APPENDIX H

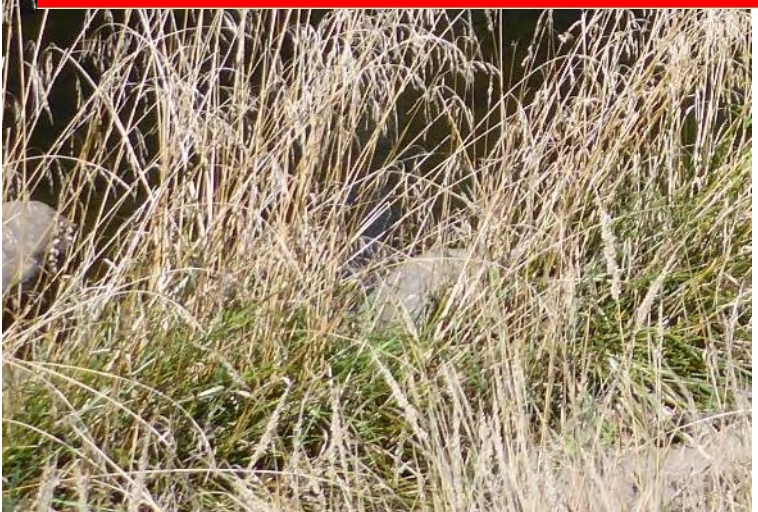
Terrestrial Ecology Assessment of Effects – Ryder Environmental Limited

Trustpower

Motukawa HEPS
Terrestrial Ecology
Assessment of Effects

Note: Since the lodgement of the resource consent applications for the Motukawa Hydro-Electric Power Scheme in November 2021 (being the application to which this technical assessment relates), the proposal by Manawa Energy has been amended to retain the consented maximum water take from the Manganui River as 5.2 m^3/s. The Assessment of Environmental Effects lodged with the resource consent applications has been amended to reflect this change, but the technical assessments associated with the application (including this one) have not been amended. However, all effects on the environment will either be the same or less than previously assessed in the lodged technical assessments.

October 2021



ryder

Trustpower

Motukawa HEPS
Terrestrial Ecology Assessment of Effects

October 2021

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Cover page: Manganui River immediately downstream of Motukawa Intake weir.

Table of Contents

Executive Summary

Trustpower is applying for new resource consents to continue operating the Motukawa Hydroelectric Power Scheme ('the scheme' or 'HEPS') with a proposed increase in the maximum take from the Manganui River, from the currently-consented 5.2 m^3/s to 7.5 m^3/s. This report addresses the actual and potential effects of the scheme on terrestrial ecological values, as currently operated and as proposed under renewed consent conditions.

This report also considers the potential impact of the Motukawa HEPS on the river extent and values of the Manganui River, Waitara River, Mako Stream and Makara Stream in the context of Policy 7 of the National Policy Statement for Freshwater Management 2020 (NPSFM).

The vegetation along the riparian margins of the Manganui River, Waitara River, Mako Stream, Makara Stream, and Lake Ratapiko supports a diversity of indigenous plant species, along with various introduced species. As well as being of value in itself, this vegetation provides important habitat for indigenous and introduced birds, lizards, and invertebrates within a highly-modified landscape dominated by exotic grassland. The vegetated riparian margins contribute to, and provide connectivity with, a wider network of habitat fragments within the region.

Compared with similar vegetation within an entirely terrestrial setting, the riparian margins of these waterways provide additional value because they provide breeding, feeding and/or roosting habitat for various fauna associated with water. The riparian margins also provide habitat for the terrestrial life history stages of some aquatic invertebrates, such as adult damselflies and dragonflies.

The proposed change in maximum take from the Manganui River, and consequent changes in hydrology in downstream waterbodies, have very little scope to affect terrestrial ecological values. This is because:

- The Manganui and Waitara Rivers are single-channel rivers confined between steep banks, and therefore have only very narrow interfaces between the river margin and the riparian vegetation and associated habitat. Almost all of the riparian vegetation and habitat is located well-above the river and well-outside the influence of flow variation caused by the operation of the HEPS.
- Any changes in water level or extent would occur within the context of a century of HEPS operation, natural variation in flow that is much greater than that caused by the HEPS, and wider landscape management practices. The riparian vegetation and habitat are influenced by the presence of water and occurrence of floods, largely unrelated to the operation of the HEPS, but also

strongly reflects surrounding land management practices such as pastoral farming, riparian fencing, planting and weed and pest control.

- At the coast, the slight change in variation in flow would have no effect on coastal bird habitat which is highly dynamic because of tidal influences that are orders of magnitude greater than flow variations arising from hydro generation.
- Conceivably, the availability of aquatic invertebrates and fish that form part of the diet of some birds that forage along the Manganui River could be affected adversely or positively by the proposed change in maximum take. However, any such changes would be highly unlikely to have a significant effect – detrimental or beneficial – on size, range or viability of bird populations along the river.
- Whilst the formation of Lake Ratapiko entailed a loss of terrestrial habitat through inundation, it is likely to have resulted in a net positive effect on terrestrial ecological values, through the development of lakeside vegetation and habitat for terrestrial fauna including waterbirds. These positive effects would continue under the proposed consent conditions.

Given the lack of adverse effects and some potential and likely positive effects on terrestrial ecological values arising from the proposed ongoing operation of the Manganui HEPS, we conclude that Trustpower's proposal is consistent with Policy 7 of the NPSFM, with regard to terrestrial ecological values (in that it would not result in adverse effects on river extent or values related to ecosystem health or indigenous biodiversity values associated with the Manganui River, Waitara River, Mako Stream, or Makara Stream).

1. Introduction

Background

Trustpower is applying for new resource consents to continue operating the Motukawa Hydroelectric Power Scheme ('the scheme' or 'HEPS'). The consent application includes a proposed increase in the maximum take from the Manganui River, from the currently-consented 5.2 m^3/s to 7.5 m^3/s. This report addresses the actual and potential effects of the scheme on terrestrial ecological values. The ongoing effects of the scheme as currently operated and as proposed under renewed consent conditions are assessed.

This report also considers the potential impact of the Motukawa HEPS on the river extent and values of the Manganui River, Waitara River, Mako Stream and Makara Stream whether, with regard to terrestrial ecological values, Trustpower's proposal is consistent with in the context of Policy 7 of the National Policy Statement for Freshwater Management 2020 (NPSFM).

Potentially-affected reaches and waterbodies

With regard to terrestrial ecological values, this assessment considers potential and actual effects at the following surface waters associated with the HEPS.

a) The Manganui River at the intake weir and downstream to its confluence with the Waitara River (24 km).

b) The Motukawa water race from the intake weir to Lake Ratapiko (4.5 km including a 1.1-ha settling pond).

c) Lake Ratapiko (21 ha) including the Ratapiko Dam.

d) Mako Stream, a small outlet stream from Lake Ratapiko.

e) Makara Stream (2.5 km), downstream of the Motukawa Powerhouse and tailrace. Joins the Waitara River.

f) The Waitara River from the confluence of the Makara Stream to the sea (45 km).

Locations of these reaches and key sites are shown in Figure 1.1.

Trustpower also holds resource consent number 6381 to abstract up to 450 L/s from the Mangaotea Stream, which passes under the Motukawa water race, 2.8 km from the intake. Trustpower ceased operating the pump station to abstract this water in March 2018 and does not intend to renew its consent for this take, which expires in June 2022. The hydrological details of the take are discussed in detail in the Hydrology Report prepared by Tonkin and Taylor (2021). Because Trustpower does not propose

to renew its consent to take water from Mangaotea Stream, and the stream flow is now and will continue to be unaffected[1] by the HEPS, it is not considered in this report.

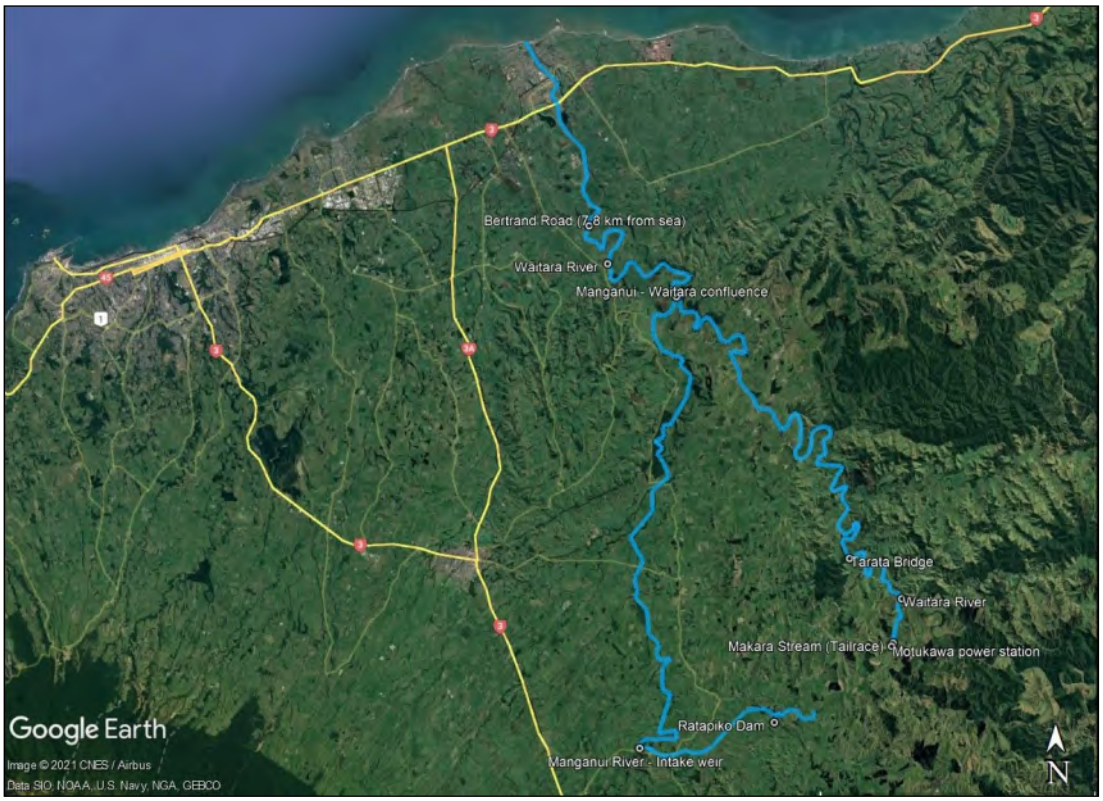

Figure 1.1 Aerial map showing location of structures and surface waters associated with the Motukawa HEPS. (Source: Google Earth).

