The River Values Assessment System:

Volume 1: Overview of the Method, Guidelines for Use and Application to Recreational Values

Edited by:

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- 612-TSDC41 – Developing a significance classification framework for water body uses and values: Project scoping workshop
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- 898-TSDC70 – Significance assessment of hydro-electric power generation values of NZ rivers

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Executive Summary

Many attempts over several decades have been made to develop priority lists of important rivers for different values (e.g., angling, kayaking, irrigation, native birds) in New Zealand. Apart from one or two of these most have lacked clear methods, have been data poor, have been *ad hoc*, and perhaps worst of all, have not been standardised to provide a method that could be applied to all values. It was within this context and with demonstrable Resource Management Act and related policy demands for such lists, that Tasman District Council sought to have a tool that would construct such lists developed. A review of the literature found that no method existed that could undertake this task; however, use of the Multi Criteria Analysis approach provided a possible means forward.

The River Values Assessment System (RiVAS) is a Multi Criteria Analysis based tool that enables any set of rivers to be prioritised for any specified value. The key elements of the tool are:

- It is expert panel based and uses the best available information – in some cases this will mean almost no quantitative scientific information (e.g., river swimming), while in others it will be mainly based on scientific data (e.g., native birds);
- The primary attributes and a key indicator of each for the value have to be identified and populated – these need to range from between 6-10 for manageability;
- Thresholds of high, medium, low relative significance need to be defined for each attribute's indicator – these are then converted to numeric scales of typically 3 to 1 for high to low respectively;
- The sum of these numeric scores (sometimes weighted where particular criteria are more or less important than others) then forms the basis for the comparative importance ranking of this value between rivers;
- Predetermined criteria to define national, regional or local importance, or high, medium or low importance (depending on the value and related legal/policy issues) are then used to perform the ranking exercise;
- The end result is a list of ranked rivers (or segments depending on the value) for that value.

The method has now been applied to multiple values in multiple regions, with a focus on repeat applications within the territory of the Tasman District Council. This two volume report outlines the method used, provides a set of guidelines for its further implementation, and then provides multiple demonstrations of it in action. Through the course of these demonstrations the changes that have occurred are documented and all are consistent with the underlying method employed.

Chapter 1
Introduction

Ken Hughey (Lincoln University)
Mary-Anne Baker (Tasman District Council)

1.1 Scope

Hearing panels at multiple levels of local and central government, the Environment Court, and local and central government generally, have for decades been seeking an objective method for ranking the comparative value of rivers for the range of in- and out-of-stream uses. Historically, Teirney et al. (1982) for recreational trout and salmon fisheries, and Egarr and Egarr (1981) for whitewater kayaking, identified lists of rivers and streams for their relative importance for these values. More recently, the relative importance issue was addressed under the Water Programme of Action, part of the Labour Government's 2003 Sustainable Development Programme of Action, run by Ministry for the Environment (MfE). The programme identified the need for the Department of Conservation (DoC) to identify water bodies of national importance (WONI) and a list of water bodies that would protect the full range of freshwater biodiversity values. In 2004, in a complementary way, MfE listed water bodies important for recreation, and MfE, the Ministry of Agriculture and Forestry (MAF) and the Ministry of Economic Development (MED) produced lists of waters of national importance for: the biodiversity dimension of natural heritage; geo-diversity and geothermal features; recreation; irrigation; energy; industry and domestic; and tourism. But, despite much work in this context there remains no objective framework that clearly identifies the criteria upon which importance is determined for specific values, or which allows for comparison between values either at a national or a local scale.

In order to address this problem, the Foundation for Science, Research and Technology funded the project 'Developing a significance classification framework for water body uses and values' (Envirolink Grant 612-TSDC41). The project arose initially from the immediate need of Tasman District Council (TDC) for a tool that would enable it to list, objectively, relative significance (see an explanation of the issues around use of 'significance' or 'importance' in footnote 23 of chapter 3.8.4) of river values in their region. In what follows we outline the general nature of the need and the approach taken to address it in this project.

1.2 Background and need

There are multiple situations within the Resource Management Act 1991 (RMA) for consideration of relative importance, e.g.,

- Policy Statements: draft National Policy Statement (e.g., 'Identify notable values of outstanding freshwater resources') - note that the Board of Inquiry recommendation did not include this term;
- Regulations: (draft) National Environmental Standard on Ecological Flows and Water Levels (the technical process involves an assessment of the relative significance aquatic values). The National Environmental Standard for Plantation Forestry requires identification of nationally significant rivers;
- Orders: Water Conservation Orders (outstanding amenity or intrinsic values, habitat, fishery, wild, scenic or other natural characteristics, scientific or ecological value, recreational value);
- Plans: Regional and District.

While each of these needs has been addressed to some extent all such attempts have used different methods, often relying on a high degree of subjectivity. Typical of the outputs produced are:

- Schedules in regional plans of water bodies to be managed for specified purposes;
- Schedules in regional plans that list values of water bodies;
- Water Conservation Orders that list rivers with outstanding value for specified uses and values.

Most often the lists are water quality and discharge management related, the language used is highly variable, and there is little or no connections between regional and national value. Even in the MfE and MAF (2004) 'Potential Water Bodies of National Importance' report, which provides lists of rivers across multiple values, there is no unifying methodology and no clear thresholds for the different levels of importance.

With the demands on freshwater being increasingly contested (e.g., see MfE 2007) there is a call for a prioritisation tool that:

- Works regionally but also has national level application potential;
- Will work with the best available information;
- Is user friendly;
- Is cost effective;
- When applied, provides defensible (e.g., Environment Court) results.

In 2008, TDC approached Envirolink (a FRST funding source for designated councils) for assistance. Based on this approach FRST provided the following support, over several stages:

- Small advice project (2008 – review the scope of the opportunity);
- Medium advice project (2008/09 – a national workshop to firm up need, finalise values and begin work on methodology and salmonid trial application);
- Tools project (2009 – multiple values, national workshop, council applications) – this was a very short term project, i.e., February-August 2009;
- Further medium advice funding linked to development of another value application and ;
- Full rollout for all values in Tasman District Council in 2010.

Concurrent with the above, the principal researchers have applied the tool where other opportunities have arisen.

1.3 Study approach

We first established a project steering group: Mary Baker (TDC), Ken Hughey (Lincoln University), Murray McLea (Greater Wellington RC), John Hayes (Cawthron Institute), and Neil Deans (Fish and Game Nelson-Marlborough). The steering group met and decided a course of action, namely it:

- Initiated a literature review (see Smith herein) – who had tried this before across a range of in- and out-of-stream values and what lessons could be learnt? There was some work within values, e.g., whitewater kayaking (Egarr and Egarr 1981), birdlife (O'Donnell and Moore 1983, O'Donnell 2000), and recreational angling (Teirney et al. 1982), and of course more recently in the WONI project. This review showed that no one, it seems, had developed a system to look objectively/ quantitatively or in a standardised way across a range of values;
- Given the above finding, it then much debated and developed a draft methodology and undertook a trial with salmonid fisheries in TDC (see Booth et al. Chapter 5, herein);
- The methodology was then further refined and trialled on seven more values with six other regional councils. These trials and the methodology were then discussed at a national workshop held in Wellington on 20th November 2009. Changes were made to the methodology to reflect agreements made at the workshop but apart from the native birds chapter, few other changes were made to the trial applications given the timing of their work and timing of the workshop;
- The tool was then applied to the full range of values in Tasman District.

There have been challenges with the tool's development and two values in particular have proved problematic, namely native fisheries and hydro energy but both for different reasons. In the case of the former, we had difficulty maintaining a stable project team and probably did not include some key individuals who through other work may have made this project more successful – work is continuing on this project. With hydro, we faced the issue of a competitive industry where it was challenging to coordinate the multiple commercial interests and a use of rivers that was only able to be accurately assessed if there was sufficient detail about the location and type of the hydro-power scheme – work is also continuing on this project.

1.4 **Methods**

Smith's (herein) review of the literature was informative – no system had been developed that provided a standard approach for ranking river values. However, notwithstanding this conclusion it was clear that considerable good research, at a high level of detail, was occurring in some areas, e.g., DoC's Freshwater Environments of New Zealand (FENZ) approach, and Fish and Game New Zealand's ongoing national angling surveys. But, some values, e.g., swimming, irrigation and natural character, have no integrated databases or systems for prioritisation, while other values, e.g., kayaking and birdlife, have databases of mixed spatial and temporal quality.

Two complementary approaches appeared most likely to address a context of: the paucity of reliable information; lack of an existing method, a short timeline, and limited resources, i.e.,

- A multi-criteria driven, standardised numeric scale approach; and
- An expert panel based approach.

Both approaches are built on the need to use the best available information, and to fill the gaps with expert judgement.

Given variable data and lack of a standardised approach, we built our method around the key attributes of river values, populating these where possible with real data, and then converting this information to numeric scales for ranking values. The use of expert panels and best available information as the cornerstones of the project also required us to use carefully controlled quality/peer review processes. The importance of expert panel judgement in the absence (sometimes) of actual data has also meant selection of these panels has been an issue that has required ongoing attention.

Ultimately the following methodological approach was developed (see Hughey et al. herein for detailed explanation of each of the processes and steps):

A. Define the value to be evaluated, e.g., birdlife, irrigation.

B. Establish (and explicitly justify) the National Expert Panel and choose (and explicitly justify) peer reviewers. The National Expert Panel must be capable of considering both the national context as well as application at a regional scale. The members (scientists, consultants, policy makers or lay people) must be nationally respected for their expertise, and ultimately be able to produce work that can be tested at the Environment Court. For national level panels, i.e., those initially identifying the attributes, indicators and thresholds) it is now agreed there is a role for central government agencies and national level non-government organisations. For regional level panels there is a similar requirement for credibility over the choice of relevant expertise but a national level input is probably unnecessary – these panels populate an existing assessment framework for particular regions. On occasions there will be complete or partial overlap between the membership of both panels and this is appropriate.

C. Assessment criteria

Step 1: define river value categories, i.e., kayaking can be subdivided into flat water and white water; and river segments;

Step 2: identify all of the value's attributes – economic, social, environmental, and cultural, depending on what is appropriate;

Step 3: select and describe primary attributes – reduce to a list of 10 or less, for manageability;

Step 4: identify indicators – choose objective/quantitative over subjective; evaluate each against SMARTA[1] criteria – the main aim is to quantify where possible with a majority of indicators represented by scientifically defensible data.

D. Determining significance

Step 5: determine indicator thresholds – quantify these where possible and think nationally: at the national level it is advised to be guided by criteria set in legislation (if such exists) or determined in the Environment Court, e.g., the 5% level for a national important population of a 'threatened or at risk' bird species; or established through WCOs;

Step 6: apply indicators and their thresholds – convert all to 1=low; 2=medium; 3= high, e.g., for birdlife a species achieving the 5% threshold in terms of proportion of the population on that river is accorded a '3';

Step 7: apply weighting to the primary attributes – preferably equal weighting, but otherwise as needed. This part of the process needs to be considered very carefully by the National Expert Panel and subject also to peer review;

Step 8: determine river significance – sum total and determine overall importance, e.g., in relation to water conservation order criteria. Also in this case a set of decision support criteria can be identified such that a particular indicator might be so important that if it achieves a '3' then the river is automatically of national important, e.g., the 5% threshold for 'threatened and at risk' species;

Step 9: outline other factors relevant to the assessment of significance, e.g., there may be particular legal or policy issues surrounding the river that need to be noted such as a Water Conservation Order.

E. Method review

Step 10: review assessment process and identify future information needs, e.g., survey needs.

F. Display Outputs.

1.5 Application of the method

The values tested, and their host councils, were:

- Salmonid angling – Tasman, Marlborough (unpublished draft), Hawkes Bay (in progress);
- Irrigation – Canterbury' Tasman;
- Native birdlife – Canterbury'; Tasman;
- Swimming – Manawatu, Tasman;
- Native fish – Wellington, Tasman (in progress);
- Iwi – Southland (and West Coast of the South Island, and in Tasman (in progress));
- Natural character – Marlborough, Tasman;
- Whitewater kayaking – West Coast, Hawkes Bay (in progress), Tasman;
- Hydro power – Bay of Plenty, Tasman (in progress).

Application of the method to each value has typically (but not always) involved a number of iterations to confirm the attributes and threshold – it has been agreed that two applications will

1 SMARTA = Specific, Measurable, Achievable, Relevant, Timely, Already in use

normally result in a finalised method for any particular value. Where the finalised method is thought likely to result in changes to the first application, then these changes are to be made in association with the host region and where possible the authors of the first chapter. Any necessary amendments to the methodology or to any of the value chapters, as a result of new findings or information, are to be recorded on the original report for each.

Further applications across more regions are also likely to be required to confirm the appropriateness of the national thresholds.

1.6 Report structure

The remainder of report is a logical sequence of literature review, methodology, and guidelines for using the tool, followed by applications of the tool to multiple values in multiple areas. The applications are organised by value, each started with a short preamble which sets the scene and comments on any methodological issues, the initial detailed trial application and subsequent applications.

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Teirney, L.D., Unwin, M.J., Rowe, D.K., McDowall, R.M., Graynoth, E. (1982). *Submission on the draft inventory of wild and scenic rivers of national importance*. Fisheries Environmental Report No 28. Christchurch, NZ: Ministry of Agriculture and Fisheries.

Chapter 2
Literature Review

Erin Smith (Lincoln University)

2.1 Introduction

This chapter summarises the relevant New Zealand and international literature regarding the methods used to assess river values. Throughout the chapter, this project is often referred to as 'the current project'.

The literature search was conducted in January 2009 and consisted of a thorough search of the Lincoln University library, online databases available at Lincoln University (namely *Web of Knowledge* and *Science Direct*), and the online search engine G*oogle Scholar*. Known websites that were likely to have relevant reports were also searched: *Environment Canterbury, National Institute of Water and Atmospheric Research (NIWA),* and *Ministry for the Environment.*

2.2 Purpose

The purpose of this chapter is threefold. Firstly, it identifies the literature which is of relevance to the River Values Assessment System (RiVAS) project. Secondly, it reports on the river values included in the literature and the ways in which these values are conceptualised in terms of attributes. For example, salmon angling includes attributes such as level of use, anticipated catch rate, water quality and perceptions of the quality of the angling experience. In addition to identifying the attributes of each value, indicators used to assess each attribute are included where they have been considered. Finally, the chapter outlines the ways in which these attributes and indicators have been evaluated, and whether or not greater importance is placed on particular attributes, by assigning weightings, for example.

2.3 Structure of the chapter

The remainder of the chapter which follows this introduction is structured into three sections. Section Two outlines the New Zealand and international literature relevant to the RiVAS project. This section is separated into six sub-sections; each addressing the river values stipulated by the project. These are:

1) Angling values,
2) Recreational values,
3) Scenic/landscape/natural values,
4) Tangata whenua values,
5) Wildlife/conservation/ecological values, and
6) Irrigation/hydro-electric development values.

This information is then summarised using a table format in Section Three. Section Four presents the conclusions of the chapter.

Several sources accessed for this chapter, outline a large number of attributes and/or indicators to assess one or more river values and, therefore, it was not feasible to reproduce them here. In such cases, the method has been described in as much detail as to give the reader a sufficient understanding to enable them to make an assessment as to whether they would like to view the original source.

2.4 Summary of the literature relating to assessment methods of river values

This section of the chapter outlines the literature accessed which was of relevance to the RiVAS project. It is separated into six sub-sections: 1) angling values, 2) recreational values, 3) landscape/scenic/natural values, 4) tangata whenua values, 5) wildlife/conservation/ecological values, and 6) irrigation and hydro-electric development values.

2.4.1 *Angling values*

New Zealand's first qualitative National Angling Survey was undertaken in 1980. It looked specifically at the relative rankings of several qualitative attributes for each water body used by freshwater anglers (see Teirney et al. 1982; Teirney & Richardson 1992). The survey also included a quantitative aspect, but the methodology was unsuitable for this purpose and these data have not been used for quantitative purposes.

The first rigorous and quantitative National Angling Survey for New Zealand was conducted between 1994 and 1996. This survey was subsequently repeated during the 2001/02 season (Unwin & Image, 2003). The purpose of this study was "to obtain consistent estimates of angler usage, for all New Zealand lake and river fisheries by New Zealand resident anglers" (p. 6). The results of the 2001/02 survey show that there were 1,111,000 ± 16,000 angler days. However, angling effort varied throughout the country, ranging from 1,870 ± 520 angler days in Northland to 229,500 ± 7600 angler days in the Eastern region. Based on these data alone, it might appear that rivers are valued more for the angling opportunities they offer in some areas when compared to other areas.

However, estimating the angling value of rivers on usage data alone has been suggested as being inadequate (Teirney, Richardson & Unwin, 1987). An alternative approach to investigate angling values was implemented in New Zealand during the 1980s, when a postal survey was conducted to gather information of anglers' use and perceptions of New Zealand rivers (Teirney et al., 1987; Teirney & Richardson, 1992). Two purposes of this study were 1) "to collect directly from the adult angling population of New Zealand, *quantitative and comparative* information on every river supporting a significant sports fishery," and 2) "to identify those attributes which characterise rivers of importance" (Teirney et al., 1987, p. 6, emphasis added). This work is particularly noteworthy because the researchers sought to determine the importance of rivers based on a variety of factors, rather than angling use alone. These factors were:

1) Distance from home;
2) Ease of access;
3) Area of fishable water;
4) Scenic beauty;
5) Peace and solitude;
6) Catch rate; and
7) Size of fish.

Each of these factors and the overall importance of the river was assessed using a five-point scale (1 = lowest, 5 = highest). An important point to note is that the factors which contributed to anglers' overall assessment of river importance differed depending on the type of fish sought: trout or salmon. The primary contributing factors for trout anglers were 1) catch rate, 2) scenic beauty, and 3) area of fishable water. In contrast, the primary factors for salmon anglers were 1) angler use and 2) fish size.

2.4.2 *Recreational values*

Rivers provide people with a myriad of recreational opportunities. The recreational value of rivers is considered widely throughout the available literature (see, for example, Daly, 2004; Griffin, 1975; Mosley, 2002; 2003; 2004; Sutherland-Downing & Elley, 2004), however, quantitative assessment of recreational value is more limited.

The first comprehensive attempt to assess the recreational value of New Zealand rivers for boating was *The New Zealand Recreational River Survey* conducted in the 1980s (Egarr & Egarr, 1981a; b; c). The applicability of this study to the current project is limited due to the largely qualitative nature of the study and subsequent changes in access, land use and boating techniques and equipment; nevertheless, the attributes used to assess recreational value might usefully be extended for use in a quantitative assessment. The following attributes were used by Egarr and Egarr: 1) suitability of use for each recreational group, 2) access, 3) problems and obstructions to use, 4) proximity to demand, and 5) skill or challenge factor. Through a qualitative assessment of these factors, rivers were categorised on the following scale of recreational value:

- Low = valueless & mediocre
- Intermediate = average
- High = popular
- Exceptional = extreme

The scenic value of each river was also assessed (see Section 2.3 below). The recreational and scenic assessments were then combined to categorise rivers. This categorisation and the descriptions for each are presented in Table 2-1 below.

Table 2-1
Categorisation of rivers as determined by their assessment of the recreational and scenic value of rivers in New Zealand

Category – a result of combining the recreational and scenic value of a river	Description
Category A	All rivers with exceptional recreational value and exceptional scenic value
Category B	All rivers with exceptional recreational value and impressive scenic value or high recreational value and exceptional scenic value
Category C	All rivers with exceptional recreational value and picturesque scenic value or high recreational value and impressive scenic value or high recreational value and picturesque scenic value or exceptional recreational value and moderate scenic value
Category D	All rivers with high recreational value and moderate scenic value or intermediate recreational value and exceptional scenic value or intermediate recreational value and impressive scenic value or intermediate recreational value and picturesque scenic value.

Source: Egarr and Egarr (1981a; b; c)

Another useful aspect of the study is a discussion which relates to the problems of trying to rank rivers based on their attributes (see p. 26 of original source). Egarr and Egarr (1981a) also highlight that weighting different attributes comprising recreational value is difficult due to the problems of finding a satisfactory formula to rank one attribute against another, particularly when trying to apply this formula in different areas of the country. The authors conclude that "each river is a unique entity that cannot be compared to any other on exactly the same formula of comparison" (Egarr & Egarr, 1981a, p. 26).

Sutherland-Downing and Elley (2004) provide a comprehensive inventory of the recreation values for rivers and lakes in Canterbury, New Zealand. The recreation value of these waterways is separated into three types: recreation physical value, recreation use values, and recreation use types. Recreation physical value comprises water quality (high/moderate/low), scenic appeal (high/moderate/low), and natural appeal (high/moderate/low). Recreation use values comprise frequency of use (high/moderate/low) and intensity of use (high/moderate/low)[2]. The inventory also includes attributes used to describe the recreational potential of water bodies. The attributes used are[3]:

- Travel time (close/moderate/far)[4];
- Facilities (extensive/many/some/limited);
- Accommodation (camping/tramping hut/caravan/camper-van/crib or bach);
- Fishing and hunting abundance of target species (very common/common/uncommon – for each species);
- Channel features (shallows/waterfalls/shallow rock drops/rock obstacles/riffles/rapids/pools)
- flow strength (sluggish/moderate/strong/powerful)[5];
- Flow conditions supporting recreation (year-round/certain times of year);
- Obstructions (bank-side willows/bank or bed obstructions);
- Accessibility (along bank/bed = good/limited; road to & from water-body = good/moderate/private; boat = good/moderate/limited).

