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## **Field Manual for Riparian Management Classification**

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**NIWA Client Report: HAM2009-102  
June 2009**

**NIWA Project: ENC09202**



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## **Field Manual Riparian Management Classification**

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*Prepared for*

**Environment Canterbury**

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*Reviewed by:*



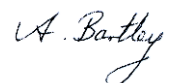
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*Approved for release by:*



Dr Stephanie Parkyn

*Formatting checked*



## 1. Introduction

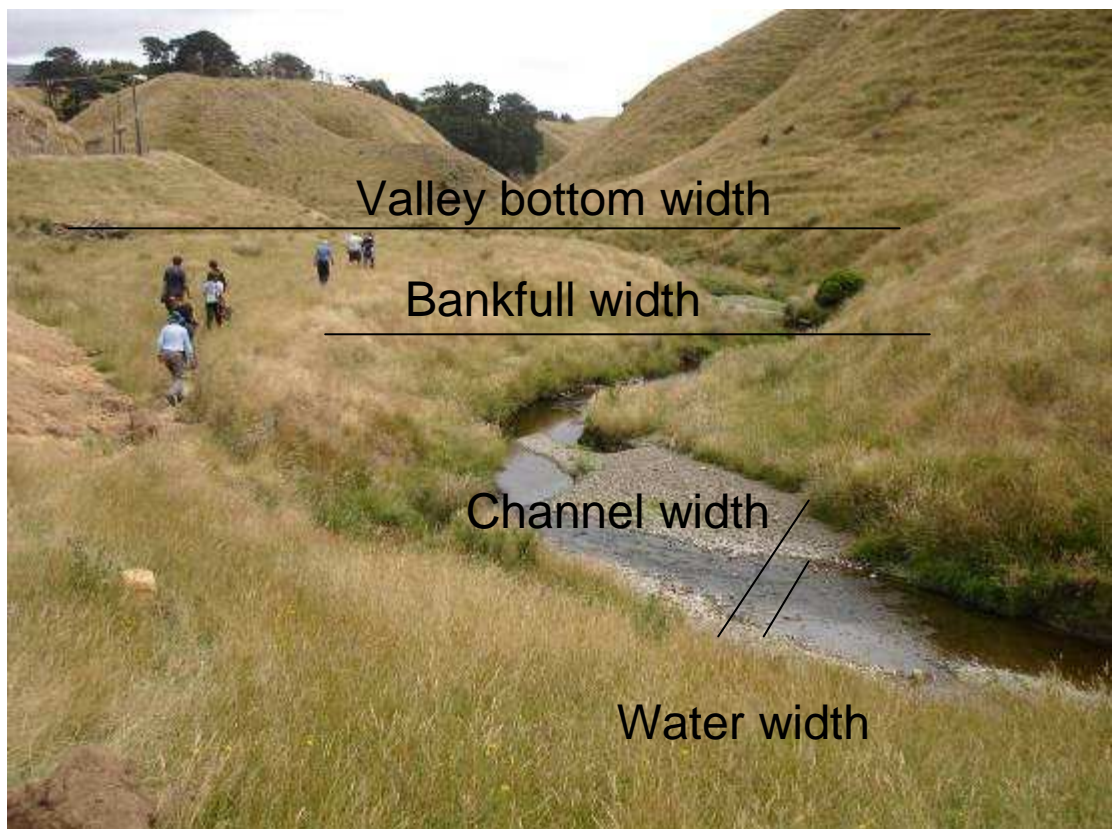
The Riparian Management Classification (RMC) provides a framework to guide catchment planning and management of the riparian margins to rehabilitate/restore stream health and functions that support ecosystem services. The RMC involves rapid assessments of the current state of riparian zones and their current and potential functions. These *state* assessments and *function* ratings provide information that can be used to prioritise and design riparian management within streams and catchments to enhance the return of investment of time and money.

This field manual is an abbreviated version of the companion desk reference manual that provides additional background information on the method and details on the research information that underpins the Riparian Management Classification (RMC) survey method. The field manual describes how to fill in the two RMC survey forms for assessing riparian state and functions. It includes examples of current RMC ratings for a range of stream conditions and Appendix 1 provides an example of completed RMC state and function forms.

This manual covers two aspects of the RMC: (1) assessment of the state of the riparian area and key attributes of the stream and surrounding land (Section 2); and (2) rating riparian functions under current conditions and future scenarios of pragmatic management and best riparian practice (Section 3). The function rating is the most important aspect of the RMC for planning. The state assessment provides the context for the function ratings but **may be substituted by other protocols**, such as the ECan Streamwalk methodology or Protocol 1 of the Stream Habitat Assessment Protocols. Section 2 of this manual (on assessing the state of the riparian areas) can be skipped if another protocol is used to familiarise with the site before doing the function assessment.

## 2. Riparian State Assessment

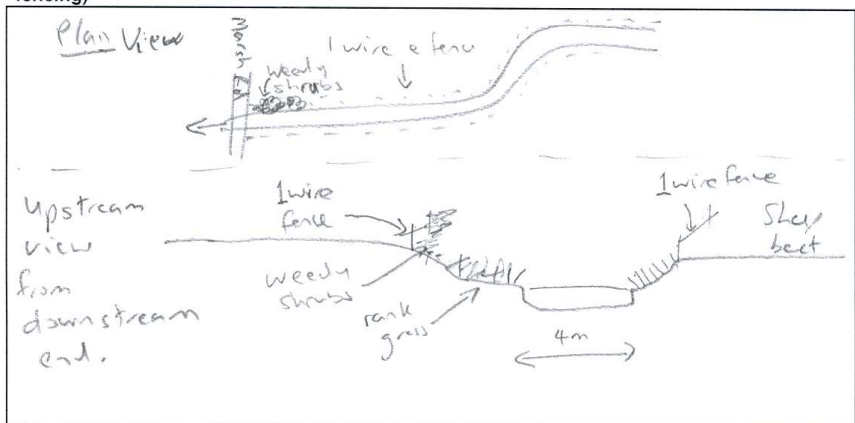
- 2.1 Introduction** The methodology below follows the order of the items in the riparian state assessment form. An example of a completed riparian state assessment form is provided in Figure 2. The example site is the Northbrook and Marsh's Rd (see lower image in Figure 21c for a site photograph). Note that the left and right sides of the stream are defined looking downstream (as is standard for hydrological assessments).
- 2.2 General land use** = land use beyond the riparian area
- 2.3 Riparian land use** = use of streamside land that comprises an identifiable riparian zone or, if this is not identifiable, to 10-20 m from the edge of the stream channel. Use L or R to define riparian land uses on the left and right sides of the stream.
- 2.4 Streams widths (Fig. 2).** If the stream reach runs through extensive plains enter "plains".



