4. Conclusions

- Three sites (7.9%) recorded 'clean water' this year based on SQMCI results (two of these were also the only sites to record 'clean water' based on the MCI index). Two further sites potentially fall into the SQMCI 'clean water' category if a buffer is considered (see table below). Also, one site potentially falls into the MCI 'clean water' category if a buffer is considered. However, declining trends are observed for several of these 'top sites'.

Site	Biological index
Waipoua River @ SH12 Rest Area	SQMCI and MCI
Pukenui Stream u/s Ridge Track crossing	SQMCI and MCI
Mangahahuru Stream @ end of Main Rd	SQMCI only
Otaika Stream @ Otaika Valley Rd	SQMCI only (buffer)
Victoria River @ Thompsons Bridge	SQMCI only (buffer)
Waipapa River @ Forest Ranger	MCI only (buffer)

- Twenty sites (52.6%) recorded SQMCI scores of less than 4.00, which is interpreted as water of probable 'severe pollution' (worst five tabled below). However, a further 11 sites (28.9%) were recorded in the 'moderate pollution' interpretation; **a total of 81.6% of sites in poorly polluted categories** (SQMCI <5.00).

Stream/River	SQMCI value (out of 10)
Waiarohia Stream @ Kamo Tributary Culvert	1.84
Waitangi River @ Watea	2.13
Utakura River @ Okaka Rd Bridge	2.21
Waiotu River @ SH1 Bridge	2.24
Oruru River @ Oruru Rd	2.25

  These sites regularly feature at/near the bottom of the invertebrate monitoring programme and for most part the reasons will be related to difficulties of sampling due to their large size combined with the nature of their position in their river continuum, effectively receiving nutrients from large agricultural catchments.

  One particular concern is the **Kamo Tributary Culvert site** on the Waiarohia Stream which has had poor biological scores since monitoring began however the surrounding environment, in-stream habitat, as well as physical water parameters, all appear excellent. This site was highlighted as a particular concern in the 2010 and 2011 monitoring reports and a member of the public also reported concerns in 2010. **Further investigation is strongly suggested.**

- With regard to the consented activities (RC sites), the Meatworks activity, and to a lesser extent the Dam operation, showed considerable differences between the downstream and upstream SQMCI values. Regarding the Dam operation, index scores are most likely due to the retention of sediment at the downstream site which considerably impairs both the biological communities, and also the ability to collect comparable samples. In terms of general stream health (as opposed to testing upstream/downstream differences), the Oxidation Pond activity sites (both upstream and downstream) regularly record very poor index scores.

- A 'shotgun' inspection of collective MCI and SQMCI index trends, for SoE sites, indicated that 19 of the 32 sites (59.4%) showed little ecological change. A further nine sites (28.1%) indicated a reduction in their biotic index over time and four sites (12.5%) indicated an increase in their biotic index over time. When looking at the trend results of MCI and SQMCI collectively, and loosely fitting them into the water quality classes, 65.6% of sites can be interpreted as 'probable moderate' or 'probable severe pollution', 28.1% of sites as 'mild pollution' and 6.3% as 'clean water'.

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7. Appendix A

Results of 2012 QC as reported by an independent taxonomist are presented below in full. Note that only the format of the QC report was modified, to allow clarity and confidentiality within the report.

Quality Control exercise: Examination of stream invertebrate samples from Northland for Pohe Environmental. I have re-examined vials of voucher specimens from 5 stream samples, scanned the 5 bulk samples to look for any missed taxa and checked the coded-abundances indicated on the list provided by Pohe Environmental.

Results

1. Ngunguru (110603)

Taxonomic accuracy: I agree with all identifications made: **QC - Pass**.
Abundance coding 1: One 'new taxa' was recorded, being *Zelandobius*. The missed taxa was 'Rare': **QC - Pass**.
Abundance coding 2: I only recorded two taxa with abundance codes that differed from those provided by Pohe Environmental. In both cases the codes only differed by one abundance class: **QC – Pass**.

2. Otaika (110431)

Taxonomic accuracy: I corrected the identification of one larva only. It was identified as *Paralimnophila*, however I preferred upper taxonomic category and identified it as Hexatomini: **QC - Pass**.
Abundance coding 1: One 'new taxa' was recorded, being *Polyplectropus*. It was 'Rare': **QC - Pass**.
Abundance coding 2: I recorded three taxa with abundance codes that differed from those provided by Pohe Environmental. In all cases the codes only differed by one abundance class: **QC – Pass**.

3. Victoria (105532)

Taxonomic accuracy: I agree with all identifications made: **QC - Pass**.
Abundance coding 1: One 'new taxa' was recorded, being *Plectrocnemia*. It was 'Rare': **QC - Pass**.
Abundance coding 2: I only recorded two taxa with abundance codes that differed from those provided by Pohe Environmental. In both cases the codes only differed by one abundance class: **QC – Pass**.

4. Opouteke (102258)

Taxonomic accuracy: I agree with all identifications made: **QC - Pass**.
Abundance coding 1: No 'new taxa' was recorded from the sample: **QC - Pass**.
Abundance coding 2: I recorded three taxa with abundance codes that differed from those provided by Pohe Environmental. In all cases the codes only differed by one abundance class: **QC – Pass**.

5. Hatea (100194)

Taxonomic accuracy: I disagree with identification of one larva, being Dolichopodidae instead of Hexatomini. The taxonomic position of Dolichopodidae in New Zealand is not certain yet and the family is not included in the identification key for the country (Winterbourn et al. 2006): **QC - Pass**.
Abundance coding 1: No 'new taxa' was recorded from the sample: **QC - Pass**.
Abundance coding 2: I did not record coded abundances that differ from those provided by Pohe Environmental: **QC – Pass**.

Conclusion

Both species identification and coded abundances provided by Pohe Environmental were accurate. The only disagreement in identification was regarding Dolichopodidae due to taxonomic uncertainties of the group in New Zealand. I recommend to the Council to have a full confident in the results provided by the principal investigator.

Dr Milen Marinov
University of Canterbury
01 July 2012

7. Appendix B

Table 3. Summary of peripyhton results from the 16 collection sites. Average Chlorophyll a (mg/sample) and standard errors were derived from replicate samples (N=4, samples analysed by Hill Laboratories). Periphyton taxa were recorded from one sample (samples analysed by NIWA). For full periphyton datasets (including taxon abundances, ash free dry weights, Pheophytin a and detection limits) contact Northland Regional Council Monitoring Department. * Results were below detection limits.

