Northland rivers & streams Habitat Assessment

2011-2012

Putting Northland first

NORTHLAND REGIONAL COUNCIL

Executive Summary

River habitat assessments are undertaken biennially by the Northland Regional Council (the Council) at a selection of sites on rivers around the region. Sites assessed are all in the Regional River Water Quality Monitoring Network (RWQMN).

Habitat assessments follow the protocol detailed in Pfankuch D. J. (1975), Stream Reach Inventory and Channel Stability Evaluation. This allows for the quality of the riparian environment to be assessed (stream health), along with an estimate of the amount (quantity) of different habitats present and the stability of the environment.

Other data collected by the Council is used to aid interpretation of results from the habitat assessments including results from the Council's macroinvertebrate monitoring programme carried out in RWQMN.

This report presents the results from habitat assessments undertaken in 2010 and 2012. A total of 35 sites were assessed in 2010 and 2012. Also included in this report is some provisional trend analysis of results from the last four rounds of sampling (2005, 2007, 2008 and 2010).

In 2010, no sites recorded excellent stability, 13 sites recorded good stability, 14 sites recorded fair stability and two sites recorded poor stability. The two most stable sites were the Kaihu and Waipoua rivers.

Also in 2010, three sites recorded poor habitat, 16 sites recorded marginal habitat, 15 sites recorded sub-optimal habitat and no sites recorded optimal habitat. The two best sites were the Mangahahuru River at Main Road and Waipapa River at Forest Ranger.

In 2012, three sites recorded excellent stability, 14 sites recorded good stability, 16 sites recorded fair stability and two sites recorded poor stability. The two most stable sites were the Waipoua River and the Waipapa River at Forest Ranger.

Also in 2012, three sites recorded poor habitat quality, 18 recorded marginal habitat quality, 12 recorded sub-optimal habitat quality and two recorded optimal habitat quality. The two best sites were the Waipoua River and the Waipapa River at Forest Ranger.

Trends observed over five assessments – carried out in 2005, 2007, 2008, 2010 and 2012 – indicate that habitat quality has not improved at any sites and declined at four sites with the remaining 26 sites being stable. Results were inconclusive at five sites. In comparison, channel stability has improved at 10 sites, declined at two sites and remained stable at 15 sites. Results were inconclusive at eight sites.

Further investigation is required at sites with declining habitat quality and macroinvertebrate scores. Further investigation is also required at sites with declining stability in order to identify the cause of the decline, i.e. whether it is a result of land-use change or human activity, or natural events. Information collected through investigations will assist interpretation of results which will help in targeting land management in those areas.

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Introduction

This report has been prepared as a continuation of the Northland Regional Council's (the Council) State of the Environment Monitoring Programme. It presents the results from habitat assessment work undertaken in 2010 and 2012, along with an initial analysis of data collected over the last five years, to identify any emerging trends in habitat quality or channel stability at 35 River Water Quality Monitoring Network sites. Data from the 2010 monitoring round is available in a separate report entitled Northland Rivers Habitat Assessment 2008 – 20101.

River habitat assessments are undertaken by the Council in order to monitor stream health and stability and track changes over time in Northland's rivers. They also provide valuable information on the state of Northland's riparian environment and the information can aid in the interpretation of both water quality and macroinvertebrate data collected by the Council at the same sites.

River habitat quality is a reflection of both natural and human influences. River sites located in catchments where human influence is negligible generally have good stream health and are mainly characterised by natural factors such as stream geology, gradient, and naturally fluctuating physico-chemical properties. On the other hand, impacted river sites – sites located in catchments where human influence is important – tend to have poorer stream health such as increased sedimentation in river beds, excessive nutrients levels, and pathogenic bacteria from both point source discharges, and diffuse surface runoff.

Although channel stability has an influence, it is not always a direct indicator of stream health. This is because the degree of channel stability depends on physical characteristics such as bank and substrate type, the flow regime and riparian vegetation, as well as human activity, such as surrounding land-use and channel alteration. It is also influenced by other natural factors including rainfall and storm events. For example, a headwater stream within an unmodified catchment may have extensive riparian vegetation but due to high rain fall and steep channel gradient the stream has a lot of energy so the bank is regularly undermined and eroded.

Photo 1: Kerikeri River at Stone Store, upstream view

1 Publication available from Northland Regional Council Resource Library website: http://www.nrc.govt.nz/

Methodology

1. Habitat Assessment Methodology

The habitat assessment protocol used by the Council is both a qualitative (quality of the habitat) and quantitative (occurrence of each habitat) assessment of environmental factors at each site, such as channel stability, periphyton abundance, riparian vegetation, the composition of organic and inorganic substrate in the stream and surrounding land-use (see Appendix 1 – Habitat Assessment Field Data Sheet). The protocol used is based on Pfankuch D. J. (1975), 'Stream Reach Inventory and Channel Stability Evaluation'.

1.1. Qualitative Assessment

Sites are assessed every two years. The procedure involves visiting the same location at each site to assess the environmental factors in the immediate vicinity of the site. An upstream and downstream transect of the stream channel from this site is walked, with quantitative assessments made every five metres or where a new feature is observed, e.g. a pool.

The qualitative habitat assessment involves assigning scores to the following stream characteristics: aquatic habitat abundance, aquatic habitat diversity, hydrologic heterogeneity, channel alteration, bank stability, channel shade, and riparian vegetation. Scores for each characteristic range from 0 to 20, with a lower total score indicating a lower habitat quality. Habitat quality is divided into four categories as shown in Table 1.

Table 1: Habitat qualitative assessment scoring system

Habitat quality	Score
Optimal	109 ≤ score ≤ 140
Sub-optimal	74 ≤ score ≤ 108
Marginal	39 ≤ score ≤ 73
Poor	score < 39

Periphyton type and abundance is recorded in four types: diatom, mat algae, filamentous algae, and bryophytes, with abundance classified as none, rare, common, or abundant. The same scoring system is used to assess the presence of submerged aquatic plants (i.e. macrophytes).

1.2. Quantitative Assessment

The quantitative habitat assessment also involves walking an upstream/downstream transect of the stream channel, with recordings made at a number of stops. Variables recorded include canopy and understorey cover within 0 to 5 metres and 5 to 20 metres of the stream bank; stability and bank type of each bank; inorganic and organic substrate on the bottom of the stream; wetted width (edge of water on one bank to edge of water on opposite bank); maximum depth of channel and flow type.

Pfankuch Stability Index

Stability of the streambed and channel at each site is assessed using the Pfankuch stability index (Pfankuch, 1975). This involves assigning scores to 15 environmental variables (such as bank wasting, deposition, stability of stream bed, etc.). The variables are split into upper bank, lower bank and stream bottom.
The scores are summed and can range from 38 to 152, where a lower total score indicates a

more stable stream channel. Indexes are broken down in four categories as shown in Table 2 below.

Table 2: Pfankuch stability index scoring system

Stability index	Score
Excellent	score < 39
Good	39 ≤ score ≤ 76
Fair	77 ≤ score ≤ 114
Poor	score >114

Other factors noted include evidence of livestock access, channel shading, water odour and other observations of interest. Water quality is also measured and includes water temperature, dissolved oxygen, conductivity and water clarity.

2. Other Sampling Data

In addition to the habitat assessments, macroinvertebrate data is collected for each site annually. Although this sampling programme runs independently from the habitat assessment, data collected through the macroinvertebrate programme can be used to help interpret results from the habitat assessment and vice versa. Both programmes are carried out during the summer months.

Macroinvertebrate sampling involves collecting benthic (bottom) samples from each site to record the number and type of macroinvertebrates present. Sites are characterised according to whether they have a hard or soft bottom river bed, with appropriate sampling protocols used for each type.

The number of species present (taxonomic richness) at each site is recorded, along with the percentage of Ephemeroptera (Mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) (% EPT). The more species present, the higher the conservation value of each site.