**Figure 1:** Examples of different stream and valley widths measured in RMC state assessment.

Site state assessment										
Site <i>Northbrook at Murchie Rd</i>			Site Code <i>7</i>		Date <i>30/4/09</i>		Length(m) <i>50</i>			
GPS Top: E <i>2479335</i> N <i>5675080</i>			Bottom: E <i>2479395</i> N <i>5665000</i>							
Gen. land use left side		native forest planted forest		<input checked="" type="checkbox"/> sheep <input checked="" type="checkbox"/> beef		deer dairy horticulture		peri-urban urban		
Gen. land use right side		native forest planted forest		<input checked="" type="checkbox"/> sheep <input checked="" type="checkbox"/> beef		deer dairy horticulture		peri-urban urban		
Riparian land use (mark R for right & L for left bank)					conservation		filter strip	woodlot	urban stopbank whitebaiting	
cattle	sheep	deer	crop	hort	esplanade	reserve	waterfowl	shooting	engineered floodway Other=	
Widths (m)		Water= <i>4</i>		Channel= <i>4</i>		Bankfull= <i>7</i>		valley bottom= <i>plain</i>		
Channel plan shape		channelised straight		<input checked="" type="checkbox"/> meandering		sinuous		Valley form		V U <input checked="" type="checkbox"/> plain
Flow		ephemeral intermittent		<input checked="" type="checkbox"/> perennial		regulated wetland		Stream shade (% of open) = <i>10</i>		

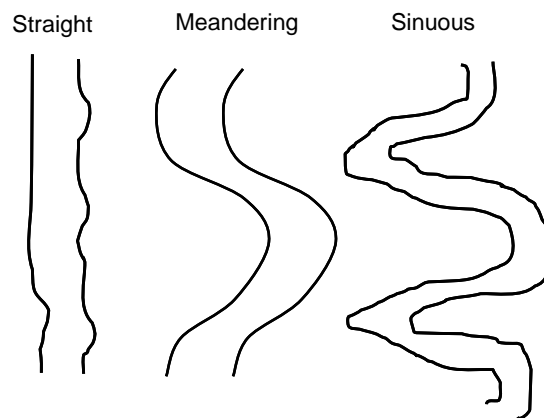
Sketch stream plan, cross-section & comments: (including where planting zones occur, position of current fencing)

	<p style="text-align: center;">Photo numbers and descriptions</p> <p><i>23/24</i> up 10m downstream from mid reach</p>
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Streambed		clay mud silt sand <input checked="" type="checkbox"/> gravel		cobble bedrock		% riffle/run/pool		<i>15 / 75 / 10</i>	
Bank left	Height (m) lower= <i>0.2</i> upper= <i>1</i>		Stability		%stable= <i>100</i> %undercut=		%slumping=		%earthflow=
Bank right	Height (m) lower= <i>0.2</i> upper= <i>1</i>		Stability		%stable= <i>100</i> %undercut=		%slumping=		%earthflow=
Stabilised by	Left <input checked="" type="checkbox"/> grasses <input type="checkbox"/> shrubs		sedge/rushes		trees		bedrock		riprap/artificial
	Right <input checked="" type="checkbox"/> grasses <input type="checkbox"/> shrubs		sedge/rushes		trees		bedrock		riprap/artificial
Macrophytes		% cover = <i>50</i> Type = <i>P. crispus</i>							
Periphyton		none <input checked="" type="checkbox"/> slippery <input type="checkbox"/> obvious <input type="checkbox"/> abundant		excessive, Fil Alg>30%		Wood		<input checked="" type="checkbox"/> absent <input type="checkbox"/> sparse <input type="checkbox"/> common <input type="checkbox"/> abundant	
Live-stock access to stream & bank damage		Left Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	Left damage		<input checked="" type="checkbox"/> none <input type="checkbox"/> minor <input type="checkbox"/> moderate <input type="checkbox"/> extensive		Other		
		Right Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	Right damage		<input checked="" type="checkbox"/> none <input type="checkbox"/> minor <input type="checkbox"/> moderate <input type="checkbox"/> extensive		damage		
Riparian veg: mark left (L) & right (R)			rock	bare soil	grass	annuals	wetland	toetoe	flax
			treeferns	low shrubs	high shrubs	native trees	coniferous	deciduous	exotic other=
Dominant riparian plant species			Left = <i>pasture grass</i>			Right = <i>pasture grass</i>			
Local runoff potential	Left slope length (m) <i>40</i>		Left land slope class		<input checked="" type="checkbox"/> <2° <input type="checkbox"/> 2-5° <input type="checkbox"/> 5-10° <input type="checkbox"/> 10-15° <input type="checkbox"/> 15-25° <input type="checkbox"/> >25°				
	Right slope length (m) <i>50</i>		Right land slope class		<input checked="" type="checkbox"/> <2° <input type="checkbox"/> 2-5° <input type="checkbox"/> 5-10° <input type="checkbox"/> 10-15° <input type="checkbox"/> 15-25° <input type="checkbox"/> >25°				
Riparian wetlands		Left absent <input checked="" type="checkbox"/> sparse <input type="checkbox"/> common <input type="checkbox"/> extensive		Right absent <input checked="" type="checkbox"/> sparse <input type="checkbox"/> common <input type="checkbox"/> extensive					

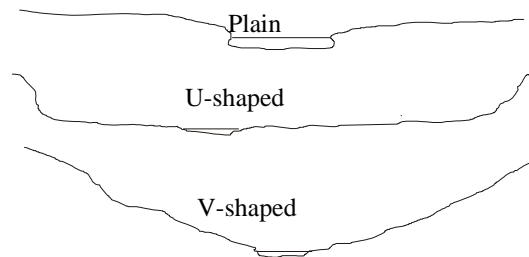
**Figure 2:** An example of a completed RMC state assessment form. Reach is shown in lower photograph in Figure 15c.

**2.5 Channel plan shape** See Figure 3



**Figure 3:** Representative channel plan forms in RMC state assessment.

**2.6 Valley form** see Figure 4



**Figure 4:** Schematic illustrations of valley forms in RMC state assessment.

**2.7 Stream flow permanence:** Ephemeral (carries water in wet weather events), intermittent (typically dry up in summer or reduced to residual, non-connected, pools), perennial (usually run year round) and wetlands (seasonally or permanently saturated soils, typically with wetland vegetation such as sedges and flax).

**2.8 Stream shade:** Assessed over channel throughout survey reach (not just mid-channel), taking into account the effects of streambanks, riparian vegetation and hillslopes on both sides of the stream, throughout the day (not just mid-day). Shade is often patchy so needs to be integrated for the whole reach. Estimates are as a percentage of the “open” condition (i.e., full 180° as on an unshaded hilltop or plain). An “open” stream will have little shade (e.g., <20% of the bed) and sunlight reaches most of the stream bed, whereas a heavily shaded reach will contain riparian vegetation, topography and/or human structures (e.g., culverts) which shade >80% of the bed (Fig. 5).