While these assessments are qualitative in nature, they provide a foundation for the attributes comprising recreational value and could potentially be converted to quantitative measurement[6].

Within the context of the current project, the inventory compiled by Sutherland-Downing and Elley is perhaps most useful due to their inclusion of desirable values and attributes for a wide range of recreational activities which can be undertaken on, in or near rivers[7]. For the lists of these values and attributes, readers are directed to the original report.

2.4.3 *Scenic/landscape/natural values*

Compared to the amount of work associated with angling and recreational values, a greater amount of work seems to have been done regarding the assessment of scenic, landscape or natural values relating to rivers. With this in mind, a point worth noting is that landscape values tend to overlap with other river values (Ministry for the Environment, 1998), thus work in this area might be usefully applied to assess other river values such as recreation or wildlife. Egarr and Egarr (1981a) reinforced this perspective when they noted that it is difficult to separate recreational use of a river from the

2 For a full description of the high/moderate/low assessments, readers are directed to the original report (pp. 10-13).
3 For a full description of the categories for each attribute, readers are directed to the original report (pp. 23-29).
4 While unstated in their report it is assumed to refer to travel time from home.
5 There is no explanation in the report about how this attribute applies for the context of a lake.
6 The data in the original report were not verified or field checked and attention should be given to the 'general terms and conditions' for using the information contained in the report (p. 1).
7 The recreation activities included in Sutherland-Downing and Elley's (2004) inventory are: passive (sightseeing, walking, tramping, picnicking/BBQ, camping, horse trekking, bird watching); contact (swimming, paddling/wading, diving); mechanised water craft (jet boating, water skiing, jet skiing, power boating); paddling and floating water craft (canoe/kayaking, rafting, floating, drift boating, rowing); sail water craft (sail boating, board sailing, kite sailing); fishing and hunting (salmon, trout, white-baiting, eeling, other fishing, waterfowl, small game, big game); off-road vehicles (four-wheel driving, trail biking, mounting biking, dune-buggies, land sailing); other (multi-sports, ice skating).

scenic qualities of a river, therefore their study also included an assessment of scenic value (see Section 2.2 and Table 2-2 the way in which recreational and scenic value were combined).

The way in which Egarr and Egarr assessed scenic value in *The New Zealand Recreational River Survey* was used previously in the now classic study titled *64 New Zealand Rivers* (Egarr, Egarr & MacKay, 1979). This study appears to be the first in New Zealand to respond to an observed need for an objective quantitative analysis of the scenic qualities (value) of New Zealand rivers. As was noted in Section 2.1 concerning angling values, Egarr et al. (1979) noted that a user numbers/cost-benefit analysis does not give a valid indication of the ways in which people value a given river. Consequently, they developed a five-point scale of qualitative distinctions that would allow "reasonably clear-cut judgements to be made" (p. 6). The scale (0 = dull, 1 = ordinary, 2 = interesting, 3 = impressive, 4 = exceptional) was used to evaluate seven factors which were selected as comprising the scenic quality of a river. These factors were:

1) Vegetation;,
2) Banks and riverbed;
3) Landscape;
4) Wilderness feeling;
5) Water quality;
6) Water movement; and
7) Other factors (see Table 2-2).

These attributes were each given equal weighting "not so much because we can make a case for them all to be equally important, but because we cannot make a convincing case that some are more important than others" (p. 11). Rivers were then divided into stretches and each stretch assessed according to the seven factors/attributes. Individual factor scores were then summed resulting in an overall scenic value score for each section of river. The overall scenic score was evaluated using the following scale: 0-3 = dull, 4-6 = ordinary, 7-9 = interesting, 10-15 = impressive, and over 16 = exceptional. An alternative way to designate categories is suggested by Mosley (2002): "if comparable features or values are ranked, 'outstanding' [for example] might be taken to equate to a given percentile range (e.g., the top 10%) of all cases" (p. 34).

A source which outlines a more complex quantitative assessment for the natural value of rivers is Collier's (1993) report *Towards a protocol for assessing the natural value of New Zealand rivers*[8]. Collier based the method on the South African River Conservation System reported in O'Keefe, Danilewitz & Bradshaw (1987). The five criteria for assessing the natural value of waterways were developed at a Limnological Society conference in 1987.

8 Another source addressing Collier's method is:
Collier, K.J., & McColl, R.H.S. (1992). Assessing the natural value of New Zealand rivers. In P.J. Boon, P. Calow, & G.E. Petts. (Eds.). River conservation and management, pp. 21-37. Chichester, UK: John Wiley & Sons.

Table 2-2

Factors (attributes) of the scenic value of rivers and the way in which they were evaluated in the *64 New Zealand Rivers study (***Egarr, Egarr & MacKay, 1979) and the New Zealand Recreational River Survey (Egarr & Egarr, 1981a; b; c)**

Factors (attributes) comprising scenic quality/value	Indicators comprising the factors (attributes)	Method of evaluation
Vegetation	• Volume • Variety • Virginity	0 = dull (e.g., barren stopbanks, introduced grasses and weeds) 1 = ordinary (banks lined with a single introduced species, e.g., willow, broom, gorse, blackberry) 2 = interesting (a variety of vegetation types) 3 = impressive (e.g., mainly indigenous bush, or a variety of vegetation that fits particularly well into the landscape) 4 = exceptional (untouched native forest with a high density of tall trees and diversity of species)
Banks and riverbed	• Visible geological make up of the river environment	0 = dull (e.g., polluted mud) 1 = ordinary (e.g., shingle, sand, earth – underlying geological structure not evident) 2 = interesting (more varied riverbed, boulders, rocks) 3 = impressive (river in bedrock, interesting rock formations) 4 = exceptional (spectacular rock formations and cliffs)
Landscape	• The more distant views beyond the immediate banks and cliffs cut by the river itself.	0 = dull (flat, dull, developed country) 1 = ordinary (e.g., rolling, low-relief farmland, or landscape obscured altogether by banks or vegetation) 2 = interesting (e.g., close bush or tussock-covered hills, or a variety of short and long-range views of different landscape types) 3 = impressive (e.g., particularly beautiful developed country or high hills) 4 = exceptional (e.g., spectacular mountainous country)
Wilderness feeling	• Difficulty of access. • Distance from civilisation • Subjective feeling of wilderness	0 = dull (stopbanks dominant – visible development) 1 = ordinary (farming country largely obscured by bank vegetation) 2 = interesting (varied – river difficult to get to in places) 3 = impressive (mostly remote – access difficult and infrequent) 4 = exceptional (extremely remote – cross-country travel daunting)
Water quality	• Visual perception of water quality NB: a three-point scale was used	0 = dull (undrinkable, or permanently discoloured) 1 = ordinary (clear and apparently unpolluted) 2 = interesting (impressively pure and sparkling)
Water movement		0 = flat, without noticeable movement 1 = noticeably moving (includes Grade 1 rapids in shingle) 2 = significant rapids (attractive patterns or up to Grade 3) 3 = impressive rapids (in bedrock, or up to Grade 5) 4 = spectacular (very big water or high waterfalls)
Other factors		Including wildlife, historic sites, other scientific interest A three-point scale was used (0-2)

The criteria used in Collier's method were:
1) Ecological representativeness or rare type of ecosystem;
2) Diversity and pattern;
3) Rarity and unique features or species;
4) Long-term viability; and
5) Degree of modification.

The quantitative descriptors/indicators and weightings assigned to the criteria were developed through a questionnaire sent to 36 limnologists[9]. To combine the indicators used for each criterion/attribute, the values assigned were divided by the maximum score and then multiplied by the weighting. The sum of the indicator scores was then divided by the sum of the weightings for all indicators and multiplied by 100 (the score for the attribute 'degree of modification' was then subtracted from 100). Table 2-3 presents the calculation method adopted by Collier.

Table 2-3
Method of calculation used in Collier's protocol for assessing the natural value of New Zealand rivers (1993, p. 4)

Descriptor	Upper limit	Weight	Value
% catchment in native vegetation	≥ 80	+ 17.1	81
% length lined by native vegetation	100	+ 15.7	90
% base flow abstracted	≥ 60	- 15.4	50
No. exotic nuisance species	≥ 10	- 10.5	2
Sum of weighting factors		58.7	

NB: All factors are converted to positive values to calculate the sum of weightings.

Descriptor	calculation	Score
% catchment in native vegetation	80/80 x 17.1	17.1
% length lined by native vegetation	90/100 x 15.7	14.1
% base flow abstracted	50/60 x –15.4	(-12.8)* 2.6
No. exotic nuisance species	2/10 x -10.5	(-2.1)* 8.4
Sum of scores		42.2

* Where there are negative weights, scores calculated from the formula are subtracted from the weighting factor before being summed.

Final score on a scale of 0-100 is 42.2/58.7 x 100 = 71.9. This indicates the extent to which the river is unmodified. To indicate degree of modification the score is subtracted from 100 (NB: this is only done for the degree of modification attribute). Therefore, the score for degree of modification using the above indicators is 100 - 71.9 = 28.1.

An important point to note is that the scores derived from the criteria were not meant to be combined to produce an overall natural value score. Nevertheless, Collier concluded that the method appeared to render 'sensible' scores, but required further refinement (the weightings and descriptors in particular) before being applied more widely. Despite Collier viewing his work as a

9 Due to the number of descriptors and weightings, they are not reproduced here. Readers are directed to the original source.

starting point for developing a method for assessing the natural value of rivers, it appears that no further work has been undertaken to refine and adopt the method he proposed[10]. However, the method proposed could potentially be extended to the other values in the RiVAS project.

Another "attempt to quantify some elements of aesthetic appeal while eliminating, insofar as possible, value judgements or personal preferences" is Leopold's (1969, p. 1) *Quantitative comparison of some aesthetic factors among rivers*. He also adopted a five-point scale to assess 46 attributes relating to the aesthetic value of rivers[11], but rather than simply summing and averaging scores, he calculated what he termed uniqueness ratios after having scored each site under investigation according to the listed attributes. For example, if a site shares the same score for a given factor with seven other sites it is unique in the ratio 1 to 7 (0.14). If no other site shares the same score for a given factor then the site has a uniqueness ratio of 1:1 (1.0). Therefore, the uniqueness ratio is defined on a scale of 0-1.0. Uniqueness ratios from each attribute are summed for a given site to produce an overall uniqueness score, and then sites can be ranked according to their uniqueness scores. Leopold also undertakes further comparative analyses of selected factors (attributes) by which to evaluate different sites. These analyses appear to be unique and readers are directed to the original source to assess their merit.

In general, most sources assess only one river value (an exception is Egarr & Egarr, 1981a). One source which addresses *both* biological and aesthetic values is an assessment of islands and shoals around New York (Knutson, Leopold & Smardon, 1993). The purpose of the study was to develop a system with which small islands and shoals could be prioritised for conservation. This work is significant for two reasons. First, the researchers noted that most systems of categorisation at the time were based solely on biological factors; therefore they sought to combine both biological and aesthetic values. Second, the approach used adopts a system which is not based on a five-point scale. The biological quality score was determined by assessing five criteria: common tern nesting site, bald eagle winter feeding area, rare plant habitat, significant coastal wildlife habitat, and plant species richness. Each of these criteria was assigned a score from 1-10. A visual quality rating was determined by assessing four criteria: landform, vegetation, colour and cultural features. The subsequent visual quality score was then weighted on the basis of how visible the island or shoal was from popular scenic vantage points. Table 2-4 presents the method used to assess the biological and visual scores of each island or shoal.

An important feature of the method used by Knutson et al. (1993) is that the criteria for the biological and visual quality scores were not simply summed and then averaged. Instead, the researchers adopted a system of selecting either the highest or lowest score given to any one of the criteria (see original article for a full description of the method used). The authors also provide a brief, yet useful discussion of other ways in which criteria have been combined for given values. This article also refers to several other sources which might be useful to the current river values project.

10 Dunn (2004) refers extensively to Collier's proposed method and only cites the 1993 report.

11 Due to the large number of attributes and their associated indicators, the list will not be reproduced here. Readers are directed to the original article.

Table 2-4
Method used to derive a final score for each island from the determined attributes (Knutson, Leopold & Smardon, 1993, p. 202)

Category	Factors (a-e)	Max. factor score	Weighting (W)	Category score Range (1-10)	Final score Range (1-10)
Biological (B)	a) Common tern nesting	10	1	B = max (a-e)	Max (B, V)
	b) Bald eagle feeding	10	1		
	c) Rare plant habitat	7	1		
	d) Significant coastal wildlife habitat	6	1		
	e) Plant species richness	6	1		
Visual (V)	Visual quality rating	5	1, 1.5, or 2	V = Q x W	

2.4.4 *Tangata whenua values*

From a Maori perspective, water is considered an essential ingredient to life and is a priceless treasure left by ancestors (Waugh, 1992). Despite the importance placed on water sources by Maori, no studies were found which attempted a comprehensive quantitative assessment of tangata whenua values associated with rivers. This is perhaps unsurprising given the relatively recent acceptance of Maori perspectives and participation in managing waterways. Although literature containing reference to tangata whenua values of high relevance to the current project was scarce, a number of sources did include reference to the ways in which Tangata whenua value waterways (see, for example, Ministry for the Environment, 1998; Mosley, 2001; 2002; 2003; 2004; Tipa, 2001; Daly, 2004).

From the available literature, several attributes of tangata whenua values regarding rivers can be identified. These are mauri (Daly, 2004; Tipa & Teirney, 2003; Tipa, 2001; Te Runanga o Ngai Tahu, 1999), wahi tapu/taonga (Daly, 2004; Mosley, 2002; 2003; 2004), mahinga kai (Daly, 2004; Mosley, 2002; 2003; 2004; Tipa & Teirney, 2003), kaitiakitanga (Tipa & Teirney, 2003; Tipa, 2001; Te Runanga o Ngai Tahu, 1999), and consideration of the wider catchment or mountains to the sea philosophy (Tipa & Teirney, 2003; Tipa, 2001).

The best source of how these attributes might be conceptualised through set criteria is provided in the Te Runanga o Ngai Tahu *Freshwater Policy Statement* (1999). This statement identified several tangible attributes which can represent mauri. These are 1) aesthetic qualities (e.g., clarity, natural character and indigenous flora and fauna), 2) life-supporting capacity and ecosystem robustness, 3) depth and velocity of flow, 4) continuity of flow from the mountain source of a river to the sea, 5) fitness for cultural usage, and 6) productive capacity. A principal indicator used by Ngai Tahu to assess the mauri of a water body is the productivity of food and other resources sourced from it, however, no means by which this productivity might be assessed is provided.

In relation to kaitiakitanga, the following attributes are listed:

1) The role of particular waterways in unique tribal creation stories;,
2) The role of those waterways in historical accounts;
3) The proximity of important wahi tapu;
4) Settlement or other historical sites in or adjacent to specific waterways, the use of waterways as access routes or transport courses;
5) The value of waterways as traditional sources of mahinga kai food and other cultural materials and;
6) The continued capacity for future generations to access, use and protect the resource (Te Runanga o Ngai Tahu, 1999).

Other attributes of tangata whenua values that might be considered include place names and the presence of Maori trails (Tipa, 2001). Although Tipa's (2001) assessment of the tangata whenua values associated with the Rangitata River in Canterbury is largely descriptive and primarily sought to determine how these values could be negatively/positively affected by several proposed management options, the impacts on mauri and mahinga kai listed might be used in developing indicators for these attributes. Influences on mauri include inappropriate flow regime, channelisation/stopbanks/river protection, abstraction of water, drainage, dewatering, cross mixing of water, coastal environment health, catchment impacts, and water quality (p. 4). Characteristics affecting mahinga kai include:
1) Modifications to the waterways and the resultant loss of habitat;
2) Changing land use and the resultant loss of habitat;
3) The abundance and diversity of mahinga kai species has changed;
4) Health of fish has deteriorated;
5) Adverse effects are felt throughout the catchment; and
6) 6) There are problems with passage by fish throughout the system (p. 5).

One source which moves beyond simply identifying tangata whenua values and associated attributes is a tool developed by Tipa and Teirney (2003; 2006) called the Cultural Health Index. This was developed in order "to facilitate the input and participation of iwi into land and water management processes and decision making" (Tipa & Teirney, 2003, p. vii). Although this index only considers the health of waterways from an ecological perspective (in terms of mahinga kai species), it provides a useful example of quantitatively assessing water bodies in relation to tangata whenua values. The index has three components: status of the site, a mahinga kai measure and a cultural health stream measure. Table 2-5 summarises these components and the ways in which they are assessed and evaluated using the Cultural Health Index. Maori leaders were consulted to develop the indicators. The Cultural Health Index has recently been applied in the Motueka River Integrated Catchment Management project (see http://icm.landcareresearch.co.nz/ research/research.asp?theme_id=4&research_id=121) and in Te Waihora/Lake Ellesmere (Pauling & Arnold 2009),

Table 2-5
Components, attributes and scoring of the Cultural health index used to assess the health of streams and waterways
(Tipa & Teirney, 2006)

Components of cultural health index	Attributes	Evaluation indicators	Combining of scores
Component 1: Site status	1. Traditional/non-traditional site? 2. Would Tangata whenua use the site in the future?	A = traditional site B = non-traditional site 1 = tangata whenua would use site 2 = tangata whenua would not use site	
Component 2: Mahinga kai	1. Number of mahinga kai species present at the site today.	1 = 1-3 species present 2 = 4-7 species present 3 = 8-10 species present 4 = 11-14 species present 5 = 15+ species present	The four scores for the attributes of mahinga kai are totalled and then averaged. i.e., equal weight is given to each.
	2. Comparison of the number of mahinga kai species present today with historical indications	1 = non-traditional site 1 = none of the species recorded in the past are still present 2 = less than half present 3 = at least half present 4 = more than half present 5 = all species present	1 = poor mahinga kai values 2.5 = average mahinga kai values 5 = excellent mahinga kai values
	3. Accessibility of the site	1 = no access to the site 3 = either physical or legal barriers make access difficult 5 = Unimpeded easy access to the site	
	4. Whether tangata whenua would return to the site	1 = no, would not return for mahinga kai gathering 5 = yes, would return for mahingakai gathering	
Component 3: Cultural stream health	1. Catchment land use	1 = Land heavily modified, wetlands & marshes lost 5 = Appears unmodified	Multiple people evaluate a given site according to the 8 attributes. The scores for each attribute are totalled, then, averaged. Then, the average scores for each attribute are added and averaged giving an overall stream health score. i.e., equal weight is given to each attribute.
	2. Riparian vegetation	1 = Little or no vegetation, neither exotic or indigenous 5 = Complete cover of vegetation – mostly indigenous	
	3. Use of riparian margin	1 = Margins heavily modified 5 = Margins unmodified	1 = poor stream health 2.5 = average stream health

	4. Riverbed condition/sediment	1 = Covered by mud/sand/slime/weed 5 = Clear of mud/sand/sediment/weed	5 = excellent stream health
	5. Channel modification	1 = Evidence of modification, e.g., stopbanks, straightening, gravel, removal, shingle build up 5 = Appears unmodified	
	6. Water quality	1 = Appears polluted 5 = No pollution evident	
	7. Water clarity	1 = Water badly discoloured 5 = Water is clear	
	8. Flow and habitat variety	1 = Little or no current, uniform depth and limited variety of flow related habitats 5 = Current and depth varies, creating a variety of habitats	

2.4.5 ***Wildlife/conservation/ecological values***

Much of the literature refers to the wildlife, conservation or ecological values of rivers (see, for example, Daly, 2004; Dunn, 2000; 2004; Knutson et al. 1993; Mosley 2002; 2003; 2004; O'Donnell 2000; O'Donnell and Moore 1983), but like many of the other values specified in the *Significance assessment for river values method* project, few sources utilise a quantitative assessment.

O'Donnell and Moore (1983) were amongst the first to use a criteria-based evaluation system to assign relative values to rivers, for birdlife on Canterbury's braided rivers. Their scoring system was based on Wildlife Service criteria for rating habitats for conservation values. In this application it led to rivers being rated as: outstanding, high, moderate-high, moderate or potential. The system continues to be used today and applied in a variety of one-off resource management contexts (e.g., resource consent or water conservation order processes). Table 2-6 lists the criteria used for scoring under this system.