Each site is also given a Macroinvertebrate Community Index (MCI) and a Semi-Quantitative (SQ) MCI score, which reflect the species present and their tolerance to environmental changes and human activity, and the number of individuals belonging to each taxon. The higher the score, the less impacted the environment is by human activity. The lower the score, the more impacted a site is.

3. Sampling Sites

The sites assessed by the Council are those included in the Regional River Water Quality Monitoring Network (RWQMN). There are currently 35 sites in the network; 31 of which are monitored by the Council and four by the National Institute of Water and Atmospheric Research (NIWA) (shown in pink in Figure 1).

Figure 1: Map showing the 35 Regional Water Quality Monitoring Network sites (National River Water Quality Network sites in pink)

Sites have been gradually added to the RWQMN since monitoring first began in 1996. In 2005, 19 sites had habitat assessments completed. In 2007, 22 sites were assessed; in 2008, 25 sites were assessed and in 2010 and 2012, 35 sites were assessed. The sites are listed in Table 3 below.

Table 3: RWQMN sites and years sampled

		Year Assessed				
Site Name	Site No.	2005	2007	2008	2010	**2012**
Awanui 1 @ FNDC take	100363	✓	✓	✓	✓	✓
Awanui 2 @ Waihoe Channel	100370	✓	✓	✓	✓	✓
Hakaru @ Topuni Creek Farm	109021			✓	✓	✓
Hatea @ Mair Park	100194				✓	✓
Kaeo River @ Dip Rd	102674		✓	✓	✓	✓
Kaihu @ Gorge	102256	✓	✓	✓	✓	✓
Kerikeri @ Stone Store	101530			✓	✓	✓
Mangahahuru 1 @ Main Rd	100237	✓	✓		✓	✓
Mangahahuru 2 @ Apotu	100281	✓	✓	✓	✓	✓
Mangakahia 1 @ Titoki	101038	✓	✓	✓	✓	✓
Mangakahia 2 @ Gorge	109096	✓	✓		✓	✓
Mangamuka @ Iwiatua Rd	108978			✓	✓	✓
Manganui @ Mititai Rd	102257	✓		✓	✓	✓
Mangere @ Knight Rd	101625	✓	✓	✓	✓	✓
Ngunguru @ Waipoka Rd	109100			✓	✓	
Ngunguru @ Coalhill Lane	110603					✓
Opouteke @ Suspension Bridge	102258		✓		✓	✓
Oruru @ Oruru Rd	108979			✓	✓	✓
Paparoa @ Walking bridge	108977			✓	✓	✓
Punakitere @ Loop Rd bridge	105231	✓	✓	✓	✓	✓
Ruakaka @ Flyger Rd	105008		✓	✓	✓	✓
Utakura @ 177 Horeke Rd	109020			✓	✓	✓
Victoria @ Thompson's Bridge	105532	✓	✓	✓	✓	✓
Waiarohia 1 @ 2nd Avenue	105672		✓		✓	✓
Waiarohia 2 @ Whau Valley	107773	✓	✓		✓	✓
Waiharakeke @ Stringer Rd	100007				✓	✓
Waimamaku @ SH12	109098			✓	✓	✓
Waiotu @ SH1	102248	✓	✓	✓	✓	✓
Waipao @ Draffin Rd Bridge	108941				✓	✓
Waipapa 1 @ Waipapa Landing	101524			✓	✓	✓
Waipapa 2 @ Forest Ranger	101751	✓	✓	✓	✓	✓
Waipoua @ SH12	103304	✓	✓	✓	✓	✓
Wairua @ Purua	101753	✓	✓	✓	✓	✓
Waitangi 1 @ Watea	101752	✓	✓		✓	✓
Waitangi 2 @ Waimate	103178	✓	✓		✓	✓
Whakapara @ Cableway	102249	✓	✓	✓	✓	✓

4. Sampling Period

Comprehensive habitat assessments are carried out at all sites at the same time or as close as possible to the macroinvertebrate sample collection undertaken by the Council. This means that habitat assessment data can be used when interpreting the results from macroinvertebrate sample collection at each site.

In 2008, assessments were undertaken from the end of March to the start of April. In 2010, they were undertaken from mid January to mid April, and in 2012 from mid February to the end of March.

5. Data Analysis

The data collected in 2010 and 2012 has been analysed using Microsoft Excel to compare the substrate, vegetation, stability, and overall habitat quality between sites.

In addition, total Pfankuch stability scores and habitat quality scores for each site from 2005, 2007, 2008, 2010 and 2012 have been compared, in order to identify any changes over time.

Photo 2: Waipoua River, upstream view

Results

1. Results from 2010

1.1. Pfankuch Stability Index

Six sites – Utakura, Ngunguru, Awanui 2, Waiotu, Mangere and Wairua – could not be waded due to depth. These sites do not have bottom data and it was therefore not possible to calculate a stability score for these sites in 2010.

Of the 29 remaining sites assessed, no sites had excellent stability; 13 sites had good stability, 14 sites had fair stability and two sites had poor stability as per Figure 2 below.

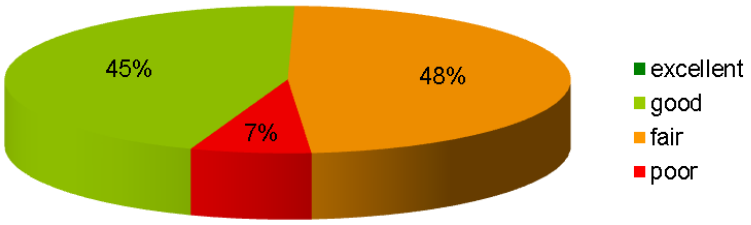

Figure 2: Pfankuch stability index distribution 2010

Figure 3 shows the total Pfankuch stability score, broken down into bottom, lower bank and upper bank scores, for all sites assessed in 2010. Sites are ranked from lowest score (most stable habitat) to highest score (least stable habitat).

The three most stable sites in 2010 were Kaihu (43), Waipoua (47) and Hatea (50). The two least stable sites were Waitangi 1 (128) and Paparoa (122).

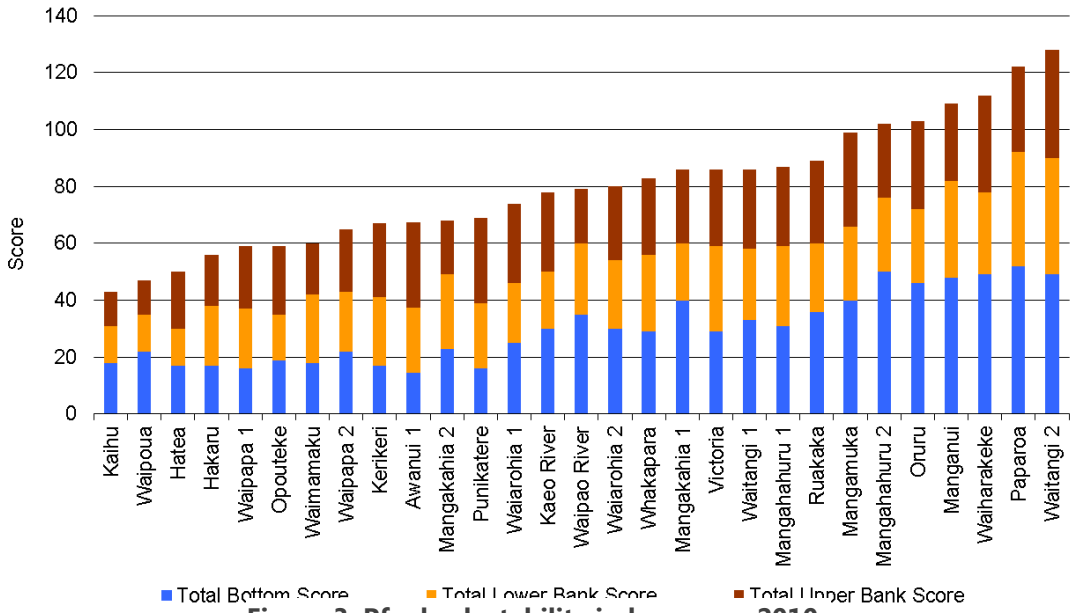

Figure 3: Pfankuch stability index scores 2010

1.2. Habitat Quality

Of the 35 sites assessed in 2010, four had poor habitat quality, 16 sites had a marginal habitat, 15 sites had a sub-optimal habitat and none had an optimal habitat as shown in Figure 4.