Shade = 99%



Shade = 95%



Shade = 84%



Shade = 84%



Shade = 81%



Shade = 70%



Shade = 70%



Shade = 68%



Shade = 64%



Shade = 26%



Shade = 23%



Shade = 21%

**Figure 5:** Reach photographs and shade levels measured with paired canopy analysers.

**2.9 Reach sketch drawing and photographs:** Sketch the stream plan (bird's-eye) view and cross-sectional view and take photographs of the stream reach and riparian areas. The sketches are intended a quick schematics showing riparian areas in the context of the surrounding landforms, land management (e.g., location of fences, significant trees, raceways, buildings etc.) and the stream channel. The photographs should include at least one representative image looking upstream and one looking downstream, as well as representative images looking towards each of the left and right banks. A high elevation photograph of the whole reach is also often useful and may replace the plan sketch.

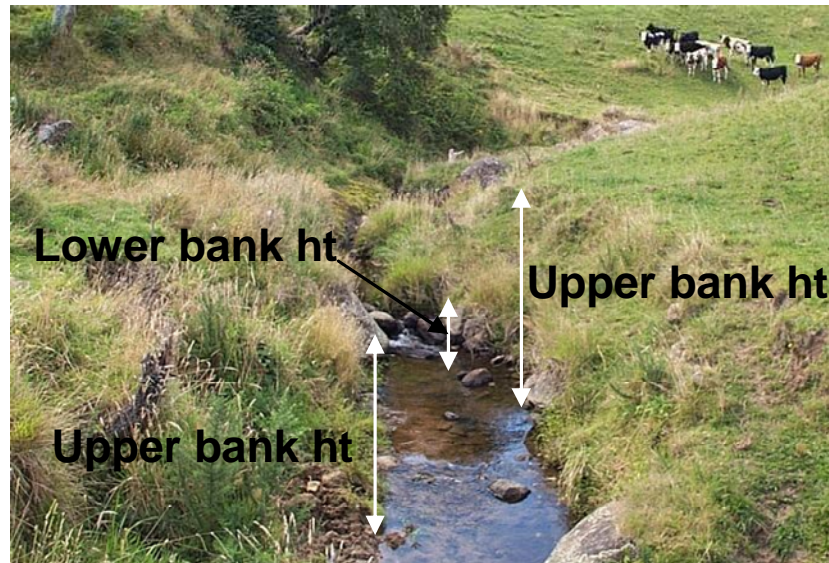
**2.10 Streambed substrate type:** Clay/mud is very fine substrate which typically holds together in clumps when handled. Silt and sand are progressively coarser, larger particles and typically disperse when handled. Gravel substrate is >2 mm, cobbles are 64-256 mm and boulders are >256 mm across the stone "b" axis (width).

**2.11 Flow habitat classification:** (Fig. 6) Riffle – shallow depth, moderate to fast water velocity, with mixed currents, surface rippled (class includes rapids (surface broken)) and chutes/falls in this simplified classification); Run – character in between that of riffle and pool, slow - moderate depth and water velocity, uniform – slightly variable current, surface unbroken, smooth – rippled; Pool – deep, slow flowing with a smooth water surface, usually where the stream widens and/or deepens.



**Figure 6:** Example of riffle, run and pool classes in Waitao Stream, Bay of Plenty.

**2.12 Streambank height:** Measured from the streambed to the top of the bank when the flow can escape the channel (Fig. 7). Record separately the low banks on the margin of the unvegetated active channel and the high banks that control flow into the broader valley floodplain. Upper and lower banks may be differentiated by a change in slope. Where there is no obvious change, lower bank height equals upper bank height.



**Figure 7:** Examples of lower and upper streambank heights in RMC state assessment.

**2.13 Streambank stability:** Assess percentage of the length of each streambank that is stable, undercut (note that these may be stable), slumping (Fig. 8A, B) and subject to earthflow (i.e., sediment input from a hillslope rather than just the streambank, Fig. 8C).



**Figure 8:** Stream bank examples of (A & B) slumping, (C) earthflow erosion and (D) a stable undercut.

- 2.14 Bank stabilising vegetation or other features:** Note the types that contribute to stream bank stabilisation by circling the listed features (grasses, shrubs, sedge/rushes, trees, bedrock and riprap/artificial structures) and ticking the dominant feature.
- 2.15 Macrophytes:** Evaluate the average % cover of the streambed throughout the reach and, if known, the species present. Specimens (ideally including flowers) collected in the field for identification should be stored on ice or dried out between sheets of absorbent paper for later identification in the laboratory.
- 2.16 Periphyton:** If possible, pick up several rocks to distinguish between bare rocks (none) and those with thin biofilms (slippery). Obvious growths are those that are clearly visible as green or brown growths. Abundant growths include filamentous algae or periphyton mats (defined as >3mm thick to distinguish these from thinner biofilms) (Fig. 9). Periphyton is classed as excessive (in terms of aesthetic effects) when >30% of the bed is covered by filamentous growths or >60% is covered by mats (Biggs 2000).