Site name	Avg. Chlorophyll a (SE)	Taxa present
Hakaru River @ Topuni Creek Farm	1.37 (single sample)	**Chlorophyta**: *Oedogonium* sp.; **Cyanobacteria**: *Phormidium* sp.; **Desmids**: *Mougeotia* sp.; **Diatoms**: *Aulacoseira granulata*, *Cocconeis* sp., *Gomphonema* sp., *Melosira* sp., *Synedra* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**.
Hatea River u/s Mair Park Bridge	0.009* (0.004)	**Chrysophyceae**: *Synura* sp.; **Cyanobacteria**: *Phormidium* sp., *Pseudanabaena* sp.; **Diatoms**: *Cocconeis* sp., *Cymbella* sp., *Diatoma* sp., *Rhoicosphenia abbreviata*, *Surirella* sp., unidentified pennate diatoms; **Euglenoids**: *Trachelomonas* sp.; **Flagellates/Unicells <5um**; **Rhodophyta**: *Audouinella* sp.
Pukenui Stream u/s of Ridge Track crossing	0.007* (0.003)	**Cyanobacteria**: *Phormidium* sp., *Pseudanabaena* sp.; **Desmids**: *Mougeotia* sp.; **Diatoms**: *Diatoma* sp., *Gomphonema* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**; **Rhodophyta**: *Audouinella* sp.
Waiarohia Stream @ Whau Valley Road	0.345 (0.081)	**Chlorophyta**: *Cladophora* sp., *Oedogonium* sp.; **Cyanobacteria**: *Phormidium* sp., *Planktothrix isothrix*, *Pseudanabaena* sp.; **Desmids**: *Cosmarium bioculatum*, *Mougeotia* sp.; **Diatoms**: *Cyclotella stelligera*, *Cymbella* sp., *Gomphonema* sp., *Melosira varians*, *Navicula* sp., *Synedra* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**.
Kerikeri River @ stone store bridge	0.079 (0.012)	**Chlorophyta**: *Scenedesmus* sp.; **Cyanobacteria**: *Phormidium* sp., *Pseudanabaena* sp.; **Desmids**: *Mougeotia* sp., *Spirogyra* sp.; **Diatoms**: *Cocconeis* sp., *Cyclotella stelligera, Cymbella* sp., *Gomphonema* sp., *Melosira varians*, *Navicula* sp.; **Dinoflagellates**: *Ceratium hirundinella*; **Flagellates/Unicells <5um**.
Waipapa River @ Waipapa Landing Bridge	0.027 (0.010)	**Cyanobacteria**: *Dolichospermum* sp., *Limnothrix* sp., *Phormidium* sp., *Planktothrix* sp., *Rivularia* sp.; **Chlorophyta**: *Ankistrodesmus falcatus*, *c.f. Klebsormidium* sp., *Scenedesmus* sp.; **Desmids**: *Cosmarium* sp., *Mougeotia* sp., *Spirogyra* sp.; **Diatoms**: *Cocconeis* sp., *Eunotia* sp., *Gomphonema* sp., *Navicula* sp., *Synedra* sp., *Tabellaria* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**.
Waiharakeke Stream @ Stringers Road Bridge	0.104 (0.095)	**Cyanobacteria**: *Tolypothrix* sp.; **Diatoms**: *Aulacoseira granulata* var. *angustissima*, *Diatoma* sp., *Melosira varians*, *Navicula* sp., *Nitzschia* sp., *Synedra* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**.
Mangakahia River d/s of Twin Bridges	0.248 (0.079)	**Chlorophyta**: *Cladophora* sp.; **Cyanobacteria**: *Oscillatoria* sp.; **Diatoms**: *Aulacoseira granulata* var. *angustissima*, *Cocconeis* sp., *Cyclotella stelligera*; *Cymbella* sp., *Diatoma* sp., *Encyonema* sp., *Gomphoneis* sp., *Melosira varians*, *Synedra* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**.
Opouteke River @ suspension bridge	0.069 (0.015)	**Chlorophyta**: *Oedogonium* sp., *Stigeoclonium* sp.; **Cyanobacteria**: *Phormidium* sp.; **Diatoms**: *Cocconeis* sp., *Cyclotella stelligera*, *Cymbella* sp., *Diatoma* sp., *Gomphoneis* sp., *Melosira varians*, unidentified pennate diatoms; **Flagellates/Unicells <5um**.
Victoria River @ Thompsons Bridge	0.009 (<0.001)	**Chlorophyta**: *Stigeoclonium* sp.; **Desmids**: *Spirogyra* sp.; **Diatoms**: *Aulacoseira granulata* var. *angustissima*; *Cymbella* sp., *Diatoma* sp., *Epithemia* sp., *Gomphoneis* sp., *Melosira varians*, *Navicula* sp., *Synedra* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**.
Awanui River @ FNDC watertake	0.038 (0.009)	**Chlorophyta**: *Ankistrodesmus falcatus*, *Cladophora* sp., *Microspora* sp., *Stigeoclonium* sp.; **Cyanobacteria**: *Planktothrix isothrix*; **Desmids**: *Mougeotia* sp.; **Diatoms**: *Cocconeis* sp., *Diatoma* sp., *Gomphonema* sp., *Melosira varians*, *Navicula* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**; **Xanthophyta**: *Vaucheria* sp.
Mangamuka River @ Iwiatua Road Bridge	0.107* (0.053)	**Chlorophyta**: *Cladophora* sp.; **Cyanobacteria**: *Dolichospermum* sp., *Microcystis* sp., *Phormidium* sp., *Planktothrix isothrix*; **Diatoms**: *Aulacoseira granulata* var. *angustissima, Cocconeis* sp., *Cyclotella stelligera, Cymbella* sp., *Diatoma* sp., *Gomphoneis* sp., *Gomphonema* sp., *Melosira varians*, *Navicula* sp., *Tabellaria* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**.
Waipoua River @ SH12 Rest Area	0.003* (<0.001)	**Cyanobacteria**: *Limnothrix* sp., *Microcystis* sp., *Phormidium* sp.; **Diatoms**: *Cocconeis* sp., *Diatoma* sp., *Epithemia* sp., *Melosira varians*, *Nitzschia* sp., *Synedra* sp., unidentified pennate diatoms; **Euglenoids**: *Trachelomonas* sp.; **Flagellates/Unicells <5um**.
Kaihu River @ gorge	0.045 (0.015)	**Chlorophyta**: *Microspora* sp., *Oedogonium* sp.; **Desmids**: *Cosmarium bioculatum*, *Spirogyra* sp.; **Diatoms**: *Cocconeis* sp., *Gomphoneis* sp., *Gomphonema* sp., *Melosira* sp., *Nitzschia* sp., *Synedra* sp., unidentified pennate diatoms; **Flagellates/Unicells <5um**.
Waipapa River @ Forest Ranger	0.096 (0.045)	**Cyanobacteria**: *Cylindrospermopsis raciborskii*, *Phormidium* sp.; **Diatoms**: *Cymbella* sp., *Diatoma* sp., *Gomphonema* sp., *Melosira varians*, *Navicula* sp., unidentified pennate diatoms; **Rhodophyta**: *Chroodactylon* sp.
Waimamaku River @ SH12	0.233 (0.035)	**Chlorophyta**: *Stigeoclonium* sp., *Oedogonium* sp.; **Cyanobacteria**: *Dolichospermum* sp., *Pseudanabaena* sp.; **Desmids**: *Spirogyra* sp.; **Diatoms**: *Aulacoseira granulata* var. *angustissima*, *Cymbella* sp., *Diatoma* sp., *Epithemia* sp., *Gomphoneis* sp., *Gomphonema* sp., *Melosira varians*, unidentified pennate diatoms; **Flagellates/Unicells <5um**; **Rhodophyta**: *Audouinella* sp.

