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REGIONAL COUNCIL
Te Pane Matua Taiao

Rivers State of the Environment monitoring programme

Annual data report, 2013/14

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Contents

1. Introduction

This report summarises the key results from the Rivers State of Environment (RSoE) monitoring programme for the period 1 July 2013 to 30 June 2014 inclusive. The RSoE programme incorporates monthly monitoring of water quality, periphyton cover and sediment deposition at 55 river and stream sites across the Wellington region. Macrophyte cover is also assessed monthly at selected RSoE sites. In addition, annual assessments of invertebrate community composition, periphyton biomass and habitat quality are conducted at all 55 RSoE sites in summer/autumn.

Note that the suitability of rivers for contact recreation purposes is reported separately under Greater Wellington Regional Council's (GWRC) recreational water quality monitoring programme; for the 2013/14 results, see Morar and Greenfield (2014). Information on river and stream flows is reported under GWRC's hydrological monitoring programme (see Harkness 2014).

2. Overview of RSoE monitoring programme

River and stream water quality has been routinely monitored in the western half of the Wellington region since 1987 and in the Wairarapa since 1991. The monitoring programme has continued to evolve since this time with changes made to the location and number of monitoring sites, the range of variables monitored, and the methods of analysis (see Milne and Perrie (2005) and Perrie et al. (2012) for details). However, since September 2003, the RSoE monitoring programme has remained largely unchanged, with only minor changes to the existing suite of monitoring sites and variables.

2.1 Monitoring objectives

The aims of GWRC's Rivers SoE monitoring programme are to:

1. Assist in the detection of spatial and temporal changes in rivers and streams;

2. Contribute to our understanding of freshwater biodiversity in the Wellington region;

3. Determine the suitability of rivers and streams for designated uses;

4. Provide information to assist in targeted investigations where remediation or mitigation of poor water quality or ecosystem health is desired; and

5. Provide information required to determine the effectiveness of regional plans and policies.

2.2 Monitoring network

Water quality and ecosystem health are currently monitored at 55 river and stream sites (Figure 2.1, Appendix 1). These sites were chosen to represent the major land uses and human activities, and also the natural diversity of rivers and streams, in the Wellington region.

2.3 Monitoring variables

2.3.1 Water quality variables

River and stream water quality is assessed at monthly intervals by measuring a range of physico-chemical and microbiological variables: dissolved oxygen, temperature, pH, conductivity, visual clarity, turbidity, suspended solids, faecal indicator bacteria, total organic carbon, and dissolved and total nutrients. Water samples from ten RSoE sites located in urban catchments with likely exposure to heavy metal inputs, or which discharge into sensitive downstream receiving environments (eg, harbours and estuaries), are also analysed for dissolved concentrations of copper and zinc. The full list of variables monitored, together with details of field and analytical methods, is provided in Appendix 2.

During the 2013/14 year, additional laboratory test methods were trialled in parallel alongside existing test methods for dissolved nutrients and total nitrogen (Appendix 2). This trial, which also encompassed six-months of parallel field versus laboratory filtering for dissolved nutrient testing, was carried out following recommendations made to improve national consistency in freshwater monitoring and reporting (see Davies-Colley et al. 2012).

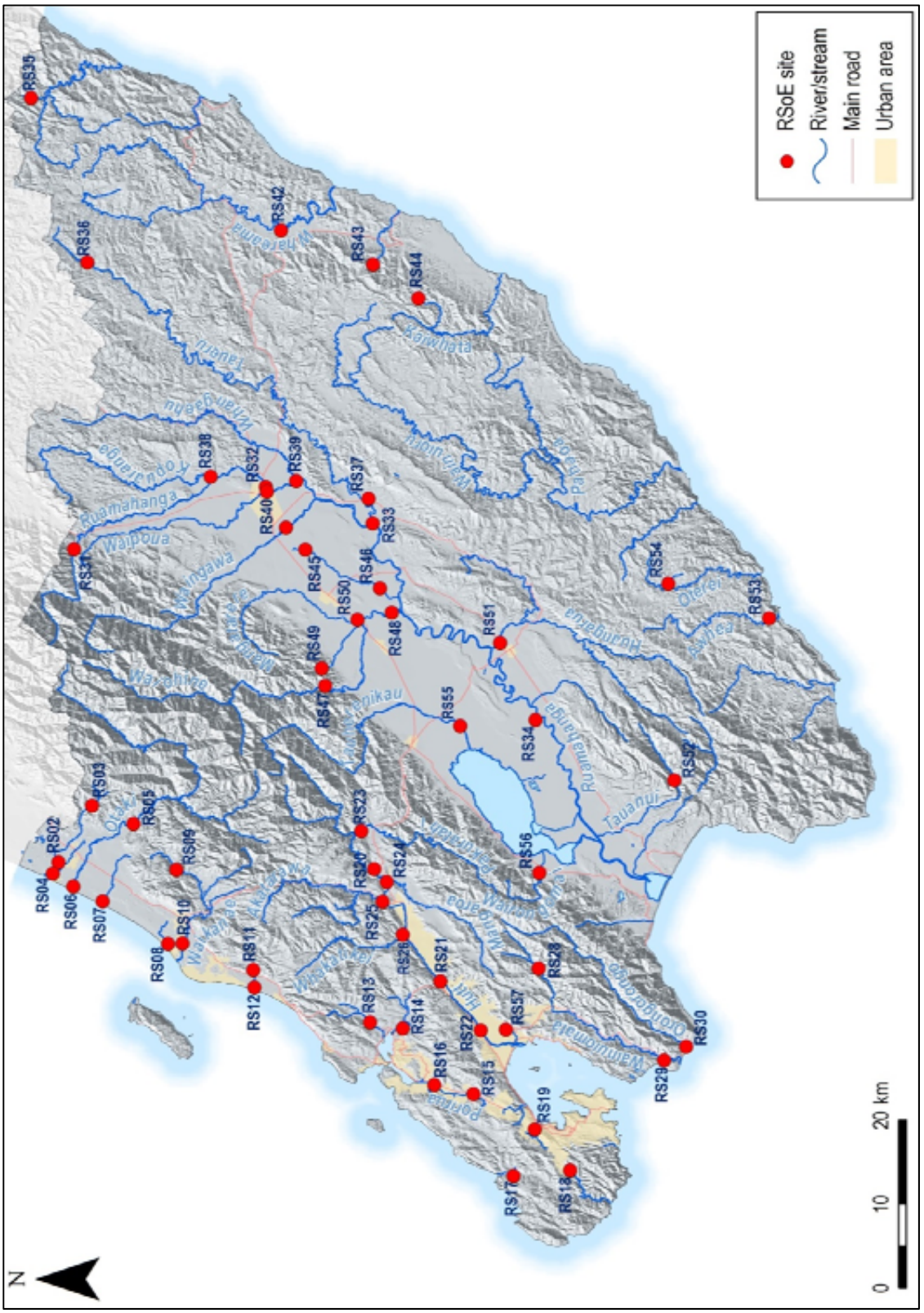

Figure 2.1: RSoE sites monitored over 2013/14

2.3.2 Biological variables

Rivers and streams are also assessed for ecological condition. This involves semi-quantitative assessments of macroinvertebrate communities and periphyton biomass during stable/low flows in summer/autumn. Assessments of periphyton (which includes taxonomic identification) are only undertaken at sites with hard substrates such as cobbles and large gravel (46 in total, see Appendix 1 for RSoE site substrate types). Periphyton cover is also assessed monthly at these sites at the time of water sample collection. Details of current biological monitoring methods are summarised in Appendix 2.

2.3.3 Changes to monitoring variables in 2013/14

In 2013/14, a number of changes/additions to the variables monitored and reported were implemented. These included:

- An increase in the total number of periphyton cover observations made during each monthly site assessment (from 10 to 20 and encompassing both run and riffle habitat);
- The addition of a cyanobacterial mat cover category to the monthly periphyton cover assessments (previous assessments were limited to filamentous and 'general' mat-forming periphyton cover);
- An assessment of macrophyte cover at selected sites (undertaken monthly at the time of water sample collection);
- An assessment of streambed sediment cover (undertaken monthly at the time of water sample collection); and
- The application of a new rapid habitat quality assessment method[1] (undertaken with annual biological sampling).

Details of these methods can be found in Appendix 2.

[1] Habitat assessments, in some form, have always been undertaken in conjunction with annual biological sampling (eg, see Perrie et al. 2012); however, this information has not been regularly reported.

3. Physico-chemical and microbiological water quality

3.1 Approach to analysis

In this section a water quality index is used as a comparative measure to summarise water quality across the Wellington region, based on physico-chemical and microbiological data collected monthly from July 2013 to June 2014 inclusive (see Appendix 3 for tabulated data). Concentrations of heavy metals (copper and zinc) recorded at selected urban sites are also summarised (Appendix 4). The summary information is typically based on 12 sampling events for all 55 sites. However, sampling at three sites (Mataikona tributary at Sugar Loaf Road, Coles Creek tributary at Lagoon Hill Road and Parkvale tributary at Lowes Reserve) was not always possible due to access issues (eg, during lambing or calving) or safety concerns (eg, access tracks can be dangerous during winter).

During data processing, any water quality variables reported as less than or greater than detection limits were replaced by values one half of the detection limit or the detection limit respectively (eg, a value of <2 became 1, a value of >400 became 400). The exception is minimum values reported in the tabulated summaries in Appendices 3 and 4 (ie, if a value was reported as <2 the minimum value presented is <2).

3.1.1 Water quality index

A water quality index (WQI), as described in Perrie (2007) and Perrie et al. (2012), is used to facilitate inter-site comparisons of the state of water quality in the region's rivers and streams. The WQI is derived from the *median* values of the following six variables: visual clarity (black disc), dissolved oxygen (% saturation), dissolved reactive phosphorus, ammoniacal nitrogen, nitrite-nitrate nitrogen and *Escherichia coli (E. coli)*.

The application of the WQI enables water quality at each site to be classified into one of four categories as follows:

- Excellent: median values for all 6 variables comply with guideline values
- Good: median values for 5 of the 6 variables comply with guideline values, of which dissolved oxygen is one variable that must comply[2]
- Fair: median values for 3 or 4 of the 6 variables comply with guideline values, of which dissolved oxygen is one variable that must comply[2]
- Poor: median values for <3 of the 6 variables comply with guideline values, or the median dissolved oxygen concentration/value does not comply with the guideline value.

The guidelines used in the WQI assessment are listed in Table 3.1. Refer to Perrie (2007) and Perrie et al. (2012) for further discussion on these guidelines.

[2] If the median dissolved oxygen concentration does not comply with the guideline value, then the WQI grade automatically drops to 'poor'.

Table 3.1: Physico-chemical and microbiological variables and guideline values used in GWRC's WQI

Variable	Guideline value	Reference
Dissolved oxygen (% saturation)	≥80	RMA 1991 Third Schedule
Visual clarity (m)	≥1.6	MfE (1994)
Nitrite-nitrate nitrogen (mg/L)	≤0.444	ANZECC & ARMCANZ (2000)
Ammoniacal nitrogen (mg/L)	≤0.021	ANZECC & ARMCANZ (2000)
Dissolved reactive phosphorus (mg/L)	≤0.010	ANZECC & ARMCANZ (2000)
E. coli (cfu/100mL)	≤100	ANZECC & ARMCANZ (2000)

As outlined in Perrie (2007), the WQI is for comparative purposes rather than an absolute measure of water quality; sites with a grade of 'good', 'fair', or 'poor' are all considered degraded to some degree because the median value of at least one of the six physico-chemical or microbiological variables in the WQI exceeded a guideline value. In addition, as the WQI is based on median values (ie, 50% compliance), sites awarded the same water quality grade may exhibit varying degrees of compliance (from 51 to 100%) with the guideline value. Therefore, to differentiate between 'better' and 'poorer' sites, the sites within each WQI class are ranked based on the number of guideline exceedances for each of the six key variables (ie, a site that exceeded a guideline on 40% of sampling occasions will be ranked lower than a site with the same WQI grade that exceeded the same guideline on 10% of sampling occasions).

3.1.2 Heavy metals

Median heavy metal concentrations are compared against ANZECC (2000) chronic toxicity 'trigger values' (95% level of protection). Because water hardness affects the toxicity of some heavy metals, where a median concentration exceeds the trigger value, site-specific, hardness-modified trigger values are calculated based on recommendations and equations in ANZECC (2000). The median concentrations are then compared against their respective modified trigger value. Because water hardness is not part of the existing suite of variables analysed in the RSoE programme, the median water hardness from monthly monitoring over July 2012 to June 2013 (inclusive) is used as a surrogate of local water hardness conditions (see Morar & Perrie (2013) for hardness information).

3.2 Results

3.2.1 Water quality index

Application of the WQI resulted in the following overall water quality grades for the 55 RSoE sites monitored in the Wellington region over the July 2013 to June 2014 reporting period (Table 3.2; Figure 3.1):

- Excellent: 16 sites (29.1%)
- Good: 9 sites (16.4%)
- Fair: 13 sites (23.6%)
- Poor: 17 sites (30.9%)

Table 3.2: Water Quality Index grades for RSoE sites sampled at monthly intervals over July 2013 to June 2014 inclusive, based on compliance of median dissolved oxygen (DO), visual clarity (clarity), *E. coli,* nitrite-nitrate nitrogen (NNN), ammoniacal nitrogen (Amm. N) and dissolved reactive phosphorus (DRP) values with guideline values

Rank	Site no.	Site name	Guideline compliance (median values)					
			DO	Clarity	*E. coli*	NNN	Amm. N	DRP
Excellent water quality								
1	RS56	Waiorongomai R at Forest Pk	✓	✓	✓	✓	✓	✓
2	RS03	Waitohu S at Forest Pk	✓	✓	✓	✓	✓	✓
3=	RS52	Tauanui R at Whakatomotomo Rd	✓	✓	✓	✓	✓	✓
	RS05	Otaki R at Pukehinau	✓	✓	✓	✓	✓	✓
5	RS31	Ruamahanga R at McLays	✓	✓	✓	✓	✓	✓
6	RS10	Waikanae R at Greenaway Rd	✓	✓	✓	✓	✓	✓
7=	RS55	Tauherenikau R at Websters	✓	✓	✓	✓	✓	✓
	RS49	Beef Ck at Headwaters	✓	✓	✓	✓	✓	✓
	RS06	Otaki R at Mouth	✓	✓	✓	✓	✓	✓
10=	RS47	Waiohine R at Gorge	✓	✓	✓	✓	✓	✓
	RS25	Akatarawa R at Hutt confl.	✓	✓	✓	✓	✓	✓
12	RS30	Orongorongo R at Orongorongo Stn	✓	✓	✓	✓	✓	✓
13=	RS26	Whakatikei R at Riverstone	✓	✓	✓	✓	✓	✓
	RS41	Waingawa R at South Rd	✓	✓	✓	✓	✓	✓
15	RS51	Huangarua R at Ponatahi Br	✓	✓	✓	✓	✓	✓
16	RS32	Ruamahanga R at Te Ore Ore	✓	✓	✓	✓	✓	✓
Good water quality								
17	RS43	Motuwaireka S at Headwaters	✓	x	✓	✓	✓	✓
18	RS35	Mataikona Trib at Sugar Loaf Rd	✓	x	✓	✓	✓	✓
19=	RS44	Totara S at Stronvar	✓	x	✓	✓	✓	✓
	RS54	Coles Ck Trib at Lagoon Hill Rd	✓	x	✓	✓	✓	✓
21	RS28	Wainuiomata R at Manuka Track	✓	✓	✓	✓	✓	x
22	RS20	Hutt R at Te Marua Intake Site	✓	x	✓	✓	✓	✓
23	RS09	Waikanae R at Mangaone Walkway	✓	✓	✓	✓	✓	x
24	RS40	Waipoua R at Colombo Rd Br	✓	✓	✓	x	✓	✓
25	RS29	Wainuiomata R d/s of White Br	✓	✓	✓	✓	✓	x
Fair water quality								
26	RS22	Hutt R at Boulcott	✓	x	x	✓	✓	✓
27	RS23	Pakuratahi R 50m d/s Farm Ck	✓	x	x	✓	✓	✓
28=	RS21	Hutt R opp. Manor Park G.C.	✓	x	x	✓	✓	✓
	RS53	Awhea R at Tora Rd	✓	x	✓	✓	✓	x
30	RS36	Taueru R at Castlehill	✓	x	x	✓	✓	✓
31	RS48	Waiohine R at Bicknells	✓	x	✓	✓	✓	x
32	RS42	Whareama R at Gauge	✓	x	x	✓	✓	✓
33	RS33	Ruamahanga R at Gladstone Br	✓	✓	✓	✓	x	x
34	RS34	Ruamahanga R at Pukio	✓	x	✓	✓	✓	x
35	RS13	Horokiri S at Snodgrass	✓	✓	x	x	✓	x
36	RS24	Mangaroa R at Te Marua	✓	x	x	✓	✓	x
37	RS14	Pauatahanui S at Elmwood Br	✓	x	x	✓	✓	x
38	RS19	Kaiwharawhara S at Ngaio Gorge	✓	✓	x	x	✓	x
Poor water quality								
39	RS45	Parkvale Trib at Lowes Res.	x	✓	✓	x	✓	✓
40	RS11	Whareroa S at Waterfall Rd	✓	x	x	x	✓	x
41	RS38	Kopuaranga R at Stewarts	✓	x	x	x	✓	x
42	RS17	Makara S at Kennels	✓	x	x	x	✓	x
43=	RS50	Mangatarere S at SH 2	✓	✓	x	x	x	x
	RS15	Porirua S at Glenside	✓	x	x	x	✓	x
45	RS39	Whangaehu R 250m u/s confl.	✓	x	x	x	✓	x
46	RS16	Porirua S at Wall Park (Milk Depot)	✓	x	x	x	✓	x
47	RS18	Karori S at Makara Peak	✓	✓	x	x	x	x
48	RS46	Parkvale S at Weir	✓	x	x	x	✓	x
49	RS04	Waitohu S at Norfolk Cres	✓	x	x	✓	x	x
50	RS37	Taueru R at Gladstone	✓	x	x	x	x	x
51	RS57	Waiwhetu S at Whites Line East	✓	x	x	x	x	x
52	RS08	Ngarara S at Field Way	x	x	x	✓	x	x
53	RS12	Whareroa S at QE Park	x	x	x	✓	x	x
54=	RS02	Mangapouri S at Bennetts Rd	x	x	x	x	x	x
	RS07	Mangaone S at Sims Rd Br	x	x	x	x	x	x

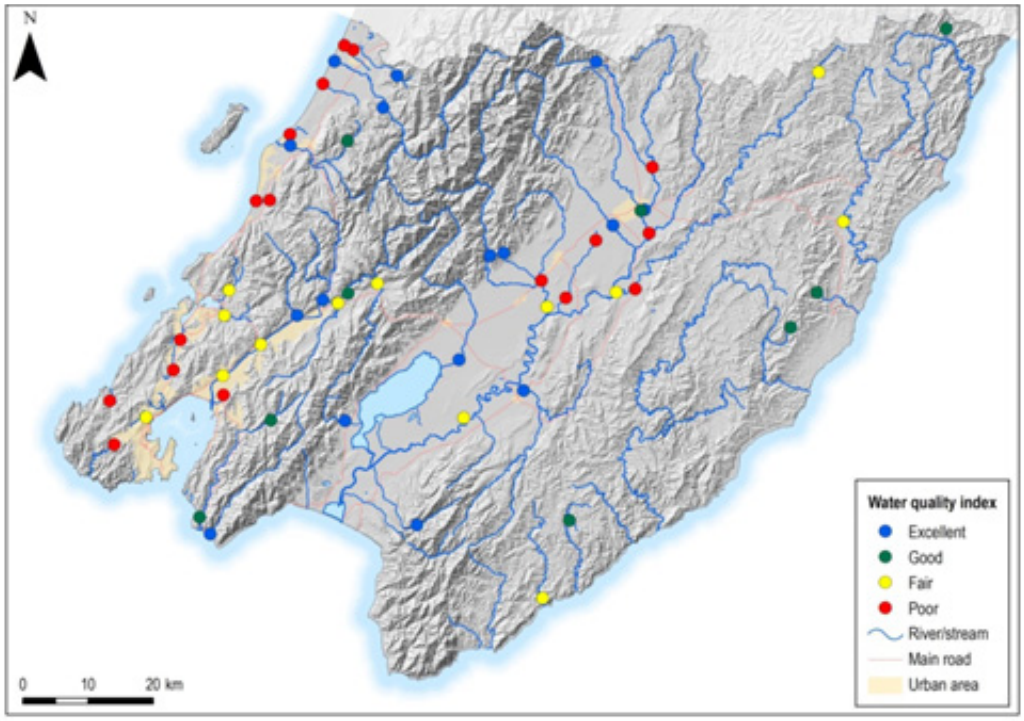

Figure 3.1: Water Quality Index grades for RSoE sites sampled at monthly intervals between July 2013 and June 2014, based on compliance of median dissolved oxygen, visual clarity, nitrite-nitrate nitrogen, ammoniacal nitrogen, dissolved reactive phosphorus and *E. coli* values with guideline values

Thirteen of the 16 RSoE sites graded 'excellent' are located on river and stream reaches in catchments with predominantly unmodified indigenous forest cover (refer Appendix 1 for dominant land cover). These tend to be sites on rivers flowing out of the Aorangi, Tararua and Rimutaka ranges and include the Otaki, Tauanui and Waiorongomai rivers, and the upper reaches of the Waitohu and Ruamahanga rivers. In contrast, RSoE sites graded 'poor' are typically located on small rivers or streams draining predominantly pastoral (nine sites) or urban (seven sites) catchments. Sites with the poorest water quality during 2013/14 were Mangaone Stream at Sims Road Bridge and Mangapouri Stream at Bennetts Road (Table 3.2).