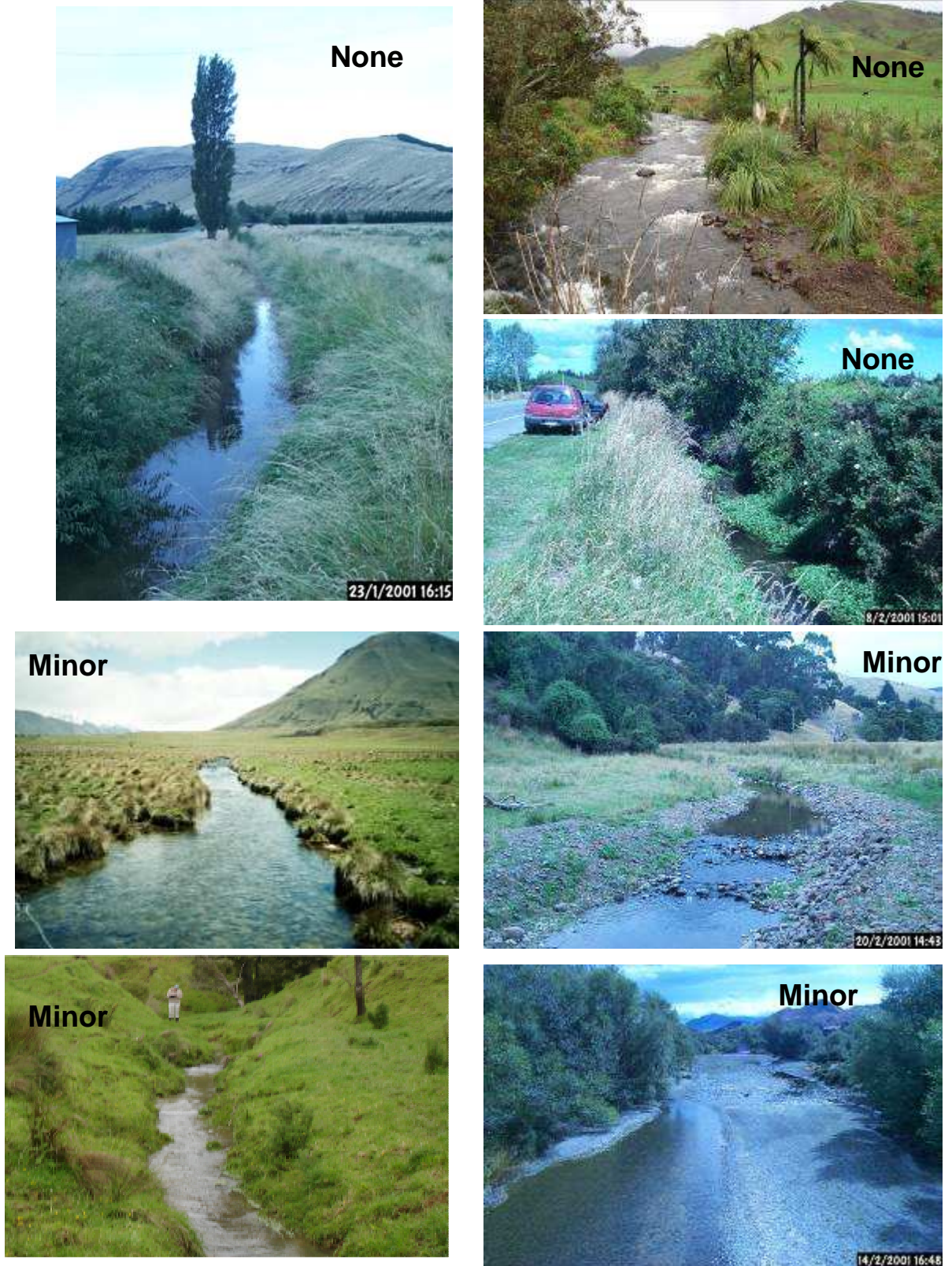
**Figure 9:** Periphyton cover as filamentous green algae and a thick diatom mat (photo on right from Biggs 1990).

- 2.17 Wood:** Wood abundance within the active channel (i.e., total within and above the wetted and unvegetated area of the channel) is classed as “absent”, “sparse” (isolated pieces, < 2% cover of the bed), “common” (2-10% cover) or “abundant” (>10% cover). This includes wood that is both living (Fig. 10A) and dead, small and large (Fig. 10B-D).



**Figure 10:** Wood in streams examples. A, Live wood B & C, Coromandel streams showing common and abundant wood levels; D, Central NI stream with abundant wood. Photos A & D, Rob Davies-Colley.

- 2.18 Livestock access:** Infer from fencing, adjacent land use and obvious signs of livestock access (tracks, hoof marks, pugging, dung, and vegetation grazing). Brief notes can be added in the sketch space provided on partial access (e.g., single wire electric fencing allowing sheep access but not cattle).
- 2.19 Livestock damage to streambanks**  
 Livestock damage to streambanks rated as “none”, “minor”, “moderate” or “extensive”. Figures 11 and 12 provide examples of these ratings.



**Figure 11:** Examples of livestock stream damage to streambanks rated as none and minor.



**Figure 12:** Examples of livestock stream damage to streambanks rated as none to extensive.

**2.20 Riparian vegetation cover**

Note types present within the riparian area (i.e., to 10-20 m from the streambanks or an obvious natural riparian zone outer edge) by marking L and/or R next to the vegetation types present on left and right sides and the dominant type.

**2.21 Local land slope angle and length**

Estimate the local land slope from the top of the hillslope draining to the riparian area = potential source of surface runoff and associated contaminants.

**2.22 Riparian wetlands**

Circle one of the abundance classes to note amount of wetland (water-logged soils that are moist and soft underfoot and often have wetland plants present, such as sedges, flax or raupo along each bank (Fig. 13).



**Figure 13:** Examples of riparian wetlands.



## 3. Riparian Function Assessment

### 3.1 Introduction

The following sections provide RMC rating guides, an example of a completed function assessment form (Fig. 14) and photographs (Fig. 15) with examples of RMC scores for current conditions at eighteen stream reaches, covering a variety of conditions, which can also be used to benchmark function activity ratings.

Begin with rating the activity of each riparian function under **current conditions** on a 0 to 5 scale as follows:

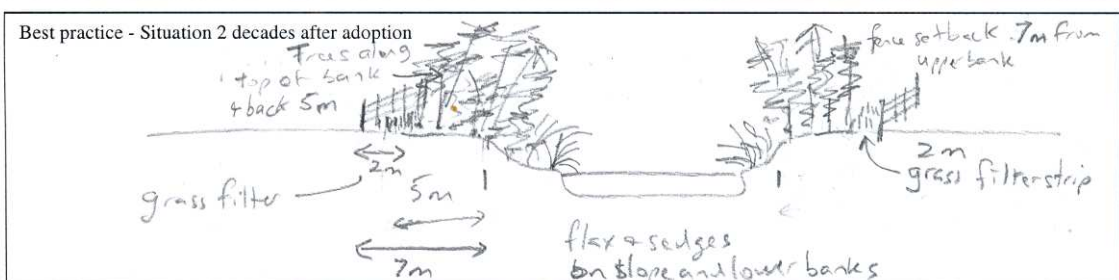
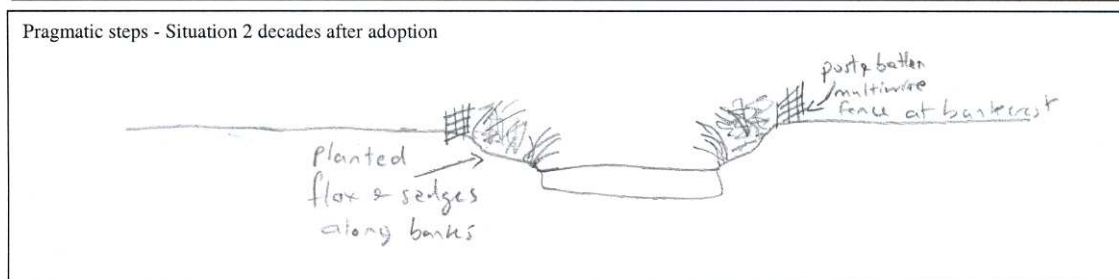
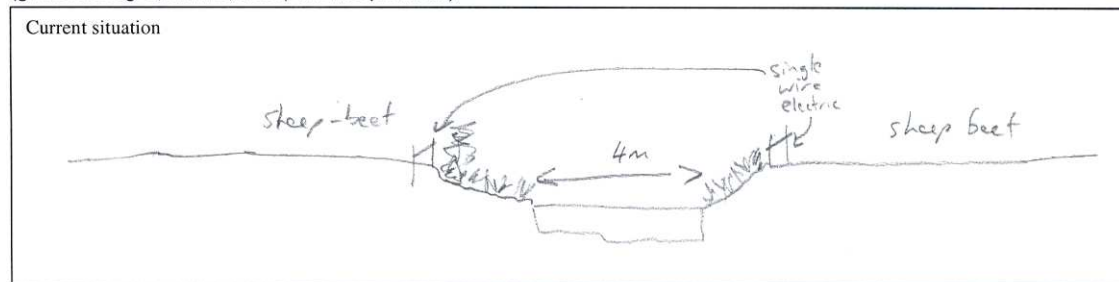
0 = function absent;    1 = very low activity;    2 = low-moderate activity;  
3 = moderate activity;    4 = high activity;    5 = very high activity.

