

the Kaniere River. For shut downs and restarts of the scheme the flow changes are greatest but are limited to a flow around 4.5 cumecs (maximum of 5 cumecs) (Lennie Palmer, TPL, *pers. comm.*).

The enhanced scheme is, however, likely to be operated (depending on lake level) at full, half or no output and this could change within a day. Daily flow changes are therefore expected downstream of the existing McKays and proposed Wards Road power stations, with flow increases of around 7.5 cumecs possible (maximum of 8 cumecs). Such short-term flow fluctuations will result in the formation of a varial zone - an area on the edge of the channel that is intermittently inundated as flow fluctuates. The width of this zone will vary, but based on IFIM modelling the maximum width is predicted to average approximately 3.1m in the upper river and 6.6m in the lower river with the maximum flow range from minimum flow to full output (range 0.3 to 7.8 cumecs). Smaller or larger changes may be observed at different locations depending on the specific channel characteristics. Due to the intermittent inundation in this zone it will provide marginal habitat for benthic invertebrates, and the overall benthic productivity of the river will therefore be reduced (Jowett 2007). Observations from other New Zealand rivers with flow fluctuations indicate though that high fish density can still be sustained in this environment (Jowett 2007). Unlike trout, native fish density does not appear to be closely related to benthic invertebrate density so a reduction in benthic production is less likely to effect native fish as long as good macroinvertebrate habitat is provided at the minimum flow (Jowett *et al.* 1996).

Ramping rate trials were undertaken in the upper Kaniere River by TPL to investigate how quickly river level changes due to generation would occur in different locations (Figure 6.24). Adjustments to the control gates at the lake outlet were made to increase flows from a minimum of 0.31 to a maximum of 6.5 cumecs (Lennie Palmer, TPL, *pers. comm.*). The corresponding flows down the Kaniere River took 20 to 45 minutes to reach Wards Road (approximately 3km downstream of the lake), and another 1 to 2 hours to reach the McKays weir (approximately 7km downstream of the lake) (Lennie Palmer, TPL, *pers. comm.*). Once rising river flows reached Wards Road, they arrived very quickly (with a 0.55m level change experienced in 5 minutes), but were attenuated in the lower river when they arrived at McKays weir (Lennie Palmer, TPL, *pers. comm.*). Flow reductions from full flow to

near minimum flow took 40 minutes to stabilise at Wards Road, and 3 hours to stabilise at McKays weir (Lennie Palmer, TPL, *pers. comm.*). Flows in the Kaniere River have been observed to rise and fall rapidly naturally during high rainfall events. Analysis of catchment flow records indicates that flow increases and decreases of greater than 5 cumecs per hour are not uncommon, and increases of 20 cumecs per hour and decreases of 10 cumecs per hour have been observed (Lennie Palmer, TPL, *pers. comm.*). Although predicted generation ramping rates are within those experienced in the river naturally scheme operation will generate sunny day changes in flow over the whole length of the river and potentially more frequently (Lennie Palmer, TPL, *pers. comm.*). This raises safety concerns for river users (e.g. fishers) if flow changes are so rapid as to not allow detection and avoidance of the rising river.