The water quality variables that most commonly failed to meet guideline values (based on median values) were visual clarity (29 sites), followed by dissolved reactive phosphorus (27 sites), *E. coli* (25 sites) and nitrite-nitrate nitrogen (17 sites). Guidelines for ammoniacal nitrogen and dissolved oxygen were not met at ten and five sites, respectively.

3.2.2 Heavy metals

Median concentrations of dissolved copper exceeded the ANZECC (2000) default trigger value at three sites, with two of these sites (Porirua Stream at Wall Park and Karori Stream at Makara Mountain Bike Park) also exceeding their site-specific, hardness-modified trigger value. Three sites (Karori Stream at Makara Mountain Bike Park, Porirua Stream at Wall Park and Waiwhetu Stream at Whites Line East) exceeded both the ANZECC (2000) default trigger value and their respective site-specific, hardness-modified trigger value for dissolved zinc. Summary statistics for heavy metals can be found in Appendix 4.

4. Periphyton and macrophytes

4.1 Approach to analysis

Assessment of periphyton data is limited to RSoE sites with hard substrates (46 of the 55 sites). Monthly observations of percent streambed periphyton cover (filamentous and mat-forming (including cyanobacteria) periphyton) from July 2013 to June 2014 inclusive, and an assessment of periphyton biomass (chlorophyll *a* and Ash Free Dry Mass (AFDM)) undertaken in late summer/early autumn 2014 are compared against various MfE (2000) guidelines (Table 4.1). Monthly cover assessments of potentially toxic mat-forming cyanobacteria are compared against the MfE and MoH (2009) guidelines (Table 4.2). Macrophyte cover, measured monthly at 16 RSoE sites, is also summarised.

Table 4.1: MfE (2000) guidelines used to assess periphyton streambed cover and biomass

Instream value/variable	Mat periphyton	Filamentous periphyton
Aesthetics/recreation		
Maximum cover of visible streambed	60% >0.3 cm thick	30% >2 cm long
Benthic biodiversity		
Maximum chlorophyll *a*	50 mg/m^2	50 mg/m^2
Trout habitat and angling		
Maximum AFDM	35 g/m^2	35 g/m^2
Maximum cover of visible streambed	N/A	30% >2 cm long

Table 4.2: MfE/MoH (2009) alert framework for benthic cyanobacteria cover in rivers

Alert level	Guideline
Green	≤20% coverage of potentially toxic cyanobacteria attached to substrate
Amber	20–50% coverage of potentially toxic cyanobacteria attached to substrate
Red	>50% coverage of potentially toxic cyanobacteria attached to substrate

[1] The red alert level is slightly modified from the MfE and MoH (2009) guidelines; detached mats are not recorded.

4.2 Results

The number of observations of streambed periphyton cover made during the reporting period varied among the 46 RSoE sites due to either site access being restricted or because turbid water or high flows prevented periphyton assessments being carried out on some occasions. Observations for sites in the Hutt River catchment were particularly few in number as a result of sampling often coinciding with high river flows during or following rainfall.

Of the 46 RSoE sites, 15 exceeded the MfE (2000) guideline for filamentous periphyton streambed cover on at least one sampling occasion (Table 4.3). The sites that most often exceeded the guideline were Huangarua River at Ponatahi Bridge, Mangatarere Stream at SH 2 and Parkvale Stream at Weir (all on three occasions). These sites are all located in the Wairarapa and in catchments dominated by pastoral land use.

Table 4.3: Summary of monthly observations at RSoE sites, over July 2013 to June 2014 inclusive, of visible streambed periphyton cover in relation to exceedances of the MfE (2000) and MfE & MoH (2009) guidelines

Site no.	Site name	*n*	Streambed cover						
			Filamentous (>2 cm long)		Mats[1] (>0.3 cm thick)		Cyanobacterial mats[1] (>0.1 cm thick)		
			Max	*n* >30%	Max	*n* >60%	Max	*n* 20–50%	*n* >50%
RS03	Waitohu S at Forest Pk	10	0	0	3	0	3	0	0
RS05	Otaki R at Pukehinau	9	0	0	0	0	3	0	0
RS06	Otaki R at Mouth	9	33	1	23	0	11	0	0
RS09	Waikanae R at Mangaone Walkway	12	0	0	0	0	0	0	0
RS10	Waikanae R at Greenaway Rd	11	3	0	7	0	4	0	0
RS11	Whareroa S at Waterfall Rd	12	0	0	0	0	0	0	0
RS13	Horokiri S at Snodgrass	10	15	0	14	0	7	0	0
RS14	Pauatahanui S at Elmwood Br	10	43	1	0	0	0	0	0
RS15	Porirua S at Glenside	9	2	0	0	0	0	0	0
RS16	Porirua S at Wall Park (Milk Depot)	6	30	0	0	0	0	0	0
RS17	Makara S at Kennels	7	48	1	0	0	0	0	0
RS18	Karori S at Makara Peak	9	54	1	3	0	0	0	0
RS19	Kaiwharawhara S at Ngaio Gorge	9	79	1	0	0	0	0	0
RS20	Hutt R at Te Marua Intake Site	4	0	0	0	0	1	0	0
RS21	Hutt R opp. Manor Park G.C.	3	1	0	0	0	2	0	0
RS22	Hutt R at Boulcott	3	22	0	16	0	23	1	0
RS23	Pakuratahi R 50m d/s Farm Ck	3	0	0	0	0	1	0	0
RS24	Mangaroa R at Te Marua	4	12	0	0	0	2	0	0
RS25	Akatarawa R at Hutt confl.	10	8	0	8	0	20	1	0
RS26	Whakatikei R at Riverstone	9	9	0	1	0	3	0	0
RS28	Wainuiomata R at Manuka Track	12	4	0	4	0	2	0	0
RS29	Wainuiomata R d/s of White Br	7	30[2]	1[2]	41	0	34	1	0
RS30	Orongorongo R at Orongorongo Stn	9	50	2	0	0	0	0	0
RS31	Ruamahanga R at McLays	8	0	0	0	0	0	0	0
RS32	Ruamahanga R at Te Ore Ore	7	6	0	17	0	3	0	0
RS33	Ruamahanga R at Gladstone Br	7	6	0	7	0	6	0	0
RS34	Ruamahanga R at Pukio	6	23	0	0	0	1	0	0
RS35	Mataikona Trib at Sugar Loaf Rd	10	0	0	0	0	0	0	0
RS37	Taueru R at Gladstone	5	61	1	16	0	5	0	0
RS38	Kopuaranga R at Stewarts	7	89	2	18	0	7	0	0
RS40	Waipoua R at Colombo Rd Br	12	58	2	57	0	24	1	0
RS41	Waingawa R at South Rd	10	8	0	0	0	0	0	0
RS43	Motuwaireka S at Headwaters	12	0	0	0	0	0	0	0
RS44	Totara S at Stronvar	9	24	0	41	0	4	0	0
RS45	Parkvale Trib at Lowes Res.	7	0	0	0	0	0	0	0
RS46	Parkvale S at Weir	8	59	3	11	0	11	0	0
RS47	Waiohine R at Gorge	7	2	0	0	0	1	0	0
RS48	Waiohine R at Bicknells	9	71	1	13	0	2	0	0
RS49	Beef Ck at Headwaters	12	0	0	0	0	0	0	0
RS50	Mangatarere S at SH 2	9	76	3	0	0	0	0	0
RS51	Huangarua R at Ponatahi Br	10	59	3	31	0	30	1	0
RS52	Tauanui R at Whakatomotomo Rd	12	0	0	1	0	0	0	0
RS53	Awhea R at Tora Rd	8	66	2	53	0	0	0	0
RS54	Coles Ck Trib at Lagoon Hill Rd	8	3	0	17	0	0	0	0
RS55	Tauherenikau R at Websters	9	19	0	5	0	0	0	0
[1]RS56	Waiorongomai R at Forest Pk	12	0	0	0	0	0	0	0

[1] Mat-forming and cyanobacterial mat-periphyton cover data are not mutually exclusive (eg, cyanobacterial mats >0.3 cm thick would also be counted under mat-forming periphyton.

[2] Note that the maximum observed cover has been rounded down from 30.3% to 30% so does represent a guideline exceedance.

No sites exceeded the MfE (2000) guideline for mat-forming periphyton cover during the reporting period. However, five sites (all on one occasion) exceeded the MfE/MoH (2009) alert guideline for benthic mat-forming cyanobacteria cover.

Five RSoE sites exceeded the MfE (2000) chlorophyll *a* guideline for benthic biodiversity (Table 4.4). The highest chlorophyll *a* biomass recorded was in the Kopuaranga River at Stewarts (248.7 mg/m^2). The Kopuaranga River at Stewarts was also the only site that exceeded the MfE (2000) AFDM guideline for trout habitat and angling (37.9 g/m^2).

There was a reasonable relationship between periphyton guideline compliance and WQI grades. In general, sites with 'excellent' water quality were more likely to comply with guidelines for periphyton cover and biomass than sites assigned lower WQI grades. However, at some sites variables other than water quality, such as accrual periods and streamside shade, more strongly influence periphyton growth and hence compliance with guidelines.

Table 4.4: Periphyton biomass (AFDM and chlorophyll *a*) from one-off sampling during late summer/autumn 2014. Non-compliance with MfE (2000) guidelines is highlighted in bold type

Site no.	Site name	AFDM (g/m^2)	Chlorophyll *a* (mg/m^2)
RS03	Waitohu S at Forest Pk	0.61	0.64
RS05	Otaki R at Pukehinau	0.68	0.37
RS06	Otaki R at Mouth	5.13	15.35
RS09	Waikanae R at Mangaone Walkway	0.23	0.46
RS10	Waikanae R at Greenaway Rd	1.89	4.95
RS11	Whareroa S at Waterfall Rd	0.69	0.98
RS13	Horokiri S at Snodgrass	2.42	12.35
RS14	Pauatahanui S at Elmwood Br	11.99	43.65
RS15	Porirua S at Glenside	1.54	9.37
RS16	Porirua S at Wall Park (Milk Depot)	1.74	10.85
RS17	Makara S at Kennels	2.65	8.84
RS18	Karori S at Makara Peak	2.47	12.77
RS19	Kaiwharawhara S at Ngaio Gorge	1.55	9.23
RS20	Hutt R at Te Marua Intake Site	0.34	0.48
RS21	Hutt R opp. Manor Park G.C.	0.98	6.55
RS22	Hutt R at Boulcott	3.85	38.43
RS23	Pakuratahi R 50m d/s Farm Ck	0.20	0.81
RS24	Mangaroa R at Te Marua	2.51	11.74
RS25	Akatarawa R at Hutt confl.	0.21	0.09
RS26	Whakatikei R at Riverstone	1.78	10.97
RS28	Wainuiomata R at Manuka Track	1.86	9.28
RS29	Wainuiomata R d/s of White Br	8.74	**50.66**
RS30	Orongorongo R at Orongorongo Stn	2.06	2.04
RS31	Ruamahanga R at McLays	0.13	0.48
RS32	Ruamahanga R at Te Ore Ore	1.82	6.50
RS33	Ruamahanga R at Gladstone Br	2.50	9.62
RS34	Ruamahanga R at Pukio	0.35	0.71
RS35	Mataikona Trib at Sugar Loaf Rd	0.61	0.30
RS37	Taueru R at Gladstone	24.60	**114.82**
RS38	Kopuaranga R at Stewarts	**37.91**	**248.71**
RS40	Waipoua R at Colombo Rd Br	2.85	13.45
RS41	Waingawa R at South Rd	0.09	0.09
RS43	Motuwaireka S at Headwaters	0.86	0.84
RS44	Totara S at Stronvar	2.28	1.82
RS45	Parkvale Trib at Lowes Res.	3.43	0.85
RS46	Parkvale S at Weir	13.91	**50.55**
RS47	Waiohine R at Gorge	0.10	0.08
RS48	Waiohine R at Bicknells	0.43	0.45
RS49	Beef Ck at Headwaters	0.66	2.08
RS50	Mangatarere S at SH 2	3.96	19.96
RS51	Huangarua R at Ponatahi Br	27.48	**136.19**
RS52	Tauanui R at Whakatomotomo Rd	0.40	0.32
RS53	Awhea R at Tora Rd	1.66	7.73
RS54	Coles Ck Trib at Lagoon Hill Rd	3.18	9.17
RS55	Tauherenikau R at Websters	0.33	0.16
RS56	Waiorongomai R at Forest Pk	0.33	0.29

A summary of total streambed macrophyte cover data is presented in Table 4.5. Sites that recorded the highest median cover were Mangapouri Stream at Bennetts Road (86%), Parkvale tributary at Lowes Reserve (66%) and Mangaone Stream at Sims Road Bridge (58%).

Table 4.5: Summary of total streambed macrophyte cover from selected RSoE sites, based on monthly observations between July 2013 and June 2014 inclusive

Site no.	Site name	Total macrophyte streambed cover (%)			
		n	Median	Minimum	Maximum
RS02	Mangapouri S at Bennetts Rd	12	86	0	100
RS04	Waitohu S at Norfolk Cres	12	11	0	54
RS07	Mangaone S at Sims Rd Br	12	58	0	100
RS08	Ngarara S at Field Way	12	0	0	11
RS12	Whareroa S at QE Park	12	7	0	70
RS14	Pauatahanui S at Elmwood Br	12	6	0	24
RS17	Makara S at Kennels	12	1	0	9
RS29	Wainuiomata R d/s of White Br	12	6	0	63
RS36	Taueru R at Castlehill	12	0	0	0
RS37	Taueru R at Gladstone	12	0	0	32
RS38	Kopuaranga R at Stewarts	12	5	0	14
RS39	Whangaehu R 250m u/s confl.	12	0	0	26
RS42	Whareama R at Gauge	11	0	0	20
RS45	Parkvale Trib at Lowes Res.	9	66	54	80
RS46	Parkvale S at Weir	12	14	0	48
RS57	Waiwhetu S at Whites Line East	12	33	0	100

5. Macroinvertebrates

5.1 Approach to analysis

Macroinvertebrate sampling was undertaken at each of the 55 RSoE sites during late summer/early autumn 2014. The Macroinvertebrate Community Index (MCI), an index of sensitivity to a wide range of environmental variables (Stark & Maxted 2007), is used to summarise macroinvertebrate health. Additional macroinvertebrate indices (QMCI, %EPT taxa, and taxa richness)[3] are presented in Appendix 5. Refer to Perrie et al. (2012) for further explanation of these indices.

The quality classifications, as recommended by Stark and Maxted (2007), for interpretation of the MCI scores are outlined in Table 5.1. Soft bottomed MCI scores (MCI-sb) have also been calculated for the nine RSoE sites with soft substrates (see Appendix 1).

Table 5.1: Interpretation of MCI-type scores (from Stark & Maxted 2007)

Quality class	MCI and MCI-sb
Excellent	≥ 120
Good	100–119
Fair	80–99
Poor	<80

5.2 Results

The MCI scores based on one sample collected from each monitoring site are presented in Table 5.2. The 55 RSoE sites fell into the following MCI quality classes (Figure 5.1):

- Excellent: 17 sites (30.9%)
- Good: 21 sites (38.2%)
- Fair: 11 sites (20.0%)
- Poor: 6 sites (10.9%)

The majority (16 of 17) of the RSoE sites in the 'excellent' MCI quality class are located in catchments dominated by indigenous forest cover (eg, Waikanae River at Mangaone Walkway). The six RSoE sites in the 'poor' quality class all have soft-sediment substrate and are located in catchments dominated by either pastoral landcover (three sites) or urban landcover (three sites).

There was a reasonable relationship between the MCI quality classes and WQI grades. For example, of the 17 RSoE sites with an 'excellent' MCI quality class, 9 had a WQI grade of 'excellent' and seven a WQI grade of 'good'. Similarly, all six RSoE sites with an MCI quality class of 'poor' also had a WQI grade of 'poor'. The relationship between water quality and macroinvertebrate health based on WQI grades and MCI quality grades was less clear in the 'good' and 'fair' classes.

[3] QMCI = Quantitative MCI and %EPT taxa = the percentage of pollution-sensitive Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa. See Perrie et al. (2012) for index calculation details.