Next repeat the assessments for the riparian conditions expected to develop in a medium time frame (2 decades) with **pragmatic steps** that the land manager is likely to adopt and maintain (with a modest level of support from the regional council), taking into account important non-ecological values of the stream reach.

Finally, assess ratings after adoption of **best practice** riparian management appropriate for the geographic setting. Best practice for riparian management typically involves fencing to exclude stock and establishing a filter strip of dense groundcover or woody vegetation (trees and/or shrubs) or combinations of these in tiers (e.g., a filter strip adjacent to the pasture then woody vegetation adjacent to the stream). The management practices and riparian infrastructure (fences) vegetation are summarised by the surveyor in the best practice sketch at the bottom of the back page of the RMC field sheet.

Riparian function assessment (score 0 = absent, 5 = very highly active)				
Function	Current	Prag' steps	Best practice	Comments
Livestock excreta input & damage control	2	3	5	
Bank stabilisation	L 4	L 5	L 5	
	R 3	R 5	R 5	
Overland flow filtering	L 1	L 2	L 5	Flat land so narrow grass buffer will be effective
	R 1	R 2	R 5	
Nutrient uptake by riparian plants	L 1	L 2	L 4	
	R 1	R 2	R 4	
Denitrification	L 1	L 1	L 2	
	R 1	R 1	R 2	
Shading	1	1	2	
Leaf litter input	0	1	2	
Wood input	0	0	1	
Enhancing in-stream fish habitat	1	2	3	
Controlling downstream flooding	1	2	3	
Human recreation	1	1	4	
Aesthetics	1	2	4	

Sketch stream cross-sections & key elements of current situation (if not already done in state assessment), pragmatic (first steps) and best practicable riparian management: (including where planting zones occur, general vegetation types (grasses/sedges, shrubs, trees) & fence positions).



**Figure 14** Example of a completed RMC function assessment form (for the North brook at Marsh's Rd).

### 3.1.1 RMC function activity rating guide livestock excreta input and damage

0 = function absent, Uncontrolled livestock access to stream (e.g., Fig. 15a)

1 = very low activity; partial control of cow or deer access to stream but riparian area largely unprotected and sheep have access e.g., single wire electric fence (dairy or beef) or deer fence along stream bank on one side; or drinking troughs in paddock; or high banks/deep water deter livestock access; no fencing but low grazing pressure

2 = low-moderate activity; full control of cattle (but not sheep) access to stream but riparian area unprotected; e.g., single wire near stream bank on both sides of stream (e.g., Fig. 15d)

3 = moderate activity; full control of all livestock access to stream but riparian area unprotected and livestock drinking watering-point access maintained; e.g., post and batten or deer fence near the streambank on both sides of stream or single wire electric fence if farm is dairy with not sheep.

4 = high activity; full control of all livestock access to stream and riparian area but livestock drinking watering-point access maintained; e.g., post and batten or deer fence set back 5-10 m from streambank on both sides of stream

5 = very high activity; access of all livestock to the riparian area and stream prevented consistently on both sides of stream and stream crossings are bridged or culverted.

### 3.1.2 RMC function activity rating guide for streambank stabilisation

0 = function absent, banks bare of vegetation

1 = very low activity; banks poorly vegetated/heavily grazed or vertical banks with veg. rooting depth of vegetation  $< 1/3$  of bank height (e.g., grasses on 1 m high vertical bank or overstorey trees on 5 m high vertical bank)

2 = low-moderate activity; banks moderately vegetated or vertical banks with veg. rooting depth of vegetation  $1/3$ - $2/3$  of bank height (e.g., grasses on 0.5 m high vertical bank; shrubs on 1.5 m high vertical bank)

3 = moderate activity; banks well vegetated by plants with rooting depth = streambank height (e.g., pasture grass on  $< 45^\circ$  banks edge height 0.3 m); or vegetation with roots to  $> 1.5$  x bank height but patchy so that  $<$  half length is well-protected

4 = high activity; vegetation has rooting depth 1-2 x bank height

5 = very high activity; vegetation has rooting depth  $> 2$  x bank height and is permanently protected from livestock damage (e.g., tussock/sedges on  $< 0.2$  m high banks; shrubs on  $< 0.5$  m high vertical banks; trees on 1 m high vertical banks)

### 3.1.3 RMC function activity rating guide for filtering particulates from overland flow

0 = function absent, banks bare or short veg with high soil compaction

1 = very low activity; short (grazed) veg. with high level of soil compaction; or mod. veg. length (ca. 10 cm) but most of flow passes through area in channels/rills; or mod. veg. length (ca. 10 cm) but low soil porosity (clay); or buffer width totally inadequate for slope angle, length & particle load draining to riparian area (e.g., 1-2 m along v-shaped valley with 100m long 30° land slopes of sheep/beef grazed pasture)

2 = low-moderate activity; mod cover of grass (>10 cm) or med litter layer (3-5 cm); mod channels/rills; mod compaction, mod porosity (silty) soil (e.g., macropores abundant, sandy soil); buffer width barely adequate for slope angle & length & particulate load of land draining to rip area

3 = moderate activity; mod cover of grass (>10 cm) or med litter layer (ca. 5 cm); few channels/rills; uncompacted, moderately porous (silty) soil (e.g., macropores abundant, sandy soil); buffer width almost adequate for slope angle and length and particulate load of land draining to rip area

4 = high activity; dense groundcover of grass (ca. 20 cm high) or thick (>10 cm) litter layer; minor channels/rills; uncompacted, highly porous soil buffer width adequate for slope angle and length and particulate load of land draining to rip area

5 = very high activity; dense groundcover of grass or thick litter layer; no channels/rills; uncompacted, highly porous soil (e.g., macropores abundant, sandy soil); buffer width more than adequate for slope angle and length and particulate load of land draining to riparian area

### 3.1.4 RMC function activity rating guide for nutrient uptake from groundwater

0 = function absent, banks bare of vegetation

1 = very low activity; banks poorly vegetated or rooting depth of vegetation  $< 1/2$  of bank height above normal water level (e.g., grasses on 1.2 m high bank or overstorey trees on 5 m high bank)

2 = low-moderate activity; narrow buffer ( $\leq 5$  m wide) of veg. with rooting depth ca.  $1/2$  bank height above normal water level (e.g., grasses on 0.5 m high vertical bank; shrubs on 1.5 m high vertical bank)

3 = moderate activity; narrow buffer ( $\leq 5$  m wide) of veg. with rooting depth to water level at baseflow

4 = high activity; medium buffer (5-10 m wide) of veg. with rooting depth to water level at baseflow

5 = very high activity; wide buffer ( $\geq 10$  m) of vegetation has rooting depth  $> 2$  x bank height to water level at baseflow (e.g., tussock/sedges on  $< 0.2$  m high banks; shrubs on  $< 0.5$  m high vertical banks; trees on 1 m high vertical banks)

### 3.1.5 RMC function activity rating guide for denitrification of groundwater inflows

0 = function absent, banks bare of vegetation or grassed over dry, free-draining soils (sand/gravel).