Table 2-6
Wildlife Service Criteria for rating habitats for conservation values (O'Donnell & Moore 1983)

Outstanding	a) Presence of a breeding population of a highly endangered or rare endemic species. b) Presence of a population of an endemic species of very restricted distribution and which could become endangered. c) Areas essential to species from (a) and (b) for purposes other than breeding. d) Areas of vital importance to internationally uncommon species (breeding and/or migratory). e) Areas of vital importance to internally migratory species with very limited distribution or abundance. f) Largely unmodified ecosystem or example of original habitat type not represented elsewhere in the country, of large size and containing viable populations of all or almost all species which are typical of the ecosystem or habitat type.
High	a) Habitat containing an indigenous species which has declined significantly because of man's influence. b) One of few or the only breeding area for a non-endemic indigenous species of limited abundance.

	c) Habitat of an uncommon, discontinuously distributed species not adequately represented in the ecological region or only represented in a particular ecological region. d) Example of a largely unmodified habitat which is not represented to the same extent elsewhere in the ecological region and is used by most species which are typical of that habitat type for the region. e) Presence of a species of an endemic family which is of limited abundance throughout the country although adequately represented in one ecological region but whose habitat is at some risk.
Moderate-High	a) Presence of a species which is still quite widely distributed but whose habitat has been and still is being significantly reduced or modified because of man's influence. b) Areas containing high numbers of breeding or moulting birds or where breeding or moulting areas are of inter-regional significance to wildlife. c) A large and fairly unmodified habitat or ecosystem which is represented elsewhere in the ecological region and contains all or almost all species typical of that habitat type for a particular region. d) An area where any particular species is exceptional in terms of, say, abundance or behaviour but which is otherwise widespread.
Moderate	a) All habitats supporting good numbers of species which are typical of that particular habitat within an ecological region and which have not been heavily modified by man's influence.
Potential	a) All areas of some wildlife significance which are limited by size, heavy modification or other reasons, but are of potential wildlife value if left to generate or are managed or developed for wildlife. (May include habitat which functions as a corridor or is sub-optimal habitat which is necessary for maintaining genetic diversity.

O'Donnell (2000) developed a more robust and quantitative system than that used in O'Donnell and Moore (1983) and has applied this to a broader range of wetland habitat types, including the original set of braided rivers. His criteria (summarised in Table 2-7are based "on general conservation principles" (O'Donnell 2000, p. 17). Each habitat (or section thereof as decided) is scored against these criteria and then the total is simply the sum of these scores. The total score is then used (Table 2-8) to assign the site to one of six categories of significance. This is a simple, yet seemingly effective method of developing a comparative ranking index for rivers.

Table 2-7
Criteria for ranking habitat value to birds
(O'Donnell 2000)

Criteria	Sub criteria	Weighting scale range
A. Representativeness	Number of guilds present	1-7
	Level of endemism	1-3
	Quality of representation of habitat	1-3
B. Life supporting capacity	Habitat size	1-4
	Numbers	1-4
	Breeding guilds	0-7
	Feeding guilds	0-7
	Roosting guilds	0-7
C. Natural diversity	Within guilds	1-2
	Microhabitat diversity	1-10
	Number threatened species	0-7
D. Distinctiveness	Overwintering	0-1
	Migration stopover	0-1
	Significant breeding site	0-1
	Significant moulting site	0-1
	Only region typically supporting a particular species	0-1
	Habitat for specialist needs	0-1
	Habitat for species with special diet or foraging behaviour	0-1
E. Intactness/naturalness	Level of modification	1-4
F. Long term viability	Vulnerability to natural perturbations	1-3

Table 2-8
Habitat significance scores for wildlife
(O'Donnell 2000, p.21)

Rank	Score	Habitat significance
High 1	>50	National-International
High 2	40-49	National
High 3	30-39	Regional
Medium 1	20-29	Local
Medium 2	<20	Low

In Daly's (2004) inventory of in-stream values for Canterbury rivers and lakes aquatic ecological values are assessed according to the species present in the following categories: indigenous plants, indigenous invertebrates, indigenous birds, indigenous fish, salmonids and other. Other than species identification, no assessment criteria are provided. In Mosely's (2002; 2003; 2004) assessments of the natural character, amenity values and flow regimes of several Canterbury rivers, he adopts the term 'natural values' which comprises of the following attributes:

- Life-supporting capacity of water and associated aquatic and riparian ecosystems;
- Significant habitats of indigenous fauna and flora;
- Natural character;
- Habitat areas of braided river birds;
- Significant habitat of trout and salmon;
- Significant natural features and landscapes.

In contrast, Norton and Roper-Lindsay (2004) sought to develop an "ecologically sound and consistent approach that could be used throughout the country" (p. 298) to determine ecological significance. Although the approach used is not wholly quantitative, the criteria or attributes contributing to ecological significance are assessed as being either positive or negative. Four criteria/attributes to assess ecological significance were proposed: 1) rarity and distinctiveness, 2) representativeness, 3) ecological context and 4) sustainability. The first three pertain to a given site's current state and the sustainability criterion pertains to the future of the site. The authors concluded that these four criteria "provide sufficient information for assessment of the ecological values of terrestrial and freshwater sites in New Zealand" (p. 298). Table 2-9 presents the criteria used to assess ecological significance and the indicators for determining if a site is positive or negative.

Table 2-9
Criteria/attributes and the indicators used to assess ecological value and site significance
(Norton & Roper-Lindsay, 2004)

Criteria/attributes for assessing site significance	Indicators used to determine if site is positive or negative
Rarity and distinctiveness (site criterion)	A site is positive if it is known to support a species: • That is listed acutely threatened on the New Zealand Threat Classification system • That is at a national distributional limit • Only occurs in that area, or is particularly uncommon in the study area.
Representativeness (site criterion)	A site is positive if it: • Supports an ecosystem that is now at less than *c.*10% of its former extent in the ecological district • Supports a high quality example of an ecosystem that is now less than *c.*20% of its former extent in the ecological district.

Ecological context (site criterion)	An area is positive if it: • Enhances connectivity between patches • Buffers or similarly enhances the ecological values of a specific site of value • Provides seasonal or "core" habitat for specific indigenous species.
Sustainability (future criterion)	A site is considered positive if: • Key ecological processes remain viable or still influence the site • The key ecosystem within the site are known to be or are likely to be resilient to existing or potential threats under some realistic level of management activity • Existing of potential land and water uses in the area around the site could be feasibly modified to protect ecological values.

Using the above assessment, if a site is positive for a site criterion and positive for sustainability, the site is considered 'significant'. If the site has no positive site criteria, or it has a positive site criteria but is negative in terms of sustainability then the site is not considered to be a 'significant natural area'[12].

Internationally, researchers in Britain and Australia have attempted to standardise attributes relating to the ecological or conservation value of rivers (Boon, Wilkinson & Martin, 1998; Boon, Holmes, Maitland & Fozzard, 2002; Dunn, 2000; 2003; 2004). In Britain during the 1990s, a system for evaluating the conservation values of rivers was developed: 'System for Evaluating Rivers for Conservation' (SERCON) (Boon et al., 1998). Although this system only considers conservation value, the method developed could potentially be extended to the other values included in the current project. SERCON utilises a wide variety of information to generate scores (on a scale of 0-5) for six attributes:
1) Physical diversity;
2) Naturalness;
3) Representativeness;
4) Rarity;
5) Species richness; and
6) 'Special features'.

Each of these attributes has a number of indicators (see Table 2-10).

Table 2-10
List of attributes and indicators used in the System for Evaluating Rivers for Conservation SERCON) (Boon et al. 1998)

Attribute	Indicators	Attribute	Indicators
1. Physical diversity	1. Substrates 2. Fluvial features 3. Structure of aquatic vegetation	**2. Naturalness**	1. Channel naturalness 2. Physical features of the bank 3. Plant assemblages on the bank 4. Riparian zone 5. Aquatic and marginal macrophytes 6. Aquatic invertebrates 7. Fish 8. Breeding birds

12 The term 'significant' is used in this study according to the definition given in the Resource Management Act 1991.

3. Representativeness	1. Substrate diversity 2. Fluvial features 3. Aquatic macrophytes 4. Aquatic invertebrates 5. Fish 6. Breeding birds	**4. Rarity**	1. Habitats Directive/Bern Convention species (+ rare in UK) 2. Scheduled species 3. Habitats Directive species (but not rare in UK) 4. Red Data Book/Nationally scarce macrophyte species 5. Red Data Book/Nationally scarce macrophyte species
5. Richness	1. Aquatic and marginal macrophytes 2. Aquatic invertebrates 3. Fish 4. Breeding birds	**6. Special features**	1. Influence of natural on-line lakes 2. Extent and character of riparian zone 3. Floodplain: recreatable water-dependent habitats 4. Floodplain: unrecreatable water-dependent habitats 5. Invertebrates of river margins and banks 6. Amphibians 7. Wintering birds on floodplain 8. Mammals

Attribute scores are weighted and combined to produce a series of conservation and impact indices. During 1999, a review of SERCON was undertaken and improvements made (Boon et al., 2002). SERCON appears to be a sophisticated and well-developed method for evaluating the conservation value of rivers. It incorporates a weighting system which many of the other methods lack. The weights used in SERCON were determined through extensive consultation with experts.

Drawing from SERCON and work by Collier (1993), Dunn (2000; 2004) implemented a survey of Australian river scientists and managers to determine the particular values and attributes that describe conservation significance of Australian rivers. The survey consisted of a series of attributes associated with conservation values relating to rivers and respondents were asked to indicate the importance of each attribute. Five criteria were determined:

1) Naturalness;
2) Representativeness;
3) Diversity and richness;
4) Rarity;
5) Special features[13].

The survey results revealed that there were 47 attributes which indicated high ecological value[14]. It is important to note, however, that the results from this survey were simply to provide a foundation from which an assessment tool might be developed (Dunn, 2004).

Dunn's (2000) report of this process *Identifying and protecting rivers of high ecological value* might be particularly useful to the current project. Dunn identified three elements which were necessary to achieving an assessment method; two of which bear much resemblance to the RiVAS project. The first is "definition – laying out those criteria and attributes which define ecological value", and the second is "evaluation – specifying the basis on which comparisons will be made and making judgements" (p, 23). In addition, Dunn extensively reviews models and approaches which have been used to assess rivers in Australia and internationally. She includes much information about the

13 These criteria were based on the SERCON tool developed in Britain, and Collier's (1993) work.
14 See original sources for the list of attributes defined.

criteria and attributes used in the different assessment methods, but little on what indicators were used and how they were measured. One method included in Dunn's review is the 'draft framework for conservation and sustainability' developed by the *Environment Protection Agency (Queensland)* (see pages 14 & 33 in Dunn, 2000). Little detail is provided, but this approach uses a weighting system to evaluate the attributes and obtaining the original source might reveal an appropriate method which could be adapted for the purposes of the current project.

2.4.6 ***Irrigation/hydro-electric development values***

When compared with the other values included in the *Significance assessment for river values* project, few sources that were directly relevant were found concerning industrial values such as irrigation or hydro-electricity. In addition, the methods which have been used for assessing industrial values depart from the approaches described above. In New Zealand, water is not commonly traded; therefore, it is difficult to place a monetary value on water resources especially with regard to irrigation and hydro-electric development (Waugh, 1992). Despite this characteristic of industrial water use in New Zealand, those sources that were found considered these values from an economic perspective (Grimes & Aitken, 2008; Ministry of Agriculture and Forestry, 2004).

One such method is the hedonic property value approach to water valuation used by Grimes and Aitken (2008). This method uses sales prices and valuation data together with resource consent data and the value of farm improvements to calculate the net economic contribution of irrigation water. Characteristics of individual farms, such as slope, drainage, rainfall and distance to nearest towns/cities, must also be controlled for to allow comparisons of irrigation value. This method is appropriate in the New Zealand context because legal rights (via consents) to abstract water from waterways are not transferable; they remain with the farm when it is sold. Grimes and Aitken concluded that for the Mackenzie District, where they applied this approach, water and the right to abstract water was a valuable commodity. However, water was more highly valued in areas which were more suitable for water-intensive land uses and these areas could be determined through particular farm characteristics (e.g., slope, drainage, rainfall, or distance to nearest town). Such characteristics might usefully be converted to attributes by which irrigation values could be assessed.

Another method applied in New Zealand to value irrigation is the adjusted gross margin (GM) method which utilised a "with minus without" irrigation approach (Ministry for Agriculture and Forestry, 2004). The resultant formula used was:

Farm gate GDP due to irrigation = GDP with irrigation – GDP without irrigation

GDP with irrigation = (irrigated land use mix X (irrigated GM – fixed costs))

GDP without irrigation = (dryland use mix X (dryland GM – fixed costs)

The purpose of the study was to assess the economic value to New Zealand of water use through irrigation. The results of this work showed that in 2002/2003 the net contribution of irrigation to GDP at the farm gate was approximately $920 million. This is equivalent to 11% of total GDP at the farm gate for the same period. While this report only addressed the socio-economic value of irrigation to New Zealand, the intention of the report was that it would be used in conjunction with work being done involving other water values such as recreational, cultural and conservation values.

2.5 Table summary of the sourced literature

A summary of the sources reviewed in this chapter is given in Table 2-11. The table is organised according to the relevancy (high, medium or low) of each source to the current project (the final column) and then within each relevancy classification, sources are listed in alphabetical order by author/s.

Sources which have been categorised as highly relevant are those sources which include quantitative assessment and evaluation of river values (or values associated with the landscape setting under investigation). Sources of medium relevancy provide information regarding multiple river values and their associated attributes, but lack quantitative assessment. Sources of low relevancy include those sources which provide more general information relating to the ways in which rivers are valued.

Table 2-11
Summary table of relevant literature relating to the RiVAS project
Note that literature is organised according to a subjective assessment of relevancy to this research project (far right column) and author (far left column)

Author/s	Title	Location	Values identified	Attributes identified	Means of combining and evaluating attributes	Relevancy to project (high, medium, low)
Collier (1993) Collier & McColl (1992)	Towards a protocol for assessing the natural value of new Zealand rivers Assessing the natural value of New Zealand rivers.	New Zealand	1. Natural values	1. Ecological representativeness or rare type of ecosystem 2. Degree of modification 3. Diversity and pattern 4. Rarity and unique species or features 5. Long-term viability	Descriptors and weightings (in terms of importance) were determined through expert opinion collected via surveys. Due to the number of descriptors and weightings, they are not reproduced here (see original report). To combine the indicators used for each criterion/attribute the values assigned were divided by the maximum score, and then multiplied by the weighting. The sum of the indicator scores was then divided by the sum of the weightings for all indicators and multiplied by 100 (the score for the attribute, degree of modification, was then subtracted from 100). This method could potentially be extended to the other values in the RiVAS project.	High
Boon, Wilkinson & Martin (1998) Boon, Holmes, Maitland & Fozzard (2002)	The application of SERCON (System for Evaluating Rivers for Conservation) to a selection of rivers in Britain Developing a new version of SERCON (System for Evaluating Rivers for	Britain	1. Conservation values	1. Physical diversity 2. Naturalness 3. Representativeness 4. Rarity 5. Species richness 6. Special features 7. Additional features (this criterion does not contribute to the calculation of the conservation indices) 34 indicators are used to measure these attributes which are presented in Table 2-10. Readers are also directed to the original source for more information.	Data are gathered via a field survey of the river corridor and other data on physical, biological and chemical features of the river is gathered from other sources. These data are then converted into a series of scores on a 0-5 scale for each of the identified attributes. Scores are weighted and combined to produce separate indices of conservation value (0-100) for the 6 criteria.	High

	Conservation)				Data are given a quality score of A (high), B (medium) or C (low) confidence in the data. This aids in data interpretation and appropriate caution can be taken for particularly poor quality data.	
Dunn (2000) Dunn (2004)	Identifying and protecting rivers of high ecological value Defining the ecological values of rivers: The views of Australian river scientists and managers	Australia	1. Aquatic biodiversity/conservation/ecological values	1. Naturalness 2. Representativeness 3. Diversity and richness 4. Rarity 5. Special features Taken from survey of Australian river scientists and managers	A survey of river scientists and managers was implemented to determine the attributes of rivers with high ecological value. The survey was a foundation to the development of assessment tools.	High (Although this source does not include any quantitative assessment of river values, it has been rated as having 'high relevancy' because the report bears much resemblance to the current project and includes a comprehensive review of the ways in which rivers (and other ecosystems) have been assessed according to conservation or ecological values)
Egarr, Egarr & MacKay (1979)	64 New Zealand Rivers: A scenic evaluation	New Zealand – nationwide	1. Scenic values	1. Vegetation 2. Banks and riverbed 3. Landscape 4. Wilderness feeling 5. Water quality 6. Water movement 7. Other factors	Each attribute was evaluated on a five-point scale (with the exception of water quality and other factors). Rivers in the study were divided into stretches. Each stretch was evaluated for each attribute and then the scores summed. All attributes were given equal significance.	High

Knutson, Leopold & Smardon (1993)	Selecting islands and shoals based for conservation based on biological and aesthetic criteria	America	1. Biological 2. Aesthetic/visual	Biological 1. Common tern nesting site 2. Bald eagle winter use area 3. Rare plant habitat 4. Significant coastal wildlife habitat 5. Plant species richness Scores for each biological criteria potentially ranged from 1-10 (see original article for the ways in which these scores were assigned). Visual/aesthetic 1. Landform 2. Vegetation 3. Colour 4. Cultural features Each visual criterion was assessed as being Distinctive (5), Average (3), or Minimal (1). (See original article for a table detailing the ways in which these assessments were made).	"The maximum of the biological and the visual scores becomes the final rating for an individual island. This assures a high ranking for any island important in either one of these categories" (p. 201). Visual quality score weighted on the basis of the visibility of the island or shoal from scenic vantage points.	High
Leopold (1969)	Quantitative comparison of some aesthetic factors among rivers	United States – Idaho	1. Landscape/aesthetic/scenic values	46 factors/attributes are included in this assessment. Due to the large number of factors they are not listed here (see original article). The factors are grouped into three broad categories: 1. Physical features 2. Biological features 3. Human interest features Each factor/attribute is evaluated on a 1-5 scale (see original report for this scaling system).	Ranking schemes – between sites a uniqueness ratio is calculated. For example, if a site shares the same score for a given factor with 7 other sites it is unique in the ratio 1 to 7 (0.14). If no other site shares the same score for a given factor then the site has a uniqueness ratio of 1:1 (1.0). The uniqueness ratio is defined on a scale of 0-1.0. Uniqueness ratios are then summed to give an overall uniqueness score and subtotals for each of the 3 categories (physical, biological & human interest). Sites can then be ranked according to these scores. Leopold also undertakes a comparative analysis of selected factors by which to evaluate the different sites. He presents these analyses in a series of figures (see original article).	High
O'Donnell & Moore (1983)	The wildlife and conservation of braided river systems in Canterbury	New Zealand, Canterbury	1. Wildlife	Using O'Donnell (2000): 1. Representativeness 2. Life supporting capacity 3. Natural diversity	Many criteria have multiple sub criteria. These are all weighted on scales of 0-1 (No or Yes), or 0-'x' (depending on the number of sub criteria) and then scored accordingly.	High

O'Donnell (2000)	The wildlife and conservation of braided river systems in Canterbury			4. Distinctiveness 5. Intactness/naturalness 6. Long term viability	The overall score is the sum of this evaluation. Habitat significance is then comparatively evaluated on a 5-tiered scale from High 1 (= National-International significance) to Medium 2 (= Low significance).	
Teirney & Richardson (1992) Teirney, Richardson & Unwin (1987)	Attributes that characterize angling rivers of importance in New Zealand, based on angler use and perceptions The relative value of North Canterbury rivers to New Zealand anglers (NB: This is a regional report of the nationwide study reported in the 1992 article above.)	New Zealand – nationwide New Zealand – Canterbury	1. Angling values	1. Distance from home (1 = remote, 5 = close) 2. Ease of access (1 = difficult, 5 = easy) 3. Area of fishable water (1 = restricted, 5 = extensive) 4. Scenic beauty (1 = low, 5 = high) 5. Peace and solitude (1 = low, 5 = high) 6. Catch rate (1 = low, 5 = high) 7. Size of fish (1 = small, 5 = large)	Using a 1 (lowest) to 5 (highest) scale, respondents rated each attribute and the overall importance of the river. Spearman rank correlations and stepwise regressions were used to determine which attributes were most closely associated with anglers' perceptions of overall importance.	High
Tipa & Teirney (2006)	Using the cultural health index: How to assess the health of streams and waterways	New Zealand	1. Tangata whenua/Maori/Cultural values	Status of site 1. Traditional/non-traditional site 2. Future use Mahinga kai 1. Number of mahinga kai species 2. Historical comparison 3. Accessibility 4. Would tangata whenua gather mahinga kai in the future Cultural stream health 1. Catchment land use 2. Riparian vegetation 3. Use of Riparian margin 4. Riverbed condition/sediment 5. Channel modification 6. Water quality 7. Water clarity 8. Flow and habitat variation	Mahinga kai and cultural stream health attributes were evaluated using a 1-5 scale. Scores were then totalled and average giving equal weight to each attribute.	High
Bergmann,	Valuing the attributes	Scotland	1. Renewable energy	1. Impacts on the landscape	The Choice Experiment method was used.	Medium