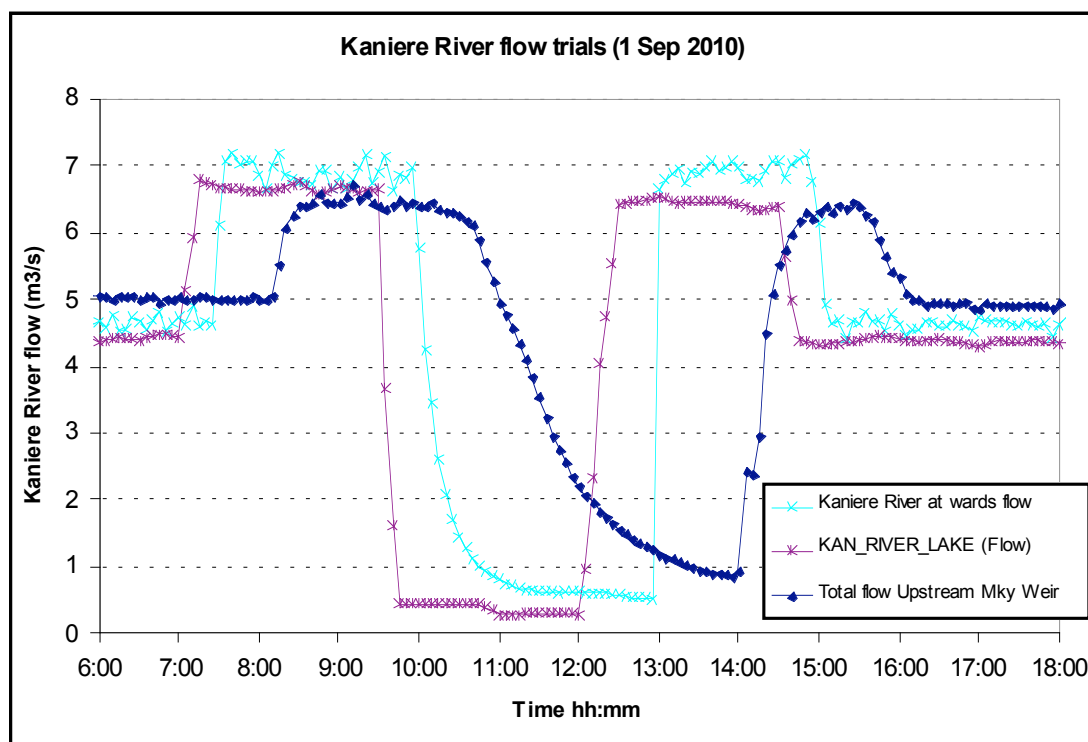


Figure 6.24 Kaniere River flow at Lake Kaniere, Wards Road, and McKays weir during flow trials on 1 September 2010. Time of day (24-hour) is shown on the bottom axis (Lennie Palmer, TPL, *pers. comm.*).

## 6.5 Effects of Scheme construction

### 6.5.1 Background

Construction works associated with the enhanced scheme include the modification of the Kaniere and McKays water races and the construction of a power station at Wards Road. The potential effects of these works on aquatic communities within the races and in the Kaniere River include direct habitat disturbance and also indirect effects due to elevated levels of sediment or other contaminants, or the introduction of aquatic weeds or algae.

### 6.5.2 Water race modification

Construction work will be required under the enhanced scheme to increase the capacity of McKays water race, and also to increase the capacity of the Kaniere (Wards Road) water race. To undertake the works the races will be dewatered and excavation of the race channel will be undertaken to widen and/or deepen it. Dewatering of the race is currently undertaken regularly to enable routine maintenance. It is likely that fish living within the race are able to survive these periods of temporary dewatering by moving to areas within the race where deeper water remains. However, the length and the extent of the works under the enhanced scheme will be greater and it is unlikely that fish will be able to move to avoid the works. Macroinvertebrate communities (including koura and freshwater mussels) in sections where excavation of the channel bottom is undertaken will need to be removed. Elevated suspended sediment levels in the race as a consequence of excavation will also be unfavourable for macroinvertebrates and fish. Post-construction, macroinvertebrates and fish will, however, be able, to re-colonise the races if similar habitat to that present pre-construction (i.e. gravel/cobble dominated substrate) remains.

Materials and machinery may be brought in from outside locations for the construction works and with this comes the potential for the introduction and spread of aquatic weeds and nuisance algae (e.g., *Didymosphenia geminata*). There is also the potential for materials and machinery to spill contaminants to waterways (e.g., diesel or concrete).

Several small tributaries of the Kaniere River are currently either captured or

crossed by the Kaniere and McKays water races. There is the potential for modifications to the races to result in disturbance to these tributaries through the downstream flow of contaminants. Race modification should also not result in further capture of tributaries or prevent upstream or downstream fish passage within the tributary or to the Kaniere River.

