MWH

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REPORT

Stream Ecological Valuation: Upper Karamu Waterways

Prepared for Hawke's Bay Regional Council

June 2010

QUALITY ASSURANCE STATEMENT

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HAWKE'S BAY REGIONAL COUNCIL

Stream Ecological Evaluation: Upper Karamu Waterways

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 Introduction

1.1 Study Objectives and Scope

The Hawke's Bay Regional Council (HBRC) has engaged MWH New Zealand Ltd (MWH) to design and implement an aquatic ecological survey of selected upper tributaries of the Karamu Stream. The survey method adopted for these surveys is the Auckland Regional Council's "Stream Ecological Valuation" (SEV) (Rowe *et al* 2008).

The specific objectives of the project are as follows:

1. Determine and justify appropriate SEV reference values for monitoring reaches at subject waterways.

2. Design an SEV monitoring programme (spatial and temporal arrangement) for subject waterways.

3. Undertake baseline survey of the identified upper Karamu waterways using the SEV method.

4. Provide summary report containing:

    a. SEV method;
    b. SEV results;
    c. Key ecological function issues for each waterway; and
    d. Identification and outline of opportunities for greatest improvement in SEV values.

1.2 Information Sources

Information used to compile this report has been obtained from the following sources:

- Catchment boundary and area information was provided by HBRC.
- Background information on the aquatic ecology and water quality of Karamu Stream was provided by HBRC.
- A macroinvertebrate survey and field measurement of other SEV function variables was undertaken at the study reaches by MWH over the period 19 to 21 January 2010.
- Spotlight fish surveys were undertaken at the study reaches by MWH on the nights of 23 February, and 2, 5 and 8 March 2010.

2 Background

2.1 Ecological Functions of Streams

Rowe *et al* (2008) developed a method to score the ecological condition of stream reaches in the Auckland region based on the performance of their key ecological functions. Sixteen functions in four groups were identified (refer Figure 2.1). Performance of these ecological functions is determined by field measurement of thirty-one variables. The variable scores are combined in an algorithm to assess the overall performance of the stream function on a scale of 0.0 to 1.0, for each study reach. This value is referred to here as the SEV score.

Although this methodology was designed for Auckland streams, the principles can readily be adapted to other regions. The SEV method has been successfully applied to Hawke's Bay streams (refer Forbes 2008, 2009a, and 2009b) and elsewhere in New Zealand.

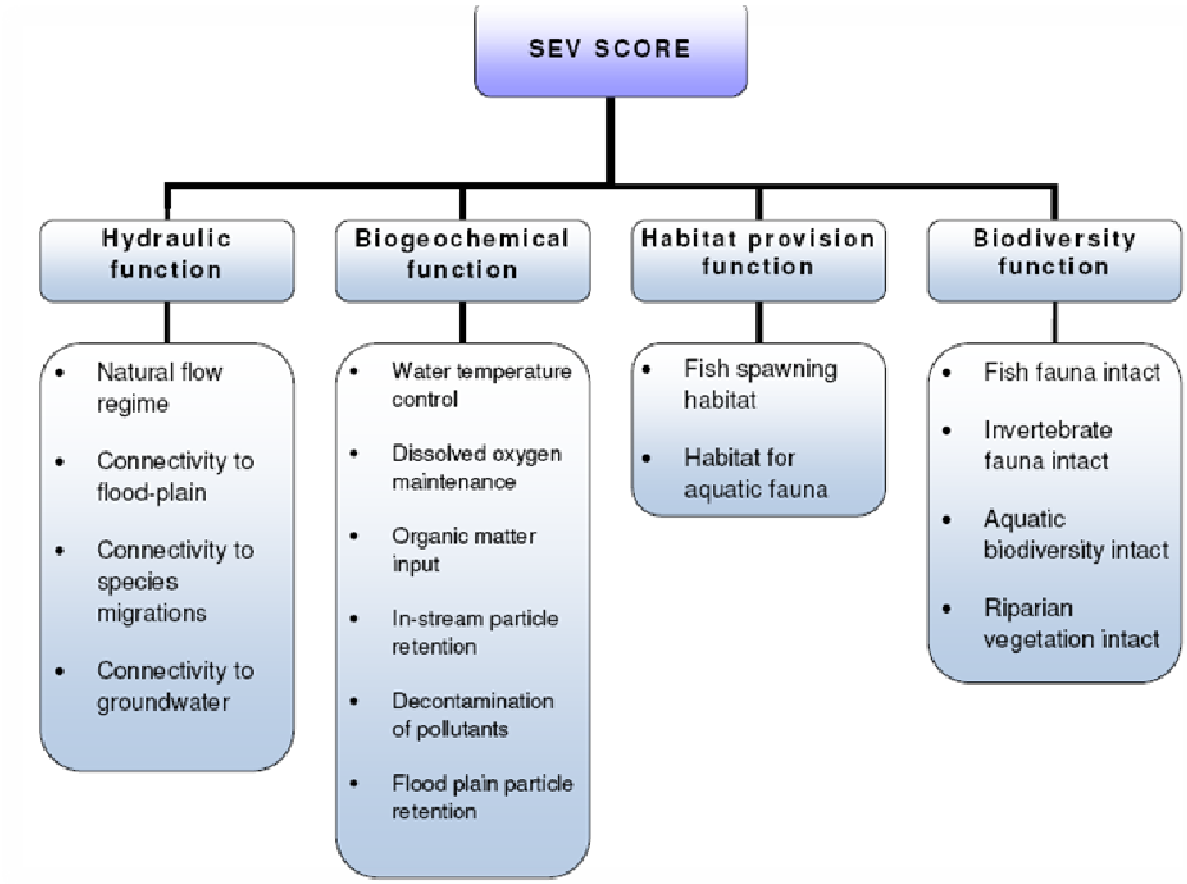

Figure 2.1 : Ecological functions addressed by the SEV method

2.2 Alignment with HBRC Waterway Management Philosophy

HBRC have considered and adopted a "Council Waterway Management Philosophy", which sets a vision for streams and drains administered as part of a Council Flood Control and Drainage Scheme using a "multi-value" approach. Specifically the Vision states:

> "*That streams and drains administered as part of a Council Flood Control and Drainage Scheme flowing through public land are managed using a multi-value approach, which where appropriate creates improved*

ecological, recreational, heritage, cultural, landscape and drainage values within the waterway network and that communities take ownership of, and have pride in, their waterways."

The Council Waterway Management Philosophy sets out the following goals:

- *To manage all Council waterways under a multiple value approach to enable the Regional Council to lead by example.*
- *To improve ecological, recreational, heritage, cultural, landscape and drainage values of Councils waterways.*
- *To provide a regional vision for waterway management.*
- *To increase community ownership and pride.*
- *To promote a multiple value approach to waterway management to local authorities within Hawke's Bay.*

The Council Waterway Management Philosophy sets out the following objectives:

- *That a "toolbox" of appropriate management methods are developed to implement a multi-value approach to the management of Council streams and drains.*
- *That by 2019 all drains and streams owned or managed by the HBRC are actively managed using a multi-value approach.*
- *That by 2019 all drains and streams owned or managed by the HBRC have plans in place to achieve appropriate added values that take account of any site constraints.*

The application of the SEV method in the upper Karamu contributes to the "*toolbox*" for planning, management and monitoring of aquatic ecological management of those waterways. In order to complete the "ecological" consideration of the multi-value approach, there is further scope to select and implement methods to plan, manage and monitor the terrestrial ecology values associated with those waterway corridors.

3 Methods

3.1 SEV Reference Sites

The SEV methodology requires that valuations be standardised against near-pristine reference streams. Ideally, the reference streams would be of a similar order, underlying geology, gradient and substrate type to the study streams. The normal practice would be to determine the 'variable' values for three reference sites within the study area and to then calculate the mean of these to act as the standard value.

In this case, however, due to the highly modified character of the entire catchment, no pristine reference sites are available for lowland streams on the Heretaunga Plains. Consequently, we have adopted reference values previously calculated for Auckland streams (Albany), but have amended them slightly for Hawke's Bay conditions. MWH has received an opinion from NIWA (pers. comm. Stephanie Parkyn) that Auckland reference values are suitable for use in Hawke's Bay.

All of the upper Karamu study sites are on low gradient land, much of which was previously wetland. Nevertheless, the pre-Polynesian vegetation of Hawke's Bay was forest cover. For this reason, "native forest cover" setting has been used in the three reference sites.

With regard to reference macroinvertebrate values, the Albany macroinvertebrate scores have been adopted. A fish "Index of Biotic Integrity" (IBI) score of 59 ("excellent") has been applied to all reference sites.

The three synthetic reference sites for Heretaunga Plains are denoted HP1, HP2 and HP3 in this study. The reference scores along with study sites values are included in Section 4.1.1 of this report.

3.2 Selection of SEV Survey Reaches

Study reaches were located in different ecological settings by application of the following selection criteria:

- Examination of Land Cover Database 2 GIS layer to identify variation in land use adjacent to and upstream of a potential study reach;
- Examination of NIWA River Environment Classification GIS layer to identify variations in channel characteristics;
- Examination of aerial photographs;
- Examination of topographical maps;
- The survey reach is readily accessible for baseline and future surveys; and
- The survey reach has ecological enhancement or restoration potential (e.g. land tenure, physical space).

Eight survey reaches representative of adjacent (upstream, downstream and riparian) land use, ecological conditions and stream morphology were selected using the criteria above, and then marked on aerial photographs and topographical maps. Those preliminary sites were then refined through a 'ground-truthing' process in the field. One preliminary site on the lower Paritua Stream (at Bridge Pa) was found to be dry and, subsequently, excluded from the study. The baseline survey of the remaining seven sites was carried out during January to March 2010.

3.3 Location of SEV Survey Reaches

Seven SEV survey reaches on four upper tributaries of the Karamu Stream were included in the study. These are listed in Table 3.1 below and shown in Figures 4.2, 4.3 and 4.4. Survey reaches are identified using a letter-number labelling system. Labels comprise the first three letters of the stream name followed by one number, which ascends in an upstream direction (lowest numbers are nearest the sea).

Table 3.1 : Survey reaches

Stream Name	Site Code	Sev Reach Coordinates (NZMG)		Description
		Top	Bottom	
Awanui	AWA1	E2837107 N6161920	E2837191 N6162026	Located in the lower Awanui Stream catchment, immediately upstream of the Crystal Road Bridge. Channelised with narrow floodplain inside mown stopbanks (a strip of un-mown grass remains on the true right bank). The stream is slow moving with excess fine sediment on the bed – sediments anaerobic in places. Extensive macrophyte development. Predominantly agricultural catchment.
	AWA2	E2831930 N6162070	E2832045 N6161980	Located in the middle Awanui catchment at the end of Turamoe Road. Deeply incised modified channel with straight alignment and steep batter slopes. Riparian vegetation of long grass and exotic shrubs. Negligible floodplain. Excess fine sediments on parts of the bed, elsewhere hard limestone substrate. Predominantly agricultural catchment.
	AWA3	E2826969 N6160115	E2826956 N6160228	Located in the upper Awanui catchment on farmland off Raukawa Road, downstream of the confluence of three intermittent minor water courses. The stream flows slowly through a wide swampy channel. The bed is overlain with deep layer of fine silt and most of the channel is overgrown with emergent macrophytes. The true right bank is grazed short grass; longer grass on the left bank, and intermittent willows on both banks. Predominantly agricultural catchment.
Karewarewa	KAR1	E2833042 N6163420	E2832995 N6163278	Located on Karewarewa Stream immediately downstream of the Rosser Road Bridge. Moderately incised unconfined channel. Both banks are grazed, with short to long grass. Bed mostly overlain with fine silt. Predominantly agricultural catchment.
Paritua	PAR1	E2827439 N6165641	E2827555 N6165710	Located on Paritua Stream amongst farmland at Maraekakaho Road (access via Washpool Station). Relatively natural channel but riparian areas and both banks are grazed short grass. Broad floodplain with no stopbanks. Moderate water velocity maintains a clean cobble bed in places, but excess sediment occurs in places. Extensive periphyton and macrophyte development. Predominantly agricultural catchment. The Paritua Stream joins the Karewarewa Stream which flows into the Awanui at Pakipaki.
Poukawa	POU1	E2835269 N6160368	E2835274 N6160516	Located on lower reaches of Poukawa Stream immediately upstream of Stock Road bridge. Channelised to moderately straight alignment with steep banks. Riparian vegetation of long grass, occasional willow and exotic shrubs. Excess fine sediment on bed - sediment anaerobic in places. Extensive macrophyte development. Located downstream of the extensive Pekapeka Wetland, within a predominantly agricultural catchment. The Poukawa Stream flows into the Awanui Stream at Pakipaki.
	POU2	E2829925 N6153290	E2829840 N6153405	Located on the upper reaches of Poukawa Stream between Lake Poukawa and Pekapeka Wetland, immediately downstream of HBRC flow monitoring station. Channelised to straight alignment with steep batter slopes. Riparian vegetation of grasses, sedges,willow and poplar. Extensive macrophyte growths. Negligible floodplain. Predominantly agricultural catchment.

3.4 Field Application of the SEV

The standard SEV method (Rowe *et al*, 2008) was adhered to. Survey reaches were defined and marked on the ground using spray paint. All study reaches were 150.0 metres in total length, with ten transects laterally crossing the stream at 15.0 metre intervals. This arrangement aligned with the transect design required for the fish survey, as outlined below.

3.5 Fish Surveys

Electric fishing was not attempted due to relatively high electrical conductivity of stream water in most reaches. Therefore, all fish surveys were undertaken by night spotlighting in accordance with the Standardised Fish Sampling Protocols for New Zealand Wadable Streams (Bruno, 2009). Rather than the abundance data derived from full application of the Bruno's 2009 method, the SEV method requires presence/absence data. On that basis, the fish sampling protocol was varied so only presence/absence data was collected. Fishing was undertaken in tandem by Andrea Sinclair and Adam Forbes (both of MWH) with 30W Lightforce spotlights.

3.6 Macroinvertebrate Surveys

Macroinvertebrate surveys were carried out in accordance with the MfE (2001) Protocols for Sampling Macroinvertebrates in Wadeable Streams. All surveys followed the soft-bottomed semi-quantitative protocol "C2", except Paritua 1 which had a gravel/cobble substrate and where protocol "C1" was followed. A macroinvertebrate kick-net with 0.5 mm mesh aperture was used for sample collection. Samples were preserved with 70:30 isopropyl alcohol:water solution in the field and shipped to Landcare Research (Auckland) for analysis.

3.7 Desktop Analyses

Delineation and measurement of catchment boundaries was calculated using HBRC spatial data and GIS (ArcGIS 9.3). Given the rural nature of catchment land use within the study area, the proportion of the catchment above each study reach in impervious cover was too small to warrent GIS mapping. Therefore, this aspect was estimated from topographical maps and aerial photographs

Fish survey data was input into the IBI calculator to calculate IBI scores. Those scores were imported into the SEV calculator.

SEV scores were calculated using Version 8 of the spreadsheet calculator.

When calculating enhancement potential of study reaches, biotic provision function scores were removed for the calculation (as specified by the SEV method) as it is not possible to predict how biota would respond to enhancement actions. With the removal of biotic function scores, the test SEV scores presented in that section of the report are different to those reported in the results, as it is an average of only three of the four function groups.

Full descriptions of the SEV method are provided by Rowe *et al* (2008; 2009).

3.8 Limitations

No actual reference site is available on the Heretaunga Plains for the upper Karamu SEV study. Consequently, previously developed reference data for Auckland, modified slightly for Hawke's Bay conditions, were relied upon to compile representative reference scores.

4 Results

4.1 Overview

4.1.1 SEV Scores

Ecological function scores and overall SEV scores are presented for each upper Karamu study reach and the three reference streams in Table 4.1. The reference SEV scores HP1, HP2 and HP3 are the expected values for unmodified lowland streams on the Heretaunga Plains, with a range of 0.932 to 0.938.

The upper Karamu Stream SEV test scores reflect the extent to which ecological function has been impaired by modifications to the stream and surrounding catchment. These range from 0.400 to 0.523 (refer Table 4.1 and Figure 4.1). The individual function scores identify specific functions that are impaired and which are probably responsible for the decline in ecological performance (and where enhancement efforts would likely yield the greatest benefits in terms of stream health). The most severely impaired functions, with scores less than 0.3, are shown in red.

Table 4.1 : Function & SEV scores (0.0 to 1.0) for upper Karamu streams & reference streams

No.	Ecological Function	Reference Streams			Upper Karamu Streams						
		HP1	HP2	HP3	AWA1	AWA2	AWA3	KAR1	PAR1	POU1	POU2
Hydraulic											
1	Natural flow regime	1.00	1.00	1.00	0.60	0.60	0.64	0.60	0.68	0.68	0.60
2	Connectivity to floodplain	1.00	0.85	0.90	0.55	0.05	0.05	0.40	0.40	0.20	0.05
3	Connectivity for migrations	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	Connectivity to groundwater	1.00	1.00	1.00	0.50	0.50	0.60	0.50	0.70	0.70	0.50
	Mean	**1.00**	**0.96**	**0.98**	**0.66**	**0.54**	**0.57**	**0.63**	**0.70**	**0.65**	**0.54**
Biogeochemical											
5	Water temperature control	0.83	0.82	0.85	0.54	0.53	0.88	0.53	0.52	0.58	0.68
6	Dissolved oxygen maintained	1.00	1.00	1.00	0.28	0.50	0.21	0.29	0.49	0.27	0.63
7	Organic matter input	0.90	0.80	0.60	0.01	0.00	0.12	0.12	0.00	0.06	0.29
8	Instream particle retention	0.88	0.88	0.88	0.75	0.59	0.60	0.70	0.64	0.91	0.59
9	Decontamination of pollutants	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	Floodplain particle retention	0.96	0.86	0.89	0.48	0.21	0.13	0.50	0.49	0.38	0.26
	Mean	**0.93**	**0.89**	**0.89**	**0.51**	**0.47**	**0.49**	**0.52**	**0.52**	**0.53**	**0.58**
Habitat provision											
11	Fish spawning habitat	0.88	1.00	1.00	0.16	0.50	0.24	0.88	0.88	0.59	0.50
12	Habitat for aquatic fauna	0.98	0.98	0.98	0.36	0.40	0.45	0.43	0.52	0.40	0.55
	Mean	**0.93**	**0.99**	**0.99**	**0.26**	**0.45**	**0.34**	**0.65**	**0.70**	**0.50**	**0.53**
Biotic											
13	Fish fauna intact	0.95	0.97	1.00	0.43	0.30	0.00	0.43	0.50	0.43	0.40
14	Invertebrate fauna intact	0.56	0.85	1.00	0.14	0.14	0.00	0.14	0.43	0.07	0.14
15	Aquatic biodiversity intact	0.98	0.98	1.00	0.41	0.26	0.16	0.41	0.44	0.28	0.46
16	Riparian vegetation intact	1.00	1.00	1.00	0.37	0.43	0.35	0.43	0.37	0.43	0.45
	Mean	**0.87**	**0.95**	**1.00**	**0.34**	**0.28**	**0.13**	**0.35**	**0.43**	**0.30**	**0.36**
SEV (mean function score)		0.932	0.937	0.950	0.474	0.438	0.400	0.523	0.565	0.499	0.507

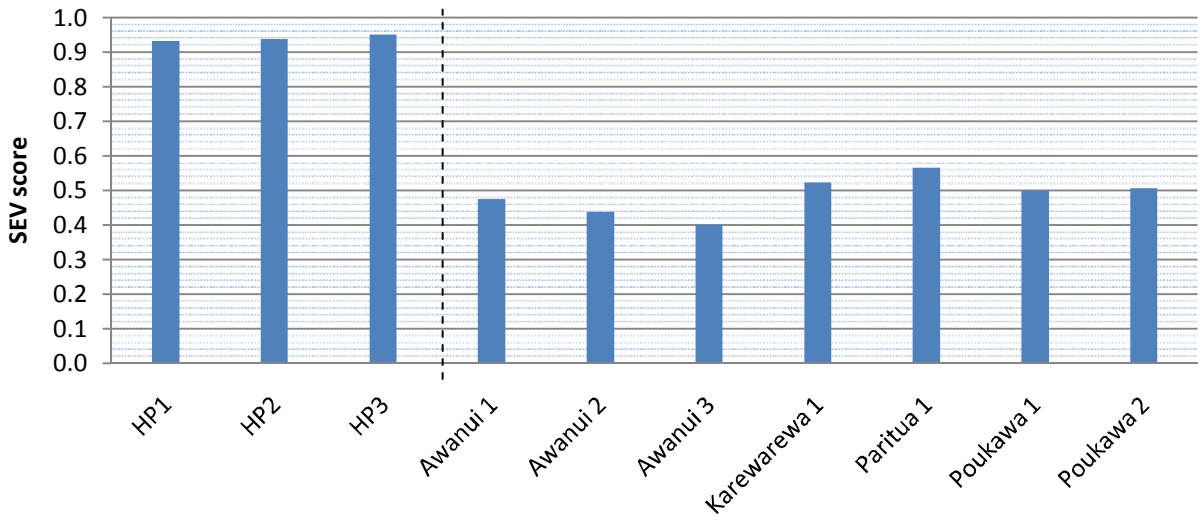

Figure 4.1 : Test & reference SEV scores for upper Karamu streams

4.1.2 Water Quality

Field measurements of water temperature, pH, conductivity and dissolved oxygen were made at each survey site prior to the habitat and biotic surveys. The results, summarised in Table 4.2, show low levels of dissolved oxygen present at sites lower in the catchment, particularly Awanui 1 and Poukawa 1. Small patches of anaerobic sediment were present at both sites. (Note: The Awanui 1 and Poukawa 1 dissolved oxygen measurements were made in the morning and probably represent the bottom of the diurnal range for these sites.)

Table 4.2 : Water quality results

	Awanui 1	Awanui 2	Awanui 3	Karewarewa 1	Paritua 1	Poukawa 1	Poukawa 2
Date	19/1/10	21/1/10	20/1/10	21/1/10	22/1/10	20/1/10	19/1/10
Time	9.00am	8.50am	1.40pm	2.00pm	8.45am	8.30am	2.30pm
Temperature (^oC)	18.8	20.0	21.3	18.68	17.38	18.96	22.95
pH	6.80	6.95	7.27	7.37	6.82	6.69	7.43
Conductivity (µS/cm)	601	566	378	598	657	621	628
Dissolved O_2 (% sat)	12.9	46.5	38.6	62.0	71.4	11.6	45.0
Dissolved O_2 (g/m^3)	1.22	4.22	3.5	5.75	6.82	1.04	4.05

4.1.3 Macroinvertebrate Community Composition

The results of macroinvertebrate surveys at seven upper Karamu Stream sites are summarised below in Table 4.3. The total number of taxa at each site varied between thirteen and twenty-two. A relatively small proportion of these are pollution sensitive taxa from the Ephemeroptera, Plectotera and Trichoptera groups (EPT). This is reflected in low MCI scores (<80) which place all seven sites in the “poor” water quality class as defined by Stark and Maxted (2007).