Table 5.2: MCI scores for RSoE sites sampled in summer/autumn 2014

(* denotes MCI-sb scores that were used to apply quality classes at soft-bottomed sites while values in brackets are the MCI-hb scores for these sites)

Site no.	Site name	MCI score	MCI quality class
RS02	Mangapouri S at Bennetts Rd	77.6* (82.9)	Poor
RS03	Waitohu S at Forest Pk	146.4	Excellent
RS04	Waitohu S at Norfolk Cres	81.7* (95.7)	Fair
RS05	Otaki R at Pukehinau	131	Excellent
RS06	Otaki R at Mouth	116.5	Good
RS07	Mangaone S at Sims Rd Br	75.7* (91.4)	Poor
RS08	Ngarara S at Field Way	72.9* (88.4)	Poor
RS09	Waikanae R at Mangaone Walkway	130.4	Excellent
RS10	Waikanae R at Greenaway Rd	104.5	Good
RS11	Whareroa S at Waterfall Rd	116	Good
RS12	Whareroa S at QE Park	73.6* (91.8)	Poor
RS13	Horokiri S at Snodgrass	115	Good
RS14	Pauatahanui S at Elmwood Br	105.6	Good
RS15	Porirua S at Glenside	104.4	Good
RS16	Porirua S at Wall Park (Milk Depot)	87	Fair
RS17	Makara S at Kennels	107.3	Good
RS18	Karori S at Makara Peak	91.8	Fair
RS19	Kaiwharawhara S at Ngaio Gorge	95.7	Fair
RS20	Hutt R at Te Marua Intake Site	128	Excellent
RS21	Hutt R opp. Manor Park G.C.	127.7	Excellent
RS22	Hutt R at Boulcott	111	Good
RS23	Pakuratahi R 50m d/s Farm Ck	124.8	Excellent
RS24	Mangaroa R at Te Marua	127.5	Excellent
RS25	Akatarawa R at Hutt confl.	134.6	Excellent
RS26	Whakatikei R at Riverstone	138.5	Excellent
RS28	Wainuiomata R at Manuka Track	143.6	Excellent
RS29	Wainuiomata R d/s of White Br	109.5	Good
RS30	Orongorongo R at Orongorongo Stn	106.7	Good
RS31	Ruamahanga R at McLays	150.6	Excellent
RS32	Ruamahanga R at Te Ore Ore	113.8	Good
RS33	Ruamahanga R at Gladstone Br	94.5	Fair
RS34	Ruamahanga R at Pukio	103.3	Good
RS35	Mataikona Trib at Sugar Loaf Rd	127.5	Excellent
RS36	Taueru R at Castlehill	108.9* (101.7)	Good
RS37	Taueru R at Gladstone	95.5	Fair
RS38	Kopuaranga R at Stewarts	98.3	Fair
RS39	Whangaehu R 250m u/s confl.	62.2* (76.7)	Poor
RS40	Waipoua R at Colombo Rd Br	97	Fair
RS41	Waingawa R at South Rd	118.6	Good
RS42	Whareama R at Gauge	105.9* (98.8)	Good
RS43	Motuwaireka S at Headwaters	135.9	Excellent
RS44	Totara S at Stronvar	104	Good
RS45	Parkvale Trib at Lowes Res.	96	Fair
RS46	Parkvale S at Weir	91.1	Fair
RS47	Waiohine R at Gorge	136	Excellent
RS48	Waiohine R at Bicknells	117.1	Good
RS49	Beef Ck at Headwaters	134.5	Excellent
RS50	Mangatarere S at SH 2	113.3	Good
RS51	Huangarua R at Ponatahi Br	103.8	Good
RS52	Tauanui R at Whakatomotomo Rd	133.3	Excellent
RS53	Awhea R at Tora Rd	98.8	Fair
RS54	Coles Ck Trib at Lagoon Hill Rd	105.9	Good
RS55	Tauherenikau R at Websters	110.9	Good
RS56	Waiorongomai R at Forest Pk	123.1	Excellent
RS57	Waiwhetu S at Whites Line East	51.2* (68)	Poor

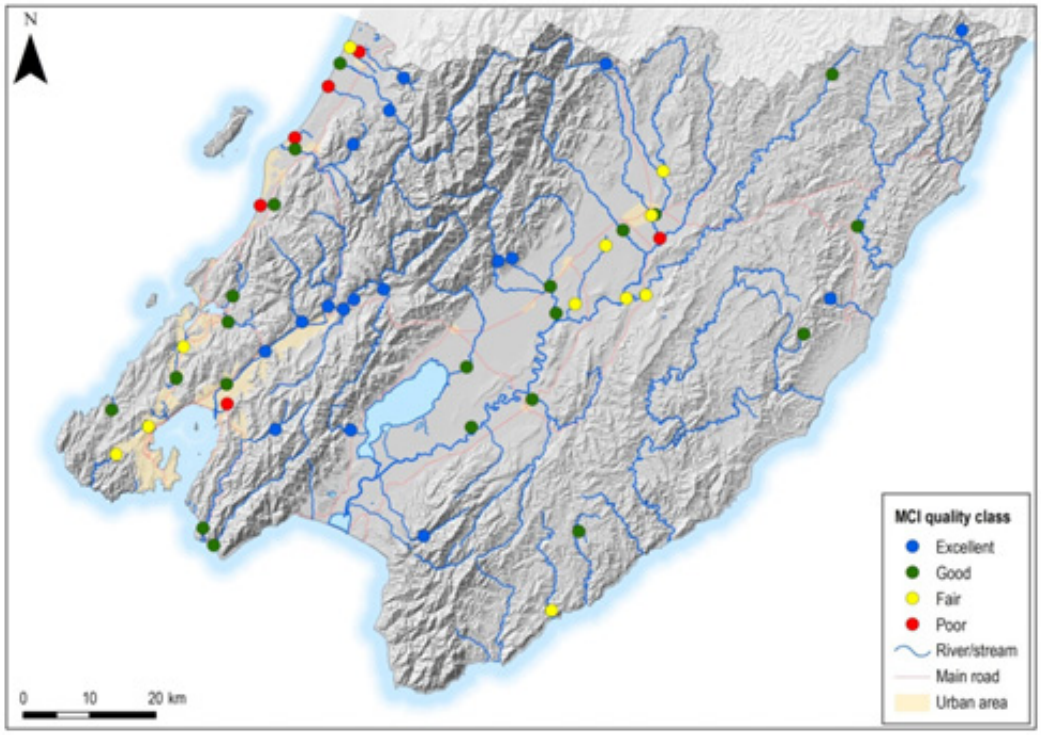

Figure 5.1: MCI quality classes for the 55 RSoE sites, determined from one sampling event over summer/autumn 2013/14

Sites that recorded higher MCI scores were also more likely to comply with both periphyton cover and biomass guidelines. For example, out of the 31 sites that complied with all periphyton guidelines, 17 had MCI grades of 'excellent' and 11 sites had MCI scores of 'good'.

6. Habitat quality

6.1 Approach to analysis

Habitat assessments were undertaken at each of the 55 RSoE sites at the time annual biological samples were collected in late summer/early autumn 2014. A summary of the overall habitat scores for each site is provided (individual scores for each of the nine components that make up the overall habitat score can be found in Appendix 6); these overall scores provide an indication of the physical steam habitat condition and its ability to support stream biota.

Streambed fine sediment cover was assessed monthly at the time of water sample collection. A tabulated summary of these monthly assessments is presented.

6.2 Results

6.2.1 Habitat assessment

Overall habitat scores ranged from 39 (Whareama River at Gauge) to 217 (Waikanae River at Mangaone Walkway) with a median score across all 55 sites of 132 (Table 6.1). RSoE sites that had the highest habitat scores were all located in catchments with indigenous forest as the dominant landcover and had hard-bottomed substrate (eg, Waikanae River at Mangaone Walkway and Wainuiomata at Manuka Track). These sites also tended to record 'excellent' MCI and WQI classes. In contrast, the RSoE sites that had the lowest habitat scores were all located in catchments dominated by either pastoral or urban landcover and tended to have soft-sediment substrates (eg, Ngarara Stream at Field Way and Mangaone Stream at Sims Road Bridge). These sites were more likely to record 'fair' or 'poor' MCI and WQI classes.

6.2.2 Fine sediment cover

The number of observations of fine sediment streambed cover made during the reporting period varied among the 55 sites due to site access being restricted, turbid water or high flows on some occasions[4]. Unsurprisingly, the nine sites considered 'soft-bottomed' typically had the highest proportions of fine sediment cover (ie, median values generally >50% cover). Of the 46 RSoE sites considered hard-bottomed, median fine sediment cover values ranged from 0 (eg, Waitohu Stream at Forest Park) to 90% at Makara Stream at Kennels (Table 6.1). Sites that recorded higher median fine sediment streambed cover values tended to be located on smaller streams and also included a number of sites located in the eastern Wairarapa (eg, Coles Creek tributary at Lagoon Hills Rd).

While sites that had low median cover scores tended to be located in indigenous forest catchments, obvious relationships between dominant landuse and fine sediment cover were not overly apparent, indicating that factors such as catchment geology and hydrology (flushing flows) are also important.

[4] In addition, fine sediment cover was not always assessed at sites considered to be 'soft-bottomed' so the number of assessments at these sites is even more variable. However, given the nature of these sites the values provided are probably fairly representative of these sites (ie, the proportion of fine sediment cover at soft-bottomed sites is not expected to vary significantly over time).

Table 6.1: Overall habitat quality scores based on a one-off assessment and summary of monthly observations of fine sediment (<2 mm) streambed cover at RSoE sites during 2013/14

Site no.	Site name	Overall habitat score	Fine sediment streambed cover			
			n	Median	Minimum	Maximum
RS02	Mangapouri S at Bennetts Rd	75	4	100	100	100
RS03	Waitohu S at Forest Pk	197	11	0	0	0
RS04	Waitohu S at Norfolk Cres	65	5	100	100	100
RS05	Otaki R at Pukehinau	188	10	0	0	0
RS06	Otaki R at Mouth	113	10	0	0	10
RS07	Mangaone S at Sims Rd Br	56	3	100	100	100
RS08	Ngarara S at Field Way	46	1	100	100	100
RS09	Waikanae R at Mangaone Walkway	217	12	0	0	20
RS10	Waikanae R at Greenaway Rd	151	11	13	0	40
RS11	Whareroa S at Waterfall Rd	120	12	45	20	90
RS12	Whareroa S at QE Park	72	1	100	100	100
RS13	Horokiri S at Snodgrass	124	10	10	5	35
RS14	Pauatahanui S at Elmwood Br	109	10	70	40	90
RS15	Porirua S at Glenside	144	9	10	5	20
RS16	Porirua S at Wall Park (Milk Depot)	98	6	15	10	30
RS17	Makara S at Kennels	134	7	90	70	90
RS18	Karori S at Makara Peak	149	9	10	5	30
RS19	Kaiwharawhara S at Ngaio Gorge	160	9	20	10	95
RS20	Hutt R at Te Marua Intake Site	185	5	0	0	0
RS21	Hutt R opp. Manor Park G.C.	114	6	22.5	0	40
RS22	Hutt R at Boulcott	116	3	0	0	0
RS23	Pakuratahi R 50m d/s Farm Ck	200	3	5	5	30
RS24	Mangaroa R at Te Marua	177	4	0	0	5
RS25	Akatarawa R at Hutt confl.	207	10	0.5	0	20
RS26	Whakatikei R at Riverstone	210	10	10	0	70
RS28	Wainuiomata R at Manuka Track	211	12	0	0	10
RS29	Wainuiomata R d/s of White Br	119	12	40	0	65
RS30	Orongorongo R at Orongorongo Stn	97	10	10	0	50
RS31	Ruamahanga R at McLays	207	10	0	0	20
RS32	Ruamahanga R at Te Ore Ore	100	7	30	20	60
RS33	Ruamahanga R at Gladstone Br	109	8	0	0	10
RS34	Ruamahanga R at Pukio	90	7	30	0	76
RS35	Mataikona Trib at Sugar Loaf Rd	188	11	40	30	70
RS36	Taueru R at Castlehill	109	5	100	100	100
RS37	Taueru R at Gladstone	102	5	10	0	10
RS38	Kopuaranga R at Stewarts	137	7	15	5	25
RS39	Whangaehu R 250m u/s confl.	80	7	30	0	100
RS40	Waipoua R at Colombo Rd Br	142	9	0	0	20
RS41	Waingawa R at South Rd	119	9	10	10	30
RS42	Whareama R at Gauge	39	2	100	100	100
RS43	Motuwaireka S at Headwaters	207	12	20	0	33
RS44	Totara S at Stronvar	153	10	30	20	60
RS45	Parkvale Trib at Lowes Res.	189	6	47.5	0	90
RS46	Parkvale S at Weir	73	6	55	10	95
RS47	Waiohine R at Gorge	194	9	0	0	10
RS48	Waiohine R at Bicknells	132	11	0	0	20
RS49	Beef Ck at Headwaters	202	12	0	0	10
RS50	Mangatarere S at SH 2	125	11	10	0	63
RS51	Huangarua R at Ponatahi Br	107	11	10	0	50
RS52	Tauanui R at Whakatomotomo Rd	209	12	0	0	30
RS53	Awhea R at Tora Rd	85	10	45	10	100
RS54	Coles Ck Trib at Lagoon Hill Rd	147	8	50	30	60
RS55	Tauherenikau R at Websters	163	11	10	0	40
RS56	Waiorongomai R at Forest Pk	190	12	0	0	30
RS57	Waiwhetu S at Whites Line East	80	11	50	0	70

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Appendix 1: RSoE monitoring sites

Site no.	Site name	NZTM site coordinates		Substrate (hard or soft bottomed)	REC	Dominant land cover
		Easting	Northing			
RS02	Mangapouri S at Bennetts Rd*	1780903	5487645	Soft	WD/L/Al/U**	Urban
RS03	Waitohu S at Forest Pk	1787593	5483689	Hard	CW/H/HS/IF	Indigenous forest
RS04	Waitohu S at Norfolk Cres	1779537	5488304	Soft	CW/L/HS/P	Pasture
RS05	Otaki R at Pukehinau	1785426	5478749	Hard	CW/H/HS/IF	Indigenous forest
RS06	Otaki R at Mouth	1777983	5485886	Hard	CW/H/HS/IF	Indigenous forest
RS07	Mangaone S at Sims Rd Br	1776242	5482408	Soft	WW/L/AL/P	Pasture
RS08	Ngarara S at Field Way*	1771180	5474620	Soft	WW/L/AL/U**	Urban
RS09	Waikanae R at Mangaone Walkway	1779974	5473638	Hard	CW/L/HS/IF	Indigenous forest
RS10	Waikanae R at Greenaway Rd*	1771223	5472915	Hard	CW/L/HS/IF**	Indigenous forest
RS11	Whareroa S at Waterfall Rd	1768074	5464532	Hard	WW/L/HS/IF**	Indigenous forest
RS12	Whareroa S at QE Park	1765976	5464400	Soft	WW/L/HS/P	Pasture
RS13	Horokiri S at Snodgrass	1761804	5450653	Hard	CW/L/HS/P	Pasture
RS14	Pauatahanui S at Elmwood Br	1761097	5446783	Hard	CW/L/HS/P	Pasture
RS15	Porirua S at Glenside*	1753289	5438364	Hard	CW/L/HS/U	Urban
RS16	Porirua S at Wall Park (Milk Depot)*	1754366	5443031	Hard	WW/L/HS/U	Urban
RS17	Makara S at Kennels	1743530	5433635	Hard	CW/L/HS/P	Pasture
RS18	Karori S at Makara Peak M.P. Park*	1744213	5426874	Hard	CW/L/HS/U	Urban
RS19	Kaiwharawhara S at Ngaio Gorge*	1749069	5431077	Hard	CW/L/HS/U	Urban
RS20	Hutt R at Te Marua Intake Site	1780071	5450158	Hard	CX/H/HS/IF	Indigenous forest
RS21	Hutt R opp. Manor Park G.C.*	1766679	5442285	Hard	CW/H/HS/IF	Indigenous forest
RS22	Hutt R at Boulcott*	1760858	5437486	Hard	CW/L/HS/IF	Indigenous forest
RS23	Pakuratahi R 50m d/s Farm Ck	1784607	5451677	Hard	CX/H/HS/IF	Indigenous forest
RS24	Mangaroa R at Te Marua	1778543	5448643	Hard	CW/L/HS/P	Pasture
RS25	Akatarawa R at Hutt confl.	1776183	5449184	Hard	CW/L/HS/IF	Indigenous forest
RS26	Whakatikei R at Riverstone	1772256	5446748	Hard	CW/L/HS/S	Indigenous forest
RS28	Wainuiomata R at Manuka Track	1768242	5430634	Hard	CW/L/HS/IF	Indigenous forest
RS29	Wainuiomata R d/s of White Br	1757316	5415724	Hard	CW/L/HS/IF	Indigenous forest
RS30	Orongorongo R at Orongorongo Stn	1758930	5413095	Hard	CW/H/HS/IF	Indigenous forest
RS31	Ruamahanga R at McLays	1818149	5485809	Hard	CX/H/HS/S	Indigenous forest
RS32	Ruamahanga R at Te Ore Ore	1825574	5463019	Hard	CW/L/SS/P	Pasture
RS33	Ruamahanga R at Gladstone Br	1821208	5450327	Hard	CW/L/SS/P	Pasture
RS34	Ruamahanga R at Pukio	1797832	5431010	Hard	CW/L/SS/P	Pasture
RS35	Mataikona Trib at Sugar Loaf Rd	1871844	5490906	Hard	CW/L/SS/IF**	Indigenous forest
RS36	Taueru R at Castlehill	1852300	5484198	Soft	CW/L/SS/P	Pasture
RS37	Taueru R at Gladstone	1824148	5450815	Hard	CD/L/SS/P	Pasture
RS38	Kopuaranga R at Stewarts	1826761	5469569	Hard	CW/L/SS/P	Pasture
RS39	Whangaehu R 250m u/s confl.	1826267	5459407	Soft	CD/L/SS/P	Pasture
RS40	Waipoua R at Colombo Rd Br	1825018	5462890	Hard	CW/L/HS/P	Pasture
RS41	Waingawa R at South Rd	1820716	5460649	Hard	CX/H/HS/IF	Indigenous forest
RS42	Whareama R at Gauge	1856090	5461229	Soft	WW/L/SS/P	Pasture
RS43	Motuwaireka S at Headwaters	1852018	5450302	Hard	CW/L/HS/S	Indigenous forest
RS44	Totara S at Stronvar	1848025	5444916	Hard	CW/L/HS/EF	Exotic forest
RS45	Parkvale Trib at Lowes Res.	1818094	5458352	Hard	WD/L/Al/P	Pasture
RS46	Parkvale S at Weir	1813515	5449469	Hard	WD/L/Al/P	Pasture
RS47	Waiohine R at Gorge	1801889	5455995	Hard	CX/H/HS/IF	Indigenous forest
RS48	Waiohine R at Bicknells	1810615	5448099	Hard	CW/H/HS/P	Pasture
RS49	Beef Ck at Headwaters	1803963	5456398	Hard	CW/L/HS/S	Indigenous forest
RS50	Mangatarere S at SH 2	1809768	5452160	Hard	CW/L/HS/P	Pasture
RS51	Huangarua R at Ponatahi Br	1807009	5435213	Hard	CD/L/SS/P	Pasture
RS52	Tauanui R at Whakatomotomo Rd	1790648	5414515	Hard	CW/H/HS/IF	Indigenous forest
RS53	Awhea R at Tora Rd	1809951	5403289	Hard	WW/L/SS/P	Pasture
RS54	Coles Ck Trib at Lagoon Hill Rd	1814020	5415217	Hard	WW/L/SS/S	Indigenous forest
RS55	Tauherenikau R at Websters	1797082	5439942	Hard	CW/H/HS/P**	Pasture
RS56	Waiorongomai R at Forest Pk	1779604	5430559	Hard	CW/H/HS/IF	Indigenous forest
RS57	Waiwhetu S at Whites Line East	1760977	5434510	Soft	WW/L/HS/U	Urban

*RSoE sites where water samples are also analysed for selected heavy metals.

**REC landcover class changed to reflect more up-to-date catchment scale landcover information from MfE (2010).

Appendix 2: Monitoring variables and methods

Physico-chemical and microbiological water quality

Core water quality variables measured/analysed at each RSoE site are presented in Table A2.1. As far as practicable, individual RSoE monitoring sites are sampled at the same time of the month (and usually at the same time of the day) throughout the year, and where possible all sites on a river or stream are sampled on the same day. Field meters are calibrated on the morning of the day of sampling. Water samples are collected in mid-stream (where possible), typically in run-type habitat from a representative reach of stream. Samples requiring laboratory analysis are placed in chillibins with ice and couriered overnight to RJ Hill Laboratories in Hamilton. Water samples for heavy metal analysis were all laboratory filtered. Water samples for dissolved nutrient analysis were field filtered up until December 2013 and then laboratory filtered from January 2014. The switch to laboratory filtration is a permanent protocol change that was made following completion of a six-month parallel filtering trial (refer Section 2.3.1).