### **6.5.3 Construction of Wards Road power station**

Under the enhanced scheme a new power station will be constructed on the true right bank of the Kaniere River in the vicinity of Wards Road. The construction process, which will require the removal of a substantial area of riparian vegetation, could result in the release of sediment or other contaminants to the river. Excavation of an area of the river bed is also likely to be required to construct the tailrace channel. Adverse effects on aquatic communities in the immediate area and downstream are possible if appropriate guidelines to prevent contaminants entering the river are not followed.

## **7. Monitoring and mitigation**

### **7.1 Fish passage**

#### **7.1.1 Screening**

Currently there is effectively no screening of intakes to the Kaniere Forks and McKays water races with the consequence that fish are entrained to the schemes. We therefore recommend that the existing water races and the new Wards Road race are screened at some point prior to the power station penstocks and that safe fish passage is provided back to the Kaniere River. Emphasis should be on excluding adult eels and migratory adult galaxiids therefore 20mm maximum gap size for screens is required. No true right tributaries of the Kaniere River are to be captured by the new Wards Road race.

Similarly there is no screening of the Blue Bottle Creek intake. A screen is therefore recommended to prevent adult eels and galaxiids entering the intake.

#### **7.1.2 Instream barriers**

Upstream fish passage in the Kaniere River currently appears to be limited by instream structures at the Lake Kaniere outlet and McKays weir. Modifications to these structures are therefore required to provide unhindered native fish passage. Due to the low height of the structures, only minor modifications should be necessary to achieve this. A survey of additional tributaries of the Kaniere River is also recommended to identify any other artificial barriers to native fish passage (e.g. engineered fords).

#### **7.1.3 Connectivity**

Maintaining connectivity within the Kaniere River mainstem itself and to tributaries is an important issue as the majority of native fish species in the river are diadromous and therefore need to be able to move up and down the river at various times. Flow reductions and flow variation among river reaches are likely to hinder upstream and downstream fish passage. The extent to which fish passage will be affected is difficult to predict, as it has not been possible to view the lower river under the proposed flows. IFIM modelling indicates that mean water depths will be sufficient to allow native fish passage; however, there may be 'pinch' points where sufficient depth is not provided. In this case it may be possible to modify the channel

through the use of excavators to maintain passage.

In the situation where power station discharge channels carry higher flow than that of the main river upstream migrating fish may also be encouraged to enter station tailraces. Suitable screening or modification to outlet channels to provide a return channel to the river is therefore required to ensure this risk is minimised. Alternatively a trap and transfer system could be established from the tailraces to suitable habitats upstream.

Opportunities for enhancing downstream eel passage should also be considered, where increased flow is provided in the river downstream of the lake outlet at times when downstream eel migration may be occurring (e.g. during periods of high rainfall in May and June).

There is currently no residual flow provision in respect of Blue Bottle Creek, which results in a loss of connectivity in the lower reaches of the creek during low flow periods. A residual flow is required to ensure connectivity is maintained and enhance the habitat for native fish downstream of the intake; however, recommending a residual flow is not possible at this stage because we are uncertain of what flow is sufficient to maintain connectivity, and this is likely to vary at different times of year due to variation in ground and surface water inflows downstream. A trial of residual flow options is therefore recommended.

## 7.2 Water quality

The existing water quality of the Kaniere River catchment is good and this is not anticipated to change under the enhanced scheme. The potential effect of further flow reductions on elevating water temperatures is of concern, however, as existing water temperatures in the river have reached levels (23°C) that are unfavourable for some aquatic species, particularly if they are sustained over long periods. Water temperatures in the river appear to be driven by those at the lake outlet and although daily fluctuations in water temperature are expected to increase as a result of the enhanced scheme daily mean temperatures should not be altered greatly. Temperature monitoring in the river is recommended with flow releases required if mean daily water temperatures exceed those at the lake outlet by 3 degrees.