Paritua 1 and Poukawa 2 had the highest MCI scores and the highest number of “sensitive” taxa, indicating better instream conditions than at the five other sites.

Table 4.3 : Macroinvertebrate survey summary results

	Awanui 1	Awanui 2	Awanui 3	Karewarewa1	Paritua1	Poukawa 1	Poukawa 2
Ephemeroptera	0	0	0	0	0	0	1
Plecoptera	0	0	0	0	0	0	0
Trichoptera	2	2	0	1	2	2	5
Number of taxa	17	14	16	13	22	18	16
#EPT taxa	2	2	0	1	2	2	6
MCI	42.3	31.5	46.3	32.9	54	44.3	55.5

4.1.4 Fish Fauna

The results of the spotlight fish surveys undertaken in February and March 2010 are summarised below in Table 4.4. A total of three native fish and two exotic species were identified. Because electric fishing was not able to be undertaken, these results may underestimate the range of fish actually present at some locations. This is particularly the case at locations such as Awanui 3, where most of the stream was covered by floating or emergent aquatic vegetation which impaired visibility.

Fish records were used to calculate Index of Biological Integrity (IBI) values (Joy and Death 2004) for each survey reach. As a guide to interpreting IBI scores, the potential range is from 0 ("no native fish") to 50-60 ("excellent"). Scores in the range 18 to 27 indicate "poor" integrity with severely impacted species richness, while scores in the range 28 to 35 indicates "fair" integrity with significantly reduced species richness. The best performing upper Karamu site was Paritua 1, which was rated "fair". All other sites were "poor", except for Awanui 3 in which no native fish were found.

Table 4.4 : Fish survey presence/absence results (2 & 5 March 2010)

	Awanui 1	Awanui 2	Awanui 3	Karewarewa1	Paritua1	Poukawa 1	Poukawa 2
Shortfin eel	✓	✓		✓	✓	✓	
Unidentified eel	✓	✓		✓	✓	✓	✓
Inanga	✓			✓	✓	✓	
Common bully							✓
Goldfish	✓		✓	✓	✓	✓	✓
Mosquitofish	✓	✓		✓		✓	✓
IBI Score	26	18	0	26	30	26	24

4.2 Awanui Stream

4.2.1 Overview

The three study sites on Awanui Stream extend from the lower stream at Crystall Road (Awanui 1) through the middle reaches at Turamoe Road (Awanui 2) to the headwaters off Raukawa Road (Awanui 3). An overview of these sites is presented in Figure 4.2.

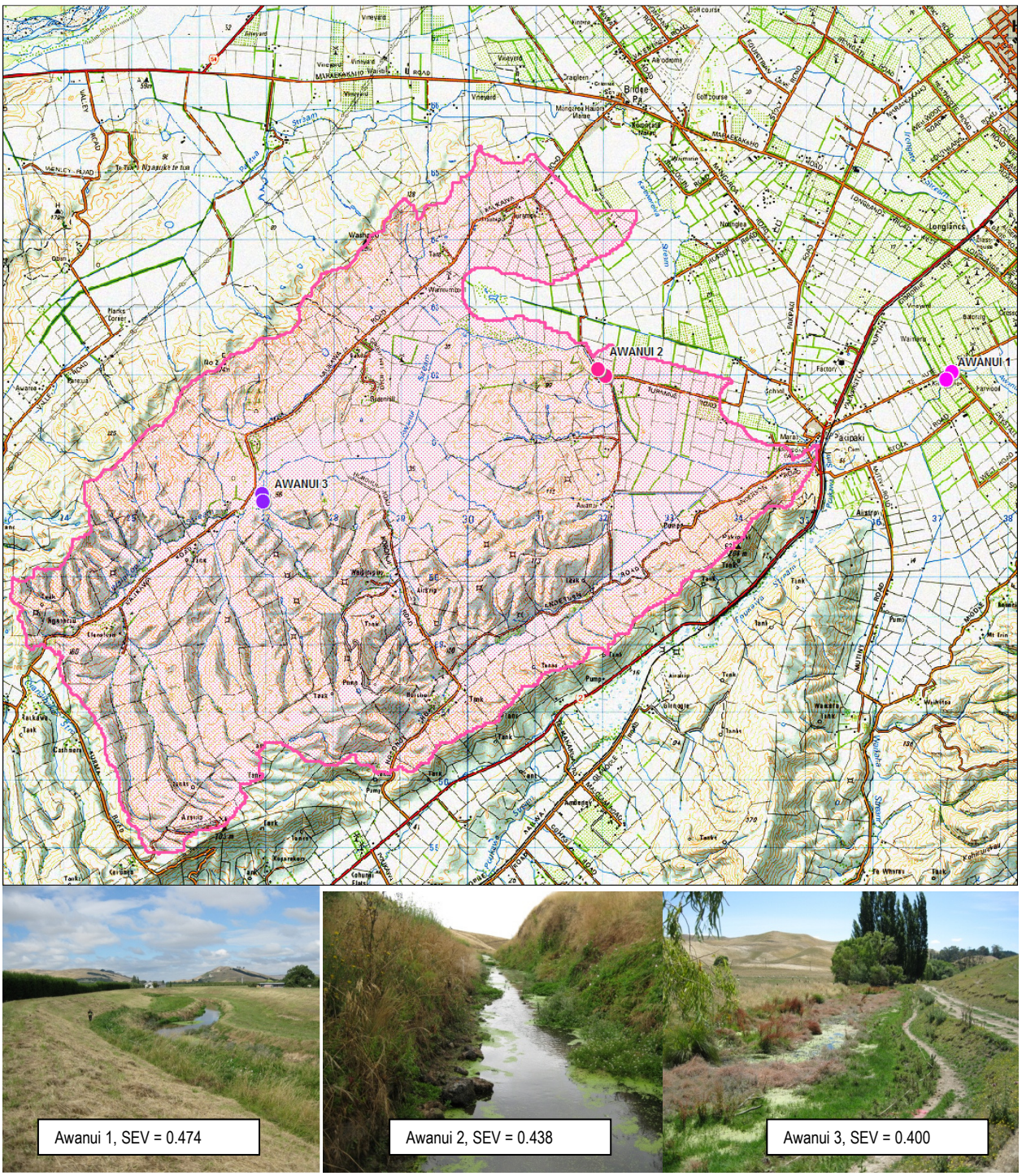

Figure 4.2 : Awanui Stream SEV study sites

4.2.2 Awanui 1

The Awanui 1 study reach is located in the lower catchment, downstream of the six other sites included in this study. The total catchment area above this reach is 29,128 hectares, which is mostly in agricultural land use, with very little urban development and less than 2% impervious area. The SEV score for this reach was 0.474. This is a relatively large watercourse with a broad channel inside high stopbanks with a very limited floodplain. The riparian vegetation is grass, which is mown down to the water's edge on one bank but longer on the other. It scored poorly for *habitat provision* and *biodiversity provision* functions. The poor condition of the riparian zone and reduced habitat for fish spawning and aquatic fauna contributed to the poor performance of those functions.

It scored well for *hydraulic* functions due to the low levels of impervious surface within the catchment and absence of artificial structures within the active channel.

4.2.3 Awanui 2

The Awanui 2 study reach, being higher in the catchment, has a significantly lower flow than Awanui 1. The total catchment area above this reach is 4,683 hectares. The SEV score for this reach was 0.438. The stream channel is deeply incised through limestone, with a very uniform channel, no floodplain and limited riparian vegetation. It scored poorly for *biodiversity provision* functions while the *hydraulic*, *biogeochemical* and *habitat provision* functions were fair.

The poor condition of the riparian zone, lack of connectivity to the floodplain and poor aquatic biodiversity were significant features of this reach.

4.2.4 Awanui 3

The Awanui 3 study reach is a minor upper tributary. The total catchment area above this reach is 2,504 hectares. The SEV score for this reach was 0.400, the lowest of all of the upper Karamu study reaches. This reach is broad with a low gradient, very low water velocity, a deep soft sediment substrate and dense floating and emergent aquatic macrophyte growth. Overhanging riparian vegetation is sparse. Eight of the sixteen ecological functions listed in Table 4.1 were found to be severely degraded. It scored particularly poorly for *habitat provision* and *biodiversity* functions, while the *hydraulic* and *biogeochemical* functions were only "fair". No native fish were recorded in the reach (but shortfin eels are likely to be present).

4.3 Paritua and Karewarewa Streams

4.3.1 Overview

Paritua Stream and Karewarewa Stream constitute a single tributary of the Awanui Stream. The upper site is located on the Paritua Stream adjacent to Washpool Station; the lower is located on Karewarewa Stream immediately downstream of the Rosser Road Bridge (refer Figure 4.3)

Figure 4.3 : Paritua/Karewarewa Stream sites

4.3.2 Paritua 1

The total catchment area above the Paritua 1 study reach is 9,724 hectares. The SEV score for Paritua 1 was 0.565, the highest of the all the upper Karamu sites included in this study. This is a moderate sized watercourse, including deep pools and faster shallow runs which provide a variety of habitat types for invertebrates and fish. The later include inanga and shortfin eel (refer Figure 4.4).

The invertebrate and fish fauna communities, while degraded, were in better condition than at most other sites in this study. (It is noted, however, that further downstream the Paritua had lost most of its surface water to groundwater and perhaps irrigation, possibly with serious consequences for habitat quality in the lower stream.) Paritua 1 has a predominantly stony bottom substrate, indicating that the stream flow had sufficient energy to sweep away fine sediment inputs from the surrounding agricultural land. This contrasts with the other upper Karamu study sites which had lower water velocities and a soft sediment bed.

This reach of the stream was not constrained by stopbanks and remained well connected to the floodplain and groundwater. It scored moderately well for *hydraulic function* and *habitat provision* and achieved fair scores for *biogeochemical functions* and *biotic functions*.

The poorest ecological functions of this reach were associated with the absence of riparian vegetation, other than pasture grasses which were grazed down to the water's edge. The lack of shading over the channel had contributed to the development of a proliferation of filamentous green algae (Figure 4.4).

Figure 4.4 : Paritua 1 – Adult inanga (left) & proliferation of filamentous green algae (right)

4.3.3 Karewarewa 1

The total catchment area above the Karewarewa 1 study reach is 11,200 hectares, including the Paritua Stream catchment. The SEV score for Karewarewa 1 is 0.523, the second highest of the all the upper Karamu sites. This is a narrow watercourse but water depths are variable, exceeding 0.7 metres in places. It scored moderately well for *hydraulic* functions and *habitat provision* but fair to poor for *biogeochemical* and *biotic* functions.

The poor condition of the riparian zone and poor biodiversity were significant features of this reach.

4.4 Poukawa Stream

4.4.1 Overview

The two Poukawa Stream sites are located in the middle and lower catchment at Douglas Road and Stock Road, respectively. The Poukawa is a tributary of the Awanui Stream, having its confluence at Pakipaki (refer Figure 4.5).

Figure 4.5 : Poukawa Stream SEV study sites

4.4.2 Poukawa 1

The total catchment area above the Poukawa 1 study reach is 10,920 hectares. The SEV score for Poukawa 1 was 0.499. This is a moderate sized watercourse with water depths greater than 1.0 metre in places, but low water velocity and a soft sediment substrate. The sediment included significant quantities of decomposing organic matter which had gone anaerobic in places. Poukawa 1 scored moderately well for *hydraulic* functions, fair for *biogeochemical* and *habitat* functions, but poor for *biodiversity* – particularly of invertebrate fauna. An inability to maintain an acceptable level of dissolved oxygen in the sediments and water column is likely to limit biodiversity.

4.4.3 Poukawa 2

The total catchment area above the Poukawa 2 study reach is 7,684 hectares. The SEV score for Poukawa 2 was 0.507. This is a narrow watercourse with moderate water depth and a soft sediment substrate. Poukawa 2 scored moderately well for *hydraulic*, *biogeochemical* and *habitat* functions, but poor for *biodiversity*. A lack of connection to the floodplain, due to the deeply incised channel, was a key feature of this reach.

5 Stream Enhancement Potential

5.1 Stream Restoration Threshold Values

The SEV method (Rowe *et al*, 2008) was developed to provide a scientific framework for calculating environmental compensation. That is, for a given loss of ecological functions at one stream site, the SEV method provides a rationale for the calculation of the type and amount of restoration required in order to achieve "no-net-loss" of ecological performance at an enhancement site.

The SEV method provides a scale from 0.0 to 1.0, along which the potential ecological performance gains from enhancement actions can vary. When the SEV score at a given site is very low, it may not be feasible to create a significant improvement in ecological performance. For example if the amount of impervious area caused by urban development above the site is greater than 25%, it is likely that the potential for restoration of ecological functions is very low. Alternatively, the reach may already have a very high ecological value such that no further improvement is required.

Rowe *et al* (2008) considers that threshold SEV values between 0.4 and 0.8 would provide the best indicators of whether significant improvement is likely to be achievable. The SEV results, summarised in Table 4.1 and illustrated in Figure 4.1, indicate that all seven upper Karamu sites have SEV scores in that range and may be suitable candidates for enhancement.

5.2 Options for Enhancement of Ecological Functions

The ecological functions identified earlier in Table 4.1 as being most impaired are listed below, together with potential enhancement actions:

Ecological Function	*Potential enhancement actions*
Connectivity to floodplain	Relocate stopbanks
Dissolved oxygen maintained	Increase evergreen vegetation over stream
Organic matter input	Increase evergreen vegetation over stream
Floodplain particle retention	Increase floodplain vegetation thickness
Habitat for aquatic fauna	Increase habitat diversity & native riparian vegetation
Invertebrate fauna intact	Increase habitat diversity & native riparian vegetation
Riparian vegetation intact	Increase indigenous vegetation

These results suggest that the single action with the greatest potential ecological benefit would be riparian vegetation enhancement, as this could improve a number of functions. Improved connectivity to the floodplain would also be beneficial for five of the study sites. However, in all cases the lack of connectivity is due to stopbanks being located close to the active channel, leaving minimal floodplain area inside the stopbanks. It is anticipated that relocating stopbanks may not be a realistic or affordable option in most cases. The following assessment has, therefore, focused on the potential benefits of enhancement of floodplain and riparian vegetation.

5.3 Evaluation of Floodplain and Riparian Vegetation Enhancement

Potential enhancement actions and assumed outcomes focused around floodplain and riparian vegetation enhancement are listed in Table 5.1, and an evaluation of how these actions would enhance ecological functions at the seven upper Karamu study sites is given in Table 5.2. This evaluation of floodplain and riparian vegetation enhancement indicates that all of the study sites, with the possible exception of Poukawa 2, are likely to yield good gains in ecological performance. The lesser potential for Poukawa 2 is largely due to the waterway being deeply incised, with no meaningful connection to the floodplain.

Table 5.1 : Potential enhancement actions & assumed outcomes after vegetation reaches maturity (30 years)

Enhancement Action	Assumed Outcome
Floodplain vegetation enhancement	• 60% of floodplain covered in flax, shrubs and thick understorey • 40% covered in sedges and long grass
Riparian vegetation enhancement	• >50% of channel containing stable habitat and fish cover, primarily woody debris, root mats, rooted aquatic vegetation, overhanging bank-side vegetation • Three to four types of aquatic habitat such as woody debris, overhanging vegetation cover, undercut banks, deep water • 80% of water surface shaded by riparian and overhanging native vegetation • Developed native tree or scrub canopy with semi-intact understorey tier • High quality of riparian landforms suitable for galaxiid spawning • Mature status of native vegetation in riparian zone • 100% cover in native trees and bush 10 metres either side of stream wetted width • Increased woody debris, macrophyte, algae, leaf litter inputs to stream • 80% of wetted width shaded • 60% of wetted width covered by overhanging vegetation • Dissolved oxygen maintained at or near optimal

Table 5.2 : Potential improvement in ecological performance from floodplain & riparian vegetation enhancement at seven upper Karamu SEV sites (the current (C) & potential (P) SEV scores are shown)

Ecological Function	AWA1		AWA2		AWA3		KAR1		PAR1		POU1		POU2	
	C	P	C	P	C	P	C	P	C	P	C	P	C	P
Natural flow regime	0.60	0.60	0.60	0.60	0.64	0.64	0.60	0.60	0.68	0.68	0.68	0.68	0.60	0.60
Connectivity to floodplain	0.55	0.55	0.05	0.05	0.05	0.05	0.40	0.40	0.40	0.40	0.20	0.20	0.05	0.05
Connectivity for migrations	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Connectivity to groundwater	0.50	0.50	0.50	0.50	0.60	0.60	0.50	0.50	0.70	0.70	0.70	0.70	0.50	0.50
Water temperature control	0.54	0.88	0.53	0.83	0.88	0.85	0.53	0.83	0.52	0.85	0.58	0.88	0.68	0.82
Dissolved O_2 maintained	0.28	1.00	0.50	1.00	0.21	1.00	0.29	1.00	0.49	1.00	0.27	1.00	0.63	1.00
Organic matter input	0.01	0.60	0.00	0.60	0.12	0.60	0.12	0.60	0.00	0.60	0.06	0.60	0.29	0.60
Instream particle retention	0.75	0.75	0.59	0.59	0.60	0.60	0.70	0.70	0.64	0.64	0.91	0.91	0.59	0.59
Decontam. of pollutants	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Floodplain particle retention	0.48	0.66	0.21	0.33	0.13	0.33	0.50	0.50	0.49	0.56	0.38	0.43	0.26	0.33
Fish spawning habitat	0.16	0.35	0.50	0.50	0.24	0.75	0.88	1.00	0.88	1.00	0.59	0.63	0.50	0.50
Habitat for aquatic fauna	0.36	0.64	0.40	0.67	0.45	0.63	0.43	0.66	0.52	0.69	0.40	0.64	0.55	0.69
Riparian vegetation intact	0.37	1.00	0.43	1.00	0.35	1.00	0.43	1.00	0.37	1.00	0.43	1.00	0.45	1.00
SEV (mean function score)	0.508	0.733	0.485	0.628	0.481	0.696	0.568	0.753	0.590	0.779	0.554	0.743	0.547	0.667
Potential SEV gain(%)	44%		29%		45%		33%		32%		34%		22%	

Note: The functions for aquatic biodiversity are not included in these calculations because of the difficulty of predicting these outcomes. Consequently the SEV scores differ from the full scores given in Table 4.1.

6 Conclusions

By providing an integrated assessment of ecological functioning in a stream reach, the SEV score provides water managers with a standardised measure of ecological value based on the performance of stream functions. This assessment establishes that all seven of the upper Karamu study streams are significantly compromised by development in the catchment and particularly within the floodplain and riparian areas. It also highlights the functions which are most impaired and responsible for the decline in ecological functioning.

All these water courses are affected by agricultural development rather than urban development; the two most important factors being loss of floodplain and riparian vegetation and lack of connection to the floodplain due to placement of stopbanks.

An important conclusion of this assessment is that the action likely to provide the largest gains in ecological functioning is the enhancement of floodplain and riparian vegetation. Six of the seven study reaches have the potential to achieve a significant improvement in ecological functioning as a result of floodplain and riparian vegetation enhancement, although a 30 year timeframe would likely be required for the benefits to be fully realised.

7 References

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MWH

BUILDING A BETTER WORLD

APPENDICES

Appendix A: SEV Field Results

SEV (Stream Ecological Valuation) field sheet

Check Sheet

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10
Project #	

Project task	**Tick when completed**
Macroinvertebrates surveyed (do first)	√
Fish surveyed (do second)	
Site description sheet completed	√
Visual assessment sheets (3) completed	√
Cross section sheets (2) completed	√
Other components assessment sheet completed	√
Instream Retention datasheet completed	√
Habitat Assessment datasheet completed	√
Substrate Assessment datasheet completed	√
Photos taken	√

SEV (Stream Ecological Valuation) field sheet

Sheet 1 of 1

These field sheets have been designed to guide the collection of data suitable for assessment of stream reaches using the Stream Ecological Valuation technique (Rowe et al, 2006). A separate set of field sheets should be completed for each site. Where deviation from the listed method is used please provide details in comments section

Site description

Date	19.01.10	**Team**	DC AF (MWH)		**Current (tick)**	
Stream Name	Awanui	**Weather conditions**		**Clear/sunny**	√	**Has there been heavy rain in the past week (circle)?**
Site Code	AWA1			**Cloudy**		**Yes**
Site location	Crystal Road Bridge			**Rain**		No
GPS coordinates	**Easting**	2837191				
Upstream	**Northing**	6162026	**Photo nos**			
Downstream	**Easting**	2837107				
Site location map	**Northing**	6161920				

Comments

Temp	18.8 degrees C		
Conductivity	601 ms/cs		
DO%	12.9		
DO	1.22g/m3		
pH	6.8		

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)
Natural flow (NFR)	**1. Vbed**	**Extent of channel bed modification**	**Channel type**	**Proportion of channel affected (0 - 1)**
		See Figure p15 of SEV report for examples	Natural channel bed with no modification	0
			Natural channel bed but with some unnatural fine sediment loading	0
			Channelised with some or no modification (eg gabions)	1
			Channelised with total modification (eg concrete lining)	0

Natural flow (NFR)	**2. Verosn**	**Proportion of bank length affected by flood flows resulting in erosion (circle appropriate range)**	**<5%**
			6-30%
			31-60%
			61-100%

Connectivity to flood plain (CFP)	**3. Vfreq**	**Estimate of mean annual frequency of flooding**	**Estimated annual frequency of flood-plain inundation (circle appropriate value)**
		If no data available, estimate using informed judgement. Need to take into account position in catchment, bank height and channel dimensions, presence of debris and/or sediment of floodplain, wet soils, degree of upstream imperviousness, presence of detention ponds, extent of channelisation. Consultation with locals may be useful.	Rare (<1/yr)
			Occasional (1-2/yr)
			Often (3-5/yr)
			Frequent (>5/yr)

Connectivity for species migrations (CSM)	**4. Vbarr**	**Identify natural and artificial barriers**	**Barrier types (# in reach)**	**Barriers present (circle appropriate category)**
		See Figure p21 of SEV report for examples		**None**
				Partial
				Total

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10

Dissolved oxygen demand (DOM)	**5. Vdod**	**Score DOD as per descriptors in next column**	**Indicators of oxygen reducing processes**	**Status of stream substrate (circle appropriate category)**
			much black anaerobic sediment extensive sediment bubbling when disturbed sulphide odour when disturbed surface scums present abundant sewage fungus	Poor
			small patches of anaerobic sediment some sediment bubbling and sulphide odour when disturbed abundant macrophyte biomass some sewage fungus may be present	**Marginal**
			no anaerobic sediment no sediment bubbling or sulphide odour moderate macrophyte biomass	Sub-optimal
			no anaerobic sediment no bubbling or adours little or no macrophyte biomass	Optimal

