TrustPower Limited

McKays Creek/Kaniere Forks Hydroelectric Power Scheme Reconsenting

Aquatic Ecology Assessment of Effects

prepared by

Ryder Consulting

November 2010

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environment + planning + project management

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Cover: McKays Creek power station.

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1. Introduction

1.1 Background

TrustPower Limited (TPL) is currently in the process of re-consenting the McKays Creek/Kaniere Forks Hydroelectric Power Scheme (hereafter 'the scheme'), which is located in the Kaniere River catchment, approximately 10km inland from Hokitika (Figure 1.1).

Water for the Kaniere Forks scheme is taken into the Kaniere water race through a control and intake structure at Lake Kaniere (Figure 1.2). The mean and median inflows to the lake are 7.0 and 5.6 cumecs, respectively (Palmer 2010). The lake has a minimum operating level of 1.2m below the natural outlet of the lake. The water level of the lake is not altered to provide storage for the scheme. A minimum flow of 0.2 cumecs is maintained in the Kaniere River below the intake, with up to 1 cumec being taken into the Kaniere water race (Figure 1.3). The race follows the course of an old gold mining channel, which has been improved, and conveys water approximately 9km to the Kaniere Forks Power Station. From here it is discharged to the Kaniere River (Figure 1.4).

Water for the McKays Creek scheme is taken from the Kaniere River approximately 7km downstream of Lake Kaniere at McKays Weir (Figure 1.5). Up to 5 cumecs is taken at the weir, with a minimum flow of 0.2 cumecs maintained in the Kaniere River downstream of the weir (Figure 1.6). Additional water (up to 1 cumec) is provided by an intake on Blue Bottle Creek (Figure 1.7), and the water is then conveyed through a race (Figure 1.8) to the McKays Creek Power Station (cover photo). From the station the water (up to 6 cumecs) is discharged to a tailrace where it travels a further 1km to enter the Kaniere River. Note that as the intake for the McKays Creek scheme is located upstream of the discharge from the Kaniere Forks Power Station, the Kaniere Forks scheme does not currently contribute water to the McKays Creek scheme.