### 7.3 Instream habitat

Native fish are present throughout the Kaniere River system, with the most obvious effect of the existing scheme due to passage restrictions created by the McKays weir. We consider this can be rectified relatively easily.

Maintenance of safe fish passage for native species up and down the Kaniere River system can be regarded as an important management objective primarily for sustaining the eel population supported in the catchment, but also other native fish species where access to and from coastal waters is essential.

Maintaining optimal physical habitat in the river itself is perhaps less critical given the river has been modified for many years now as a result of the hydro scheme, yet populations of native fish species still reside in the river and in the lake and tributaries.

A minimum flow range of 0.2-0.23 cumecs in the river upstream of the McKays Creek discharge was initially proposed by TPL for the enhanced scheme, which was lower than the existing minimum flow range (0.2 to 1.0 cumecs, Table 6.1), and is at the bottom end of the adequate flows for instream habitat, despite being at or just above the currently consented minimum flow. We assessed this proposed flow regime and determined it was likely to have more than minor effects on aquatic communities through loss of physical habitat and algal growths, and that a higher flow would provide much better habitat for native fish and juvenile trout as well as reduce the likelihood of connectivity issues.

In order to identify a more appropriate minimum flow regime, physical habitat and flow relationships developed from the IFIM models (Section 6.4) were examined. The critical 'break point' in the flow versus water width/depth relationship for the river appears to be around the 0.3-0.6 cumecs range (Figures 6.13 and 6.14). As depth does not change substantially with flow, species requiring deeper water are unlikely to benefit substantially from major increases in flow. Changes in velocity with flow are more marked and fish with high velocity requirements, but not needing significant water depth, consequently benefit substantially from a major increase in flow in this river (up to a point), in particular bluegill bully, koaro and

torrentfish (Figures 6.15 and 6.19). Similarly, invertebrate taxa such as *Aoteapsyche* and *Deleatidium* (to a lesser extent) benefit from higher flows through greater velocities despite little change in water depth (Figures 6.17 and 6.21).

Tables 6.24 and 6.25 present a simple 'ranking' of the benefits to various fish and invertebrate species (in terms of providing physical habitat) from changing the flow from 0.2 to 5 cumecs (detailed graphs of this information are provided in Section 6.4). Long filamentous algae are also included in this analysis as its prevalence can increase with reduced flow (due to much lower velocities at low flow) and this can have ramifications for benthic invertebrate communities and aesthetics.

Several fish species have almost no habitat at flows of between 0.2 and 0.5 cumecs, namely bluegill bully, koaro, torrentfish and adult brown trout. Further, food producing habitat (which is related to suitable habitat for a range of aquatic macroinvertebrate species that provide food for larger fish) is minimal in this flow range. Torrentfish require flows well in excess of 1 cumec to provide much in the way of habitat, however we have observed reasonable numbers of torrentfish in one regulated river that is subject to both low and high daily flows (lower Waipori River, Otago, daily flow range 0.6 – 19 cumecs) suggesting that they may be capable of tolerating low flow habitat provided regular high flows are also provided. There is little habitat for small brown trout (<100mm in length) at 0.2 cumecs, but this increases considerably at 0.4 cumecs at both Wards Road and McKays Ford. There is considerable habitat for several fish species at flows of between 0.2 and 0.4 cumecs (common bully, redfin bully, small shortfin eel and shortjaw kokopu).

Note, however, that these analyses do not account for other potential effects associated with reduced flow and slowing moving water, such as effects on water quality and temperature. They simply assess potential physical habitat. Long filamentous algae is also likely to proliferate at Wards Road at low flows (less than 1 cumec) without occasional higher flushing flows.

In general, 0.2 cumecs at both Wards Road and McKays Ford probably provides marginal habitat for many fish species and their food supply, and only small native fish are likely to take advantage of such a low flow if it is prolonged. A flow of 0.4-0.5 cumecs provides additional habitat for bluegill bully, koaro, longfin eel, small brown

trout and adult brown trout (the latter only at McKays Ford).