Hanley, Wright (2006)	for renewable energy investments		– including hydro electric schemes	2. Impacts on wildlife 3. Impacts on pollution levels, in particular air pollution 4. Creation of long-term employment opportunities 5. Potential increases in electricity prices to pay for renewable sources		
Egarr & Egarr (1981a; b; c)	New Zealand recreational river survey	New Zealand – nationwide	1. Recreational values/potential Scenic value	1. Suitability of use for each recreational group 2. Access 3. Problems and obstructions to use 4. Proximity to demand 5. Skill or challenge factor Consideration of these factors leads to categorising rivers according to the following scale of recreational value. 1. Low (valueless & mediocre) 2. Intermediate (average) 3. High (popular) 4. Exceptional (extreme) 1. Vegetation (volume, variety & virginity) 2. Geological makeup 3. Vista 4. Wilderness or naturalness 5. Water quality 6. Water movement 7. Utilities 8. Wildlife Consideration of these attributes lead to evaluating each river on the following six-point scale. 1. Dull 2. Uninspiring 3. Moderate 4. Picturesque 5. Impressive 6. Exceptional	Difficult to find satisfactory formula to rank one attribute against another, especially when trying to apply this formula in different areas of the country. Combining the recreational and scenic values assigned to each river. Category A: all rivers with exceptional recreational value and exceptional scenic value Category B: all rivers with exceptional recreational value and impressive scenic value or high recreational value and exceptional scenic value Category C: all rivers with exceptional recreational value and picturesque scenic value or high recreational value and impressive scenic value or high recreational value and picturesque scenic value or exceptional recreational value and moderate scenic value Category D: all rivers with high recreational value and moderate scenic value or intermediate recreational value and exceptional scenic value or intermediate recreational value and impressive scenic value or intermediate recreational value and picturesque scenic value.	Medium
Daly (2004)	Inventory of instream values for rivers and lakes of Canterbury New Zealand	New Zealand – Canterbury	1. Landscape values	1. Natural character = high/moderately high/moderate/moderately low/low 2. Outstanding natural features and landscapes = high (outstanding)/moderately high/ moderate (significant)/moderately low/low (unremarkable)	Evaluations for the attributes comprising 'landscape' and 'visual amenity and recreational' values have associated indicators and numerical scores. These have been taken from a report prepared for Environment Canterbury by Boffa and Miskell (2001). In most cases a 1-5 scale was used	Medium
			2. Aquatic Ecological	1. Indigenous plants		

			values	2. Indigenous invertebrates 3. Indigenous birds 4. Indigenous fish 5. Salmonids 6. Other Lists of appropriate species obtained from Department of Conservation documents	and scores summed to provide score categories of high/moderate/low etc. Indicators are not weighted.	
			3. Visual amenity and recreational values	1. Visual amenity (wild and scenic) = high/moderate/low 2. Recreation (frequency of use) = high/moderate/low		
			4. Education, scientific and heritage values	1. Importance = international/national/regional Determined from New Zealand Geological Society geo-preservation sites inventories and classifications.		
			5. Tangata whenua values	1. Mauri 2. Mahinga kai 3. Wahi tapu		
Grimes & Aitken (2008)	Water, water somewhere: The value of water in a drought-prone farming region	New Zealand – Mackenzie Country	1. Industrial values (irrigation)	1. Farm sale prices 2. Land values assessed by an independent body 3. Value of improvements to the property	Hedonic property value approach to water valuation Statistical analyses using farm sale prices, land valuation data, and resource consent data. Farm Characteristics such as value of improvements, slope, drainage, rainfall and distance to towns, are controlled for. (See original source for equations).	Medium
Ministry of Agriculture and Forestry (2004)	The economic value of irrigation in New Zealand	New Zealand	1. Industrial values (irrigation)	1. GDP with irrigation 2. GDP without irrigation	The gross margin method was used which utilised a “with minus without” irrigation approach. (See Section 2.6 for the formula used).	Medium
Ministry for the Environment (1998)	Flow guidelines for instream values – volume A	New Zealand	Report is organised according to the following: 1. Ecological values 2. Landscape values 3. Recreational values 4. Maori values		These river values are considered and discussed within the context of the Resource Management Act 1991. No quantitative assessment is made.	Medium

			The report also separates river values into 'in-stream values' and 'out-of-stream values'. In-stream values 1. Ecological values 2. Aesthetic values (recreation & landscape) 3. Maori cultural and traditional values Out-of-stream values 1. Abstraction of water 2. Diversion of water into or out of rivers 3. Damming 4. Changing land use patterns			
Ministry for the Environment. (2004)	Water bodies of national importance: Potential water bodies of national importance for recreation value.	New Zealand	Part of the *Water Programme of Action* which seeks to identify water bodies of national importance for a range of values: 1. Natural heritage 2. Recreation 3. Cultural and historic heritage 4. Irrigation 5. Energy industry 6. Domestic use 7. Tourism This report seeks to develop methodology for determining water	Two primary reasons for assessing water bodies of national importance in terms of recreational value were identified. 1. Location 2. Type of water body.	Three methods were employed. An internet survey, a telephone survey, and a literature review	Medium

			bodies of national importance for recreation value.			
Mosley (1989)	Perceptions of New Zealand river scenery	New Zealand	1. Scenic 2. Recreational	43 primary variables or characteristics of rivers were selected to describe the river scapes. Due to the high number of factors, they have not been reproduced here. The variables were measured in a variety of different ways. For example, percentage of native forest, five-point scales (e.g., velocity class of river), distance to farthest point visible in photograph. See original source for a full list of variables and the measurements used.	A series of statistical analyses were used to determine the variables influencing people's perceptions the most.	Medium
Mosley (1999)	Natural character and amenity values of rivers and lakes	New Zealand	1. Natural character 2. Amenity values	This report "does not specify the particular measurements that are required to describe the attributes…. Nor does it include protocols for carrying out the measurements…… This task would be a major exercise, although a considerable amount of guidance already is available in documents such as the *Lake Managers Handbook* (Vant, 1987) and *A procedure for characterising river channels* (Mosley, 1982). In terms of evaluating the degree of natural character of a locality, however, a simple ranking of the degree of naturalness of a particular attribute would be more economical than carrying out a full quantitative survey" (p. 23).	Includes discussion of the ways in which amenity values and natural character are defined in legislation and regional policies.	Medium
Mosley, (2002) Mosley (2003) Mosley (2001)	Hurunui River: In-stream values and flow regime Waipara River: In-stream values and flow regime Rangitata River: natural character, amenity values and flow regime (NB: this report adopts a slightly different format to the above three, however includes discussion of	New Zealand – Canterbury	1. Natural values 2. Cultural values 3. Heritage values 4. Amenity values 5. Recreational values	Natural values 1. Life-supporting capacity of water and associated aquatic and riparian ecosystems 2. Significant habitats of indigenous fauna and flora 3. Natural character 4. Habitat areas of braided river beds 5. Significant habitat of trout and salmon 6. Significant natural features and landscapes Cultural values 1. Mahinga kai areas 2. Wahi tapu and other wahi taonga	Values of the specified river are considered within particular flow regimes.	Medium

	the same values.)					
Mosley (2004)	Waiau River: In-stream values and flow regime	New Zealand – Canterbury	NB: Owing to the multiple number of values identified in this reference, the attributes comprising each value have been listed under according to each. 1. Landscape values • Natural character • Outstanding natural features and landscapes 2. Aquatic Ecosystem values • Indigenous plants • Indigenous fauna (birds, fish, other) • Salmonids 3. Visual amenity (wild and scenic and recreation values 4. Educational scientific heritage values tangata whenua values			Medium
Norton, & Roper-Lindsay (2004)	Assessing significance for biodiversity conservation on private land in New Zealand	New Zealand	1. Ecological/conservation/indigenous biodiversity values	Site criteria/attributes 1. Rarity and distinctiveness 2. Representativeness 3. Ecological context Future viability of site criterion 4. Sustainability Each criterion is assessed as being positive or negative. The original article includes the descriptions necessary to determine if a site is positive or negative for each criterion. Two stage assessment process. 1. Site criterion assessed. If any one is positive then: 2. Assessed against the sustainability criterion.	If a site is positive for a site criterion and positive for sustainability, the site is considered 'significant'. If the site has no positive site criteria, or it has a positive site criteria but is negative in terms of sustainability then the site is not considered to be a 'significant natural area' (in terms of the RMA).	Medium
Rob Greenaway and Associates (2003b)	Waitaki River recreation survey	New Zealand – Waitaki River	1. Recreational values	1. Fish 2. Peacefulness 3. Quality of the water 4. Accessibility 5. Size of the river 6. The landscape 7. Other people you meet		Medium
Sutherland-	Inventory of	New Zealand	1. Recreational value	1. Travel time (close/ moderate/far)	Document is simply a descriptive inventory,	Medium

Downing & Elley (2004)	recreation values for rivers and lakes of Canterbury New Zealand	– Canterbury	This is broken down into sub-values 1. Recreation physical value • water quality = high/moderate/low • natural appeal = high/moderate/low • scenic appeal = high/moderate/low 2. Recreation use values Frequency = high/moderate/low Intensity = high/moderate/low 3. Recreation use types	2. Facilities (Extensive/many/ some/limited) 3. Accommodation (Camping/ Tramping hut/caravan/ campervan/crib or batch) 4. Fishing and hunting abundance of target species (very common/ common/ uncommon – for each species) 5. Channel features (Shallows/ waterfalls/shallow rock drops/rock obstacles/ riffles/ rapids/pools) 6. Flow strength (Sluggish/ moderate/strong/ powerful) 7. Flow conditions supporting recreation (Year-round/ certain times of year) 8. Obstructions (Bank-side willows/bank or bed obstructions) 9. Accessibility (Along bank/bed = good/limited; Road to & from water-body = good/moderate/ private; Boat = good/ moderate/ limited)	i.e., no quantitative evaluation is undertaken. Descriptions for each evaluation are given in the report. An evaluation of the desirable values and attributes for a number of different types of recreation is also provided. The recording sheets are contained as an appendix to the report.	
Te Runanga o Ngai Tahu (1999)	Te Runanga o Ngai Tahu: Freshwater policy statement	Ngai Tahu – South Island, NZ	1. Tangata whenua/Maori/cultural values – mauri and kaitiakitanga	Mauri 1. Aesthetic qualities, e.g., clarity, natural character and indigenous flora and fauna 2. Life-supporting capacity and ecosystem robustness 3. Depth and velocity of flow 4. Continuity of flow from the mountain source of a river to the sea 5. Fitness for cultural usage 6. Productive capacity Kaitiakitanga 1. Role of particular waterways in unique tribal creation stories 2. Role of those waterways in historical accounts 3. Proximity of important wahi tapu, settlement or other historical sites in or adjacent to specific waterways 4. Use of waterways as access routes or transport courses 5. Value of waterways as traditional sources of mahinga kai food and other cultural materials; and 6. Continued capacity for future generations to access, use and protect the resource	This source is a policy statement, rather than a method of assessment.	Medium

Tipa (2001)	Rangitata River: Tangata Whenua values	New Zealand – Canterbury	1. Tangata whenua/Maori/Cultura l values	1. Place names 2. The wider catchment 3. Mauri 4. Waahi tapu/taonga (sites of significance access to areas), mahinga kai (resource use), Trails 5. Kaitiakitanga.	Primarily descriptive and qualitative	Medium
Dunn (2003)	Can conservation assessment criteria developed for terrestrial systems be applied to riverine systems	Australia	1. Conservation values		Useful discussion of the applicability of assessment criteria developed for terrestrial systems to riverine systems.	Low
Grindell & Guest (1986) – cited in Mosley (2002)	A list of rivers and lakes deserving inclusion in a schedule of protected waters		1. Wild values 2. Scenic values 3. Recreational values 4. Fisheries values 5. Wildlife habitat values 6. Flora values 7. Scientific values 8. Educational values 9. Cultural values 10. Other amenity values			
Griffin (1975)	A comprehensive study of the Styx River and river catchment	New Zealand – Christchurch	2. Recreational	1. Geology 2. Soils 3. Relief 4. Climate 5. Visual aspects of land use 6. Emergent features 7. Ecology 8. Zoning 9. Roading 10. Landscape character 11. Access and availability if the river to the public 12. Present uses 13. Associated problems	A qualitative assessment of the recreational value of the Styx River in Christchurch, New Zealand. However, this source has been included here because Griffin considers a range of factors/criteria which influence recreational value.	Low
Jowett (1992)	River hydraulics and instream habitat modelling for river biota	New Zealand	1. Wildlife/biota (trout)	1. Adult trout habitat 2. Food production 3. In-stream cover 4. Water temperature	No numerical assessment of these criteria. Source is about the relationship between river flows and amount of suitable habitat for wildlife.	Low

				5. Substrate		
Kingston Reynolds Tom and Allardice Limited., & Kearsley (1982)	Ministry of Works and Development for New Zealand electricity (a division of Ministry of Energy): Upper Clutha Development Kawarau River recreation study.	New Zealand – Kawarau River	1. Recreational Value 2. Scenic value	In terms of scenic value, the survey implemented in this study requested respondents to indicate what was the most visually appealing feature of the Kawarau Gorge from the following list: 1. Outcrops of bare rock 2. Type of vegetation 3. The narrow road 4. Movement of the river 5. The steep slopes 6. Absence of habitation 7. The historic context 8. Colour of the river 9. Height of the road 10. The power of the river 11. The wildlife 12. The power station	Questionnaire Primarily descriptive analyses	Low
Phillips & Joy (2002)	State of the environment report: Native fish in the Manawatu-Wanganui region	Manawatu-Wanganui region	1. Wildlife – native fish values	1. Presence or absence of different species of fish	Multivariate statistical analyses were used to develop relationships between the areas where fish were present and the associated habitat characteristics	Low
Unwin & Image (2003)	Angler usage of lake and river fisheries managed by Fish and Game New Zealand: Results from the 2001/02 national angling survey	New Zealand - nationwide	1. Angling values	1. Angler usage	Calculated as number of angler days. NB: Other studies have suggested that angler days are not an adequate indication of the true value of a river in terms of its angling opportunities.	Low

2.6 **Conclusions**

This chapter has described and analysed the available New Zealand and international literature addressing the ways in which rivers might be classified according to their associated values. It has shown that while much is known about the ways in which rivers are valued, less work has been done which incorporates these values in such a way that rivers can be compared and subsequently classified. Consequently, none of the sources outlined in this chapter appears to offer a method which is directly applicable to the RiVAS.

The most highly relevant sources for the current project are those which quantitatively assess the river values with which they are concerned. To date, most quantitative assessment work and, consequently, that which is directly relevant to the current project, assesses scenic/landscape/natural and wildlife/conservation/ecological values. Work assessing the other values appears to be less common. Moreover, the approaches used to assess angling, recreational, scenic/landscape/natural, tangata whenua, and wildlife/conservation/ecological values are broadly similar in that they identify appropriate attributes and indicators (in some cases attempting quantitative assessment). However, methods used to assess irrigation values are more economic in nature. Also, with the exception of Egarr and Egarr (1981a) and Knutson et al. (1993), most of the literature employing quantitative assessment methods considers just a single value.

Many of these quantitative assessments adopt an arbitrary five-point scale and denote descriptors to each end of the scale (see, for example, Egarr & Eggar, 1981a; b; c; Egarr, Egarr & MacKay, 1979; Teirney & Richardson, 1992; Tipa & Teirney, 2006). The number of studies which assign weightings denoting relative importance to attributes is small though. As identified by Egarr and Egarr (1981a) developing a rational argument for allotting greater importance to particular attributes will be difficult. Even within a given value (e.g., angling), there will be differences in the importance placed on different attributes by different types of anglers (see, for example, Ferrer, Montano, Dibble, Jackson & Rundle, 2005). This point was also highlighted by Teirney and Richardson (1992) when they found that the factors influencing the importance anglers placed on rivers differed depending on the type of fish caught.

Several sources, however, offer approaches that warrant consideration during the development of the current project. These most highly relevant sources are:

- The System for Evaluating Rivers for Conservation (SERCON) developed in Britain (Boon, Wilkinson & Martin, 1998; Boon, Holmes, Maitland & Fozzard, 2002)
- Collier's (1993) Towards a protocol for assessing the natural value of New Zealand rivers
- Knutson, Leopold and Smardon's (1993) Selecting islands and shoals based for conservation based on biological and aesthetic criteria
- Leopold's (1969) Quantitative comparison of some aesthetic factors among rivers

In addition, Dunn's (2000) report *Identifying and protecting rivers of high ecological value* also warrants attention, primarily because the purposes of her study regarding the ecological value of Australian rivers bears much resemblance to those of the current project. Further investigations could be made as to whether an assessment tool has been developed as a result of the process used to define attributes of ecological value undertaken by Dunn.

While these sources appear to offer the current project some direction, Dunn (2000) issued an appropriate caution for the development of river value assessment tools when she posed the question "Are the kinds of values reflected in river assessment protocols developed overseas relevant and adequate for Australian [or New Zealand] rivers?" (Dunn, 2004, p. 417).

Much of the work outlined in this chapter is descriptive and qualitative in nature, lacking any quantitative assessment. However, the ways in which values are discussed and the attributes listed in these sources could provide a useful foundation for the current project and further quantitative assessment. Specifically, Sutherland-Downing & Elley's (2004) inventory of recreational values associated with Canterbury waterways seems particularly useful due to their inclusion of lists of values and desirable attributes associated with a wide range of recreational activities undertaken in riverine environments.

While there is some consistency regarding the attributes which constitute different values, there is also much diversity, which is probably a reflection of the ad hoc nature of the body of literature concerning river value assessment. Perhaps the soundest approach for standardising attributes for given river values is that employed by Boon et al. (1998; 2002), Collier (1993), Dunn (2000; 2004) and Tipa & Teirney (2003; 2006), consultation with experts in the relevant field.

By way of a final point, a factor influencing the ways in which rivers are valued that seems to be absent from the literature is place attachment or sense of place. Although a central premise of the angling survey conducted in the 1980s (Teirney et al., 1987; Teirney & Richardson, 1992) was that visitation alone could not adequately indicate the true value of a given river, none of the other factors included in the study addressed the ways in which people value rivers as a result of place attachment. This factor would be particularly applicable for angling and other recreational values.

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Chapter 3
River Values Assessment System (RiVAS) – The method

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3.1 Background

The Foundation for Research Science and Technology funded five short-term Envirolink projects designed to develop a 'useable' system for regional councils to assess the significance of in- and out-of-stream river values in New Zealand. This resulted in the development of the River Values Assessment System (RiVAS) tool.

There were seven main phases to the overall project (see also Figure 3-1):

(a) A national planning workshop to agree on values to be examined, host councils, suggested lead consultants and timelines. This workshop was held in Wellington on 21 August 2008.

(b) Development of a RiVAS, together with the agreed terminology. This chapter describes the method and terminology that support RiVAS.

(c) Application of the method to salmonid angling to provide an exemplar.

(d) Application of the method (with reference to the salmonid angling template) to the other river values at selected host councils.

(e) A second national river values workshop to receive results, identify and resolve issues, and provide directions for future development of the tool.

(f) Application and further refinement of the tool for prioritising the river values within one region, namely Tasman District Council.

(g) Production of a set of guidelines and case examples to be supplied to all councils in New Zealand.

A steering group was developed as part of the overall project: Mary-Anne Baker (Project Chair, Tasman District Council), Ken Hughey (Project Manager, Lincoln University), Neil Deans (Fish and Game NZ, Nelson/Marlborough), and Murray McLea (Greater Wellington Regional Council)[15]. Each stage of the project involved 'sign off' from this group and advice provided to the wider project participants (including most regional councils, Ministry for the Environment, Ministry of Agriculture and Forestry and Department of Conservation).

3.2 Purpose

This section provides guidance for parties assessing the significance of river values and represents phase (b) and part of (f) of the overall project.

3.2.1 *Purpose of RiVAS*

To outline an explicit and standardised method to develop assessment criteria and significance thresholds for multiple in- and out-of-river values. The method can be applied to national and regional planning under the RMA (e.g., to generate lists of rivers graded by relative importance for

15 John Hayes, Cawthron Institute, Nelson, was part of the initial steering group that proposed the method and trialled it on salmonid angling in Tasman District.

different uses which, in turn, provides information to guide water management decision making for a range of policy interventions/actions) and for other appropriate purposes (e.g., as advocacy tools).

3.2.2 *Ethical use of RiVAS*

Given the level of voluntary and expert input made by multiple stakeholders in some of the value assessments (e.g., kayaking with multiple lay experts) to this process it is expected that these users will be consulted in any application of the RiVAS methodology results for regional water plans or resource consent applications. The application of the methodology does not, in and of itself, constitute such consultation.

3.2.3 *Aim of RiVAS*

The RiVAS tool (and its underlying method) uses a multi-criteria analysis (MCA) approach and aims to:

1. Establish criteria to assess the river value;
2. Identify significance thresholds for these criteria (to identify their importance) and additional factors pertinent to rating the significance of the river value;
3. Outline a means to determine the significance of a river for a specific river value;
4. Define terms in order to provide a common language for practitioners and decision-makers.

The intention was to define a method that has applicability for all river values. The method, while operating under a standard framework has the capacity to facilitate variation in its implementation to accommodate the particular characteristics of each river value. However, once applied for a specific river value (e.g., whitewater kayaking), the expectation is that the method developed *for that river value* will become the standard approach to significance assessment for New Zealand rivers with respect to that value. Thus, the eight river values tested as part of method development and then subsequently applied again in Tasman District should now be considered to have a reasonably standard[16] approach for assessment. The project steering group is of the view that no more than three trial applications should be necessary before a particular value application method is confirmed[17].