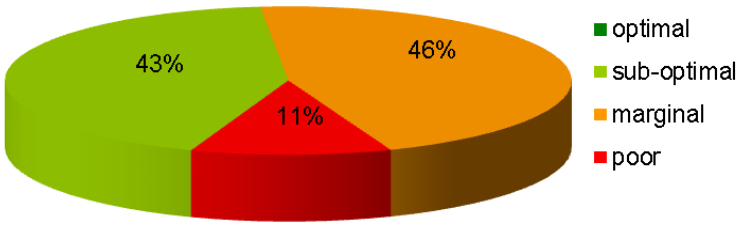

Figure 4: Habitat quality distribution 2010

Figure 5 shows total habitat quality scores, broken down into component parts, for all sites assessed in 2010. Sites are ranked from lowest score (poorest habitat) to highest score (best habitat).

The two sites with best habitat quality in 2010 were Mangahahuru 1 (99) and Waipapa 2 (91.5). The two sites with the poorest habitat quality were Kaeo (20) and Paparoa (27).

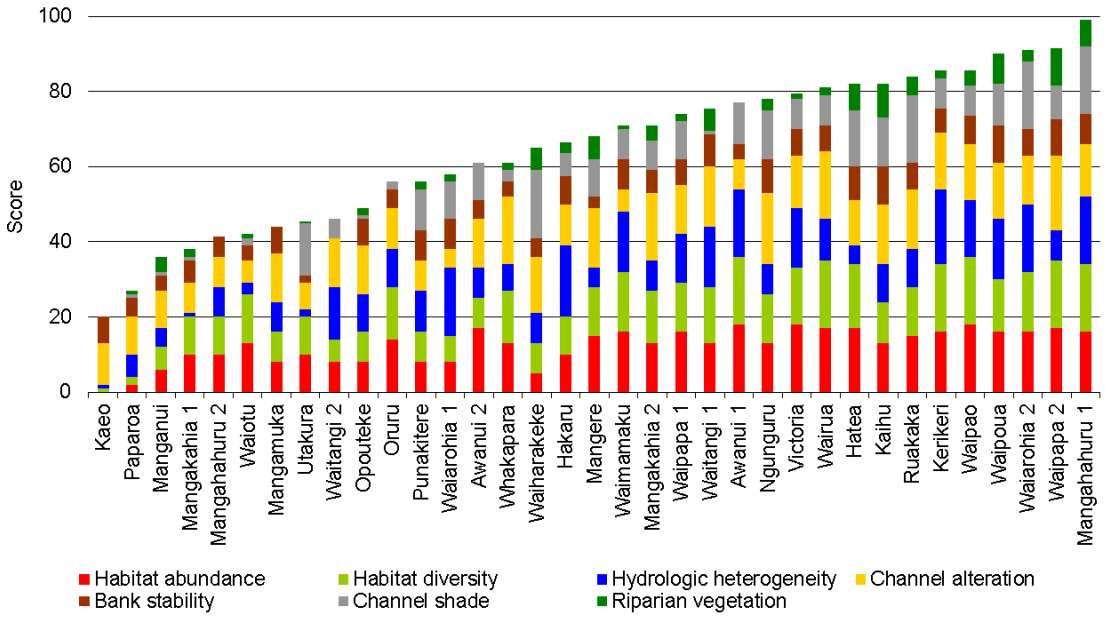

Figure 5: Habitat quality scores 2010

1.3. Site Data Summary 2010

Data collected in 2010 from 35 sites monitored indicated that:

- 20 sites were open to livestock access
- 18 had over 50% bank stability
- 17 had under 50% bank stability
- Five out of 29 sites had a soft bottom sediment
- 13 out of 29 sites had a hard bottom; and
- 11 had a mixed bottom sediment

Of the 15 sites with a sub-optimal habitat quality grade, seven had good stability and six had fair stability – no index was calculated for two sites (Ngunguru and Wairua) because they were not wadeable.

Of the 16 sites with a marginal habitat quality grade, six had good stability, five had fair stability and one had poor stability. Of the four sites with a poor habitat quality grade, three had a fair stability and one had poor stability.

2. Results from 2012

In 2012 all 35 sites were assessed for their habitat quality and stability.

2.1. Pfankuch Stability Index

Of the 35 sites assessed, three sites had excellent stability; 14 sites had good stability, 16 sites had fair stability and two sites had poor stability as per Figure 6 below.

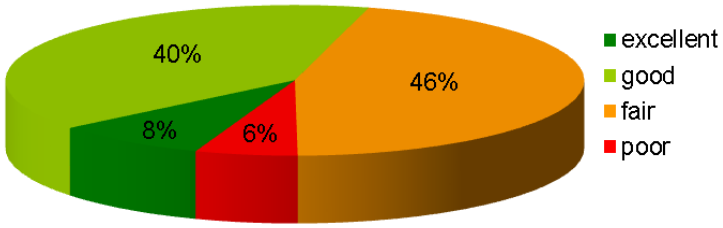

Figure 6: Pfankuch stability index distribution 2012

Figure 7 shows the total Pfankuch stability score, broken down into bottom, lower bank and upper bank scores, for all sites assessed in 2012. Sites are ranked from lowest score (most stable habitat) to highest score (least stable habitat).

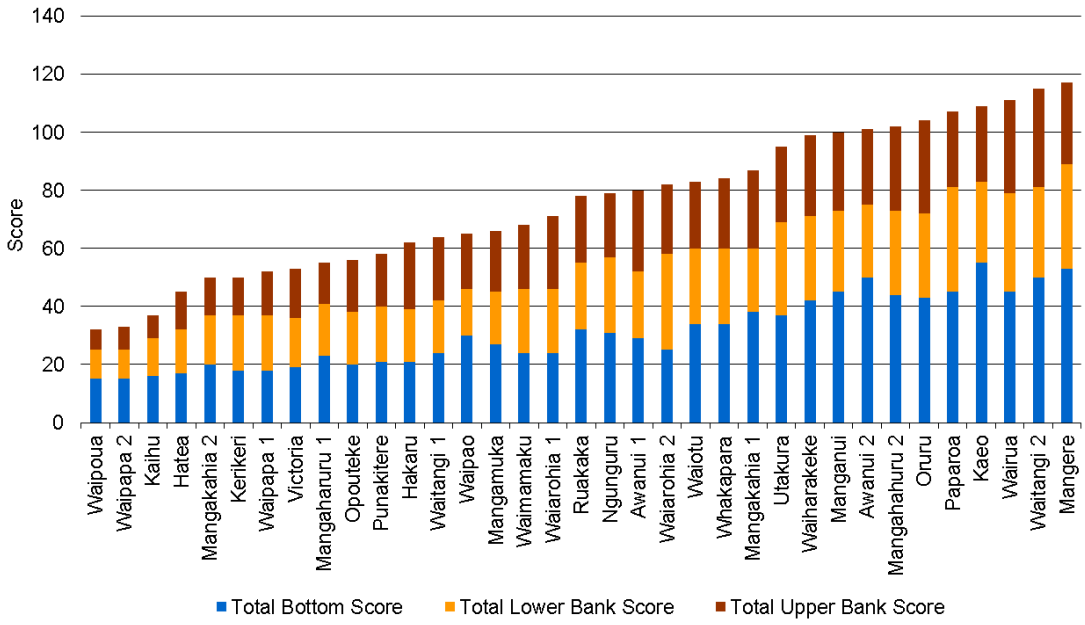

Figure 7: Pfankuch stability index scores 2012

The three most stable sites in 2012 were Waipoua (32), Waipapa 2 (33) and Kaihu (37). In comparison, the three most stable sites in 2010 were Kaihu (43), Waipoua (47) and Hatea (50). Waipapa 2 was the eighth most stable site in 2010 with a score of 65 suggesting it has become more stable over the past two years. Kaihu was the third most stable site in 2012 with a score of 37 and also appears more stable in 2012. The Hatea River was the fourth most stable site in 2012 with a score of 45. It is worth noting that in the summer of 2010 Northland received less rainfall than in 2012, so it is likely the improvements in stability were a result of differences in surveyor's judgement, rather than any real change in stability.