If the proposed Wards Road enhancement is to be constructed, maintaining the higher minimum flow of 0.4 cumecs at Wards Road should therefore provide suitable physical habitat for a range of native fish species, and some habitat for small brown trout. Hydrological modelling indicates that 0.07 to 0.1 cumecs is contributed to the river from tributary inflows in the reach from the lake outlet to Wards Road (Lennie Palmer, TPL, *pers. comm.*) therefore a minimum flow of 0.3 cumecs at the lake outlet should result in a flow of 0.4 cumecs at Wards Road. The lower river below McKays weir is generally less constrained and therefore wider than upstream and more water is required to achieve the same extent of instream habitat as upstream. If the McKays scheme enhancement is to be constructed a minimum flow of 0.5 cumecs is therefore recommended downstream of Kaniere Forks Station at the McKays Ford, and hydrological modelling indicates that this can be achieved with tributary inflows by maintaining a minimum flow of 0.3 cumecs at McKays weir.

Nuisance filamentous algae growths have the potential to develop under the enhanced scheme, but these may be able to be managed by shutting out water from the scheme for 12-24 hours to create a 'flushing flow' effect of up to 8 cumecs. This approach would need to be monitored and adjusted to determine the most appropriate and efficient flushing regime.

**Table 6.24** *Habitat ranking for a range of species in the Kaniere River at flows ranging from 0.2 to 5 cumecs. Predicted using the Wards Road IFIM model and therefore relevant to the constrained, upper reaches of the river.*

Flow (m <sup>3</sup> /s)	Bluegill bully	Common bully	Redfin bully	Koaro	Shortjawed Kokopu	Longfin eel <300mm	Longfin eel >300mm	Shortfin eel <300mm	Shortfin eel >300mm	Torrentfish	Brown trout <100mm	Brown trout adult	Food producing	Long filamentous
0.2	0	√√√	√√	0	√√	√	√	√√	√	0	√	0	0	√√
0.4	√	√√	√√	√	√	√√	√	√√	√	0	√	0	√	√√
0.5	√	√√	√√	√	√	√√	√	√√	√	0	√	0	√	√√
1	√√	√√	√√	√	0	√√	√√	√√	√√	√	√√	√	√	√√
5	√√	√	√	√	0	√	√	√	0	√	√	√	√√	0

**Table 6.25** *Habitat ranking for a range of species in the Kaniere River at flows ranging from 0.2 to 5 cumecs. Predicted using the McKays Ford IFIM model and therefore relevant to the less constrained, lower reaches of the river.*

Flow (m <sup>3</sup> /s)	Bluegill bully	Common bully	Redfin bully	Koaro	Shortjawed Kokopu	Shortfin eel <300mm	Shortfin eel >300mm	Longfin eel <300mm	Longfin eel >300mm	Torrentfish	Brown trout <100mm	Brown trout adult	Food producing	Long filamentous
0.2	0	√√√	√	0	√	√	√	√	√	0	√	0	0	√
0.4	0	√√	√√	√	√	√√	√√	√	√	0	√	√	0	√√
0.5	√	√√	√√	√	√	√√	√√	√√	√√	0	√	√	0	√√
1	√	√√	√√	√	√	√√	√√	√√	√√	√	√√	√	√	√√
5	√√	√	√	√	√	√	√	√	√	√√	√√	√	√√	√

KEY	INTERPRETATION
0	Almost no habitat
√	Some habitat
√√	Good habitat
√√√	Very good or near optimum habitat

#### **7.4 Fluctuating water levels in Lake Kaniere**

Under the enhanced scheme median water levels in Lake Kaniere will decrease by 0.54m relative to the existing situation, with the percentage of time that the lake is spilling decreasing by 34%. Such changes may potentially adversely impact aquatic plant communities in the littoral zone of the lake although effects are expected to be minor. The littoral zone plant community is expected to adjust its vertical distribution to accommodate the altered lake level regime.