The method outlined here results from refinements to a draft methodology that was first tested via application to salmonid angling within the Tasman District (project phase c: 2009). Some changes were made to the method before continuing testing with seven other values. The method was refined slightly from the case study applications for the various river values that form part of the initial value investigations (project phase d: 2009/10), and for a few values during the Tasman District Council application (see Table 3-1 for a summary of the key method steps as now confirmed after at least two applications for almost all values).

The method is intended to provide a means to inform decision-makers as to the significance of particular values, using a consistent approach. It does not (without further development and evaluation) extend to the exercise of prioritising between different river values.

The first applications of RiVAS have been to:

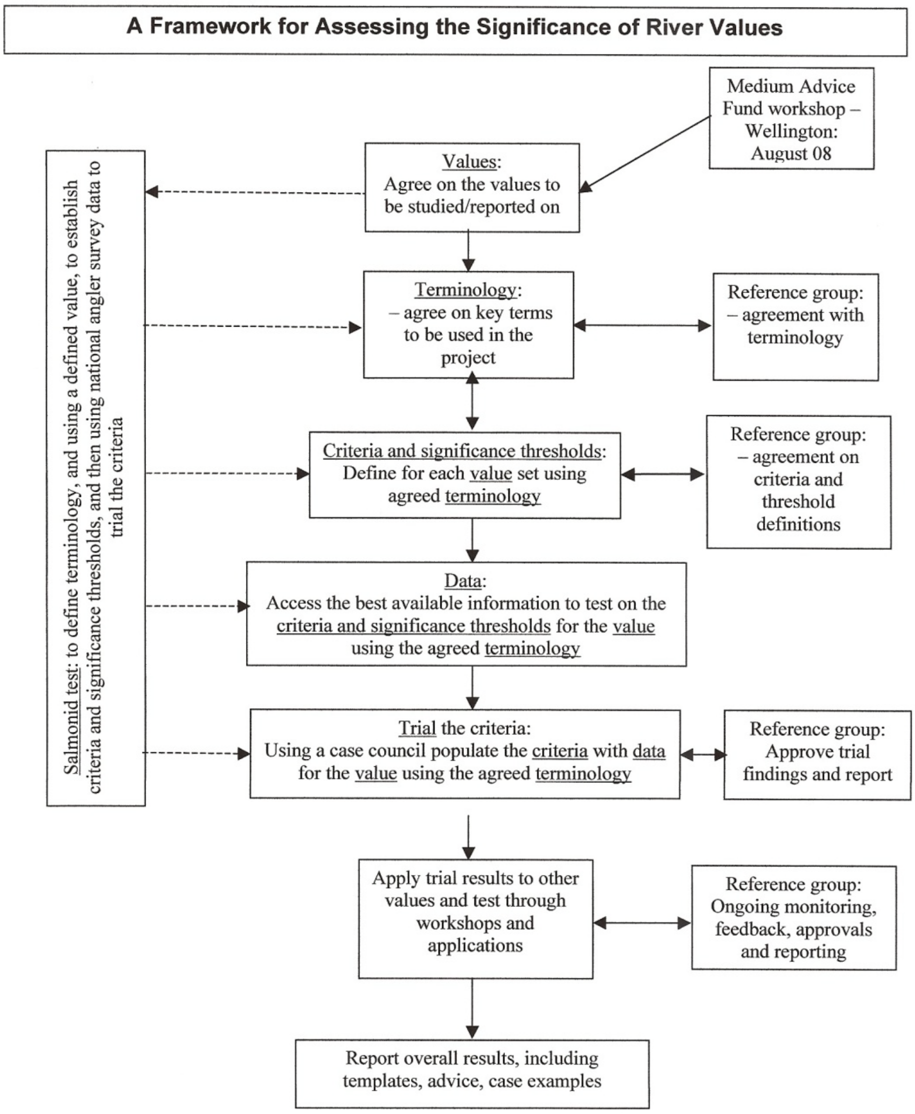
- Salmonid angling – Tasman District Council and Marlborough District Council
- Irrigation – Canterbury Regional Council and Tasman District Council
- Native birdlife – Canterbury Regional Council and Tasman District Council

16 This wording might at first sight appear somewhat ambiguous. The idea however, is to allow further applications of the method to continue on the eight values trialled already – changes can still be made in light of lessons from such applications, but only after full review of the project steering group, or its subsequent equivalent.

17 Three is obviously somewhat arbitrary, but changes to any subsequent application then might imply a need to 'redo' the previous applications with obvious policy and resource implications.

- Whitewater kayaking – West Coast Regional Council and Tasman District Council
- Swimming – Manawatu-Wanganui Regional Council and Tasman District Council
- Natural character – Marlborough District Council and Tasman District Council
- Tangata whenua – Southland Regional Council
- Hydro – Bay of Plenty Regional Council and Tasman District Council[18]
- Native fisheries – Wellington Regional Council.

Figure 3-1
Project overview



3.3 Underpinning criteria, assumptions and limitations of the method

In order to be *practical*, the method works within the constraints of available information. The following criteria have been followed in developing the method:

1. Consistent – The same basic framework is used for all river values (e.g., recreation, irrigation, biodiversity), with adaptation within the framework as required;

18 Work on both the hydro and native fish applications continues. The former has been constrained by issues associated largely with 'whole of industry' engagement. The latter has proved challenging due to a range of scientific issues including 'competing', albeit largely complementary models/approaches/world views.

2. Transparent – All steps in the method are defined explicitly;
3. Holistic understanding of values – A comprehensive description of a value's attributes is provided. Attributes are identified from the literature (see Smith 2009) and via a National Expert Panel;
4. Representative – The attributes chosen for each river value do not bias the assessment or scoring for any *specific* river or type of river;
5. Quantitative – The selected representative attributes are measured using *numerical or categorical* indicators wherever possible. Where quantitative data are not available, a proxy is used, that is, the judgment of an Expert Panel – appointment of expert panels is a fraught process with great care required;
6. Adaptive – When quantitative indicators are unavailable, data requirements are recorded. A river value research strategy may be compiled from this information across all river values;
7. Standardised – While the assessment criteria are based on neutral or quantitative data as much as possible, the determination of significance is by nature judgmental. The method standardises this judgmental process by setting significance thresholds and importance weightings. Factors influencing judgments are recorded – written documentation is used to avoid a 'black box' result, which is open to criticism;
8. Tiered significance – The method recognises national and regional and local significance or, in some cases, high, medium and low significance. International significance is not addressed as the method is targeted at national and regional level decision-making. Nevertheless, there is room in the method for recording matters of international significance;
9. Focused – Most rivers may be treated as single entities but larger rivers may need to be subdivided into two or more segments where their character alters. Sometimes smaller rivers may need to be aggregated to represent like values;
10. Iterative – As the Expert Panel progresses through the steps, decisions taken within previous steps may be reconsidered. Furthermore, the application of the method to a particular river value can be revised as new data become available;
11. Incorporates 'well-beings' – Attributes which represent the river value are chosen with consideration to the four well-beings (social, economic, environmental, cultural). This helps decision-makers consider the implications for each well-being of their decisions. Not every river value assessment will express each well-being.

3.3.1 ***Assumption***

Research by its very nature contains inherent assumptions and limitations and it is important they are addressed explicitly. During application of the method to whitewater kayaking there was considerable debate about the extent to which these were being explicitly acknowledged by the tool developers and project teams. As a result of ongoing discussions the following statement was agreed and is now intended for inclusion in all RiVAS reports, or should alternatively be cross-referenced in any such reports.

"The RiVAS methodology was designed to account for the relatively scarce availability of both up-to-date and relevant data to assess significance (e.g., the lack of a recent and comprehensive survey of freshwater recreation). An expert panel approach which uses the 'best available information' to populate and score the attributes within the RiVAS framework is a viable means of doing this."

3.3.2 ***Limitations***

Multi Criteria Analysis has existed in a formal sense since the 1970s and is now widely used as a decision support tool in a wide range of forums. However, as with any methodology, it has limitations. Consistent with the expression of an overarching assumption about the project it was agreed that limitations particularly relevant to RiVAS should be outlined and reconciled as far as the science of MCA and its implementation can permit. These matters are below:

- *Expert Panels*

The use of expert panels and the need for subjective decision-making by them is challenging. The method includes criteria to guide the appointment of panel members and to ensure credibility these criteria must be complied with. Despite these criteria, deficiencies inherent in the use of expert panels exist, including the need for oversight and consistency of application. This limitation is managed, and its effect minimised, by complying with the expert panel selection criteria. Ideally a national body will 'take up the reins' and apply the RiVAS nationally in a coordinated manner, thus reducing any expert panel bias.

- *Correlation between attributes*

There are likely to be, despite best attempts to reduce this, relationships between some of the primary attributes, known technically as correlation. The smaller the list of primary attributes, the less likely this is to occur, but when it does occur, results may be influenced. The RiVAS method requires 6-10 primary attributes to adequately encompass the various aspects of each river value. The balance between providing an adequate number/diversity of attributes and minimising their correlation is challenging, and some correlation is almost unavoidable. The method separates attributes as far as possible and weighting attributes can be used to explicitly address attributes with, or suspected to have, such relationships.

- *Weighting Attributes*

Attributes can be weighted in the RiVAS methodology (i.e., adjusted to recognise their greater 'contribution' to explaining the relative importance of the river value). The default in the method is to apply equal weighting to attributes but this may not be correct. The challenge is there is little data about the relative importance of the attributes. Without empirical data, this problem cannot easily be resolved. However, the method does consider and allow for attributes to be weighted. Weighting attributes should be considered when the framework is applied to a new value and should be addressed explicitly.

- *Thresholds*

For some values (e.g., native birdlife and to an extent native fish), criteria already exist to identify national importance, and these have been applied where appropriate. Examples of such criteria include definitions of threatened and endangered species and thresholds of nationally important populations. These criteria need to be applied in the context of the Resource Management Act (RMA) 1991 Part II requirements[19]. For other values, including recreation, natural character and abstractive uses, there are no nationally relevant significance criteria so the threshold tests are not so clear. For these values, relevant RMA interpretations have been used, e.g., water bodies defined as outstanding in water conservation orders (WCO) for particular values are accorded nationally important status. As there is no consistency in the criteria used between each WCO deliberation, the selected thresholds need to be tested and, where necessary (after approval of an ongoing project steering group or similar), amended as the method is applied within and between councils.

- *Connectivity between rivers*

The method involves developing river specific rankings. However, rivers may occur as clusters, for two reasons. In some circumstances, a series of rivers in relatively close proximity are attractive

19 For example where Part II S6(c) refers to 'The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna', the emphasis is on habitat – in development of criteria this emphasis has to be met. Thus, in the development of criteria the presence of significant populations of 'threatened or at risk species' is assumed to also signify the presence of significant habitat.

because of their proximity to each other, e.g., the Buller region for kayaking. RiVAS addresses these situations by entering the cluster similar to a single river (i.e., a row in the spreadsheet – see Appendix 6A-4 in chapter 6 herein for example). Individual rivers within the cluster will be separately listed in the spreadsheet. Alternatively, a set of rivers may have similar attributes suggesting they can be treated as 'the same' for the purposes of the exercise (e.g., rivers within Abel Tasman National Park for the value Natural Character). In this instance, individual rivers would not be separately listed.

- *Comparative Grades*

In developing the method, 'raw' indicator data has been converted to comparative (normally) 1-3 (low to high relative significance) scores which are then aggregated to give a total relative significance or importance score. An alternative system of 1-5 scores could also be used and has been used in limited situations. The 1-3 scoring, however, does adequately differentiate across the range of attributes in most cases. It provides a less complicated approach that also reflects the three-grade system in the ultimate ranking (i.e., national, regional and local). The appropriateness of this grading for particular indicators is reviewable, but it appears that after two or a maximum of three applications of the method for a particular value that the attributes and their criteria do not need revising.

- *Mathematical issues*

MCA type analyses assume that all the values lie in what is effectively our 'normal mathematical world', i.e., that all values lie in a comparable and (effectively) linear 'space'. This may not always be true – values may lie in a logarithmic or other non-linear spacing, there may be gaps or big jumps between different states of a value, or the differences between states may not even be comparable in an ordinal manner. There is also the 'apples and oranges' problem when comparing two different values, in that they may not be comparable within our understanding or interpretation of the world, despite having been scored on a similar numerical scale. Mathematical manipulation of values makes further assumptions about the nature and ordinality of the values, and their comparability. While we cannot know the degree to which this underlying assumption is true, and it does not undermine the value of MCA in laying transparent the heuristic behind a decision, it is important that the assumption underlying MCA is understood.

3.4 Definition of terms

River value A river-related tangible resource (e.g., birdlife), activity (e.g., salmonid angling or kayaking), or resource use (e.g., irrigation).

River value category A specific type or style of the river value (e.g., whitewater kayaking, flatwater kayaking; wilderness fishery, lowland fishery).

River segment Subdivision of a river into different portions based on significant changes in its geomorphologic character or use characteristic.

Assessment criteria Part 1 of the method. Identifies *primary attributes* and their associated *indicators* as the means to assess the river value.

Determination of significance Part 2 of the method. Identifies *importance thresholds* and *relative weightings* for each primary attribute. Summing the threshold scores gives a river significance score and ranking.

Attribute One facet of the river value. Taken collectively, attributes *describe* the river value. For example, salmonid angling includes the attributes of level of use, anticipated catch rate and perceptions of scenic attractiveness. Where possible, at least one attribute should be identified for each of the four 'well-beings', i.e., social, economic, environmental, cultural, identified in the Local Government Act 2002.

Primary attribute Those key attributes that are considered to best *represent* the river value under consideration: a subset of the comprehensive listing of all attributes for the river value. The ultimate set of attributes used in applying the method.

Indicator A measure of a primary attribute defined using SMARTA criteria, i.e., indicators that are specific, measurable, achievable, relevant, timely, and may be already in use.

Indicator threshold The threshold applied to an indicator to determine high, medium and low relative importance for that indicator. Thresholds, where possible, are quantitatively defined (e.g., <1,000 angler days per annum = relatively low importance).

Indicator threshold score Relative importance for each indicator is translated to a threshold score to allow mathematical calculation. Typically, except for the application to Natural Character, High importance = 3; Medium importance = 2; Low importance = 1; No importance = 0. For Natural Character the scores range from 5 to 1.

Weighting score The relative contribution of the primary attribute to the river value. Equal weightings may apply – this is the default position.

River significance score The resulting score for each river. This is the sum of the indicator threshold scores for each primary attribute (multiplied by their weighting score where weightings are not uniform).

Significance ranking Rivers are ranked based on their significance scores and labelled as significant at the national, regional or local level (or High, Medium, Low importance for values that are already considered nationally important under the RMA, e.g., tangata whenua and natural character values).

Expert panel The group of people (3-5) considered expert in their understanding of the river value (such as scientists and other river value experts) which form a panel to score indicators of each primary attribute for a specific river value.

3.5 Establish Expert Panel and identify peer reviewers

The method is predicated upon an Expert Panel (3-5 people), and these panels operate either as a:

(a) 'National' Expert Panel which initially identifies and develops the assessment criteria for a particular river value and tests it in a host region; or

(b) 'Regional' (or Local) Expert Panel which applies the value-specific criteria developed in (a) above in their respective regions.

Panel members will normally be scientists and other river value experts, e.g., recognised kayaking expert/lay experts, resource economist, council manager with a responsibility for the river value. When establishing a National Expert Panel, the relevant Ministries (e.g., MfE or MAF), government departments (e.g., DoC), and national level non-government organisations (e.g., Irrigation NZ, Fish and Game NZ) should be consulted on the membership of the panel. The credibility of this group is very important, so members should be selected carefully[20].

The Regional (or Local) Expert Panel applies the relevant method to the river value under consideration, making the necessary judgements where data are insufficient.

It typically takes a Regional Expert Panel for a particular value, one-two days to apply the method to their region. Panel members should be selected to ensure that collectively the panel has the necessary expertise and local knowledge to apply the process in the region. It may be that a single panel is able to fulfil both roles (National Expert Panel and Regional Expert Panel).

The defensibility of the method is contingent upon the credibility of the expert panel(s). Therefore, the composition of the panel(s) should be clearly documented including a justification for the members chosen (members' relevant experience and expertise provided).

When the method is applied to a new river value, the resulting attributes and indicator thresholds should be peer reviewed by at least two people who are regarded as being experts in that value.

3.6 Outline of the method

The method comprises three parts:

- Part 1 - applies the assessment criteria
- Part 2 - assesses significance
- Part 3 - considers future data.

Each part is divided into a series of steps (Table 3-1). More detail for each step is provided below the table. Appendix 3-1a and b, for the purposes of illustration, provides a notional and simplified application of the method to salmonid angling and irrigation respectively.

This is written for two forms of application: first, the national level exercise which develops the attributes, thresholds, etc, for a given river value, and then the regional applications of the method. The National Expert Panel addresses every step in their application of the method for a specific river value (using 'dummy' data for Steps 6 onwards for testing purposes). The Regional Expert Panel addresses Step 1 (confirms the list of rivers that has been prepared in advance), confirms Steps 2-5 (i.e., affirms the work of the National Expert Panel) and applies Steps 6 onwards to their region for a given river value.

Table 3-1
Method summary

Step		Purpose
PART 1: ASSESSMENT CRITERIA		
1	Define river value categories and river segments	The river value may be subdivided into categories to ensure the method is applied at a meaningful level of detail Rivers are listed and may be subdivided into segments or aggregated into clusters to ensure that the rivers/river segments being scored and ranked are appropriate for the value being assessed

20 Simple terms of reference for panel members include: producing brief documented evidence of expertise that can be included in value assessment reports; willingness to contribute expert knowledge from their field of expertise; understanding of and willingness to work in a multi-criteria context. Panels should operate under Chatham House rules and members are specifically asked to represent the national interest and not their personal or organisational interests.

Step		Purpose
		A preliminary scan of rivers in the region is undertaken to remove those rivers considered to be of 'no' or less-than-local level significance for the value being considered
2	Identify attributes	All attributes are listed to ensure that decision-makers are cognisant of the various aspects that characterise the river value
3	Select and describe the primary attributes	A subset of attributes (called primary attributes) is selected A synopsis is provided for each primary attribute to inform decision-makers about its validity and reliability
4	Identify indicators	Indicator(s) are identified for each primary attribute using SMARTA criteria. Quantitative criteria are used where possible.
PART 2: DETERMINATION OF SIGNIFICANCE		
5	Determine indicator thresholds	Thresholds are identified for each indicator to convert indicator raw data to 'not present', 'low', 'medium', 'high' (scores 0-3)[21]
6	Apply indicators and indicator thresholds	Indicators are populated with data (or data estimates using an expert panel) for each river A threshold score is assigned for each indicator for each river
7	Weight the primary attributes	Primary attributes are weighted. Weights reflect the relative contribution of each primary attribute to the river value. The default weighting is that all primary attributes are weighted equally
8	Determine river significance	A river significance score is calculated: If unequal weightings have been applied to the primary attributes, then multiply the threshold score by the weighting for each primary attribute, and sum the calculations If weightings are equal, then indicator threshold scores are summed Order all rivers by their significance scores to provide a list of rivers ranked by their significance for the river value under examination Assign significance (national, regional, local) based on a set of criteria (a simple Decision Support System which operates as part of the overall RiVAS tool – see below)
9	Outline other relevant factors	Factors which cannot be quantified but influence significance are outlined to inform decision-making
PART 3: METHOD REVIEW		
10	Identify information requirements	Data desirable for assessment purposes (but not currently available) are listed to inform a river value research strategy (such a strategy might result from a value or values which are clearly data deficient, and be recommended to appropriate organisations for consideration and determine future information requirements)

21 The most common scale will be 1-3 indicating that in many cases there will always be some 'presence' of the indicator for this primary attribute. The Natural Character value Expert Panel adopted a 1-5 scale (confirmed subsequently by a second application in Tasman District). This is not ideal although a simple translation of scores, e.g., by means of 1-2 to 1, 3 to 2, and 4-5 to 3, could be undertaken (and has been trialled) to 'normalise' the Natural Character application.

3.7 Assessment criteria

Part 1 of the method comprises Steps 1-4 in Table 3-1 Method summary. Much of this part is relevant only for the National Expert Panel. Regional Expert Panels will be expected to apply the steps, not change the identified attributes and indicators.

3.7.1 *Step 1: Define river value categories and river segments*

Output

(1) The river value is subdivided into more refined categories where necessary (e.g., kayaking can be divided into whitewater kayaking; flatwater kayaking).
(2) All rivers within the region are listed, with long rivers subdivided into two or more segments where necessary (e.g., in Marlborough the Upper Wairau, Lower Wairau – divided at Wash Bridge). The number of segments a river is divided into should be as low as possible and should mark distinct differences in river geomorphology or river use. Rivers can also be grouped in a cluster if they are similar across most primary attributes and therefore likely to have the same significance rating, or if the river value requires all rivers in the group to realise the value (e.g., if a rare bird species relies on different rivers for different life stages, or a kayaking experience is only highly valued because there are several rivers in an area). It is possible to list both a whole river and river segments, and a cluster of rivers plus the individual rivers in the cluster, if their significance is different. This should be kept to a minimum, however, or the workload for the expert panel will become unmanageable.
(3) A preliminary scanning exercise is undertaken to remove rivers of 'no' or less-than-local significance for this value. Criteria are needed for this step (e.g., for native birds, a list of rivers with no known significant presence of native birds; and for whitewater kayaking, a list of lowland streams of no value for the sport) – this step should occur iteratively with the process being developed in part 2 of the method.