The three least stable sites in 2012 were Mangere (117), Waitangi 2 (115) and Wairua (111). In comparison, the three least stable sites in 2010 were Waitangi 2 (128), Paparoa (122) and Waiharakeke (112). Wairua and Mangere could not be graded in 2010 and so a comparison between years cannot be made. Paparoa was the fifth least stable site in 2012 with a score of 107 and Waiharakeke was the tenth least stable site in 2012 with a score of 99.

2.2. Habitat Quality

Of the 35 sites assessed in 2012, three had poor habitat quality grade, 18 sites had a marginal habitat, 12 sites had a sub-optimal habitat and two sites had an optimal habitat as shown in Figure 8.

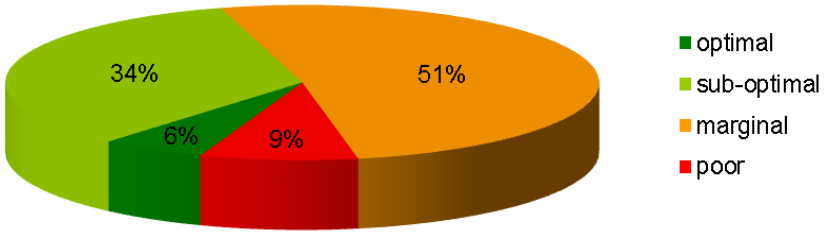

Figure 8: Habitat quality distribution 2012

Figure 9 shows total habitat quality scores, broken down into component parts, for all sites assessed in 2012. Sites are ranked from lowest score (poorest habitat) to highest score (best habitat).

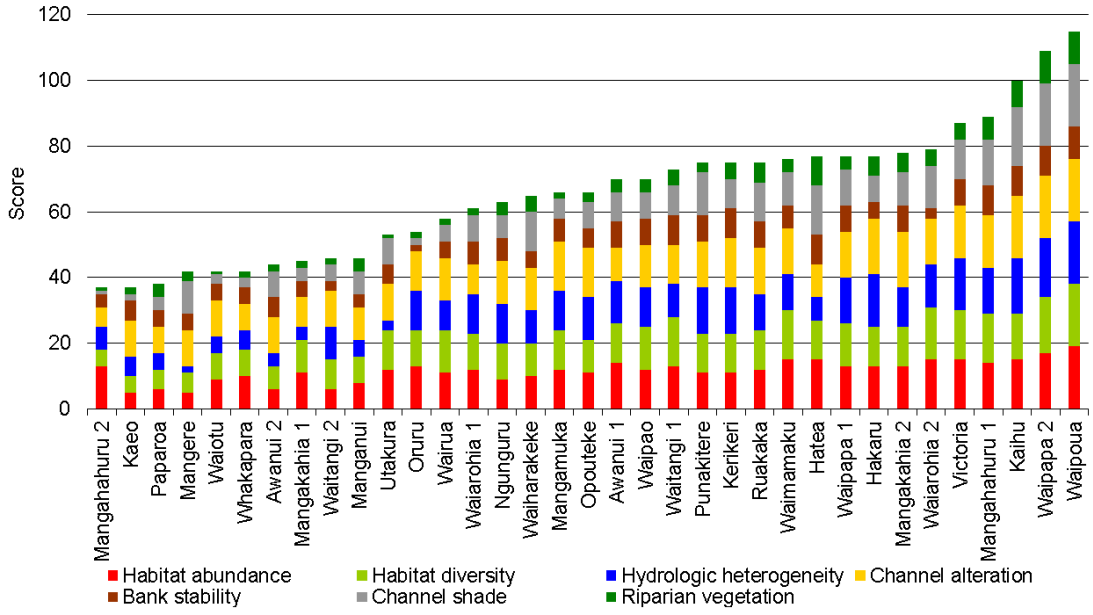

Figure 9: Habitat quality scores 2012

In 2012 the two best sites were Waipoua (115) and Waipapa 2 (109) with an optimal habitat quality grade. In 2010 the two best sites were Mangahahuru 1 (99) and Waipapa 2 (91.5) with a sub-optimal habitat quality grade. The habitat quality improvements at Waipoua and Waipapa 2 over the last two years (sub-optimal in 2010 to optimal in 2012), were probably driven by differences in surveyor's judgement rather than any real change in habitat quality. Mangahahuru 1 habitat quality remained sub-optimal although scores slightly dropped from 99 in 2010 to 89 in 2012.

The two poorest sites in 2012 were Mangahahuru 2 (37) and Kaeo (37) with a poor habitat quality grade. In 2010 the two poorest sites were Kaeo (20) and Paparoa (27) with a poor habitat quality grade. Habitat quality for the Kaeo site appeared to slightly improve although it remained in the same grade.
Mangahahuru 2 fell from marginal in 2010 to poor habitat in 2012. Paparoa showed a slight improvement and was graded second poorest in 2010 and third poorest in 2012.

2.3. Site Data Summary 2012

Data collected in 2012 from 35 sites monitored indicated that:

- 16 sites were open to livestock access
- 30 had over 50% bank stability
- five had under 50% bank stability
- 10 out of 35 sites had a soft bottom sediment
- 12 out of 35 sites had a hard bottom; and
- 13 had a mixed bottom sediment

A full summary of these results can be seen in Appendix 5: Site Data Summary 2012.

Both sites with an optimal habitat quality grade, i.e. Waipoua and Waipapa 2 had an excellent stability. Also, of the 12 sites with a sub-optimal habitat quality grade, one had excellent stability, nine had good stability and two had fair stability.
This indicates that in general, sites with good habitat quality tend to be more stable.

Of the 18 sites with a marginal habitat quality grade, five had good stability, 11 had fair stability and two had poor stability. All three sites with poor habitat quality, i.e. Mangahahuru 2, Kaeo and Paparoa had fair stability.
This indicates that in general, sites with poorer habitat quality tend to be those that are less stable.

All results are summarised in Appendix 2: Raw Habitat data.

Changes over time

Long-term changes in habitat stability and quality were based on observable changes over the four preceding monitoring years. If a site was identified with marginal habitat quality for three or four consecutive years and then was graded poor quality in the last monitoring year, then a negative change was attributed. However, caution was given when interpreting results because the subjectivity of the surveyor conducting the assessment can provide a different grading for a site (either positive or negative) when in reality no such change has occurred. For example, when comparing grades across all sites for all years (Table 4 andTable 5) it appears the surveyor in 2010 graded harder than in other years.
Summary tables showing the stream stability and habitat quality scores are listed in Appendix 3: Changes observed for Habitat Stability – 2012 and Appendix 4: Changes observed for Habitat Quality – 2012.

1. Pfankuch Stability Index

Figure 10 and Figure 11 show Pfankuch stability index scores for sites that have three or more years' data (30 of 35 sites).