Table A2.1: RSoE field and analytical water quality methods and detection limits

Variable	Method	Detection limit
Water temperature	Field meter – generally YSI ProODO	0.01 ºC
Dissolved oxygen	Field meter – generally YSI ProODO	0.01 mg/L
Visual clarity	Black disc (20 mm disc if clarity <0.5 m, 60 mm disc for clarity between 0.5 m and 1.5 m, 200 mm disc for clarity >1.5 m)	0.01 m
pH	Field meter – generally YSI Professional Plus	0.01 units
Conductivity	Field meter – generally YSI Professional Plus	0.1 µS/cm
Turbidity	Analysis using a Hach 2100N, Turbidity meter. APHA 2130 B 22nd Ed. 2012	0.05 NTU
Total suspended solids	Filtration using Whatman 934 AH, Advantec GC-50 or 1-2 equivalent filters (nominal pore size 1.2–1.5µm), gravimetric determination. APHA 2540 D 22nd Ed. 2012	2 mg/L
Total organic carbon	Catalytic oxidation, IR detection, for Total C. Acidification, purging for Total Inorganic C. TOC = TC–TIC. APHA5310 B 22nd Ed. 2012	0.5 mg/L
Ammoniacal nitrogen	Filtered sample. Phenol/hyperclorite colorimetry. Discrete Analyser. (NH4-N = NH_4+-N + NH_3-N) APHA 4500-NH_3 F (modified from manual analysis) 22nd Ed. 2012	0.01 mg/L
Nitrite nitrogen	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (Modified) 22nd Ed. 2012	0.002 mg/L
Nitrate nitrogen	Calculation: (Nitrate-N + Nitrite-N) – Nitrite-N	0.002 mg/L
Nitrate + nitrite nitrogen	Total oxidised nitrogen. Automated cadmium reduction, Flow injection analyser. APHA 4500-NO_3^- I (Modified) 22nd Ed. 2012	0.002 mg/L
Total Kjeldahl nitrogen	Kjeldahl digestion, phenol/hyperclorite colorimetry (Discrete Analysis). APHA 4500-N Org C. (modified) 4500-NH_3 F (modified) 22nd Ed. 2012	0.1 mg/L
Total nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N	0.05 mg/L[1]
Total phosphorus	Total Phosphorus digestion, ascorbic acid colorimetry. Discrete Analyser. APHA 4500-P E (modified from manual analysis) 22nd Ed. 2012	0.004 mg/L
Dissolved reactive phosphorus	Filtered sample. Molybdenum blue colorimetry. Discrete Analyser. APHA 4500-P E (modified from manual analysis) 22nd Ed. 2012	0.004 mg/L
Faecal coliforms	APHA 9222D 22nd Ed. 2012	1 cfu/100mL
E. coli	APHA 9222G 22nd Ed. 2012	1 cfu/100mL
Dissolved copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd Ed. 2012	0.0005 mg/L
Dissolved zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd Ed. 2012	0.0010 mg/L

[1] Typically only achieved if samples are analysed in duplicate.

Table A2.2 lists the analytical methods used in the parallel nutrient test trial carried out during 2013/14 (refer Section 2.3.1). Note that soluble nutrients were only measured in parallel from January 2014.

Table A2.2: Analytical water quality methods and detection limits trialled in parallel with existing RSoE methods during 2013/14

Variable	Method	Detection limit
Total nitrogen	Alkaline persulphate digestion, automated Cd reduction/sulphanilamide colorimetry. APHA 4500-N C & 4500-NO3- I. 22nd Ed. 2012	0.01 mg/L
Ammoniacal nitrogen	Filtered sample. Phenol/hypochlorite colorimetry. Flow injection analyser. (NH4-N = NH4+-N + NH_3-N). APHA 4500-NH_3 H. 22nd Ed. 2012.	0.005 mg/L
Dissolved reactive phosphorus	Filtered sample. Molybdenum blue colorimetry. Flow injection analyser. APHA 4500-P G. 22nd Ed. 2012	0.001 mg/L
Nitrite nitrogen	Filtered sample. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3 – I. 22nd Ed. 2012	0.001 mg/L
Nitrate + nitrite nitrogen	Total oxidised nitrogen. Automated cadmium reduction, flow 1-2 injection analyser. APHA 4500-NO_3 – I. 22nd Ed. 2012	0.001 mg/L

Periphyton

Formal periphyton assessments are limited to the 46 RSoE sites with hard substrates.

Monthly assessment of visible streambed cover

Periphyton cover is determined by estimating the percentage of mat (>0.3 cm thick), cyanobacterial mat (>0.1 cm thick) and filamentous (>2 cm long) periphyton present on the stream or river bed. Note that cover of mat and cyanobacterial mat-periphyton are not mutually exclusive (ie, cyanobacterial mat cover >0.3 cm thick will also be counted as mat-periphyton). A total of 20 observations are undertaken at each site from two transects of ten observations or, if the stream or river is not wide enough or too deep/swift to wade across more than half of the river's width, four transects of five observations. Each observation is typically made with an underwater viewer and covers an approximate area of a 30 cm diameter circle.

Visible streambed periphyton cover assessments are carried out equally in both run and riffle-type habitats if these are present at a sampling site/reach.[5]

Annual assessment of biomass and relative abundance

Periphyton samples for quantitative biomass assessments (chlorophyll *a* and Ash Free Dry Matter), taxa identification and relative abundance are collected during late summer/early autumn at the time of macroinvertebrate sample collection. Sampling protocols follow a modified version of quantitative method 1a (QM-1a), as outlined by Biggs and Kilroy (2000) that involves pooling periphyton samples from 10 rocks into a single composite sample for analysis.

Biomass assessments are carried out on periphyton samples collected in riffle-type habitats in close proximity to macroinvertebrate sampling sites.

[5] As noted in Section 2.3.3, this represents a change in methods from previous years (eg, Morar & Perrie 2013) when assessments were largely limited to run habitat (see Section 3.3.1).

Macrophytes

Macrophyte cover is assessed monthly at 16 of the 55 RSoE sites (at the time of water sample collection). These sites were selected because they are either soft-bottomed sites and hence are more likely to support macrophyte communities and/or were known to have, at least at times, moderate to high macrophyte cover.

Macrophyte cover is assessed following the method in Collier et al. (2007) except that information on the native and exotic components of the macrophyte community are not recorded. This method provides a general overview of reach scale rooted macrophyte cover (Collier et al. 2007) and involves estimating the proportion of emergent, surface reaching and submerged rooted macrophyte cover in 1 m strips at 5 evenly spaced transects along a sampling reach (~50–100 m). Total macrophyte cover is calculated by summing the total cover from each transect (eg, % emergent + % surface reaching + % subsurface) and dividing by five.

Macroinvertebrates

A single macroinvertebrate sample is collected at or adjacent to each RSoE water sampling site during late summer/early autumn. The timing of sampling is determined at random, although macroinvertebrate sampling is, where practicable, avoided within two weeks of any flood event (flood events are defined as flows greater than three times the median river flow).

Samples are collected with the use of a kick-net (0.5 mm mesh size) following Protocol C1 of the national macroinvertebrate sampling protocols (Stark et al. 2001) for the 46 RSoE sites with hard substrate (in riffle habitat) and Protocol C2 for the nine RSoE sites with a soft substrate. All samples are processed in accordance with Protocol P2 (Stark et al. 2001).

Habitat quality assessments

Habitat assessments are undertaken annually at each of the 55 RSoE sites during late summer/early autumn (at the time biological samples are collected) following the methods outlined in Clapcott (2013). This assessment provides an indication of the condition of the physical habitat and its ability to support stream biota, and incorporates the following variables: fine sediment cover, invertebrate habitat abundance and diversity, fish habitat abundance and diversity, hydraulic heterogeneity, bank stability, channel modification and riparian buffer width, integrity and shade. Each category is scored between 1 (‘poor’) and 20 (‘excellent’) with both invertebrate and habitat categories weighted double that of the other variables. Summation of individual scores provides an overall total habitat quality score for each site (lowest and highest possible scores are 11 and 220, respectively).

Note that the habitat assessment methodology is considered a working draft and is expected to be refined over time. This methodology was also developed with a focus on wadeable hard-bottomed streams (Clapcott 2013) and hence its applicability to other stream/river types has not been explored.

Fine sediment streambed cover

Assessments of fine sediment streambed cover are undertaken monthly and coincide with the collection of water samples at each of the 55 RSoE sites using a modified version of Sediment Assessment Method 1 (Clapcott et al. 2011; bankside visual

estimate of % sediment cover). This method involves a relatively quick visual estimate of the proportion fine sediment (<2 mm) cover of the streambed and it is undertaken from the bankside of the river. Visual estimates are typically made in run-type habitat over a representative reach (typically 20–50 m) and information on the length and width or streambed assessed is also recorded. The modification to the method is that, apart from sand, proportions of streambed cover of other substrates (eg, gravels, cobbles, etc.) are not estimated.

Appendix 3: Physico-chemical and microbiological data

Table A3.1: Water temperature (°C)

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	15.0	9.6	10.2	17.4	17.6	12.0
RS03	Waitohu S at Forest Pk	12.0	7.3	8.3	14.7	14.9	12.0
RS04	Waitohu S at Norfolk Cres	13.7	9.0	9.6	17.2	17.7	12.0
RS05	Otaki R at Pukehinau	11.4	7.4	7.6	14.8	14.9	12.0
RS06	Otaki R at Mouth	13.2	7.9	9.0	16.9	17.1	12.0
RS07	Mangaone S at Sims Rd Br	13.2	9.5	9.7	17.8	18.1	12.0
RS08	Ngarara S at Field Way	14.4	8.4	10.3	18.2	18.3	12.0
RS09	Waikanae R at Mangaone Walkway	11.5	7.7	8.8	14.5	14.6	12.0
RS10	Waikanae R at Greenaway Rd	14.1	9.0	10.3	19.3	19.5	12.0
RS11	Whareroa S at Waterfall Rd	12.1	7.8	9.2	14.3	14.3	12.0
RS12	Whareroa S at QE Park	13.1	9.0	10.4	16.5	16.6	12.0
RS13	Horokiri S at Snodgrass	13.2	7.9	9.8	15.9	15.9	12.0
RS14	Pauatahanui S at Elmwood Br	12.8	6.7	8.8	15.8	16.5	12.0
RS15	Porirua S at Glenside	12.6	9.9	10.0	14.9	15.4	12.0
RS16	Porirua S at Wall Park (Milk Depot)	12.9	9.7	9.8	15.0	15.5	12.0
RS17	Makara S at Kennels	13.4	9.3	9.6	16.8	17.4	12.0
RS18	Karori S at Makara Peak	12.3	10.4	10.6	15.5	15.8	12.0
RS19	Kaiwharawhara S at Ngaio Gorge	12.8	10.0	10.1	17.7	18.3	12.0
RS20	Hutt R at Te Marua Intake Site	11.1	7.0	8.5	13.9	15.1	12.0
RS21	Hutt R opp. Manor Park G.C.	13.6	8.5	9.7	17.9	18.8	12.0
RS22	Hutt R at Boulcott	13.7	8.4	9.7	18.5	19.0	12.0
RS23	Pakuratahi R 50m d/s Farm Ck	11.8	7.4	8.8	15.1	16.5	12.0
RS24	Mangaroa R at Te Marua	12.7	8.2	9.6	16.0	16.7	12.0
RS25	Akatarawa R at Hutt confl.	12.6	7.4	9.1	16.1	17.4	12.0
RS26	Whakatikei R at Riverstone	12.6	7.9	9.4	16.3	17.1	12.0
RS28	Wainuiomata R at Manuka Track	11.1	8.1	8.7	13.2	13.8	12.0
RS29	Wainuiomata R d/s of White Br	13.5	9.7	10.4	17.5	18.2	12.0
RS30	Orongorongo R at Orongorongo Stn	14.9	10.2	10.8	19.6	20.1	12.0
RS31	Ruamahanga R at McLays	9.1	5.4	6.3	12.3	12.3	12.0
RS32	Ruamahanga R at Te Ore Ore	12.3	8.8	9.1	18.9	19.7	12.0
RS33	Ruamahanga R at Gladstone Br	13.0	9.7	9.8	19.6	20.1	12.0
RS34	Ruamahanga R at Pukio	12.8	9.1	9.3	19.4	19.8	12.0
RS35	Mataikona Trib at Sugar Loaf Rd	11.8	8.6	9.2	16.3	16.5	11.0
RS36	Taueru R at Castlehill	13.0	8.3	8.5	18.0	18.2	12.0
RS37	Taueru R at Gladstone	14.3	6.9	8.3	19.5	19.9	12.0
RS38	Kopuaranga R at Stewarts	12.9	8.4	8.5	15.9	15.9	12.0
RS39	Whangaehu R 250m u/s confl.	14.1	8.8	8.9	17.7	18.2	12.0
RS40	Waipoua R at Colombo Rd Br	13.8	10.7	10.9	21.4	21.5	12.0
RS41	Waingawa R at South Rd	12.7	9.7	9.9	21.9	22.3	12.0
RS42	Whareama R at Gauge	14.7	7.8	9.3	20.6	22.7	12.0
RS43	Motuwaireka S at Headwaters	11.9	8.9	8.9	15.6	15.9	12.0
RS44	Totara S at Stronvar	14.3	8.7	9.4	19.1	21.2	12.0
RS45	Parkvale Trib at Lowes Res.	13.0	10.5	11.1	14.2	14.3	9.0
RS46	Parkvale S at Weir	14.6	9.7	10.0	19.3	20.8	12.0
RS47	Waiohine R at Gorge	9.7	5.6	6.9	14.4	15.0	12.0
RS48	Waiohine R at Bicknells	12.1	9.4	9.8	16.6	17.1	12.0
RS49	Beef Ck at Headwaters	10.6	6.0	7.5	13.3	14.1	12.0
RS50	Mangatarere S at SH 2	12.2	7.6	9.0	16.2	16.9	12.0
RS51	Huangarua R at Ponatahi Br	13.2	9.0	9.4	17.3	17.5	12.0
RS52	Tauanui R at Whakatomotomo Rd	11.0	8.9	9.0	14.9	15.0	12.0
RS53	Awhea R at Tora Rd	15.1	10.1	10.5	20.3	21.3	12.0
RS54	Coles Ck Trib at Lagoon Hill Rd	13.6	9.0	9.0	15.9	16.0	8.0
RS55	Tauherenikau R at Websters	10.9	7.7	8.3	18.6	19.6	12.0
RS56	Waiorongomai R at Forest Pk	11.9	10.2	10.3	18.4	18.8	12.0
RS57	Waiwhetu S at Whites Line East	14.2	11.2	11.4	17.1	17.2	12.0

Table A3.2: Dissolved oxygen (% saturation)

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	79.3	43.8	52.9	93.1	101.5	12
RS03	Waitohu S at Forest Pk	100.5	94.1	94.7	105.6	108.1	12
RS04	Waitohu S at Norfolk Cres	88.2	61.5	66.2	100.6	105.3	12
RS05	Otaki R at Pukehinau	99.5	93.6	94.3	101.6	102.4	12
RS06	Otaki R at Mouth	101.8	90.8	93.3	107.8	108.6	12
RS07	Mangaone S at Sims Rd Br	75.5	30.7	44.3	93.9	97.3	12
RS08	Ngarara S at Field Way	47.9	19.4	22.7	68.9	71.5	12
RS09	Waikanae R at Mangaone Walkway	98.3	93.1	94.0	101.2	102.5	12
RS10	Waikanae R at Greenaway Rd	101.4	94.8	95.1	109.6	109.7	12
RS11	Whareroa S at Waterfall Rd	95.6	89.7	90.5	100.3	101.1	12
RS12	Whareroa S at QE Park	73.4	55.6	58.1	81.9	82.9	12
RS13	Horokiri S at Snodgrass	100.9	93.7	94.9	108.5	111.5	12
RS14	Pauatahanui S at Elmwood Br	95.1	89.8	90.0	99.6	101.6	12
RS15	Porirua S at Glenside	99.7	95.7	96.7	111.6	113.6	12
RS16	Porirua S at Wall Park (Milk Depot)	99.8	96.0	97.5	107.1	107.5	12
RS17	Makara S at Kennels	99.3	88.8	92.6	110.7	113.7	12
RS18	Karori S at Makara Peak	99.3	93.6	94.4	105.9	111.8	12
RS19	Kaiwharawhara S at Ngaio Gorge	99.9	97.0	97.1	108.7	117.2	12
RS20	Hutt R at Te Marua Intake Site	100.6	98.6	99.0	102.9	103.2	12
RS21	Hutt R opp. Manor Park G.C.	101.2	99.0	99.4	109.5	114.8	12
RS22	Hutt R at Boulcott	101.0	98.1	99.0	108.7	114.1	12
RS23	Pakuratahi R 50m d/s Farm Ck	96.1	92.9	93.4	97.8	98.2	12
RS24	Mangaroa R at Te Marua	98.9	95.7	95.7	103.4	104.8	12
RS25	Akatarawa R at Hutt confl.	101.1	98.7	99.0	102.6	103.0	12
RS26	Whakatikei R at Riverstone	101.8	99.2	99.2	106.2	106.4	12
RS28	Wainuiomata R at Manuka Track	98.6	93.2	93.6	101.9	102.8	12
RS29	Wainuiomata R d/s of White Br	104.7	92.4	93.9	114.5	121.8	12
RS30	Orongorongo R at Orongorongo Stn	101.3	95.7	96.2	107.3	108.5	12
RS31	Ruamahanga R at McLays	96.9	90.1	90.5	99.8	99.8	11
RS32	Ruamahanga R at Te Ore Ore	98.9	92.6	93.5	113.4	115.1	11
RS33	Ruamahanga R at Gladstone Br	99.3	93.7	94.6	111.6	113.7	12
RS34	Ruamahanga R at Pukio	99.6	93.6	94.0	112.5	112.5	12
RS35	Mataikona Trib at Sugar Loaf Rd	99.9	92.6	93.0	103.2	105.0	11
RS36	Taueru R at Castlehill	96.7	90.7	92.0	104.9	106.0	12
RS37	Taueru R at Gladstone	91.6	74.4	80.3	112.2	113.3	12
RS38	Kopuaranga R at Stewarts	96.3	89.8	90.0	105.7	109.0	11
RS39	Whangaehu R 250m u/s confl.	106.1	79.2	80.5	115.3	118.5	11
RS40	Waipoua R at Colombo Rd Br	105.4	95.3	95.9	124.6	124.6	12
RS41	Waingawa R at South Rd	100.1	96.1	96.5	114.8	117.9	12
RS42	Whareama R at Gauge	94.9	88.4	90.5	98.0	99.5	12
RS43	Motuwaireka S at Headwaters	100.0	92.9	95.0	102.1	103.0	12
RS44	Totara S at Stronvar	99.9	96.8	96.9	106.6	107.4	12
RS45	Parkvale Trib at Lowes Res.	71.1	66.4	66.6	75.4	75.6	9
RS46	Parkvale S at Weir	102.3	95.2	96.8	121.2	122.6	12
RS47	Waiohine R at Gorge	99.2	92.1	92.2	102.6	102.8	12
RS48	Waiohine R at Bicknells	98.4	94.8	95.2	115.1	117.9	12
RS49	Beef Ck at Headwaters	98.0	91.7	92.0	100.0	100.8	12
RS50	Mangatarere S at SH 2	95.2	84.7	87.5	120.2	124.7	12
RS51	Huangarua R at Ponatahi Br	99.8	91.8	92.5	120.4	131.1	12
RS52	Tauanui R at Whakatomotomo Rd	95.4	91.6	92.4	99.1	99.4	12
RS53	Awhea R at Tora Rd	99.2	92.7	92.9	118.3	124.1	12
RS54	Coles Ck Trib at Lagoon Hill Rd	94.8	92.5	92.6	101.5	102.3	8
RS55	Tauherenikau R at Websters	97.8	92.6	92.6	105.0	106.6	12
RS56	Waiorongomai R at Forest Pk	99.1	94.0	94.7	105.0	106.6	12
RS57	Waiwhetu S at Whites Line East	80.1	51.2	53.5	88.5	92.1	12

Table A3.3: Dissolved oxygen (mg/L)