Rationale

Without further refinement into categories, the river value may be too heterogeneous for the method to be applied meaningfully. Similarly, the river may also require subdividing for the assessment to be meaningful. While it is advantageous to have consistency across all river values – the same list of rivers (and segments) used for every value within the region – it may not be sensible or practical to do so. For instance, swimming will have identifiable pools only in some river segments whereas angling may be an entire river. Removal of rivers through a preliminary scanning process reduces the size of the task.

Who

Expert Panel (host council, scientist/s, expert users, others). Host council should provide initial list of rivers to assess.

Notes

(1) While it is tempting to further refine the river value into different categories or subdivide the river into additional segments, be circumspect. Each additional category or river segment increases the workload considerably and may result in issues later in the process (e.g., in the whitewater kayaking river value, the numbers of users will be split across the separate river segments reducing the magnitude of use for that river). River segments remain separate throughout the method – they are not 'added together' at any stage. The method is repeated separately for each river value category, so the work load substantially increases.
(2) For recreation values, the principles of the Recreation Opportunity Spectrum apply to any consideration of categorising the river value (i.e., consider the different styles of activity which

require different settings to provide the types of experiences being sought, such as whitewater c.f. flatwater kayaking).

(3) List the rivers with names and identifier numbers. Use a recognised list of rivers, such as the Ministry of Works (Anon., 1956[22]) list. Links to the River Environment Classification system could be investigated further.

(4) Segment rivers on the basis of geographical and/or use characteristics. Segments should be commonly recognised by users, where applicable.

(5) If a similar exercise has been done for another river value in the region, preferably use the same list of rivers (i.e., where possible, match rivers and their segments across all river values within the region).

(6) Nested sites may need to be identified – e.g., a set of rapids, a swimming hole. These should not be identified as a river segment – but highlighted as specific sites on a river or river segment. Specific geographic definition is important for 'small' sites such as swimming holes.

3.7.2 *Step 2: Identify attributes*

Output

Attributes which attach to the river value are listed comprehensively.

Rationale

Attributes are identified (including, where relevant, at least one for each of the four 'well-beings' identified in the Local Government Act 2002: social, economic, environmental, cultural) that describe the nature of the river value. The list should be as comprehensive as possible to provide a holistic 'picture' of the river value.

Who

Expert Panel

Notes

(1) Wherever possible, an accepted research/planning framework should be used to structure the list and indicate attributes. For recreation values, use the Recreation Opportunity Spectrum. Economic frameworks may apply for some other river values (e.g., irrigation). Where no framework exists, the Expert Panel will identify attributes based on their professional judgment. Individual attributes may also be suggested within the research literature (see Smith, 2009).

(2) Think broadly and comprehensively when defining attributes. If in doubt, list it. Do not be concerned about pragmatism (that the list is too long or data are not available) - those considerations are addressed in later steps.

(3) When devising the list of attributes, consider the following factors: quality, rarity, diversity, representativeness, substitutability, connectivity, use levels, social, cultural and economic benefits.

(4) Some attributes may be contingent upon others (inter-related). Note as appropriate and try to avoid, in the next step, closely related primary attributes. Attributes may be nested, and it may be necessary to 'drill down' to a greater level of detail in order to adequately describe the river value.

3.7.3 *Step 3: Select and describe primary attributes*

Output

Attributes which will be used to represent the river value are selected and described (including the validity and reliability of each attribute). These are called primary attributes.

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22 Anon. (1956). *Catchments of New Zealand.* Soil Conservation and Rivers Control Council, Wellington.

Rationale

The method used to select the primary attributes must be practical, be able to be implemented, be explicit and defensible. Pragmatically, all attributes cannot be considered, therefore a subset of attributes is chosen. If the river value under consideration (e.g., kayaking) has been divided into categories (e.g., whitewater and flatwater kayaking), the same primary attributes should be applied to all river value categories.

Who

Expert Panel

Notes

From the list of attributes outlined in Step 2, select those 'primary' attributes considered most important. These will be used to *represent* the river value within the assessment. Document the basis for selection. Keep the list of primary attributes short (5-10), to ensure the method is practical to implement and easily transferable.

For each selected primary attribute, discuss its validity and reliability, including its strengths and weaknesses, in representing the river value.

3.7.4 ***Step 4: Identify indicators***

Output

Indicators which will be used to measure the primary attributes are listed.

Rationale

The indicators used to score each primary attribute should allow a cost-effective, and where possible, a quantitative assessment. This increases the practicality and objectivity of the method. A key component of this step is the availability of data. Estimates from the Expert Panel are required where and when data are deficient.

Who

Expert Panel. Where many data exist, heavy reliance will be placed upon the scientist(s) on the Expert Panel to advise and interpret data. Where few data exist, all members of the Expert Panel will play an equal role (to provide surrogate estimates).

Notes

Choose the single most relevant indicator for each primary attribute (i.e., only one indicator per primary attribute). Decisions must be based on the availability of data and relevance of the data. If data are deficient, the best available information and/or an Expert Panel will be used to estimate data (see Step 6). Use SMARTA criteria to select the indicator.

When choosing indicators, return to the list of factors provided in Step 2, that is: quality, rarity, diversity, representativeness, substitutability, connectivity, use levels, economic benefits. Make sure, in-so-far-as possible, that indicators reflect the four well-beings.

Identify and document the data sources used and the reliability of the data.

3.8 Determining significance

Part 2 of the method determines significance via a five-step process as outlined in Table 1.

1. Importance thresholds are determined for each indicator (Step 5).

2. Indicators and their thresholds are applied using available data or data estimates made by the Expert Panel (Step 6) to convert data to scores.
3. Primary attributes are weighted to represent their relative contribution; however, weightings may be equal. Where weightings are other than equal, it is important to record the reasoning (Step 7).
4. Threshold scores are calculated for each primary attribute and summed for each river to provide a ranked list of rivers for the river value under examination. Rivers are then identified to be of national, regional or local significance based on a simple Decision Support System (Step 8).
5. Consideration is given to other factors which are relevant to the assessment (Step 9).

As with Part 1, most of Part 2 is relevant for the National Expert Panels. However, regional expert panels should be aware of the overall process before entering at Step 6.

3.8.1 *Step 5: Determine indicator thresholds*

Output

A list of high/medium/low thresholds for each indicator which describe divisions to represent relative importance. Thresholds are defined quantitatively where possible (e.g., >5,000 angler days p.a. = high relative importance).

Rationale

Definition of relative importance is a judgmental exercise. The use of thresholds (to quantify the assessment) and the Expert Panel to undertake this exercise (use of best available knowledge) increases the robustness of the approach. Any existing data will inform the Expert Panel's assessment.

Who

Expert Panel

Notes

Use data (where available) and the Expert Panel's judgment to identify thresholds between high/medium and medium/low for each indicator. Think about the relativity between low – medium – high importance that the data thresholds imply.

Example: Salmonid angling 'level of use' thresholds are: high relative importance is >5,000 angler days p.a. while low relative importance is <1,000 angler days p.a. – an implied ratio of 5:1 re high:low importance (high is five times more important than low for this attribute). While still a subjective judgement, the 5:1 ratio was recognised by the national Expert Panel as adequately reflecting the relativity between high and low importance.

3.8.2 *Step 6: Apply indicators and their thresholds*

Output

- Step 6a: Indicators are populated with data (or data estimates developed by the Expert Panel).
- Step 6b: A threshold score is assigned by applying the indicator thresholds to these data.

Rationale

The method makes the significance assessment process explicit. The Expert Panel is used to overcome data deficiencies.

Who

Expert Panel

Action

- Step 6a: Populate each indicator with data. Where no data are available or data are not robust, the Expert Panel estimates data for each indicator.

- Step 6b: Apply the thresholds to each indicator and assign a score: high relative importance = 3; medium relative importance = 2; low relative importance = 1; 'no' importance = 0.

Notes

(1) A spreadsheet is used for these (and subsequent) calculations.
(2) Scores will normally range from 1-3, except in cases where the indicator for the attribute can itself score a zero, i.e., the indicator is not present. For example, for native birdlife a zero score would be used where there is no presence of threatened or at-risk species, or where there is no presence of toilet facilities at a swimming site.
(3) Consideration of 'potential' use. As applied in this report and to date, the method provides for consumptive uses (i.e., irrigation and hydro) to consider potential future uses, but non-consumptive uses do not (i.e., they cannot consider restoration potential). There has been considerable debate about this issue (although in application it has been consistent with previous attempts to prioritise values on a river-by-river basis). On the one hand it was argued that to not do so puts consumptive uses at an advantage. The counter view, and it remains as such in the method applied here, is that while such is true it would not be helpful to have potential reflected in rankings as it is extremely difficult to measure in many cases, e.g., salmonid angling is based on the National Angling Survey and how could this possibly measure potential use, etc, except from a limited historical context?

    A potential approach that may meet both needs, i.e., an evaluation of the importance of existing values and of 'restoration' potential importance where the two differ, exists. This would involve supplementing the existing approach for non-consumptive uses with a similar assessment specifically for potential (including use and restoration), e.g., the Pukaki River for native birds or salmonid angling – existing importance is low but potential is for high for both if there was an appropriate managed flow restored in the river. Knowing both of these potential scores is valuable, i.e., it is the integral of the difference between actual and potential. Such information could provide a measure of cost utility if a scale/measure of utility (better than national, regional and local - although that is a start) could be developed. The cost of achieving the potential can likely be measured in dollar terms – for the Pukaki River, the net present value of power foregone in providing a flow for native birds has previously been calculated (Hughey, unpubl. data) and the same could be done for salmonid angling. RiVAS+ is being trialled in 2011 to explore the utility of this approach, as a complement to RiVAS.
(4) Difficulty with measurement may cause some primary attributes to drop out.
(5) If there is an international commitment or value (e.g., internationally designated protected area or species), this presents a case for extremely high importance (recorded as high importance), and in such cases, Step 8 will indicate national significance. However, use or demand for a river value by international people does not by itself indicate extremely high importance (nor necessarily national significance in Step 8). Document any internationally recognised factors considered in the assessment of indicators.
(6) Document data deficiencies and ensure they are incorporated in Step 10.
(7) Collating regional assessments into one national assessment is problematic because Regional Expert Panels may be using different frames to suit their region. In other words, national assessments are best done by a single Expert Panel (perhaps in liaison with Regional Expert Panels).

3.8.3 *Step 7: Weighting the primary attributes*

Output

Weightings for the primary attributes.

Rationale

The weighting is a measure of the relative contribution of each attribute to the river value. For example, 50% of the total weights may be given to 'rapids' for whitewater kayaking indicating a 50% weighting of that attribute. An attribute with a weight of 2 contributes twice as much to the final score as an attribute with a weight of 1.

Who

Expert Panel

Action

Determine the primary attribute weightings via the Expert Panel. These may be equal.

If unequal weights are chosen, identify the weighting given to each attribute and record these in the spreadsheet (1, 2, 3, etc). The multiplier that achieves a 50% weighting will of course differ depending on the number of primary attributes and their relative weights.

Where several weighting combinations are tested, provide a comparative evaluation of their usefulness, including a synopsis of the results.

Notes

(1) This step could be used as a sensitivity analysis. The default is equal weighting for each attribute. However, different weighting combinations could be tested to assess the robustness of the rankings. The salmonid angling case study tested three weighting regimes but chose to keep all attributes of equal weight (see salmonid angling chapter). But, in all cases, weighting should be guided by the experience of the expert panel in evaluating the relative importance of specific attributes for a value. Irrigation provides such an example, i.e., where a significant soil moisture deficit is indicated, a weighting is applied to emphasise both the size of the resource from a supply perspective, and size of the irrigated area from a demand perspective. The weighting selected is that when the soil moisture deficit threshold for a river is two (medium) or three (high), then the threshold scores for both size of resource and irrigated areas are weighted to power of three. For all rivers, the key secondary attributes of soil moisture deficit, reliability and presence of an alternative supply are all weighted +50%. The other attributes were not weighted.

3.8.4 *Step 8: Determine river significance*

Output

- Step 8a: A significance or importance[23] score for every river, ranked by significance for the river value under consideration.

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23 Whether to use 'significance' or 'importance' has been debated in the context of both the method generally but also in terms of RMA application. In brief, because 'significance' is a term with specific meaning and application in the RMA it is recommended here that in general the default term should generally be 'importance'. Where the results of the applied method are then translated directly into an RMA application then consideration can be given to using either 'significance' or 'importance'. Both terms are used in the applications reported herein but care is required in their subsequent interpretation and use in policy and planning contexts.

- Step 8b: The list is re-ordered into rivers of national, regional and local significance (or high, medium or low importance) via application of a simple Decision Support System, i.e., a set of criteria and heuristics for assigning these rankings.

Rationale

- Step 8a: The sum of the threshold scores (weighted by relative importance) for each primary attribute will provide a river significance score. Every river will receive a significance ranking within the list of rivers.
- Step 8b: Using Expert Panel assessment, structured around specified decision support criteria, rivers are identified as nationally, regionally or locally significant (or high, medium or low importance) (see Action step 8b below).

Who

Expert Panel

Action

- Step 8a: If primary attribute weightings are equal, then sum the threshold scores. If the primary attribute weightings are not equal, then first multiply each threshold score by its weight and then sum the resulting weighted scores for each river. All rivers are ranked based on their score.
- Step 8b: The decision support criteria define those rivers that qualify for national, regional and local (or high, medium or low) importance, based on the river significance scores. All rivers that are assessed fall into one of these significance levels. These criteria are:

  National significance is defined by satisfying one of the following three criteria:

  1. A 'trigger' attribute exists which suggests national significance, e.g., presence of a nationally significant native bird population (i.e., at least 5% of the total population) of a 'threatened or at-risk' species, which records a high significance score.

  Criterion 1: Identified trigger attribute = 3.

  2. An attribute exists which appears to 'predict' significance (e.g., % anglers from overseas, using the assumption that international anglers choose the 'best rivers' to fish). In combination with relatively high significance scores across many of the remaining attributes, a high score for this attribute suggests national significance.

  Criterion 2: Identified 'predictor' attribute = 3, plus 25% or more of the other attributes = 3.

  3. The set of significance scores is consistently high – the river performs well across many attributes of the river value.

  Criterion 3: 50% or more of the attributes = 3.

  Local significance is defined by satisfying both of the following two criteria:

  1. The identified 'trigger' attribute does not score highly.

  Criterion 1: Where a trigger attribute < 3.

  2. Where the 'predictor' attribute score is low, and is matched with relatively low significance scores across many of the remaining attributes, this suggests local significance.

  Criterion 2: Identified 'predictor' attribute < 3, + all other attributes < 3.

  Regional significance is defined by default – being neither national nor locally significant.

An alternative approach has been employed for some river values (e.g., whitewater kayaking). Instead of using decision support system criteria, the Regional Expert Panel has decided that particular points in the ranked list provide natural cut-off points between rivers of high/medium and medium/low importance.

Notes

(1) Percentage thresholds (i.e., 25%, 50%) are approximate - the resulting number of attributes may need to be rounded up or down to a whole number (will depend on the number of attributes, e.g., in the case of a value with 5, 7, or 9 primary attributes).

(2) These national and local significance criteria are intended to provide consistency across river values. However, if there are compelling reasons to do so, the significance criteria may be adjusted to better fit the river value. These exceptions and there explanation should be clearly documented.

(3) Step 8a provides approximate significance ranking for the list of rivers. This allows the Expert Panel to review the data in a coherent form for Step 8b (significance identification). Further interpretation of the data may indicate if the use of trigger and predictor attributes is appropriate. In the salmonid angling example, the attribute '% overseas anglers' closely matched the ranked list and suggested this was a powerful predictive attribute for salmonid angling in the Tasman District.

(4) The method is based upon assessment by river value. It does not attempt to compare significance across values, e.g., comparing irrigation values with native birdlife values. The relevant decision-makers will need to make this comparison. Further research is required in this topic area.

(5) The method does not 'add together' river segments. Once separated, they remain separate throughout the process, although an entire river can be assessed separately from its component segments. Similarly, river value categories (e.g., whitewater c.f. flatwater kayaking) are presented as separate sets of results. A potential weakness of the method would occur if values were constantly being further subdivided, e.g., whitewater kayaking into Grade 4-5 paddlers and those Grade 3 or less. The number of categories should be limited to those that are useful for management and policy development.

3.8.5 ***Step 9: Outline other factors relevant to the assessment of significance***

Output

Attributes which are relevant to the significance assessment but *cannot be measured* (and are not included as primary attributes) are identified and described.

Rationale

Some attributes do not lend themselves to the style of assessment outlined in this method as they cannot be easily quantified; however, any discussion of significance would be incomplete without their consideration. While these attributes sit outside the scoring process, they should be identified and discussed so that they can be taken into account by decision-makers.

Action

Review the initial comprehensive list of attributes from Step 2. Identify any attributes pertinent to assessment of significance that are not covered adequately within the method. This should consider the following factors: quality, rarity, diversity, representativeness, substitutability, connectivity, use levels, economic benefits.

Example

'Potential future recreational use' whereby a river may become a recreation resource (in the future) owing to new technology or other changes. A good example is the development of plastic kayaks, which dramatically expanded the type of rivers that could be kayaked (see the salmonid angling chapter for other examples). This attribute cannot be encompassed by the method as it cannot be measured; however, it is worthy of consideration by decision-makers.

For consideration

Attributes associated with the river's *context* (e.g., rarity of the recreation opportunity or habitat type) could be handled in two ways: included as an attribute in Step 2 and/or Step 3 (e.g., native birdlife value), or identified in Step 9 (e.g., salmonid angling value). When the attribute is a primary attribute (i.e., listed in Step 3) then the rarity 'count' is included in the quantitative significance assessment. The 'best' approach for considering these types of attributes will be determined following completion of the case studies and included in the final project guidelines (phase e). Feedback is sought from the case study teams.

3.9 **Method review**

Part 3 consists of one step and provides information for future assessments.

3.9.1 ***Step 10: Review assessment process and identify future information needs***

Output

Information desired for future assessments is identified.

Rationale

It is likely that many assessments will have issues with data availability. This step accounts for future decision-making, identifying future research needs. It also provides an opportunity for reflection of what has been learnt about the river value and its measurement (lessons for next time).

Action

List data required to adequately measure primary attributes.

Notes

This list will 'fall out of' Step 6, that is, as you identify existing data for indicators, by default you will identify data deficiencies.

3.10 **Outputs**

Part 1 of the method (assessment criteria) will produce:

1. Classification of the river into segments and the river value into categories, where appropriate (Step 1);
2. A list of attributes (Step 2);
3. A list of primary attributes with a short explanation of why each was chosen (Step 3);
4. A list of indicators for the primary attributes (one indicator per attribute) explicitly checked against SMARTA criteria (Step 4).

Part 2 of the method (determination of significance) will produce:

1. A list of indicator thresholds (Step 5);
2. Data for each indicator for each river (Step 6a);

3. A threshold score for each indicator for each river (Step 6b);
4. A list of weightings for each primary attribute (Step 7);
5. A significance score for each river (Step 8a);
6. A list of rivers ranked by their significance or importance scores and either, using a Decision Support System, identified as significant at the national, regional or local level, or, using cut-off points, identified as being of high, medium or low importance for that river value (Step 8b);
7. A discussion of other factors pertinent to the assessment of significance (Step 9).

Part 3 (method review) will produce:
1. A description of future information requirements (Step 10).

It is suggested that these outputs are presented in spreadsheet form for transparency (see salmonid angling, chapter 5, for illustration).