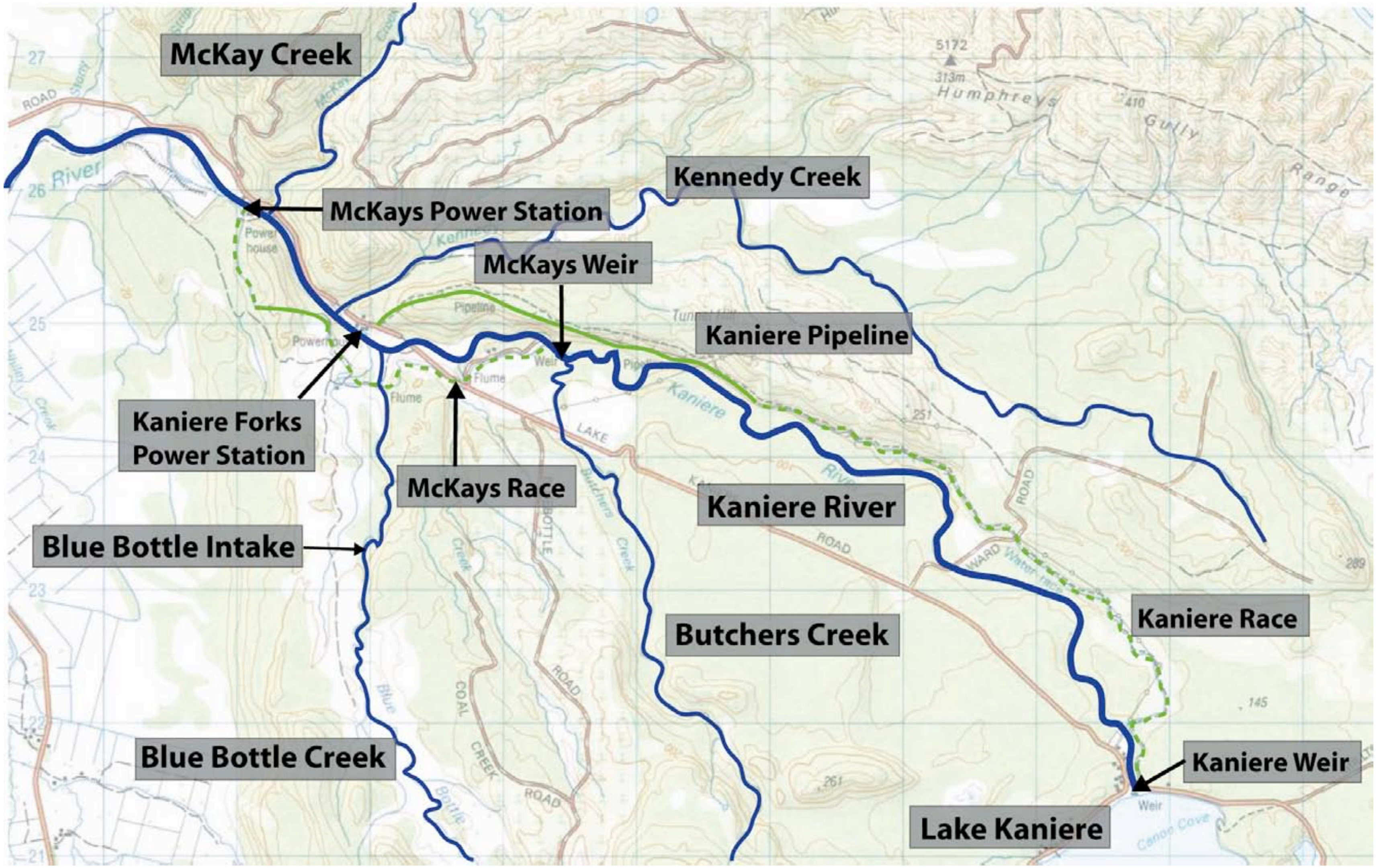

Figure 1.1 Layout of the McKays Creek/Kaniere Forks hydroelectric power scheme.

Figure 1.2 Lake Kaniere outlet weir (left) and intake (right) structure for Kaniere water race.

Figure 1.3 Kaniere water race.

Figure 1.4 Kaniere Forks power station discharge to the Kaniere River.

Figure 1.5 McKays weir (left) and intake to McKays race (right).

Figure 1.6 Kaniere River below McKays weir.

Figure 1.7 Blue Bottle Creek intake structure (left) and race (right).

Figure 1.8 McKays water race.

Water rights authorising the operation of the scheme were granted in 1986 and expire in 2011. In reconsenting the scheme TPL wishes to optimise the existing scheme and install two enhancements to improve the scheme's efficiency (hereafter referred to as the 'enhanced scheme'). The enhanced scheme is as follows (key locations for the scheme are shown in Figure 1.1):

- Increase abstraction to Kaniere Race from 1 cumec to 8 cumecs.
- Upgrade existing race from Lake Kaniere to Wards Road to take 8 cumec

flow.

- Construct new Kaniere Power Station at Wards Road (discharge to Kaniere River at this point).
- Increase abstraction to McKays Race (at McKays Weir) from 5 cumecs to 8 cumecs.
- Improve McKays race through deepening / heightening or widening.
- Increase existing McKays Creek Power Station capacity from 6 cumecs to discharge up to 9 cumecs (to account for existing additional 1 cumec from Blue Bottle Creek).

1.2 Objectives

Ryder Consulting Limited was engaged by TPL to provide an aquatic ecological assessment of the Kaniere River catchment to determine the nature and magnitude of any ecological effects associated with the enhanced scheme. The assessment included the following components:

- Collation of existing published and unpublished information on the aquatic ecosystem of the Kaniere River catchment.
- Identification of potential adverse aquatic ecological effects associated with the existing and proposed revised operating regimes of the scheme.
- Recommendations for the future operations of the scheme to avoid, remedy or mitigate significant adverse effects and optimise benefits to the aquatic ecosystem.

2. A Review of Existing Information

2.1 Hydrology

A review of existing hydrological information for the Kaniere River has been undertaken by TPL and is presented in Palmer (2010).

2.2 Water quality

The West Coast Regional Council (WCRC) monitors surface water quality at a number of sites throughout the region. Although no sites in the Kaniere River itself are monitored the water quality of Lake Kaniere is monitored for contact recreation purposes. A surface water quality summary prepared by the WCRC in 2005 reported that Lake Kaniere's water quality was adequate and had the highest water quality for contact recreation of those monitored in the region (WCRC 2005).

The only existing water quality information for the Kaniere River that we are aware of comes from a study of West Coast lake outlets undertaken by Harding (1992). Harding (1992) measured physical and water chemistry parameters at two points in the Kaniere River (K2 and K3, Figure 2.1) monthly from December 1988 to January 1990 (Table 2.1). Mean water chemistry values were similar at both sites (Harding 1992). The highest water temperature during the monitoring period was 22°C, recorded at the lake outlet site (K2) in January.