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	8.2	4.3	5.1	9.7	10.1	12
RS03	Waitohu S at Forest Pk	10.7	10.1	10.1	11.7	11.8	12
RS04	Waitohu S at Norfolk Cres	9.7	6.0	6.5	10.7	10.8	12
RS05	Otaki R at Pukehinau	10.8	10.0	10.1	11.9	12.2	12
RS06	Otaki R at Mouth	10.6	9.3	9.6	11.8	12.1	12
RS07	Mangaone S at Sims Rd Br	8.2	2.9	4.7	9.6	9.7	12
RS08	Ngarara S at Field Way	4.8	1.9	2.2	7.3	7.6	12
RS09	Waikanae R at Mangaone Walkway	10.5	9.7	9.7	11.4	11.4	12
RS10	Waikanae R at Greenaway Rd	10.5	9.2	9.4	11.4	11.6	12
RS11	Whareroa S at Waterfall Rd	10.3	9.4	9.5	11.3	11.3	12
RS12	Whareroa S at QE Park	7.8	5.7	5.8	9.1	9.2	12
RS13	Horokiri S at Snodgrass	10.4	9.7	9.7	11.7	12.2	12
RS14	Pauatahanui S at Elmwood Br	10.1	9.0	9.1	11.4	11.5	12
RS15	Porirua S at Glenside	10.8	9.8	10.0	11.8	12.4	12
RS16	Porirua S at Wall Park (Milk Depot)	10.6	9.7	9.9	11.8	12.1	12
RS17	Makara S at Kennels	10.5	9.1	9.5	11.8	12.3	12
RS18	Karori S at Makara Peak	10.5	10.0	10.1	11.1	11.1	12
RS19	Kaiwharawhara S at Ngaio Gorge	10.8	9.7	9.9	11.2	11.4	12
RS20	Hutt R at Te Marua Intake Site	10.9	9.9	10.1	12.0	12.5	12
RS21	Hutt R opp. Manor Park G.C.	10.7	10.3	10.4	11.5	11.9	12
RS22	Hutt R at Boulcott	10.6	9.3	9.8	11.6	12.0	12
RS23	Pakuratahi R 50m d/s Farm Ck	10.3	9.6	9.6	11.3	11.7	12
RS24	Mangaroa R at Te Marua	10.6	10.1	10.2	11.2	11.6	12
RS25	Akatarawa R at Hutt confl.	10.8	9.9	10.0	11.7	12.3	12
RS26	Whakatikei R at Riverstone	10.9	9.9	10.1	11.7	12.2	12
RS28	Wainuiomata R at Manuka Track	10.7	10.2	10.3	11.8	11.9	12
RS29	Wainuiomata R d/s of White Br	10.6	9.7	9.8	11.6	11.8	12
RS30	Orongorongo R at Orongorongo Stn	10.1	9.2	9.4	11.3	11.5	12
RS31	Ruamahanga R at McLays	11.0	9.9	10.0	11.6	11.7	11
RS32	Ruamahanga R at Te Ore Ore	10.5	9.9	9.9	11.6	12.0	11
RS33	Ruamahanga R at Gladstone Br	10.4	9.7	9.8	11.7	11.9	12
RS34	Ruamahanga R at Pukio	10.5	9.7	9.8	11.4	11.6	12
RS35	Mataikona Trib at Sugar Loaf Rd	10.7	9.5	9.5	11.4	11.4	11
RS36	Taueru R at Castlehill	10.3	9.2	9.3	11.1	11.3	12
RS37	Taueru R at Gladstone	10.1	7.4	8.2	10.8	11.2	12
RS38	Kopuaranga R at Stewarts	10.2	8.9	9.1	11.4	11.5	11
RS39	Whangaehu R 250m u/s confl.	11.1	7.7	7.8	12.0	12.4	11
RS40	Waipoua R at Colombo Rd Br	10.9	9.5	9.8	12.2	12.6	12
RS41	Waingawa R at South Rd	10.4	9.2	9.5	11.3	11.6	12
RS42	Whareama R at Gauge	9.7	8.3	8.5	10.9	11.4	12
RS43	Motuwaireka S at Headwaters	10.7	9.7	9.7	11.4	11.6	12
RS44	Totara S at Stronvar	10.5	9.4	9.5	11.5	11.5	12
RS45	Parkvale Trib at Lowes Res.	7.4	6.8	6.9	8.2	8.4	9
RS46	Parkvale S at Weir	10.8	9.8	9.9	11.6	11.8	12
RS47	Waiohine R at Gorge	11.2	9.9	9.9	11.9	12.0	12
RS48	Waiohine R at Bicknells	10.8	9.9	10.0	11.2	11.2	12
RS49	Beef Ck at Headwaters	10.9	10.1	10.3	11.5	11.5	12
RS50	Mangatarere S at SH 2	10.2	9.5	9.5	11.8	12.1	12
RS51	Huangarua R at Ponatahi Br	10.5	9.5	9.6	13.0	14.9	12
RS52	Tauanui R at Whakatomotomo Rd	10.6	9.2	9.6	11.3	11.5	12
RS53	Awhea R at Tora Rd	10.3	8.8	9.2	11.7	13.1	12
RS54	Coles Ck Trib at Lagoon Hill Rd	10.3	9.5	9.5	10.9	11.0	8
RS55	Tauherenikau R at Websters	10.5	9.5	9.6	11.4	11.7	12
RS56	Waiorongomai R at Forest Pk	10.5	9.5	9.7	11.2	11.3	12
RS57	Waiwhetu S at Whites Line East	7.9	5.1	5.4	9.4	9.5	12

Table A3.4: pH – field meter

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	*n**
RS02	Mangapouri S at Bennetts Rd	6.9	6.8	6.8	7.1	7.2	12
RS03	Waitohu S at Forest Pk	7.6	7.1	7.3	7.8	7.9	12
RS04	Waitohu S at Norfolk Cres	6.9	6.8	6.8	7.1	7.1	12
RS05	Otaki R at Pukehinau	7.5	7.2	7.3	7.7	7.7	12
RS06	Otaki R at Mouth	7.5	7.1	7.2	7.7	7.8	12
RS07	Mangaone S at Sims Rd Br	6.9	6.7	6.7	7.1	7.1	12
RS08	Ngarara S at Field Way	7.0	6.7	6.8	7.1	7.1	12
RS09	Waikanae R at Mangaone Walkway	7.5	7.3	7.3	7.7	7.7	12
RS10	Waikanae R at Greenaway Rd	7.4	7.2	7.3	7.6	7.7	12
RS11	Whareroa S at Waterfall Rd	7.6	7.3	7.4	7.7	7.8	12
RS12	Whareroa S at QE Park	6.8	6.4	6.6	7.2	7.2	12
RS13	Horokiri S at Snodgrass	7.4	7.1	7.1	7.8	7.8	12
RS14	Pauatahanui S at Elmwood Br	7.4	6.3	6.7	7.8	7.9	12
RS15	Porirua S at Glenside	7.4	6.6	6.9	8.1	8.1	12
RS16	Porirua S at Wall Park (Milk Depot)	7.3	6.2	6.5	7.6	7.6	12
RS17	Makara S at Kennels	7.4	6.9	7.0	7.7	7.8	12
RS18	Karori S at Makara Peak	7.2	6.8	6.9	7.5	7.7	12
RS19	Kaiwharawhara S at Ngaio Gorge	7.5	7.0	7.2	8.3	8.9	12
RS20	Hutt R at Te Marua Intake Site	7.2	6.7	6.7	7.6	7.7	12
RS21	Hutt R opp. Manor Park G.C.	7.2	6.9	7.0	7.8	8.0	12
RS22	Hutt R at Boulcott	7.2	6.9	6.9	7.6	7.9	12
RS23	Pakuratahi R 50m d/s Farm Ck	7.0	6.2	6.3	7.3	7.3	12
RS24	Mangaroa R at Te Marua	7.0	6.7	6.7	7.4	7.4	12
RS25	Akatarawa R at Hutt confl.	7.3	7.0	7.0	7.7	7.7	12
RS26	Whakatikei R at Riverstone	7.5	7.1	7.2	8.0	8.1	12
RS28	Wainuiomata R at Manuka Track	7.4	7.1	7.2	7.5	7.6	12
RS29	Wainuiomata R d/s of White Br	7.3	7.0	7.1	7.8	8.1	12
RS30	Orongorongo R at Orongorongo Stn	7.8	7.6	7.6	8.1	8.2	12
RS31	Ruamahanga R at McLays	7.6	7.2	7.2	7.9	8.0	11
RS32	Ruamahanga R at Te Ore Ore	7.8	7.6	7.7	8.3	8.3	11
RS33	Ruamahanga R at Gladstone Br	7.6	7.4	7.4	8.0	8.1	11
RS34	Ruamahanga R at Pukio	7.6	7.4	7.4	7.9	8.0	11
RS35	Mataikona Trib at Sugar Loaf Rd	8.2	7.5	7.7	8.3	8.3	11
RS36	Taueru R at Castlehill	7.7	7.3	7.3	7.9	7.9	12
RS37	Taueru R at Gladstone	7.9	7.5	7.5	8.2	8.2	12
RS38	Kopuaranga R at Stewarts	7.9	7.5	7.5	8.0	8.0	11
RS39	Whangaehu R 250m u/s confl.	7.6	7.2	7.3	8.1	8.3	11
RS40	Waipoua R at Colombo Rd Br	7.5	7.1	7.2	8.5	8.5	12
RS41	Waingawa R at South Rd	7.5	7.3	7.3	8.1	8.4	12
RS42	Whareama R at Gauge	7.9	7.7	7.7	8.0	8.1	12
RS43	Motuwaireka S at Headwaters	7.8	7.6	7.7	8.0	8.1	12
RS44	Totara S at Stronvar	7.8	7.4	7.5	8.2	8.2	12
RS45	Parkvale Trib at Lowes Res.	6.5	6.3	6.4	6.7	6.7	9
RS46	Parkvale S at Weir	7.5	7.2	7.2	8.7	8.9	12
RS47	Waiohine R at Gorge	7.4	6.7	6.8	7.9	7.9	12
RS48	Waiohine R at Bicknells	7.1	7.0	7.0	7.4	7.5	12
RS49	Beef Ck at Headwaters	7.6	7.3	7.4	7.8	7.9	12
RS50	Mangatarere S at SH 2	7.0	6.8	6.9	7.3	7.4	12
RS51	Huangarua R at Ponatahi Br	8.1	7.9	7.9	8.5	8.6	12
RS52	Tauanui R at Whakatomotomo Rd	7.6	7.2	7.4	7.8	7.9	12
RS53	Awhea R at Tora Rd	8.2	8.0	8.0	8.5	8.5	12
RS54	Coles Ck Trib at Lagoon Hill Rd	8.0	7.8	7.9	8.1	8.2	8
RS55	Tauherenikau R at Websters	7.6	7.1	7.1	7.8	7.9	12
RS56	Waiorongomai R at Forest Pk	7.5	7.3	7.3	7.7	7.7	12
RS57	Waiwhetu S at Whites Line East	6.8	6.5	6.6	7.1	7.2	12

*Lower *n* counts for some sites (when compared to other variables) reflects sampling occasions when the field pH meter had malfunctioned and no measurement could be made. In such instances, the lab was asked to measure pH from a supplied water sample.

Table A3.5: Visual clarity (m)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	0.68	0.06	1.50	12
RS03	Waitohu S at Forest Pk	2.67	0.21	3.63	12
RS04	Waitohu S at Norfolk Cres	0.74	0.14	1.14	12
RS05	Otaki R at Pukehinau	3.21	0.15	11.54	12
RS06	Otaki R at Mouth	2.87	0.08	6.81	12
RS07	Mangaone S at Sims Rd Br	0.64	0.21	1.26	12
RS08	Ngarara S at Field Way	0.47	0.24	0.94	12
RS09	Waikanae R at Mangaone Walkway	2.80	0.97	5.93	12
RS10	Waikanae R at Greenaway Rd	3.38	0.53	6.13	12
RS11	Whareroa S at Waterfall Rd	0.51	0.15	0.86	12
RS12	Whareroa S at QE Park	0.62	0.34	1.21	12
RS13	Horokiri S at Snodgrass	1.90	0.48	2.97	12
RS14	Pauatahanui S at Elmwood Br	1.35	0.28	2.78	12
RS15	Porirua S at Glenside	1.50	0.17	2.36	12
RS16	Porirua S at Wall Park (Milk Depot)	1.34	0.13	2.58	12
RS17	Makara S at Kennels	1.37	0.13	2.07	12
RS18	Karori S at Makara Peak	3.12	0.59	4.90	12
RS19	Kaiwharawhara S at Ngaio Gorge	2.46	0.45	4.63	12
RS20	Hutt R at Te Marua Intake Site	1.15	0.35	6.18	12
RS21	Hutt R opp. Manor Park G.C.	0.95	0.21	3.22	12
RS22	Hutt R at Boulcott	0.83	0.29	3.98	12
RS23	Pakuratahi R 50m d/s Farm Ck	1.06	0.33	7.01	12
RS24	Mangaroa R at Te Marua	0.60	0.33	1.86	12
RS25	Akatarawa R at Hutt confl.	2.58	0.33	7.21	12
RS26	Whakatikei R at Riverstone	2.84	0.85	5.09	12
RS28	Wainuiomata R at Manuka Track	3.06	2.03	5.42	12
RS29	Wainuiomata R d/s of White Br	1.62	0.63	3.30	12
RS30	Orongorongo R at Orongorongo Stn	2.23	0.14	5.74	12
RS31	Ruamahanga R at McLays	5.63	0.22	>15.00	12
RS32	Ruamahanga R at Te Ore Ore	1.75	0.04	5.53	12
RS33	Ruamahanga R at Gladstone Br	1.97	0.06	4.48	12
RS34	Ruamahanga R at Pukio	1.14	0.09	3.31	12
RS35	Mataikona Trib at Sugar Loaf Rd	1.30	0.43	3.21	11
RS36	Taueru R at Castlehill	0.85	0.24	2.61	12
RS37	Taueru R at Gladstone	0.53	0.12	4.20	12
RS38	Kopuaranga R at Stewarts	1.36	0.09	5.18	12
RS39	Whangaehu R 250m u/s confl.	0.76	0.05	2.94	12
RS40	Waipoua R at Colombo Rd Br	3.35	1.03	5.60	12
RS41	Waingawa R at South Rd	1.68	0.24	6.70	12
RS42	Whareama R at Gauge	0.27	0.09	1.95	12
RS43	Motuwaireka S at Headwaters	1.64	0.75	2.85	12
RS44	Totara S at Stronvar	1.37	0.34	5.15	12
RS45	Parkvale Trib at Lowes Res.	2.84	1.49	>3.50	8
RS46	Parkvale S at Weir	0.76	0.15	3.31	12
RS47	Waiohine R at Gorge	3.14	0.32	9.64	12
RS48	Waiohine R at Bicknells	1.59	0.21	4.12	12
RS49	Beef Ck at Headwaters	2.97	0.99	5.03	12
RS50	Mangatarere S at SH 2	1.84	0.34	5.48	12
RS51	Huangarua R at Ponatahi Br	1.74	0.05	4.83	12
RS52	Tauanui R at Whakatomotomo Rd	3.98	0.84	6.94	12
RS53	Awhea R at Tora Rd	1.05	0.03	3.90	12
RS54	Coles Ck Trib at Lagoon Hill Rd	0.93	0.27	4.21	8
RS55	Tauherenikau R at Websters	2.55	0.07	4.48	12
RS56	Waiorongomai R at Forest Pk	4.20	2.20	8.08	12
RS57	Waiwhetu S at Whites Line East	1.39	0.41	2.82	12

Table A3.6: Turbidity (NTU)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	6.7	3.2	70	12
RS03	Waitohu S at Forest Pk	1.1	0.7	17.7	12
RS04	Waitohu S at Norfolk Cres	5.0	1.9	17.5	12
RS05	Otaki R at Pukehinau	0.9	0.3	46	12
RS06	Otaki R at Mouth	1.1	0.5	60	12
RS07	Mangaone S at Sims Rd Br	7.0	3.2	47	12
RS08	Ngarara S at Field Way	7.0	4.8	16.4	12
RS09	Waikanae R at Mangaone Walkway	0.7	0.4	4.2	12
RS10	Waikanae R at Greenaway Rd	0.6	0.2	9.6	12
RS11	Whareroa S at Waterfall Rd	10.5	7.1	38	12
RS12	Whareroa S at QE Park	5.7	3.0	28	12
RS13	Horokiri S at Snodgrass	1.2	0.5	7.3	12
RS14	Pauatahanui S at Elmwood Br	2.7	1.5	20	12
RS15	Porirua S at Glenside	4.0	1.5	68	12
RS16	Porirua S at Wall Park (Milk Depot)	4.3	1.9	87	12
RS17	Makara S at Kennels	3.9	1.4	199	12
RS18	Karori S at Makara Peak	1.5	0.8	10.3	12
RS19	Kaiwharawhara S at Ngaio Gorge	1.6	0.7	16.0	12
RS20	Hutt R at Te Marua Intake Site	4.6	0.4	23	12
RS21	Hutt R opp. Manor Park G.C.	5.7	1.1	30	12
RS22	Hutt R at Boulcott	6.0	0.6	35	12
RS23	Pakuratahi R 50m d/s Farm Ck	5.7	0.5	27	12
RS24	Mangaroa R at Te Marua	6.6	1.1	15.2	12
RS25	Akatarawa R at Hutt confl.	1.0	0.3	18.1	12
RS26	Whakatikei R at Riverstone	1.2	0.4	5.2	12
RS28	Wainuiomata R at Manuka Track	0.8	0.5	1.4	12
RS29	Wainuiomata R d/s of White Br	1.9	1.0	6.0	12
RS30	Orongorongo R at Orongorongo Stn	2.9	0.5	66	12
RS31	Ruamahanga R at McLays	0.7	0.2	28	12
RS32	Ruamahanga R at Te Ore Ore	3.6	0.4	220	12
RS33	Ruamahanga R at Gladstone Br	2.4	0.5	220	12
RS34	Ruamahanga R at Pukio	4.6	1.0	70.0	12
RS35	Mataikona Trib at Sugar Loaf Rd	4.9	1.0	24.0	11
RS36	Taueru R at Castlehill	5.1	1.8	30.0	12
RS37	Taueru R at Gladstone	13.3	0.7	81.0	12
RS38	Kopuaranga R at Stewarts	3.4	0.8	56	12
RS39	Whangaehu R 250m u/s confl.	7.7	1.4	220	12
RS40	Waipoua R at Colombo Rd Br	0.6	0.3	4.9	12
RS41	Waingawa R at South Rd	2.3	0.5	26	12
RS42	Whareama R at Gauge	27	2.5	181	12
RS43	Motuwaireka S at Headwaters	1.9	0.4	7.9	12
RS44	Totara S at Stronvar	3.9	0.5	16.3	12
RS45	Parkvale Trib at Lowes Res.	0.5	0.3	1.7	9
RS46	Parkvale S at Weir	4.5	0.9	59	12
RS47	Waiohine R at Gorge	1.1	0.2	16.0	12
RS48	Waiohine R at Bicknells	2.7	0.7	26	12
RS49	Beef Ck at Headwaters	1.0	0.4	9.7	12
RS50	Mangatarere S at SH 2	1.7	0.7	19.3	12
RS51	Huangarua R at Ponatahi Br	2.7	0.5	250	12
RS52	Tauanui R at Whakatomotomo Rd	0.6	0.3	7.2	12
RS53	Awhea R at Tora Rd	5.2	0.4	1,510	12
RS54	Coles Ck Trib at Lagoon Hill Rd	7.5	1.0	21.0	8
RS55	Tauherenikau R at Websters	2.1	0.5	58	12
RS56	Waiorongomai R at Forest Pk	0.7	0.3	1.9	12
RS57	Waiwhetu S at Whites Line East	3.6	1.4	13.1	12