Appendix 3-1a
The method in action (Excerpt from Tasman salmonid angling)

Step 1: Define river segments			Step 6A: Apply indicators and thresholds									Step 6B: Apply indicators and thresholds											
River code	Reach	River	Angler days (n) (NAS 2007/8,2001/2,1994/6)	Travel distance (km) (NAS 2007/08,2001/2,1994/6)	Overseas anglers (%) (NAS 2007/8,2001/02,1994/6)	Perception catch rate (0.0-1.0) (FGNZ 2008)	Perception fish size (0.0-1.0) (FGNZ 2008)	Water quality (0.0-1.0) (Expert Panel)	Perception scenic attractiveness (0.0-1.0) (FGNZ 2008)	Perception wilderness (0.0-1.0) (FGNZ 2008)	Perception importance (0.0-5.0) (NAS 1979)	Angler days score	Travel distance score	Overseas score	Perception catch rate score	Perception fish size score	Water quality score	Perception scenic score	Perception wilderness score	Perception importance score	Sum Weights 1	Rank1	River significance
21048	0	Sabine River	208	108.2	45%	0.27	0.55	1.00	0.82	0.65	4.21	1	3	3	2	3	3	3	3	3	24	1	National
21060	0	Travers River	342	105.3	43%	0.37	0.44	1.00	0.81	0.74	4.06	1	3	3	2	2	3	3	3	3	23	2	National
21013	0	D`Urville River	560	113.2	39%	0.09	0.41	1.00	0.64	0.77	4.18	1	3	3	1	2	3	3	3	3	22	3	National
21027	0	Maruia River	1109	119.9	39%	0.32	0.25	1.00	0.68	0.20	3.84	2	3	3	2	2	3	3	2	2	22	3	National
21009	1	Buller River	1470	170.5	59%	0.57	0.21	0.90	0.52	0.18	3.78	2	3	3	3	2	3	3	1	2	22	3	National
21017	0	Gowan River	267	110	81%	1.00	0.10	0.90	0.50	0.35	3.33	1	3	3	3	1	3	3	2	2	21	6	National
21028	0	Matakitaki River	1037	78.2	49%	0.20	0.36	1.00	0.64	0.18	3.54	2	2	3	2	2	3	3	1	2	20	7	National
21011	0	Cobb River	106	106.7	0%	0.50	1.00	1.00	0.96	0.54	3.22	1	3	1	3	1	3	3	3	2	20	7	National
21026	0	Mangles River	479	103	45%	0.28	0.17	0.60	0.61	0.22	3.69	1	3	3	2	1	2	3	2	2	19	9	National
21035	0	Owen River	519	85.9	68%	0.33	0.45	0.90	0.50	0.28	2.93	1	2	3	2	2	3	3	2	1	19	9	National
21095	0	Fyfe River	17	541.2	0%			1.00				1	3	1	1	2	3	3	3	2	19	9	Regional
21068	0	Waingaro River	29	220.5	0%	0.00	1.03	1.00	0.53	0.83	1.00	1	3	1	1	3	3	3	3	1	19	9	National
21073	0	Wangapeka River	911	46.7	44%	0.18	0.48	1.00	0.73	0.49	3.76	1	1	3	1	2	3	3	2	2	18	13	National
21054	2	Takaka River	638	76.5	0%	0.33	0.53	0.80	0.53	0.00	3.04	1	2	1	2	3	2	3	1	2	17	14	Regional
21042	0	Riwaka River	304	46.7	44%	0.14	0.09	0.90	0.54	0.20	3.51	1	1	3	1	1	3	3	2	2	17	14	National
21007	0	Baton River	222	36	36%	0.23	0.19	0.90	0.73	0.15	3.29	1	1	3	2	1	3	3	1	2	17	14	National
21004	0	Aorere River	845	116.9	10%	0.17	0.12	0.90	0.56	0.48	2.91	1	3	2	1	1	3	3	2	1	17	14	Regional
21002	0	Anatoki River	17	100.7	0%	0.00	0.25	1.00	0.58	0.25	2.50	1	3	1	1	2	3	3	2	1	17	14	Regional
21030	1	Motueka River	1642	33.9	39%	0.35	0.11	0.80	0.32	0.10	3.84	2	1	3	2	1	2	2	1	2	16	19	Regional
21050	0	Speargrass Creek	19	149.9	0%	0.00	1.50	0.90	0.00	0.00	3.00	1	3	1	1	3	3	1	1	2	16	19	Regional

Colour coding
Blue rows - reliable data
Green rows - less reliable data
Red typeface - data checked by Expert Panel and may have been adjusted

Set of weightings used to test rankings									
Weights 1	1	1	1	1	1	1	1	1	1
Weights 2	2	1	1	1	1	1	1	1	2
Weights 3	1	1	1	1	1	1	1	1	3

e.g. Weights set 3 gives 3x relative contribution to 'Perception importance' attribute

Step 6A > Step 6B

Data for each indicator are tested against the thresholds (identified in Step 5) and translated into an indicator threshold score (1, 2, 3). E.g., Sabine River has 208 angler days p.a. (Step 6A). This is <1,000 days (the lower threshold) and therefore the Sabine River is of relatively low importance for angler days. In Step 6B it scores 1.

River ranking vs. significance

River rankings do not exactly match river significance (national, regional, local) owing to specific Decision Support System criterion.
E.g., Howard River is assessed as nationally significant because it has a high score (3) for *% overseas anglers* plus it achieves a high score (3) for two other attributes

Appendix 3-1b
The method in action (Excerpt from Canterbury irrigation)

River	Attributes and indicators											Conversion to threshold values										Ranking and scores		
	Feasibility of abstraction	Feasibility of storage	Reliability (ROR)	Reliability (Storage)	Size of resource	Soil moisture deficit	Irrigable area	Receiving environment	Alternative supply	Socio economic benefit		Feasibility of abstraction	Feasibility of storage	Reliability (ROR)	Reliability (Storage)	Size of resource	Soil moisture deficit	Irrigable area	Receiving environment	Alternative supply	Socio economic benefit	Aggregate	Ranking (weighted)	Significance
	Expert ranking (1 - 3)	Expert ranking (1 - 3)	MALF/Mean %	Annual vol m3	Mean annual flow[24] (m3/s)	Rainfall[25] (mm)	Irrigable area (ha)[26]	Rank 1 - 5[27]	Bypass solution[28] %	Ranking[29] from 1 - 3		3 = 3	3 = 3	>40% = 3, >20%=2,<20%= 1	>3000=3, <100 = 1	>70 = 3,>5 = 2,	>1700 = 1,>1200 = 2	> 100000 = 3, > 5000 = 2 ha	Rank 5 = 1, 3 and 4 = 2, 1 and 2 = 3	> 60% = 1, > 30% = 2	Direct transfer (3 = 3)	Sum	See note below[30]	See note below[31]
Waitaki	3	3	53	11668	370	500	212596	2	0	2		3	3	3	3	3	3	3	3	3	2	29	81.5	National
Rakaia	2	3	43	6402	203	700	270000	2	30	2		2	3	3	3	3	3	3	3	3	2	28	80.5	National
Rangitata	2	2	42	3154	100	700	270000	2	30	2		2	2	3	3	3	3	3	3	3	2	27	79.5	National
Waimakariri	2	2	32	3784	120	700	141000	3	20	2		2	2	2	3	3	3	3	2	3	2	25	77	National
Sth Ashburton	3	3	39	347	11	700	270000	2	30	2		3	3	2	2	2	3	3	3	3	2	26	60	Regional
Waiau	3	1	26	3059	97	900	54206	1	0	2		3	1	2	3	3	3	2	3	3	2	25	59	Regional
Hurunui	3	3	30	2302	73	600	63716	3	0	2		3	3	2	2	3	3	2	2	3	2	25	59	Regional
Opihi	3	3	24	189	6	600	105012	4	10	2		3	3	2	2	2	3	3	2	3	2	25	59	Regional
Opuha	3	3	27	315	10	600	105012	4	10	2		3	3	2	2	2	3	3	2	3	2	25	59	Regional
Ashley	3	3	18	378	12	700	141000	3	10	2		3	3	1	3	2	3	3	2	3	2	25	58.5	Regional
Orari	3	2	28	347	11	600	105012	4	10	2		3	2	2	2	2	3	3	2	3	2	24	58	Regional
Nth Ashburton	2	2	32	284	9	700	270000	2	10	2		2	2	2	2	2	3	3	3	3	2	24	58	Regional
Clarence	3	1	26	2271	72	900	1653	1	0	3		3	1	2	2	3	3	1	3	3	3	24	52	Local
Hope	3	1	33	1419	45	1200	54206	1	0	1		3	1	2	2	2	3	2	3	3	1	22	38	Regional
Ahuriri	2	3	38	757	24	500	24000	4	0	1		2	3	2	2	2	3	2	2	3	1	22	38	Regional
Hakataramea	3	1	18	189	6	500	8077	2	0	1		3	1	1	2	2	3	2	3	3	1	21	36.5	Regional
Pareora	3	2	13	126	4	600	41000	2	0	2		3	2	1	2	1	3	2	3	3	2	22	31.5	Local
Selwyn	3	3	23	95	3	700	5000	5	20	2		3	3	2	1	1	3	2	1	3	2	21	31	Local
Waipara	3	2	4	95	3	600	60000	3	10	3		3	2	1	1	1	3	2	2	3	3	21	30.5	Local
Tengawai	3	2	14	126	4	600	41000	3	0	2		3	2	1	2	1	3	2	2	3	2	21	30.5	Local
Maerewhenua	3	1	22	95	3	500	74000	2	0	1		3	1	2	1	1	3	2	3	3	1	20	30	Local
Waihao	3	1	9	126	4	600	41000	4	10	2		3	1	1	2	1	3	2	2	3	2	20	29.5	Local
Cust	3	1	24	32	1	700	1000	3	20	2		3	1	2	1	1	3	1	2	3	2	19	23	Local
Okuku	3	1	14	158	5	700	1000	3	0	2		3	1	1	2	1	3	1	2	3	2	19	22.5	Local
Halswell	3	1	67	32	1	700	1000	5	100	2		3	1	3	1	1	3	1	1	1	2	17	20.5	Local
Kaituna	3	1	5	32	1	700	1000	5	80	3		3	1	1	1	1	3	1	1	1	3	16	18.5	Local
Avon	3	1	72	63	2	700	0	5	0	2		2	1	3	1	1	3	1	1	1	1	15	18.5	Local

24 From Canterbury Strategic Water Study
25 Average Annual Rainfall (mm) over irrigable area (nearest rainfall site)
26 From Canterbury Strategic Water Study. Some areas assigned by expert opinion
27 With 1 being low risk and 5 being high risk (expert assessment)
28 Bypass solution ranking from % of irrigable area (maps from CSWS)
29 Socio-economic benefit -ranking 1 (low) - 3 (high) Expert assessment
30 Irrigated area and size of resource cubed, reliability soil moisture and alternative supply +50%, remainder aggregated. Weighting for irrigable area and size of resource only applies if Soil Moisture deficit is >1, otherwise they receive a 50% weighting.
31 National - irrigated area 3, size of resource 3, soil moisture deficit 2 or greater. Local - resource size = 1, irrigated area = 1 or no soil moisture deficit. Remainder regional

Chapter 4
A Guide to Using the River Values Assessment System (RiVAS)

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4.1 Introduction

The River Values Assessment System (RiVAS) has taken three years to develop, and has been applied successfully to a diverse range of values (e.g., irrigation, tangata whenua, native birds, whitewater kayaking). In developing the method we have continued to be reminded of the importance of 'reality checks' and of making sure the method is both 'user friendly' and defensible. In what follows we briefly describe the key steps[32] for applying RiVAS to 'new' values and then for subsequent applications elsewhere (i.e., where the method has already been developed for a value).

4.2 Initial application of RiVAS to a 'new' value

Where RiVAS is applied to a 'new' value for the first time, an application is derived that is tailored to the specific value, while being consistent with the method as described by Hughey et al. (Chapter 3, herein). It is tested through application in a particular region.

a. Identify a supportive host council

This is a vital component as it provides a home base and support from staff of the host organisation as well as access to relevant data sets, GIS and other resources. Alongside the host council is the need for a key contact within that organisation. This key contact is essential for establishing and maintaining internal council linkages required for the work and for helping to identify and maintain external stakeholder contacts. Typically this person would be a planner or environmental scientist. It is important that the council contact person will also be the person with expertise to sit on the expert panel, since this ensures commitment and continuity for the project.

b. Explain clearly the method to the council

The briefing should involve staff and other interested parties including councillors and stakeholders as appropriate.

A sample briefing presentation is available on the Lincoln University project website – located at http://hdl.handle.net/10182/3132.

c. Funding

Funding a 'new' value application costs from $10-20,000. This cost comprises the following inputs:

- A lead consultant: planning, including identifying and consulting with potential expert panel members; attendance at the workshop(s); subsequently writing a draft report, circulating for comment and making corrections, arranging and managing peer review – all in all, time involved at this stage can be in the order of 5-10 days;
- Holding 1-2 one-day workshops: likely costs include transport, meals and occasionally accommodation. Most representatives of professional and voluntary organisations internalise their time input costs; and

32 See also Tipa (Herein, sections 8.9.7-8.9.14)

- Potentially also some costs around report publishing and also hosting on a central website (currently Lincoln University) – likely, including overheads, to be in the order of around $1500 per 'new' value.

d. Lead consultant

Appointment of a project facilitator is imperative. This person needs:

- A working knowledge of the value;
- Facilitation and other organisational skills;
- Technical ability to write the value report; and
- A good understanding of Multi Criteria Analysis approaches.

e. National expert panel

Applications to 'new' values require formation of a panel that can identify and evaluate primary attributes from a national perspective while concurrently being able to apply the method at a specific regional level. Where individuals cannot fulfil both roles, the Panel should comprise national-level experts and experts with strong regional knowledge.

Key attributes of the national expert panel members include:

- Credibility, i.e., they are known and respected 'experts' in the value – such experts would include value practitioners (e.g., farmers using irrigation for irrigation, kayakers for whitewater kayaking), relevant scientists/consultants (e.g., a bird ecologist for native birds, a recreation specialist for river swimming, a hydrologist for irrigation), and appropriate policy makers (e.g., planner from a regional or district council with an understanding of the value, policy advisor from key stakeholder organisations (e.g., field officer from Fish and Game);
- An appreciation of the value from a national perspective;
- A demonstrated record of working within the collaborative approach of an expert panel context; and
- An understanding of multi criteria approaches.

f. Peer review

'New' applications require peer review. These experts must have:

- Credibility, i.e., they are known and respected experts in the value;
- An appreciation of the value from a national perspective; and
- An understanding of multi criteria approaches.

g. Timelines

Now that the method is developed, it should be possible to complete initial application to a 'new' value in around 4-6 months. The key components of this time are:

- Obtaining host organisation and key stakeholder buy-in;
- Identifying and securing expert panel member involvement;
- Organising and running the workshop(s);
- Writing the report, gaining joint author comments, etc; and
- Undertaking the peer review and responding to concerns before finalising.

h. Testing

The method for each new 'value' should be tested at least once and a maximum of twice more in other regions depending on how much data are available and how representative the regions are for that value, before the application to that value is finalised. One test must be done as a minimum and results of the test reported back to the national expert panel.

4.3 Subsequent applications of RiVAS to 'existing' values in new regions

When the RiVAS method has already been tailored for a specific value and applied in an initial region, subsequent applications for this value elsewhere follow the tailored method. Therefore, the task is more straight-forward.

i. Policy relevance

Second, third and subsequent applications of RiVAS to a defined value are always driven by a policy need or other imperative (e.g., potentially as part of a national-level roll out of the tool). It is important to be clear on this need and if it has implications for how the work is undertaken, who might be involved in the work, and key timelines.

The more transparent the process and the wider the representation and involvement of key stakeholder groups, the potentially greater 'buy-in' to the process and outputs.

j. Funding

Subsequent applications of RiVAS appear to cost in the order of $3-6,000 per value per region, for most values. Given the method has already been applied to the value, there should be greatly reduced costs in running it again. Only one workshop should be necessary and writing up time should be greatly reduced, with no need for peer review. This will depend on the number of rivers to be assessed and whether the value is present for all of them.

k. Lead consultant

Appointment of a project facilitator is imperative. This person needs:

- A working knowledge of the value;
- Facilitation and other organisational skills;
- Technical ability to write the value report; and
- A good understanding of Multi Criteria Analysis approaches, including of the RiVAS approach.

l. Regional expert panel

Subsequent applications of RiVAS to 'existing' values require formation of a panel that can apply the method at the specific regional level.

Key attributes of the regional expert panel members include:

- Credibility, i.e., they are known and respected 'experts' in the value – such experts would include value practitioners (e.g., farmers using irrigation for irrigation, kayakers for whitewater kayaking), relevant scientists/consultants (e.g., a bird ecologist for native birds, a recreation specialist for river swimming, a hydrologist for irrigation), and appropriate policy makers (e.g., planner from a regional or district council with an understanding of the value, policy advisor from key stakeholder organisations (e.g., field officer from the local Fish and Game New Zealand region);
- An appreciation of the value from a regional/district perspective;
- Ideally one member who is a 'national' expert for that value and also familiar with the process;
- A demonstrated record of working within the collaborative approach of an expert panel context; and
- Ideally, the regional expert panel will reflect the types of expertise and perspectives present in the original national expert panel. This will minimise discussion about the appropriateness of the methodology and focus time to assessing the values.

m. Information

Council support at the RiVAS workshop should include someone who can take notes (much useful knowledge is imparted) and someone skilled at spreadsheet data entry and calculation.

Almost all workshops will be based around an interactive spreadsheet populating process – it is vital the spreadsheet is set up before the workshop and includes:

- The list of the region's rivers – with pre-agreed low importance ones deleted (but available to be used if need be); and
- Objective, 'hard' data (e.g., for salmonid angling data for the National Angler Survey), assuming such are available.

Where data are missing or inputs rely on expert panel assessments, ensure the process remains transparent by recording reasoning and rationale for decisions made.

n. Timelines

It should be possible to produce these subsequent reports much more quickly than initial applications, probably in a 2-4 month time period.

Chapter 5
Salmonid angling in Tasman District: Application of the River Values Assessment System (RiVAS)

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Peer reviewed by:
John Hayes (Cawthron Institute) and Chris Arbuckle (MAF)

Preamble

The first application of RiVAS, following development of the draft method, was to salmonid angling in Tasman District. The choice of this value and this district reflected the following:

- Key individuals in the project team had management and research responsibilities for salmonid angling;
- Salmonid angling has a large base of supporting information;
- The entire project was designed around outputs required by Tasman District for planning purposes; and
- Half of the team worked within Tasman District boundaries.

Because this was the first application of the method it was expected there would be a range of teething issues and such proved to be the case. Probably most notable amongst these was the narrow geographical focus the team applied to the task, especially to the choice of primary attributes and related indicators, and to cut off points around national, regional and local important – the implications of this narrow focus only became apparent when the method was subsequently trialled in the neighbouring Marlborough District. As a result of the Marlborough trial, a range of changes were required to the Tasman assessment – these changes have been made. The amended, detailed application to Tasman that follows reflects the finalised approach.

5.1 Introduction

5.1.1 *Purpose*

This report applies the River Values Assessment Method (RiVAS) outlined in, *River Values Assessment System (RiVAS) – The Method* (Hughey et al. herein, Chapter 3), and should be read in conjunction with that chapter. Its purpose is two-fold: (1) to provide a case study of how to apply the method, using the exemplar of salmonid[33] angling in the Tasman District; and (2) to provide an assessment for salmonid angling for the Tasman District.

This is the second version of this report. It was revised in July 2010 in order to incorporate minor revisions to the salmonid angling method arising from its application in the Marlborough District (Deans et al. 2010). Two changes were made: (1) the addition of a new primary attribute (*intensity of use*), and (2) a change to the calculation of the water quality index (the faecal coliform metric). As a result of these changes, one river (Station Creek) was reclassified from local significance to regional

33 Salmonid species are brown trout, rainbow trout, lake trout, brook trout, Chinook salmon, sockeye salmon and Atlantic salmon. Only brown and rainbow trout and Chinook salmon are widespread and these fisheries provide the vast majority of angling effort.

significance (see an explanation of the issues around use of 'significance' or 'importance' in footnote 23 of chapter 3.8.4.). Appendix 5-1 outlines report revisions.

5.1.2 ***Preparatory step: Establish an expert panel and identify peer reviewers***

The National Expert Panel for the salmonid trial in Tasman District comprised Neil Deans, Martin Unwin, Mary-Anne Baker and, for the water quality attribute only, Trevor James, Rob Smith and Tom Kroos. Peer reviewers were John Hayes and Chris Arbuckle. Kay Booth facilitated the case study. Credentials of the Expert Panel and peer reviewers are provided in Appendix 5-2.

5.2 Application of the method

5.2.1 ***Step 1: Define river value categories and river segments***

River value categories

Expert Panel discussion identified that trout and salmon angling are very different in nature and these may represent different categories of salmonid angling, in that a slightly different approach or weighting may be required for rivers with salmon (c.f. trout) fisheries. For the purposes of this analysis, there was considered to be little difference between angling for different trout species.

However, Expert Panel knowledge identified that Tasman District primarily offers brown trout angling and has no salmon angling opportunities; therefore there was no need to divide salmonid angling into separate categories.

River segments

Work in advance of the meeting to collate existing data, identified that the four national angling surveys would be the primary sources of data. The surveys provide a list of rivers, a small number of which are subdivided into two segments. This list was chosen for this exercise and rivers (and segments) within the Tasman District were copied into a spreadsheet (See Appendix 5-5). This resulted in a list of 36 river segments on 33 individual rivers.

Some rivers within the Tasman District were not listed, i.e., were excluded from the assessment. These included: (1) rivers which hold negligible value for salmonid angling (survey data did not identify any angling use; the Expert Panel considered they had no known angling value) and (2) rivers for which robust data were not available owing to small survey sample size (i.e., few anglers) and which the Expert Panel considered to be of local significance. An alternative approach for rivers known to have limited salmonid angling value was considered but rejected - to include them and identify them as having 'local value but insufficient data for assessment', or simply identify them as 'data deficient' or 'value unknown'.

Other

The Expert Panel noted that the national angling survey provides a categorisation of rivers based on angling amenity: headwaters, backcountry, lowland. Fish & Game New Zealand (FGNZ) have applied a similar classification to Nelson/Marlborough rivers based upon a Recreational Opportunity Spectrum typology: remote, natural, rural, urban. It was decided that these categories would provide a useful 'check' on the representativeness of the final list of rivers and that this information should be recorded as part of the process. In other words, it provided one means to consider the validity of results. No changes were made as a result of this subsequent deliberation.