#### **7.5 Fluctuating water levels in the Kaniere River**

Daily flow fluctuations in the Kaniere River downstream of the existing McKays and proposed Wards Road power stations will result in the formation of a varial zone of varying width. This zone will not provide habitat for benthic invertebrates, and the overall benthic productivity of the river will therefore be reduced, however observations from other New Zealand rivers with flow fluctuations indicate though that high native fish densities can still be sustained.

Rapid changes in river levels are predicted to occur in some sections of the river with generation and restrictions on ramping rates are therefore necessary to ensure that river users are able to detect flow changes and avoid the rising river.

#### **7.6 Construction**

Prior to any construction works commencing, management plans should be developed to minimise the risk of sediment, weeds and contaminants entering waterways during construction. An example of the objectives of Construction Management and Earthworks and Sediment Control plans, for the Arnold River HEPS, are given below.

*“The objectives of the Construction Management Plan shall be:*

- To ensure that construction activities achieve compliance with conditions of consent for these activities.*
- To minimise the environmental nuisance effects of construction activities.*
- To ensure that bed disturbance is limited to that necessary to undertake the construction works.*
- To minimise the release of sediment during disturbance to the bed of any*

waterway.

- *To avoid the spread of Didymo as a result of instream works.*
- *To keep the use of machinery in the bed of any waterway to a minimum.*
- *To ensure that bed disturbance does not damage any riverbank or cause flooding or erosion.”*

*“The Earthworks and Sediment Control Plan shall as a minimum address the following matters:*

- *Methods of conducting earthworks, disposal of excavated material and surface water and sediment and erosion management.*
- *Detailed design, location, operation and maintenance of stormwater runoff control and sediment control facilities during construction activities, including detailed engineering plans and design specifications.*
- *Methods to minimise sediment generation and sediment laden runoff.*
- *Procedures for maintaining sediment control devices and the disposal of sludge/sediment.*
- *Training and supervision of operators and contractors associated with sediment control activities.*
- *Methods for ensuring that all stormwater runoff from construction activities is directed through sediment control facilities prior to discharge to natural watercourses.”*

## **8. Conclusion**

The proposed enhancements for the McKays Creek/Kaniere Forks hydroelectric power scheme have been assessed in relation to the existing environment in order to assess potential adverse aquatic ecological effects.

Although the Kaniere River has been modified for many years as a result of the existing hydroelectric scheme there are significant diadromous native fish and invertebrate populations (including six threatened species) in the river and in the lake and tributaries. Maintenance of safe fish passage up and down the Kaniere River system can therefore be regarded as a key management objective. In regards to effects on fish passage, the existing and enhanced schemes are similar in that the main instream passage barriers at McKays Weir and the lake outlet will remain. The enhanced scheme differs in that the percentage of time that the lake is spilling and

therefore when passage is possible from the river to the lake will be reduced by 34% relative to the existing situation, and this will reduce opportunities for fish passage. Modifications to instream barriers are therefore recommended to enhance fish passage under the enhanced scheme, as is the installation of screens at intakes and in tailrace channels. Screening is also recommended at the Blue Bottle Creek intake and consideration should be given to the provision of a residual flow in this creek to maintain connectivity. It is noted though that fish can and do move freely throughout Blue Bottle Creek at higher flows, although fish densities indicate instream structures may limit this movement somewhat.

The proposed minimum flow limits in the Kaniere River of 0.4 cumecs at Wards Road and 0.5 cumecs downstream of Kaniere Forks station (at McKays Ford), in combination with improvements to fish passage, and the other mitigation measures that have been discussed, is expected to result in no more than minor effects on the aquatic ecology of the Kaniere River relative to the existing environment. Should the enhanced scheme be commissioned monitoring is recommended to confirm this assessment. We also recommend that TPL give consideration towards the development of a timed flow release programme that provides short periods of higher flows at critical periods of the year associated with fish migration. These flow releases need only occur when naturally high flow events do not manifest as a result of climatic conditions or flow manipulation for power generation.