Table A3.7: Total suspended solids (mg/L)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	7	<2	92	12
RS03	Waitohu S at Forest Pk	1	<2	38	12
RS04	Waitohu S at Norfolk Cres	9	3	44	12
RS05	Otaki R at Pukehinau	1	<2	58	12
RS06	Otaki R at Mouth	1	<2	72	12
RS07	Mangaone S at Sims Rd Br	10	<2	55	12
RS08	Ngarara S at Field Way	6	<2	17	12
RS09	Waikanae R at Mangaone Walkway	1	<2	5	12
RS10	Waikanae R at Greenaway Rd	1	<2	12	12
RS11	Whareroa S at Waterfall Rd	7	4	30	12
RS12	Whareroa S at QE Park	5	<2	27	12
RS13	Horokiri S at Snodgrass	1	<2	10	12
RS14	Pauatahanui S at Elmwood Br	4	<2	23	12
RS15	Porirua S at Glenside	3	<2	74	12
RS16	Porirua S at Wall Park (Milk Depot)	4	<2	98	12
RS17	Makara S at Kennels	5	<2	320	12
RS18	Karori S at Makara Peak	1	<2	15	12
RS19	Kaiwharawhara S at Ngaio Gorge	2	<2	57	12
RS20	Hutt R at Te Marua Intake Site	5	<2	33	12
RS21	Hutt R opp. Manor Park G.C.	6	<2	47	12
RS22	Hutt R at Boulcott	7	<2	42	12
RS23	Pakuratahi R 50m d/s Farm Ck	5	<2	38	12
RS24	Mangaroa R at Te Marua	8	<2	34	12
RS25	Akatarawa R at Hutt confl.	1	<2	5	12
RS26	Whakatikei R at Riverstone	1	<2	39	12
RS28	Wainuiomata R at Manuka Track	1	<2	2	12
RS29	Wainuiomata R d/s of White Br	3	<2	9	12
RS30	Orongorongo R at Orongorongo Stn	1	<2	63	12
RS31	Ruamahanga R at McLays	1	<2	31	12
RS32	Ruamahanga R at Te Ore Ore	4	<2	650	12
RS33	Ruamahanga R at Gladstone Br	3	<2	500	12
RS34	Ruamahanga R at Pukio	5	<2	140	12
RS35	Mataikona Trib at Sugar Loaf Rd	8	<2	47	11
RS36	Taueru R at Castlehill	6	<2	35	12
RS37	Taueru R at Gladstone	12	<2	96	12
RS38	Kopuaranga R at Stewarts	5	<2	142	12
RS39	Whangaehu R 250m u/s confl.	6	<2	310	12
RS40	Waipoua R at Colombo Rd Br	1	<2	5	12
RS41	Waingawa R at South Rd	1	<2	34	12
RS42	Whareama R at Gauge	53	<2	260	12
RS43	Motuwaireka S at Headwaters	2	<2	5	12
RS44	Totara S at Stronvar	3	<2	12	12
RS45	Parkvale Trib at Lowes Res.	2	<2	4	9
RS46	Parkvale S at Weir	7	<2	89	12
RS47	Waiohine R at Gorge	1	<2	17	12
RS48	Waiohine R at Bicknells	3	<2	30	12
RS49	Beef Ck at Headwaters	1	<2	5	12
RS50	Mangatarere S at SH 2	3	<2	31	12
RS51	Huangarua R at Ponatahi Br	3	<2	660	12
RS52	Tauanui R at Whakatomotomo Rd	1	<2	6	12
RS53	Awhea R at Tora Rd	6	<2	1,570	12
RS54	Coles Ck Trib at Lagoon Hill Rd	5	<2	22	8
RS55	Tauherenikau R at Websters	1	<2	66	12
RS56	Waiorongomai R at Forest Pk	1	<2	2	12
RS57	Waiwhetu S at Whites Line East	4	<2	20	12

Table A3.8: Electrical conductivity – field meter (µS/cm)

Site no.	Site name	Median	Minimum	5th percentile	95th percentile	Maximum	*n**
RS02	Mangapouri S at Bennetts Rd	202	138	166	244	244	12
RS03	Waitohu S at Forest Pk	87	57	69	100	101	12
RS04	Waitohu S at Norfolk Cres	149	90	108	182	197	12
RS05	Otaki R at Pukehinau	63	45	51	73	74	12
RS06	Otaki R at Mouth	65	45	52	75	75	12
RS07	Mangaone S at Sims Rd Br	203	134	152	218	223	12
RS08	Ngarara S at Field Way	300	225	237	456	519	12
RS09	Waikanae R at Mangaone Walkway	87	75	79	97	98	12
RS10	Waikanae R at Greenaway Rd	105	87	92	114	115	12
RS11	Whareroa S at Waterfall Rd	238	199	202	274	276	12
RS12	Whareroa S at QE Park	258	212	218	291	292	12
RS13	Horokiri S at Snodgrass	194	178	178	208	209	12
RS14	Pauatahanui S at Elmwood Br	180	159	161	205	207	12
RS15	Porirua S at Glenside	227	103	105	259	266	12
RS16	Porirua S at Wall Park (Milk Depot)	235	118	119	265	270	12
RS17	Makara S at Kennels	268	225	237	295	305	12
RS18	Karori S at Makara Peak	213	88	111	230	232	12
RS19	Kaiwharawhara S at Ngaio Gorge	263	127	139	297	299	12
RS20	Hutt R at Te Marua Intake Site	62	52	53	73	75	12
RS21	Hutt R opp. Manor Park G.C.	80	71	73	101	104	12
RS22	Hutt R at Boulcott	79	71	71	96	100	12
RS23	Pakuratahi R 50m d/s Farm Ck	73	61	63	87	87	12
RS24	Mangaroa R at Te Marua	96	82	84	109	110	12
RS25	Akatarawa R at Hutt confl.	78	74	74	92	92	12
RS26	Whakatikei R at Riverstone	111	102	104	125	125	12
RS28	Wainuiomata R at Manuka Track	109	99	100	116	117	12
RS29	Wainuiomata R d/s of White Br	143	127	131	152	152	12
RS30	Orongorongo R at Orongorongo Stn	141	128	129	164	170	12
RS31	Ruamahanga R at McLays	52	28	31	62	64	11
RS32	Ruamahanga R at Te Ore Ore	118	55	65	158	164	11
RS33	Ruamahanga R at Gladstone Br	105	58	63	140	147	11
RS34	Ruamahanga R at Pukio	109	73	76	168	192	11
RS35	Mataikona Trib at Sugar Loaf Rd	402	315	321	469	495	11
RS36	Taueru R at Castlehill	193	155	158	278	281	12
RS37	Taueru R at Gladstone	397	239	265	455	473	12
RS38	Kopuaranga R at Stewarts	244	119	139	372	379	11
RS39	Whangaehu R 250m u/s confl.	339	154	206	366	369	11
RS40	Waipoua R at Colombo Rd Br	98	67	79	118	119	12
RS41	Waingawa R at South Rd	58	40	45	73	76	12
RS42	Whareama R at Gauge	506	347	377	666	669	12
RS43	Motuwaireka S at Headwaters	209	187	188	280	289	12
RS44	Totara S at Stronvar	212	182	186	266	273	12
RS45	Parkvale Trib at Lowes Res.	185	160	161	207	212	9
RS46	Parkvale S at Weir	144	115	126	164	177	12
RS47	Waiohine R at Gorge	56	36	41	64	66	12
RS48	Waiohine R at Bicknells	76	51	51	86	89	12
RS49	Beef Ck at Headwaters	98	66	74	108	108	12
RS50	Mangatarere S at SH 2	114	83	91	131	136	12
RS51	Huangarua R at Ponatahi Br	378	207	259	422	431	12
RS52	Tauanui R at Whakatomotomo Rd	146	113	113	161	163	12
RS53	Awhea R at Tora Rd	405	267	303	438	443	12
RS54	Coles Ck Trib at Lagoon Hill Rd	467	324	331	855	866	8
RS55	Tauherenikau R at Websters	70	49	54	82	82	12
RS56	Waiorongomai R at Forest Pk	118	101	102	140	141	12
RS57	Waiwhetu S at Whites Line East	236	217	220	393	574	12

*Lower *n* counts for some sites (when compared to other variables) reflects sampling occasions when the field conductivity meter had malfunctioned and no measurement could be made. In such instances, the lab was asked to measure conductivity from a supplied water sample.

Table A3.9: Total organic carbon (mg/L)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	6.7	2.9	25.0	12
RS03	Waitohu S at Forest Pk	2.2	1.5	12.9	12
RS04	Waitohu S at Norfolk Cres	4.3	3.5	10.4	12
RS05	Otaki R at Pukehinau	1.7	0.9	5.5	12
RS06	Otaki R at Mouth	1.7	0.7	6.5	12
RS07	Mangaone S at Sims Rd Br	6.1	3.1	21.0	12
RS08	Ngarara S at Field Way	14.6	8.9	19.5	12
RS09	Waikanae R at Mangaone Walkway	1.9	1.1	3.2	12
RS10	Waikanae R at Greenaway Rd	1.4	1.1	3.2	12
RS11	Whareroa S at Waterfall Rd	4.6	2.8	6.8	12
RS12	Whareroa S at QE Park	15.0	6.9	21.0	12
RS13	Horokiri S at Snodgrass	2.3	1.3	3.8	12
RS14	Pauatahanui S at Elmwood Br	4.1	3.1	6.1	12
RS15	Porirua S at Glenside	4.3	2.2	9.8	12
RS16	Porirua S at Wall Park (Milk Depot)	4.6	2.2	10.0	12
RS17	Makara S at Kennels	5.1	3.9	24.0	12
RS18	Karori S at Makara Peak	2.4	1.2	7.9	12
RS19	Kaiwharawhara S at Ngaio Gorge	4.0	2.6	10.6	12
RS20	Hutt R at Te Marua Intake Site	5.6	1.6	11.4	12
RS21	Hutt R opp. Manor Park G.C.	5.0	2.3	9.1	12
RS22	Hutt R at Boulcott	4.8	2.0	8.7	12
RS23	Pakuratahi R 50m d/s Farm Ck	5.8	1.4	10.1	12
RS24	Mangaroa R at Te Marua	6.6	3.9	10.4	12
RS25	Akatarawa R at Hutt confl.	3.0	1.8	7.2	12
RS26	Whakatikei R at Riverstone	2.5	1.2	3.9	12
RS28	Wainuiomata R at Manuka Track	2.0	1.3	2.7	12
RS29	Wainuiomata R d/s of White Br	2.0	1.5	3.4	12
RS30	Orongorongo R at Orongorongo Stn	1.3	0.3	2.8	12
RS31	Ruamahanga R at McLays	1.5	0.7	3.7	12
RS32	Ruamahanga R at Te Ore Ore	3.2	0.7	9.1	12
RS33	Ruamahanga R at Gladstone Br	2.6	1.3	8.5	12
RS34	Ruamahanga R at Pukio	3.1	1.7	6.3	12
RS35	Mataikona Trib at Sugar Loaf Rd	2.5	1.3	4.5	11
RS36	Taueru R at Castlehill	6.5	4.3	12.0	12
RS37	Taueru R at Gladstone	6.3	3.2	11.3	12
RS38	Kopuaranga R at Stewarts	3.9	0.3	12.0	12
RS39	Whangaehu R 250m u/s confl.	6.5	2.0	18.3	12
RS40	Waipoua R at Colombo Rd Br	2.5	1.0	5.8	12
RS41	Waingawa R at South Rd	1.5	0.3	4.5	12
RS42	Whareama R at Gauge	6.6	3.6	10.4	12
RS43	Motuwaireka S at Headwaters	2.5	1.2	4.0	12
RS44	Totara S at Stronvar	3.8	2.4	7.0	12
RS45	Parkvale Trib at Lowes Res.	3.9	2.5	6.9	9
RS46	Parkvale S at Weir	5.6	3.4	11.6	12
RS47	Waiohine R at Gorge	1.5	0.7	4.1	12
RS48	Waiohine R at Bicknells	1.7	0.9	3.0	12
RS49	Beef Ck at Headwaters	1.8	0.8	3.5	12
RS50	Mangatarere S at SH 2	2.0	0.9	3.7	12
RS51	Huangarua R at Ponatahi Br	2.9	0.3	22.0	12
RS52	Tauanui R at Whakatomotomo Rd	2.4	1.5	8.9	12
RS53	Awhea R at Tora Rd	3.1	0.3	17.7	12
RS54	Coles Ck Trib at Lagoon Hill Rd	4.0	0.3	7.8	8
RS55	Tauherenikau R at Websters	2.0	0.6	4.9	12
RS56	Waiorongomai R at Forest Pk	2.1	0.3	4.6	12
RS57	Waiwhetu S at Whites Line East	3.5	0.7	6.2	12

Table A3.10: Ammoniacal nitrogen (mg/L)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	0.057	0.025	0.110	12
RS03	Waitohu S at Forest Pk	0.005	<0.01	0.005	12
RS04	Waitohu S at Norfolk Cres	0.027	0.013	0.069	12
RS05	Otaki R at Pukehinau	0.005	<0.01	0.005	12
RS06	Otaki R at Mouth	0.005	<0.01	0.005	12
RS07	Mangaone S at Sims Rd Br	0.065	0.021	0.171	12
RS08	Ngarara S at Field Way	0.025	<0.01	0.048	12
RS09	Waikanae R at Mangaone Walkway	0.005	<0.01	0.013	12
RS10	Waikanae R at Greenaway Rd	0.005	<0.01	0.005	12
RS11	Whareroa S at Waterfall Rd	0.005	<0.01	0.014	12
RS12	Whareroa S at QE Park	0.081	0.012	0.260	12
RS13	Horokiri S at Snodgrass	0.005	<0.01	0.014	12
RS14	Pauatahanui S at Elmwood Br	0.017	<0.01	0.027	12
RS15	Porirua S at Glenside	0.005	<0.01	0.041	12
RS16	Porirua S at Wall Park (Milk Depot)	0.020	<0.01	0.166	12
RS17	Makara S at Kennels	0.015	<0.01	0.069	12
RS18	Karori S at Makara Peak	0.031	<0.01	0.062	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.012	<0.01	0.052	12
RS20	Hutt R at Te Marua Intake Site	0.005	<0.01	0.005	12
RS21	Hutt R opp. Manor Park G.C.	0.005	<0.01	0.045	12
RS22	Hutt R at Boulcott	0.005	<0.01	0.005	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.005	<0.01	0.012	12
RS24	Mangaroa R at Te Marua	0.005	<0.01	0.014	12
RS25	Akatarawa R at Hutt confl.	0.005	<0.01	0.005	12
RS26	Whakatikei R at Riverstone	0.005	<0.01	0.010	12
RS28	Wainuiomata R at Manuka Track	0.005	<0.01	0.005	12
RS29	Wainuiomata R d/s of White Br	0.005	<0.01	0.079	12
RS30	Orongorongo R at Orongorongo Stn	0.005	<0.01	0.005	12
RS31	Ruamahanga R at McLays	0.005	<0.01	0.005	12
RS32	Ruamahanga R at Te Ore Ore	0.005	<0.01	0.020	12
RS33	Ruamahanga R at Gladstone Br	0.030	<0.01	0.118	12
RS34	Ruamahanga R at Pukio	0.011	<0.01	0.059	12
RS35	Mataikona Trib at Sugar Loaf Rd	0.005	<0.01	0.015	11
RS36	Taueru R at Castlehill	0.011	<0.01	0.023	12
RS37	Taueru R at Gladstone	0.024	<0.01	0.078	12
RS38	Kopuaranga R at Stewarts	0.005	<0.01	0.027	12
RS39	Whangaehu R 250m u/s confl.	0.008	<0.01	0.141	12
RS40	Waipoua R at Colombo Rd Br	0.005	<0.01	0.005	12
RS41	Waingawa R at South Rd	0.005	<0.01	0.630	12
RS42	Whareama R at Gauge	0.008	<0.01	0.028	12
RS43	Motuwaireka S at Headwaters	0.005	<0.01	0.005	12
RS44	Totara S at Stronvar	0.005	<0.01	0.005	12
RS45	Parkvale Trib at Lowes Res.	0.005	<0.01	0.015	9
RS46	Parkvale S at Weir	0.016	<0.01	0.100	12
RS47	Waiohine R at Gorge	0.005	<0.01	0.028	12
RS48	Waiohine R at Bicknells	0.008	<0.01	0.039	12
RS49	Beef Ck at Headwaters	0.005	<0.01	0.005	12
RS50	Mangatarere S at SH 2	0.076	<0.01	0.250	12
RS51	Huangarua R at Ponatahi Br	0.005	<0.01	0.018	12
RS52	Tauanui R at Whakatomotomo Rd	0.005	<0.01	0.005	12
RS53	Awhea R at Tora Rd	0.005	<0.01	0.012	12
RS54	Coles Ck Trib at Lagoon Hill Rd	0.005	<0.01	0.005	8
RS55	Tauherenikau R at Websters	0.005	<0.01	0.005	12
RS56	Waiorongomai R at Forest Pk	0.005	<0.01	0.005	12
RS57	Waiwhetu S at Whites Line East	0.063	0.015	0.210	12

Table A3.11: Nitrite-nitrate nitrogen (mg/L)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	1.670	0.260	2.800	12
RS03	Waitohu S at Forest Pk	0.029	0.003	0.047	12
RS04	Waitohu S at Norfolk Cres	0.250	0.150	0.750	12
RS05	Otaki R at Pukehinau	0.037	0.008	0.068	12
RS06	Otaki R at Mouth	0.053	0.010	0.116	12
RS07	Mangaone S at Sims Rd Br	1.100	0.820	2.700	12
RS08	Ngarara S at Field Way	0.066	<0.002	0.350	12
RS09	Waikanae R at Mangaone Walkway	0.139	0.059	0.280	12
RS10	Waikanae R at Greenaway Rd	0.240	0.034	0.410	12
RS11	Whareroa S at Waterfall Rd	0.455	0.167	0.830	12
RS12	Whareroa S at QE Park	0.305	0.025	0.910	12
RS13	Horokiri S at Snodgrass	0.620	0.134	1.150	12
RS14	Pauatahanui S at Elmwood Br	0.335	0.048	0.780	12
RS15	Porirua S at Glenside	0.900	0.330	1.940	12
RS16	Porirua S at Wall Park (Milk Depot)	0.845	0.330	1.930	12
RS17	Makara S at Kennels	0.585	0.012	1.450	12
RS18	Karori S at Makara Peak	1.150	0.590	1.600	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.995	0.520	1.570	12
RS20	Hutt R at Te Marua Intake Site	0.063	0.033	0.110	12
RS21	Hutt R opp. Manor Park G.C.	0.152	0.081	0.340	12
RS22	Hutt R at Boulcott	0.143	0.083	0.270	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.161	0.059	0.230	12
RS24	Mangaroa R at Te Marua	0.305	0.166	0.460	12
RS25	Akatarawa R at Hutt confl.	0.107	<0.002	0.194	12
RS26	Whakatikei R at Riverstone	0.130	0.017	0.290	12
RS28	Wainuiomata R at Manuka Track	0.087	0.033	0.156	12
RS29	Wainuiomata R d/s of White Br	0.193	0.022	0.490	12
RS30	Orongorongo R at Orongorongo Stn	0.047	<0.002	0.083	12
RS31	Ruamahanga R at McLays	0.018	0.008	0.055	12
RS32	Ruamahanga R at Te Ore Ore	0.365	0.113	1.450	12
RS33	Ruamahanga R at Gladstone Br	0.350	0.152	1.550	12
RS34	Ruamahanga R at Pukio	0.310	0.111	1.350	12
RS35	Mataikona Trib at Sugar Loaf Rd	0.039	<0.002	0.320	11
RS36	Taueru R at Castlehill	0.184	0.012	0.510	12
RS37	Taueru R at Gladstone	0.655	0.450	1.150	12
RS38	Kopuaranga R at Stewarts	0.985	0.490	1.720	12
RS39	Whangaehu R 250m u/s confl.	0.865	0.480	2.500	12
RS40	Waipoua R at Colombo Rd Br	1.015	0.300	2.900	12
RS41	Waingawa R at South Rd	0.065	0.013	0.260	12
RS42	Whareama R at Gauge	0.112	<0.002	0.760	12
RS43	Motuwaireka S at Headwaters	0.022	<0.002	0.054	12
RS44	Totara S at Stronvar	0.110	<0.002	0.370	12
RS45	Parkvale Trib at Lowes Res.	7.000	4.100	8.300	9
RS46	Parkvale S at Weir	2.600	0.027	4.200	12
RS47	Waiohine R at Gorge	0.029	<0.002	0.065	12
RS48	Waiohine R at Bicknells	0.325	0.192	0.860	12
RS49	Beef Ck at Headwaters	0.021	0.005	0.041	12
RS50	Mangatarere S at SH 2	1.185	0.690	2.700	12
RS51	Huangarua R at Ponatahi Br	0.166	0.100	0.770	12
RS52	Tauanui R at Whakatomotomo Rd	0.010	0.003	0.030	12
RS53	Awhea R at Tora Rd	0.112	0.004	0.250	12
RS54	Coles Ck Trib at Lagoon Hill Rd	0.010	<0.002	0.017	8
RS55	Tauherenikau R at Websters	0.056	0.014	0.164	12
RS56	Waiorongomai R at Forest Pk	0.036	0.007	0.061	12
RS57	Waiwhetu S at Whites Line East	0.580	0.300	1.020	12