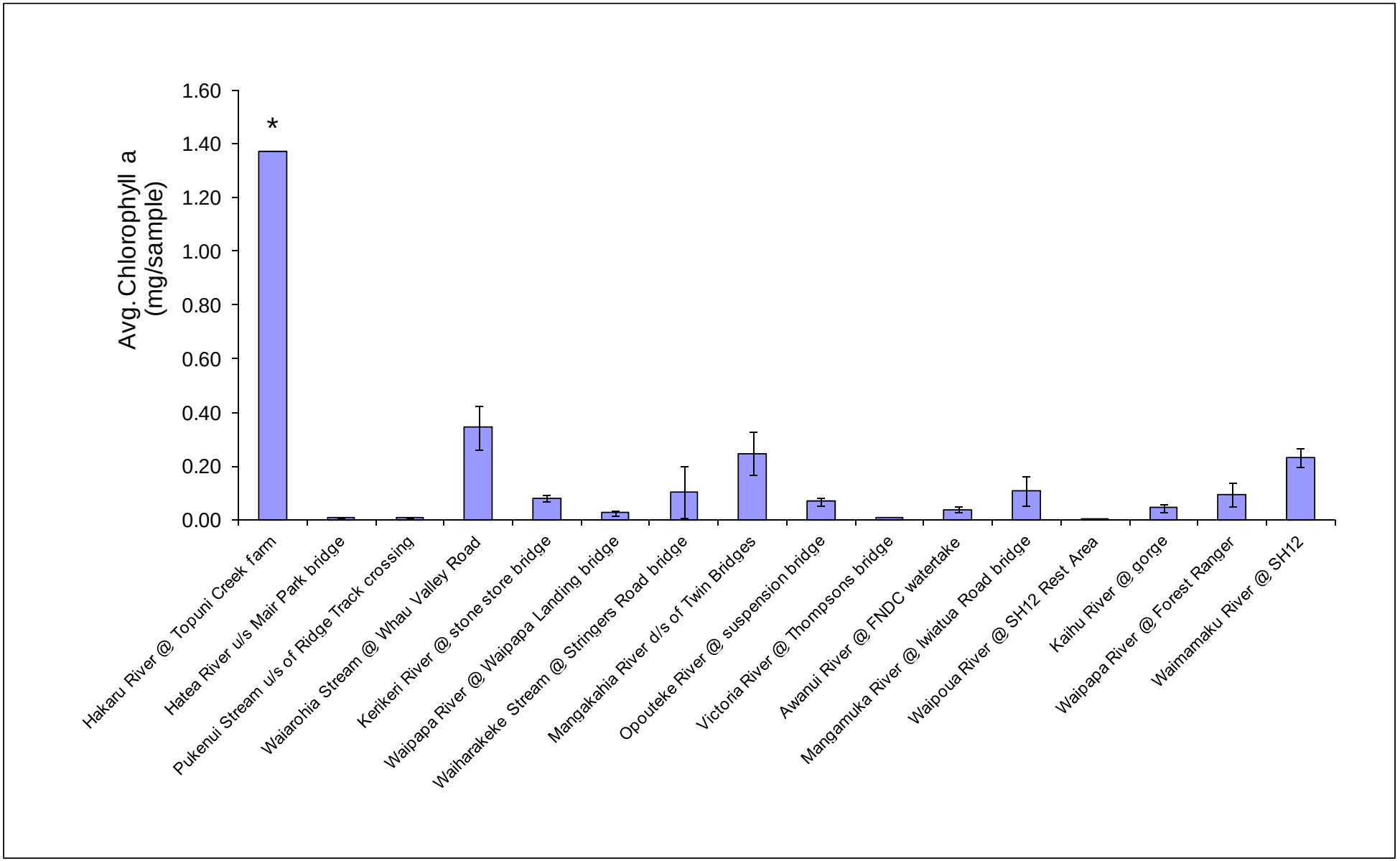

Figure 18. Summary of average Chlorophyll a results (SE, n=4) from the 16 collection sites. For full periphyton datasets (including taxon abundances, ash free dry weights, Pheophytin a and detection limits) contact Northland Regional Council Monitoring Department. * Single sample only.

7. Appendix C

Table 4. Physico-chemical data (water temperature, dissolved oxygen, air saturated dissolved oxygen, temperature compensated conductivity, and salinity) recorded at the 38 State of the Environment sites throughout Northland during 2012 invertebrate sampling (u/s = upstream, d/s = downstream). Values are presented as recorded by the YSI-85 meter.