Flood-plain particle retention (FPR)	**6. Vrough**	**Measures the thickness of vegetation on the floodplain**	**Proportion of banks covered by any of the following individual or combined vegetation types:**			
		Refer to Figure p 33 of SEV report for examples	**Bare, short grass (grazed, mown)**	**Sedges & long grass**	**Flax, shrubs, thick under-storey**	**Trees & thin under-storey**
			0.6	0.4		

Habitat for aquatic fauna (HAF)	**7. Vphyshab**	Provides an assessment of instream habitat quality	**Complete \Habitat Assessment Datasheet√**

Habitat for aquatic fauna (HAF)	**8. Vwatqual**	**Provides an assessment of the extent of shading upstream of the reach**	**Extent of stream upstream of the reach being assessed that is shaded**	**Tick appropriate category**
		Can estimate this using topographic maps as well as site visit	Well shaded (I.e. >50% of entire stream above site is forested)	
			Partially shaded (I.e. <50% of stream above site is forested)	
			Minimal shade (e.g. mainly pasture, but some riparian cover present)	
			No shade (mainly open pasture)	√

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10

Fish spawning habitat (FSH)	**9. Vgalspwn**	**This provides a measure of area of available spawning habitat for galaxiids**	**Length of spawning habitat (m)**
		Measure the length of near-flat (slope<10°) that would be inundated by floods or high tides. Measure entire bank edge length. Do for entire reach.	40

Fish spawning habitat (FSH)	**10. Vgalqual**	**This provides a measure of the quality of spawning habitat for galaxiids**	**Quality of spawning habitat (circle appropriate category)**
		Assess the quality of spawning habitat for galaxiids in terms of substrate vegetation among which eggs are deposited. Refer to Figure p36 of SEV report for examples.	High
			Medium
			Low

Riparian vegetation intact (RVI)	**11. Vripcond**	**Assesses the current condition of riparian vegetation within the stream reach**	**Status of riparian vegetation**	**Tick appropriate category**
			Mature indigenous vegetation, regeneration, diverse canopy and under-storey	
			intact mature canopy but damaged under-storey	
			regenerating bush (e.g. manuka scrub), low diversity, early stage in climax, protected	
			as for above but unprotected (e.g. cattle grazing in understorey)	
			occasional native trees present, non-native trees	
			areas of distuibed soils common (e.g. from animal pugging, herbicide use, cultivation in riparian areas)	
			grazed/short grass	√
			long grass	

Riparian vegetation intact (RVI)	**12. Vripconn**	**Assesses the connection between riparian trees and streams**	**Proportion of stream channel with linkages intact (0-1)**
		Determine the proportion of stream channel where the connection(s) between riparian trees and the stream channel (eg. Root linkages) are NOT prevented by culverts, concrete linings, gabions, fences etc	1

Riparian vegetation intact (RVI)	**13. Vripar**	**Assesses the intactness of the riparian zone**	**Proportion of intact riparian zone (0-1)**
		Measure the proportion of riparian buffer zone (defined as 10m on either side of the stream) that is covered by trees or bush. Measure as horizontal distance from stream.	0

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)	
Connectivity to flood plain (CFP)	**14. Vfpwidth**	**Floodplain width compared to wetted channel width (floodplain extent defined by annual flood level)**	**Cross-section #**	**Floodplain width (m) (A)**	**Wetted channel width (m) (B)**
			1	L 13.5 R2.7	7.5
			2	L13.0 R3.1	7.6
			3	L 8.8 R 4.2	10.8
			4	L 7.8 R9.5	5.3
			5	L7.6 R12.0	5.2
			6	L 6.8 R13.9	4.9
			7	L 6.2 R14.8	5.4
			8	L 5.9 R14.8	5.1
			9	L 4 R8.9	6
			10	L 8.6 R2	10.8
			Mean		

Water temperature control (WTC)	**15. Vdepth**	**Measure depth at selected positions across channel**	**Cross-section #**	**% of channel width/depth (m)**				
				0 L	**25**	**50**	**75**	**100 R**
		Water temperature control within a reach may be influenced by water depth, water velocity and the area of stream exposed to both solar radiation and ambient air temperature	1	0.02	0.84	0.47	0.26	0.02
			2	0.05	0.76	0.38	0.29	0.02
			3	0.05	0.53	0.3	0.36	0.03
			4	0.15	0.46	0.5	0.66	0.02
			5	0.02	0.71	0.6	0.69	0.02
			6	0.09	0.6	0.7	0.58	0.09
			7	0.04	0.55	0.69	0.8	0.05
			8	0.01	0.64	0.85	0.84	0.04
			9	0.3	0.82	1.2	/	/
			10	0.18	0.35	0.14	0.29	0.04
			Mean					

Determination of pollutants (DOP)	**16. Vsurf**	**Assess bio-surface type and proportional cover**	**Complete Substrate Assessment Sheet**
		Measure the proportions of biosurface categories for each cross section. Record at same time as substrate assessment	

Fish spawning habitat (FSH)	**17. Vgobspwn**	**Assesses the amount of available spawning habitat for bullies**	**Complete Substrate Assessment Sheet**
		Measure the proportions of hard substrate categories (excluding bedrock) for each cross section, as well as medium to large woody debris	

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10

Water temperature control (WTC)	**18. Vshade**	**Proportion of stream channel shaded by vegetation, topographic features and artifical structures**	**Cross-section #**	**Shaded proportion (A) (0 - 1)**
		Assess the proportion of shading that the stream surface is subject to. For example, zero shading would be a flat plain. Assume trees in full leaf (mid-summer conditions). Refer to Figure p25 of SEV report for examples	1	0.05
			2	0.05
			3	0.3
			4	0.1
			5	0.1
			6	0.05
			7	0.1
			8	0.1
			9	0.05
			10	
			Mean	

Organic matter input (OMI)	**19. Vcanop**	**Measures the amount of leaf fall likely to be contributed from overhead vegetation.**	**Cross-section #**	**Proportion of stream reach directly covered with overhead vegetation (0 - 1)**
			1	0.05
			2	0.05
			3	0
			4	0
			5	0
			6	0
			7	0
			8	0
			9	0
			10	
			Mean	

Organic matter input (OMI)	**20. Vdecid**	**Records whether or not overhead vegetation contributes leaf fall year round or only part of the year**	**Cross-section #**	**Proportion of canopy cover over stream that is deciduous (0-1)**
			1	0
			2	0
			3	0
			4	0
			5	0
			6	0
			7	0
			8	0
			9	0
			10	
			Mean	

SEV (Stream Ecological Valuation) field sheet

Other components

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10

Water temperature control (WTC)	**21. Vlength**	**Measure length of reach**	**Reach length (m) (L)**
		Standardise survey reach length among sites, if appropriate	150

Water temperature control (WTC)	**22. Vveloc**	**Calculate mean velocity (Sm)**	**Velocity (m/s)**
		Take gauging at 1 point	0.044508

Instream particle retention (IPR)	**23. Vtrans**	**This measure provides an assessment of the capacity of the stream reach to retain material**	**Complete Instream Retention Datasheet**
	24. Vretain		

Invertebrate fauna intact (IFI)	**25. Vmci**	**Provides a species list and community composition of macroinvertebrate fauna**	**Hard (HB) or soft (SB) bottomed sampling protocol applied?**
	26. Vept	Sample using ARC protocols for hard and soft-bottomed streams, as appropriate. 1 composite sample per site to be collected.	**SB**
	27. Vinvert		

Fish fauna intact (FFI)	**28. Vfish**	**Measures the species diversity of fish within the reach**	**Fish species present (list)**	
	29. Vvert	Electrofish with a single pass along the entire length of the stream reach. Also note any other vertebrates or large invertebrates.		

SEV (Stream Ecological Valuation) field sheet

23 and 24 Instream Retention Datasheet

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10

This needs to be undertaken at 2 sections (runs) within the reach, starting with an upper section and then working downstream. The value is obtained by a: running a measuring tape from top to bottom of the reach section, b: releasing 20 painted plastic paper triangles into the stream at the top of the reach section and 3: recording the distance downstream each triangle travels within the reach section, as well as the structure(s) they are retained on.

Run 1

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
4	1	PL
8	1	PL
15	1	PL
17	1	PL
0	5	AP
-2	3	AP
31	1	AP
40	7	Not retained

Run 2

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
0	4	AP
0.5	1	PL
1	3	PL
2	1	PL
19	1	PL
40	9	Not retained

Structures retaining leaves							
Boulders and cobbles	Large wood and tree roots	Rooted aquatic plants/	Periphyton and leaf litter	Small wood	Bankside vegetation	Non-natural debris	Pool
B	LW	AP	PERI	SW	VEGE	NON	PL

SEV (Stream Ecological Valuation) field sheet

16 and 17 Habitat Assessment Datasheet

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10

These data combined provide an assessment of instream habitat quality. For each habitat parameter, determine the most appropriate condition category for the survey reach, based on the descriptions provide. Within the selected condition category, circle the value which best describes the relative condition.

	Condition Category (circle most relevant value within range for category)			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Aquatic Habitat Abundance - proportion of stream channel occupied by sutable habitat fesatures for instream fauna	> 50% of channel favourable for epifaunal colonisation and fish cover; includes woody debris, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat. Also includes macrophyte dominated streams.	30-50% of channel contains stable habitat.	10-30% of channel contains stable habitat.	< 10% of channel contains stable habitat. Note: Algae does not constitute stable habitat.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 **6**	5 4 3 2 1 0
2. Aquatic Habitat Diversity	Wide variety of stable aquatic habitat types present including: woody debris, riffles, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat.	Moderate variety of habitat types; 3-4 habitats present including woody debris.	Habitat diversity limited to 1-2 types; woody debris rare or may be smothered by sediment.	Stable habitats lacking or limited to macrophytes (a few macrophyte species scores lower than several).
	20 19 18 17 16	15 14 13 12 11	10 9 **8** 7 6	5 4 3 2 1 0
3. Hydrologic Heterogeneity	Mixture of hydrologic conditions i.e. pool, riffle, run, chute, waterfalls; variety of pool sizes and depths.	Moderate variety of hydrologic conditions; deep and shallow pools present (pool size relative to size of stream).	Limited variety of hydrologic conditions; deep pools absent (pool size relative to size of stream).	Uniform hydrologic conditions; uniform depth and velocity; pools absent (includes uniformly deep streams).
	20 19 18 17 16	15 14 13 12 11	10 9 **8** 7 6	5 4 3 2 1 0
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Shade	>80% of water surface shaded. Full canopy.	60 - 80% of water surface shaded; mostly shaded with open patches.	20 - 60% of water surface shaded; mostly open with shaded patches.	<20% of water surface shaded. Fully open; lack of canopy cover.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 **1** 0
7.Riparian Vegetation Integrity (within 20 meters)	No direct human activity in the last 30 years; mature native tree canopy and intact native understory	Minimal human activity; mature native tree canopy or native scrub; understory shows some impact (e.g. weeds, feral animal grazing).	Extensive human activity affecting canopy and understory; trees exotic (pine, willow, poplar); understory native or exotic.	Extensive human activity; little or no canopy; managed vegetation (e.g. livestock grazing, mowed); permanent structures may be present (e.g. building, roads, carparks).
Left bank	10 9	8 7 6	5 4 3	2 **1** 0
Right bank	10 9	8 7 6	5 4 3	**2** 1 0

SEV (Stream Ecological Valuation) field sheet

Substrate Assessment Datasheet

Stream Name	Awanui
Site Code	AWA1
Date	19.01.10

This assessment addresses spawning habitat for gobies, as well as providing data for assessment of the decontamination capacity of the stream reach based on organic material. The aim is to determine the relative proportion of different substrates and organic material within the reach. This can be acheived either through a broad-scale reach assessment (where diversity of types is low) or by detailed cross-section information(where diversity is of types is high). Where cross-sections are surveyed, divide the stream into 10 equally spaced points. At each point record the predominant substrate categories immediately in front of the mid-line of your boot or similar (1 = present). At the same point also record the organic material below/above the substrate (1=present). Remember to record the substrate underneath the organic material (in inorganic category). Record material only from stream bed.

Record the dominant substrate (inorganic or wood) at a minimum of 10 points across each cross-section

Inorganic material category										Wood		
Substrate category	**SI/SA**	**SG**	**SMG**	**MLG**	**LG**	**SC**	**LC**	**B**	**BR**	**SW (<25)**	**MW (25-100)**	**LW (>100)**
Size (mm)/Cross-section #	**<2**	**2-8**	**8-16**	**16-32**	**32-64**	**64-128**	**128-256**	**>256**				
1	10											
2	9	1			1							
3	7		1	1	1							
4	7		3									
5	8		1								1	
6	7		1							1		1
7	8	1		1								
8	8	1	1									
9	10											
10	10											

Record dominant organic material (if any) on substrate at same 10 points as substrate

Organic material category			
Cross-section #	**Leaf litter**	**Periphyton, submerged macrophytes**	**Roots, plus emergent and floating vegetation**
1			6
2		4	8
3		5	7
4		4	3
5			7
6		3	4
7	1	3	6
8	1	1	6
9	3	4	6
10	1	2	3

Substrate category descriptors

SI/SA	Silt/Sand	**MLG**	Medium-large gravel	**LC**	Large cobbles	**SW**	Small wood
SG	Small gravel	**LG**	Large gravel	**B**	Boulders	**MW**	Medium wod
SMG	Small-medium gravel	**SC**	Small cobbles	**Bedrock**		**LW**	Large wood

SEV (Stream Ecological Valuation) field sheet

Check Sheet

Stream Name	Awanui
Site Code	AWA2
Date	21.01.10
Project #	

Project task	**Tick when completed**
Macroinvertebrates surveyed (do first)	√
Fish surveyed (do second)	
Site description sheet completed	√
Visual assessment sheets (3) completed	√
Cross section sheets (2) completed	√
Other components assessment sheet completed	√
Instream Retention datasheet completed	√
Habitat Assessment datasheet completed	√
Substrate Assessment datasheet completed	√
Photos taken	√

SEV (Stream Ecological Valuation) field sheet

Sheet 1 of 1

These field sheets have been designed to guide the collection of data suitable for assessment of stream reaches using the Stream Ecological Valuation technique (Rowe et al, 2006). A separate set of field sheets should be completed for each site. Where deviation from the listed method is used please provide details in comments section

Site description

Date	21.01.10	**Team**	DC AF (MWH)		**Current (tick)**	
Stream Name	Awanui	**Weather conditions**		**Clear/sunny**		**Has there been heavy rain in the past week (circle)?**
Site Code	AWA2			**Cloudy**		**Yes**
Site location	Crystal Road Bridge			**Rain**	√	No
GPS coordinates	**Easting**	2831930				
Upstream	**Northing**	6162070	**Photo nos**			
Downstream	**Easting**	2832045				
Site location map	**Northing**	6161980				

Comments

Temp	20 degrees C		
Conductivity	566 ms/cs		
DO%	46.5		
DO	4.22g/m3		
pH	6.95		

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Awanui
Site Code	AWA2
Date	21.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)
Natural flow (NFR)	**1. Vbed**	**Extent of channel bed modification**	**Channel type**	**Proportion of channel affected (0 - 1)**
		See Figure p15 of SEV report for examples	Natural channel bed with no modification	0
			Natural channel bed but with some unnatural fine sediment loading	0
			Channelised with some or no modification (eg gabions)	1
			Channelised with total modification (eg concrete lining)	0

Natural flow (NFR)	**2. Verosn**	**Proportion of bank length affected by flood flows resulting in erosion (circle appropriate range)**	**<5%**
			6-30%
			31-60%
			61-100%

Connectivity to flood plain (CFP)	**3. Vfreq**	**Estimate of mean annual frequency of flooding**	**Estimated annual frequency of flood-plain inundation (circle appropriate value)**
		If no data available, estimate using informed judgement. Need to take into account position in catchment, bank height and channel dimensions, presence of debris and/or sediment of floodplain, wet soils, degree of upstream imperviousness, presence of detention ponds, extent of channelisation. Consultation with locals may be useful.	**Rare (<1/yr)**
			Occasional (1-2/yr)
			Often (3-5/yr)
			Frequent (>5/yr)

Connectivity for species migrations (CSM)	**4. Vbarr**	**Identify natural and artificial barriers**	**Barrier types (# in reach)**	**Barriers present (circle appropriate category)**
		See Figure p21 of SEV report for examples		**None**
				Partial
				Total

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Awanui
Site Code	AWA2
Date	21.01.10

			Indicators of oxygen reducing processes	**Status of stream substrate (circle appropriate category)**
Dissolved oxygen demand (DOM)	**5. Vdod**	**Score DOD as per descriptors in next column**	much black anaerobic sediment extensive sediment bubbling when disturbed sulphide odour when disturbed surface scums present abundant sewage fungus	Poor
			small patches of anaerobic sediment some sediment bubbling and sulphide odour when disturbed abundant macrophyte biomass some sewage fungus may be present	Marginal
			no anaerobic sediment no sediment bubbling or sulphide odour moderate macrophyte biomass	**Sub-optimal**
			no anaerobic sediment no bubbling or adours little or no macrophyte biomass	Optimal

Flood-plain particle retention (FPR)	**6. Vrough**	**Measures the thickness of vegetation on the floodplain**	**Proportion of banks covered by any of the following individual or combined vegetation types:**			
		Refer to Figure p 33 of SEV report for examples	**Bare, short grass (grazed, mown)**	**Sedges & long grass**	**Flax, shrubs, thick under-storey**	**Trees & thin under-storey**
			0.3	0.7		

Habitat for aquatic fauna (HAF)	**7. Vphyshab**	Provides an assessment of instream habitat quality	**Complete \Habitat Assessment Datasheet √**

Habitat for aquatic fauna (HAF)	**8. Vwatqual**	**Provides an assessment of the extent of shading upstream of the reach**	**Extent of stream upstream of the reach being assessed that is shaded**	**Tick appropriate category**
		Can estimate this using topographic maps as well as site visit	Well shaded (I.e. >50% of entire stream above site is forested)	
			Partially shaded (I.e. <50% of stream above site is forested)	
			Minimal shade (e.g. mainly pasture, but some riparian cover present)	√
			No shade (mainly open pasture)	

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Awanui
Site Code	AWA2
Date	21.01.10

Fish spawning habitat (FSH)	**9. Vgalspwn**	**This provides a measure of area of available spawning habitat for galaxiids**	**Length of spawning habitat (m)**
		Measure the length of near-flat (slope<10°) that would be inundated by floods or high tides. Measure entire bank edge length. Do for entire reach.	0

Fish spawning habitat (FSH)	**10. Vgalqual**	**This provides a measure of the quality of spawning habitat for galaxiids**	**Quality of spawning habitat (circle appropriate category)**
		Assess the quality of spawning habitat for galaxiids in terms of substrate vegetation among which eggs are deposited. Refer to Figure p36 of SEV report for examples.	High
			Medium
			Low

Riparian vegetation intact (RVI)	**11. Vripcond**	**Assesses the current condition of riparian vegetation within the stream reach**	**Status of riparian vegetation**	**Tick appropriate category**
			Mature indigenous vegetation, regeneration, diverse canopy and under-storey	
			intact mature canopy but damaged under-storey	
			regenerating bush (e.g. manuka scrub), low diversity, early stage in climax, protected	
			as for above but unprotected (e.g. cattle grazing in understorey)	
			occasional native trees present, non-native trees	
			areas of distuibed soils common (e.g. from animal pugging, herbicide use, cultivation in riparian areas)	
			grazed/short grass	
			long grass	√

Riparian vegetation intact (RVI)	**12. Vripconn**	**Assesses the connection between riparian trees and streams**	**Proportion of stream channel with linkages intact (0-1)**
		Determine the proportion of stream channel where the connection(s) between riparian trees and the stream channel (eg. Root linkages) are NOT prevented by culverts, concrete linings, gabions, fences etc	1

Riparian vegetation intact (RVI)	**13. Vripar**	**Assesses the intactness of the riparian zone**	**Proportion of intact riparian zone (0-1)**
		Measure the proportion of riparian buffer zone (defined as 10m on either side of the stream) that is covered by trees or bush. Measure as horizontal distance from stream.	0

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Awanui
Site Code	AWA2
Date	21.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)	
Connectivity to flood plain (CFP)	**14. Vfpwidth**	**Floodplain width compared to wetted channel width (floodplain extent defined by annual flood level)**	**Cross-section #**	**Floodplain width (m) (A)**	**Wetted channel width (m) (B)**
			1	L 0 R0	2.7
			2	L0.1 R0.3	2.7
			3	L 0.5 R 0.8	3
			4	L 0.5 R1.2	3.4
			5	L0 R0.1	4.3
			6	L 0 R0.8	4.2
			7	L 0 R0.9	4
			8	L 0.1 R0.8	4.3
			9	L 0.5 R0.5	4
			10	L 0.6 R0.5	3.7
			Mean		

Water temperature control (WTC)	**15. Vdepth**	**Measure depth at selected positions across channel**	**Cross-section #**	**% of channel width/depth (m)**				
				0 L	**25**	**50**	**75**	**100 R**
		Water temperature control within a reach may be influenced by water depth, water velocity and the area of stream exposed to both solar radiation and ambient air temperature	1	0.05	0.08	0.08	0.1	0.01
			2	0.01	0.2	0.25	0.15	0.01
			3	0.01	0.1	0.08	0.08	0.01
			4	0.05	0.11	0.14	0.18	0.1
			5	0.05	0.5	0.38	0.26	0.05
			6	0.1	0.3	0.45	0.35	0.05
			7	0.05	0.2	0.35	0.4	0..35
			8	0.05	0.25	0.25	0.35	0.1
			9	0.05	0.4	0.35	0.2	0.05
			10	0.05	0.45	0.5	0.4	0.1
			Mean					

Determination of pollutants (DOP)	**16. Vsurf**	**Assess bio-surface type and proportional cover**	**Complete Substrate Assessment Sheet**
		Measure the proportions of biosurface categories for each cross section. Record at same time as substrate assessment	

Fish spawning habitat (FSH)	**17. Vgobspwn**	**Assesses the amount of available spawning habitat for bullies**	**Complete Substrate Assessment Sheet**
		Measure the proportions of hard substrate categories (excluding bedrock) for each cross section, as well as medium to large woody debris	

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Awanui
Site Code	AWA2
Date	21.01.10

Water temperature control (WTC)	**18. Vshade**	**Proportion of stream channel shaded by vegetation, topographic features and artifical structures**	**Cross-section #**	**Shaded proportion (A) (0 - 1)**
		Assess the proportion of shading that the stream surface is subject to. For example, zero shading would be a flat plain. Assume trees in full leaf (mid-summer conditions). Refer to Figure p25 of SEV report for examples	1	0.05
			2	0.05
			3	0
			4	0.2
			5	0.1
			6	0.2
			7	0.1
			8	0.1
			9	0.1
			10	0.1
			Mean	

Organic matter input (OMI)	**19. Vcanop**	**Measures the amount of leaf fall likely to be contributed from overhead vegetation.**	**Cross-section #**	**Proportion of stream reach directly covered with overhead vegetation (0 - 1)**
			1	0
			2	0
			3	0
			4	0
			5	0
			6	0
			7	0
			8	0
			9	0
			10	0
			Mean	

Organic matter input (OMI)	**20. Vdecid**	**Records whether or not overhead vegetation contributes leaf fall year round or only part of the year**	**Cross-section #**	**Proportion of canopy cover over stream that is deciduous (0-1)**
			1	0
			2	0
			3	0
			4	0
			5	0
			6	0
			7	0
			8	0
			9	0
			10	0
			Mean	

SEV (Stream Ecological Valuation) field sheet

Other components

Stream Name	Awanui
Site Code	AWA2
Date	21.01.10

Water temperature control (WTC)	**21. Vlength**	**Measure length of reach**	**Reach length (m) (L)**
		Standardise survey reach length among sites, if appropriate	150

Water temperature control (WTC)	**22. Vveloc**	**Calculate mean velocity (Sm)**	**Velocity (m/s)**
		Take gauging at 1 point	0.037032

Instream particle retention (IPR)	**23. Vtrans**	**This measure provides an assessment of the capacity of the stream reach to retain material**	**Complete Instream Retention Datasheet**
	24. Vretain		

Invertebrate fauna intact (IFI)	**25. Vmci**	**Provides a species list and community composition of macroinvertebrate fauna**	**Hard (HB) or soft (SB) bottomed sampling protocol applied?**
	26. Vept	Sample using ARC protocols for hard and soft-bottomed streams, as appropriate. 1 composite sample per site to be collected.	**HB**
	27. Vinvert		

Fish fauna intact (FFI)	**28. Vfish**	**Measures the species diversity of fish within the reach**	**Fish species present (list)**	
	29. Vvert	Electrofish with a single pass along the entire length of the stream reach. Also note any other vertebrates or large invertebrates.		