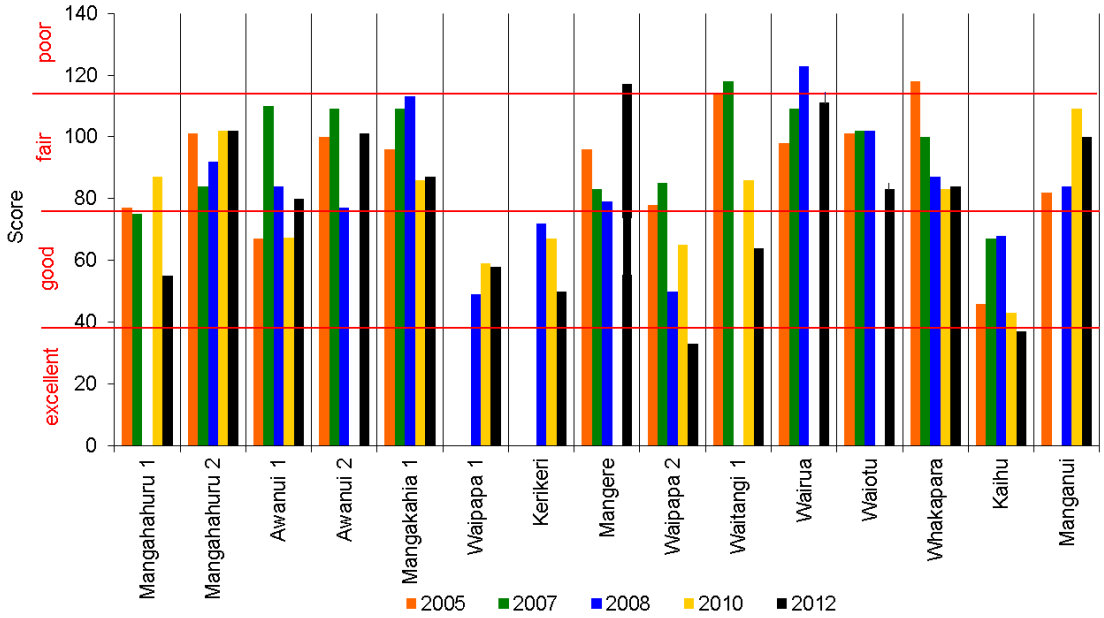

Figure 10: Pfankuch stability index scores 2005-2012

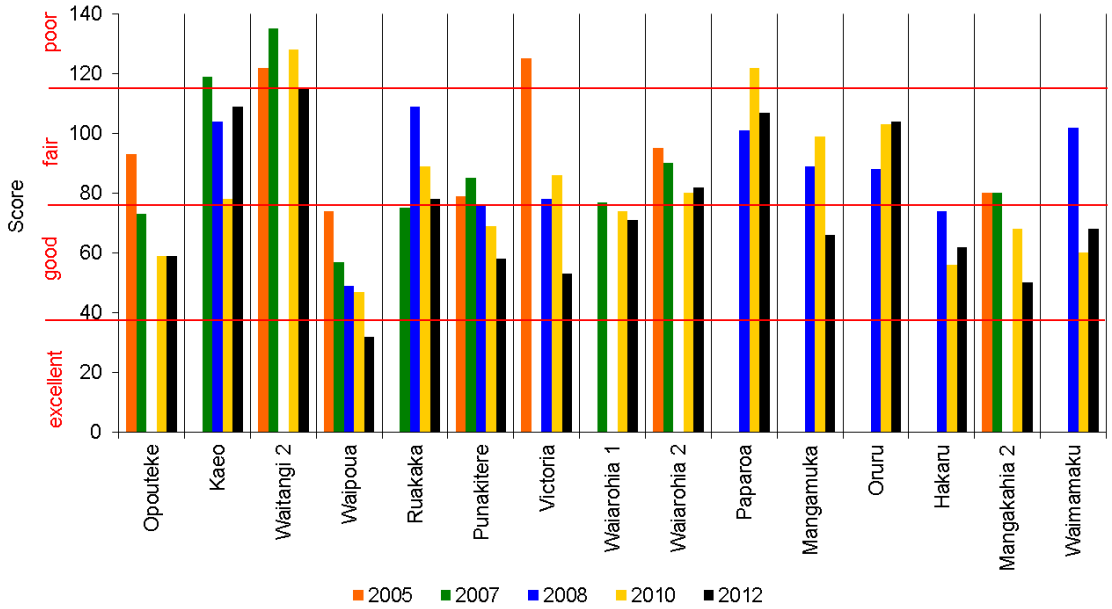

Figure 11: Pfankuch stability index scores 2005-2012 continued

Between 2010 and 2012 stability improved at eight sites. Four of these sites – Mangahahuru 1, Waitangi 1, Victoria and Mangamuka – went from a fair to a good stability, three – Waipapa 2, Kaihu and Waipapa 1 – went from good to excellent and one – Paparoa – went from poor to fair. In contrast, stability deteriorated at one site – Awanui 1 – going from a good to a fair stability.

Since 2005, habitat stability changed at 20 sites, with one site – Ngunguru – being assessed for the first time in 2012. Out of the 20 sites, stability improved at 10 – Waipoua, Waipapa 2, Kaihu, Mangakahia 2, Mangahahuru 1, Oputeke, Punakitere, Waimamaku, Waiarohia 1 and Kaeo – and deteriorated at two – Ruakaka and Awanui 1. At eight sites – Victoria, Waitangi 1, Waipao, Mangamuka, Ngunguru, Whakapara, Utakura and Mangere – the results were inconclusive due to insufficient data and/or surveyor bias.
The largest change was at Waipapa 2 which improved from fair to excellent habitat stability. The Waipoua and Kaihu Rivers also improved from good to excellent. Other sites including Mangakahia 2, Punakitere, Waimamaku and Waiarohia 1 improved from fair to good stability. Degrading trends were observed at two sites – Ruakaka and Awanui 1 – going from good to fair stability.

Trend results are presented in Table 4 below. Increasing arrows and green smiley faces indicate an improving trend, decreasing arrows and red frowning faces indicate a deteriorating trend and double arrows and orange faces indicate no trend and/or no change during the overall 2005-2012 period. Question marks indicate inconclusive trends.

Table 4: Habitat stability trends 2005-12

Site Name	Habitat quality grade					Habitat quality rank 2012	Overall trend	
	2005	2007	2008	2010	2012			
Waipoua	sub-optimal	optimal	optimal	sub-optimal	optimal	1	↔	😐
Waipapa 2	optimal	optimal	optimal	sub-optimal	optimal	2	↔	😐
Kaihu	sub-optimal	sub-optimal	sub-optimal	sub-optimal	sub-optimal	3	↔	😐
Mangahahuru 1	sub-optimal	sub-optimal		sub-optimal	sub-optimal	4	↔	😐
Victoria	sub-optimal	sub-optimal	sub-optimal	sub-optimal	sub-optimal	5	↔	😐
Waiarohia 2	sub-optimal	marginal		sub-optimal	sub-optimal	6	↔	😐
Mangakahia 2	sub-optimal	sub-optimal		marginal	sub-optimal	7	↔	😐
Hakaru			sub-optimal	marginal	sub-optimal	8	↔	😐
Waipapa 1			sub-optimal	sub-optimal	sub-optimal	9	↔	😐
Hatea				sub-optimal	sub-optimal	10	↔	😐
Waimamaku			marginal	marginal	sub-optimal	11	↗?	?
Ruakaka	sub-optimal	sub-optimal	sub-optimal	sub-optimal	sub-optimal	12	↔	😐
Kerikeri			sub-optimal	sub-optimal	sub-optimal	13	↔	😐
Punakitere	sub-optimal	sub-optimal	sub-optimal	marginal	sub-optimal	14	↔	😐
Waitangi 1	marginal	sub-optimal		sub-optimal	marginal	15	↘?	?
Waipao				sub-optimal	marginal	16	↘?	?
Awanui 1	sub-optimal	marginal	marginal	sub-optimal	marginal	17	↘	☹
Opouteke	marginal	sub-optimal		marginal	marginal	18	↔	😐
Mangamuka			marginal	marginal	marginal	19	↔	😐
Waiharakeke				marginal	marginal	20	↔	😐
Ngunguru					marginal	21	?	?
Waiarohia 1		marginal		marginal	marginal	22	↔	😐
Wairua	marginal	marginal	marginal	sub-optimal	marginal	23	↔	😐
Oruru			marginal	marginal	marginal	24	↔	😐
Utakura			sub-optimal	marginal	marginal	25	↘?	?
Manganui	marginal		marginal	poor	marginal	26	↔	😐
Waitangi 2	marginal	marginal		marginal	marginal	27	↔	😐
Mangakahia 1	marginal	marginal	marginal	poor	marginal	28	↔	😐
Awanui 2	marginal	sub-optimal	marginal	marginal	marginal	29	↔	😐
Whakapara	marginal	marginal	marginal	marginal	marginal	30	↔	😐
Waiotu	marginal	marginal	marginal	marginal	marginal	31	↔	😐
Mangere	marginal	sub-optimal	marginal	marginal	marginal	32	↔	😐
Paparoa			marginal	poor	poor	33	↘	☹
Kaeo		marginal	marginal	poor	poor	34	↘	☹
Mangahahuru 2	marginal	marginal	marginal	marginal	poor	35	↘	☹

2. Habitat Quality

Figure 12 and Figure 13 show habitat quality scores for sites that have three or more years' data. Hence, of the 35 sites assessed, only 31 are represented.