Site name	Temp. (°C)	D.O. (%)	D.O. (mg/L)	Cond.‡ (μS_{25}/cm)	Sal. (ppt)
Awanui River @ FNDC watertake	22.6	108.4	9.38	197.6	0.1
Awanui River u/s of Waihue Channel	22.9	98.3	8.44	206.1	0.1
Hakaru River @ Topuni Creek Farm	18.8	62.1	5.81	186.0	0.1
Hatea River u/s Mair Park Bridge	18.4	97.0	9.11	210.3	0.1
Kaeo River @ Dip Road	21.0	95.1	8.48	151.1	0.1
Kaihu River @ gorge	18.8	91.6	8.53	126.0	0.1
Kerikeri River @ stone store bridge	22.8	92.2	7.94	97.7	0.1
Mangahahuru Stream @ Apotu Rd Bridge	19.4	80.6	7.41	133.9	0.1
Mangahahuru Stream @ end of Main Rd	17.6	92.5	8.82	107.6	0.1
Mangakahia River @ Titoki Bridge	21.6	85.6	7.54	143.5	0.1
Mangakahia River d/s of Twin Bridges	22.6	124.6	10.77	130.1	0.1
Mangamuka River @ Iwiatua Road Bridge	24.2	109.3	9.17	167.5	0.1
Manganui River @ Mitaitai Road	22.3	63.1	5.53	208.0	0.1
Mangere Stream @ Knight Road	18.5	78.0	7.31	206.5	0.1
Ngunguru River @ Coalhill Lane	20.5	105.6	9.51	125.6	0.1
Opouteke River @ suspension bridge	22.0	107.0	9.27	150.2	0.1
Oruru River @ Oruru Road	20.9	80.8	7.20	167.1	0.1
Otaika Stream @ Otaika Valley Rd	17.8	85.8	8.14	225.5	0.1
Pukenui Stream u/s of Ridge Track crossing	15.6	93.0	9.25	163.0	0.1
Punakitere River @ Taheke Recorder	19.9	91.7	8.34	128.7	0.1
Ruakaka River @ Flyger Road	18.2	78.6	7.41	237.7	0.1
Utakura River @ Okaka Road Bridge	20.9	76.7	6.85	117.3	0.1
Victoria River @ Thompsons Bridge	23.9	99.0	8.35	176.3	0.1
Waiarohia Stream @ Kamo tributary culvert	17.6	87.4	8.33	232.4	0.1
Waiarohia Stream @ Russell Rd Bridge Nth	19.6	87.3	7.99	627.0	0.3
Waiarohia Stream @ Rust Ave Bridge	21.8	117.2	10.28	588.0	0.3
Waiarohia Stream @ Whau Valley Road	17.9	85.1	8.07	280.0	0.1
Waiharakeke Stream @ Stringers Rd Bridge	20.4	86.9	7.83	158.0	0.1
Waimamaku River @ SH12	21.1	95.8	8.52	137.4	0.1
Waiotu River @ SH1	20.0	80.4	7.31	95.0	0.0
Waipao River @ Draffin Road	19.2	101.2	9.34	367.5	0.2
Waipapa River @ Forest Ranger	19.4	83.2	7.66	136.0	0.1
Waipapa River @ Waipapa Landing Bridge	23.6	90.6	7.68	90.8	0.0
Waipoua River @ SH12 Rest Area	16.3	84.8	8.31	106.0	0.1
Wairua River @ Purua	21.8	122.2	10.71	209.7	0.1
Waitangi River @ Watea	22.7	108.3	9.34	125.1	0.1
Waitangi River @ Waimate Road	21.5	110.0	9.72	113.4	0.1
Whakapara River @ cableway	19.6	71.8	6.58	97.9	0.0

‡ Conductivity temperature compensated to 25°C.

Table 5. Physico-chemical data (water temperature, dissolved oxygen, air saturated dissolved oxygen, temperature compensated conductivity, and salinity) recorded at the four Resource Consent locations throughout Northland during 2012 invertebrate sampling (u/s = upstream, d/s = downstream). Values are presented as recorded by the YSI-85 meter.

Site name (site number)	Temp (°C)	D.O. (%)	D.O. (mg/L)	Cond.[§] (μS_{25}/cm)	Sal. (ppt)
Dam d/s (106508)	17.5	78.9	7.55	134.1	0.1
Dam u/s (106509)	17.4	99.1	9.49	133.2	0.1
Meatworks d/s (100010)	20.7	77.0	6.90	161.0	0.1
Meatworks u/s (100007)	20.4	86.9	7.83	158.0	0.1
Oxidation Pond A d/s (100280)	20.4	78.5	7.08	152.4	0.1
Oxidation Pond A u/s (100279)	20.2	100.1	9.06	121.3	0.1
Quarry d/s (103824)	19.9	79.0	7.21	136.1	0.1
Quarry u/s (103823)	20.2	82.3	7.42	120.1	0.1

[§] Conductivity temperature compensated to 25°C.