SEV (Stream Ecological Valuation) field sheet

Sheet 1 of 1

23 and 24 Instream Retention Datasheet

Stream Name		Awanui
Site Code		AWA2
Date		21.01.10

This needs to be undertaken at 2 sections (runs) within the reach, starting with an upper section and then working downstream. The value is obtained by a: running a measuring tape from top to bottom of the reach section, b: releasing 20 painted plastic paper triangles into the stream at the top of the reach section and 3: recording the distance downstream each triangle travels within the reach section, as well as the structure(s) they are retained on.

Run 1

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
20	2	AP
35	1	AP
5	3	PL
1	5	PL
9	1	AP
2	2	PL
40-6	Not retained	

Run 2

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
30	1	PL
26	1	PL
25	3	PL
15	5	AP
4	5	PL
1	2	PL
40	3	Not retained

Structures retaining leaves							
Boulders and cobbles	Large wood and tree roots	Rooted aquatic plants/	Periphyton and leaf litter	Small wood	Bankside vegetation	Non-natural debris	Pool
B	LW	AP	PERI	SW	VEGE	NON	PL

SEV (Stream Ecological Valuation) field sheet

16 and 17 Habitat Assessment Datasheet

Stream Name	Awanui
Site Code	AWA2
Date	21.01.10

These data combined provide an assessment of instream habitat quality. For each habitat parameter, determine the most appropriate condition category for the survey reach, based on the descriptions provide. Within the selected condition category, circle the value which best describes the relative condition.

	Condition Category (circle most relevant value within range for category)			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Aquatic Habitat Abundance - proportion of stream channel occupied by sutable habitat fesatures for instream fauna	> 50% of channel favourable for epifaunal colonisation and fish cover; includes woody debris, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat. Also includes macrophyte dominated streams.	30-50% of channel contains stable habitat.	10-30% of channel contains stable habitat.	< 10% of channel contains stable habitat. Note: Algae does not constitute stable habitat.
	20 19 18 17 16	15 14 13 12 11	10 **9** 8 7 6	5 4 3 2 1 0
2. Aquatic Habitat Diversity	Wide variety of stable aquatic habitat types present including: woody debris, riffles, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat.	Moderate variety of habitat types; 3-4 habitats present including woody debris.	Habitat diversity limited to 1-2 types; woody debris rare or may be smothered by sediment.	Stable habitats lacking or limited to macrophytes (a few macrophyte species scores lower than several).
	20 19 18 17 16	15 14 13 12 11	10 9 **8** 7 6	5 4 3 2 1 0
3. Hydrologic Heterogeneity	Mixture of hydrologic conditions i.e. pool, riffle, run, chute, waterfalls; variety of pool sizes and depths.	Moderate variety of hydrologic conditions; deep and shallow pools present (pool size relative to size of stream).	Limited variety of hydrologic conditions; deep pools absent (pool size relative to size of stream).	Uniform hydrologic conditions; uniform depth and velocity; pools absent (includes uniformly deep streams).
	20 19 18 17 16	15 14 13 12 11	10 **9** 8 7 6	5 4 3 2 1 0
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Shade	>80% of water surface shaded. Full canopy.	60 - 80% of water surface shaded; mostly shaded with open patches.	20 - 60% of water surface shaded; mostly open with shaded patches.	<20% of water surface shaded. Fully open; lack of canopy cover.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 **2** 1 0
7.Riparian Vegetation Integrity (within 20 meters)	No direct human activity in the last 30 years; mature native tree canopy and intact native understory	Minimal human activity; mature native tree canopy or native scrub; understory shows some impact (e.g. weeds, feral animal grazing).	Extensive human activity affecting canopy and understory; trees exotic (pine, willow, poplar); understory native or exotic.	Extensive human activity; little or no canopy; managed vegetation (e.g. livestock grazing, mowed); permanent structures may be present (e.g. building, roads, carparks).
Left bank	10 9	8 7 6	5 4 3	2 **1** 0
Right bank	10 9	8 7 6	5 4 3	2 **1** 0

SEV (Stream Ecological Valuation) field sheet

Substrate Assessment Datasheet

Stream Name	Awanui
Site Code	AWA2
Date	21.01.10

This assessment addresses spawning habitat for gobies, as well as providing data for assessment of the decontamination capacity of the stream reach based on organic material. The aim is to determine the relative proportion of different substrates and organic material within the reach. This can be acheived either through a broad-scale reach assessment (where diversity of types is low) or by detailed cross-section information(where diversity is of types is high). Where cross-sections are surveyed, divide the stream into 10 equally spaced points. At each point record the predominant substrate categories immediately in front of the mid-line of your boot or similar (1 = present). At the same point also record the organic material below/above the substrate (1=present). Remember to record the substrate underneath the organic material (in inorganic category). Record material only from stream bed.

Record the dominant substrate (inorganic or wood) at a minimum of 10 points across each cross-section

Inorganic material category										Wood		
Substrate category	**SI/SA**	**SG**	**SMG**	**MLG**	**LG**	**SC**	**LC**	**B**	**BR**	**SW (<25)**	**MW (25-100)**	**LW (>100)**
Size (mm)/Cross-section #	**<2**	**2-8**	**8-16**	**16-32**	**32-64**	**64-128**	**128-256**	**>256**				
1	2	2		1	2	2	1					
2	4	1	1		1		1	1		1		
3	1	1		2			1	3	2			
4	1	3				1			5			
5	4		1	1	1	1			1	1		
6	8			1	1							
7	8	1				1						
8	8	1	1									
9	8											
10	8		1									

Record dominant organic material (if any) on substrate at same 10 points as substrate

Organic material category			
Cross-section #	**Leaf litter**	**Periphyton, submerged macrophytes**	**Roots, plus emergent and floating vegetation**
1		3	8
2	1	1	3
3		1	3
4	2	3	
5	5	1	2
6	4		2
7	6		2
8	5		2
9	5		1
10	5		2

Substrate category descriptors

SI/SA	Silt/Sand	**MLG**	Medium-large gravel	**LC**	Large cobbles	**SW**	Small wood
SG	Small gravel	**LG**	Large gravel	**B**	Boulders	**MW**	Medium wod
SMG	Small-medium gravel	**SC**	Small cobbles	**Bedrock**		**LW**	Large wood

SEV (Stream Ecological Valuation) field sheet

Check Sheet

Stream Name	Awanui
Site Code	AWA3
Date	20.01.10
Project #	

Project task	**Tick when completed**
Macroinvertebrates surveyed (do first)	√
Fish surveyed (do second)	
Site description sheet completed	√
Visual assessment sheets (3) completed	√
Cross section sheets (2) completed	√
Other components assessment sheet completed	√
Instream Retention datasheet completed	√
Habitat Assessment datasheet completed	√
Substrate Assessment datasheet completed	√
Photos taken	√

SEV (Stream Ecological Valuation) field sheet

These field sheets have been designed to guide the collection of data suitable for assessment of stream reaches using the Stream Ecological Valuation technique (Rowe et al, 2006). A separate set of field sheets should be completed for each site. Where deviation from the listed method is used please provide details in comments section

Site description

Date	20.01.10	**Team**	DC (MWH)		**Current (tick)**	
Stream Name	Awanui	**Weather conditions**		**Clear/sunny**	√	**Has there been heavy rain in the past week (circle)?**
Site Code	AWA3			**Cloudy**		**Yes**
Site location				**Rain**		No
GPS coordinates	**Easting**	2826969				
Upstream	**Northing**	6160116	**Photo nos**	2		
Downstream	**Easting**	2826956				
Site location map	**Northing**	6160228				

Comments

Temp	21.3 degrees C		
Conductivity	378 ms/cs		
DO%	38.6		
DO	3.5g/m3		
pH	7.27		

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Awanui
Site Code	AWA3
Date	20.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)
Natural flow (NFR)	**1. Vbed**	**Extent of channel bed modification**	**Channel type**	**Proportion of channel affected (0 - 1)**
		See Figure p15 of SEV report for examples	Natural channel bed with no modification	0
			Natural channel bed but with some unnatural fine sediment loading	1
			Channelised with some or no modification (eg gabions)	0
			Channelised with total modification (eg concrete lining)	0

Natural flow (NFR)	**2. Verosn**	**Proportion of bank length affected by flood flows resulting in erosion (circle appropriate range)**	**<5%**
			6-30%
			31-60%
			61-100%

Connectivity to flood plain (CFP)	**3. Vfreq**	**Estimate of mean annual frequency of flooding**	**Estimated annual frequency of flood-plain inundation (circle appropriate value)**
		If no data available, estimate using informed judgement. Need to take into account position in catchment, bank height and channel dimensions, presence of debris and/or sediment of floodplain, wet soils, degree of upstream imperviousness, presence of detention ponds, extent of channelisation. Consultation with locals may be useful.	**Rare (<1/yr)**
			Occasional (1-2/yr)
			Often (3-5/yr)
			Frequent (>5/yr)

Connectivity for species migrations (CSM)	**4. Vbarr**	**Identify natural and artificial barriers**	**Barrier types (# in reach)**	**Barriers present (circle appropriate category)**
		See Figure p21 of SEV report for examples		**None**
				Partial
				Total

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Awanui
Site Code	AWA3
Date	20.01.10

Dissolved oxygen demand (DOM)	**5. Vdod**	**Score DOD as per descriptors in next column**	**Indicators of oxygen reducing processes**	**Status of stream substrate (circle appropriate category)**
			much black anaerobic sediment extensive sediment bubbling when disturbed sulphide odour when disturbed surface scums present abundant sewage fungus	Poor
			small patches of anaerobic sediment some sediment bubbling and sulphide odour when disturbed abundant macrophyte biomass some sewage fungus may be present	**Marginal**
			no anaerobic sediment no sediment bubbling or sulphide odour moderate macrophyte biomass	Sub-optimal
			no anaerobic sediment no bubbling or adours little or no macrophyte biomass	Optimal

Flood-plain particle retention (FPR)	**6. Vrough**	**Measures the thickness of vegetation on the floodplain**	**Proportion of banks covered by any of the following individual or combined vegetation types:**			
		Refer to Figure p 33 of SEV report for examples	**Bare, short grass (grazed, mown)**	**Sedges & long grass**	**Flax, shrubs, thick under-storey**	**Trees & thin under-storey**
			0.8	0.3		

Habitat for aquatic fauna (HAF)	**7. Vphyshab**	Provides an assessment of instream habitat quality	**Complete \Habitat Assessment Datasheet √**

Habitat for aquatic fauna (HAF)	**8. Vwatqual**	**Provides an assessment of the extent of shading upstream of the reach**	**Extent of stream upstream of the reach being assessed that is shaded**	**Tick appropriate category**
		Can estimate this using topographic maps as well as site visit	Well shaded (I.e. >50% of entire stream above site is forested)	
			Partially shaded (I.e. <50% of stream above site is forested)	
			Minimal shade (e.g. mainly pasture, but some riparian cover present)	√
			No shade (mainly open pasture)	

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Awanui
Site Code	AWA3
Date	20.01.10

Fish spawning habitat (FSH)	**9. Vgalspwn**	**This provides a measure of area of available spawning habitat for galaxiids**	**Length of spawning habitat (m)**
		Measure the length of near-flat (slope<10°) that would be inundated by floods or high tides. Measure entire bank edge length. Do for entire reach.	60

Fish spawning habitat (FSH)	**10. Vgalqual**	**This provides a measure of the quality of spawning habitat for galaxiids**	**Quality of spawning habitat (circle appropriate category)**
		Assess the quality of spawning habitat for galaxiids in terms of substrate vegetation among which eggs are deposited. Refer to Figure p36 of SEV report for examples.	High
			Medium
			Low

Riparian vegetation intact (RVI)	**11. Vripcond**	**Assesses the current condition of riparian vegetation within the stream reach**	**Status of riparian vegetation**	**Tick appropriate category**
			Mature indigenous vegetation, regeneration, diverse canopy and under-storey	
			intact mature canopy but damaged under-storey	
			regenerating bush (e.g. manuka scrub), low diversity, early stage in climax, protected	
			as for above but unprotected (e.g. cattle grazing in understorey)	
			occasional native trees present, non-native trees	
			areas of distuibed soils common (e.g. from animal pugging, herbicide use, cultivation in riparian areas)	√
			grazed/short grass	
			long grass	

Riparian vegetation intact (RVI)	**12. Vripconn**	**Assesses the connection between riparian trees and streams**	**Proportion of stream channel with linkages intact (0-1)**
		Determine the proportion of stream channel where the connection(s) between riparian trees and the stream channel (eg. Root linkages) are NOT prevented by culverts, concrete linings, gabions, fences etc	1

Riparian vegetation intact (RVI)	**13. Vripar**	**Assesses the intactness of the riparian zone**	**Proportion of intact riparian zone (0-1)**
		Measure the proportion of riparian buffer zone (defined as 10m on either side of the stream) that is covered by trees or bush. Measure as horizontal distance from stream.	0

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Awanui
Site Code	AWA3
Date	20.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)	
Connectivity to flood plain (CFP)	**14. Vfpwidth**	**Floodplain width compared to wetted channel width (floodplain extent defined by annual flood level)**	**Cross-section #**	**Floodplain width (m) (A)**	**Wetted channel width (m) (B)**
			1	L 3 R5	10
			2	L0 R0	2.9
			3	L 10 R 6	7.1
			4	L 11 R0.5	7.2
			5	L3 R1	10.2
			6	L 3 R2	8.1
			7	L 4 R1.5	10.3
			8	L 3.5 R0.5	9.2
			9	L 3.5 R0.5	11.8
			10	L 3 R0.5	12.9
			Mean		

Water temperature control (WTC)	**15. Vdepth**	**Measure depth at selected positions across channel**	**Cross-section #**	**% of channel width/depth (m)**				
				0 L	**25**	**50**	**75**	**100 R**
		Water temperature control within a reach may be influenced by water depth, water velocity and the area of stream exposed to both solar radiation and ambient air temperature	1	0.05	0.3	0.2	0.1	0.1
			2	0.1	0.58	0.65	0.34	0.9
			3	0.1	0.4	0.55	0.38	0.05
			4	0.2	0.61	0.79	0.8	0.41
			5	0.1	0.2	0.15	0.55	0.31
			6	0.05	0.23	0.55	0.78	0.1
			7	0.05	0.1	0.15	0.55	0.1
			8	0.05	0.1	0.05	0.45	0.2
			9	0.05	0.1	0.55	0	0.2
			10	0.05	0.1	0	0.86	0.4
			Mean					

Determination of pollutants (DOP)	**16. Vsurf**	**Assess bio-surface type and proportional cover**	**Complete Substrate Assessment Sheet**
		Measure the proportions of biosurface categories for each cross section. Record at same time as substrate assessment	

Fish spawning habitat (FSH)	**17. Vgobspwn**	**Assesses the amount of available spawning habitat for bullies**	**Complete Substrate Assessment Sheet**
		Measure the proportions of hard substrate categories (excluding bedrock) for each cross section, as well as medium to large woody debris	

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Awanui
Site Code	AWA3
Date	20.01.10

Water temperature control (WTC)	**18. Vshade**	**Proportion of stream channel shaded by vegetation, topographic features and artifical structures**	**Cross-section #**	**Shaded proportion (A) (0 - 1)**
		Assess the proportion of shading that the stream surface is subject to. For example, zero shading would be a flat plain. Assume trees in full leaf (mid-summer conditions). Refer to Figure p25 of SEV report for examples	1	0.9
			2	0.7
			3	0.8
			4	1
			5	0.9
			6	0.8
			7	0.9
			8	0.9
			9	0.9
			10	0.9
			Mean	

Organic matter input (OMI)	**19. Vcanop**	**Measures the amount of leaf fall likely to be contributed from overhead vegetation.**	**Cross-section #**	**Proportion of stream reach directly covered with overhead vegetation (0 - 1)**
			1	0
			2	0
			3	0.2
			4	1
			5	0.1
			6	0
			7	0
			8	0
			9	0
			10	0
			Mean	

Organic matter input (OMI)	**20. Vdecid**	**Records whether or not overhead vegetation contributes leaf fall year round or only part of the year**	**Cross-section #**	**Proportion of canopy cover over stream that is deciduous (0-1)**
			1	0
			2	0
			3	1
			4	1
			5	0
			6	0
			7	0
			8	0
			9	0
			10	0
			Mean	

SEV (Stream Ecological Valuation) field sheet

Stream Name	Awanui
Site Code	AWA3
Date	20.01.10

Other components

Water temperature control (WTC)	**21. Vlength**	**Measure length of reach**	**Reach length (m) (L)**
		Standardise survey reach length among sites, if appropriate	150

Water temperature control (WTC)	**22. Vveloc**	**Calculate mean velocity (Sm)**	**Velocity (m/s)**
		Take gauging at 1 point	0.008391

Instream particle retention (IPR)	**23. Vtrans**	**This measure provides an assessment of the capacity of the stream reach to retain material**	**Complete Instream Retention Datasheet**
	24. Vretain		

Invertebrate fauna intact (IFI)	**25. Vmci**	**Provides a species list and community composition of macroinvertebrate fauna**	**Hard (HB) or soft (SB) bottomed sampling protocol applied?**
	26. Vept	Sample using ARC protocols for hard and soft-bottomed streams, as appropriate. 1 composite sample per site to be collected.	**SB**
	27. Vinvert		

Fish fauna intact (FFI)	**28. Vfish**	**Measures the species diversity of fish within the reach**	**Fish species present (list)**	
	29. Vvert	Electrofish with a single pass along the entire length of the stream reach. Also note any other vertebrates or large invertebrates.		

SEV (Stream Ecological Valuation) field sheet

23 and 24 Instream Retention Datasheet

Stream Name		Awanui
Site Code		AWA3
Date		20.01.10

This needs to be undertaken at 2 sections (runs) within the reach, starting with an upper section and then working downstream. The value is obtained by a: running a measuring tape from top to bottom of the reach section, b: releasing 20 painted plastic paper triangles into the stream at the top of the reach section and 3: recording the distance downstream each triangle travels within the reach section, as well as the structure(s) they are retained on.

Run 1

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
0	20	AP

Run 2

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
0	20	AP

Structures retaining leaves							
Boulders and cobbles	Large wood and tree roots	Rooted aquatic plants/	Periphyton and leaf litter	Small wood	Bankside vegetation	Non-natural debris	Pool
B	LW	AP	PERI	SW	VEGE	NON	PL

SEV (Stream Ecological Valuation) field sheet

16 and 17 Habitat Assessment Datasheet

Stream Name	Awanui
Site Code	AWA3
Date	20.01.10

These data combined provide an assessment of instream habitat quality. For each habitat parameter, determine the most appropriate condition category for the survey reach, based on the descriptions provide. Within the selected condition category, circle the value which best describes the relative condition.

	Condition Category (circle most relevant value within range for category)			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Aquatic Habitat Abundance - proportion of stream channel occupied by sutable habitat fesatures for instream fauna	> 50% of channel favourable for epifaunal colonisation and fish cover; includes woody debris, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat. Also includes macrophyte dominated streams.	30-50% of channel contains stable habitat.	10-30% of channel contains stable habitat.	< 10% of channel contains stable habitat. Note: Algae does not constitute stable habitat.
	20 19 18 17 16	15 14 13 12 11	10 9 **8** 7 6	5 4 3 2 1 0
2. Aquatic Habitat Diversity	Wide variety of stable aquatic habitat types present including: woody debris, riffles, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat.	Moderate variety of habitat types; 3-4 habitats present including woody debris.	Habitat diversity limited to 1-2 types; woody debris rare or may be smothered by sediment.	Stable habitats lacking or limited to macrophytes (a few macrophyte species scores lower than several).
	20 19 18 17 16	15 14 13 12 11	10 9 8 **7** 6	5 4 3 2 1 0
3. Hydrologic Heterogeneity	Mixture of hydrologic conditions i.e. pool, riffle, run, chute, waterfalls; variety of pool sizes and depths.	Moderate variety of hydrologic conditions; deep and shallow pools present (pool size relative to size of stream).	Limited variety of hydrologic conditions; deep pools absent (pool size relative to size of stream).	Uniform hydrologic conditions; uniform depth and velocity; pools absent (includes uniformly deep streams).
	20 19 18 17 16	15 14 13 12 11	10 9 **8** 7 6	5 4 3 2 1 0
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Shade	>80% of water surface shaded. Full canopy.	60 - 80% of water surface shaded; mostly shaded with open patches.	20 - 60% of water surface shaded; mostly open with shaded patches.	<20% of water surface shaded. Fully open; lack of canopy cover.
	20 19 18 17 16	15 14 **13** 12 11	10 9 8 7 6	5 4 3 2 1 0
7.Riparian Vegetation Integrity (within 20 meters)	No direct human activity in the last 30 years; mature native tree canopy and intact native understory	Minimal human activity; mature native tree canopy or native scrub; understory shows some impact (e.g. weeds, feral animal grazing).	Extensive human activity affecting canopy and understory; trees exotic (pine, willow, poplar); understory native or exotic.	Extensive human activity; little or no canopy; managed vegetation (e.g. livestock grazing, mowed); permanent structures may be present (e.g. building, roads, carparks).
Left bank	10 9	8 7 6	5 4 3	2 **1** 0
Right bank	10 9	8 7 6	5 4 3	2 **1** 0

SEV (Stream Ecological Valuation) field sheet

Substrate Assessment Datasheet

Stream Name	Awanui
Site Code	AWA3
Date	20.01.10

This assessment addresses spawning habitat for gobies, as well as providing data for assessment of the decontamination capacity of the stream reach based on organic material. The aim is to determine the relative proportion of different substrates and organic material within the reach. This can be acheived either through a broad-scale reach assessment (where diversity of types is low) or by detailed cross-section information(where diversity is of types is high). Where cross-sections are surveyed, divide the stream into 10 equally spaced points. At each point record the predominant substrate categories immediately in front of the mid-line of your boot or similar (1 = present). At the same point also record the organic material below/above the substrate (1=present). Remember to record the substrate underneath the organic material (in inorganic category). Record material only from stream bed.