Ecological context

The HEPS and the above surface waters are located within the Egmont and North Taranaki Ecological Districts in the Egmont and Taranaki Ecological Regions, respectively (McEwen 1987). The Manganui River flows along the eastern edge of the Taranaki ring plain. The Waitara River arises in the eastern hill country and flows through the frontal hill country before being joined by the Manganui River and flowing a further 18 km to the sea at Waitara.

[1] Except in extreme flood events when flow from the Mangaotea Stream floodplain has been observed to enter the race and also spill out of the race at numerous locations, refer to Riley (2019), cited in Tonkin and Taylor (2021).

The climate is generally mild, with relatively high humidity and fairly high, evenly distributed annual rainfall. Soils and underlying geology are varied, and include soils of sandstone, mudstone, limestone and volcanic origin. Slopes and topography within the broader landscape around the potentially affected sites ranges from gently undulating to steep and finely dissected.

Assessment methods

This assessment is informed by site visits and a review of existing information. The potentially affected sites were visited on several occasions between November 2018 and January 2020. Existing information on terrestrial ecological values was obtained from a range of sources, including the scientific literature, district and regional council reports, and various online sources such as bird and plant databases. These are cited where relevant, below.

2. Significant Natural Areas etc.

A number of sites in the vicinity of the potentially affected reaches are recognised for their biodiversity values as one or more of the following.

a) Rural **Significant Natural Areas (SNAs)**, in the Proposed New Plymouth District Plan (PNPDP)[2], which was notified on 23 September 2019. (The Operative District Plan[3] does not identify any SNAs in the vicinity of the above reaches.)

b) **Key Native Ecosystems (KNEs)**, listed in the Taranaki Regional Council's (TRC) inventory of sites with indigenous biodiversity values of regional significance (KNEs, TRC 2006).[4]

c) **Queen Elizabeth II National Trust Covenants** (**QEII covenants**) of sites that private landholders have covenanted to protect their biodiversity values.

d) **Public Conservation Land (PCL),** administered by the Department of Conservation (DOC), including sites with biodiversity values but also sites managed for other purposes such as gravel reserves, local purpose (e.g. cemetery) reserves, marginal strips and historic reserves.

In this section, the biodiversity values of SNAs, KNEs, PCL, and QEII covenants immediately adjacent to, or within approximately 100 metres of the potentially affected reaches are described, as reported in the TRC inventory of KNEs and the PNPDP. Many of the sites identified by one entity overlap or are contiguous with sites identified by other entities. The biodiversity descriptions from TRC and PNPDP are cited in full[5] because, as well as describing the specific sites, these descriptions provide a good indication of the mix of vegetation types present along the margins of the Manganui and Waitara Rivers and the Mako and Makara Streams.

The operative New Plymouth District Plan (ONPDP) lists 'notable trees'. Some of these trees are near the Waitara River but all are well back from the river bank, and, with the exception of one pohutukawa tree, are all introduced species (e.g. English and pin oaks, Japanese cedar, London plane, Norfolk pine). Notable trees are not considered further because of their limited ecological value and because they are too far from the river to be affected by the proposed changes to the Motukawa HEPS.

The OPNDP lists Urban Biodiversity Areas but these are all located in urban New Plymouth; none is present along the potentially-affected above reaches.

[2] Online version of the PNPDP viewed at https://districtplan.npdc.govt.nz/eplan/# on 9 February 2020.
[3] District Plan, Appendix 21 and maps.
[4] Schedule 6, as viewed on https://maps.trc.govt.nz/LocalMapsViewer 9 February 2021
[5] For brevity, headings are removed and replaced with ellipses (…).

PNPDP SNA sites 504 and 505

These sites are located on either side of the Manganui River, 200 m upstream from the intake weir. Schedule 6 of the PNPDP describes site 504 as '*Tawa forest, mahoe-porokaiwhiri forest'* and site 505 as *'Tawa forest with few rimu and kahikatea'.*

Pirinoa KNE

This is also a Private QEII National Trust Covenant (Covenant No. 5-06-390).

The Pirinoa site is located on privately owned land on the true left (western side) of the Manganui River, 4.5 km downstream from the intake weir. In the KNE inventory, it is described as comprising '*a small (1.3 ha) QEII covenanted area of lowland tawa and swamp forest located close to the Manganui River off Ngaro Road. The remnant is loosely connected to other riparian vegetation along the Manganui River and provides greater connectivity to other priority sites in the area such as Tariki Bush, Maketawa Stream Forests and Dravitzki QEII covenants on Salisbury Road …*

The high canopy at Pirinoa is dominated by tawa with occasional kahikatea, rimu and miro. The understory is intact and includes species such as kanono, pigeonwood, mahoe and turepo. Native ferns are well established and include shining spleenwort, sickle spleenwort, hen and chicken fern etc. Green mistletoe (Pirinoa) and swamp maire (both Regionally Distinctive) are present and are notable for this site …

Birds are generally in moderate to low numbers in the area and include kereru, tui, bellbird, fantail, grey warbler, silvereye and morepork. A range of exotic species are also present. Good habitat exists for native reptiles including dense vegetation, epiphytes, loose bark, leaf litter, logs and ground cover. Native notable reptile species may be present such as the goldstripe gecko, forest gecko, striped skink and ornate skink. The habitat will contain a very diverse range of terrestrial invertebrates likely including notable species such as peripatus. A small stream is present which may contain notable native fish species such as banded kokopu.'

Everett Park Scenic Reserve KNE

This is a scenic reserve, administered by DOC. It is located adjacent to the Manganui River on the true left (western) bank from 15 km to 18 km downstream of the intake weir. The Mākara Scenic Reserve (2.9 ha, DOC) is located opposite Everett Park, by Bristol Road. In the TRC KNE inventory, Everett Park is described as '*a large (86.7 ha) remnant of primary kahikatea/tawa forest on relatively flat terrain on the western bank of the Manganui River. This type of forest is now very rare on the Egmont Ring Plain...The canopy of Everett Park is predominantly tawa (*Beilschmedia tawa*), which is up to 12 metres in height. There is also some scattered emergent podocarps over 25 metres in height, principally kahikatea (*Dacrycarpus dacrydioides*). Dominant species in the understorey are wheki (*Dicksonia squarrosa*), soft tree fern (*Cyathea

smithii*),* Alseuosmia macrophylla *and terepo* [sic[6]] *(*Streblus heterophylla*). The ground cover comprises numerous ferns such as hen and chicken fern (*Asplenium bulbiferum*),* Cyclosorus pennigerus [[7]], Blechnum discolor, Lastreopsis hispida *…*

*Notable bird species present in Everett Park include New Zealand pigeon (*Hemiphaga novaeseelandiae*), which is identified as 'Chronically threatened (Gradual Decline)'. Other bird species present include bellbird (*Anthornis melanura*), shining cuckoo (*Chrysococcyx lucidus lucidus*), fantail (*Rhipidura fuliginosa*), kingfisher (*Halcyon sancta vegans [sic]*), tomtit (*Petroica macrocephala*), tui (*Prosthemadera novaeseelandiae*), and grey warbler (*Gerygone igata*).*

Hann Bush & Kahikatea Block KNE

This pair of sites is located near and alongside the outlet stream of Lake Ratapiko, 300 m downstream of the intake to the Motukawa Power Station. The TRC KNE sites are described as comprising *'two QEII covenants (5.48 ha & 6.06 ha) of cutover lowland tawa dominant forest. Both remnants have areas of modification and regeneration from historic or existing exotic forest management. The remnants are of a native forest type (MF7.3: Tawa, pukatea, podocarp forest) that has been greatly reduced in Taranaki. This site has been identified as a priority representative area for management (Top 30% priority ecosystem) and will enhance connectivity between fragmented indigenous habitats in this area …*

The forest canopies of both remnants are dominated by tawa with occasional pukatea, miro, titoki, kahikatea and rewarewa. The understory is intact in the west remnant although more sparse in the east remnant. The understory and ground cover is a mix of pigeonwood, mahoe, coprosma, NZ gloxinia, tree ferns and ground ferns. Climbers and epiphytes are fairly common. Two species of threatened rata are present and are notable for the site …

Native birds present include kereru, tui, silvereye, grey warbler, fantail, kingfisher and morepork will be present. A small stream on the east forest margin may contain notable species such as kokopu species and the longfin eel and freshwater crayfish will be present. There is very good habitat for a range of other notable native species including reptiles and invertebrates.