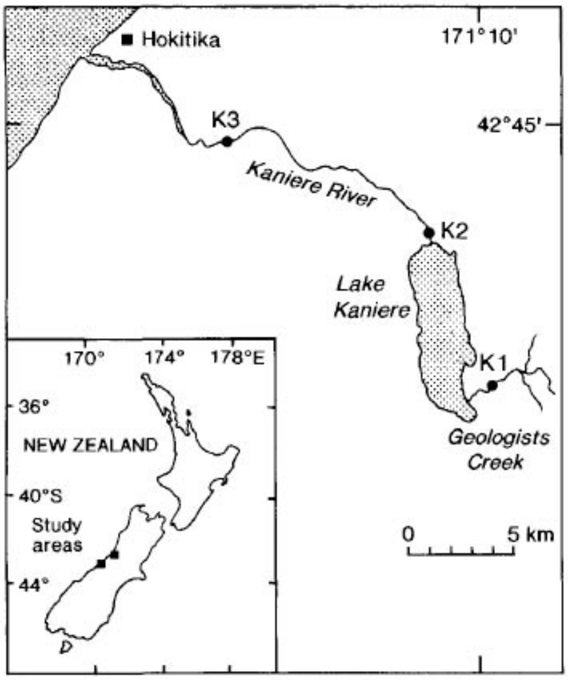

Figure 2.1 Location of sampling sites in the Kaniere River, from Harding (1992).

Table 2.1 Mean water quality parameters measured at two sites in the Kaniere River monthly from December 1998 to January 1990. Adapted from Harding (1992).

Parameter	**Kaniere River (K2) At Lake Kaniere outlet**	**Kaniere River (K3) 13km downstream of Lake Kaniere outlet**
Mean temperature (°C)	15.2	14.9
Dissolved organic carbon (g/m^3)	2.6	4.0
Alkalinity (g/m^3)	12	16
Conductivity (μS/m)	101	91
pH	7.4	7.3

2.3 Lake Kaniere macrophytes

The aquatic plant community of Lake Kaniere has been sampled on three occasions by NIWA (Table 2.2). Thirty-seven species or sub-species have been identified, almost all of which are indigenous with only three non-indigenous species recorded: *Elodea canadensis*, *Juncus bulbosus*, and *Ludwigia palustris*. Two of the indigenous species are identified as threatened, *Isolepis fluitans* and *Ranunculus limosella*, being ranked as in 'gradual decline' (Hitchmough *et al.* 2007). Aquatic plants have been found at depths of up to 9.3m, although most are found in the depth range of 0-3.5m (Table 2.2). Most species grow at a depth range that extends over several metres (Table 2.2). The median cover of the majority of species is less than 6% (Table 2.2). Median cover of *Chara australis*, *Elodea canadensis*, *Isoetes alpinus*, *Nitella hookeri* and *Pratia perpusilla* has exceeded 26% though on at least one sampling occasion.

Table 2.2 *Depth range (m) of aquatic plant species in Lake Kaniere. Median cover is given in brackets according to the scale 1=1-5%, 2=6-35%, 3=26-50%, 4=51-75%, 5=76-95%, 6=96-100%. Some species have two values for median cover, indicating that cover varies over the depth range shown (data obtained from NIWA freshwater biodata information system based on 6-10 profiles).*