Record the dominant substrate (inorganic or wood) at a minimum of 10 points across each cross-section

Inorganic material category										Wood		
Substrate category	**SI/SA**	**SG**	**SMG**	**MLG**	**LG**	**SC**	**LC**	**B**	**BR**	**SW (<25)**	**MW (25-100)**	**LW (>100)**
Size (mm)/Cross-section #	**<2**	**2-8**	**8-16**	**16-32**	**32-64**	**64-128**	**128-256**	**>256**				
1	10											
2	9										1	
3	9											1
4	9											1
5	8									1	1	
6	9											1
7	10											
8	10											
9	8										1	
10	10											

Record dominant organic material (if any) on substrate at same 10 points as substrate

Organic material category			
Cross-section #	**Leaf litter**	**Periphyton, submerged macrophytes**	**Roots, plus emergent and floating vegetation**
1		8	10
2			10
3		7	10
4			10
5		8	9
6		6	4
7			10
8		5	8
9		5	10
10		5	5

Substrate category descriptors

SI/SA	Silt/Sand	**MLG**	Medium-large gravel	**LC**	Large cobbles	**SW**	Small wood
SG	Small gravel	**LG**	Large gravel	**B**	Boulders	**MW**	Medium wod
SMG	Small-medium gravel	**SC**	Small cobbles	**Bedrock**		**LW**	Large wood

SEV (Stream Ecological Valuation) field sheet

Check Sheet

Stream Name	Kawerawera
Site Code	KAR1
Date	21.01.10
Project #	

Project task	**Tick when completed**
Macroinvertebrates surveyed (do first)	√
Fish surveyed (do second)	
Site description sheet completed	√
Visual assessment sheets (3) completed	√
Cross section sheets (2) completed	√
Other components assessment sheet completed	√
Instream Retention datasheet completed	√
Habitat Assessment datasheet completed	√
Substrate Assessment datasheet completed	√
Photos taken	√

SEV (Stream Ecological Valuation) field sheet

These field sheets have been designed to guide the collection of data suitable for assessment of stream reaches using the Stream Ecological Valuation technique (Rowe et al, 2006). A separate set of field sheets should be completed for each site. Where deviation from the listed method is used please provide details in comments section

Site description

Date	21.01.10	**Team**	DC (MWH)		**Current (tick)**	
Stream Name	Karewarewa	**Weather conditions**		**Clear/sunny**		**Has there been heavy rain in the past week (circle)?**
Site Code	KAR1			**Cloudy**		**Yes**
Site location	Dosser Road			**Rain**	√	No
GPS coordinates	**Easting**	2833042				
Upstream	**Northing**	6163420	**Photo nos**			
Downstream	**Easting**	2832995				
Site location map	**Northing**	6163278				

Comments

Temp	18.68 degrees C		
Conductivity	598 ms/cs		
DO%	62		
DO%	5.75 g/m3		
pH	7.37		

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Kawerawera
Site Code	KAR1
Date	21.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)
Natural flow (NFR)	**1. Vbed**	**Extent of channel bed modification**	**Channel type**	**Proportion of channel affected (0 - 1)**
		See Figure p15 of SEV report for examples	Natural channel bed with no modification	
			Natural channel bed but with some unnatural fine sediment loading	1
			Channelised with some or no modification (eg gabions)	
			Channelised with total modification (eg concrete lining)	

Natural flow (NFR)	**2. Verosn**	**Proportion of bank length affected by flood flows resulting in erosion (circle appropriate range)**	**<5%**
			6-30%
			31-60%
			61-100%

Connectivity to flood plain (CFP)	**3. Vfreq**	**Estimate of mean annual frequency of flooding**	**Estimated annual frequency of flood-plain inundation (circle appropriate value)**
		If no data available, estimate using informed judgement. Need to take into account position in catchment, bank height and channel dimensions, presence of debris and/or sediment of floodplain, wet soils, degree of upstream imperviousness, presence of detention ponds, extent of channelisation. Consultation with locals may be useful.	Rare (<1/yr)
			Occasional (1-2/yr)
			Often (3-5/yr)
			Frequent (>5/yr)

Connectivity for species migrations (CSM)	**4. Vbarr**	**Identify natural and artificial barriers**	**Barrier types (# in reach)**	**Barriers present (circle appropriate category)**
		See Figure p21 of SEV report for examples		**None**
				Partial
				Total

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Kawerawera
Site Code	KAR1
Date	21.01.10

Dissolved oxygen demand (DOM)	**5. Vdod**	**Score DOD as per descriptors in next column**	**Indicators of oxygen reducing processes**	**Status of stream substrate (circle appropriate category)**
			much black anaerobic sediment extensive sediment bubbling when disturbed sulphide odour when disturbed surface scums present abundant sewage fungus	Poor
			small patches of anaerobic sediment some sediment bubbling and sulphide odour when disturbed abundant macrophyte biomass some sewage fungus may be present	**Marginal**
			no anaerobic sediment no sediment bubbling or sulphide odour moderate macrophyte biomass	Sub-optimal
			no anaerobic sediment no bubbling or adours little or no macrophyte biomass	Optimal

Flood-plain particle retention (FPR)	**6. Vrough**	**Measures the thickness of vegetation on the floodplain**	**Proportion of banks covered by any of the following individual or combined vegetation types:**			
		Refer to Figure p 33 of SEV report for examples	**Bare, short grass (grazed, mown)**	**Sedges & long grass**	**Flax, shrubs, thick under-storey**	**Trees & thin under-storey**
				1		

Habitat for aquatic fauna (HAF)	**7. Vphyshab**	Provides an assessment of instream habitat quality	**Complete \Habitat Assessment Datasheet√**

Habitat for aquatic fauna (HAF)	**8. Vwatqual**	**Provides an assessment of the extent of shading upstream of the reach**	**Extent of stream upstream of the reach being assessed that is shaded**	**Tick appropriate category**
		Can estimate this using topographic maps as well as site visit	Well shaded (I.e. >50% of entire stream above site is forested)	
			Partially shaded (I.e. <50% of stream above site is forested)	
			Minimal shade (e.g. mainly pasture, but some riparian cover present)	√
			No shade (mainly open pasture)	

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Kawerawera
Site Code	KAR1
Date	21.01.10

Fish spawning habitat (FSH)	**9. Vgalspwn**	**This provides a measure of area of available spawning habitat for galaxiids**	**Length of spawning habitat (m)**
		Measure the length of near-flat (slope<10°) that would be inundated by floods or high tides. Measure entire bank edge length. Do for entire reach.	100

Fish spawning habitat (FSH)	**10. Vgalqual**	**This provides a measure of the quality of spawning habitat for galaxiids**	**Quality of spawning habitat (circle appropriate category)**
		Assess the quality of spawning habitat for galaxiids in terms of substrate vegetation among which eggs are deposited. Refer to Figure p36 of SEV report for examples.	High
			Medium
			Low

Riparian vegetation intact (RVI)	**11. Vripcond**	**Assesses the current condition of riparian vegetation within the stream reach**	**Status of riparian vegetation**	**Tick appropriate category**
			Mature indigenous vegetation, regeneration, diverse canopy and under-storey	
			intact mature canopy but damaged under-storey	
			regenerating bush (e.g. manuka scrub), low diversity, early stage in climax, protected	
			as for above but unprotected (e.g. cattle grazing in understorey)	
			occasional native trees present, non-native trees	
			areas of distuibed soils common (e.g. from animal pugging, herbicide use, cultivation in riparian areas)	
			grazed/short grass	
			long grass	√

Riparian vegetation intact (RVI)	**12. Vripconn**	**Assesses the connection between riparian trees and streams**	**Proportion of stream channel with linkages intact (0-1)**
		Determine the proportion of stream channel where the connection(s) between riparian trees and the stream channel (eg. Root linkages) are NOT prevented by culverts, concrete linings, gabions, fences etc	1

Riparian vegetation intact (RVI)	**13. Vripar**	**Assesses the intactness of the riparian zone**	**Proportion of intact riparian zone (0-1)**
		Measure the proportion of riparian buffer zone (defined as 10m on either side of the stream) that is covered by trees or bush. Measure as horizontal distance from stream.	0

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Kawerawera
Site Code	KAR1
Date	21.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)	
Connectivity to flood plain (CFP)	**14. Vfpwidth**	**Floodplain width compared to wetted channel width (floodplain extent defined by annual flood level)**	**Cross-section #**	**Floodplain width (m) (A)**	**Wetted channel width (m) (B)**
			1	L 4.1 R1	2.6
			2	L5.8 R2.0	3.9
			3	L 5.2 R2.2	2.3
			4	L 5.5 R1.1	3.1
			5	L 8.1 R0.4	3
			6	L 6.9 R1.17	2.9
			7	L 3.2 R1.5	2.5
			8	L 2.6 R0.5	4
			9	L 2.0 R1.0	3.4
			10	L 1.5 R2.5	1.6
			Mean		

Water temperature control (WTC)	**15. Vdepth**	**Measure depth at selected positions across channel**	**Cross-section #**	**% of channel width/depth (m)**				
				0 L	**25**	**50**	**75**	**100 R**
		Water temperature control within a reach may be influenced by water depth, water velocity and the area of stream exposed to both solar radiation and ambient air temperature	1	0.1	0.34	0.32	0.15	0.05
			2	0.2	0.29	0.2	0.18	0.09
			3	0.2	0.4	0.15	0.65	0.2
			4	0.01	0.08	0.05	0.07	0.02
			5	0.01	0	0.1	0.11	0.1
			6	0.71	0.5	0.5	0.3	0.01
			7	0.17	0.2	0.15	0.15	0.01
			8	0.25	0.25	0.25	0.28	0.2
			9	0.1	0.23	0.18	0.05	0.05
			10	0.1	0.41	0.42	0.4	0.1
			Mean					

Determination of pollutants (DOP)	**16. Vsurf**	**Assess bio-surface type and proportional cover**	**Complete Substrate Assessment Sheet**
		Measure the proportions of biosurface categories for each cross section. Record at same time as substrate assessment	

Fish spawning habitat (FSH)	**17. Vgobspwn**	**Assesses the amount of available spawning habitat for bullies**	**Complete Substrate Assessment Sheet**
		Measure the proportions of hard substrate categories (excluding bedrock) for each cross section, as well as medium to large woody debris	

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Kawerawera
Site Code	KAR1
Date	21.01.10

Water temperature control (WTC)	**18. Vshade**	**Proportion of stream channel shaded by vegetation, topographic features and artifical structures**	**Cross-section #**	**Shaded proportion (A) (0 - 1)**
		Assess the proportion of shading that the stream surface is subject to. For example, zero shading would be a flat plain. Assume trees in full leaf (mid-summer conditions). Refer to Figure p25 of SEV report for examples	1	0.1
			2	0.1
			3	0.8
			4	0.05
			5	0.4
			6	0
			7	0.1
			8	0.1
			9	0.1
			10	0.2
			Mean	

Organic matter input (OMI)	**19. Vcanop**	**Measures the amount of leaf fall likely to be contributed from overhead vegetation.**	**Cross-section #**	**Proportion of stream reach directly covered with overhead vegetation (0 - 1)**
			1	0.1
			2	0.1
			3	0.1
			4	0
			5	0.4
			6	0
			7	0.1
			8	0.1
			9	0.1
			10	0.2
			Mean	

Organic matter input (OMI)	**20. Vdecid**	**Records whether or not overhead vegetation contributes leaf fall year round or only part of the year**	**Cross-section #**	**Proportion of canopy cover over stream that is deciduous (0-1)**
			1	0
			2	0
			3	0
			4	0
			5	0
			6	0
			7	0
			8	0
			9	0
			10	0
			Mean	

SEV (Stream Ecological Valuation) field sheet

Stream Name	Kawerawera
Site Code	KAR1
Date	21.01.10

Other components

Water temperature control (WTC)	**21. Vlength**	**Measure length of reach**	**Reach length (m) (L)**
		Standardise survey reach length among sites, if appropriate	150

Water temperature control (WTC)	**22. Vveloc**	**Calculate mean velocity (Sm)**	**Velocity (m/s)**
		Take gauging at 1 point	0.02403

Instream particle retention (IPR)	**23. Vtrans**	**This measure provides an assessment of the capacity of the stream reach to retain material**	**Complete Instream Retention Datasheet √**
	24. Vretain		

Invertebrate fauna intact (IFI)	**25. Vmci**	**Provides a species list and community composition of macroinvertebrate fauna**	**Hard (HB) or soft (SB) bottomed sampling protocol applied?**
	26. Vept	Sample using ARC protocols for hard and soft-bottomed streams, as appropriate. 1 composite sample per site to be collected.	**SB**
	27. Vinvert		

Fish fauna intact (FFI)	**28. Vfish**	**Measures the species diversity of fish within the reach**	**Fish species present (list)**	
	29. Vvert	Electrofish with a single pass along the entire length of the stream reach. Also note any other vertebrates or large invertebrates.		

SEV (Stream Ecological Valuation) field sheet

23 and 24 Instream Retention Datasheet

Stream Name	Kawerawera
Site Code	KAR1
Date	21.01.10

This needs to be undertaken at 2 sections (runs) within the reach, starting with an upper section and then working downstream. The value is obtained by a: running a measuring tape from top to bottom of the reach section, b: releasing 20 painted plastic paper triangles into the stream at the top of the reach section and 3: recording the distance downstream each triangle travels within the reach section, as well as the structure(s) they are retained on.

Run 1

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
0	14	AP
0.5	5	AP
1	1	AP

Run 2

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
0	13	PL
0	3	AP
1	1	AP
2	1	PL

Structures retaining leaves							
Boulders and cobbles	Large wood and tree roots	Rooted aquatic plants/	Periphyton and leaf litter	Small wood	Bankside vegetation	Non-natural debris	Pool
B	LW	AP	PERI	SW	VEGE	NON	PL

SEV (Stream Ecological Valuation) field sheet

16 and 17 Habitat Assessment Datasheet

Stream Name	Kawerawera
Site Code	KAR1
Date	21.01.10

These data combined provide an assessment of instream habitat quality. For each habitat parameter, determine the most appropriate condition category for the survey reach, based on the descriptions provide. Within the selected condition category, circle the value which best describes the relative condition.

	Condition Category (circle most relevant value within range for category)			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Aquatic Habitat Abundance - proportion of stream channel occupied by sutable habitat fesatures for instream fauna	> 50% of channel favourable for epifaunal colonisation and fish cover; includes woody debris, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat. Also includes macrophyte dominated streams.	30-50% of channel contains stable habitat.	10-30% of channel contains stable habitat.	< 10% of channel contains stable habitat. Note: Algae does not constitute stable habitat.
	20 19 18 17 16	15 14 13 12 11	**10** 9 8 7 6	5 4 3 2 1 0
2. Aquatic Habitat Diversity	Wide variety of stable aquatic habitat types present including: woody debris, riffles, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat.	Moderate variety of habitat types; 3-4 habitats present including woody debris.	Habitat diversity limited to 1-2 types; woody debris rare or may be smothered by sediment.	Stable habitats lacking or limited to macrophytes (a few macrophyte species scores lower than several).
	20 19 18 17 16	15 14 13 12 11	10 **9** 8 7 6	5 4 3 2 1 0
3. Hydrologic Heterogeneity	Mixture of hydrologic conditions i.e. pool, riffle, run, chute, waterfalls; variety of pool sizes and depths.	Moderate variety of hydrologic conditions; deep and shallow pools present (pool size relative to size of stream).	Limited variety of hydrologic conditions; deep pools absent (pool size relative to size of stream).	Uniform hydrologic conditions; uniform depth and velocity; pools absent (includes uniformly deep streams).
	20 19 18 17 16	15 14 13 12 **11**	10 9 8 7 6	5 4 3 2 1 0
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Shade	>80% of water surface shaded. Full canopy.	60 - 80% of water surface shaded; mostly shaded with open patches.	20 - 60% of water surface shaded; mostly open with shaded patches.	<20% of water surface shaded. Fully open; lack of canopy cover.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	**5** 4 3 2 1 0
7.Riparian Vegetation Integrity (within 20 meters)	No direct human activity in the last 30 years; mature native tree canopy and intact native understory	Minimal human activity; mature native tree canopy or native scrub; understory shows some impact (e.g. weeds, feral animal grazing).	Extensive human activity affecting canopy and understory; trees exotic (pine, willow, poplar); understory native or exotic.	Extensive human activity; little or no canopy; managed vegetation (e.g. livestock grazing, mowed); permanent structures may be present (e.g. building, roads, carparks).
Left bank	10 9	8 7 6	5 4 3	2 **1** 0
Right bank	10 9	8 7 6	5 4 3	2 **1** 0

SEV (Stream Ecological Valuation) field sheet

Substrate Assessment Datasheet

Stream Name	Karewarewa
Site Code	KAR1
Date	21.01.10

This assessment addresses spawning habitat for gobies, as well as providing data for assessment of the decontamination capacity of the stream reach based on organic material. The aim is to determine the relative proportion of different substrates and organic material within the reach. This can be acheived either through a broad-scale reach assessment (where diversity of types is low) or by detailed cross-section information(where diversity is of types is high). Where cross-sections are surveyed, divide the stream into 10 equally spaced points. At each point record the predominant substrate categories immediately in front of the mid-line of your boot or similar (1 = present). At the same point also record the organic material below/above the substrate (1=present). Remember to record the substrate underneath the organic material (in inorganic category). Record material only from stream bed.

Record the dominant substrate (inorganic or wood) at a minimum of 10 points across each cross-section

Inorganic material category										Wood		
Substrate category	**SI/SA**	**SG**	**SMG**	**MLG**	**LG**	**SC**	**LC**	**B**	**BR**	**SW (<25)**	**MW (25-100)**	**LW (>100)**
Size (mm)/Cross-section #	**<2**	**2-8**	**8-16**	**16-32**	**32-64**	**64-128**	**128-256**	**>256**				
1	6			3	1							
2	5	3	1		1							
3	4		1	2	2		1					
4	6	3	1									
5	5	2			1	1						
6	10											
7	5			**2**	**2**	1						
8	6	3	1									
9	5	2			2	1						
10	5		1	1	2		1					

Record dominant organic material (if any) on substrate at same 10 points as substrate

Organic material category			
Cross-section #	**Leaf litter**	**Periphyton, submerged macrophytes**	**Roots, plus emergent and floating vegetation**
1	4	2	
2	1	1	
3		10	2
4			
5	1		2
6		4	1
7		3	1
8	**2**		
9	2		
10	3		

Substrate category descriptors

SI/SA	Silt/Sand	**MLG**	Medium-large gravel	**LC**	Large cobbles	**SW**	Small wood
SG	Small gravel	**LG**	Large gravel	**B**	Boulders	**MW**	Medium wod
SMG	Small-medium gravel	**SC**	Small cobbles	**Bedrock**		**LW**	Large wood

SEV (Stream Ecological Valuation) field sheet

Check Sheet

Stream Name	Paritua
Site Code	PAR 1
Date	22.01.10
Project #	

Project task	**Tick when completed**
Macroinvertebrates surveyed (do first)	√
Fish surveyed (do second)	
Site description sheet completed	√
Visual assessment sheets (3) completed	√
Cross section sheets (2) completed	√
Other components assessment sheet completed	√
Instream Retention datasheet completed	√
Habitat Assessment datasheet completed	√
Substrate Assessment datasheet completed	√
Photos taken	√

SEV (Stream Ecological Valuation) field sheet

Sheet 1 of 1

These field sheets have been designed to guide the collection of data suitable for assessment of stream reaches using the Stream Ecological Valuation technique (Rowe et al, 2006). A separate set of field sheets should be completed for each site. Where deviation from the listed method is used please provide details in comments section

Site description

Date	22.01.10	**Team**	DC (MWH)		**Current (tick)**	
Stream Name	Paritua	**Weather conditions**		**Clear/sunny**		**Has there been heavy rain in the past week (circle)?**
Site Code	PAR1			**Cloudy**	√	**Yes**
Site location				**Rain**		No
GPS coordinates	**Easting**	2827439				
Upstream	**Northing**	6165641	**Photo nos**			
Downstream	**Easting**	2827555				
Site location map	**Northing**	6165710				

Comments

Temp	17.38 degrees C		
Conductivity	657 ms/cs		
DO%	71.4		
DO%	6.82 g/m3		
pH	6.82		

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Paritua
Site Code	PAR 1
Date	22.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)
Natural flow (NFR)	**1. Vbed**	**Extent of channel bed modification**	**Channel type**	**Proportion of channel affected (0 - 1)**
		See Figure p15 of SEV report for examples	Natural channel bed with no modification	
			Natural channel bed but with some unnatural fine sediment loading	1
			Channelised with some or no modification (eg gabions)	
			Channelised with total modification (eg concrete lining)	

Natural flow (NFR)	**2. Verosn**	**Proportion of bank length affected by flood flows resulting in erosion (circle appropriate range)**	**<5%**
			6-30%
			31-60%
			61-100%

Connectivity to flood plain (CFP)	**3. Vfreq**	**Estimate of mean annual frequency of flooding**	**Estimated annual frequency of flood-plain inundation (circle appropriate value)**
		If no data available, estimate using informed judgement. Need to take into account position in catchment, bank height and channel dimensions, presence of debris and/or sediment of floodplain, wet soils, degree of upstream imperviousness, presence of detention ponds, extent of channelisation. Consultation with locals may be useful.	Rare (<1/yr)
			Occasional (1-2/yr)
			Often (3-5/yr)
			Frequent (>5/yr)

Connectivity for species migrations (CSM)	**4. Vbarr**	**Identify natural and artificial barriers**	**Barrier types (# in reach)**	**Barriers present (circle appropriate category)**
		See Figure p21 of SEV report for examples		**None**
				Partial
				Total

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Paritua
Site Code	PAR1
Date	22.01.10