SNA sites on Waitara River upstream of Bristol Road bridge

SNA sites 403 – 405 are located beside the Tarata cemetery. The PNPDP provides no information on biodiversity values at these sites. Sites 551, 395 and 396 are 3 km upstream of the Bristol Road bridge. Site 551 is described as '*Rewarewa/tawa-(hinau) forest, rewarewa/ponga-mamaku-horoeka treefernland, some gorse shrubland.*' The

[6] Tūrepo
[7] Now *Pneumatopteris pennigera*

Kerekeringa Conservation Area (DOC, 0.4 ha, grass) is located 100 m north of the Tarata Cemetery.

Watson's Hill Bush KNE

This site is located on privately owned land along the true left bank of the Waitara River, off Toe Toe Road, 3.5 km north-west of Tarata, and about halfway between the Motukawa Power Station and the Bristol Road bridge. In the TRC KNE inventory, Watson's Hill Bush is described as '*a 2.9 ha remnant of lowland tawa, kohekohe, rewarewa, hinau, podocarp forest, on short steep slopes descending to the Waitara River. The forest provides good connectivity to nearby wetlands and forest, including the Taramoukou, Tarata and Junction Road Conservation Areas and Fairy Forest KNE…*

The canopy of the bush remnant is dominated by tawa, rewarewa, pukatea, kahikatea, rimu and miro. A variety of native vines and epiphytes are present. The understory is in recovering condition following fencing and contains hangehange, nikau, pate, parataniwha and numerous ground and tree ferns, grasses and herbs. Riparian species can be found on reefs, cliffs and alluvial terraces along the river…

Good forest bird life is present, including kereru, tui, grey warbler, silver-eye, bellbird, fantail and harrier. Also provides good habitat for riverine fauna; kotare, grey duck, paradise shelduck, white faced heron, shag, lamprey, freshwater mussel, longfin eel and Galaxid fish species. Longtailed bats may be present in the Taramokou CA and may use the Waitara River corridor as part of their feeding territories. There is adequate habitat for terrestrial and arboreal reptiles, although no confirmed records to date.'

Jupp Covenant (Bean Dogs Bush) KNE

The Jupp Covenant (Bean Dogs Bush) is located on privately owned land on Otaraoa Road, 2.5 km upstream from the Manganui – Waitara confluence on the true right of the Waitara River. It is adjacent to and/or partly overlaps with PNPDP SNA sites 287 and 289. The DOC-administered Pukerangiora Pa Historic Reserve (forest and pasture) is located 600 m downstream on the true left of the river…

The site is described by TRC as *'a 12 ha remnant of semi-coastal tawa, kohekohe, rewarewa, hinau, podocarp forest on a slope bordered by a small stream on one side and the Waitara river on the other. The forest remnant provides good connectivity to other habitats in the nearby area including the Bushy Park and Mangahewa KNE's … The canopy of the bush remnant is dominated by rewarewa, pukatea, tawa and rimu. A variety of native vines and epiphytes are present. The understory is in reasonable condition and contains mahoe, pigeonwood, hangehange, nikau, pate, parataniwha*

*and numerous ground and tree ferns. The site contains the 'regionally distinctive' fern Deparia (*Deparia petersenii *subsp.* congrua*) …*

Good birdlife is present in the remnant including, kereru, grey warbler, bellbird, tui and fantail. The remnant provides good habitat for native freshwater fish and it is likely that notable species would be present. There is adequate habitat for terrestrial and arboreal reptile species ranging from deep leaf litter, logs on the forest floor, epiphytes in the canopy and abundant foliage. No reptile records are known for the site although reptiles will be present and may include threatened or regionally distinctive species.'

Bushy Park QEII covenants at Ngatimaru Road and KNE

One of four Bushy Park QEII covenants (also KNEs) at Ngatimaru Road is located on private land beside the Waitara River, 1 km downstream of the Manganui – Waitara River confluence. It is contiguous with PCL land along the true right river: the Awa te Take Scenic Reserve (22.7 ha, forest) and the Awa te Take Pa Historic Reserve (4.1 ha), forest.

TRC describes the Bushy Park QEII Covenants as comprising *'four small blocks (block A 3.1ha, block B 2.3ha, block C 1.2ha and block D 1.0ha) that total 7.6ha in size. All four blocks are semi-coastal forest remnants on uplifted marine terrace. In the past stock have had access to the forest remnants however the understory has potential to recover quickly. There are a few unnamed tributaries of the Waiau Stream that flow through the site. The forest remnants also provides good connectivity to other habitats in the nearby area. These remnants are close to Bushy Park KNE ...*

*Flora Bushy Park QEII Covenants consists primarily of tawa (*Beilschmedia tawa*) forest with the canopy including kohekohe (*Dysoxylum spectabile*) and Pukatea (*Laurelia novaezelandiae*). Block A, B and D have large mature trees that form a dense canopy. However the understory is sparse and recovering from stock damage. Blocks A and D are fully fenced. Since stock have been excluded, seedlings are emerging and ferns are starting to cover the forest floor. There is suitable habitat for king fern ('At Risk, Declining') which is present in the nearby Bushy Park KNE. Block A has many native flowering orchids such as* Pterostylis *sp. (greenhood orchid),* Earina mucronata *(bamboo orchid) and* Drymoanthus adversus *...*

*The Bush remnants are reasonably small but provide a good corridor for native forest birds such as tui (*Prosthemadera novaeseelandiae*), grey warbler (*Gerygone igata*) and kereru (*Hemiphaga novaeseelandiae*). There is good habitat for native fish in the unnamed tributaries of the Waiau Stream. The 'At Risk (Declining)' Freshwater crayfish (*Paranephrops planifrons*) are present in block D.'*

SNA 282

This site is located on the true right of the Waitara River on Tikorangi Road West, 4 km downstream of the Manganui – Waitara River confluence. It is contiguous with QEII covenant 5-06-256 and opposite a DOC reserve on the true left of the river. The PNDP describes it as '*(Pukatea)-tawa/porokaiwhiri-mahoe forest, (pukatea)-(kahikatea)/mahoe-kawakawa forest*.'

KNE: Mangahinau Stream Esplanade Reserve

The 9-ha Mangahinau Stream Esplanade Reserve is on the outskirts of Waitara, on the true left of the Waitara River immediately downstream of State Highway 3. Part of the reserve (1.3 ha) is administered by DOC. The Waipapa Road Conservation Area (13.1 ha, lake and forest), also administered by DOC is located 200 m upstream on the true right of the river. The Mangahinau Stream Esplanade Reserve is described in the KNE inventory as '*a small (1.3 ha) wetland strip alongside the lower Mangahinau Stream. This long narrow strip drains into and is part of the tidal reaches of the lower Waitara River just upstream of the confluence of the Mangahinau Stream and the Waitara River. The lower Mangahinau Stream Mouth is modified by flood control works with a residential area on the northern bank of the wetland. This site is a significant spawning habitat for whitebait …*

Vegetation in the Mangahinau Stream Esplanade Reserve includes tidal rushes and introduced grasses, willows (Salicaceae), and other weeds …

The Mangahinau Stream Esplanade Reserve (combined with similar type wetlands in the vicinity) provides one of the most significant habitat for whitebait spawning in the Waitara River.'

The Mangahinau Stream has been a focus for local conservation, cultural, and educational activities involving local schools and DOC, TRC, Otaraua Hapu and Waitara Alive.

KNE: Waitara River Scenic Reserve Ownership: Crown - DOC

The Waitara River Scenic Reserve administered by DOC, is located on the true left of the Waitara River, off Queen Street, and beside the Waitara Boating Club. It is described by TRC as '*part of the Waitara River estuary, located approximately 500 metres upstream from the sea. The wetland site consists of mudflats which support saltmarsh vegetation, whitebait and wading birds ... The Waitara River Scenic Reserve contains saltmarsh vegetation including sea sedge (*Carex litorosa*), which is identified as 'Chronically Threatened (Serious Decline)', and the regionally uncommon saltmarsh ribbonwood (*Plagianthus divaricatus*). Other saltmarsh vegetation includes rushes (*Leptocarpus *species), sedge (*Isolepis nodosa*), raupo (*Typha orientalis*), flax*

*(*Phormium tenax*), taupata (*Coprosma petiolata*), and cabbage trees (*Cordyline australis*) ...*

*The wetland is a whitebait congregating and spawning area. It also provides a habitat for many wading birds, including occasional royal spoonbills (*Platalea regia*) and white faced heron (*Ardea novaehollandiae novaehollandiae*).'*

3. Description of the existing environment

Manganui River at and downstream of the intake weir

The Manganui River is a narrow, single channel river, typically 10-m to 30-m wide in the reaches downstream of the intake weir (Figure 3.1 & Figure 3.2), set within a channel of 30-m to 100-m width. From the intake weir, it flows for 24 km before joining with the Waitara River, which then flows a further 18 km to the sea at Waitara. The banks of the Manganui River are frequently very steep and densely-vegetated, and river usually occupies most of the incised channel; that is, only small areas of exposed substrate (typically cobbles and boulders) are present. More photographs of the river can be found in the aquatic ecology report (Ryder 2021).

The vegetation in the wider landscape along the Manganui River is typical of the Taranaki ring plain, comprising predominantly developed pasture with numerous patches of introduced and/or indigenous scrub and forest. Under the Land Environments New Zealand (LENZ) classification system (Leathwick *et al.* 2002) almost all of the landscape through which the Manganui River flows is classified as retaining less than 10% of its original indigenous vegetation (i.e. tawa, kohekohe, rewarewa, hinau, podocarp forest)[8].