7. Appendix D

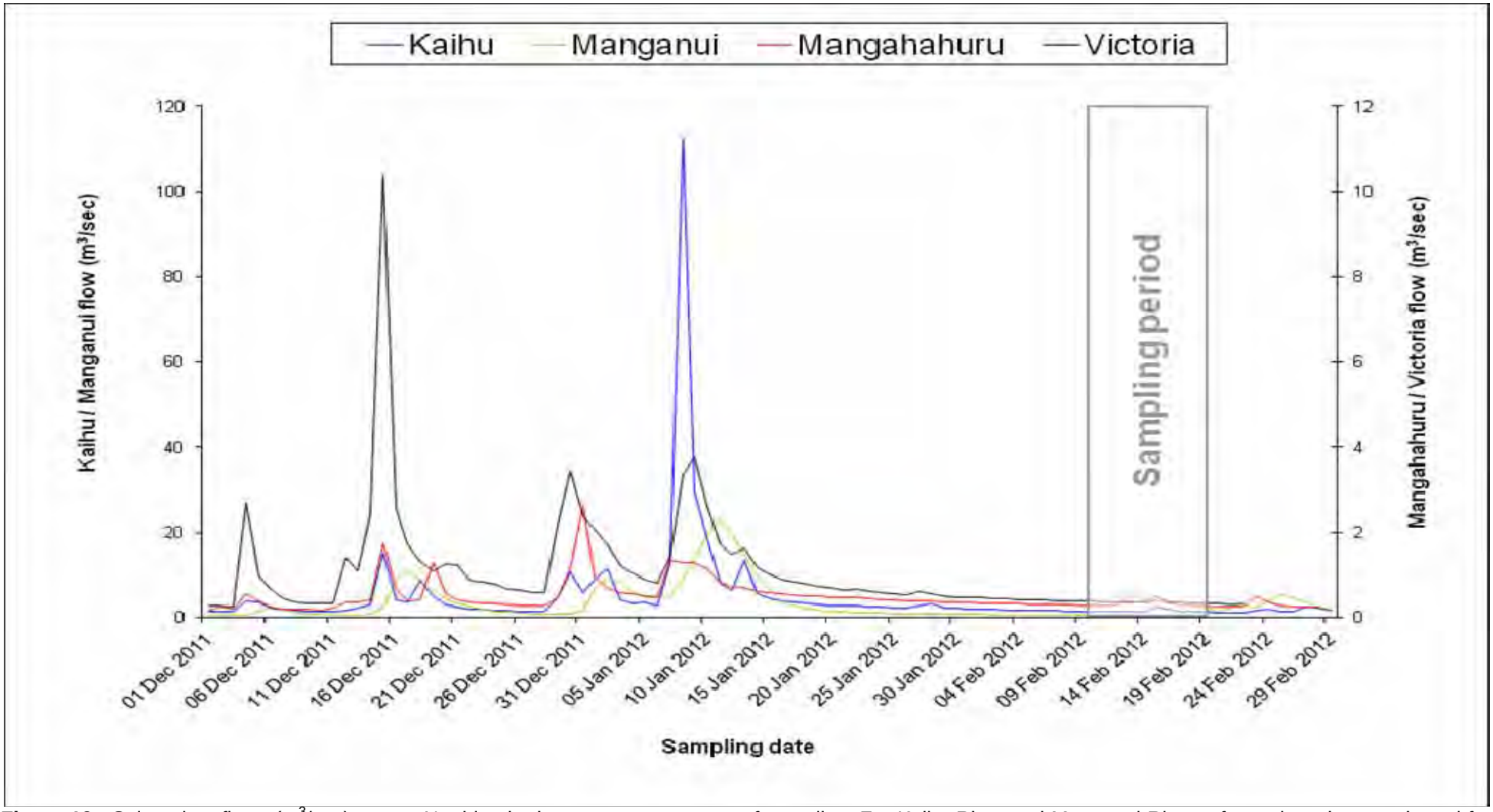

Figure 19. Select river flows (m^3/sec) across Northland prior to commencement of sampling. For Kaihu River and Manganui River refer to the primary axis and for Mangahahuru Stream and Victoria River refer to the secondary axis. Flow data are a combination of raw data (not quality controlled) and quality system approved data supplied by NRC.

7. Appendix E

Table 6. Raw macroinvertebrate coded-abundance data for the State of Environment sites, February 2012. Sites in red have been reprocessed by an independent taxonomist as a measure of Quality Control.

Site name			Waiarohia @ Rust Ave Bridge	Waiarohia @ Russell Rd Bridge (Nth)	Waiarohia @ Kamo Tributary Culvert	Waiarohia @ Whau Valley Rd Bridge	Awanui u/s Waihue Channel	Awanui @ FNDC watertake	Victoria @ Thompsons Bridge	Utakura @ Okaka Rd Bridge	Mangamuka @ Iwiatua Rd Bridge	Oruru @ Oruru Rd	Waipapa @ Forest Ranger	Pukenui u/s Ridge Track crossing	Waitangi @ Waimate Rd	Waitangi @ Watea	Kaeo River @ Dip Rd Bridge	Waipapa @ Waipapa Landing	Kerikeri @ stone store bridge	Whakapara @ cableway	Mangahahuru @ Apotu Rd Bridge
Site number			**105672**	**105674**	**105677**	**107773**	**100370**	**100363**	**105532**	**109020**	**108978**	**108979**	**10175**	**11037**	**10317**	**10175**	**10267**	**10152**	**10153**	**102249**	**100281**
Collection date			**11.02.12**	**11.02.12**	**11.02.12**	**11.02.12**	**13.02.12**	**13.02.12**	**13.02.12**	**14.02.12**	**13.02.12**	**13.02.12**	**13.02.12**	**12.02.12**	**14.02.12**	**14.02.12**	**13.02.12**	**14.02.12**	**14.02.12**	**14.02.12**	**12.02.12**
TAXA	Tolerance																				
Ephemeroptera	HB	SB [1]																			
Acanthophlebia	7	9.6	1			1			1				1	1							
Ameletopsis	10																				
Arachnocolus	8	8.1												5							
Atalophlebioides	9	4.4																			
Austroclima	9	6.5											1	20	5						
Austronella [1]	7	4.7																			
Coloburiscus	9	8.1							20		5		20	100	20				1		
Deleatidium	8	5.6		5		100		1	100		100		100	20	100		20				
Ichthybotus	8	9.2												1							
Mauiulus	5	4.1						20	1			5	1	1	1				1		
Neozephlebia	7	7.6							5					20							
Nesameletus	9	8.6				1			5		1			1							
Oniscigaster	10																1				
Rallidens	9	3.9							5												
Siphlaenigma	9	**9.0**												1							
Zephlebia	7	8.8	1	1		5		5	1	1	1	5	1	20	1	1			5	20	20
Plecoptera																					
Austroperla	9	8.4							1					1							
Megaleptoperla	9	7.3																			
Spaniocerca	8	8.8												1							
Stenoperla	10													1							
Zelandobius	5	7.4							1						1						
Zelandoperla	10										1		1		1						
Megaloptera - *Archichauliodes*	7	7.3		5	1	1			20				5	20	1				1		
Odonata																					
Antipodochlora	6	6.3												5							
Austrolestes	6	0.7																	1		
Hemicordulia	5	0.4								1								1			
Xanthocnemis	5	1.2			1	1	1			20		5				100		5		20	1
Hemiptera																					
Anisops	5	2.2								1											
Microvelia	5	4.6		1																	
Sigara	5	2.4		1			1			1						1					
Coleoptera																					
Antiporus	5	3.5																			
Dytiscidae		0.4														1					
Elmidae		7.2	5	20	1	20		5	100		20		20	1	100	1	20				
Hydraenidae		6.7												1							
Hydrophilidae	5	8.0					1														
Scirtidae		6.4												1							
Staphylinidae		6.2					1														
Diptera																					
Aphrophila	5	5.6		1	1	1			5		1		5						1		
Austrosimulium	3	3.9	5	5	1				5	1	20	5		5	5				1	20	100
Ceratopogonidae		6.2														1					
Chironomidae [2]	**2.5**	**4.7**		1	20	20	1	20	20	1	20		100	20	5	20	20	5	5	1	100
Dolichopodidae		8.6																			
Empididae		5.4			1								1								
Ephydridae		1.4		1		1													1		
Eriopterini		7.5							1		1		1	1							
Harrisius	6	4.7																			
Hexatomini		6.7				1											1				
Limonia	6	6.3			1																
Maoridiamesa	3	4.9							1				1						20		
Mischoderus (Tanyderidae)	4	5.9		1				1													
Muscidae		1.6		1				1					5		1				5		