1 = very low activity; banks poorly vegetated; or veg. rooting depth  $< 1/2$  of bank height above normal water level (e.g., grasses on 1.2 m high bank or overstorey trees on 5 m high bank) or grass buffer on free-draining/dry soils

2 = low-moderate activity; narrow riparian forest vegetation buffer ( $\leq 5$  m wide) on soils that are moderately drained (e.g., silts) and typically moist but unsaturated

3 = moderate activity; wide buffer ( $> 10$  m) of riparian forest vegetation on soils that are moderately drained (e.g., silts) and typically moist but unsaturated.

4 = high activity; medium of wetland/swamp forest vegetation buffer (2-5 m wide) with rooting depth to water level at baseflow and saturated soils

5 = very high activity; wide wetland/swamp forest vegetation buffer ( $\geq 5$  m) with rooting depth  $> 2$  x bank height to water level at baseflow, soils saturated

### 3.1.6 RMC function activity rating guide for providing stream shade

0 = function absent, banks bare of vegetation and banks + riparian vegetation shade <10% of channel (considering whole 180° hemisphere and all points across stream)
1 = very low activity; banks + riparian vegetation shade 10-30% of wetted width at baseflow
2 = low-moderate activity; banks + riparian vegetation shade 30-50% of wetted width at baseflow
3 = moderate activity; banks + riparian vegetation shade 50-70% of wetted width at baseflow
4 = high activity; banks + riparian vegetation shade 70-90% of wetted width at baseflow
5 = very high activity; banks + riparian vegetation shade >90% of wetted width at baseflow

### 3.1.7 RMC function activity rating guide for providing wood input to stream

0 = function absent, banks bare of woody vegetation (e.g., grassland, tussock, wetland sedge and flax)
1 = very low activity; riparian shrub vegetation (provide limited input of small wood and roots may penetrate streambed) along medium width streams (3-6 m wide channels)
2 = low-moderate activity; riparian shrub vegetation (provide limited input of small wood and roots may penetrate streambed) along small streams (<3 m wide channels); or riparian softwoods planted for stream bank stabilisation (e.g., poplars and willows) along medium width hill-fed streams (e.g., 3-6 m wide).
3 = moderate activity; narrow riparian buffer (<5 m) of regenerating riparian forest along small rivers (< ca.10 m wide channel); or riparian softwoods planted for stream bank stabilisation (e.g., poplars and willows) or pine plantations along small hill-fed streams (e.g., ≤3 m wide) or along wider spring-fed streams that lack flood flows that move wood
4 = high activity; wide riparian buffer (≥20 m) of mid-succession growth (50-200 years) riparian forest along small–medium streams and rivers (< 20 m wide)
5 = very high activity; wide riparian buffer (≥20 m) of old growth (>200 years) riparian forest along small–medium streams and rivers (< 20 m wide)

### 3.1.8 RMC function activity rating guide for providing leaf litter input to stream

0 = function absent, banks bare of vegetation or short grazed grass

1 = very low activity; riparian vegetation is long grass or wetland/flax

2 = low-moderate activity; channel poorly shaded (20-50%) by shrubs or trees or moderately shaded but has low retention of leaf input (e.g., due to combinations of depth, high current velocities, flow variability, fine sediments, lack of debris dams or encroaching vegetation)

3 = moderate activity; channel well shaded (>70%) by deciduous vegetation, or moderately shaded (50-70%) by evergreen vegetation, but low litter retention (e.g., few protruding substrates or debris dams, little encroaching riparian vegetation and lacking quiescent pools and backwaters).

4 = high activity; channel well shaded (>70%) by deciduous vegetation, or moderately shaded (50-70%) by evergreen vegetation, and moderate-high litter retention (e.g., shallow with protruding substrates, debris dams, encroaching riparian vegetation, or deeper with quiescent pools and backwaters)

5 = very high activity; channel well shaded (>70%) by native or evergreen vegetation and moderate-high litter retention (e.g., shallow with protruding substrates, debris dams, encroaching riparian vegetation or deeper with quiescent pools and backwaters)

**3.1.9 RMC function activity rating guide for enhancing fish habitat** (focusing on inanga and banded kokopu spawning and cover habitat and generalised for common species such as eels and trout).

0 = function absent, banks bare of vegetation or short grazed grass

1 = very low activity; sparse deciduous streambank trees or long grass provides patchy, temporary, overhang cover along small streams

2 = low-moderate activity; <20% of streambank with permanent encroaching/overhanging riparian cover

3 = moderate activity; common bankside cover (e.g., 20-50% of streambank with some form of overhang cover) by encroaching riparian vegetation; low-moderate input of large wood as instream cover; or livestock excluded from inanga spawning areas during spawning season (autumn) only.

4 = high activity; abundant encroaching riparian vegetation (e.g., >50% of streambank with some form of overhang cover) provides bankside cover and enhances food input as terrestrial insects; high input of large wood as instream cover habitat.

5 = very high activity; heavy shade (>ca.70%) over very small headwater streams (BK); rank grasses or wetland vegetation in the tidal area upstream of the salty wedge and livestock excluded permanently (Inanga spawning); riparian forest with abundant leaf litter and wood in the flood inundated zone (spawning for other kokopu species)



### 3.1.10 RMC function activity rating guide for reducing downstream flooding

0 = function absent, banks and floodplain are bare or short grass or high flows remain within the non-vegetated channel and interact minimally with riparian vegetation.

1 = very low activity; some (<50%) of the area of likely inundation by flood flows has vegetation with low-mod. flow resistance (e.g., native grassland, tussock, wetland sedges) that is substantially overtopped by annual flood flows; or high flows remain within the main channel and only minor interact with riparian vegetation that encroaches the channel (e.g., overhanging flax, shrubs or trees)

2 = low-moderate activity; most (>50%) of the area of likely inundation by flood flows has flexible vegetation with low flow resistance (e.g., native grassland, tussock, wetland sedges) that is overtopped by annual flood flows; or high riparian cover by stiff vegetation but flood inundation constrained by land form (e.g., in v-shaped valleys)

3 = moderate activity; most (>50%) of the area of likely inundation by flood flows has low-mod flexible vegetation (e.g., tussock, wetland sedges, flax, shrubs) that interacts with most of flood water.