From the intake weir, downstream for 25 km, the steep banks of the Manganui River are heavily-vegetated with a mixture of indigenous and introduced vegetation, set mainly within developed agricultural landscape dominated by exotic pasture, rough pasture and introduced shrubs and trees. As detailed in Section 2, several KNEs and SNAs are located adjacent to this reach of the Manganui River, namely SNAs 504 and 505 and the Pirinoa and Everett Park Scenic Reserve KNEs. Common indigenous plant species include tawa, makomako, kanono, mahoe, hangehange, pate, ti, mamaku, wheki, soft tree fern, flax, toetoe, kiokio and various other ferns. Rimu, kahikatea, totara and miro are present in places. Numerous exotic species, typical of NZ agricultural landscapes, are present, such as sycamore, pines, macrocarpas, willows, poplars, gorse, blackberry, and a diversity of introduced grasses and herbs.

[8] Viewed 10 February 2021 at https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Habitats/lenz_tec

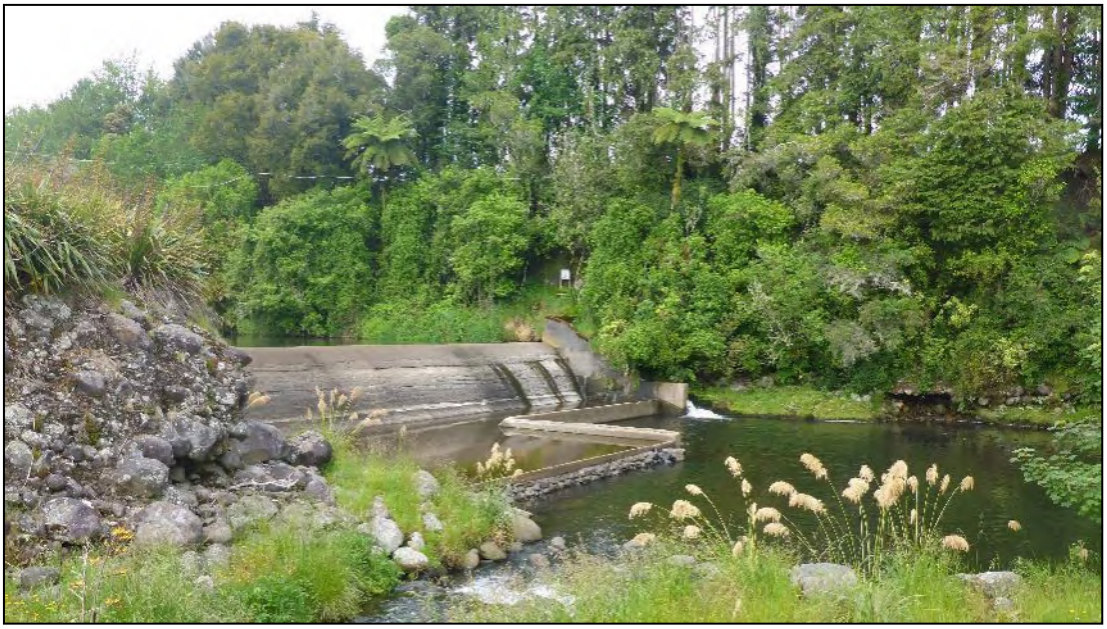

Figure 3.1. Mixture of exotic and indigenous vegetation types at the Motukawa HEPS intake weir on the Manganui River.

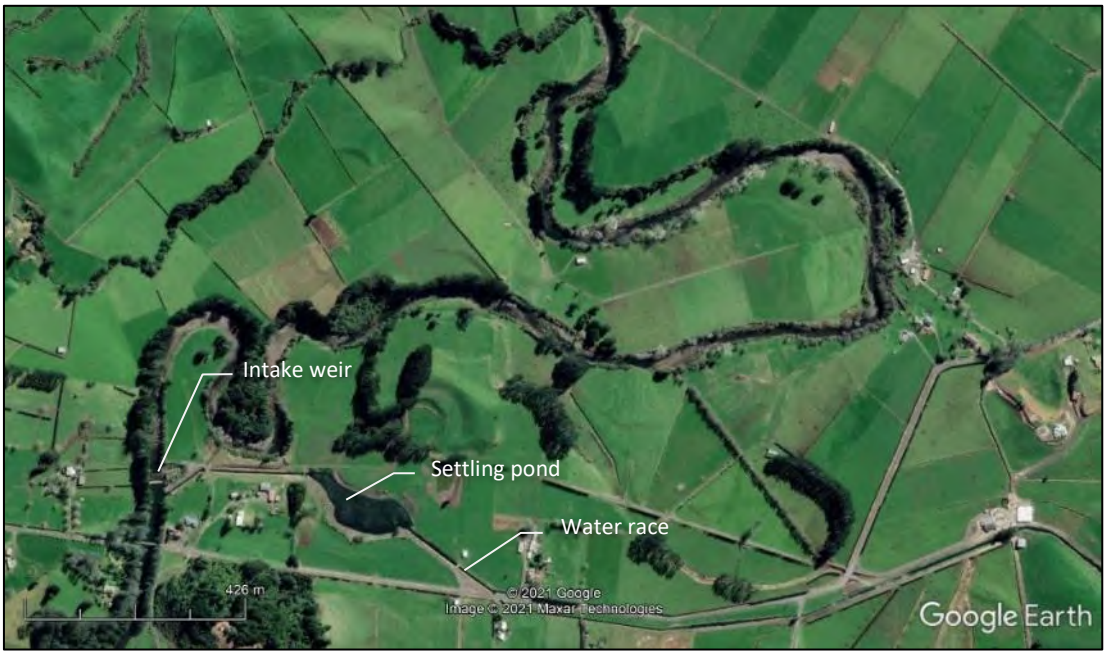

Figure 3.2 Aerial view of landcover in the vicinity of the Motukawa intake weir on the Manganui River, the Motukawa water race, and settling pond.

The race from the intake weir to Lake Ratapiko

The vegetation along the race (Figure 3.3) and around the settling pond (Figure 3.4) consists of flat to gently rolling pasture and cropland, with a few small patches of exotic trees (esp. willows), as shown in Figure 3.4 & Figure 3.3. Native plants such as flaxes, toe toe, sedges, rushes, and swamp kiokio are present as scattered individuals

at various places along the margins of the race and settling pond. The vegetated margins of the race and settling pond provide some habitat and foraging opportunities for water birds, lizards, and terrestrial invertebrates (including terrestrial life stages of invertebrates with aquatic larvae, such as damselflies and dragonflies).

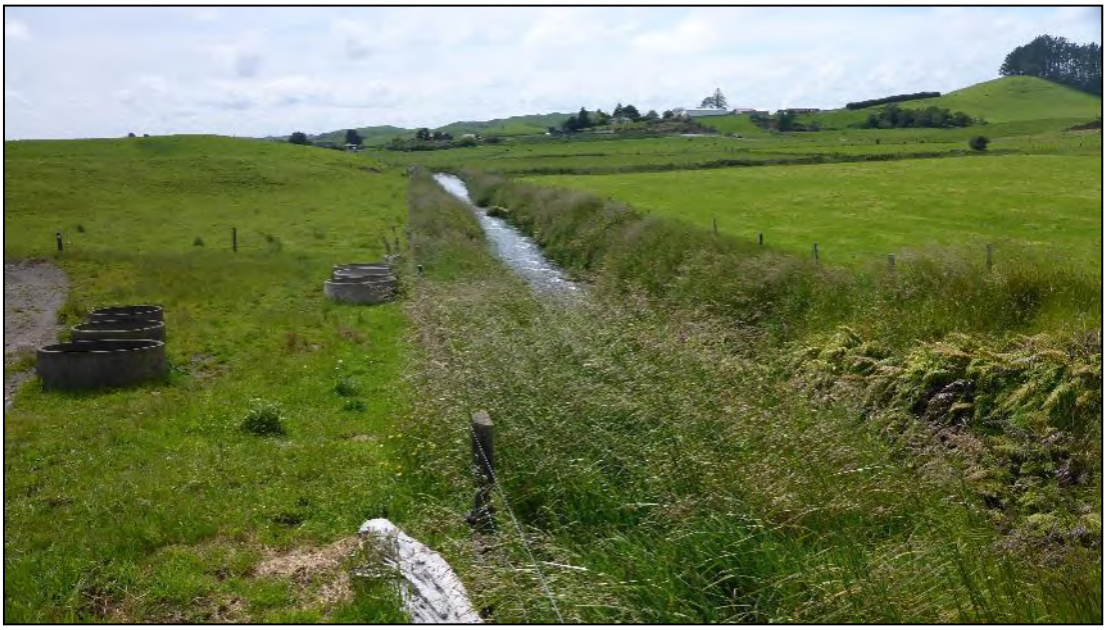

Figure 3.3. Motukawa race, between intake and Lake Ratapiko.