Table A3.12: Total Kjeldahl nitrogen (mg/L)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	0.50	0.32	1.90	12
RS03	Waitohu S at Forest Pk	0.05	<0.10	0.36	12
RS04	Waitohu S at Norfolk Cres	0.28	0.15	0.40	12
RS05	Otaki R at Pukehinau	0.05	<0.10	0.13	12
RS06	Otaki R at Mouth	0.05	<0.10	0.14	12
RS07	Mangaone S at Sims Rd Br	0.58	0.27	2.80	12
RS08	Ngarara S at Field Way	0.61	0.39	0.91	12
RS09	Waikanae R at Mangaone Walkway	0.05	<0.10	0.13	12
RS10	Waikanae R at Greenaway Rd	0.05	<0.10	0.13	12
RS11	Whareroa S at Waterfall Rd	0.17	0.13	0.42	12
RS12	Whareroa S at QE Park	0.56	0.26	0.95	12
RS13	Horokiri S at Snodgrass	0.12	<0.10	0.31	12
RS14	Pauatahanui S at Elmwood Br	0.20	0.14	0.38	12
RS15	Porirua S at Glenside	0.24	0.18	0.80	12
RS16	Porirua S at Wall Park (Milk Depot)	0.28	0.19	0.89	12
RS17	Makara S at Kennels	0.29	0.21	2.20	12
RS18	Karori S at Makara Peak	0.22	0.13	0.48	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.26	<0.10	0.64	12
RS20	Hutt R at Te Marua Intake Site	0.14	<0.10	0.28	12
RS21	Hutt R opp. Manor Park G.C.	0.17	<0.10	0.35	12
RS22	Hutt R at Boulcott	0.14	<0.10	0.21	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.19	<0.10	0.28	12
RS24	Mangaroa R at Te Marua	0.22	0.13	0.38	12
RS25	Akatarawa R at Hutt confl.	0.05	<0.10	0.39	12
RS26	Whakatikei R at Riverstone	0.05	<0.10	0.15	12
RS28	Wainuiomata R at Manuka Track	0.05	<0.10	0.24	12
RS29	Wainuiomata R d/s of White Br	0.10	<0.10	0.17	12
RS30	Orongorongo R at Orongorongo Stn	0.05	<0.10	0.10	12
RS31	Ruamahanga R at McLays	0.05	<0.10	0.11	12
RS32	Ruamahanga R at Te Ore Ore	0.14	<0.10	0.73	12
RS33	Ruamahanga R at Gladstone Br	0.19	<0.10	0.64	12
RS34	Ruamahanga R at Pukio	0.17	0.10	0.33	12
RS35	Mataikona Trib at Sugar Loaf Rd	0.11	<0.10	0.25	11
RS36	Taueru R at Castlehill	0.32	0.17	0.60	12
RS37	Taueru R at Gladstone	0.47	0.29	0.86	12
RS38	Kopuaranga R at Stewarts	0.28	0.14	1.47	12
RS39	Whangaehu R 250m u/s confl.	0.46	0.29	1.66	12
RS40	Waipoua R at Colombo Rd Br	0.17	0.14	0.31	12
RS41	Waingawa R at South Rd	0.05	<0.10	0.61	12
RS42	Whareama R at Gauge	0.37	0.24	0.84	12
RS43	Motuwaireka S at Headwaters	0.05	<0.10	0.17	12
RS44	Totara S at Stronvar	0.08	<0.10	0.23	12
RS45	Parkvale Trib at Lowes Res.	0.32	<0.10	0.60	9
RS46	Parkvale S at Weir	0.48	0.27	1.23	12
RS47	Waiohine R at Gorge	0.05	<0.10	0.10	12
RS48	Waiohine R at Bicknells	0.05	<0.10	0.14	12
RS49	Beef Ck at Headwaters	0.05	<0.10	0.13	12
RS50	Mangatarere S at SH 2	0.22	0.11	0.40	12
RS51	Huangarua R at Ponatahi Br	0.23	<0.10	1.70	12
RS52	Tauanui R at Whakatomotomo Rd	0.05	<0.10	0.19	12
RS53	Awhea R at Tora Rd	0.19	0.13	1.38	12
RS54	Coles Ck Trib at Lagoon Hill Rd	0.16	0.12	0.22	8
RS55	Tauherenikau R at Websters	0.05	<0.10	0.15	12
RS56	Waiorongomai R at Forest Pk	0.05	<0.10	0.13	12
RS57	Waiwhetu S at Whites Line East	0.27	0.13	0.43	12

Table A3.13: Total nitrogen (mg/L)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	2.45	0.59	3.40	12
RS03	Waitohu S at Forest Pk	0.11	<0.11	0.38	12
RS04	Waitohu S at Norfolk Cres	0.58	0.32	1.13	12
RS05	Otaki R at Pukehinau	0.06	<0.11	0.16	12
RS06	Otaki R at Mouth	0.06	<0.11	0.18	12
RS07	Mangaone S at Sims Rd Br	1.90	1.20	3.90	12
RS08	Ngarara S at Field Way	0.70	0.39	1.20	12
RS09	Waikanae R at Mangaone Walkway	0.20	0.10	0.41	12
RS10	Waikanae R at Greenaway Rd	0.33	<0.11	0.47	12
RS11	Whareroa S at Waterfall Rd	0.64	0.29	1.26	12
RS12	Whareroa S at QE Park	0.87	0.29	1.73	12
RS13	Horokiri S at Snodgrass	0.75	0.23	1.40	12
RS14	Pauatahanui S at Elmwood Br	0.53	0.21	1.17	12
RS15	Porirua S at Glenside	1.30	0.58	2.20	12
RS16	Porirua S at Wall Park (Milk Depot)	1.31	0.68	2.30	12
RS17	Makara S at Kennels	0.95	0.22	2.80	12
RS18	Karori S at Makara Peak	1.34	0.83	1.83	12
RS19	Kaiwharawhara S at Ngaio Gorge	1.29	0.56	1.82	12
RS20	Hutt R at Te Marua Intake Site	0.21	<0.11	0.32	12
RS21	Hutt R opp. Manor Park G.C.	0.35	0.19	0.52	12
RS22	Hutt R at Boulcott	0.31	0.15	0.41	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.32	0.16	0.44	12
RS24	Mangaroa R at Te Marua	0.56	0.34	0.69	12
RS25	Akatarawa R at Hutt confl.	0.21	<0.11	0.50	12
RS26	Whakatikei R at Riverstone	0.23	<0.11	0.40	12
RS28	Wainuiomata R at Manuka Track	0.15	<0.11	0.37	12
RS29	Wainuiomata R d/s of White Br	0.29	<0.11	0.66	12
RS30	Orongorongo R at Orongorongo Stn	0.08	<0.11	0.18	12
RS31	Ruamahanga R at McLays	0.06	<0.11	0.14	12
RS32	Ruamahanga R at Te Ore Ore	0.53	0.30	1.62	12
RS33	Ruamahanga R at Gladstone Br	0.60	0.34	1.77	12
RS34	Ruamahanga R at Pukio	0.50	0.24	1.58	12
RS35	Mataikona Trib at Sugar Loaf Rd	0.16	<0.11	0.47	11
RS36	Taueru R at Castlehill	0.46	0.19	0.87	12
RS37	Taueru R at Gladstone	1.18	0.81	1.95	12
RS38	Kopuaranga R at Stewarts	1.27	0.84	2.60	12
RS39	Whangaehu R 250m u/s confl.	1.54	0.94	2.90	12
RS40	Waipoua R at Colombo Rd Br	1.22	0.48	3.10	12
RS41	Waingawa R at South Rd	0.15	<0.11	0.68	12
RS42	Whareama R at Gauge	0.48	0.24	1.60	12
RS43	Motuwaireka S at Headwaters	0.06	<0.11	0.21	12
RS44	Totara S at Stronvar	0.21	<0.11	0.60	12
RS45	Parkvale Trib at Lowes Res.	7.00	4.40	8.60	9
RS46	Parkvale S at Weir	3.15	0.29	4.70	12
RS47	Waiohine R at Gorge	0.06	<0.11	0.14	12
RS48	Waiohine R at Bicknells	0.39	0.28	0.91	12
RS49	Beef Ck at Headwaters	0.06	<0.11	0.15	12
RS50	Mangatarere S at SH 2	1.40	0.88	3.10	12
RS51	Huangarua R at Ponatahi Br	0.43	0.20	1.83	12
RS52	Tauanui R at Whakatomotomo Rd	0.06	<0.11	0.22	12
RS53	Awhea R at Tora Rd	0.32	0.14	1.56	12
RS54	Coles Ck Trib at Lagoon Hill Rd	0.17	0.12	0.22	8
RS55	Tauherenikau R at Websters	0.13	<0.11	0.20	12
RS56	Waiorongomai R at Forest Pk	0.10	<0.11	0.15	12
RS57	Waiwhetu S at Whites Line East	0.89	0.44	1.35	12

Table A3.14: Dissolved reactive phosphorus (mg/L)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	0.039	0.029	0.072	12
RS03	Waitohu S at Forest Pk	0.010	0.008	0.012	12
RS04	Waitohu S at Norfolk Cres	0.018	0.013	0.027	12
RS05	Otaki R at Pukehinau	0.005	<0.004	0.007	12
RS06	Otaki R at Mouth	0.006	<0.004	0.007	12
RS07	Mangaone S at Sims Rd Br	0.033	0.021	0.051	12
RS08	Ngarara S at Field Way	0.053	0.019	0.064	12
RS09	Waikanae R at Mangaone Walkway	0.013	0.011	0.016	12
RS10	Waikanae R at Greenaway Rd	0.009	<0.004	0.011	12
RS11	Whareroa S at Waterfall Rd	0.030	0.019	0.036	12
RS12	Whareroa S at QE Park	0.050	0.042	0.074	12
RS13	Horokiri S at Snodgrass	0.014	0.006	0.028	12
RS14	Pauatahanui S at Elmwood Br	0.015	0.013	0.022	12
RS15	Porirua S at Glenside	0.018	0.016	0.034	12
RS16	Porirua S at Wall Park (Milk Depot)	0.018	0.016	0.037	12
RS17	Makara S at Kennels	0.027	0.014	0.065	12
RS18	Karori S at Makara Peak	0.032	0.023	0.050	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.036	0.023	0.045	12
RS20	Hutt R at Te Marua Intake Site	0.003	<0.004	0.006	12
RS21	Hutt R opp. Manor Park G.C.	0.006	<0.004	0.008	12
RS22	Hutt R at Boulcott	0.006	<0.004	0.008	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.006	<0.004	0.011	12
RS24	Mangaroa R at Te Marua	0.012	0.005	0.015	12
RS25	Akatarawa R at Hutt confl.	0.005	<0.004	0.008	12
RS26	Whakatikei R at Riverstone	0.008	0.005	0.012	12
RS28	Wainuiomata R at Manuka Track	0.012	0.010	0.014	12
RS29	Wainuiomata R d/s of White Br	0.012	0.006	0.028	12
RS30	Orongorongo R at Orongorongo Stn	0.005	<0.004	0.008	12
RS31	Ruamahanga R at McLays	0.002	<0.004	0.005	12
RS32	Ruamahanga R at Te Ore Ore	0.007	<0.004	0.022	12
RS33	Ruamahanga R at Gladstone Br	0.012	0.007	0.030	12
RS34	Ruamahanga R at Pukio	0.015	<0.004	0.022	12
RS35	Mataikona Trib at Sugar Loaf Rd	0.006	<0.004	0.009	11
RS36	Taueru R at Castlehill	0.010	0.006	0.013	12
RS37	Taueru R at Gladstone	0.024	0.005	0.052	12
RS38	Kopuaranga R at Stewarts	0.016	0.007	0.039	12
RS39	Whangaehu R 250m u/s confl.	0.029	0.014	0.165	12
RS40	Waipoua R at Colombo Rd Br	0.005	<0.004	0.009	12
RS41	Waingawa R at South Rd	0.005	<0.004	0.006	12
RS42	Whareama R at Gauge	0.010	<0.004	0.018	12
RS43	Motuwaireka S at Headwaters	0.003	<0.004	0.008	12
RS44	Totara S at Stronvar	0.002	<0.004	0.006	12
RS45	Parkvale Trib at Lowes Res.	0.010	0.005	0.019	9
RS46	Parkvale S at Weir	0.026	0.011	0.073	12
RS47	Waiohine R at Gorge	0.003	<0.004	0.006	12
RS48	Waiohine R at Bicknells	0.012	0.008	0.029	12
RS49	Beef Ck at Headwaters	0.008	0.006	0.010	12
RS50	Mangatarere S at SH 2	0.052	0.012	0.141	12
RS51	Huangarua R at Ponatahi Br	0.008	<0.004	0.028	12
RS52	Tauanui R at Whakatomotomo Rd	0.007	<0.004	0.012	12
RS53	Awhea R at Tora Rd	0.011	<0.004	0.016	12
RS54	Coles Ck Trib at Lagoon Hill Rd	0.006	<0.004	0.010	8
RS55	Tauherenikau R at Websters	0.003	<0.004	0.005	12
RS56	Waiorongomai R at Forest Pk	0.004	<0.004	0.006	12
RS57	Waiwhetu S at Whites Line East	0.039	0.029	0.072	12

Table A3.15: Total phosphorus (mg/L)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	0.075	0.059	0.530	12
RS03	Waitohu S at Forest Pk	0.013	0.009	0.034	12
RS04	Waitohu S at Norfolk Cres	0.040	0.026	0.062	12
RS05	Otaki R at Pukehinau	0.007	<0.004	0.018	12
RS06	Otaki R at Mouth	0.007	<0.004	0.036	12
RS07	Mangaone S at Sims Rd Br	0.066	0.038	0.158	12
RS08	Ngarara S at Field Way	0.119	0.078	0.280	12
RS09	Waikanae R at Mangaone Walkway	0.017	0.012	0.021	12
RS10	Waikanae R at Greenaway Rd	0.011	<0.004	0.026	12
RS11	Whareroa S at Waterfall Rd	0.040	0.027	0.065	12
RS12	Whareroa S at QE Park	0.081	0.064	0.126	12
RS13	Horokiri S at Snodgrass	0.018	0.008	0.044	12
RS14	Pauatahanui S at Elmwood Br	0.023	0.020	0.040	12
RS15	Porirua S at Glenside	0.029	0.020	0.142	12
RS16	Porirua S at Wall Park (Milk Depot)	0.028	0.018	0.176	12
RS17	Makara S at Kennels	0.040	0.023	0.450	12
RS18	Karori S at Makara Peak	0.038	0.028	0.086	12
RS19	Kaiwharawhara S at Ngaio Gorge	0.048	0.027	0.108	12
RS20	Hutt R at Te Marua Intake Site	0.010	<0.004	0.032	12
RS21	Hutt R opp. Manor Park G.C.	0.014	0.006	0.034	12
RS22	Hutt R at Boulcott	0.012	<0.004	0.036	12
RS23	Pakuratahi R 50m d/s Farm Ck	0.013	0.005	0.036	12
RS24	Mangaroa R at Te Marua	0.024	0.014	0.046	12
RS25	Akatarawa R at Hutt confl.	0.007	<0.004	0.032	12
RS26	Whakatikei R at Riverstone	0.012	0.008	0.016	12
RS28	Wainuiomata R at Manuka Track	0.015	0.010	0.054	12
RS29	Wainuiomata R d/s of White Br	0.015	0.008	0.064	12
RS30	Orongorongo R at Orongorongo Stn	0.005	<0.004	0.024	12
RS31	Ruamahanga R at McLays	0.003	<0.004	0.011	12
RS32	Ruamahanga R at Te Ore Ore	0.017	0.004	0.230	12
RS33	Ruamahanga R at Gladstone Br	0.034	0.010	0.180	12
RS34	Ruamahanga R at Pukio	0.027	0.006	0.100	12
RS35	Mataikona Trib at Sugar Loaf Rd	0.009	<0.004	0.025	11
RS36	Taueru R at Castlehill	0.020	0.015	0.062	12
RS37	Taueru R at Gladstone	0.061	0.013	0.103	12
RS38	Kopuaranga R at Stewarts	0.031	0.012	0.161	12
RS39	Whangaehu R 250m u/s confl.	0.064	0.024	0.520	12
RS40	Waipoua R at Colombo Rd Br	0.009	<0.004	0.014	12
RS41	Waingawa R at South Rd	0.006	<0.004	0.027	12
RS42	Whareama R at Gauge	0.053	0.008	0.147	12
RS43	Motuwaireka S at Headwaters	0.006	<0.004	0.013	12
RS44	Totara S at Stronvar	0.007	<0.004	0.022	12
RS45	Parkvale Trib at Lowes Res.	0.016	0.007	0.024	9
RS46	Parkvale S at Weir	0.046	0.034	0.147	12
RS47	Waiohine R at Gorge	0.006	<0.004	0.014	12
RS48	Waiohine R at Bicknells	0.017	0.007	0.034	12
RS49	Beef Ck at Headwaters	0.011	0.009	0.020	12
RS50	Mangatarere S at SH 2	0.073	0.012	0.170	12
RS51	Huangarua R at Ponatahi Br	0.018	<0.004	0.280	12
RS52	Tauanui R at Whakatomotomo Rd	0.008	0.004	0.020	12
RS53	Awhea R at Tora Rd	0.016	<0.004	0.730	12
RS54	Coles Ck Trib at Lagoon Hill Rd	0.010	0.006	0.017	8
RS55	Tauherenikau R at Websters	0.006	<0.004	0.014	12
RS56	Waiorongomai R at Forest Pk	0.006	<0.004	0.008	12
RS57	Waiwhetu S at Whites Line East	0.035	0.015	0.053	12

Table A3.16: *E. coli* (cfu/100mL)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	705	290	18,000	12
RS03	Waitohu S at Forest Pk	7	<1	90	12
RS04	Waitohu S at Norfolk Cres	450	100	2,600	12
RS05	Otaki R at Pukehinau	9	1	43	12
RS06	Otaki R at Mouth	60	2	290	12
RS07	Mangaone S at Sims Rd Br	1,200	300	8,000	12
RS08	Ngarara S at Field Way	170	50	3,700	12
RS09	Waikanae R at Mangaone Walkway	12	4	90	12
RS10	Waikanae R at Greenaway Rd	50	8	270	12
RS11	Whareroa S at Waterfall Rd	190	36	1,400	12
RS12	Whareroa S at QE Park	135	20	1,800	12
RS13	Horokiri S at Snodgrass	465	60	5,000	12
RS14	Pauatahanui S at Elmwood Br	370	90	700	12
RS15	Porirua S at Glenside	510	120	7,000	12
RS16	Porirua S at Wall Park (Milk Depot)	3,200	200	11,000	12
RS17	Makara S at Kennels	530	120	20,000	12
RS18	Karori S at Makara Peak	1,450	800	2,500	12
RS19	Kaiwharawhara S at Ngaio Gorge	600	90	5,300	12
RS20	Hutt R at Te Marua Intake Site	65	8	240	12
RS21	Hutt R opp. Manor Park G.C.	210	50	2,100	12
RS22	Hutt R at Boulcott	265	31	900	12
RS23	Pakuratahi R 50m d/s Farm Ck	275	37	4,400	12
RS24	Mangaroa R at Te Marua	650	100	3,100	12
RS25	Akatarawa R at Hutt confl.	88	23	440	12
RS26	Whakatikei R at Riverstone	55	14	360	12
RS28	Wainuiomata R at Manuka Track	3	1	100	12
RS29	Wainuiomata R d/s of White Br	85	26	280	12
RS30	Orongorongo R at Orongorongo Stn	11	1	590	12
RS31	Ruamahanga R at McLays	10	1	16	12
RS32	Ruamahanga R at Te Ore Ore	75	8	16,000	12
RS33	Ruamahanga R at Gladstone Br	43	3	5,100	12
RS34	Ruamahanga R at Pukio	48	9	3,000	12
RS35	Mataikona Trib at Sugar Loaf Rd	19	9	200	11
RS36	Taueru R at Castlehill	130	18	1,400	12
RS37	Taueru R at Gladstone	190	60	4,400	12
RS38	Kopuaranga R at Stewarts	215	70	12,000	12
RS39	Whangaehu R 250m u/s confl.	320	60	30,000	12
RS40	Waipoua R at Colombo Rd Br	39	6	430	12
RS41	Waingawa R at South Rd	11	<1	46	12
RS42	Whareama R at Gauge	300	20	1,900	12
RS43	Motuwaireka S at Headwaters	5	<1	110	12
RS44	Totara S at Stronvar	23	4	260	12
RS45	Parkvale Trib at Lowes Res.	10	1	30	9
RS46	Parkvale S at Weir	305	140	1,800	12
RS47	Waiohine R at Gorge	10	1	120	12
RS48	Waiohine R at Bicknells	55	9	270	12
RS49	Beef Ck at Headwaters	13	<1	180	12
RS50	Mangatarere S at SH 2	165	40	430	12
RS51	Huangarua R at Ponatahi Br	85	27	18,000	12
RS52	Tauanui R at Whakatomotomo Rd	6	2	60	12
RS53	Awhea R at Tora Rd	52	7	7,000	12
RS54	Coles Ck Trib at Lagoon Hill Rd	30	12	1,800	8
RS55	Tauherenikau R at Websters	21	6	170	12
RS56	Waiorongomai R at Forest Pk	5	1	36	12
RS57	Waiwhetu S at Whites Line East	410	150	1,000	12

