in the Project area:

- Biological surveys of streams and rivers in the Project area were carried out in March 2011, July 2012 and February 2013;
- A biological survey of the railway wetland was carried out in July 2012;
- Extraction of records of fish from the New Zealand Freshwater Fish Database (NZFFDB); and
- Additional records of fish occurrence and invertebrate communities were compiled from technical reports (Boffa Miskell 2001, Perrie and Cockeram 2010).

20.2 The Existing Aquatic Environment

The existing aquatic environments in the Project area were characterised using data from field surveys, regional council monitoring programmes and publically available databases. Stream flow is monitored at flow recorders on the Ōtaki River and Waitohu and Mangaone Streams. Water quality, aquatic invertebrates and periphyton (attached algae) are monitored by GWRC at two sites each on the Ōtaki River and Waitohu Stream and one site each on Mangaone and Mangapouri Streams. No GWRC monitoring is carried out at other waterways in the Project area, most of which are intermittent. No GWRC monitoring is carried at wetlands in the Project area.

Fish, aquatic invertebrates, riparian plants and physical habitat in waterways in the Project area were surveyed in March 2011, July 2012 and February 2013. Fish, invertebrates and macrophytes were surveyed in the lentic (pool) portion of the Railway Wetland in July 2012. The aims of the surveys were to compile the most complete taxonomic lists possible (within a defined period), identify any fish or invertebrates in the Project area with threatened or declining conservation status, and identify streams inhabited by migratory native fish, as these streams will require fish passage at road crossings.

There are 23 natural streams and artificial drains in the Project area, including several ephemeral swales and the secondary channels of larger streams. The largest waterway is the perennial Ōtaki River. The second and third largest, Waitohu and Mangaone Streams, are near-perennial (rarely dry), and the fourth largest, Mangapouri Stream, is spring-fed and perennial. All smaller waterways in the Project area are intermittent, and many of these are highly ephemeral (i.e. they only flow for brief periods after heavy rainfall). Most of the waterways that will cross the Expressway have intermittent reaches.

20.2.1 **Water Quality**

Water quality in the Ōtaki River at Pukehinau, the Ōtaki River at Mouth, and Waitohu Stream at Forest Park was classed as excellent in 2009-10 and 2010-11 by GWRC. The Pukehinau and Forest Park sites are in indigenous forest-dominated catchments upstream of the Project area, and water quality may decline downstream, as agricultural and urban land-use increases. Water quality in Waitohu Stream at Norfolk Crescent (near the mouth), Mangaone Stream at Sims Road (near the mouth), and Mangapouri Stream at Bennett's Road was classed as poor in 2009-10 and 2010-11 by GWRC. These three sites are downstream of the Project area, and water quality may be higher in the Project area upstream, which is less influenced by upwelling, nutrient-rich groundwater.

20.2.2 **Physical Habitat**

Physical habitat assessments were made at waterways in the Project area using the New Zealand stream habitat assessment protocols. Physical habitat scores were generally low; the median score was 2.3 (47% of the maximum possible). The low scores reflect the fact

that most waterways in the Project area are in intensively grazed farmland, with minimal or no riparian setback, minimal riparian shading, frequent access to livestock, and a predominance of silt and clay substrate. The highest physical habitat scores were for Waitohu and Mangapouri Streams; these high scores are primarily due to the dense and continuous riparian zones at both sites.

20.2.3 **Biological Environment**

At least one native, migratory fish was caught in nine out of 10 waterways surveyed in the Project area. A total of nine native fish species were caught during the field surveys, of which eight are migratory. A total of 16 native fish species, of which 13 are migratory and three are naturalised non-native species, have been reported from the Project area in the New Zealand Freshwater Fish Database. The Ōtaki River and Waitohu and Mangaone Streams are each inhabited by several species of native fish with poor climbing abilities (e.g. giant kokopu). Longfin eels were the only fish species observed in Mangapouri Stream.

A total of 83 invertebrate taxa were found in the nine waterways surveyed in the Project area. The numerically dominant invertebrate taxa in the largest waterways, Ōtaki River and Mangaone and Waitohu Streams, were aquatic insects. The dominant taxa in the other, smaller streams were amphipods and snails. Stream health indicators calculated from the invertebrate survey data indicated that Mangapouri Stream and an intermittent stream draining the Settlement Heights catchment were low, indicating poor ecological conditions. Higher scores for Mangaone and Waitohu Streams and the stream at Mary Crest indicated good ecological conditions, and the Ōtaki River score indicated excellent ecological conditions.

With the exception of Mangapouri Stream and the stream near Mary Crest, riparian-zone vegetation bordering streams in the Project area is composed entirely of non-native species. Riparian vegetation at the Mangapouri Stream site in the Pare-o-Matangi reserve is dominated by native trees and shrubs that were planted in a restoration programme. The stream at Mary Crest flows through a native-bush fragment and has a native species-dominated riparian zone for approximately half of its 300m length. The riparian vegetation at all other sites is composed of mixtures of non-native grasses, forbs, shrubs and trees.