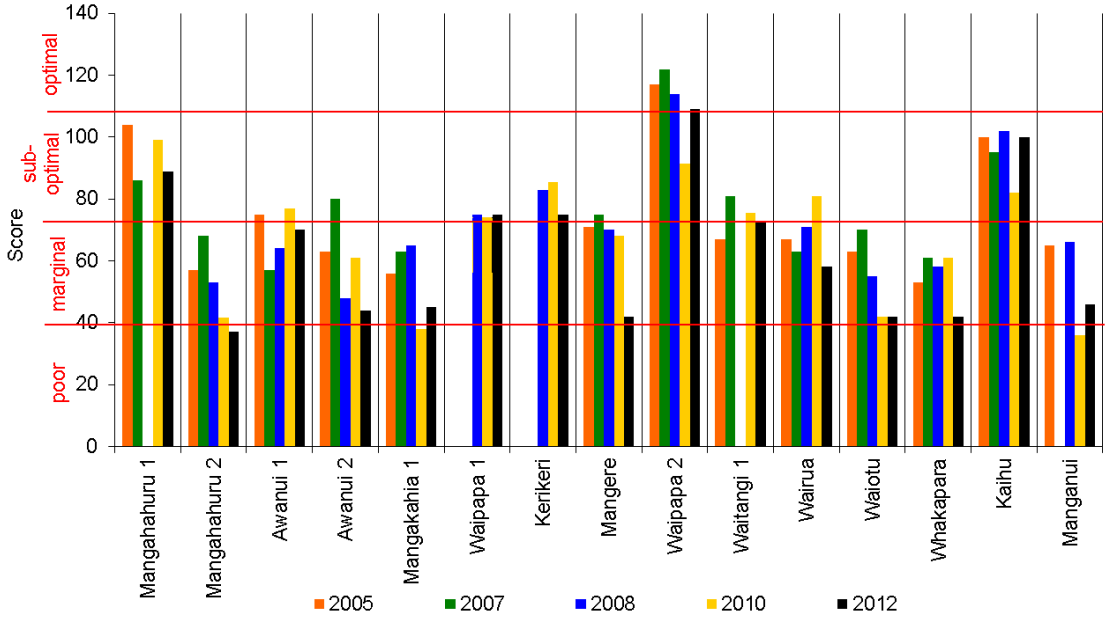

Figure 12: Habitat quality scores 2005-2012

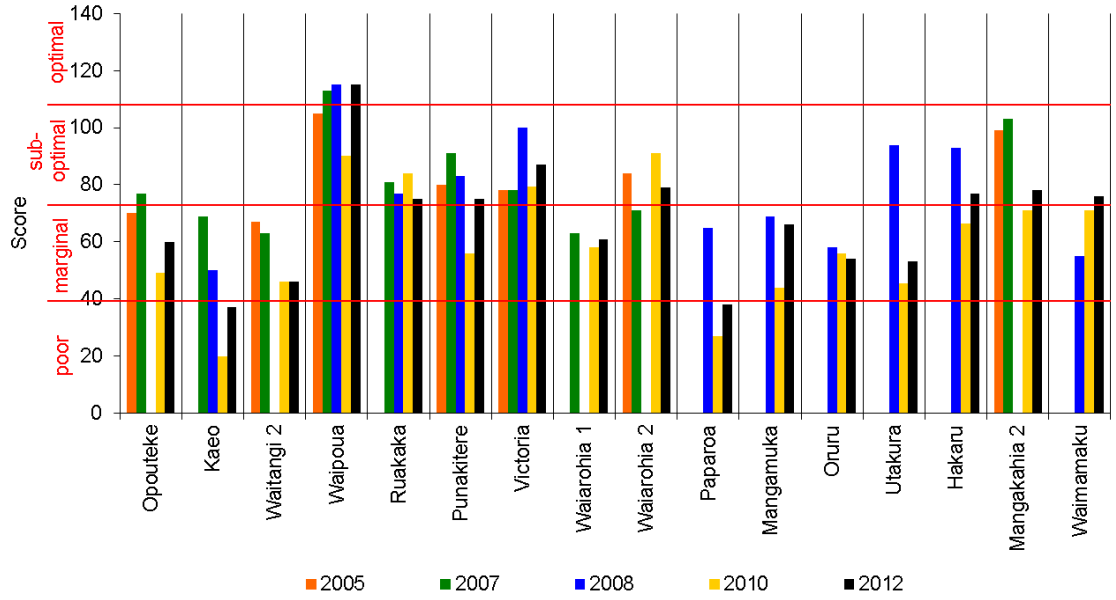

Figure 13: Habitat quality scores 2005-2012 continued

Between 2010 and 2012 habitat quality improved at eight sites. Four of these sites – Punakitere, Hakaru, Mangakahia 2 and Waimamaku – went from a marginal to a sub-optimal habitat quality, two sites – Waipoua and Waipapa 2 – went from sub-optimal to optimal and two – Mangakahia 1 and Manganui – went from poor to marginal. However, habitat quality deteriorated at four sites. Three sites – Awanui 1, Waitangi 1 and Wairua – went from a sub-optimal to a marginal habitat quality; and one site – Mangahahuru 2 – went from marginal to poor.

Since 2005, habitat quality changed at eight sites, with one site – Ngunguru – being assessed for the first time in 2012. Out of the eight sites, habitat quality improved at no sites and deteriorated at four – Awanui 1, Paparoa, Kaeo and Mangahahuru 2. At five sites – Waimamaku, Waitangi 1, Waipao, Ngunguru and Utakura – the results were inconclusive due to insufficient data and/or surveyor bias.

Degrading trends were observed at Paparoa, Kaeo and Mangahahuru 2 (marginal to poor habitat quality), and Awanui 1 degraded from sub-optimal to marginal habitat quality.

Trend results are presented in Table 5 below. Increasing arrows and green smiley faces indicate an improving trend, decreasing arrows and red frowning faces indicate a deteriorating trend and double arrows and orange faces indicate no trend and/or no change during the overall 2005-2012 period. Question marks indicate inconclusive trends.