Dissolved oxygen demand (DOM)	**5. Vdod**	**Score DOD as per descriptors in next column**	**Indicators of oxygen reducing processes**	**Status of stream substrate (circle appropriate category)**
			much black anaerobic sediment extensive sediment bubbling when disturbed sulphide odour when disturbed surface scums present abundant sewage fungus	Poor
			small patches of anaerobic sediment some sediment bubbling and sulphide odour when disturbed abundant macrophyte biomass some sewage fungus may be present	Marginal
			no anaerobic sediment no sediment bubbling or sulphide odour moderate macrophyte biomass	**Sub-optimal**
			no anaerobic sediment no bubbling or adours little or no macrophyte biomass	Optimal

Flood-plain particle retention (FPR)	**6. Vrough**	**Measures the thickness of vegetation on the floodplain**	**Proportion of banks covered by any of the following individual or combined vegetation types:**			
		Refer to Figure p 33 of SEV report for examples	**Bare, short grass (grazed, mown)**	**Sedges & long grass**	**Flax, shrubs, thick under-storey**	**Trees & thin under-storey**
			0.1	0.8	0.1	

Habitat for aquatic fauna (HAF)	**7. Vphyshab**	Provides an assessment of instream habitat quality	**Complete \Habitat Assessment Datasheet**

Habitat for aquatic fauna (HAF)	**8. Vwatqual**	**Provides an assessment of the extent of shading upstream of the reach**	**Extent of stream upstream of the reach being assessed that is shaded**	**Tick appropriate category**
		Can estimate this using topographic maps as well as site visit	Well shaded (I.e. >50% of entire stream above site is forested)	
			Partially shaded (I.e. <50% of stream above site is forested)	
			Minimal shade (e.g. mainly pasture, but some riparian cover present)	√
			No shade (mainly open pasture)	

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Paritua
Site Code	PAR1
Date	22.01.10

Fish spawning habitat (FSH)	**9. Vgalspwn**	**This provides a measure of area of available spawning habitat for galaxiids**	**Length of spawning habitat (m)**
		Measure the length of near-flat (slope<10°) that would be inundated by floods or high tides. Measure entire bank edge length. Do for entire reach.	250

Fish spawning habitat (FSH)	**10. Vgalqual**	**This provides a measure of the quality of spawning habitat for galaxiids**	**Quality of spawning habitat (circle appropriate category)**
		Assess the quality of spawning habitat for galaxiids in terms of substrate vegetation among which eggs are deposited. Refer to Figure p36 of SEV report for examples.	High
			Medium
			Low

Riparian vegetation intact (RVI)	**11. Vripcond**	**Assesses the current condition of riparian vegetation within the stream reach**	**Status of riparian vegetation**	**Tick appropriate category**
			Mature indigenous vegetation, regeneration, diverse canopy and under-storey	
			intact mature canopy but damaged under-storey	
			regenerating bush (e.g. manuka scrub), low diversity, early stage in climax, protected	
			as for above but unprotected (e.g. cattle grazing in understorey)	
			occasional native trees present, non-native trees	
			areas of distuibed soils common (e.g. from animal pugging, herbicide use, cultivation in riparian areas)	
			grazed/short grass	√
			long grass	

Riparian vegetation intact (RVI)	**12. Vripconn**	**Assesses the connection between riparian trees and streams**	**Proportion of stream channel with linkages intact (0-1)**
		Determine the proportion of stream channel where the connection(s) between riparian trees and the stream channel (eg. Root linkages) are NOT prevented by culverts, concrete linings, gabions, fences etc	1

Riparian vegetation intact (RVI)	**13. Vripar**	**Assesses the intactness of the riparian zone**	**Proportion of intact riparian zone (0-1)**
		Measure the proportion of riparian buffer zone (defined as 10m on either side of the stream) that is covered by trees or bush. Measure as horizontal distance from stream.	0

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Paritua
Site Code	PAR1
Date	22.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)	
Connectivity to flood plain (CFP)	**14. Vfpwidth**	**Floodplain width compared to wetted channel width (floodplain extent defined by annual flood level)**	**Cross-section #**	**Floodplain width (m) (A)**	**Wetted channel width (m) (B)**
			1	L 16 R18	9.2
			2	L 9 R18	9
			3	L 9 R16	8.2
			4	L 3 R7	9.3
			5	L 0 R10	8.7
			6	L 0 R27	6.3
			7	L 2 R13.5	7.1
			8	L 4.2 R2.2	6.9
			9	L 25 R1.0	7.3
			10	L 2.1 R3	7.3
			Mean		

Water temperature control (WTC)	**15. Vdepth**	**Measure depth at selected positions across channel**	**Cross-section #**	**% of channel width/depth (m)**				
				0 L	**25**	**50**	**75**	**100 R**
		Water temperature control within a reach may be influenced by water depth, water velocity and the area of stream exposed to both solar radiation and ambient air temperature	1	0.3	0.55	0.36	0.22	0.05
			2	0.05	0.28	0.33	0.29	0.05
			3	0.1	0.25	0.25	0.25	0.1
			4	0.1	0.25	0.38	0.3	0.1
			5	0.2	0.81	0.38	0.4	0.2
			6	0.5	0.88	0.58	0.4	0.2
			7	0.9	0.84	0.8	0.45	0.1
			8	0.1	0.3	0.28	0.22	0.1
			9	0.1	0.25	0.26	0.19	0.1
			10	0.1	0.4	0.35	0.26	0.1
			Mean					

Determination of pollutants (DOP)	**16. Vsurf**	**Assess bio-surface type and proportional cover**	**Complete Substrate Assessment Sheet**
		Measure the proportions of biosurface categories for each cross section. Record at same time as substrate assessment	

Fish spawning habitat (FSH)	**17. Vgobspwn**	**Assesses the amount of available spawning habitat for bullies**	**Complete Substrate Assessment Sheet**
		Measure the proportions of hard substrate categories (excluding bedrock) for each cross section, as well as medium to large woody debris	

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Paritua
Site Code	PAR1
Date	22.01.10

Water temperature control (WTC)	**18. Vshade**	**Proportion of stream channel shaded by vegetation, topographic features and artifical structures**	**Cross-section #**	**Shaded proportion (A) (0 - 1)**
		Assess the proportion of shading that the stream surface is subject to. For example, zero shading would be a flat plain. Assume trees in full leaf (mid-summer conditions). Refer to Figure p25 of SEV report for examples	1	0.1
			2	0.1
			3	0.1
			4	0.2
			5	0.1
			6	0.2
			7	0.1
			8	0
			9	0.2
			10	0.2
			Mean	

Organic matter input (OMI)	**19. Vcanop**	**Measures the amount of leaf fall likely to be contributed from overhead vegetation.**	**Cross-section #**	**Proportion of stream reach directly covered with overhead vegetation (0 - 1)**
			1	0
			2	0
			3	0
			4	0
			5	0
			6	0
			7	0
			8	0
			9	0
			10	0
			Mean	

Organic matter input (OMI)	**20. Vdecid**	**Records whether or not overhead vegetation contributes leaf fall year round or only part of the year**	**Cross-section #**	**Proportion of canopy cover over stream that is deciduous (0-1)**
			1	0
			2	0
			3	0
			4	0
			5	0
			6	0
			7	0
			8	0
			9	0
			10	0
			Mean	

SEV (Stream Ecological Valuation) field sheet

Stream Name	Paritua
Site Code	PAR1
Date	22.01.10

Other components

Water temperature control (WTC)	**21. Vlength**	**Measure length of reach**	**Reach length (m) (L)**
		Standardise survey reach length among sites, if appropriate	150

Water temperature control (WTC)	**22. Vveloc**	**Calculate mean velocity (Sm)**	**Velocity (m/s)**
		Take gauging at 1 point	0.053173

Instream particle retention (IPR)	**23. Vtrans**	**This measure provides an assessment of the capacity of the stream reach to retain material**	**Complete Instream Retention Datasheet √**
	24. Vretain		

Invertebrate fauna intact (IFI)	**25. Vmci**	**Provides a species list and community composition of macroinvertebrate fauna**	**Hard (HB) or soft (SB) bottomed sampling protocol applied?**
	26. Vept	Sample using ARC protocols for hard and soft-bottomed streams, as appropriate. 1 composite sample per site to be collected.	**HB**
	27. Vinvert		

Fish fauna intact (FFI)	**28. Vfish**	**Measures the species diversity of fish within the reach**	**Fish species present (list)**	
	29. Vvert	Electrofish with a single pass along the entire length of the stream reach. Also note any other vertebrates or large invertebrates.		

SEV (Stream Ecological Valuation) field sheet

Sheet 1 of 1

23 and 24 Instream Retention Datasheet

Stream Name		Paritua
Site Code		PAR1
Date		22.01.10

This needs to be undertaken at 2 sections (runs) within the reach, starting with an upper section and then working downstream. The value is obtained by a: running a measuring tape from top to bottom of the reach section, b: releasing 20 painted plastic paper triangles into the stream at the top of the reach section and 3: recording the distance downstream each triangle travels within the reach section, as well as the structure(s) they are retained on.

Run 1

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
0.5	11	AP
1	1	PL
2	1	AP
6	1	AP
740	7	Not retained

Run 2

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
0	4	AP
1	6	AP
2	5	AP
4	3	PL
10	1	PL
20	1	PL

Structures retaining leaves							
Boulders and cobbles	Large wood and tree roots	Rooted aquatic plants/	Periphyton and leaf litter	Small wood	Bankside vegetation	Non-natural debris	Pool
B	LW	AP	PERI	SW	VEGE	NON	PL

SEV (Stream Ecological Valuation) field sheet

16 and 17 Habitat Assessment Datasheet

Stream Name	Paritua
Site Code	PAR1
Date	22.01.10

These data combined provide an assessment of instream habitat quality. For each habitat parameter, determine the most appropriate condition category for the survey reach, based on the descriptions provide. Within the selected condition category, circle the value which best describes the relative condition.

	Condition Category (circle most relevant value within range for category)			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Aquatic Habitat Abundance - proportion of stream channel occupied by sutable habitat fesatures for instream fauna	> 50% of channel favourable for epifaunal colonisation and fish cover; includes woody debris, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat. Also includes macrophyte dominated streams.	30-50% of channel contains stable habitat.	10-30% of channel contains stable habitat.	< 10% of channel contains stable habitat. Note: Algae does not constitute stable habitat.
	20 19 18 17 16	**15** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Aquatic Habitat Diversity	Wide variety of stable aquatic habitat types present including: woody debris, riffles, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat.	Moderate variety of habitat types; 3-4 habitats present including woody debris.	Habitat diversity limited to 1-2 types; woody debris rare or may be smothered by sediment.	Stable habitats lacking or limited to macrophytes (a few macrophyte species scores lower than several).
	20 19 18 17 16	15 14 **13** 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Hydrologic Heterogeneity	Mixture of hydrologic conditions i.e. pool, riffle, run, chute, waterfalls; variety of pool sizes and depths.	Moderate variety of hydrologic conditions; deep and shallow pools present (pool size relative to size of stream).	Limited variety of hydrologic conditions; deep pools absent (pool size relative to size of stream).	Uniform hydrologic conditions; uniform depth and velocity; pools absent (includes uniformly deep streams).
	20 19 18 17 16	15 14 **13** 12 11	10 9 8 7 6	5 4 3 2 1 0
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Shade	>80% of water surface shaded. Full canopy.	60 - 80% of water surface shaded; mostly shaded with open patches.	20 - 60% of water surface shaded; mostly open with shaded patches.	<20% of water surface shaded. Fully open; lack of canopy cover.
	20 19 18 17 16	15 14 13 12 11	10 9 **8** 7 6	5 4 3 2 1 0
7.Riparian Vegetation Integrity (within 20 meters)	No direct human activity in the last 30 years; mature native tree canopy and intact native understory	Minimal human activity; mature native tree canopy or native scrub; understory shows some impact (e.g. weeds, feral animal grazing).	Extensive human activity affecting canopy and understory; trees exotic (pine, willow, poplar); understory native or exotic.	Extensive human activity; little or no canopy; managed vegetation (e.g. livestock grazing, mowed); permanent structures may be present (e.g. building, roads, carparks).
Left bank	10 9	8 7 6	5 4 3	2 **1** 0
Right bank	10 9	8 7 6	5 4 3	2 **1** 0

SEV (Stream Ecological Valuation) field sheet

Substrate Assessment Datasheet

Stream Name	Paritua
Site Code	PAR1
Date	22.01.10

This assessment addresses spawning habitat for gobies, as well as providing data for assessment of the decontamination capacity of the stream reach based on organic material. The aim is to determine the relative proportion of different substrates and organic material within the reach. This can be acheived either through a broad-scale reach assessment (where diversity of types is low) or by detailed cross-section information(where diversity is of types is high). Where cross-sections are surveyed, divide the stream into 10 equally spaced points. At each point record the predominant substrate categories immediately in front of the mid-line of your boot or similar (1 = present). At the same point also record the organic material below/above the substrate (1=present). Remember to record the substrate underneath the organic material (in inorganic category). Record material only from stream bed.

Record the dominant substrate (inorganic or wood) at a minimum of 10 points across each cross-section

Inorganic material category										Wood		
Substrate category	**SI/SA**	**SG**	**SMG**	**MLG**	**LG**	**SC**	**LC**	**B**	**BR**	**SW (<25)**	**MW (25-100)**	**LW (>100)**
Size (mm)/Cross-section #	**<2**	**2-8**	**8-16**	**16-32**	**32-64**	**64-128**	**128-256**	**>256**				
1			2	3	1	2	2					
2		2		2			5	1				
3	1		1	3	2	2	1					
4			3	2	1	4						
5		2	1	3	2	2						
6	4						4	2				
7		**2**		**2**	**1**	**1**	**3**	1				
8			1	3	3		3					
9		2	1		3	1	2	1				
10												

Record dominant organic material (if any) on substrate at same 10 points as substrate

Organic material category			
Cross-section #	**Leaf litter**	**Periphyton, submerged macrophytes**	**Roots, plus emergent and floating vegetation**
1		10	
2		9	1
3		9	1
4		7	2
5		8	1
6		5	3
7		5	2
8		**5**	1
9		5	1
10			

Substrate category descriptors

SI/SA	Silt/Sand	**MLG**	Medium-large gravel	**LC**	Large cobbles	**SW**	Small wood
SG	Small gravel	**LG**	Large gravel	**B**	Boulders	**MW**	Medium wod
SMG	Small-medium gravel	**SC**	Small cobbles	**Bedrock**		**LW**	Large wood

SEV (Stream Ecological Valuation) field sheet

Check Sheet

Stream Name	Pokawa
Site Code	POK1
Date	20.01.10
Project #	

Project task	**Tick when completed**
Macroinvertebrates surveyed (do first)	√
Fish surveyed (do second)	
Site description sheet completed	√
Visual assessment sheets (3) completed	√
Cross section sheets (2) completed	√
Other components assessment sheet completed	√
Instream Retention datasheet completed	√
Habitat Assessment datasheet completed	√
Substrate Assessment datasheet completed	√
Photos taken	√

SEV (Stream Ecological Valuation) field sheet

These field sheets have been designed to guide the collection of data suitable for assessment of stream reaches using the Stream Ecological Valuation technique (Rowe et al, 2006). A separate set of field sheets should be completed for each site. Where deviation from the listed method is used please provide details in comments section

Site description

Date	20.01.10	**Team**	DC (MWH)		**Current (tick)**	
Stream Name	Pokawa	**Weather conditions**		**Clear/sunny**	√	**Has there been heavy rain in the past week (circle)?**
Site Code	POK1			**Cloudy**		**Yes**
Site location	Dosser Road			**Rain**		No
GPS coordinates	**Easting**	2835274				
Upstream	**Northing**	6160516	**Photo nos**	2		
Downstream	**Easting**					
Site location map	**Northing**					

Comments

Temp	18.96 degrees C		
Conductivity	621 ms/cs		
DO%	11.6		
DO%	1.04 g/m3		
pH	6.69		

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Pokawa
Site Code	POK1
Date	20.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)
Natural flow (NFR)	**1. Vbed**	**Extent of channel bed modification**	**Channel type**	**Proportion of channel affected (0 - 1)**
		See Figure p15 of SEV report for examples	Natural channel bed with no modification	0
			Natural channel bed but with some unnatural fine sediment loading	1
			Channelised with some or no modification (eg gabions)	0
			Channelised with total modification (eg concrete lining)	0

Natural flow (NFR)	**2. Verosn**	**Proportion of bank length affected by flood flows resulting in erosion (circle appropriate range)**	**<5%**
			6-30%
			31-60%
			61-100%

Connectivity to flood plain (CFP)	**3. Vfreq**	**Estimate of mean annual frequency of flooding**	**Estimated annual frequency of flood-plain inundation (circle appropriate value)**
		If no data available, estimate using informed judgement. Need to take into account position in catchment, bank height and channel dimensions, presence of debris and/or sediment of floodplain, wet soils, degree of upstream imperviousness, presence of detention ponds, extent of channelisation. Consultation with locals may be useful.	Rare (<1/yr)
			Occasional (1-2/yr)
			Often (3-5/yr)
			Frequent (>5/yr)

Connectivity for species migrations (CSM)	**4. Vbarr**	**Identify natural and artificial barriers**	**Barrier types (# in reach)**	**Barriers present (circle appropriate category)**
		See Figure p21 of SEV report for examples		**None**
				Partial
				Total

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Pokawa
Site Code	POK1
Date	20.01.10

			Indicators of oxygen reducing processes	**Status of stream substrate (circle appropriate category)**
Dissolved oxygen demand (DOM)	**5. Vdod**	**Score DOD as per descriptors in next column**	much black anaerobic sediment extensive sediment bubbling when disturbed sulphide odour when disturbed surface scums present abundant sewage fungus	Poor
			small patches of anaerobic sediment some sediment bubbling and sulphide odour when disturbed abundant macrophyte biomass some sewage fungus may be present	**Marginal**
			no anaerobic sediment no sediment bubbling or sulphide odour moderate macrophyte biomass	Sub-optimal
			no anaerobic sediment no bubbling or adours little or no macrophyte biomass	Optimal

Flood-plain particle retention (FPR)	**6. Vrough**	**Measures the thickness of vegetation on the floodplain**	**Proportion of banks covered by any of the following individual or combined vegetation types:**			
		Refer to Figure p 33 of SEV report for examples	**Bare, short grass (grazed, mown)**	**Sedges & long grass**	**Flax, shrubs, thick under-storey**	**Trees & thin under-storey**
			0.9	0.1		

Habitat for aquatic fauna (HAF)	**7. Vphyshab**	Provides an assessment of instream habitat quality	**Complete \Habitat Assessment Datasheet√**

Habitat for aquatic fauna (HAF)	**8. Vwatqual**	**Provides an assessment of the extent of shading upstream of the reach**	**Extent of stream upstream of the reach being assessed that is shaded**	**Tick appropriate category**
		Can estimate this using topographic maps as well as site visit	Well shaded (I.e. >50% of entire stream above site is forested)	
			Partially shaded (I.e. <50% of stream above site is forested)	
			Minimal shade (e.g. mainly pasture, but some riparian cover present)	√
			No shade (mainly open pasture)	

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Pokawa
Site Code	POK1
Date	20.01.10

Fish spawning habitat (FSH)	**9. Vgalspwn**	**This provides a measure of area of available spawning habitat for galaxiids**	**Length of spawning habitat (m)**
		Measure the length of near-flat (slope<10°) that would be inundated by floods or high tides. Measure entire bank edge length. Do for entire reach.	20

Fish spawning habitat (FSH)	**10. Vgalqual**	**This provides a measure of the quality of spawning habitat for galaxiids**	**Quality of spawning habitat (circle appropriate category)**
		Assess the quality of spawning habitat for galaxiids in terms of substrate vegetation among which eggs are deposited. Refer to Figure p36 of SEV report for examples.	High
			Medium
			Low

Riparian vegetation intact (RVI)	**11. Vripcond**	**Assesses the current condition of riparian vegetation within the stream reach**	**Status of riparian vegetation**	**Tick appropriate category**
			Mature indigenous vegetation, regeneration, diverse canopy and under-storey	
			intact mature canopy but damaged under-storey	
			regenerating bush (e.g. manuka scrub), low diversity, early stage in climax, protected	
			as for above but unprotected (e.g. cattle grazing in understorey)	
			occasional native trees present, non-native trees	
			areas of distuibed soils common (e.g. from animal pugging, herbicide use, cultivation in riparian areas)	
			grazed/short grass	
			long grass	√

Riparian vegetation intact (RVI)	**12. Vripconn**	**Assesses the connection between riparian trees and streams**	**Proportion of stream channel with linkages intact (0-1)**
		Determine the proportion of stream channel where the connection(s) between riparian trees and the stream channel (eg. Root linkages) are NOT prevented by culverts, concrete linings, gabions, fences etc	1

Riparian vegetation intact (RVI)	**13. Vripar**	**Assesses the intactness of the riparian zone**	**Proportion of intact riparian zone (0-1)**
		Measure the proportion of riparian buffer zone (defined as 10m on either side of the stream) that is covered by trees or bush. Measure as horizontal distance from stream.	0

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Pokawa
Site Code	POK1
Date	20.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)	
Connectivity to flood plain (CFP)	**14. Vfpwidth**	**Floodplain width compared to wetted channel width (floodplain extent defined by annual flood level)**	**Cross-section #**	**Floodplain width (m) (A)**	**Wetted channel width (m) (B)**
			1	L 1.0 R1.3	4.7
			2	L0.8 R1.0	6.1
			3	L 0.62 R1.1	8.4
			4	L 0 R0.3	7.4
			5	L 0.3 R0	6.2
			6	L 1.0 R0	5.9
			7	L 0.1 R0	5
			8	L 0.3 R0	6.8
			9	L 0 R0	6.1
			10	L 0.3 R1.1	6.3
			Mean		

Water temperature control (WTC)	**15. Vdepth**	**Measure depth at selected positions across channel**	**Cross-section #**	**% of channel width/depth (m)**				
				0 L	**25**	**50**	**75**	**100 R**
		Water temperature control within a reach may be influenced by water depth, water velocity and the area of stream exposed to both solar radiation and ambient air temperature	1	0.1	0.7	0.85	0.42	0.01
			2	0.3	0.75	0.75	0.1	0.01
			3	0.05	0.69	0.88	0.73	0.1
			4	0.1	0.73	1.1	0.2	0.05
			5	0.05	0.43	0.78	0.91	0.1
			6	0.01	0.5	0.84	0.85	0.1
			7	0.1	0.68	0.73	0.86	0.1
			8	0.8	>1.5	>1.5	0.4	0.01
			9	0.5	>1.5	>1.5	0.8	0.6
			10	1	>1.5	>1.5	0.2	0.1
			Mean					

Determination of pollutants (DOP)	**16. Vsurf**	**Assess bio-surface type and proportional cover**	**Complete Substrate Assessment Sheet**
		Measure the proportions of biosurface categories for each cross section. Record at same time as substrate assessment	

Fish spawning habitat (FSH)	**17. Vgobspwn**	**Assesses the amount of available spawning habitat for bullies**	**Complete Substrate Assessment Sheet**
		Measure the proportions of hard substrate categories (excluding bedrock) for each cross section, as well as medium to large woody debris	

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Pokawa
Site Code	POK1
Date	20.01.10

Water temperature control (WTC)	**18. Vshade**	**Proportion of stream channel shaded by vegetation, topographic features and artifical structures**	**Cross-section #**	**Shaded proportion (A) (0 - 1)**
		Assess the proportion of shading that the stream surface is subject to. For example, zero shading would be a flat plain. Assume trees in full leaf (mid-summer conditions). Refer to Figure p25 of SEV report for examples	1	0.1
			2	0.6
			3	0.1
			4	0.5
			5	0.1
			6	0.1
			7	0.1
			8	0.1
			9	0.1
			10	0.2
			Mean	

Organic matter input (OMI)	**19. Vcanop**	**Measures the amount of leaf fall likely to be contributed from overhead vegetation.**	**Cross-section #**	**Proportion of stream reach directly covered with overhead vegetation (0 - 1)**
			1	0
			2	0
			3	0.1
			4	0
			5	0
			6	0.1
			7	0.1
			8	0.1
			9	0
			10	0.2
			Mean	

Organic matter input (OMI)	**20. Vdecid**	**Records whether or not overhead vegetation contributes leaf fall year round or only part of the year**	**Cross-section #**	**Proportion of canopy cover over stream that is deciduous (0-1)**
			1	0
			2	0
			3	0
			4	0
			5	0
			6	0
			7	0
			8	0
			9	0
			10	1
			Mean	

SEV (Stream Ecological Valuation) field sheet

Stream Name	Pokawa
Site Code	POK1
Date	20.01.10

Other components

Water temperature control (WTC)	**21. Vlength**	**Measure length of reach**	**Reach length (m) (L)**
		Standardise survey reach length among sites, if appropriate	150

Water temperature control (WTC)	**22. Vveloc**	**Calculate mean velocity (Sm)**	**Velocity (m/s)**
		Take gauging at 1 point	0.051897

Instream particle retention (IPR)	**23. Vtrans**	**This measure provides an assessment of the capacity of the stream reach to retain material**	**Complete Instream Retention Datasheet √**
	24. Vretain		

Invertebrate fauna intact (IFI)	**25. Vmci**	**Provides a species list and community composition of macroinvertebrate fauna**	**Hard (HB) or soft (SB) bottomed sampling protocol applied?**
	26. Vept	Sample using ARC protocols for hard and soft-bottomed streams, as appropriate. 1 composite sample per site to be collected.	**HB**
	27. Vinvert		

Fish fauna intact (FFI)	**28. Vfish**	**Measures the species diversity of fish within the reach**	**Fish species present (list)**	
	29. Vvert	Electrofish with a single pass along the entire length of the stream reach. Also note any other vertebrates or large invertebrates.		