Shortfin eels were the only fish caught in the Railway Wetland pool survey. A total of 26 invertebrate taxa were collected in the Railway Wetland pool. The numerically dominant taxa were midges, oligochaete worms and copepods. None of the invertebrate taxa in the wetland are rare in New Zealand, and the community was similar to those of other low-elevation wetlands of the Kāpiti Coast and elsewhere in the North Island. The submerged, floating and emergent macrophytes in the wetland pool were dominated by non-native species and a few widespread native species; no rare macrophytes were observed. The physical and biological condition of the Railway Wetland was assessed in Technical Report 11 (Terrestrial Ecology), Volume 3. The condition score was low, which reflects substantial modification of wetland hydrology and vegetation. Wetland drainage is impeded by railroad and road embankments; parts of the wetland are used for grazing livestock, and the wetland is vegetated with a mixture of native and invasive non-native vegetation. The wetland pool sampled for the current assessment appears to have been excavated, possibly to drain the surrounding wetland.

20.2.4 **Ecological Value**

The ecological values (i.e. ecological significance and naturalness) of waterways in the Project area were assessed using a range of attributes, including the prevalence of at-risk fish species, condition classes for fish and invertebrate communities and water quality, the prevalence of native forest in the catchment, and connectivity for migration between the headwaters and coast. Waterways for which most or all attributes were ranked highly were classed as high. Waterways for which most or all attributes had low rankings were classed as low. Waterways with approximately half high and half low rankings were classed as moderate. Four waterways were classed as having high ecological value (Waitohu, Mangaone and Mary Crest Streams and the Ōtaki River), and four waterways were classed as having moderate ecological value (Mangapouri, Settlement Heights, Jewell and Kumototo Streams). The remaining 15 waterways were classed as having low ecological value. These ecological values were used to evaluate mitigation requirements for potential adverse effects of the Project on habitat loss and alteration, as set out in the following section.

20.3 Effects Assessment and Mitigation

The Expressway will cross 12 large catchments (> 1km^2) and several smaller catchments in the Project area. Three bridges and numerous culverts are to be constructed at waterway (streams, drains and rivers) crossings. In addition, a depression containing the "Railway Wetland" near Ōtaki is to be mostly filled to accommodate the Expressway.

There are five potential adverse effects associated with the Project on aquatic ecosystems in the Project area:

- temporary effects of construction activities on water quality and habitat;
- impaired fish and invertebrate migration due to culverts;
- effects of road runoff on water quality and channel erosion;
- loss and alteration of habitat in waterways (streams, drains and rivers); and
- loss and alteration of habitat in the Railway Wetland.

The effects, mitigation and residual effects of the Project on aquatic ecology are summarised in Table 20-1.

Table 20-1: Summary of Potential Environmental Effects of the Project on Aquatic Ecosystems, Proposed Mitigation, and Evaluation of Residual Effects after Mitigation

Potential effects	Proposed mitigation	Residual effects	Evaluation of residual effects
Construction effects	Best-management practices as specified in the CEMP, and in particular, the ESCP and the EMP.	Moderately increased risk of spills and bank erosion affecting waterways. Brief periods of mobilised fine sediment, brief periods of flow blockage, minor effects of construction equipment on in-stream habitat.	Less than minor
Impaired fish migration	Provision of fish passage at every crossing that may be used by	Minimal impairment due to the presence of culverts and consequent alterations in	Less than minor

Potential effects	Proposed mitigation	Residual effects	Evaluation of residual effects
	migratory native fish.	hydrodynamic and substrate conditions.	
Road runoff and contamination of waterways	Runoff drainage to treatment swales and basins.	Reduced contaminant input to waterways compared with SH1 alone.	Positive
Habitat loss - waterways	Riparian planting, bank stabilisation and fencing at all crossing sites. Offset mitigation consisting of ≥ 2601 metres of new riparian buffers.	Very small reduction in total stream habitat, very small alterations in habitat quality. Improvements in ecological condition at sites with new riparian buffers.	Less than minor
Habitat loss – Railway Wetland	Constructed wetlands of equal or greater area.	Short (2-3 year) delay before constructed wetlands mature and provide the same habitat quality and biodiversity as established wetlands.	Less than minor

20.3.1 **Construction Effects**

Sediment input to waterways is a primary environmental concern for Expressway construction because earthworks create a risk of increased sediment yield over natural rates, and because elevated sediment input can have numerous adverse ecological effects. To assess the risk of elevated sediment input to waterways during construction, sediment yield was estimated for each catchment in the Project area during the construction period and the current (background) period. The estimated increases in sediment yield due to construction are low for most catchments, including the catchments of waterways with high ecological value. However, sediment yields in four catchments are predicted to be significantly higher than background sediment yields. These catchments are very small, have no defined channels and terminate in soakage areas or drains. Therefore, the risk of construction sediment input to waterways with high ecological value is low. Despite this low risk, the ESCP lists sediment management actions targeted at each of the four catchments.