Table 5: Habitat quality trends 2005-12

Site Name	Habitat quality grade					Habitat quality rank 2012	Overall trend	
	2005	2007	2008	2010	2012			
Waipoua	sub-optimal	optimal	optimal	sub-optimal	optimal	1	↔	😐
Waipapa 2	optimal	optimal	optimal	sub-optimal	optimal	2	↔	😐
Kaihu	sub-optimal	sub-optimal	sub-optimal	sub-optimal	sub-optimal	3	↔	😐
Mangahahuru 1	sub-optimal	sub-optimal		sub-optimal	sub-optimal	4	↔	😐
Victoria	sub-optimal	sub-optimal	sub-optimal	sub-optimal	sub-optimal	5	↔	😐
Waiarohia 2	sub-optimal	marginal		sub-optimal	sub-optimal	6	↔	😐
Mangakahia 2	sub-optimal	sub-optimal		marginal	sub-optimal	7	↔	😐
Hakaru			sub-optimal	marginal	sub-optimal	8	↔	😐
Waipapa 1			sub-optimal	sub-optimal	sub-optimal	9	↔	😐
Hatea				sub-optimal	sub-optimal	10	↔	😐
Waimamaku			marginal	marginal	sub-optimal	11	↗?	?
Ruakaka	sub-optimal	sub-optimal	sub-optimal	sub-optimal	sub-optimal	12	↔	😐
Kerikeri			sub-optimal	sub-optimal	sub-optimal	13	↔	😐
Punakitere	sub-optimal	sub-optimal	sub-optimal	marginal	sub-optimal	14	↔	😐
Waitangi 1	marginal	sub-optimal		sub-optimal	marginal	15	↘?	?
Waipao				sub-optimal	marginal	16	↘?	?
Awanui 1	sub-optimal	marginal	marginal	sub-optimal	marginal	17	↘	☹
Opouteke	marginal	sub-optimal		marginal	marginal	18	↔	😐
Mangamuka			marginal	marginal	marginal	19	↔	😐
Waiharakeke				marginal	marginal	20	↔	😐
Ngunguru					marginal	21	?	?
Waiarohia 1		marginal		marginal	marginal	22	↔	😐
Wairua	marginal	marginal	marginal	sub-optimal	marginal	23	↔	😐
Oruru			marginal	marginal	marginal	24	↔	😐
Utakura			sub-optimal	marginal	marginal	25	↘?	?
Manganui	marginal		marginal	poor	marginal	26	↔	😐
Waitangi 2	marginal	marginal		marginal	marginal	27	↔	😐
Mangakahia 1	marginal	marginal	marginal	poor	marginal	28	↔	😐
Awanui 2	marginal	sub-optimal	marginal	marginal	marginal	29	↔	😐
Whakapara	marginal	marginal	marginal	marginal	marginal	30	↔	😐
Waiotu	marginal	marginal	marginal	marginal	marginal	31	↔	😐
Mangere	marginal	sub-optimal	marginal	marginal	marginal	32	↔	😐
Paparoa			marginal	poor	poor	33	↘	☹
Kaeo		marginal	marginal	poor	poor	34	↘	☹
Mangahahuru 2	marginal	marginal	marginal	marginal	poor	35	↘	☹

Discussion

A composite of ranking results from the habitat assessment carried out in 2012 and the macroinvertebrate rankings – using the Macroinvertebrate Community Index (MCI) – from the *Northland Macroinvertebrate Monitoring Programme 2012* Report are displayed in Table 6. The results complement one another allowing for a fuller interpretation of results from the two programmes.

Table 6: Results comparison – habitat quality, stability and MCI 2012

Site Name	Habitat quality grade	Habitat quality rank	MCI rank	MCI score	Pfankuch stability rank	Pfankuch stability index
Waipoua	optimal	1	1	129.1	1	excellent
Waipapa 2	optimal	2	2	118.0	2	excellent
Kaihu	sub-optimal	3	14	97.0	3	excellent
Mangahahuru 1	sub-optimal	4	5	112.1	9	good
Victoria	sub-optimal	5	6	111.1	8	good
Waiarohia 2	sub-optimal	6	12	98.9	21	fair
Mangakahia 2	sub-optimal	7	18	90.8	5	good
Hakaru	sub-optimal	8	23	81.9	12	good
Waipapa 1	sub-optimal	9	29	68.1	7	good
Hatea	sub-optimal	10	16	92.5	4	good
Waimamaku	sub-optimal	11	11	99.6	16	good
Ruakaka	sub-optimal	12	7	106.4	18	fair
Kerikeri	sub-optimal	13	21	87.5	6	good
Punakitere	sub-optimal	14	20	89.5	11	good
Waitangi 1	marginal	15	31	65.2	13	good
Waipao	marginal	16	8	104.2	14	good
Awanui 1	marginal	17	19	90.0	20	fair
Opouteke	marginal	18	13	98.8	10	good
Mangamuka	marginal	19	3	114.2	15	good
Waiharakeke	marginal	20	17	91.9	26	fair
Ngunguru	marginal	21	15	94.6	19	fair
Waiarohia 1	marginal	22	27	75.0	17	good
Wairua	marginal	23	33	59.5	33	fair
Oruru	marginal	24	28	69.9	30	fair
Utakura	marginal	25	30	65.3	25	fair
Manganui	marginal	26	34	55.4	27	fair
Waitangi 2	marginal	27	4	113.8	34	poor
Mangakahia 1	marginal	28	10	102.5	24	fair
Awanui 2	marginal	29	32	64.4	28	fair
Whakapara	marginal	30	22	82.2	23	fair
Waiotu	marginal	31	25	77.6	22	fair
Mangere	marginal	32	24	81.8	35	poor
Paparoa	poor	33	NS		31	fair
Kaeo	poor	34	9	103.3	32	fair
Mangahahuru 2	poor	35	26	75.1	29	fair
NS: not sampled						

When comparing site rankings from the results of the different river assessments, i.e. habitat quality, habitat stability and MCI, clear differences appear. Disparities between the habitat quality and habitat stability assessments seemed to be limited, although the macroinvertebrate assessment showed instances of significant disparities with habitat quality.

The macroinvertebrate community index is used as an indicator of water quality and/or habitat quality and so there is value in comparing MCI and habitat quality scores, especially because the two programmes are carried out during the same period. However, it is important to mention that results should be interpreted with caution as rivers' ecological and biological conditions are dynamic and are influenced by a wide range of factors that are not necessarily measured or taken into account in these assessments.

The MCI scoring system is broken down into four categories listed in Table 7 below.

Table 7: Macroinvertebrate Community Index scoring system

Water/habitat quality	Score
Clean water	120 ≤ score
Possible mild pollution	100 ≤ score ≤ 119
Probable moderate pollution	80 ≤ score ≤ 99
Probable severe pollution	score < 80

A number of sites showed significant differences between the habitat quality and MCI assessments. Starting from the bottom of Table 6, the MCI score for the Kaeo River in 2012 was 103.3 (possible mild pollution) and was ranked ninth among the 35 rivers monitored in the region. This contrasts with its 34th position for habitat quality in the same year.

Kaeo River

The Kaeo River site is characterised by a soft bottom constituted by sediment including silt and/or sand, a quasi inexistent riparian canopy cover, and a surrounding land-use dominated by pastoral activity as illustrated in Photo 3. The river is subject to frequent flooding, and bank erosion and deposition. Some parts of the Kaeo River – excluding the sampling site – are also open to livestock, which together with the flood and erosion problems impact on habitat quality. The site grade has fallen from marginal to poor in the last five years.

In regards to habitat stability Kaeo has had fair stability from 2008 to 2012 since it improved from 2007 (poor stability). This may have been influenced by channel stabilisation work that was undertaken on the river for flood prevention purposes. Habitat quality will take longer to recover than channel stability and may not improve unless riparian fencing and planting is undertaken to reduce the effect of livestock on river banks, riparian vegetation and therefore water quality.

Photo 3: Kaeo River, upstream view

Waitangi River

Similarly, the Waitangi River at Waimate (Waitangi 2) also presented significant differences between habitat quality and MCI results. In 2012 the site recorded a MCI of 113.8, (possible mild pollution) and ranked fourth out of 35 sites. In contrast, the site had a marginal habitat quality grade and ranked 27th out of 35 the same year.

The site is characterised by a soft bottom constituted by sediment including silt and/or sand and fine gravel, a quasi inexistent riparian canopy cover, and a surrounding land-use dominated by pastoral activity. The river is subject to frequent erosion/cutting and deposition. It is likely that the combination of the physical characteristics and these events impact on habitat quality at this site. The site has remained with a marginal habitat quality within the last seven years.

The river is also open to livestock and has been evaluated with poor stability since the programme began in 2005. The Waitangi catchment has been classified as a "priority catchment" under the council's National Policy for Freshwater Management (NPS) work programme. As a result, community and farmer driven land management initiatives aimed at improving water quality will be undertaken in this catchment in the future.
In general, water and habitat quality degrade going further downstream. However at the Waitangi at Watea (Waitangi 1) site – located downstream of Waitangi 2 – there was a better habitat quality score but a lower MCI score of 65.2 (probable severe pollution)ranking 31st among the 35 sites.