Orthocladiinae	2	3.2	100	100	20	20		1	1		5	5	100	20	100	100	20	20	100	20	100
Paradixa	4	8.5												1							
Paralimnophila	6	7.4												5							
Psychodidae	1	6.1			5																
Tabanidae	3	6.8							1												
Tanypodinae	5	6.5						5	1		1	1		5		20	20			1	
Trichoptera																					
Aoteapsyche	4	6.0	1	100		20			100		5		20		20				20		
Beraeoptera	8	7.0							1		1		1								
Costachorema	7	7.2		1																	
Ecnomina / Zelandoptila	8	**8.3**																			
Helicopsyche	10	8.6																			
Hudsonema	6	6.5		20		5									1		5			1	
Hydrobiosella	9	7.6												5							
Hydrobiosis	5	6.7		20	1	20		1	5		20		5	1	20				1	1	1
Hydrochorema	9	**9.0**												1							
Neurochorema	6	6.0							5		1		1						1		
Oecetis [1]	6	6.8																			
Olinga	9	7.9									1		20		1		1				
Orthopsyche	9	7.5												20							
Oxyethira	2	1.2	100	20	5	100	1		5	20		20				100	5		1	100	100
Paroxyethira	2	3.7						1		1		1				1		20			1
Plectrocnemia	8	6.6							1												
Polyplectropus	8	8.1				1			1					1							
Psilochorema	8	7.8				1		1	5		1		5	5	1						
Pycnocentria	7	6.8						5	20		5			5	100		1			5	
Pycnocentrodes	5	3.8		100		5		5	100		5		5				1		5	5	
Triplectides	5	5.7		20	1		1			1	1	5				1			1	20	5
Triplectidina	5	**5.0**									1										
Lepidoptera - *Hygraula*	4	1.3					5					5									
Collembola	6	5.3			1	1				1				1							
Acarina	5	5.2	5	5	1	5			1	1						1					
Amarinus [1]	**3**	5.1		5				1				1								1	5
Amphipoda	5	5.5	20	5		100				5				1		20	1				
Cladocera	5	0.7														5		1			
Copepoda	5	2.4	1				1			1				1		1		1			
Mysidae [1]	**5**	6.4																			
OSTRACODA	3	1.9	100	20		20				1						20		1			
Paranephrops	5	8.4												1							
Paratya	5	3.6					1	1	1	5		20						5			
Ferrissia	3	2.4		5	1				5	5								5			1
Gyraulus	3	1.7	20	5	20																
Latia	3	6.1	1	5															5	1	
Lymnaeidae	3	1.2														1					
Melanopsis	3	1.9										5						20	5		
Physa	3	0.1	20	5	1	1						1				5		5		5	5
Potamopyrgus	4	2.1	100	100	1	20	100	20	100	100	1	500	1	5		20	100	20	20	500	500
Sphaeriidae	3	2.9								1					1						
HIRUDINEA	3	1.2	1	1	1																
NEMATODA	3	3.1							1	1			1			1					
NEMERTEA	3	1.8	5	20		1		1	5	1	5					100		1			
OLIGOCHAETA	1	3.8	100	20	100	100	100	1	1	20	100			1	100	20	20	5			
PLATYHELMINTHES	3	0.9	20	20	5	20	5			20	1					100		5		20	
CNIDARIA - *Hydra*	3	1.6	1	1			20									5					
Taxonomic richness			20	34	22	28	14	19	37	23	26	15	25	39	21	25	15	16	20	18	13
MCI / MCI-sb value			75.0	82.6	75.9	98.9	64.4	90.0	111.1	65.3	114.2	69.9	118.0	133.6	113.8	65.2	103.3	68.1	87.5	82.2	75.1
SQMCI / SQMCI-sb value			2.63	3.81	1.84	4.01	2.80	4.42	5.53	2.21	4.55	2.25	4.86	7.22	4.95	2.13	4.11	2.95	2.94	2.34	2.76
EPT* count			3	8	2	10	1	7	19	2	15	3	14	21	13	2	6	0	8	6	3
%EPT*			15.0	23.5	9.1	35.7	7.1	36.8	51.4	8.7	57.7	20.0	56.0	53.8	61.9	8.0	40.0	0.0	40.0	33.3	23.1

* Excludes *Oxyethira* & *Paroxyethira* (Hydroptilidae) [1] Addition from Stark & Maxted (2007). [2] Further additions to list. Bold tolerance values are additional values assigned based on professional judgement or hard-bottomed tolerances.

Table 6 continued.