4 = high activity; area of likely inundation by flood flows has abundant stiff vegetation (may include dead wood debris) that interacts with most of flood water. Vegetation could range from flax or tussock on a small headwater stream to old growth riparian forest in the floodplain of a large river.

5 = very high activity; whole area of likely inundation by flood flows has abundant stiff vegetation (may include dead wood debris) that interacts with whole depth of flood water (ranging from flax or tussock on a small headwater stream to old growth riparian forest in the floodplain of a large river)

### 3.1.11 RMC function activity rating guide for enhancing recreational use of stream/riparian area

<p>0 = function absent, riparian area covered in blackberry and other invasive weeds making stream edge in accessible and downstream passage in canoes hazardous</p> <p>1 = very low activity; minimal natural vegetation cover along small streams (e.g., &lt; 3 m wide channels) that are relatively in accessible and not used for angling, swimming or boating on for walking areas (e.g., headwaters on farmland)</p> <p>2 = low-moderate activity; native vegetation along small streams that are not used for angling or boating on relatively in accessible areas such as headwaters on farmland away; or monocultures of exotic vegetation along streams and rivers used for fishing, boating, swimming or walking</p> <p>3 = moderate activity; varied exotic vegetation or patchy native vegetation along streams and rivers used for fishing, boating, swimming or walking</p> <p>4 = high activity; mix of native and exotic forest/wetland vegetation continuous along streams and rivers used for fishing, boating, swimming or walking</p> <p>5 = very high activity; native forest along streams and rivers used for fishing, boating, swimming or walking</p>
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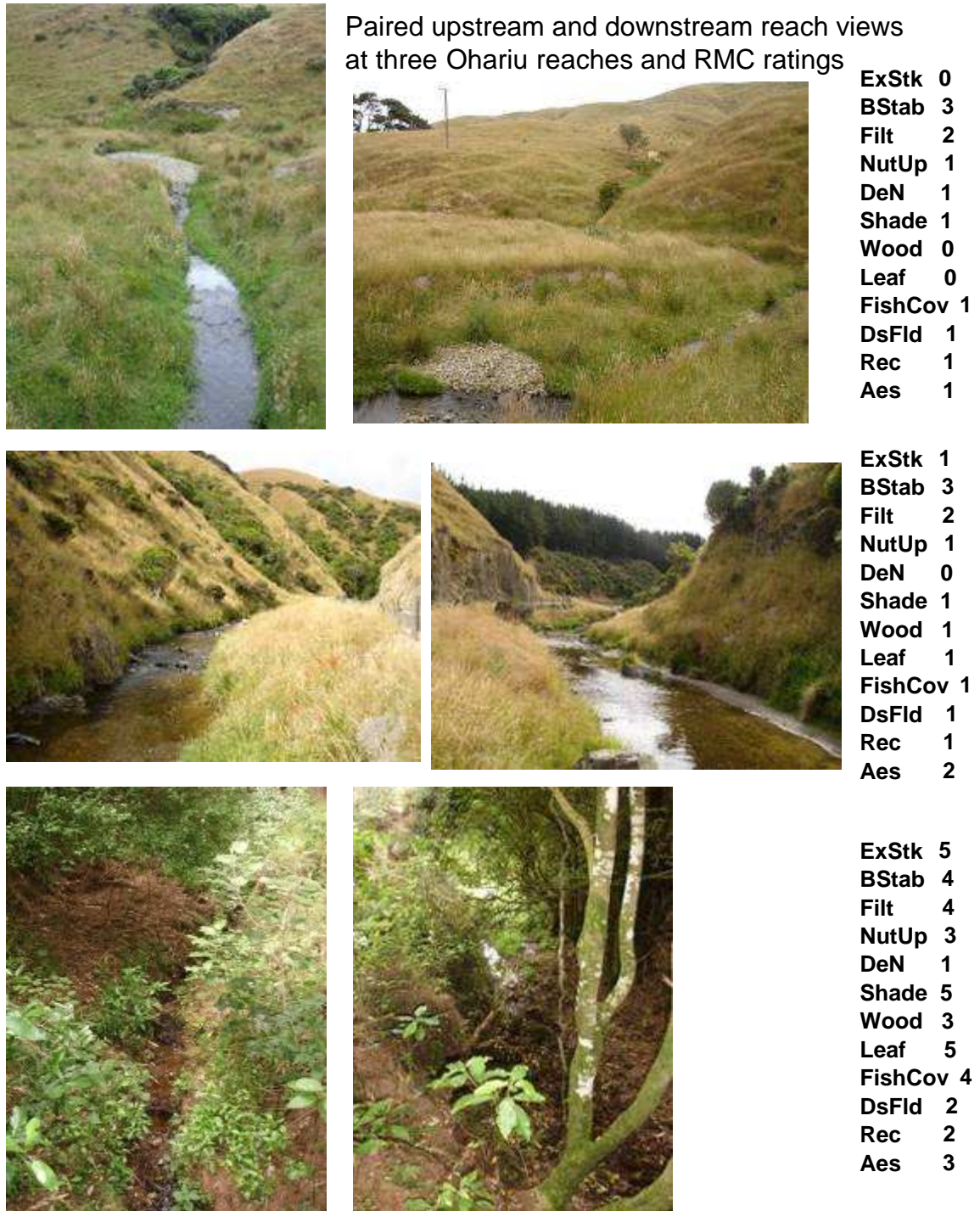
### 3.1.12 RMC function activity rating guide for enhancing stream aesthetics

<p>0 = function absent, bare ground or covered in blackberry and other invasive weeds</p> <p>1 = very low activity; pasture with unconstrained livestock access to the stream, no trees</p> <p>2 = low-moderate activity; fenced pasture grasses without livestock access to the stream; or pasture with livestock access and a 1-2 types of exotic trees (e.g., willows and/or poplars)</p> <p>3 = moderate activity; varied exotic dominated vegetation, limited livestock access</p> <p>4 = high activity; native shrubs or wetland is dominant vegetation type</p> <p>5 = very high activity; native forest is dominant vegetation</p>
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Paired upstream and downstream reach views and RMC ratings at three Ohariu reaches



**Figure 15a:** Examples of river/riparian reaches and RMC current riparian function assessments for current conditions. ExStk = control of direct input of livestock excreta; BStab = streambank stability; Filt = filtering particulates from surface runoff; NutUp = Uptake of nutrients in groundwater by plants; DeN = removal of nitrate in groundwater inflows by denitrification; Shade = shade control of instream plant growth and water temperatures; Wood = input of wood to the stream; leaf = input of leaf litter; FishCov = provision of cover to fish; DsFld = downstream flood mitigation due to flood waters being slowed by riparian vegetation; Rec = enhanced site recreational use/value; Aes = enhanced site aesthetics. Scale = 0 (function not active) to 5 (function highly active) – see text for details.