SEV (Stream Ecological Valuation) field sheet

23 and 24 Instream Retention Datasheet

Stream Name		Pokawa
Site Code		POK1
Date		20.01.10

This needs to be undertaken at 2 sections (runs) within the reach, starting with an upper section and then working downstream. The value is obtained by a: running a measuring tape from top to bottom of the reach section, b: releasing 20 painted plastic paper triangles into the stream at the top of the reach section and 3: recording the distance downstream each triangle travels within the reach section, as well as the structure(s) they are retained on.

Run 1

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
4	1	PL
2	1	PL
1	5	PL
0.5	4	PL
-1	1	PL
10	1	AP
	7 not recovered	

Run 2

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
0.5		
1		
2		

Structures retaining leaves							
Boulders and cobbles	Large wood and tree roots	Rooted aquatic plants/	Periphyton and leaf litter	Small wood	Bankside vegetation	Non-natural debris	Pool
B	LW	AP	PERI	SW	VEGE	NON	PL

SEV (Stream Ecological Valuation) field sheet

16 and 17 Habitat Assessment Datasheet

Stream Name	Pokawa
Site Code	POK1
Date	20.01.10

These data combined provide an assessment of instream habitat quality. For each habitat parameter, determine the most appropriate condition category for the survey reach, based on the descriptions provide. Within the selected condition category, circle the value which best describes the relative condition.

	Condition Category (circle most relevant value within range for category)			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Aquatic Habitat Abundance - proportion of stream channel occupied by sutable habitat fesatures for instream fauna	> 50% of channel favourable for epifaunal colonisation and fish cover; includes woody debris, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat. Also includes macrophyte dominated streams.	30-50% of channel contains stable habitat.	10-30% of channel contains stable habitat.	< 10% of channel contains stable habitat. Note: Algae does not constitute stable habitat.
	20 19 18 17 16	15 14 13 12 11	10 9 8 **7** 6	5 4 3 2 1 0
2. Aquatic Habitat Diversity	Wide variety of stable aquatic habitat types present including: woody debris, riffles, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat.	Moderate variety of habitat types; 3-4 habitats present including woody debris.	Habitat diversity limited to 1-2 types; woody debris rare or may be smothered by sediment.	Stable habitats lacking or limited to macrophytes (a few macrophyte species scores lower than several).
	20 19 18 17 16	15 14 13 12 **11**	10 9 8 7 6	5 4 3 2 1 0
3. Hydrologic Heterogeneity	Mixture of hydrologic conditions i.e. pool, riffle, run, chute, waterfalls; variety of pool sizes and depths.	Moderate variety of hydrologic conditions; deep and shallow pools present (pool size relative to size of stream).	Limited variety of hydrologic conditions; deep pools absent (pool size relative to size of stream).	Uniform hydrologic conditions; uniform depth and velocity; pools absent (includes uniformly deep streams).
	20 19 18 17 16	15 14 13 12 11	10 9 **8** 7 6	5 4 3 2 1 0
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Shade	>80% of water surface shaded. Full canopy.	60 - 80% of water surface shaded; mostly shaded with open patches.	20 - 60% of water surface shaded; mostly open with shaded patches.	<20% of water surface shaded. Fully open; lack of canopy cover.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 **4** 3 2 1 0
7.Riparian Vegetation Integrity (within 20 meters)	No direct human activity in the last 30 years; mature native tree canopy and intact native understory	Minimal human activity; mature native tree canopy or native scrub; understory shows some impact (e.g. weeds, feral animal grazing).	Extensive human activity affecting canopy and understory; trees exotic (pine, willow, poplar); understory native or exotic.	Extensive human activity; little or no canopy; managed vegetation (e.g. livestock grazing, mowed); permanent structures may be present (e.g. building, roads, carparks).
Left bank	10 9	8 7 6	5 4 3	2 **1** 0
Right bank	10 9	8 7 6	5 4 3	2 **1** 0

SEV (Stream Ecological Valuation) field sheet

Substrate Assessment Datasheet

Stream Name	Pokawa
Site Code	POK1
Date	20.01.10

This assessment addresses spawning habitat for gobies, as well as providing data for assessment of the decontamination capacity of the stream reach based on organic material. The aim is to determine the relative proportion of different substrates and organic material within the reach. This can be acheived either through a broad-scale reach assessment (where diversity of types is low) or by detailed cross-section information(where diversity is of types is high). Where cross-sections are surveyed, divide the stream into 10 equally spaced points. At each point record the predominant substrate categories immediately in front of the mid-line of your boot or similar (1 = present). At the same point also record the organic material below/above the substrate (1=present). Remember to record the substrate underneath the organic material (in inorganic category). Record material only from stream bed.

Record the dominant substrate (inorganic or wood) at a minimum of 10 points across each cross-section

Inorganic material category										Wood		
Substrate category	**SI/SA**	**SG**	**SMG**	**MLG**	**LG**	**SC**	**LC**	**B**	**BR**	**SW (<25)**	**MW (25-100)**	**LW (>100)**
Size (mm)/Cross-section #	**<2**	**2-8**	**8-16**	**16-32**	**32-64**	**64-128**	**128-256**	**>256**				
1	6			3	1							
2	5	3	1		1							
3	4		1	2	2		1					
4	6	3	1									
5	5	2			1	1						
6	10											
7	5			**2**	**2**	1						
8	6	3	1									
9	5	2			2	1						
10	5		1	1	2		1					

Record dominant organic material (if any) on substrate at same 10 points as substrate

Organic material category			
Cross-section #	**Leaf litter**	**Periphyton, submerged macrophytes**	**Roots, plus emergent and floating vegetation**
1	4	2	
2	1	1	
3		10	2
4			
5	1		2
6		4	1
7		3	1
8	**2**		
9	2		
10	3		

Substrate category descriptors

SI/SA	Silt/Sand	**MLG**	Medium-large gravel	**LC**	Large cobbles	**SW**	Small wood
SG	Small gravel	**LG**	Large gravel	**B**	Boulders	**MW**	Medium wod
SMG	Small-medium gravel	**SC**	Small cobbles	**Bedrock**		**LW**	Large wood

SEV (Stream Ecological Valuation) field sheet

Check Sheet

Stream Name	Pokawa
Site Code	POK2
Date	19.01.10
Project #	

Project task	**Tick when completed**
Macroinvertebrates surveyed (do first)	√
Fish surveyed (do second)	
Site description sheet completed	√
Visual assessment sheets (3) completed	√
Cross section sheets (2) completed	√
Other components assessment sheet completed	√
Instream Retention datasheet completed	√
Habitat Assessment datasheet completed	√
Substrate Assessment datasheet completed	√
Photos taken	√

SEV (Stream Ecological Valuation) field sheet

These field sheets have been designed to guide the collection of data suitable for assessment of stream reaches using the Stream Ecological Valuation technique (Rowe et al, 2006). A separate set of field sheets should be completed for each site. Where deviation from the listed method is used please provide details in comments section

Site description

Date	19.01.10	**Team**	DC AF (MWH)		**Current (tick)**	
Stream Name	Pokawa	**Weather conditions**		**Clear/sunny**	√	**Has there been heavy rain in the past week (circle)?**
Site Code	POK2			**Cloudy**		**Yes**
Site location				**Rain**		No
GPS coordinates	**Easting**	2829925				
Upstream	**Northing**	6153290	**Photo nos**			
Downstream	**Easting**	2829840				
Site location map	**Northing**	6153405				

Comments

Temp	22.95 degrees C		
Conductivity	628 ms/cs		
DO%	45		
DO	4.05g/m3		
pH	7.43		

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Pokawa
Site Code	POK2
Date	19.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)
Natural flow (NFR)	**1. Vbed**	**Extent of channel bed modification**	**Channel type**	**Proportion of channel affected (0 - 1)**
		See Figure p15 of SEV report for examples	Natural channel bed with no modification	0
			Natural channel bed but with some unnatural fine sediment loading	0
			Channelised with some or no modification (eg gabions)	1
			Channelised with total modification (eg concrete lining)	0

Natural flow (NFR)	**2. Verosn**	**Proportion of bank length affected by flood flows resulting in erosion (circle appropriate range)**	**<5%**
			6-30%
			31-60%
			61-100%

Connectivity to flood plain (CFP)	**3. Vfreq**	**Estimate of mean annual frequency of flooding**	**Estimated annual frequency of flood-plain inundation (circle appropriate value)**
		If no data available, estimate using informed judgement. Need to take into account position in catchment, bank height and channel dimensions, presence of debris and/or sediment of floodplain, wet soils, degree of upstream imperviousness, presence of detention ponds, extent of channelisation. Consultation with locals may be useful.	**Rare (<1/yr)**
			Occasional (1-2/yr)
			Often (3-5/yr)
			Frequent (>5/yr)

Connectivity for species migrations (CSM)	**4. Vbarr**	**Identify natural and artificial barriers**	**Barrier types (# in reach)**	**Barriers present (circle appropriate category)**
		See Figure p21 of SEV report for examples		**None**
				Partial
				Total

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Pokawa
Site Code	POK2
Date	19.01.10

Dissolved oxygen demand (DOM)	**5. Vdod**	**Score DOD as per descriptors in next column**	**Indicators of oxygen reducing processes**	**Status of stream substrate (circle appropriate category)**
			much black anaerobic sediment extensive sediment bubbling when disturbed sulphide odour when disturbed surface scums present abundant sewage fungus	Poor
			small patches of anaerobic sediment some sediment bubbling and sulphide odour when disturbed abundant macrophyte biomass some sewage fungus may be present	Marginal
			no anaerobic sediment no sediment bubbling or sulphide odour moderate macrophyte biomass	**Sub-optimal**
			no anaerobic sediment no bubbling or adours little or no macrophyte biomass	Optimal

Flood-plain particle retention (FPR)	**6. Vrough**	**Measures the thickness of vegetation on the floodplain**	**Proportion of banks covered by any of the following individual or combined vegetation types:**			
		Refer to Figure p 33 of SEV report for examples	**Bare, short grass (grazed, mown)**	**Sedges & long grass**	**Flax, shrubs, thick under-storey**	**Trees & thin under-storey**
				0.95		0.05

Habitat for aquatic fauna (HAF)	**7. Vphyshab**	Provides an assessment of instream habitat quality	**Complete \Habitat Assessment Datasheet√**

Habitat for aquatic fauna (HAF)	**8. Vwatqual**	**Provides an assessment of the extent of shading upstream of the reach**	**Extent of stream upstream of the reach being assessed that is shaded**	**Tick appropriate category**
		Can estimate this using topographic maps as well as site visit	Well shaded (I.e. >50% of entire stream above site is forested)	
			Partially shaded (I.e. <50% of stream above site is forested)	
			Minimal shade (e.g. mainly pasture, but some riparian cover present)	√
			No shade (mainly open pasture)	

SEV (Stream Ecological Valuation) field sheet

Visual assessment component - assess over entire reach length

Stream Name	Pokawa
Site Code	POK2
Date	19.01.10

Fish spawning habitat (FSH)	**9. Vgalspwn**	**This provides a measure of area of available spawning habitat for galaxiids**	**Length of spawning habitat (m)**
		Measure the length of near-flat (slope<10°) that would be inundated by floods or high tides. Measure entire bank edge length. Do for entire reach.	0

Fish spawning habitat (FSH)	**10. Vgalqual**	**This provides a measure of the quality of spawning habitat for galaxiids**	**Quality of spawning habitat (circle appropriate category)**
		Assess the quality of spawning habitat for galaxiids in terms of substrate vegetation among which eggs are deposited. Refer to Figure p36 of SEV report for examples.	High
			Medium
			Low

Riparian vegetation intact (RVI)	**11. Vripcond**	**Assesses the current condition of riparian vegetation within the stream reach**	**Status of riparian vegetation**	**Tick appropriate category**
			Mature indigenous vegetation, regeneration, diverse canopy and under-storey	
			intact mature canopy but damaged under-storey	
			regenerating bush (e.g. manuka scrub), low diversity, early stage in climax, protected	
			as for above but unprotected (e.g. cattle grazing in understorey)	
			occasional native trees present, non-native trees	
			areas of distuibed soils common (e.g. from animal pugging, herbicide use, cultivation in riparian areas)	
			grazed/short grass	
			long grass	√

Riparian vegetation intact (RVI)	**12. Vripconn**	**Assesses the connection between riparian trees and streams**	**Proportion of stream channel with linkages intact (0-1)**
		Determine the proportion of stream channel where the connection(s) between riparian trees and the stream channel (eg. Root linkages) are NOT prevented by culverts, concrete linings, gabions, fences etc	1

Riparian vegetation intact (RVI)	**13. Vripar**	**Assesses the intactness of the riparian zone**	**Proportion of intact riparian zone (0-1)**
		Measure the proportion of riparian buffer zone (defined as 10m on either side of the stream) that is covered by trees or bush. Measure as horizontal distance from stream.	0.05

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Pokawa
Site Code	POK2
Date	19.01.10

Ecological Function	Variable	Variable description	Criteria	Data to record (shaded areas)	
Connectivity to flood plain (CFP)	**14. Vfpwidth**	**Floodplain width compared to wetted channel width (floodplain extent defined by annual flood level)**	**Cross-section #**	**Floodplain width (m) (A)**	**Wetted channel width (m) (B)**
			1	L 0 R0	2.7
			2	L0.7 R0	3.6.
			3	L 0 R0.7	3.4
			4	L 1.6 R0	2.55
			5	L2.1 R1.0	2.7
			6	L 2.2 R1.6	2.3
			7	L 2.8 R1.1	2.25
			8	L 2.5 R1.2	2.7
			9	L 2 R0.7	2.6
			10	L 1.8 R1.1	2.9
			Mean		

Water temperature control (WTC)	**15. Vdepth**	**Measure depth at selected positions across channel**	**Cross-section #**	**% of channel width/depth (m)**				
				0 L	**25**	**50**	**75**	**100 R**
		Water temperature control within a reach may be influenced by water depth, water velocity and the area of stream exposed to both solar radiation and ambient air temperature	1	0.01	0.24	0.41	0.51	0.04
			2	0.21	0.42	0.31	0.35	0.18
			3	0.03	0.35	0.68	0.59	0.9
			4	0.02	0.2	0.83	0.42	0.3
			5	0.06	0.6	0.67	0.7	0.63
			6	0.02	0.2	0.4	0.4	0.3
			7	0.04	0.25	0.52	0.64	0.38
			8	0.2	0.39	0.54	0.62	0.68
			9	0.25	0.43	0.49	0.53	0.3
			10	0.06	0.32	0.51	0.57	0.32
			Mean					

Determination of pollutants (DOP)	**16. Vsurf**	**Assess bio-surface type and proportional cover**	**Complete Substrate Assessment Sheet**
		Measure the proportions of biosurface categories for each cross section. Record at same time as substrate assessment	

Fish spawning habitat (FSH)	**17. Vgobspwn**	**Assesses the amount of available spawning habitat for bullies**	**Complete Substrate Assessment Sheet**
		Measure the proportions of hard substrate categories (excluding bedrock) for each cross section, as well as medium to large woody debris	

SEV (Stream Ecological Valuation) field sheet

Cross section component - assess at each of 10 representative cross-sections along reach

Stream Name	Pokawa
Site Code	POK2
Date	19.01.10

Water temperature control (WTC)	**18. Vshade**	**Proportion of stream channel shaded by vegetation, topographic features and artifical structures**	**Cross-section #**	**Shaded proportion (A) (0 - 1)**
		Assess the proportion of shading that the stream surface is subject to. For example, zero shading would be a flat plain. Assume trees in full leaf (mid-summer conditions). Refer to Figure p25 of SEV report for examples	1	0.9
			2	0.9
			3	0.5
			4	0.35
			5	0.2
			6	0.85
			7	0.6
			8	0.3
			9	0.4
			10	0.3
			Mean	

Organic matter input (OMI)	**19. Vcanop**	**Measures the amount of leaf fall likely to be contributed from overhead vegetation.**	**Cross-section #**	**Proportion of stream reach directly covered with overhead vegetation (0 - 1)**
			1	1
			2	0
			3	0
			4	0
			5	1
			6	1
			7	1
			8	0.1
			9	0.1
			10	0
			Mean	

Organic matter input (OMI)	**20. Vdecid**	**Records whether or not overhead vegetation contributes leaf fall year round or only part of the year**	**Cross-section #**	**Proportion of canopy cover over stream that is deciduous (0-1)**
			1	1
			2	0
			3	6
			4	0
			5	1
			6	1
			7	1
			8	1
			9	1
			10	0
			Mean	

SEV (Stream Ecological Valuation) field sheet

Stream Name	Pokawa
Site Code	POK2
Date	19.01.10

Other components

Water temperature control (WTC)	**21. Vlength**	**Measure length of reach**	**Reach length (m) (L)**
		Standardise survey reach length among sites, if appropriate	150

Water temperature control (WTC)	**22. Vveloc**	**Calculate mean velocity (Sm)**	**Velocity (m/s)**
		Take gauging at 1 point	0.17539

Instream particle retention (IPR)	**23. Vtrans**	**This measure provides an assessment of the capacity of the stream reach to retain material**	**Complete Instream Retention Datasheet**
	24. Vretain		

Invertebrate fauna intact (IFI)	**25. Vmci**	**Provides a species list and community composition of macroinvertebrate fauna**	**Hard (HB) or soft (SB) bottomed sampling protocol applied?**
	26. Vept	Sample using ARC protocols for hard and soft-bottomed streams, as appropriate. 1 composite sample per site to be collected.	**HB**
	27. Vinvert		

Fish fauna intact (FFI)	**28. Vfish**	**Measures the species diversity of fish within the reach**	**Fish species present (list)**	
	29. Vvert	Electrofish with a single pass along the entire length of the stream reach. Also note any other vertebrates or large invertebrates.		

SEV (Stream Ecological Valuation) field sheet

23 and 24 Instream Retention Datasheet

Stream Name	Pokawa
Site Code	POK2
Date	20.01.10

This needs to be undertaken at 2 sections (runs) within the reach, starting with an upper section and then working downstream. The value is obtained by a: running a measuring tape from top to bottom of the reach section, b: releasing 20 painted plastic paper triangles into the stream at the top of the reach section and 3: recording the distance downstream each triangle travels within the reach section, as well as the structure(s) they are retained on.

Run 1

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
30	1	B
29	1	AP
32	1	VEGE
25	1	B
20	2	AP
16	1	AP
7	1	AP
4.5	1	AP
0	4	AP
0	3	VEGE
1	1	VEGE

Run 2

Distance (m)	# of triangles retained	Structure retained on (choose from list below)
0	11	AP
0	2	VEGE
0.5	3	AP
0.3	1	AP
0.5	1	VEGE
3	1	AP

Structures retaining leaves							
Boulders and cobbles	Large wood and tree roots	Rooted aquatic plants/	Periphyton and leaf litter	Small wood	Bankside vegetation	Non-natural debris	Pool
B	LW	AP	PERI	SW	VEGE	NON	PL

SEV (Stream Ecological Valuation) field sheet

16 and 17 Habitat Assessment Datasheet

Stream Name	Pokawa
Site Code	POK2
Date	19.01.10

These data combined provide an assessment of instream habitat quality. For each habitat parameter, determine the most appropriate condition category for the survey reach, based on the descriptions provide. Within the selected condition category, circle the value which best describes the relative condition.