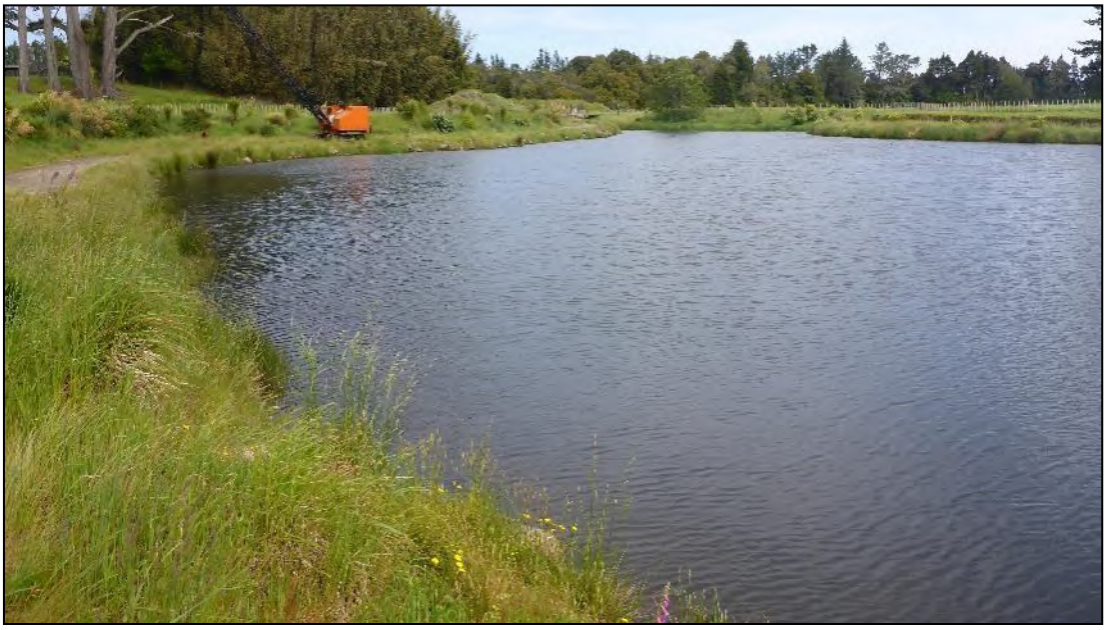

Figure 3.4. Settling pond, located 300 m – 500 m down the water race from the Motukawa intake.

Lake Ratapiko including the dam

Lake Ratapiko (Figure 3.5 &Figure 3.6) is a shallow (average depth 2.5 m), 26-ha[9] lake formed by the construction of a dam at the Mako Stream outlet in the early 1920s as a hydro-storage reservoir as part of the Motukawa HEPS, which was commissioned in 1927. The lake is a popular water-skiing and jet boating site. Fishing and canoeing are also popular activities at the lake (Greenaway 2021). Fish and Game have previously released trout to the lake to compensate for a natural lack of trout spawning habitat (Ryder 2021).

Trustpower is required to maintain a minimum normal operating lake level of Relative Level (RL) 194 m, except during periods of maintenance on aquatic habitat (aquatic weed control) when the lake level can be temporarily lowered. This is typically carried out at the end of summer in April. The consented maximum normal operating lake level is RL 198.7 m. Lake levels generally fluctuate within a 2-m operating range 80% of the time (between RL 196.5 m and RL 198.5 m). The lowest lake levels typically occur in spring (mean RL 197 m) and the highest in summer (mean RL 198.3 m) (Tonkin and Taylor 2021; Ryder 2021).

Lake Ratapiko is set within developed farmland, dominated by pasture and cropland. A narrow strip, typically <10-m, but up to 25-m wide, around much of the lake is lined with willow and poplars. Native vegetation is also present in places, notably on steep banks on the northern arm of the lake, on the small island in the lake, and as areas of native plantings around the boat ramp, jetties and boat club site. Native plants such as NZ flax, toe toe, and various sedges, rushes and ferns are also present around the lake margins.

The lake provides habitat for various species of indigenous and introduced water birds such as welcome swallow, NZ scaup, black swan, paradise shelduck, Australasian shoveler, black shag, little shag, grey teal, grey duck, sacred kingfisher, pukeko, Canada goose*[10], mallard*. Various species of open country and forest/forest-edge/scrub are also found in the immediate vicinity of the lake, e.g. bellbird, grey warbler, kereru, tui, NZ fantail, silvereye, chaffinch*, common myna*, Eurasian blackbird*, European goldfinch*, European starling*, Eastern rosella*, house sparrow*, magpie*, song thrush*. There have been occasional records of white heron and royal spoonbill at the lake.

[9] Area at consented maximum: RL 198.70 m.
[10] * Indicates introduced species.

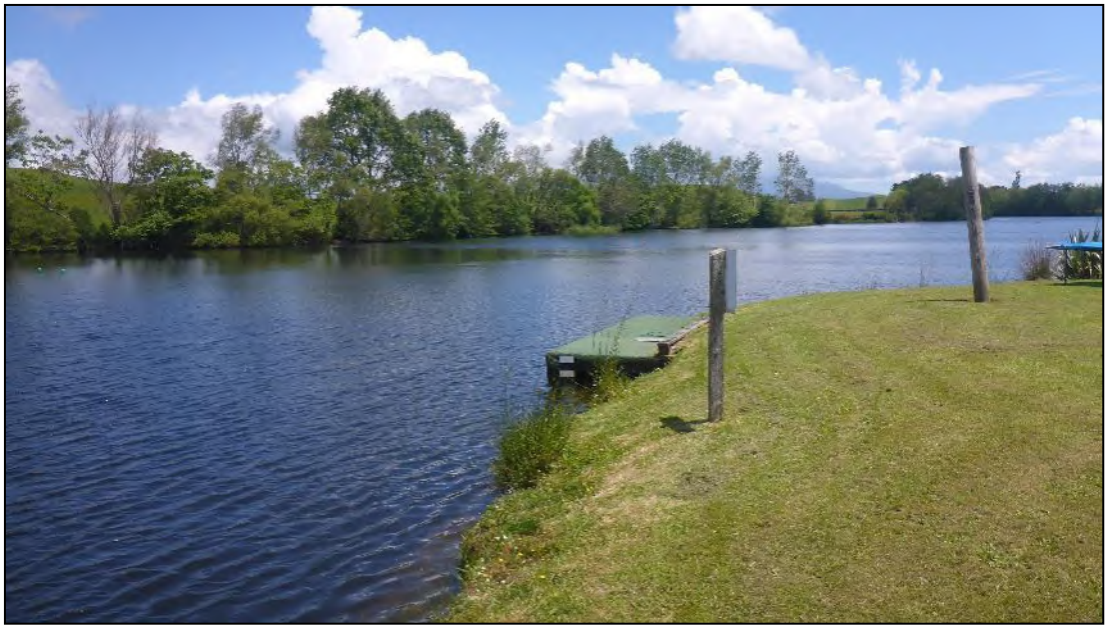

Figure 3.5. Lake Ratapiko, viewed from the grounds of the New Plymouth water-skiing club.

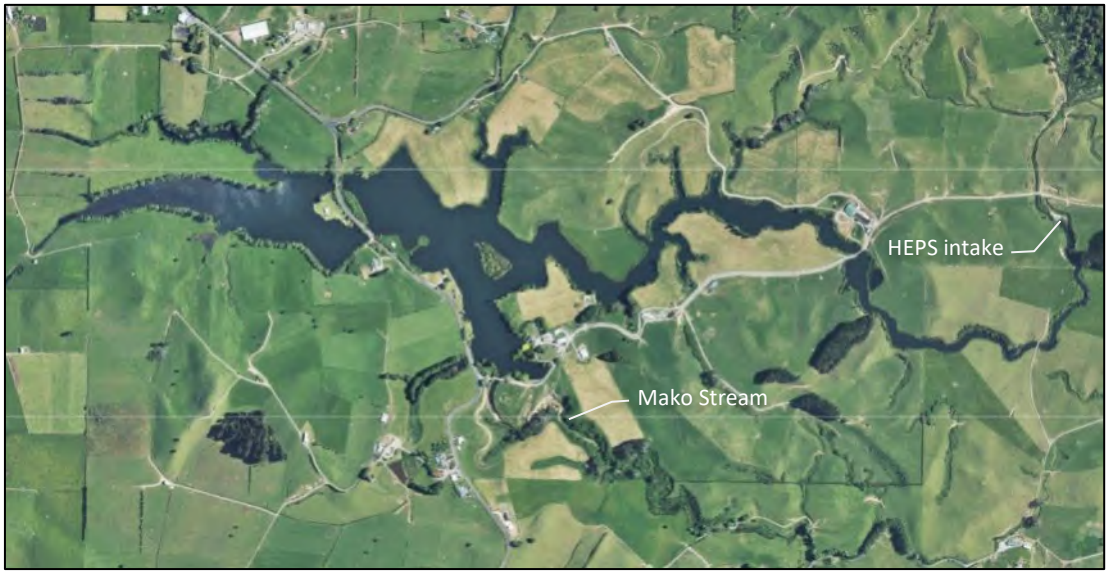

Figure 3.6. Aerial view of Lake Ratapiko (source: TRC local maps).

Mako Stream

Mako Stream (Figure 3.7) is the small outlet stream on the southern side of Lake Ratapiko that was dammed to form the lake. Water seepage from the dam flows into the upper reaches of the stream (Figure 3.7). From there, Mako Stream flows through a deeply incised, winding channel, joining with various other small tributaries and flowing into the Makara Stream, and in turn the Makino Stream, to eventually join the Waitara River, 8 km upstream of the Motukawa Power Station. The stream margins and the steep banks of its wider channel are densely vegetated with a mix of

native and exotic species (including some plantation forestry), set within developed farmland.