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## **Appendix One: Benthic macroinvertebrate data**

Table A1.1 Benthic macroinvertebrate communities at Kaniere River sites, K1, K2 and K3.

Location		K1	K1	K1	K1	K1	K2	K2	K2	K2	K2	K3	K3	K3	K3	K3	
Sample		A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	
TAXON	MCI score																
ACARI	5															1	
COLEOPTERA																	
Elmidae	6			1	1	1	4	9	1			33	41	8	94	28	
Scirtidae	8																
DIPTERA																	
<i>Aphrophila</i> species	5			2		3	3			2	1	2	12			16	62
<i>Austrosimulium</i> species	3	3	1		3	1	1		1			2	3			4	12
Empididae	3				1		2					1	7	23		43	28
<i>Maoridiamesa</i> species	3	8	16	9	3	13		1	1	1						7	16
<i>Mischoderus</i> species	4															1	
Muscidae	3															1	5
Orthoclaadiinae	2	6	16	17	18	12	3	17	14	8	3	10	17	50	96	36	
Tanytarsini	3		3	2		6	7	21	10	2		23	16	32	56	74	
EPHEMEROPTERA																	
<i>Ameletopsis perscitus</i>	10																
<i>Austroclima</i> species	9																
<i>Coloburiscus humeralis</i>	9	6	5	2		10	5			3	5	1	4	1	6	14	
<i>Deleatidium</i> species	8									4		10	16	5	1	2	
<i>Nesameletus</i> species	9											1	6				
MEGALOPTERA																	
<i>Archichauliodes diversus</i>	7	7	6	7	3	13	7	5	1	5	1	5	10	5	5	12	
MOLLUSCA																	
<i>Ferrissia</i> species	3											1	1				
<i>Potamopyrgus antipodarum</i>	4	78	126	88	95	94	32	258	38	25	11	349	345	4	635	446	
<i>Sphaerium novaezelandiae</i>	3	2			1	2											
OLIGOCHAETA	1		2	3		1						5			1	2	
PLATYHELMINTHES	3				1							1					
PLECOPTERA																	
<i>Austroperla cyrene</i>	9	1												1			
<i>Zelandobius</i> species	5											3					
<i>Zelandoperla</i> species	10	2			1		1	1	1								
TRICHOPTERA																	
<i>Aoteapsyche</i> species	4	314	394	243	100	452	34	58	16	6	11	11	51		34	88	
<i>Costachorema</i> species	7	3									1						
<i>Helicopsyche</i> species	10											64	19		3		
<i>Hudsonema amabile</i>	6											3	6				
Hydrobiosidae early instar	5		1			1	1	3	1	1			4		11	10	
<i>Hydrobiosis clavigera</i> group	5																
<i>Hydrobiosis umbripennis</i> group	5															1	
<i>Neurochorema</i> species	6	4	7	12	3	10	1	3	1	1	2	2	1		4	14	
<i>Olinga</i> species	9			2	1			1	1	1	1			1	5	4	
<i>Oxyethira albiceps</i>	2						1					14	2	113	10	2	
<i>Psilochorema</i> species	8																
<i>Pycnocentria</i> species	7								1	1		24	11				
<i>Pycnocentrodess</i> species	5								1			38	19		4	2	
Number of invertebrates		434	577	388	231	619	102	379	87	61	36	603	596	243	1047	868	
Number of taxa		12	11	12	13	14	14	12	13	14	9	22	23	11	23	19	
EPT taxa		6	4	4	4	4	6	5	6	8	4	11	12	5	11	9	
Percent EPT taxa		50	36	33	31	29	43	42	46	57	44	50	52	45	48	47	
MCI score		112	85	98	97	87	99	103	100	113	109	101	107	113	102	99	
QMCI score		4.1	4.0	4.0	3.9	4.1	4.5	4.0	3.7	4.7	4.9	4.9	4.6	2.7	4.0	4.2	

Table A1.2 Benthic macroinvertebrate communities at Kaniere River sites, K4, K5 and K6.