To minimise risks of adverse effects and to ensure construction effects are acceptably managed, all construction activities will comply with the construction methods, preventative measures (e.g. sediment detention devices) and monitoring protocols in the CEMP, EMP and ESCP.

Pre-construction and construction-phase monitoring in construction areas and at control sites upstream will be used to determine whether construction is affecting water quality and aquatic biota. Turbidity trigger levels will be developed with data from continuous turbidity monitoring in the pre-construction period at four sites. If trigger levels are exceeded during construction, and the exceedance is attributed to construction activities, a series of responses are required as set out in the conditions and EMP. These responses include audits of erosion and sediment control measures, and remedial and mitigation measures.

Construction activities in waterways can also impede fish passage. In intermittent waterways, construction activities will be concentrated into dry and drying periods when possible, to minimise effects on fish. In perennial and near-perennial streams, fish passage will be provided around in-stream works that partially impede flow. In-stream works that fully divert flow will be concentrated into periods outside of the peak migration times when possible. Periods of complete flow diversion and dewatering will be preceded by fish collection and relocation to unaffected reaches. A fish rescue plan specifying collection and relocation procedures will be in the EMP.

Based on the combination of erosion and sediment control measures, construction and post-construction monitoring, fish rescue, and the low risk of elevated sediment input to waterways with high ecological values, the effects of Expressway construction on waterways are expected to be less than minor.

20.3.2 **Fish Passage**

The perennial streams, and at least some of the intermittent streams that will cross the Expressway that have well-defined channels, are inhabited by native fish that migrate between the coast and the Tararua foothills. In the absence of fish passage structures, or if these structures are not designed appropriately, the Expressway embankment could block or impair fish migration. To minimise or eliminate adverse effects on migration, the construction plan for the Expressway includes fish passage designed for the local fish assemblage, and in particular for non-climbing or poor-climbing species, under a wide range of flow levels. All fish-passage culverts will be inspected to ensure proper operation one and four years after installation as set out in the conditions and EMP. With the provision of effective passage under the Expressway at all streams used for migration, the effects of the Project on migration are expected to be less than minor.

20.3.3 **Road Runoff**

Contaminants from vehicles can enter waterways via runoff from the Expressway. However, most runoff will be intercepted by attenuation swales and basins designed to retain and remove contaminants. The attenuation system will be maintained to ensure that its retention capacity is not depleted. Furthermore, a large proportion of the traffic will shift from SH1 to the Expressway. SH1 lacks an attenuation system or other structures designed to intercept runoff. Therefore, the net effect of the Expressway is to increase the retention of contaminants from vehicles at current traffic levels. This is a positive effect.

20.3.4 **Waterway Habitat Loss and Alteration**

Some open-channel habitat will be lost to culverts. The proportion of total channel length that will be culverted is very small. Culverts will be designed to minimise migration barriers as noted above. Components of these culverts will also ensure that they provide reasonable habitat for the biota that inhabit them. Those components include spoilers for flow reduction and rough low-flow channels. Additional portions of channels will be modified (e.g. rip-rap and concrete-cobble apron installation). These modifications may improve habitat conditions in reaches that were previously dominated by soft sediments and eroding banks. All channel lengths within the Project designation will be fenced and the channel banks planted with stabilising, native vegetation. Due to the short lengths of culverted and altered channel, the minor changes in habitat conditions, and the riparian-zone planting and fencing planned for waterway crossings, the overall effect of waterway habitat loss and alteration is expected to be minor.

A mitigation proposal to offset the loss and alteration of waterway habitat provides for at least 2601 metres of enhanced waterway length, in the form of riparian buffers on both

banks composed of native trees and shrubs. The majority of waterways in the Project area are grazed or cultivated to the banks, and lack setbacks or riparian buffers. Mitigation activities would focus on creating relatively large, long riparian buffers on a small number of waterways that currently have moderate to high ecological values, but lack riparian vegetation. Extensive riparian buffers composed on native plants should substantially improve ecological conditions in these waterways. These measures are expected to shift the overall effect of the Project on waterway habitat from minor to less than minor.

20.3.5 **Wetland Habitat Loss**

The Project will have an adverse effect on the Railway Wetland near Ōtaki. Approximately 0.5 ha of the 0.8-ha Railway Wetland will be filled to accommodate the Expressway. Based on a field survey, the wetland appears to contain few fish (by species and abundance), and no rare aquatic invertebrate taxa. A wetland condition assessment indicated that the wetland is highly modified and vulnerable to future degradation, independent of Project effects (see Technical Report 11 (Terrestrial Ecology)). Offset mitigation for the loss of the Railway Wetland will take the form of two constructed wetlands of greater area (1.1 ha) as set out in Technical Report 11. Aquatic ecological conditions will be monitored at the constructed wetlands for three years after their completion to ensure that they achieve a level of aquatic ecological value equal to that of established wetlands. The construction of wetlands of greater area than the wetland area lost indicates that the residual negative effect of habitat loss will be less than minor.