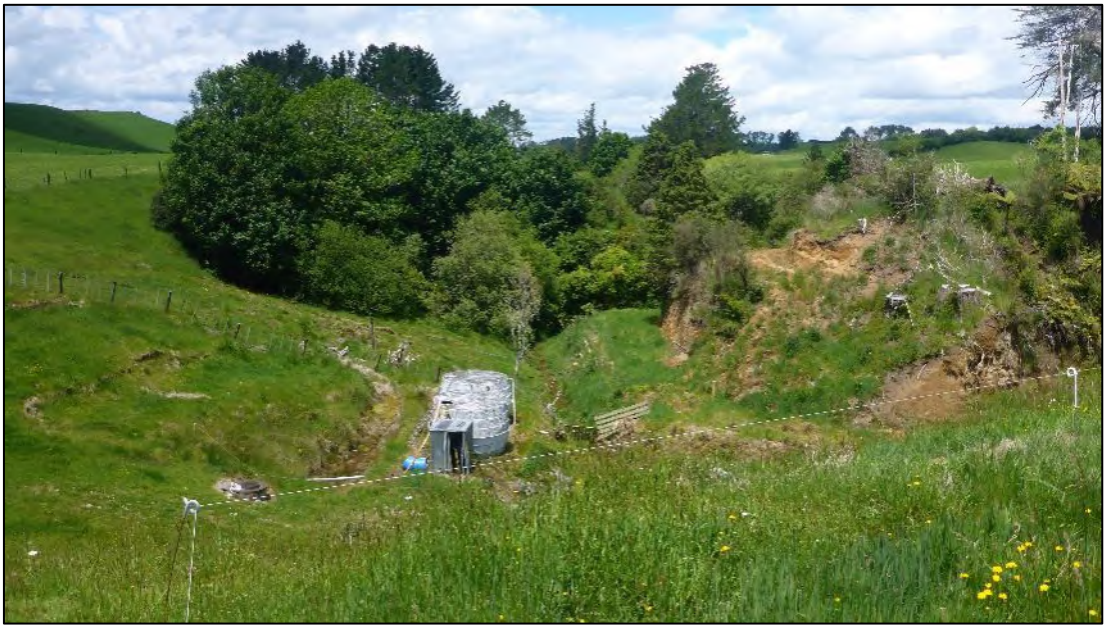

Figure 3.7. Mako Stream.

Makara Stream, downstream of the Motukawa Powerhouse and tailrace

Water from Lake Ratapiko is carried via a tunnel and penstock to the Motukawa powerhouse. The tailrace discharges into the Makara Stream (Figure 3.8), which flows 2.5 km to join the Waitara River. The margins of Makara Stream, like Mako Stream, are also fairly heavily vegetated with a mix of native and exotic species.

Figure 3.8. Makara Stream downstream of the Motukawa powerhouse.

Waitara River from the confluence of the Makara Stream to the sea

The Waitara River (Figure 3.9 & Figure 3.10) flows through steeper country in the vicinity of the Motukawa Power Station, before gradually widening and being joined by the Manganui River, 27 km downstream of the Motukawa Power Station, then flowing a further 18 km to the sea at Waitara.

The vegetation in the wider landscape along the Waitara River at and downstream of the Motukawa Power Station is typical of the Taranaki ring plain and frontal and eastern hill country, comprising predominantly developed pasture with numerous patches of introduced and/or indigenous scrub and forest.

Under the Land Environments New Zealand (LENZ) classification system (Leathwick *et al.* 2002) almost all of the landscape through which the Waitara River flows is classified as retaining less than 10% of its original indigenous vegetation (i.e. tawa, kohekohe, rewarewa, hinau, podocarp forest)[11]. In the vicinity of the Motukawa Power Station, exotic grassland dominates, although up to 30% or more of the original indigenous cover remains over the wider landscape in the mid and upper reaches of the river. The margins of the Waitara River downstream of the Power Station are more developed than the wider landscape, and typically retain <10% of original cover.

The Waitara River mouth and adjacent coast provides habitat for a diversity of coastal and other birds and is identified as a 'coastal bird feeding and nesting area' as are all other major river mouths in Taranaki. At least 44 land and water bird species have been recorded in the vicinity of the mouth[12].

[11] Viewed 10 February 2021 at https://ourenvironment.scinfo.org.nz/maps-and-tools/app/Habitats/lenz_tec
[12] E.g. as listed on the NZ ebird website: Waitara--mouth, New Plymouth District County, TKI, NZ - eBird Hotspot

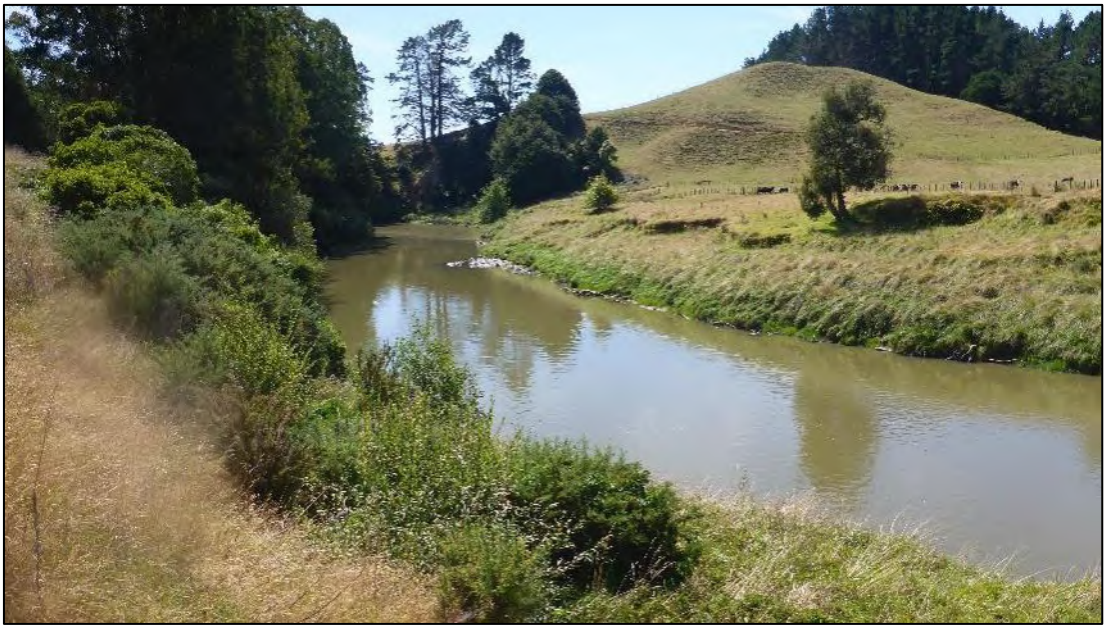

Figure 3.9. Waitara River from Motukawa Road.

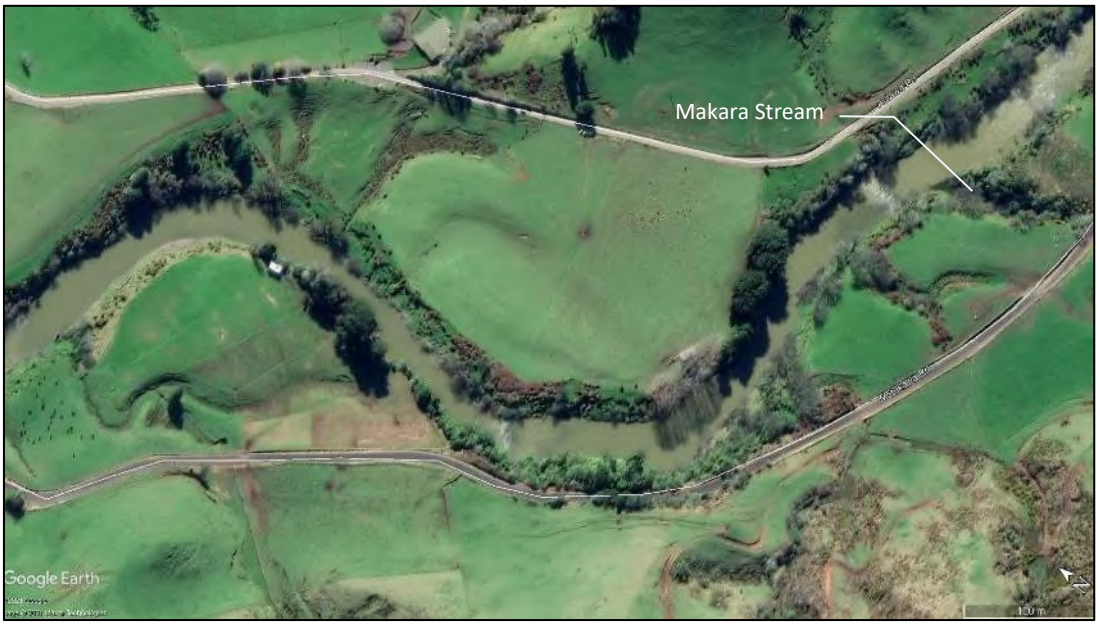

Figure 3.10. Aerial view of Waitara River immediately downstream of Makara Stream Flow is right to left. (Image source: Google Earth).

4. Assessment of effects

Summary of terrestrial values

The vegetation along the riparian margins of the Manganui River, Waitara River, Mako Stream, Makara Stream, and Lake Ratapiko supports a diversity of indigenous plant species, along with various introduced species. As well as being of value in itself, this vegetation provides important habitat for indigenous and introduced birds, lizards, and invertebrates within a highly-modified landscape dominated by exotic grassland. The vegetated riparian margins contribute to, and provide connectivity with, a wider network of habitat fragments within the region. As discussed above, some of the more substantial and/or more intact stands of vegetation are recognised as SNAs, KNEs, QEII covenants, and/or DOC conservation areas or reserves.

Compared with similar vegetation within an entirely terrestrial setting, the riparian margins of these waterways provide additional value because it provides breeding, feeding and/or roosting habitat for various fauna associated with water. For example, for birds that feed over or in the water, such as kingfisher, fantails, and various waterfowl, gulls, terns and wading birds, or birds that breed near water such as waterfowl and shags. Similarly, riparian margins provide habitat for the terrestrial life history stages of some aquatic invertebrates, such as adult damselflies and dragonflies.

HEPS infrastructure

The construction of the physical HEPS infrastructure, including roading, parking and outbuildings, required the permanent removal of some terrestrial vegetation and habitat for terrestrial fauna at the locations of the intake, race, settling pond, Ratapiko Dam, and Motukawa Power Station. In the overall context of the scheme, the ongoing presence of these various structures has negligible ecological effect because the effects are localised within small areas, and/or the adjacent vegetation and habitat at each location, and thus the likely vegetation if the structures did not exist, does not have high ecological value.