In terms of physical characteristics obvious differences between the sites also occur as illustrated in Photo 4 and Photo 5 below. Unlike the upstream site, Waitangi 1 is characterised by a mixed bottom constituted by soft material including silt and sand but also hard material including cobble, boulder and bedrock. The surrounding land-use is lifestyle, riparian canopy cover is average and livestock do not have access to the river. The MCI score difference suggests degradation has occurred between the two sites. Water quality trend analysis (available in a separate report in early 2013) – found that phosphorus levels are increasing in the river. This could be explained by on going sediment discharges from a large slip higher up in the catchment and bank erosion. Despite this the site has been moving from marginal to sub-optimal habitat quality. Habitat stability at Watea is also different from the upstream site as the river bed and banks are composed of more stable material and are less prone to degradation.

Photo 4: Waitangi (2) River at Waimate

Photo 5: Waitangi (1) River at Watea

Waipapa Stream

Another example of significant differences in MCI and habitat stability and quality scores is for Waipapa at Waipapa Landing Bridge (Waipapa 1). In 2012 the site recorded a MCI sore of 68.1 (probable sever pollution) and ranked 29th among 35. However, the site had a sub-optimal habitat quality grade and ranked ninth the same year.

The river channel is characterised by a hard bottom of bedrock, boulders and cobbles. The surrounding land-use is a mix of native scrub, lifestyle and urban areas, and there is no livestock accessing the river. Riparian canopy cover is average as illustrated in Photo 6 below. A combination of poor hydrologic heterogeneity (lack of different habitat types, e.g. pools, riffles runs, etc.), aquatic habitat diversity and abundance and average riparian canopy cover could explain the low MCI score in 2012. Furthermore, the site is located at the bottom of the catchment meaning that water quality is likely to be poorer.
This site has remained within the good stability grade since it was first assessed in 2008.

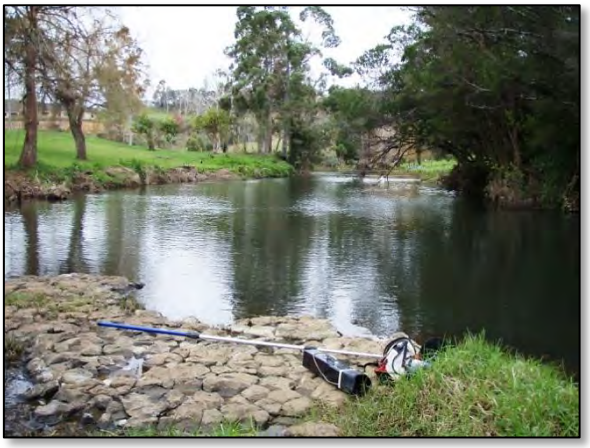

Photo 6: Waipapa Stream at Waipapa Landing Bridge, upstream view

Hakaru River

Lastly, the Hakaru River site is another example of disparities occurring between the different assessment results. In 2012 the site recorded a MCI score of 81.9, (probable moderate pollution) and ranked 23rd among the 35 sites. However, the site had a sub-optimal habitat quality grade and ranked eighth the same year.

The river channel is characterised by a hard bottom of bedrock, boulders and cobbles. The surrounding land-use is a mix of plantation forest and pastoral activity, livestock have access to the river and riparian canopy cover is average (Photo 7 & Photo 8). Interestingly this site presents good hydrologic heterogeneity, aquatic habitat diversity and abundance which should support the development of a healthy macroinvertebrate community. However, other water quality indicators such as nutrients and sediment have negatively affected the MCI score.

The Hakaru River site has been moving from a sub-optimal to a marginal habitat quality between 2008 and 2010 and was again assessed with a sub-optimal habitat quality in 2012. Regarding its stability, it has always remained within the good stability grade since it was first assessed in 2008.

Photo 7: Hakaru River

Photo 8: Hakaru River, upstream view

Waipoua River

Despite a number of inconsistencies between the two assessment programmes, most sites presented consistent results when comparing habitat quality and MCI scores and rankings. For example, the MCI score for the Waipoua River in 2012 was 129.1 (clean water) and ranked first among the 35 sites monitored. Accordingly the site had an optimal habitat quality grade and also ranked first.

This river channel is characterised by a hard bottom of bedrock, boulders and cobbles. The surrounding land-use is dominated by native forest including Kauri trees, livestock do not have access to the river and riparian canopy cover is excellent (Photo 9). The Waipoua River is considered a reference, or "control" site in Northland as it is the closest site to a natural state, i.e. pristine, without human modification.

The Waipoua River has remained within the sub-optimal/optimal habitat quality grade since it was first assessed in 2005. Its stability has also remained within the good to excellent grade since 2005.

Photo 9: Waipoua River, upstream view

Waipapa River

The same observation can be made for the Waipapa at Forest Ranger (Waipapa 2) site. In 2012 it had a MCI score of 118.0 and ranked second according to its habitat stability it ranked second among the 35 sites.

While the geology is soft sedimentary, the river channel is still characterised by a hard bottom of bedrock, boulders and cobbles. The surrounding land-use is dominated by native forest, livestock do not have access to the river and riparian canopy cover is excellent. The Waipapa River is also considered to be a reference site for Northland.

The Waipapa River site has remained within the sub-optimal/optimal habitat quality grade since it was first assessed in 2005. Its stability was first assessed as being fair in 2005 and 2007 and it then improved to reach a good stability in 2008 and 2010. It was last assessed with an excellent stability in 2012.

Summary

In total, 35 sites were assessed in 2010 and 2012. While no sites were assessed as having excellent channel stability in 2010, three sites were in 2012. In 2010, 14 sites had good stability, 13 fair, and two sites had poor channel stability. By comparison, in 2012 three sites were graded as excellent, 14 as good, 16 sites had fair, and two had a poor channel stability.

In 2012, only two sites – Waipoua and Waipapa 2 – were assessed as having high habitat quality, indicating optimal habitat for aquatic biota.

In 2012, 46% of sites were open to livestock access. Within these, 50% of the sites were graded with a fair stability, 13% were graded with a poor stability and 37% with a good stability as illustrated in Figure 14 below.

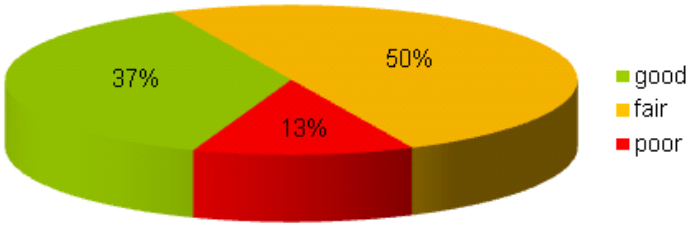

Figure 14: Stability distribution of sites with livestock access

In 2012, 20% of sites had channel shading greater than 50% and 74% had channel shading less than 50% – six percent of the sites had a channel shading of 50%. Channel shading is an important physical characteristic for macroinvertebrate abundance as shading influences in-stream temperature and riparian vegetation provides material for in-stream habitats.

Provisional analysis of data collected over the last five years indicates that habitat quality changed at eight sites, with one site – Ngunguru – being assessed for the first time in 2012. Out of eight sites, habitat quality improved at no sites and deteriorated at four. Some of the changes observed since 2005 were inconclusive due to insufficient data and/or surveyor bias.

Out of the 20 sites available for trend analysis, stability improved at 10 and deteriorated at two. At eight sites the changes since 2005 were inconclusive s due to insufficient data and/or surveyor bias.

Recommendations

- Continue with biennial stream habitat assessments, in conjunction with annual macroinvertebrate monitoring, at all RWQMN sites.
- Standardise the habitat assessment protocol so that reproducibility is easily achieved from one surveyor to another.
- Carry out multivariate statistical analysis of the macroinvertebrate data with the habitat assessment and water quality data.
- Investigate declining water quality/macroinvertebrate scores/stream health and stability at all sites that show a downward trend.
- Implement a fish monitoring programme at all RWQMN sites, to complement the macroinvertebrate and habitat assessment data.

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