Site name			Mangahahuru @ end of Main Rd	Wairua @ Purua	Waipao @ Draffin Rd	Mangere @ Knight Rd Bridge	Mangakahia @ Titoki Bridge	Opouteke @ suspension bridge	Mangakahia d/s of Twin Bridges	Punakitere @ Taheke Recorder	Waiotu @ SH1 Bridge	Kaihu @ gorge	Waipoua @ SH12 Rest Area	Waimamaku @ SH12	Manganui @ Mitaitai Rd	Ruakaka @ Flyger Road	Hakaru @ Topuni Creek Farm	Hatea u/s Mair Park Bridge	Ngunguru @ Coalhill Lane	Otaika @ Otaika Valley Rd	Waiharakeke @ Stringers Rd Bridge
Site number			100237	101753	108941	101625	101038	102258	109096	105231	102248	102256	103304	109098	102257	105008	109021	100194	110603	110431	100007
Collection date			12.02.12	11.02.12	11.02.12	11.02.12	20.02.12	20.02.12	20.02.12	20.02.12	14.02.12	20.02.12	20.02.12	20.02.12	16.02.12	16.02.12	16.02.12	12.02.12	10.02.12	16.02.12	14.02.12
TAXA	Tolerances																				
Ephemeroptera	HB	SB [1]																			
Acanthophlebia	7	9.6											5							1	
Ameletopsis	10																		1		
Arachnocolus	8	8.1																			
Atalophlebioides	9	4.4											20								
Austroclima	9	6.5	5										1				1				
Austronella [1]	7	4.7														5					1
Coloburiscus	9	8.1	100					1				1	20	5		1		20	1	20	
Deleatidium	8	5.6	100				1	20	20			5	20	20				1	5	100	1
Ichthybotus	8	9.2																			
Mauiulus	5	4.1			20			5	5				1	1		1	1		5	20	5
Neozephlebia	7	7.6												1		5				1	
Nesameletus	9	8.6	5										100								
Oniscigaster	10																				
Rallidens	9	3.9						1					1								
Siphlaenigma	9	**9.0**																			
Zephlebia	7	8.8	5		5	5	1	1	5	100	1	20	5	1		20	1	20	1	100	20
Plecoptera																					
Austroperla	9	8.4																			
Megaleptoperla	9	7.3											1								
Spaniocerca	8	8.8																			
Stenoperla	10												1								
Zelandobius	5	7.4																	1		
Zelandoperla	10	9.1										1	5								
Megaloptera																					
Archichauliodes	7	7.3	5					1	5	1		5	5	5			1	5	5	5	
Odonata																					
Antipodochlora	6	6.3																			
Austrolestes	6	0.7																			
Hemicordulia	5	0.4																			
Xanthocnemis	5	1.2		1		5					1				5						
Hemiptera																					
Anisops	5	2.2																			
Microvelia	5	4.6																			
Sigara	5	2.4									1				1						
Coleoptera																					
Antiporus	5	3.5				1															
Dytiscidae		0.4																			
Elmidae		7.2	100					20	5	20		20	20	5		1	1	5	20	20	5
Hydraenidae		6.7	1										1								
Hydrophilidae	5	8.0													1						
Scirtidae		6.4																			
Staphylinidae		6.2				1															
Diptera																					
Aphrophila	5	5.6	1					5	5			5	20	1			1	1	1	1	
Austrosimulium	3	3.9	1		5		5	1	1	1	1	5	5	5		20			1	1	1
Ceratopogonidae		6.2																			
Chironominae [2]	**2.5**	**4.7**	1	20	1	20		20	20	1	5	20	1	5		5	100	1	20	1	1
Dolichopodidae		8.6																1			
Empididae		5.4										1	1					1			
Ephydridae		1.4																			
Eriopterini		7.5	5						1											1	
Harrisius	6	4.7																			1
Hexatomini		6.7															1			1	
Limonia	6	6.3																			
Maoridiamesa	3	4.9						5	5			5						1			
Mischoderus (Tanyderidae)	4	5.9	1									1							1		
Muscidae		1.6				5		5	1			1		1			5	1	1		

Orthocladiinae	2	3.2		20				100	20	20	20	20	20	20		20	100	20	100	1	1
Paradixa	4	8.5				1	1									1					
Paralimnophila	6	7.4	1																	1	
Psychodidae	1	6.1																		1	
Tabanidae	3	6.8																			
Tanypodinae	5	6.5						1	5	1			1	1		1				1	1
Trichoptera																					
Aoteapsyche	4	6.0	5					20	5			100	20	20			20	20	20	20	100
Beraeoptera	8	7.0										1	5								
Costachorema	7	7.2	1					1					1								
Ecnomina / Zelandoptila	8	**8.3**														1					
Helicopsyche	10	8.6											100					20			
Hudsonema	6	6.5			1				1	5	1					5	1	1		5	20
Hydrobiosella	9	7.6																			
Hydrobiosis	5	6.7	1					5	5			5	5	1			5	1	1	5	1
Hydrochorema	9	**9.0**																			
Neurochorema	6	6.0						1				5		1				1			
Oecetis [1]	6	6.8								1						1				1	1
Olinga	9	7.9			1							1	20	1							
Orthopsyche	9	7.5														1					
Oxyethira	2	1.2		20		1	20	20	5	5	5	20				1	20		20	20	5
Paroxyethira	2	3.7				1					1				5		1				
Plectrocnemia	8	6.6																			
Polyplectropus	8	8.1														1				1	
Psilochorema	8	7.8											1			1				1	
Pycnocentria	7	6.8	1		5			1	1	1	1	1				20				100	1
Pycnocentrodes	5	3.8	5		1			100	5	100		100	5	5		1	20	100	5	20	1
Triplectides	5	5.7		1		20	1			1	5	1				20		1		5	20
Triplectidina	5	**5.0**																			
Lepidoptera - *Hygraula*	4	1.3													1						
Collembola	6	5.3									1				1	1					
Acarina	5	5.2						1	1	1				1		1			1	1	
CRUSTACEA																					
Amarinus [1]	**3**	5.1		5	1	5	1				1							1		5	5
Amphipoda	5	5.5		100	500	20	20			5		20			100	5	100	1	20	100	
Cladocera	5	0.7																			
Copepoda	5	2.4																			
Mysidae [1]	**5**	6.4					5														
OSTRACODA	3	1.9		1											1	1	1				
Paranephrops	5	8.4																		1	
Paratya	5	3.6					1			1						1		20			1
MOLLUSCA																					
Ferrissia	3	2.4	1	1	1				20		1	1			1	1	1		1	20	1
Gyraulus	3	1.7																1			
Latia	3	6.1			1				5	5		1				1	1	20			
Lymnaeidae	3	1.2															1				
Melanopsis	3	1.9																5			
Physa	3	0.1		1							1				1		1				
Potamopyrgus	4	2.1	20	20	500	500	500	100	100	100	500	500	5	20	500	20	100	100	20	100	100
Sphaeriidae	3	2.9				5					1					1					1
HIRUDINEA	3	1.2													1						
NEMATODA	3	3.1										1									
NEMERTEA	3	1.8	1	1				20	5					1			20	1	5	5	1
OLIGOCHAETA	1	3.8	20	20		100		20	100	5	1	20	1	20		20	100	1	20	20	20
PLATYHELMINTHES	3	0.9	1			1				5		5	1	1	20		5			20	1
CNIDARIA - *Hydra*	3	1.6														1					
Taxonomic richness			24	13	13	16	11	25	25	20	18	30	32	23	13	32	26	28	24	36	26
MCI / MCI-sb value			112.1	59.5	104.2	81.8	102.5	98.8	90.8	89.5	77.6	97.0	129.1	99.6	55.4	106.4	81.9	92.5	94.6	101.4	91.9
SQMCI / SQMCI-sb value			6.99	4.21	3.85	2.71	2.29	3.79	3.26	5.03	2.24	4.12	7.89	4.26	2.61	5.07	3.04	4.97	3.22	5.63	4.63
EPT* count			10	1	6	2	3	11	8	6	4	12	20	10	0	14	7	10	9	15	11
%EPT*			41.7	7.7	46.2	12.5	27.3	44.0	32.0	30.0	22.2	40.0	62.5	43.5	0.0	43.8	26.9	35.7	37.5	41.7	42.3