Hydrological changes

Trustpower proposes to increase the maximum take from the Manganui River, from the currently-consented 5.2 m^3/s to 7.5 m^3/s. The predicted hydrological changes arising from this proposed change in water abstraction into the scheme are described in detail in the hydrology report (Tonkin and Taylor 2021), and summarised in Table 1, below.

Table 1. Summary of hydrological changes predicted to arise from Trustpower's proposal to increase the capacity of the Motukawa Race to 7.5 m^3/s from 5.2 m^3/s. This is Table 6.2 from the hydrology report prepared by Tonkin and Taylor (2021).

Location	Catchment area	Predicted hydrological changes relative to current operation
Manganui River below diversion weir (node c.)	80 km^2	Mean flow in the residual river reduced by 0.51 m^3/s (about 7.5% of the mean inflow), with the greatest reduction over the wetter months May to September. More sustained periods at or close to the minimum flow (typically around 0.45 m^3/s) can be expected.
Manganui River at Everett Park (node d.)	282 km^2	The changes above will propagate to the confluence with the Waitara River. However, the relative change in the lower reaches of the Manganui, such as at this flow recording site, is expected to be minimal. For example, the greatest monthly mean flow reduction of 0.86 m^3/s (for the month of August) represents 3.5% of the current mean flow at Everett Park
Motukawa Race (S1) (node k.)	N/A	Mean diverted flow from the Manganui River increased by 0.51 m^3/s, with the greatest increase occurring over the wetter months May to September
Lake Ratapiko (node j.)	12.4 km^2	Trustpower will re-optimise its operation of the Scheme to use the higher river intake capacity to increase generation throughflow and minimise spill at Ratapiko Dam. Modelling shows that it is possible to keep spill at current low levels. However, lake levels may need to be held at lower levels than historically (but still some 3 m above the consented minimum) from April/May to September/ October.
Motukawa Power Station discharge (node l.)	N/A	Mean generation flow will increase by 0.55 m^3/s, with the period May to September experiencing larger increases. It is likely that the station will generate at or close to capacity for more sustained periods (i.e., potentially reduced diurnal cycling) over the wetter months
Makino Stream above Waitara confluence (node g.)	126 km^2	As noted for Lake Ratapiko above, spill flow is not expected to increase with the increased diversion capacity. Spill at Ratapiko Dam, which is relatively minor, enters the Mako Stream which becomes the Makino Stream. The Makino Stream joins the Waitara River upstream of the outflow from the Power Station
Waitara River at Tarata (node h.)	701 km^2	The changes in the Power Station discharge are comparatively minor on the main stem of the Waitara River. For example, the maximum generation increase of 0.85 m^3/s for the month of June represents less than 2% of the river mean flow at this recording site
Waitara River at Bertrand Road (node i.)	1113 km^2	At this flow recording site in the lower Waitara River, changes from the increased take capacity are further "diluted". The increase in generation flow will be offset to a degree by the reduction in the Manganui River flow. These perturbations are very minor compared with the magnitude of the river flow (mean flow of 55 m^3/s)

In general, changes in flow have the potential to directly affect the terrestrial ecological values of rivers and lakes through two main mechanisms:

a) **Varial zones**. Fluctuations in water level and thus in the extent of the wetted edges results in a 'varial zone' at the water's edge that is inundated at varying

frequencies[13] (Hoyle *et al*. 2016). At one extreme, confined waterways with steep banks and stable flows, such as canals, typically have a clear delineation between the terrestrial and aquatic ecosystem, with only a very narrow varial zone (in the order centimetres to tens of centimetres wide). Conversely, unconfined waterways with low-gradient channel water edges and variable flows, such as the expansive braided gravel rivers of the South Island can have wide varial zones (metres to tens of metres wide). Similarly, ecological communities at lake margins will transition from permanently submerged aquatic communities through a varial zone of emergent/periodically inundated communities, through to entirely terrestrial communities (Johnson 1972; de Winton and Schwarz, 2004). Plants and animals within the varial zone need to be able to cope with varying environmental conditions, especially frequent wetting and drying. This may give rise to relatively low ecological diversity (e.g. along active gravel river margins), but may also result in specialised ecological communities, such as lake edge turfs (Johnson and Rogers, 2003).

b) **Floods**. Floods (a more extreme manifestation of flow variation) can affect the substrates and thus the vegetation and habitat within the riparian margins of rivers, more intensely and beyond the normal extent of the varial zone. Large floods in particular can have dramatic short-term effects by mobilising substrates and removing vegetation/habitat, in some cases profoundly altering river geomorphology.

Indirectly, changes in flow may affect terrestrial values by affecting the species composition and/or abundance of aquatic invertebrates and fish that provide prey for birds that feed in or over water (O'Donnell *et al*. 2016).

Manganui River

Increasing the maximum take from 5.2 m^3/s to 7.5 m^3/s of water would reduce flow in the Manganui River, from the intake weir downstream to its confluence with the Waitara River, by 0.51 m^3/s on average. This is about 7.5% of the mean inflow (Tonkin and Taylor 2021 and Table 1, above), although the relative magnitude of this effect reduces with distance downstream as tributaries join the main river. The greatest reduction would occur over the wetter months of May to September. More sustained periods at or close to the minimum flow (typically around 0.45 m^3/s) are predicted. These reductions in average flows would result in slight increase in the area of non-wetted river channel, which typically comprises cobbles and boulders. The nature of the exposed substrates and vegetation within the river channel can be seen in Figure

[13] https://niwa.co.nz/freshwater-and-estuaries/research-projects/braided-river-morphodynamics-and-invasive-exotic-vegetation

3.1, above, and in Figures 4.1 to 4.10 in the aquatic ecology assessment (Ryder 2021), which present a series of photographs taken in February 2021 when flow in the river was approximately 470 L/s.

However, the slight reduction in average wetted channel width would have nil or negligible effect on the river's varial zone or associated terrestrial riparian vegetation for several reasons. Existing flow disturbance of terrestrial margins would be essentially unchanged; flow would continue to fluctuate over its full range and floods would continue to pass down the river almost unaltered. The exposed substrates within the river channel consist mainly of cobbles and boulders, which are generally unsuitable for vegetation or as foraging habitat for birds; the riparian vegetation between the river and surrounding farmland is mostly located on steep banks well-above the level of the river bed and the potentially-affected water edge.

The river and its margins provide habitat for birds, some of which feed, at times, on or over the river channel (e.g. kingfisher, various waterfowl, shags, gulls, wading birds, fantails, welcome swallow). Prey items includes aquatic invertebrates and fish. Potential effects on these are considered in the aquatic ecology assessment (Ryder 2021).

In the aquatic ecology assessment, Ryder (2021) state that the '*abstraction of water from the Manganui River (and the associated increases in water temperature) could potentially have adverse effects on macroinvertebrate communities downstream of the Motukawa HEPS take'.* To minimise the potential risk of adverse effects on macroinvertebrate community health, and in accordance with the effects management hierarchy that applies to considering effects on river extent and values in the NPS-FM (2020), Trustpower proposes a temporary reduction in take if water temperatures at a site located 2.3 km downstream of the Motukawa intake weir exceed 25°C. Methods for monitoring water temperature and implementing this reduction are described in the aquatic ecology assessment (Ryder 2021). Ryder (2021) concludes that *'this minimisation measure will ensure that the adverse effects from the abstraction of water from the Manganui River on water temperatures downstream (as a component of the ecosystem health value under the NPSFM) are no more than minor'*.

With regard to fish, (Ryder 2021) state that*:*

> *'for most native fish species there is an increase in the amount of available habitat under the Motukawa HEPS flow regime* [400 L/s] *relative to natural low flow conditions* [1180 L/s] *(i.e. the MALF upstream of the intake). This includes: Cran's bully, inanga feeding, lamprey, shortjaw kokopu, redfin bully and small shortfin eels*

> *(<300 mm), which are predicted to have increases in habitat ranging from 15 to 54% (Table 4.6)* [14]*.*
>
> *There is a moderate decline in habitat for large shortfin eels (>300 mm) and small longfin eels (<300 mm), ranging from 18 to 26%. The largest declines are for torrentfish (79%), as they prefer high water velocities. For brown trout and food resources there are declines in habitat ranging from 36 to 70% (Table 4.6). Predictions of habitat loss represent somewhat of a worst-case scenario. Flows increase downstream in the river as tributaries enter, and for approximately 33% of the time downstream flows are greater than those expected under natural low flow conditions (Tonkin and Taylor 2021).*

To minimise the potential for adverse effects on fish habitat, and in accordance with the effects management hierarchy that applies to considering effects on river extent and values in the NPS-FM (2020), Trustpower proposes that artificial freshes are provided following periods of low flow, as detailed in the aquatic ecology assessment (Ryder 2021) and AEE. Ryder (2021) conclude that this measure, combined with the proposed temporary reduction in take if water temperatures downstream exceed 25°C, discussed above, *'will ensure that potential risk of adverse effects on fish habitat occurring due to the abstraction of water from the Manganui River is no more than minor'.*

On the basis of Ryder's (2021) assessment of 'no more than minor' effects on aquatic invertebrates and fish, we conclude that potential adverse effects on bird communities along the Manganui River would be very small or negligible. It is possible that birds could benefit from the proposal if the predicted increase in suitable habitat for some fish species results in increased prey availability for birds. Regardless, any such small increases or decreases in food availability for birds are unlikely to affect bird communities, given that the confined nature of the river means that it provides relatively little aquatic habitat for birds, and that a range of other terrestrial and aquatic foraging habitats are available for birds in the wider landscape.