**Figure 15b:** RMC current function rating examples continued (Ohariu Valley). See Fig 15a for function abbreviation definitions.

### Current RMC ratings at three Cam catchment reaches



**Figure 15c:** RMC current function rating examples continued. The function ratings in the upper example differ between the left and right sides, as shown. The lower example is the Northbrook reach used in the example RMC forms in this manual. See Fig 15a for function abbreviation definitions.

Current RMC ratings at three Cam catchment reaches



**ExStk 1**  
**BStab 4**  
**Filt 2**  
**NutUp 2**  
**DeN 1**  
**Shade 3**  
**Wood 2**  
**Leaf 2**  
**FishCov 2**  
**DsFld 1**  
**Rec 3**  
**Aes 2**



**ExStk 1**  
**BStab 4**  
**Filt 2**  
**NutUp 1**  
**DeN 1**  
**Shade 2**  
**Wood 1**  
**Leaf 1**  
**FishCov 2**  
**DsFld 1**  
**Rec 3**  
**Aes 2**



**ExStk 5**  
**BStab 4**  
**Filt 5**  
**NutUp 4**  
**DeN 3**  
**Shade 2**  
**Wood 1**  
**Leaf 1**  
**FishCov 3**  
**DsFld 4**  
**Rec 4**  
**Aes 4**

**Figure 15d:** RMC current function rating examples continued (Cam catchment). See Fig 15a for function abbreviation definitions.

Current RMC ratings at three Ashley catchment reaches



**ExStk 5**  
**BStab 5**  
**Filt 5**  
**NutUp 5**  
**DeN 3**  
**Shade 1**  
**Wood 2**  
**Leaf 2**  
**FishCov 1**  
**DsFld 2**  
**Rec 5**  
**Aes 5**



**ExStk 5**  
**BStab 3**  
**Filt 5**  
**NutUp 4**  
**DeN 1**  
**Shade 5**  
**Wood 5**  
**Leaf 5**  
**FishCov 4**  
**DsFld 4**  
**Rec 5**  
**Aes 5**



**ExStk 5**  
**BStab 5**  
**Filt 3**  
**NutUp 3**  
**DeN 2**  
**Shade 5**  
**Wood 0**  
**Leaf 2**  
**FishCov 4**  
**DsFld 3**  
**Rec 0**  
**Aes 1**

**Figure 15e:** RMC current function rating examples continued (Ashley Catchment). See Fig 15a for function abbreviation definitions.

Current RMC ratings at three Waitao catchment reaches



**ExStk 5**  
**BStab 4**  
**Filt 4**  
**NutUp 3**  
**DeN 2**  
**Shade 2**  
**Wood 2**  
**Leaf 2**  
**FishCov 3**  
**DsFld 2**  
**Rec 2**  
**Aes 1**



**ExStk 5**  
**BStab 4**  
**Filt 3**  
**NutUp 3**  
**DeN 1**  
**Shade 3**  
**Wood 2**  
**Leaf 3**  
**FishCov 3**  
**DsFld 2**  
**Rec 3**  
**Aes 2**



**ExStk 5**  
**BStab 5**  
**Filt 3**  
**NutUp 4**  
**DeN 3**  
**Shade 4**  
**Wood 4**  
**Leaf 4**  
**FishCov 5**  
**DsFld 4**  
**Rec 5**  
**Aes 5**

**Figure 15f:** RMC current function rating examples continued (Waitao Catchment). See Figure 15a for function abbreviation definitions.



**4. Appendix:** Blank field survey sheets.

Site state assessment													
Site						Site Code	Date			Length (m) =			
GPS	Top: E			N		Bottom:	E			N			
Gen. land use left side	native forest		planted forest		sheep	beef	deer	dairy	horticulture	peri-urban urban			
Gen. land use right side	native forest		planted forest		sheep	beef	deer	dairy	horticulture	peri-urban urban			
Riparian land use (mark R for right & L for left bank)					conservation		filter strip	woodlot	urban	stopbank	whitebaiting		
cattle	sheep	deer	crop	hort	esplanade	reserve	waterfowl shooting		engineered floodway		Other=		
Widths (m)		Water=			Channel=			Bankfull=		valley bottom=			
Channel plan shape		channelised	straight	meandering	sinuous			Valley form		V	U	plain	
Flow	ephemeral	intermittent	perennial	regulated	wetland			Stream shade (%) =					

Sketch stream plan, cross-section & comments: (including where planting zones occur, position of current fencing)

	Photo numbers and descriptions
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Streambed	clay	mud	silt	sand	gravel	cobble	boulder	bedrock	% riffle/run/pool		/	/
Bank left	Height (m) lower=		upper=		Stability	%stable=	%undercut=	%slumping=	%earthflow=			
Bank right	Height (m) lower=		upper=		Stability	%stable=	%undercut=	%slumping=	%earthflow=			
Stabilised by	Left	grasses		shrubs	sedge/rushes		trees	bedrock	riprap/artificial			
	Right	grasses		shrubs	sedge/rushes		trees	bedrock	riprap/artificial			
Macrophytes	% cover =		Type =									
Periphyton	none	slippery	obvious	abundant	excessive, Fil Alg>30%			Wood	absent	sparse	common	abundant

Live-stock access to stream & bank damage	Left	Y / N	Left damage		none	minor	moderate	extensive	Other			
	Right	Y / N	Right damage		none	minor	moderate	extensive	damage			
Riparian veg: mark left (L) & right (R)			rock		bare soil		annuals	grass	toetoe	flax		
		treeferns	low shrubs	high shrubs	native trees	coniferous	deciduous	exotic	other=			
Dominant riparian plant species			Left =					Right =				
Local runoff potential	Left slope length (m)		Left land slope class			<2°	2-5°	5-10°	10-15°	15-25°		
	Right slope length (m)		Right land slope class			<2°	2-5°	5-10°	10-15°	15-25°		
Riparian wetlands	Left	absent	sparse	common	extensive		Right	absent	sparse	common	extensive	

**Riparian function assessment (score 0 = absent, 5 = very highly active)**

Function	Current	Prag' steps	Best practice	Comments
Livestock excreta input & damage control				
Bank stabilisation	L	L	L	
	R	R	R	
Overland flow filtering	L	L	L	
	R	R	R	
Nutrient uptake by riparian plants	L	L	L	
	R	R	R	
Denitrification	L	L	L	
	R	R	R	
Shading				
Wood input				
Leaf litter input				
Enhancing in-stream fish habitat				
Controlling downstream flooding				
Human recreation				
Aesthetics				

**Sketch stream cross-sections** & key elements of current situation (if not already done in state assessment), pragmatic (first steps) and best practicable riparian management: (including where planting zones occur, general vegetation types (grasses/sedges, shrubs, trees) & fence positions).

Current situation

Pragmatic steps - Situation 2 decades after adoption

Best practice - Situation 2 decades after adoption