Aquatic plant species	Indigenous?	1 Feb 1982	11 May 1992	17 Nov 2002
Callitriche petriei	Yes		0.4-0.5	0.6-2 (1)
Callitriche sp.		1.5-3 (1)		
Chara australis	Yes	0.5-8 (1)	0.2-8.5 (3)	0.5-9.3 (2, 3)
Chara fibrosa	Yes	0.5-5 (1)	0.2-2.5 (1)	0.5-3.5 (1)
Crassula sinclairii	Yes	0.5-0.5		
Elatine gratioloides	Yes	0.5-2 (1)	0.1-1.3 (1)	0.4-1.9 (1)
Eleocharis pusilla	Yes			0.7-1.2 (1)
Elodea canadensis	No	0.5-7 (5)	0.2-8 (3)	0.7-8.8 (3)
Glossostigma elatinoides	Yes	0-1 (1,3)	0.2-1 (1)	0.8-1.9 (1)
Glossostigma submersum	Yes	0-2.5 (1)	0.1-2 (1)	0.4-1.6 (1)
Hydrocotyle novae-zeelandiae	Yes			0.2-0.8
Isoetes alpinus	Yes	0.5-4 (1)	0.1-3.5 (3)	0.2-3.2 (3, 4)
Isolepis fluitans	Yes			0.3-2.4 (1)
Juncus bulbosus	No		0.2-3.5 (1)	0.5-1
Lepilaena bilocularis	Yes		0.4-0.4	
Lilaeopsis ruthiana	Yes			0.4-1 (1)
Limosella lineata	Yes		0.5-0.5	
Ludwigia palustris	No			0.5-0.6
Myriophyllum pedunculatum	Yes	1-1	0.2-2.2 (1)	0.4-2.8 (1)
Myriophyllum propinquum	Yes	0.5-3 (1)	0.3-5 (1)	0.2-3.4 (1)
Myriophyllum triphyllum	Yes	1-3 (1)	0.2-3.5 (1)	0.2-3.8 (2)
Myriophyllum votschii	Yes			0.7-0.7
Nitella aff. cristata	Yes			0.5-8.8 (1, 2)
Nitella hookeri var. hookeri	Yes	0.5-4 (1,3)	0.2-7.5 (1)	0.3-8 (1)
Nitella hookeri var. tricell	Yes	6-7 (1)		
Nitella hyaline	Yes	0.5-2 (1)	0.5-1	0.7-0.8
Nitella leonhardii	Yes	0.5-4 (1)		0.4-4 (1)
Nitella pseudoflabellata	Yes	0.5-5 (1)	0.2-6 (1)	0.6-5 (1)
Nitella stuartii	Yes			0.5-1.9
Pilularia novae-zelandiae	Yes	0.5-5 (1)	0.2-1 (1)	0.2-1.9 (1)
Potamogeton cheesemanii	Yes		0.5-3.5 (1)	0.5-2.5 (1)
Potamogeton ochreatus	Yes		0.5-3 (1)	1-3.7 (1)
Pratia perpusilla	Yes		0.2-0.4	0.5-1.3 (1, 6)
Ranunculus amphitrichus	Yes			1-1.6 (1)
Ranunculus limosella	Yes	1-2	0.2-1 (1)	0.6-2 (1)
Triglochin striatum	Yes			0.2-0.3
Typha orientalis	Yes		0-0.5	
Unidentified mosses & liverworts	Yes	0-0.5	3.5 -4.2	0.1-0.5

2.4 Periphyton

Existing information on periphyton communities in the Kaniere River is limited to brief descriptive observations. Long filamentous green algae have previously been observed in the Kaniere water race and low to moderate periphyton cover has been noted in the Kaniere River (V. Keesing, *pers. comm.*).

2.5 Benthic macroinvertebrates

The benthic macroinvertebrate community in the Kaniere River was sampled by Harding (1990) as part of his previously mentioned (Section 2.2) study of West Coast lake outlets. Harding (1990) sampled the macroinvertebrate community at two sites in the Kaniere River, at the lake outlet and approximately 13km downstream (Figure 2.1). Sampling was conducted at the two sites each month from December 1988 to December 1989.

Thirty-eight taxa were identified in total, with a greater number of taxa recorded at the site 13km downstream of Lake Kaniere than at the site immediately below the outlet (Table 2.3). Community composition differed between the sites, with the outlet site being numerically dominated by the dipteran Simuliidae, *Aoteapsyche* caddisflies and *Potamopyrgus antipodarum* snails and the site 13km downstream being dominated by the dipterans Simuliidae and Chironomidae and Oligochaeta worms (Table 2.3). Harding (1990) did not calculate any macroinvertebrate community health indices for his data; however, we were able to use the data he presented to calculate these. These calculations identified that a high number of pollution sensitive Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa were present at the downstream site, with EPT taxa comprising 70% of the total number of taxa (Table 2.3). Of these EPT taxa, *Oxyethira albiceps* (cased caddisfly) and *Deleatidium* mayflies were numerically dominant (Table 2.3). We also calculated macroinvertebrate community index scores (MCI and semi-quantitative MCI (SQMCI)) from Harding's (1990) data. MCI scores at the outlet site were indicative of 'fair' quality invertebrate habitat, while at the downstream site MCI scores were indicative of 'good' quality habitat. SQMCI scores at both sites were indicative of 'poor' quality habitat. These results are not surprising as lake outlet benthic fauna are typically dominated by taxa that have medium to low MCI values.

For comparison we have presented macroinvertebrate community data collected by Harding (1990) from another West Coast lake outlet river - the Okarito River. The Okarito River flows from Lake Mapourika, which has an unmodified outlet.