	Condition Category (circle most relevant value within range for category)			
Habitat Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Aquatic Habitat Abundance - proportion of stream channel occupied by sutable habitat fesatures for instream fauna	> 50% of channel favourable for epifaunal colonisation and fish cover; includes woody debris, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat. Also includes macrophyte dominated streams.	30-50% of channel contains stable habitat.	10-30% of channel contains stable habitat.	< 10% of channel contains stable habitat. Note: Algae does not constitute stable habitat.
	20 19 18 17 16	15 14 **13** 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Aquatic Habitat Diversity	Wide variety of stable aquatic habitat types present including: woody debris, riffles, undercut banks, root mats, rooted aquatic vegetation, cobble or other stable habitat.	Moderate variety of habitat types; 3-4 habitats present including woody debris.	Habitat diversity limited to 1-2 types; woody debris rare or may be smothered by sediment.	Stable habitats lacking or limited to macrophytes (a few macrophyte species scores lower than several).
	20 19 18 17 **16**	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Hydrologic Heterogeneity	Mixture of hydrologic conditions i.e. pool, riffle, run, chute, waterfalls; variety of pool sizes and depths.	Moderate variety of hydrologic conditions; deep and shallow pools present (pool size relative to size of stream).	Limited variety of hydrologic conditions; deep pools absent (pool size relative to size of stream).	Uniform hydrologic conditions; uniform depth and velocity; pools absent (includes uniformly deep streams).
	20 19 18 17 16	15 14 13 12 11	**10** 9 8 7 6	5 4 3 2 1 0
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Shade	>80% of water surface shaded. Full canopy.	60 - 80% of water surface shaded; mostly shaded with open patches.	20 - 60% of water surface shaded; mostly open with shaded patches.	<20% of water surface shaded. Fully open; lack of canopy cover.
	20 19 18 17 16	15 14 13 12 11	10 9 **8** 7 6	5 4 3 2 1 0
7.Riparian Vegetation Integrity (within 20 meters)	No direct human activity in the last 30 years; mature native tree canopy and intact native understory	Minimal human activity; mature native tree canopy or native scrub; understory shows some impact (e.g. weeds, feral animal grazing).	Extensive human activity affecting canopy and understory; trees exotic (pine, willow, poplar); understory native or exotic.	Extensive human activity; little or no canopy; managed vegetation (e.g. livestock grazing, mowed); permanent structures may be present (e.g. building, roads, carparks).
Left bank	10 9	8 7 6	5 4 3	**2** 1 0
Right bank	10 9	8 7 6	5 4 3	**2** 1 0

SEV (Stream Ecological Valuation) field sheet

Substrate Assessment Datasheet

Stream Name	Pokawa
Site Code	POK2
Date	19.01.10

This assessment addresses spawning habitat for gobies, as well as providing data for assessment of the decontamination capacity of the stream reach based on organic material. The aim is to determine the relative proportion of different substrates and organic material within the reach. This can be acheived either through a broad-scale reach assessment (where diversity of types is low) or by detailed cross-section information(where diversity is of types is high). Where cross-sections are surveyed, divide the stream into 10 equally spaced points. At each point record the predominant substrate categories immediately in front of the mid-line of your boot or similar (1 = present). At the same point also record the organic material below/above the substrate (1=present). Remember to record the substrate underneath the organic material (in inorganic category). Record material only from stream bed.

Record the dominant substrate (inorganic or wood) at a minimum of 10 points across each cross-section

Inorganic material category										Wood		
Substrate category	**SI/SA**	**SG**	**SMG**	**MLG**	**LG**	**SC**	**LC**	**B**	**BR**	**SW (<25)**	**MW (25-100)**	**LW (>100)**
Size (mm)/Cross-section #	**<2**	**2-8**	**8-16**	**16-32**	**32-64**	**64-128**	**128-256**	**>256**				
1	6			3	1							
2	5	3	1		1							
3	4		1	2	2		1					
4	6	3	1									
5	5	2			1	1						
6	10											
7	5			**2**	**2**	1						
8	6	3	1									
9	5	2			2	1						
10	5		1	1	2		1					

Record dominant organic material (if any) on substrate at same 10 points as substrate

Organic material category			
Cross-section #	**Leaf litter**	**Periphyton, submerged macrophytes**	**Roots, plus emergent and floating vegetation**
1	4	2	
2	1	1	
3		10	2
4			
5	1		2
6		4	1
7		3	1
8	**2**		
9	2		
10	3		

Substrate category descriptors

SI/SA	Silt/Sand	**MLG**	Medium-large gravel	**LC**	Large cobbles	**SW**	Small wood
SG	Small gravel	**LG**	Large gravel	**B**	Boulders	**MW**	Medium wod
SMG	Small-medium gravel	**SC**	Small cobbles	**Bedrock**		**LW**	Large wood

Appendix B: Invertebrate Survey Data

Upper Karamu	AWA1	AWA2	AWA3	POK1	POK2	KAR1	PAR1
Ephemeroptera							
Acanthophlebia							
Amelotopsis							
Arachnocolus							
Atalophlebioides							
Austroclima							
Austronella							
Coloburiscus							
Deleatidium							
Ichthybotus							
Isothraulus							
Mauiulus							
Neozephlebia							
Nesameletus							
Oniscigaster							
Rallidens							
Siphlaenigma							
Tepakia							
Zephlebia							1
Trichoptera							
Alloecentrella							
Aoteapsyche							
Beraeoptera							
Confluens							
Conuxia							
Costachorema							
Cryptobiosella							
Diplectrona							
Ecnomina							
Ecnomidae							
Edpercivalia							
Helicopsyche							
Hudsonema							1
Hydrobiosella							
Hydrobiosis							
Hydrochorema							
Kokiria							
Neurochorema							
Oecetis							1
Oeconesidae							
Olinga							
Orthopsyche							
Oxyethira	1	1			1	1	1
Paroxyethira	1	1		1	1	1	1
Philorheithrus							
Plectrocnemia							
Polyplectropus							
Psilochorema							
Pycnocentrella							
Pycnocentria							
Pycnocentrodes							
Rakiura							
Synchorema							
Tiphobiosis							

Triplectides							1
Triplectidina							
Zelandoptila							
Zelolessica							
Plecoptera							
Acroperla							
Austroperla							
Cristaperla							
Halticoperla							
Megaleptoperla							
Nesoperla							
Spaniocerca							
Spaniocercoides							
Stenoperla							
Taraperla							
Zelandobius							
Zelandoperla							
Hemiptera							
Anisops							
Diaprepocoris							
Microvelia		1	1				
Saldidae							
Sigara		1			1	1	1
Coleoptera							
Antiporus							
Berosus							
Copelatus							
Dytiscidae							
Elmidae	1						
Enochrus							
Homeodytes							
Hydraenidae							
Hydrophilidae			1				
Liodessus							
Onychohydrus							
Podaena							
Ptilodactylidae							
Rhantus							
Scirtidae							
Staphylinidae							
Odonata							
Aeshna							
Anisoptera							
Antipodochlora							
Austrolestes							
Hemianax							
Hemicordulia							
Ischnura							
Procordulia							
Uropetala							
Xanthocnemis	1		1		1		
Neuroptera							
Kempynus							
Diptera							
Aphrophila							
Austrosimulium							

Calopsectra							
Ceratopogonidae			1	1	1	1	
Chironomidae				1			
Chironomus	1	1	1		1	1	
Corynoneura			1				
Cryptochironomus							
Culex							
Culicidae							
Diptera indet.							
Dixidae							
Dolichopodidae							
Empididae							
Ephydridae	1			1	1		
Eriopterini							
Harrisius							
Hexatomini							
Limnophora							
Limonia							
Lobodiamesa							
Maoridiamesa							
Mischoderus							
Molophilus							
Muscidae	1			1	1	1	
Nannochorista							
Neocurupira							
Neolimnia							
Neoscatella							
Nothodixa							
Orthocladiinae			1				1
Parochlus							
Paradixa							
Paralimnophila							
Paucispinigera							
Pelecorhyncidae							
Peritheates							
Podonominae							
Polypedilum							
Psychodidae			1		1		
Scatella							
Sciomyzidae							
Stratiomyidae							
Syrphidae							
Tabanidae							
Tanypodoninae							
Tanytarsini		1	1		1	1	
Tanytarsus							
Thaumaleidae							
Tipulidae							
Zelandotipula							
Megaloptera							
Archichauliodes							
Lepidoptera							
Hygraula							
Collembola							
Crustacea							
Amphipoda							

Cladocera				1	1	1	
Copepoda							
Halicarcinus							
Helice							
Isopoda							
Mysidae							
Ostracoda	1	1	1	1	1	1	
Paracalliope	1	1	1		1	1	1
Paraleptamphopidae							
Paranephrops							
Paranthura							
Paratya							
Tanaidacea							
Acarina	1			1	1	1	1
Arachnida							
Dolomedes							
Mollusca							
Gundlachia = Ferrissia							
Glyptophysa = Physastra							
Gyraulus	1	1			1	1	1
Hyridella							
Latia							
Lymnaeidae			1	1			
Melanopsis							
Physa = Physella	1	1	1	1	1	1	1
Potamopyrgus	1	1	1	1	1	1	1
Sphaeriidae	1						
Bryozoa	1						
Hirudinea		1	1	1	1		1
Nematoda					1	1	1
Nematomorpha							
Nemertea						1	
Oligochaeta	1	1		1	1	1	1
Platyhelminthes	1	1	1		1	1	
Polychaeta							
Rhabdocoela							
Tardigrada							
Coelenterata							
Hydra					1		
# of taxa	17	14	16	13	22	18	16

Appendix C: Fish Survey Results

Fish collection form - Wadeable streams / rivers

Reviewed by (Initials) _____

Team members: AS & AF (MWH)

Lat/Long (GPS bottom): 2827556 / 6162054

Lat/Long (GPS top): _____

Site ID: Awanui 1 Date: 23 / 02 / 2010 Page 1 of 1

○ not fished other ○ fished none collected ○ fished all 10 subreaches ○ fished 5-9 subreaches ○ fished <5 subreaches [ ] flag for fished/not fished

Fish sample ID _____ Total shock (button) time (min) _____ Fishing time start 2100 finish 2155 Sample distance (m) Proposed 150m Actual 150~ Wetted width A ___ B ___ C ___ D ___ E ___ F ___ G ___ H ___ I ___ J ___

Sampling gear ☑ spotlight ○ EFM ○ seine length (m) ___ mesh (mm) ___ length (m) ___ mesh (mm) ___

Water visibility ○ good ○ average ○ poor Water temp. (°C) 22 Cond (uS) 589

EFM anode ○ big ○ small distance inland (km) ___ altitude (m) ___ gradient(°) ___ REC seg ID(s) ___ [ ] FLAG for other Sampling Information

EFM Volts (x100) ___ **Spotlight** (watts) 30 **Pulse Rate** (pps or Hz) ___ **FISH QIBI** Score ___ **EFM Pulse Width (ms)** ___

Common Name	Subreach Tally A	B	C	D	E	F	G	H	I	J	Total count	Vouch. count	LENGTH (mm)* Minimum	Maximum	Anom. count	Mortality count	Flag
Shortfinned eel		Present															
Unidentified eel		Present															
Mosquitofish		Present															
Inanga		Present															
Goldfish		Present															

Flag	Comment	Flag	Comment

Flag codes: K = No measurement made, U = Suspect measurement., F1,F2, etc. = flags assigned by each field crew. Explain all flags in commentx. LENGTH* - Enter single fish as minimum.

Environment Waikato REGIONAL COUNCIL

Fish collection form - Wadeable streams / rivers

Reviewed by (Initials) _____

Team members: AS + AF (MWH)

Lat/Long (GPS bottom): _____

Lat/Long (GPS top): _____

Site ID Awanui 2 Date 2 / 03 / 2010 Page 1 of 1

○ not fished other ○ fished none collected ○ fished all 10 subreaches ○ fished 5-9 subreaches ○ fished <5 subreaches [ ] flag for fished/not fished

Fish sample ID _____ Total shock (button) time (min) _____ Fishing time start 2140 finish 2222 Sample distance (m) Proposed 150 Actual 150 Wetted width A ___ B ___ C ___ D ___ E ___ F ___ G ___ H ___ I ___ J ___

Sampling gear ☑ spotlight ○ EFM ○ seine length (m) _____ mesh (mm) _____ length (m) _____ mesh (mm) _____

Water visibility ○ good ☑ average ○ poor Water temp. (°C) _____ Cond (uS) _____

EFM anode ○ big ○ small distance inland (km) _____ altitude (m) _____ gradient(°) _____ REC seg ID(s) _____ [ ] FLAG for other Sampling Information

EFM Volts (x100) _____ **Spotlight** (watts) 30 **Pulse Rate** (pps or Hz) _____ **FISH QIBI** Score _____ **EFM Pulse Width (ms)** _____

Common Name	Subreach Tally A	B	C	D	E	F	G	H	I	J	Total count	Vouch. count	LENGTH (mm)* Minimum	Maximum	Anom. count	Mortality count	Flag
Unidentified	Present																
Shortfinned eel	"																
Mosquitofish	"																

Flag	Comment	Flag	Comment

Environment Waikato REGIONAL COUNCIL

Flag codes: K = No measurement made, U = Suspect measurement., F1,F2, etc. = flags assigned by each field crew. Explain all flags in commentx. LENGTH* - Enter single fish as minimum.

Fish collection form - Wadeable streams / rivers

Reviewed by (Initials) _____

Team members: AS, AF & MWH

Lat/Long (GPS bottom): _____

Lat/Long (GPS top): _____

Site ID Awanui 3 Date 08 / 03 / 2010 Page 1 of 1

○ not fished other ○ fished none collected ○ fished all 10 subreaches ○ fished 5-9 subreaches ○ fished <5 subreaches [ ] flag for fished/not fished

Fish sample ID _____ Total shock (button) time (min) _____ Fishing time start 2035 finish 2110 Sample distance (m) Proposed 150m Actual 180m Wetted width A ___ B ___ C ___ D ___ E ___ F ___ G ___ H ___ I ___ J ___

Sampling gear ☑ spotlight ○ EFM ○ seine length (m) _____ mesh (mm) _____ length (m) _____ mesh (mm) _____

Water visibility ☑ good ○ average ○ poor Water temp. (°C) 16.8 Cond (uS) 479

EFM anode ○ big ○ small distance inland (km) _____ altitude (m) _____ gradient(°) _____ REC seg ID(s) _____ [ ] FLAG for other Sampling Information

EFM Volts (x100) _____ **Spotlight** (watts) 30 **Pulse Rate** (pps or Hz) _____ **FISH QIBI** Score _____ **EFM Pulse Width (ms)** _____

Common Name	Subreach Tally A	B	C	D	E	F	G	H	I	J	Total count	Vouch. count	LENGTH (mm)* Minimum	Maximum	Anom. count	Mortality count	Flag
Goldfish	present																

Flag	Comment	Flag	Comment

Environment Waikato REGIONAL COUNCIL

Flag codes: K = No measurement made, U = Suspect measurement., F1,F2, etc. = flags assigned by each field crew. Explain all flags in commentx. LENGTH* - Enter single fish as minimum.

Fish collection form - Wadeable streams / rivers

Reviewed by (Initials) _____

Team members: AS & AF (MWH)

Lat/Long (GPS bottom): _____

Lat/Long (GPS top): _____

Site ID Pokaua 1 Date 2 / 03 / 2010 Page 1 of 1

○ not fished other ○ fished none collected ○ fished all 10 subreaches ○ fished 5-9 subreaches ○ fished <5 subreaches [ ] flag for fished/not fished

Fish sample ID _____ Total shock (button) time (min) _____ Fishing time start 2035 finish 2136 Sample distance (m) Proposed 150 Actual 150 Wetted width A ___ B ___ C ___ D ___ E ___ F ___ G ___ H ___ I ___ J ___

Sampling gear ○ spotlight ○ EFM ○ seine length (m) _____ mesh (mm) _____ length (m) _____ mesh (mm) _____

Water visibility ○ good ✓ average ○ poor Water temp. (°C) _____ Cond (uS) _____

EFM anode ○ big ○ small distance inland (km) _____ altitude (m) _____ gradient(°) _____ REC seg ID(s) _____ [ ] FLAG for other Sampling Information

EFM Volts (x100) _____ **Spotlight** (watts) 30 **Pulse Rate** (pps or Hz) _____ **FISH QIBI** Score _____ **EFM Pulse Width (ms)** _____

Common Name	Subreach Tally A	B	C	D	E	F	G	H	I	J	Total count	Vouch. count	LENGTH (mm)* Minimum	Maximum	Anom. count	Mortality count	Flag
Uni eel	Present																
Shortfinned eel	"																
goldfish	"																
mosquito fish	"																
Inanga	"																

Flag	Comment	Flag	Comment

Environment Waikato REGIONAL COUNCIL

Flag codes: K = No measurement made, U = Suspect measurement., F1,F2, etc. = flags assigned by each field crew. Explain all flags in commentx. LENGTH* - Enter single fish as minimum.

Fish collection form ... / rivers

Reviewed by (Initials) _____

Team members: AS & AF (MWH)

Lat/Long (GPS bottom): _____

Lat/Long (GPS top): _____

Site ID: Pokeroa 2

Date: 23 / 02 / 2010 Page 1 of 1

○ not fished other ○ fished none collected ○ fished all 10 subreaches ○ fished 5-9 subreaches ○ fished <5 subreaches ☐ flag for fished/not fished

Fish sample ID _____ Total shock (button) time (min) _____ Fishing time start 2.2.1.5 finish 2.3.3.5

Sample distance (m) Proposed 150 Actual _____

Wetted width A _____ B _____ C _____ D _____ E _____ F _____ G _____ H _____ I _____ J _____

Sampling gear ✓ spotlight ○ EFM ○ seine length (m) _____ mesh (mm) _____ length (m) _____ mesh (mm) _____

Water visibility ✓ good ○ average ○ poor Water temp. (°C) 24 Cond (uS) 615

EFM anode ○ big ○ small distance inland (km) _____ altitude (m) _____ gradient(°) _____ REC seg ID(s) _____

☐ FLAG for other Sampling Information

EFM Volts (x100) _____ **Spotlight** (watts) 30 **Pulse Rate** (pps or Hz) _____ **FISH QIBI** Score _____ **EFM Pulse Width (ms)** _____

Common Name	Subreach Tally A	B	C	D	E	F	G	H	I	J	Total count	Vouch. count	LENGTH (mm) * Minimum	Maximum	Anom. count	Mortality count	Flag
Shortfinned eel	Present																
Gold fish	Present																
Mos fish	Present																
Common Bully	Present																

Flag	Comment	Flag	Comment

Environment Waikato REGIONAL COUNCIL

Flag codes: K = No measurement made, U = Suspect measurement., F1,F2, etc. = flags assigned by each field crew. Explain all flags in commentx. LENGTH* - Enter single fish as minimum.

Fish collection form - Wadeable streams / rivers

Reviewed by (Initials) _____

Team members: AF, AS (MWH)

Lat/Long (GPS bottom): _____

Lat/Long (GPS top): _____

Site ID Paritua 1 Date 5 / 3 / 2010 Page 1 of 1

○ not fished other ○ fished none collected ○ fished all 10 subreaches ○ fished 5-9 subreaches ○ fished <5 subreaches [ ] flag for fished/not fished

Fish sample ID _____ Total shock (button) time (min) _____ Fishing time start 2200 finish 2245 Sample distance (m) Proposed 150 Actual – Wetted width A ___ B ___ C ___ D ___ E ___ F ___ G ___ H ___ I ___ J ___

Sampling gear ○ spotlight ○ EFM ○ seine length (m) _____ mesh (mm) _____ length (m) _____ mesh (mm) _____

Water visibility ○ good ○ average ☑ poor Water temp. (°C) 18 Cond (uS) 339

EFM anode ○ big ○ small distance inland (km) _____ altitude (m) _____ gradient(°) _____ REC seg ID(s) _____ [ ] FLAG for other Sampling Information

EFM Volts (x100) _____ **Spotlight** (watts) 30 **Pulse Rate** (pps or Hz) _____ **FISH QIBI** Score _____ **EFM Pulse Width (ms)** _____

Common Name	Subreach Tally A	B	C	D	E	F	G	H	I	J	Total count	Vouch. count	LENGTH (mm)* Minimum	Maximum	Anom. count	Mortality count	Flag
Goldfish	Present.																
Inanga	Present.																
Unid eel	Present																
Shortfinned eel	Present.																
Unid fish	Present.																

Flag	Comment	Flag	Comment

Environment Waikato REGIONAL COUNCIL

Flag codes: K = No measurement made, U = Suspect measurement., F1,F2, etc. = flags assigned by each field crew. Explain all flags in commentx. LENGTH* - Enter single fish as minimum.

Fish collection form - Wadeable streams / rivers

Reviewed by (Initials) _____

Team members: AF & AS (HWH)

Lat/Long (GPS bottom): _____

Lat/Long (GPS top): _____

Site ID Karewarewa 1 Date 08 / 03 / 2010 Page 1 of 1

○ not fished other ○ fished none collected ○ fished all 10 subreaches ○ fished 5-9 subreaches ○ fished <5 subreaches [ ] flag for fished/not fished

Fish sample ID _____ Total shock (button) time (min) _____ Fishing time start 23 00 finish 23 45 Sample distance (m) Proposed 150 Actual _____ Wetted width A _____ B _____ C _____ D _____ E _____ F _____ G _____ H _____ I _____ J _____

Sampling gear ○ spotlight ○ EFM ○ seine length (m) _____ mesh (mm) _____ length (m) _____ mesh (mm) _____

Water visibility ○ good ○ average ☑ poor Water temp. (°C) 18 Cond (uS) 370

EFM anode ○ big ○ small distance inland (km) _____ altitude (m) _____ gradient(°) _____ REC seg ID(s) _____ [ ] FLAG for other Sampling Information

EFM Volts (x100) _____ **Spotlight** (watts) 30 **Pulse Rate** (pps or Hz) _____ **FISH QIBI** Score _____ **EFM Pulse Width (ms)** _____

Common Name	Subreach Tally A	B	C	D	E	F	G	H	I	J	Total count	Vouch. count	LENGTH (mm)* Minimum	Maximum	Anom. count	Mortality count	Flag
Inanga	Present																
Unidoel	Present																
Shortfinnedeel	Present																
mosquitofish	present																
Goldfish	present																

Flag	Comment	Flag	Comment

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Flag codes: K = No measurement made, U = Suspect measurement., F1,F2, etc. = flags assigned by each field crew. Explain all flags in commentx. LENGTH* - Enter single fish as minimum.

MWH

BUILDING A BETTER WORLD

ABOUT MWH IN NEW ZEALAND

MWH in New Zealand has been providing private and public sector clients with infrastructure and environmental expertise for over 100 years.

Our offices across New Zealand are part of a global operation of 7000 staff in 35 countries giving us an unparalleled ability to combine local knowledge with international expertise.

Around the world our purpose is to work with clients and communities to help build a better world.

In New Zealand our extensive range of services covers the following disciplines:

- Asset Management
- Business Solutions
- Civil and Structural Engineering
- Energy Generation
- Environmental Science and Management
- Geoscience and Geotechnical
- Mechanical, Electrical and Building Services
- Planning, Policy and Resource Management
- Programme Management
- Roads and Highways
- Solid Waste
- Stormwater
- Surveying
- Transport Planning
- Water Resources
- Water Supply
- Wastewater

To find out more about what we do and how we can assist visit www.mwhglobal.co.nz or www.mwhglobal.com