Intake, race and settling pond

The vegetated margins of the Motukawa Race and settling pond support some native plants and provide some habitat and foraging opportunities for water birds, lizards, and terrestrial invertebrates (Figures 3.3 and 3.4). Under the proposal, the race would carry 0.51 m^3/s more water on average, but changes in race water level and velocity would be small and would not materially affect vegetation or habitat along the race or settling pond margins. Ongoing operation of the water race and settling pond

[14] Table numbers refer to tables in the aquatic ecology report (Ryder 2021).

would therefore have no ecological effects on the flora and fauna of the riparian margins of the race and settling pond.

Lake Ratapiko

The formation of Lake Ratapiko resulted in the inundation of 21 ha of terrestrial vegetation and habitat, and the concurrent creation of the same area of aquatic habitat. We are aware of no specific information about the land use or vegetative cover prior to formation of the lake. However, given the history of early agricultural development of Taranaki, it seems likely that construction of the dam resulted in inundation of farmland (pasture) and perhaps some remnant or regenerating native vegetation.

Lake Ratapiko is managed as a reservoir for hydroelectric power generation and provides a valuable resource for recreation. The current vegetation and habitat of the lake and environs is a product of this management. As noted above, the lake and the narrow strip of vegetation around the lake provide some habitat for introduced and indigenous plants and animals, including waterfowl.

Trustpower is required to maintain a minimum lake level of RL 194 m, except during periods of maintenance (throughout the entire scheme) and for some aquatic habitat maintenance (aquatic weed control) when the lake level can be temporarily lowered. This typically occurs over 7 to 10 days during early April. Weed control is primarily undertaken for the purposes of allowing recreational boating and water-skiing activities and to protect the hydro machinery. Lake lowering also allows maintenance to be undertaken within the race upstream of the lake (lowering water level in the lake being necessary to lower the water level in the race).

During periods of drawdown, the exposed substrates at Lake Ratapiko will almost certainly provide temporary, abundant food sources for water birds (and other birds), which will congregate and feed opportunistically on aquatic and benthic invertebrates and fish. This is commonly observed in New Zealand and internationally when lakes and reservoirs are lowered and can provide some short-term benefit to birds (Sanders 1999).

Daily ramping of generation results in a daily fluctuation in lake levels of, typically, between 0.25 m and 0.4 m (Tonkin and Taylor 2021). Outside summer, there is sometimes also a weekly ramping cycle with an amplitude of 1.5 m to 2.0 m. Under the proposal, Tonkin and Taylor predict that diurnal lake level variations will differ slightly from current operation. These slight changes would not affect terrestrial vegetation or birds, which are adapted to the existing pattern of lake level variation.

Overall, the creation of Lake Ratapiko has likely resulted in a net positive effect on terrestrial ecological values, through the development of lakeside vegetation and habitat for terrestrial fauna including waterbirds. These positive effects would continue under the proposed consent conditions.

Mako Stream

The flow in the upper reaches of Mako Stream would have been reduced following the construction of the dam in the early 1920s. However, the riparian vegetation along Mako Stream appears to mainly reflect the fact that its banks are too steep to have been converted to pasture, rather than any changes in flow related to the formation of Lake Ratapiko. The proposed change in take would not affect this situation, and the ecological values associated with the stream would be unaffected.

Makara Stream, downstream of the Motukawa Powerhouse and tailrace

Flow within the Makara Stream varies widely with discharge from the Motukawa Power Station (Tonkin and Taylor 2021). The stream margins support a diversity of riparian vegetation that also provides habitat for introduced and indigenous fauna. Tonkin and Taylor (2021) predict that the proposal would result in an average increase in discharge of 0.55 m^3/s, with May to October experiencing larger increases (0.52 – 0.81 m^3/s) than November to April (0.18 – 0.64 m^3/s). Tonkin and Taylor (2021) note that '*it is likely that MTK will generate at or close to capacity for more sustained periods (i.e. potentially reduced diurnal cycling) especially over the wetter months*'. In other words, increased and sustained generation may result in reduced flow variability in the Makara Stream.

In the absence of the Motukawa HEPS, Makara Stream would have a smaller, more stable flow and a narrower 'varial zone' (defined above) than it currently has, although the stream would have still experienced a wide range of flows during freshes and floods. The existing riparian vegetation types would probably have extended slightly further down the banks toward the stream. However, any such effects of the current operation of the HEPS are of little ecological consequence, given the small interface between the stream and riparian vegetation; most of the band of riparian vegetation between the stream and surrounding pasture grows well up the stream banks, away from the direct influence of flow. For the same reasons, the proposed changes would not affect the terrestrial ecological values along the margins of the Makara Stream.

Waitara River

Operation of the Motukawa Power Station results in (usually) diurnal variation in generation flow and thus downstream changes in flow and river level in the Waitara River, as described in detail in the hydrology assessment (Tonkin and Taylor 2021), which describes Waitara River water level fluctuations at Tarata as '*typically up to 0.15 m during higher baseflows (e.g. in the winter months) and up to around 0.25 m under low flow conditions'* and, at Bertrand Road, as '*generally around 0.8 m to 0.12 m*'. Flood flows remain essentially unaffected, as can be seen in hydrographs presented in the hydrology assessment, and variation in flow attenuates with distance downstream (Tonkin and Taylor 2021).

Although no changes are proposed to the discharge consent conditions, the hydrological changes predicted for the Motukawa Power Station discharge (node l in Table 1, above) would propagate downstream in the Waitara River from Makara Stream to the confluence with the Manganui River. Tonkin and Taylor (2021) note that '*The changes in the Power Station discharge are comparatively minor on the main stem of the Waitara River. For example, the maximum generation increase of 0.85 m^3/s for the month of June represents less than 2% of the river mean flow at this recording site* [Tarata, 4 km downstream of the station discharge].*'*

Tonkin and Taylor (2021) go on to note that changes in the Waitara River resulting from the increased Motukawa Race capacity would be further 'diluted' with distance downstream of the power station discharge as a result of tributary inflows, such that, downstream of the confluence with the Manganui River, the small increase in the Waitara River flow would be *'offset to a degree by the reduction in the Manganui River flow.'* At Bertrand Road, 7.8 km from the sea, Tonkin and Taylor (2021) describe the perturbations in flow as *'very minor compared with the magnitude of the river flow (mean flow around 55 m^3/s)'*. At the coast, any remaining change in variation in flow would have no effect on coastal bird habitat which is highly dynamic because of tidal influences that are orders of magnitude greater than flow variations arising from hydro generation.

It is possible that the additional variation in water levels along the Waitara River arising from hydroelectric generation since 1927 have influenced the type and extent of vegetation in the immediate vicinity of the water's edge along the Waitara River. However, any such effects would be very small in extent and of no consequence to the riparian ecological communities, particularly given that a) natural flow variation is far greater that the variation arising from the power station operation, and b) most riparian vegetation is located up steep banks and well-above the immediate water's edge.

Significant sites, KNEs etc.

The various significant sites identified earlier in this report are either entirely or almost entirely, located outside the immediate varial zones, and are therefore entirely or almost entirely unaffected by flow. Instead, the vegetation and habitat within the broader riparian margins is most strongly affected by surrounding land management practices. In particular, there appears to be a general improvement in the terrestrial ecological values along waterways as a result of riparian fencing to exclude stock, combined with active revegetation efforts, and, in some places, formal protection as mentioned above. Despite their proximity to the water, the riparian margins of the above sites are essentially terrestrial ecosystems and are therefore almost entirely unaffected by flow in the Manganui and Waitara Rivers.

5. Conclusion

The proposed change in maximum take from the Manganui River, and consequent changes in hydrology in downstream waterbodies, have very little scope to affect terrestrial ecological values. In summary, this is because:

- The Manganui and Waitara Rivers are single-channel rivers confined between steep banks, and therefore have only very narrow interfaces between the river margin and the riparian vegetation and associated habitat. Almost all of the riparian vegetation and habitat is located well-above the river and well-outside the influence of flow variation caused by the operation of the HEPS.
- Any changes in water level or extent occur within the context of a century of HEPS operation, natural variation in flow much greater than that caused by the HEPS, and wider landscape management practices. The riparian vegetation and habitat are influenced by the presence of water and occurrence of floods (largely unrelated to the operation of the HEPS), but also strongly reflects surrounding land management practices such as pastoral farming, riparian fencing, planting and weed and pest control.
- At the coast, the slight change in variation in flow would have no effect on coastal bird habitat which is highly dynamic because of tidal influences that are orders of magnitude greater than flow variations arising from hydro generation.
- Conceivably, the availability of aquatic invertebrates and fish that form part of the diet of some birds that forage along the Manganui River could be affected adversely or positively by the proposed change in maximum take. However, as discussed above, any such changes would be highly unlikely to have a significant effect – detrimental or beneficial – on size, range or viability of bird populations along the river.
- Whilst the formation of Lake Ratapiko entailed a loss of terrestrial habitat through inundation, it has likely resulted in a net positive effect on terrestrial ecological values, through the development of lakeside vegetation and habitat for terrestrial fauna including waterbirds. These positive effects would continue under the proposed consent conditions.

Given the lack of adverse effects and some potential and likely positive effects on terrestrial ecological values arising from the proposed ongoing operation of the Manganui HEPS, we conclude that Trustpower's proposal is consistent with Policy 7 of the NPSFM, with regard to terrestrial ecological values (in that it would not result in adverse effects on river extent or values related to ecosystem health or indigenous biodiversity values associated with the Manganui River, Waitara River, Mako Stream, or Makara Stream).

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