* Excludes *Oxyethira* & *Paroxyethira* (Hydroptilidae) [1] Addition from Stark & Maxted (2007). [2] Further additions to list. Bold tolerance values are additional values assigned based on professional judgement or hard-bottomed tolerances.

7. Appendix F

Table 7. Raw macroinvertebrate coded-abundance data for the Resource Consent sites, February 2012.

Site name			Dam d/s	Dam u/s	Oxidation d/s	Oxidation u/s	Meatworks d/s	Meatworks u/s	Quarry d/s	Quarry u/s
Site number			**106508**	**106509**	**100280**	**100279**	**100010**	**100007**	**103824**	**103823**
Collection date			**20.02.12**	**20.02.12**	**12.02.12**	**12.02.12**	**14.02.12**	**14.02.12**	**13.02.12**	**13.02.12**
TAXA	Tolerances									
Ephemeroptera	HB	SB [1]								
Austroclima	9	6.5		1						1
Austronella [1]	7	4.7						1		
Coloburiscus	9	8.1		20					1	1
Deleatidium	8	5.6		20				1	1	5
Mauiulus	5	4.1					5	5		
Neozephlebia	7	7.6		5						1
Nesameletus	9	8.6							1	
Zephlebia	7	8.8			1	5	5	20	20	1
Megaloptera - *Archichauliodes*	7	7.3	1	5					1	1
Odonata										
Antipodochlora	6	6.3		1						
Austrolestes	6	0.7				1				
Hemicordulia	5	0.4	1							
Xanthocnemis	5	1.2			1	1			1	
Hemiptera - *Microvelia*	5	4.6					1			
Coleoptera										
Elmidae	6	7.2	1	5				5	20	20
Staphylinidae	5	6.2								5
Diptera										
Aphrophila	5	5.6		1					1	1
Austrosimulium	3	3.9	5	20	100	5		1	1	5
Ceratopogonidae	3	6.2							1	
Chironominae [2]	**2.5**	**4.7**	1	5	20	5	1	1	20	20
Empididae	3	5.4							1	
Eriopterini	9	7.5	1	1						
Harrisius	6	4.7						1		1
Mischoderus (Tanyderidae)	4	5.9		1					1	1
Orthocladiinae	2	3.2	1	20	5	5	1	1	20	5
Paralimnophila	6	7.4		1						
Tanypodinae	5	6.5	1			1		1		
Trichoptera										
Aoteapsyche	4	6.0	1	20				100	5	1
Costachorema	7	7.2		1						
Hudsonema	6	6.5						20		
Hydrobiosis	5	6.7	1	5				1	5	5
Oecetis [1]	6	6.8						1		
Orthopsyche	9	7.5							20	20
Oxyethira	2	1.2	5	20	100	20	1	5		
Paroxyethira	2	3.7				5				
Polyplectropus	8	8.1	1						1	
Psilochorema	8	7.8	1	5					1	
Pycnocentria	7	6.8						1	5	20
Pycnocentrodes	5	3.8						1	1	
Triplectides	5	5.7	5		1		5	20	100	5
Collembola	6	5.3			1					1
Acarina	5	5.2	1	1					1	1
Amarinus [1]	**3**	5.1			5	5	1	5		
Amphipoda	5	5.5			1		100			
Cladocera	5	0.7	1							
Copepoda	5	2.4	5	1	100				1	
OSTRACODA	3	1.9	5		1					
Paranephrops	5	8.4	1							
Paratya	5	3.6					20	1		
Ferrissia	3	2.4	1			5		1		
Physa	3	0.1			1					
Potamopyrgus	4	2.1	5	1	500	500	500	100	20	20
Sphaeriidae	3	2.9	1					1		1
HIRUDINEA	3	1.2					1			
NEMERTEA	3	1.8	1	1	1	1		1		
OLIGOCHAETA	1	3.8	20	20	1			20	5	
PLATYHELMINTHES	3	0.9	5		20		5	1	1	
CNIDARIA - *Hydra*	3	1.6	1	1						
Taxonomic richness			26	25	17	13	13	26	27	23
MCI / MCI-sb value			88.1	104.4	67.8	69.7	78.0	91.9	105.6	111.7
SQMCI / SQMCI-sb value			3.20	4.52	2.31	2.22	2.77	4.63	5.02	5.51
EPT* count			5	8	2	1	3	11	12	10
%EPT*			19.2	32.0	11.8	7.7	23.1	42.3	44.4	43.5

* Excludes *Oxyethira* & *Paroxyethira* (Hydroptilidae) [1] Addition from Stark & Maxted (2007). [2] Further additions to list. **Bold** tolerance values are additional values assigned based on professional judgement or hard-bottomed tolerances.