Location		K4	K4	K4	K4	K4	K5	K5	K5	K5	K5	K6	K6	K6	K6	K6
Sample		A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
<b>TAXON</b>	<b>MCI score</b>															
ACARI	5					1								1		
<b>COLEOPTERA</b>																
Elmidae	6	6	13	28	5	3		1	2		5	32	1	1	5	
Scirtidae	8											1				
<b>DIPTERA</b>																
<i>Aphrophila</i> species	5	16	9	13	14	6	13	17	1	9	11	9			5	2
<i>Austrosimulium</i> species	3	2		2	1					1						
Empididae	3											1				
<i>Maoriamesa</i> species	3	1		2			2	1	2	1	2		1			
<i>Mischoderus</i> species	4															
Muscidae	3															
Orthocladinae	2	2	11	16	4	3	3	8	7	6	7	54	25	32	51	16
Tanytarsini	3	5	6	8	2			1	1	1	6	22	14	3	1	1
<b>EPHEMEROPTERA</b>																
<i>Ameletopsis perscitus</i>	10									1						
<i>Austroclima</i> species	9		1													
<i>Coloburiscus humeralis</i>	9						1			2						
<i>Deleatidium</i> species	8	9	7	13	20	6	15	6	7	23	15	2	1		16	5
<i>Nesameletus</i> species	9											1				
<b>MEGALOPTERA</b>																
<i>Archichauliodes diversus</i>	7	4			2	3	3			1						
<b>MOLLUSCA</b>																
<i>Ferrissia</i> species	3															
<i>Potamopyrgus antipodarum</i>	4	19	2	1		6	2					1				
<i>Sphaerium novaezelandiae</i>	3															
<b>OLIGOCHAETA</b>	1		2	1				1							1	
<b>PLATYHELMINTHES</b>	3															
<b>PLECOPTERA</b>																
<i>Austroperla cyrene</i>	9															
<i>Zelandobius</i> species	5															
<i>Zelandoperla</i> species	10				3		7	1		2			1			
<b>TRICHOPTERA</b>																
<i>Aoteapsyche</i> species	4	9	7	4	9	2	12	11		19	17			1	3	8
<i>Costachorema</i> species	7															
<i>Helicopsyche</i> species	10	1					2					2				
<i>Hudsonema amabile</i>	6		1	1												
Hydrobiosidae early instar	5	1		2	2		1		1	2		1				
<i>Hydrobiosis clavigera</i> group	5										1					
<i>Hydrobiosis umbripennis</i> group	5	1						1								
<i>Neurochorema</i> species	6		2	1	1		1				2	1		2		
<i>Olinga</i> species	9	1	6	4		2	1			1					1	
<i>Oxyethira albiceps</i>	2	3	29	13		2			42	8	2	4	19	10	4	7
<i>Psilochorema</i> species	8								1						2	
<i>Pycnocentria</i> species	7											1				
<i>Pycnocentrodess</i> species	5	3	2		7	1	3	1	4			2	1	1	5	1
Number of invertebrates		83	98	109	70	35	66	49	68	77	68	134	63	51	94	40
Number of taxa		16	14	15	12	11	14	11	10	14	10	15	8	8	11	7
EPT taxa		8	8	7	6	5	9	5	5	8	5	8	4	4	6	4
Percent EPT taxa		50	57	47	50	45	64	45	50	57	50	53	50	50	55	57
MCI score		101	100	89	107	104	124	95	94	114	88	111	98	83	96	83
QMCI score		4.9	4.1	4.7	5.8	5.3	6.2	4.6	3.1	5.4	4.9	3.8	2.6	2.5	3.8	3.4