Table A3.17: Faecal coliforms (cfu/100mL)

Site no.	Site name	Median	Minimum	Maximum	*n*
RS02	Mangapouri S at Bennetts Rd	850	390	20,000	12
RS03	Waitohu S at Forest Pk	7	<1	100	12
RS04	Waitohu S at Norfolk Cres	600	100	3,200	12
RS05	Otaki R at Pukehinau	9	1	43	12
RS06	Otaki R at Mouth	65	2	300	12
RS07	Mangaone S at Sims Rd Br	1,200	300	8,000	12
RS08	Ngarara S at Field Way	200	50	3,900	12
RS09	Waikanae R at Mangaone Walkway	13	4	90	12
RS10	Waikanae R at Greenaway Rd	58	10	270	12
RS11	Whareroa S at Waterfall Rd	215	38	1,800	12
RS12	Whareroa S at QE Park	140	20	1,800	12
RS13	Horokiri S at Snodgrass	535	60	5,000	12
RS14	Pauatahanui S at Elmwood Br	385	90	700	12
RS15	Porirua S at Glenside	575	120	20,000	12
RS16	Porirua S at Wall Park (Milk Depot)	3,600	400	16,000	12
RS17	Makara S at Kennels	530	120	21,000	12
RS18	Karori S at Makara Peak	1,800	900	6,900	12
RS19	Kaiwharawhara S at Ngaio Gorge	600	90	5,900	12
RS20	Hutt R at Te Marua Intake Site	65	9	240	12
RS21	Hutt R opp. Manor Park G.C.	220	60	2,700	12
RS22	Hutt R at Boulcott	285	31	900	12
RS23	Pakuratahi R 50m d/s Farm Ck	300	41	4,400	12
RS24	Mangaroa R at Te Marua	800	130	3,800	12
RS25	Akatarawa R at Hutt confl.	105	25	440	12
RS26	Whakatikei R at Riverstone	57	14	410	12
RS28	Wainuiomata R at Manuka Track	3	1	100	12
RS29	Wainuiomata R d/s of White Br	90	26	330	12
RS30	Orongorongo R at Orongorongo Stn	13	1	590	12
RS31	Ruamahanga R at McLays	11	1	16	12
RS32	Ruamahanga R at Te Ore Ore	80	10	18,000	12
RS33	Ruamahanga R at Gladstone Br	46	3	5,400	12
RS34	Ruamahanga R at Pukio	48	9	3,000	12
RS35	Mataikona Trib at Sugar Loaf Rd	25	9	200	11
RS36	Taueru R at Castlehill	130	21	1,400	12
RS37	Taueru R at Gladstone	205	70	4,800	12
RS38	Kopuaranga R at Stewarts	235	80	12,000	12
RS39	Whangaehu R 250m u/s confl.	355	60	33,000	12
RS40	Waipoua R at Colombo Rd Br	42	6	430	12
RS41	Waingawa R at South Rd	15	<1	46	12
RS42	Whareama R at Gauge	335	20	1,900	12
RS43	Motuwaireka S at Headwaters	5	<1	110	12
RS44	Totara S at Stronvar	26	4	260	12
RS45	Parkvale Trib at Lowes Res.	10	1	40	9
RS46	Parkvale S at Weir	325	140	1,800	12
RS47	Waiohine R at Gorge	11	1	140	12
RS48	Waiohine R at Bicknells	55	10	280	12
RS49	Beef Ck at Headwaters	13	<1	240	12
RS50	Mangatarere S at SH 2	195	50	470	12
RS51	Huangarua R at Ponatahi Br	85	28	20,000	12
RS52	Tauanui R at Whakatomotomo Rd	7	2	60	12
RS53	Awhea R at Tora Rd	57	7	10,000	12
RS54	Coles Ck Trib at Lagoon Hill Rd	32	12	1,900	8
RS55	Tauherenikau R at Websters	21	8	170	12
RS56	Waiorongomai R at Forest Pk	7	1	38	12
RS57	Waiwhetu S at Whites Line East	535	260	1,600	12

Appendix 4: Tabulated heavy metal data

The default trigger values presented here represent the ANZECC (2000) 95% species protection level for slightly modified freshwater ecosystems.

Table A4.1: Summary of dissolved copper (mg/L) concentrations measured at 10 RSoE sites between July 2013 and June 2014 (D.L.= detection limit). The percentages of samples exceeding the ANZECC (2000) default and hardness-modified trigger values (TVs) are also presented

Site no.	Site name	Median	Minimum	Maximum	*n*	*n* <D.L.	% of samples (*n*) exceeding ANZECC (2000)	
							Default TV (≤ 0.0014)	Hardness modified TV
RS02	Mangapouri S at Bennetts Rd	0.0009	0.0005	0.0034	12	0	25	16.7
RS08	Ngarara S at Field Way	0.0003	<0.0005	0.0015	12	7	8.3	0
RS10	Waikanae R at Greenaway Rd	0.0003	<0.0005	0.0003	12	12	0	0
RS15	Porirua S at Glenside	0.0012	0.0006	0.0024	12	0	41.7	16.7
RS16	Porirua S at Wall Park (Milk Depot)	0.0025	0.0009	0.0161	12	0	83.3	66.7
RS18	Karori S at Makara Peak	0.0017	0.0008	0.0050	12	0	66.7	58.3
RS19	Kaiwharawhara S at Ngaio Gorge	0.0016	0.0010	0.0042	12	0	75	25
RS21	Hutt R opp. Manor Park G.C.	0.0006	<0.0005	0.0008	12	5	0	0
RS22	Hutt R at Boulcott	0.0006	<0.0005	0.0064	12	1	25	33.3
RS57	Waiwhetu S at Whites Line East	0.0009	<0.0005	0.0015	12	1	16.7	0

Table A4.2: Summary of dissolved zinc (mg/L) concentrations measured at 10 RSoE sites between July 2013 and June 2014 (D.L.= detection limit). The percentages of samples exceeding the ANZECC (2000) default and hardness-modified trigger values (TVs) are also presented

Site no.	Site name	Median	Minimum	Maximum	*n*	*n* <D.L.	% of samples (*n*) exceeding ANZECC (2000)	
							Default TV (≤ *0.008*)	Hardness modified TV
RS02	Mangapouri S at Bennetts Rd	0.0031	0.0015	0.0086	12	0	8.3	0
RS08	Ngarara S at Field Way	0.0015	<0.001	0.0024	12	1	0	0
RS10	Waikanae R at Greenaway Rd	0.0005	<0.001	0.0005	12	12	0	0
RS15	Porirua S at Glenside	0.0067	0.0032	0.0220	12	0	33.3	25
RS16	Porirua S at Wall Park (Milk Depot)	0.0265	0.0085	0.2500	12	0	100	91.7
RS18	Karori S at Makara Peak	0.0285	0.0080	0.0570	12	0	100	91.7
RS19	Kaiwharawhara S at Ngaio Gorge	0.0077	0.0019	0.0220	12	0	41.7	16.7
RS21	Hutt R opp. Manor Park G.C.	0.0012	<0.001	0.0054	12	5	0	0
RS22	Hutt R at Boulcott	0.0014	<0.001	0.0045	12	3	0	0
RS57	Waiwhetu S at Whites Line East	0.0163	0.0110	0.0220	12	0	100	75

Appendix 5: Additional macroinvertebrate indices

Table A5.1: QMCI, %EPT* taxa and taxa richness scores for RSoE sites sampled in summer/autumn 2014

Site no.	Site name	QMCI	%EPT* taxa	Taxa richness
RS02	Mangapouri S at Bennetts Rd	4.73	7.1	14
RS03	Waitohu S at Forest Pk	8.05	68.0	25
RS04	Waitohu S at Norfolk Cres	4.87	14.3	14
RS05	Otaki R at Pukehinau	7.41	55.0	20
RS06	Otaki R at Mouth	6.60	41.2	17
RS07	Mangaone S at Sims Rd Br	4.14	14.3	14
RS08	Ngarara S at Field Way	4.75	10.5	19
RS09	Waikanae R at Mangaone Walkway	8.17	51.9	27
RS10	Waikanae R at Greenaway Rd	5.46	45.5	22
RS11	Whareroa S at Waterfall Rd	5.82	46.7	30
RS12	Whareroa S at QE Park	4.61	18.2	22
RS13	Horokiri S at Snodgrass	6.17	46.4	28
RS14	Pauatahanui S at Elmwood Br	3.57	44.0	25
RS15	Porirua S at Glenside	5.55	38.9	18
RS16	Porirua S at Wall Park (Milk Depot)	5.02	25.0	20
RS17	Makara S at Kennels	5.50	45.5	22
RS18	Karori S at Makara Peak	3.07	22.7	22
RS19	Kaiwharawhara S at Ngaio Gorge	3.31	30.4	23
RS20	Hutt R at Te Marua Intake Site	7.99	56.0	25
RS21	Hutt R opp. Manor Park G.C.	6.24	53.8	26
RS22	Hutt R at Boulcott	7.20	40.0	20
RS23	Pakuratahi R 50m d/s Farm Ck	7.33	52.0	25
RS24	Mangaroa R at Te Marua	7.08	54.2	24
RS25	Akatarawa R at Hutt confl.	7.51	65.4	26
RS26	Whakatikei R at Riverstone	7.43	65.4	26
RS28	Wainuiomata R at Manuka Track	7.31	69.7	33
RS29	Wainuiomata R d/s of White Br	4.61	47.4	19
RS30	Orongorongo R at Orongorongo Stn	6.50	40.0	15
RS31	Ruamahanga R at McLays	8.01	64.7	17
RS32	Ruamahanga R at Te Ore Ore	7.32	50.0	16
RS33	Ruamahanga R at Gladstone Br	7.66	36.4	11
RS34	Ruamahanga R at Pukio	6.57	33.3	18
RS35	Mataikona Trib at Sugar Loaf Rd	6.66	54.2	24
RS36	Taueru R at Castlehill	4.38	29.2	24
RS37	Taueru R at Gladstone	4.04	31.8	22
RS38	Kopuaranga R at Stewarts	3.32	39.1	23
RS39	Whangaehu R 250m u/s confl.	4.42	12.5	24
RS40	Waipoua R at Colombo Rd Br	4.41	33.3	27
RS41	Waingawa R at South Rd	7.37	42.9	14
RS42	Whareama R at Gauge	4.03	43.8	16
RS43	Motuwaireka S at Headwaters	7.23	65.5	29
RS44	Totara S at Stronvar	6.89	40.0	20
RS45	Parkvale Trib at Lowes Res.	4.45	32.0	25
RS46	Parkvale S at Weir	4.41	38.9	18
RS47	Waiohine R at Gorge	7.59	73.3	15
RS48	Waiohine R at Bicknells	6.76	47.6	21
RS49	Beef Ck at Headwaters	7.61	62.1	29
RS50	Mangatarere S at SH 2	5.74	52.4	21
RS51	Huangarua R at Ponatahi Br	4.82	38.1	21
RS52	Tauanui R at Whakatomotomo Rd	7.34	58.3	24
RS53	Awhea R at Tora Rd	7.74	29.4	17
RS54	Coles Ck Trib at Lagoon Hill Rd	5.58	40.5	37
RS55	Tauherenikau R at Websters	7.56	45.5	11
RS56	Waiorongomai R at Forest Pk	6.73	53.1	32
RS57	Waiwhetu S at Whites Line East	4.01	6.7	15

*Pollution tolerant EPT taxa (*Oxyethira* and *Paroxythira*) were excluded from this calculation.

Appendix 6: Habitat scores for RSoE sites assessed in summer/autumn 2014

Site no.	Site name	Substrate (hard or soft bottomed)	Dominant Landcover	Fine sediment	Invertebrate habitat	Fish cover	Hydraulic heterogeneity	Bank stability	Bank vegetation	Riparian buffer	Riparian shade	Channel alteration	Total habitat score	Rank
RS02	Mangapouri S at Bennetts Rd	Soft	Urban	2	6	20	3	6	9	8	11	10	75	49
RS03	Waitohu S at Forest Pk	Hard	Indigenous forest	20	40	32	18	18	18	17.5	13	20	196.5	10
RS04	Waitohu S at Norfolk Cres	Soft	Pasture	1	2	12	1	10	5.5	8.5	10	15	65	52
RS05	Otaki R at Pukehinau	Hard	Indigenous forest	20	36	36	18	18	18	19.5	2	20	187.5	14=
RS06	Otaki R at Mouth	Hard	Indigenous forest	15	20	16	10	18	8.5	12.5	1	12	113	36
RS07	Mangaone S at Sims Rd Br	Soft	Pasture	1	2	10	1	19	5.5	5	1	11	55.5	53
RS08	Ngarara S at Field Way	Soft	Urban	1	2	10	1	10	5.25	6	3	8	46.25	54
RS09	Waikanae R at Mangaone Walkway	Hard	Indigenous forest	19	40	40	20	18.5	20	19.5	20	20	217	1
RS10	Waikanae R at Greenaway Rd	Hard	Indigenous forest	20	30	20	15	18	11.5	12	9	15	150.5	21
RS11	Whareroa S at Waterfall Rd	Hard	Indigenous forest	8	18	16	6	9.5	17	15	20	10	119.5	31
RS12	Whareroa S at QE Park	Soft	Pasture	1	4	26	1	6	7	5	3	19	72	51
RS13	Horokiri S at Snodgrass	Hard	Pasture	18	26	18	10	14	5	4	13	16	124	30
RS14	Pauatahanui S at Elmwood Br	Hard	Pasture	10	12	28	8	11	7.5	7	10	15	108.5	38=
RS15	Porirua S at Glenside	Hard	Urban	18	34	28	15	14	10	12	2	11	144	24
RS16	Porirua S at Wall Park (Milk Depot)	Hard	Urban	18	26	14	9	14.5	5	5	3	3	97.5	43
RS17	Makara S at Kennels	Hard	Pasture	17	16	36	18	13	8.5	7	8	10	133.5	27
RS18	Karori S at Makara Peak	Hard	Urban	18	28	24	8	16	15.5	15.5	13	11	149	22
RS19	Kaiwharawhara S at Ngaio Gorge	Hard	Urban	18	24	30	16	10.5	16.5	15	15	15	160	19
RS20	Hutt R at Te Marua Intake Site	Hard	Indigenous forest	20	38	32	18	13.5	13.5	18	12	20	185	16
RS21	Hutt R opp. Manor Park G.C.	Hard	Indigenous forest	10	24	24	11	11.5	9	16	7	1	113.5	35
RS22	Hutt R at Boulcott	Hard	Indigenous forest	15	16	26	11	13	11	14	9	1	116	34
RS23	Pakuratahi R 50m d/s Farm Ck	Hard	Indigenous forest	20	40	40	19	16	15	17.5	12	20	199.5	9
RS24	Mangaroa R at Te Marua	Hard	Pasture	20	34	32	18	18	12.5	15.5	12	15	177	17
RS25	Akatarawa R at Hutt confl.	Hard	Indigenous forest	20	40	34	20	20	17	19	17	20	207	5=
RS26	Whakatikei R at Riverstone	Hard	Indigenous forest	20	38	36	20	20	20	20	16	20	210	3
RS28	Wainuiomata R at Manuka Track	Hard	Indigenous forest	18	40	38	20	20	18.5	19.5	19	18	211	2
RS29	Wainuiomata R d/s of White Br	Hard	Indigenous forest	19	30	16	13	13	6	4.5	1	16	118.5	33

Site no.	Site name	Substrate (hard or soft bottomed)	Dominant Landcover	Fine sediment	Invertebrate habitat	Fish cover	Hydraulic heterogeneity	Bank stability	Bank vegetation	Riparian buffer	Riparian shade	Channel alteration	Total habitat score	Rank
RS30	Orongorongo R at Orongorongo Stn	Hard	Indigenous forest	13	10	10	15	12	8	9.5	1	18	96.5	44
RS31	Ruamahanga R at McLays	Hard	Indigenous forest	20	40	32	20	20	20	20	15	20	207	5=
RS32	Ruamahanga R at Te Ore Ore	Hard	Pasture	20	20	12	11	10	6	15	1	5	100	42
RS33	Ruamahanga R at Gladstone Br	Hard	Pasture	20	20	12	6	15	11	9	1	15	109	37
RS34	Ruamahanga R at Pukio	Hard	Pasture	19	10	10	3	11	8	5	4	20	90	45
RS35	Mataikona Trib at Sugar Loaf Rd	Hard	Indigenous forest	11	38	38	18	15.5	12	15	20	20	187.5	14=
RS36	Taueru R at Castlehill	Soft	Pasture	6	2	28	8	7	10.5	15	13	19	108.5	38=
RS37	Taueru R at Gladstone	Hard	Pasture	20	12	22	11	11	5	5	1	15	102	41
RS38	Kopuaranga R at Stewarts	Hard	Pasture	20	20	30	18	12.5	6	6	6	18	136.5	26
RS39	Whangaehu R 250m u/s confl.	Soft	Pasture	2	8	10	3	5.5	10	15	8	18	79.5	47=
RS40	Waipoua R at Colombo Rd Br	Hard	Pasture	19	30	30	13	8.5	7	15	9	10	141.5	25
RS41	Waingawa R at South Rd	Hard	Indigenous forest	20	22	22	11	11.5	6	16.5	5	5	119	32
RS42	Whareama R at Gauge	Soft	Pasture	1	2	12	1	2	7	4	2	8	39	55
RS43	Motuwaireka S at Headwaters	Hard	Indigenous forest	20	40	40	19	12.5	20	20	15	20	206.5	7
RS44	Totara S at Stronvar	Hard	Exotic forest	18	34	36	6	15.5	7	9	8	19	152.5	20
RS45	Parkvale Trib at Lowes Res.	Hard	Pasture	20	34	34	1	20	20	20	20	20	189	13
RS46	Parkvale S at Weir	Hard	Pasture	15	12	12	6	14.5	5	4	1	3	72.5	50
RS47	Waiohine R at Gorge	Hard	Indigenous forest	20	40	36	16	20	14	16.5	11	20	193.5	11
RS48	Waiohine R at Bicknells	Hard	Pasture	20	20	30	11	12	9	14	6	10	132	28
RS49	Beef Ck at Headwaters	Hard	Indigenous forest	20	40	34	15	17	18	17.5	20	20	201.5	8
RS50	Mangatarere S at SH 2	Hard	Pasture	20	24	26	8	16.5	5.5	8.5	8	8	124.5	29
RS51	Huangarua R at Ponatahi Br	Hard	Pasture	17	12	22	10	11	9	16	7	3	107	40
RS52	Tauanui R at Whakatomotomo Rd	Hard	Indigenous forest	19	36	40	20	17.5	18.5	20	18	20	209	4
RS53	Awhea R at Tora Rd	Hard	Pasture	19	10	8	6	16	5	1	1	19	85	46
RS54	Coles Ck Trib at Lagoon Hill Rd	Hard	Indigenous forest	19	22	12	6	16	16	20	16	20	147	23
RS55	Tauherenikau R at Websters	Hard	Pasture	20	38	30	16	15.5	6	14	10	13	162.5	18
RS56	Waiorongomai R at Forest Pk	Hard	Indigenous forest	20	40	40	16	11	12	20	11	20	190	12
RS57	Waiwhetu S at Whites Line East	Soft	Urban	10	10	16	1	14.5	6	5	9	8	79.5	47=