Outcomes

Treat salmonid angling as one river value (no separate categories).

Use the national angling survey list of rivers that fall within the Tasman District as the base list of rivers and river segments.

Include the national angling survey and FGNZ river classification systems as a ‘check’ (presented in Appendix 5-5).

5.2.2 *Step 2: Identify attributes*

Attributes which describe salmonid angling were structured around the Recreation Opportunity Spectrum (ROS) framework and classified into three groups:

1. *Existing use attributes* were identified based on the dimensions of the ‘recreation opportunity’, defined as: a chance for a *person* to participate in a specific recreational *activity* within a specific *setting*, in order to achieve a recreational *experience*, with other *outcomes* also realised (positive benefits and negative impacts which may accrue to the recreationist, their group, local communities, or the nation)[34] (Figure 5-1).

   Figure 5-1
   Framework for existing use attributes

User + Activity + Setting	➔	Experiences + Other outcomes

   Appendix 5-3 is structured on this basis – user attributes and activity attributes are presented first, followed by setting attributes, experiential attributes and attributes associated with other outcomes. The recreation setting is considered in terms of the three setting components of the ROS: environmental parameters (fishery, river features, landscape), social parameters (other recreationists) and managerial parameters (facilities and services, access).

2. *Contextual attributes* consider the river in its wider geographical context – its role within the *spectrum* of recreation settings (c.f. existing use attributes which are specific to the river itself). This set of values derives from the ROS premise that quality recreational experiences are best achieved by providing a range or diversity of recreation opportunities[35]. Given the regional (rather than river) scale of these attributes, they will be addressed in Step 9.
3. *Future and past use attributes* are identified because the notion of a ‘recreation opportunity’ highlights the chance or opportunity to undertake recreation – it is not restricted to opportunities which have been taken up (existing use). Given the conceptual nature of these attributes, they will be considered in Step 9.

Attributes encompass three of the four well-beings defined in the Local Government Act (social, economic, environmental). Cultural attributes may also be relevant for salmonid angling, but no data are available to illuminate this.

Outcome

A list of all attributes is provided in Appendix 5-3.

5.2.3 *Step 3: Select and describe primary attributes*

From the list of attributes outlined in Step 2, primary attributes were selected to *represent* salmonid angling. Selection was based on:

34 Adapted from Stankey and Wood (1982) and Driver (2009)
35 McCool et al. (2007)

1. The need for pragmatism – only ten attributes were identified but these covered three of the four well-beings;
2. Research literature on the attributes identified by anglers as important. In addition, Expert Panel members' opinion about the contribution of attributes to an understanding of salmonid angling was used;
3. Focus upon the parameters that relate to the specific river rather than the role of the river within the wider context (the recreation opportunity spectrum contextual attributes). This decision was made for practical reasons – not because contextual factors were considered less important;
4. Coverage of the following dimensions of the ROS framework, as these were considered the most important: users, environmental setting, experiences;
5. 'Experiences' attributes, which have focused upon the *overall* perceptions of users. There are many experiential attributes which have been ignored for practical reasons, e.g., sense of challenge and solitude; and
6. Existing data - consideration was not given to the availability of existing data, as later steps account for data deficiency (via the Expert Panel) and provide for input into future research needs (to overcome data deficiencies in the future).

In the initial application in Tasman District (report dated May 2009), nine primary attributes were identified. Subsequent application of the method in Marlborough produced results that suggested that there was too much emphasis upon qualitative perceptual attributes and too little on actual usage. Therefore a new attribute measuring the intensity of use was added. This acknowledges the importance of short but highly used reaches. The Tasman application was revised to accommodate this new primary attribute.

Outcome

Appendix 5-3 identifies the ten primary attributes (in bold) and describes them, with emphasis on explanation of the attribute's validity and reliability as a representative measure of salmonid angling.

5.2.4 ***Step 4: Identify indicators***

One indicator for each primary attribute was identified, using SMARTA criteria, based on:

1. Existing data – for salmonid angling, there is a wealth of appropriate and fit-for-use-now data;
2. Expert Panel judgment – especially required for the water quality indicator, in order to identify and apply those data relevant to salmonid angling; and
3. Indicator portability – based on an attempt to identify indicators that may be portable to other river values (e.g., 'level of use' and 'travel distance' are likely to be generic indicators for all recreation values).

Appendix 5-4 shows the assessment of each indicator on SMARTA criteria.

No primary attributes were dropped owing to difficulty in devising measurable indicators. Data deficiencies are outlined in Step 10.

Each indicator was considered carefully. For example, discussion about the contribution and difference between *perceptions of wilderness* and *perceptions of scenic attractiveness*, included:

1. Was it more appropriate to measure these environmental parameters by perceptions of anglers or professional assessment (e.g., from landscape architects)? As data were available for the former measurements, and this seemed the most relevant indicator, the former style of indicator was chosen.

2. Data were correlated to check the attributes' similarity. Results indicated they measured different things – e.g., some rivers were rated high scenically but low on the wilderness parameter.

A difficulty was encountered in terms of the specificity of some attributes and indicators, and some revision was undertaken to attributes as a result. In other words, the attributes were found to be too generic as originally defined. For salmonid angling, this occurred for the attribute *origin of users*. Two indicators were feasible – travel distance (for New Zealand anglers) and percentage of users who were from overseas. Since both are very different, choosing just one indicator was problematic. The decision was made to specify two attributes – *origin of New Zealand anglers* and *proportion of international anglers* fishing a particular river. Consideration was given to the relative contribution each made to the *set* of attributes – but it was noted that weighting could correct for this (Step 7). In summary, it is useful to reconsider the list of attributes and check the choice of indicators is appropriate.

Outcome

Indicators are listed in Appendix 5-3 and assessed against SMARTA criteria in Appendix 5-4.

5.2.5 ***Step 5: Determine indicator thresholds***

Thresholds for each indicator were identified by the Expert Panel. Because salmonid angling is comparatively data rich (c.f. other river values), this step was informed by data for all indicators.

Consideration was given to the meaning of the thresholds. Examples:

For the attribute, *scenic attractiveness*, the indicator relied upon survey data (anglers' perceptions of scenic attractiveness). The 'high' threshold was set so that >50% of people would have to rate scenic attractiveness of the river as a 4 or 5 (on a scale where 5 = highest value) in order for it to be considered of high relative importance.

For the attribute *level of use*, the indicator was number of angler days p.a. Considerations in the decision-making process were:

1. High use threshold - initially >10,000 angler days was considered because this measure is used by MfE in its Waters of National Importance work with respect to a catchment;
2. Data from the national angling survey, which was interrogated to check how many rivers would meet a threshold of >10,000 angler days (=15 rivers in the whole country from a total of 881 angling rivers) and >5,000 angler days (=25 rivers). The panel considered that, on usage alone, the number of 25 rivers seemed more appropriate than 15 given the total number of angling rivers.
3. Ratio - thought was given to a ratio of 10:1 compared with 5:1 for 'high' to 'low' importance. 5:1 was considered a more defensible ratio.
4. The decision was made to use >5,000 angler days p.a. as the 'high' threshold, primarily owing to the result that 25 rivers (within New Zealand) would trigger this threshold and thus indicate that a river was nationally significant.

Outcome

Thresholds are identified in Appendix 5-3.

5.2.6 ***Step 6: Apply indicators and indicator thresholds***

Given that all indicators were assessed using primary data, this step involved entering data from the relevant data sources (primarily the national angling surveys). Data were kept in their original format (e.g., *actual number* of angler days, *percentage* of international anglers). This helped the Expert Panel to relate to the data.

For the *water quality* indicator, the Expert Panel combined data that were considered relevant to salmonid angling. The process used was to:

1. Identify criteria: Selection of water quality criteria was based on the research literature about water quality and its effect upon sports fish (drawing on the knowledge of the Expert Panel);
2. Identify how to measure the criteria (indicators/thresholds): Again, scientific knowledge was used – known trigger points influence a sports fishery (e.g., fish die when the water temperature is over 24 degrees). Ranking was considered in the calculations. Appendix 5-6 (*Water quality calculations* worksheet) illustrates that each component of water quality was considered equal (i.e., maximum score of 1 for each component of water quality – all components were then simply averaged);
3. Populate with data (or estimates where no data) for each river. A scale between 0.0 and 1.0 was used since this was easy to comprehend and to compare attributes before any weighting is considered.

This example illustrates the need for the Expert Panel to be very familiar with the river value (in this case, salmonid angling), especially given the likely heavy reliance upon the Expert Panel for data estimates for many river values.

Outcome

Appendix 5-6 (*Water quality calculations* worksheet) presents the data calculations for the indicator *water quality*. The resultant data were entered into the main spreadsheet shown in Appendix 5-5.

5.2.7 ***Step 7: Weighting the primary attributes***

The Expert Panel reviewed the ten primary attributes and considered whether some made a relatively greater contribution to salmonid angling as a whole. Initial thoughts were that they made an equal contribution. Several weighting options were 'checked out' via the spreadsheet, which was easy to do (see Appendix 5-5 for the three weightings options). Results with the different weightings were reviewed and changes in rank order of rivers considered. Fundamentally little changed, so the decision was reached to keep weightings equal. In other words, an iterative process was used to 'test' weightings and decide the most appropriate.

Considerations in choosing equal weightings were:

1. Testing - various weighting sets showed no fundamental difference in river ranking;
2. Application - applying weighting(s) to attribute(s) potentially introduced spurious accuracy; and
3. Attributes - reinforcing the importance of selecting appropriate primary attributes earlier in the process.

Outcome

Equal weighting. See Appendix 5-5 for weighting testing.

5.2.8 ***Step 8: Determine river significance***

Step 8a: Rank rivers

The spreadsheet was used to sum the indicator threshold scores for each river. Since we had chosen to equally weight the primary attributes, we did not have to first multiply the threshold scores by the weights. The sum of the indicator threshold scores were placed in a column and then sorted in descending order. This provided the list of rivers ranked by their significance scores.

Step 8b: Identify river significance

Using the ranked list from Step 8a, the Expert Panel closely examined the rivers, and their attribute scores. It was noted that a strong correlation existed between angling and rivers which scored a 3 (high) for the indicator *% overseas anglers*. Intuitively this made sense – international anglers were likely to target 'the best' rivers in New Zealand. Therefore this attribute was chosen as a surrogate attribute. No obvious national trigger attribute presented itself. The following criteria were applied:

National significance:

Criterion 1: *% overseas anglers* = 3, plus 25% or more of the other attributes = 3; or
Criterion 2: 50% or more of the attributes = 3.

Regional significance:

Those rivers in the table not defined as nationally or locally significant.

Local significance:

Sole criterion: *% overseas anglers* < 3, plus maximum of one other attribute = 3.

Translation of these functions to rivers is shown in Appendix 5-5.

The Expert Panel assessed the output from this process against the results of existing assessments and other relevant considerations, including:

1. Special features of rivers in the Tasman District with respect to salmonid angling;
2. Existing Water Conservation Orders associated with salmonid angling;
3. Existing planning documents, including Regional Plans under the RMA and the Nelson Marlborough *Sports Fish and Game Management Plan*.
4. Reference to MfE *Waters of National Importance* work.

The results of these considerations showed that this significance assessment corresponded to the most significant water bodies for salmonid angling identified through other processes. The current method was considered to effectively discriminate rivers having attributes favourable to salmonid angling.

Other assessments confirmed that, compared with a national average, a higher proportion of Tasman rivers, is likely to be nationally significant for their salmonid angling. It is acknowledged that, owing to the judgmental nature of this exercise, rivers close to the threshold points could 'swing either way'.

Outcome

A list of rivers ranked by a scoring system from highest to lowest, which represents an initial significance ranking list. See Appendix 5-5 (columns highlighted in green).

Rivers identified as significant at the national, regional and local level. See Appendix 5-5.

Rivers in the Tasman District not listed have either low or no salmonid angling value.

5.2.9 *Step 9: Outline other factors relevant to the assessment of significance*

Seven attributes of salmonid angling have been identified which are not quantifiable but considered relevant to significance assessment. These attributes are discussed in Appendix 5-7 in order to highlight their importance to a meaningful understanding of salmonid angling. The attributes are:

- Access;
- Degree of scarcity of the experience;

- Contribution to a collective value;
- Users' perceptions of the river's 'status';
- Potential future angling use;
- Existence value; and
- Past use (former high quality angling rivers).

These attributes do not influence the numeric calculation of river significance, but are relevant to decision-making about salmonid angling.

Outcome

List and description of non-measured attributes (Appendix 5-7).

5.2.10 ***Step 10: Review assessment process and identify future information requirements***

The National Angling Survey provides a national angling database which greatly assists with indicator measurement. However, some desired data are not available or are out of date. For future assessment, desired data are noted in Appendix 5-8.

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Appendix 5-1
Record of report revisions

Amendments made to reflect method revisions arising from salmonid angling Marlborough application
Made by: Kay Booth
Approved by: All authors and peer reviewers
Date of approval: 10 July 2010

Section & page number	Amendment	Reason for amendment
Section 1.1, p1	Addition of explanatory paragraph that identifies the report has been revised and in what way	Alerts readers about changes to report
Step 3, p3	Additional attribute introduced: ‘intensity of use’	Provides more emphasis on angling usage within the set of attributes
Appendix 5-3, p14/15	‘Intensity of use’ attribute described	
Appendix 5-4, p22	Indicator for the new attribute described (called ‘mean free reach’)	
Appendix 5-5	Indicator data entered into spreadsheet, thresholds identified/populated, and added into calculations	
Step 6, p5	Faecal coliform index standard changed from ‘alert’ to ‘action’	Angling is not a contact recreation activity. It involves secondary contact (with water) which has an inherently lower risk of disease. Therefore the more stringent 'alert' level (which is used for contact recreation) was deemed too stringent.
Appendix 5-3, p17/18	Water quality standard described	
Appendix 5-5	Water quality calculations redone on basis of new standard. This resulted in four river sections changing their water quality score: Motueka River (below Wangapeka) Mangles River Station Creek Howard River	
Appendix 5-5	Some rivers changed their ranking as a result of the new primary attribute and revised water quality scores	
Appendix 5-5	One river (Station Creek) shifted significance status from local to regional significance. No other river sections changed river significance status	

Appendix 5-2
Credentials of the Expert Panel members and peer reviewers

The Expert Panel comprised three members. In addition, three other people contributed to the development of the water quality indicator. Their credentials are:

1. **Neil Deans** is manager of the Nelson Marlborough Fish and Game Region and has expert knowledge of all rivers and salmonid angling in the District in his field and other work over the last 20 years. He has written widely about sports fishery management, including as lead author of the chapter on Sport Fishery Management in the recently published 'Freshwaters of New Zealand'. He is the immediate Past President of the Freshwater Sciences Society of New Zealand and has produced a paper on evaluation of salmonid fisheries for Fish and Game New Zealand nationally.
2. **Martin Unwin** is a fisheries scientist with over 30 years experience, based with NIWA in Christchurch. He has contributed to, or has overseen, the four National Angler Surveys and other related angler surveys. He can access the data associated with these for the use of this analysis.
3. **Mary-Anne Baker** is a policy planner with Tasman District Council, with 20 years experience in soil conservation and freshwater management. She has contributed to the preparation of the Council's water and contaminant discharge management provisions in its Resource Management Plan.

Contributed to the water quality indicator:

1. **Trevor James** is a resource scientist at the Tasman District Council, with 18 years experience in both the private and public sector. He is responsible for surface water State of the Environment monitoring and assessment at Council, with familiarity of, and access to, water quality data for the District.
2. **Rob Smith** is the Environmental Information Manager at Tasman District Council with 18 years experience in the monitoring or management of freshwater resources.
3. **Tom Kroos** is the principal biologist at Fish & Wildlife Services, a consultancy company based in Richmond, where he has involvement in fish and water quality surveys for public and private sector organisations.

Peer reviewers for this work were:

1. **Dr John Hayes**, a senior scientist with the Cawthron Institute, has considerable national and international expertise in salmonid fisheries and the development of models of fish behaviour and energetics. He is an internationally respected fisheries scientist with an extensive publication list in fisheries management. He frequently authors popular articles in 'Fish and Game' magazine and is the co-author of 'The Artful Science of Trout Fishing', summarising his fisheries knowledge for the non-technically minded angler.
2. **Chris Arbuckle** is a senior policy advisor with MAF in Dunedin. He has a background in freshwater science, policy and management with the Otago Regional Council and Environment Southland.

Appendix 5-3
Assessment criteria for salmonid angling (Steps 2-4)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES AND RELIABILITY)
Step 2: Identify attributes Step 3: Select and describe primary attributes		Step 3: Select and describe primary attributes	Step 4: Identify indicators	Step 5: Determine significance thresholds	
ATTRIBUTES ASSOCIATED WITH EXISTING USE					
Users	**Level of use**	High use implies high value. However, this assumption will under-value special and remote places for several reasons, including: **Activity specialisation.** Resources suitable for highly specialised participants (high skill levels) will attract low numbers of users but may be highly valued and/or rare opportunities. **Access.** Restrictions upon access will reduce use and/or make it available only to some potential users due to cost, availability of time, specialised equipment or transport, physical capability, etc. **Wilderness and remote areas**. Areas that offer few encounters with other people may be highly valued for this attribute (amongst other things). This is particularly so for anglers, as other anglers represent not only a potential disturbance to wilderness values, but also a competitor for a fishing opportunity which is affected by the presence of others. In NZ, evaluation of the significance of freshwater fisheries has gone further than most other forms of water-based recreation. A review of the first national angling survey undertaken in 1980 (Teirney and Richardson, 1992: 693-702, our emphasis)	Number of angler days p.a. Notes: Ideally should be number of angler days per season, as some rivers are open to angling all year while others only for the main 7 month fishing season. Considered but dismissed an alternative indicator (angler days per km).	National: >5,000 angler days p.a. (**score: 3**) Regional: 1,000 - 5,000 angler days p.a. (**score: 2**) Local: <1,000 angler days p.a. (**score: 1**)	National Angling Survey: mean from 3 surveys (good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES AND RELIABILITY)
		summarised this issue as follows: *The total number of fishing visits made to each river provided a measure of its relative importance. [However] the relative importance (and presumably therefore the absolute value) cannot be evaluated solely by reference to measures of angler use. A list of seven other factors believed to be important determinants of high-quality river fishing experiences in New Zealand was compiled… For each river, anglers were asked to assign a rating between 1 (lowest) and 5 (highest) for distance from home, ease of access, area of fishable water (defined as the area of river bed or bank from which to fish), scenic beauty, peace and solitude, catch rate and size of fish. The overall importance of each river fished was also evaluated with the same rating scale…* *For trout rivers, our results suggest <u>angler use alone should not be used as an absolute measure of a river's value</u>; none of our three measures of angler use were correlated with anglers' perceptions of overall importance. The rivers used most in New Zealand tended to be close to home and have easy access, whereas <u>the most highly valued rivers were characterised by good catch rates of large fish, extensive areas of fishable water, and scenically attractive and peaceful surroundings…</u>* *It seems that the hope, even if unrealistic for many anglers, of landing a fish or having an occasional success weighs particularly heavily in the perception of a New Zealand river's value.*			
	Intensity of use	Intensity of use is measured by the Mean Free Reach (MFR), which is the length of the reach divided by the number of angler days. The smaller the MFR, the more crowded the river, i.e., low values imply high density. It is an idealisation, based on the assumption that anglers are evenly distributed along the	Mean free reach (MFR) = average distance (in km) an angler would have to travel on an average day before	National: MFR <5km (**score: 3**) Regional: MFR 5-20 km (**score: 2**)	National Angling Survey: 2007/8 (good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES AND RELIABILITY)
		length of each river, but NIWA suggests the measure gives credible results. High density is taken as an indicator of high value.	encountering another angler	Local: MFR >20 km (**score: 1**)	
	Level of commercial use				
	Origin of New Zealand users	Origin of users is suggested as an indicator of quality of the recreational experience, based on the assumption that the higher the expected quality of the experience, the greater the distance users will be prepared to travel.	Mean number of km travelled from home by NZ anglers Note: Actual metric is mean log travel distance in km from home address to river mid-point	National: >100 km (**score: 3**) Regional: 50-100 km (**score: 2**) Local: <50 km (**score: 1**)	National Angling Survey: mean from 3 surveys (good)
	Level of international use	Same as above.	% overseas anglers (of total number of angler days)	National: >20% overseas angler visits (**score: 3**) Regional: 10-20% overseas angler visits (**score: 2**) Local: <10% overseas angler visits (**score: 1**) None: No use by overseas anglers (**score: 0**)	National Angling Survey: mean from 3 surveys (good)
	User demographics				
	Behaviour of users				
Activity	Activity specialisation				

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES AND RELIABILITY)
	(degree of skill required)				
Environmental setting: Fishery	**Anticipated catch rate**	Data (from the National Angling Survey 1979/80 and the 2008 FGNZ pilot survey) indicate that the attributes: perceptions of "catch rate" and "chance of catching a large fish": are important components of the angling experience. Both attributes could be assessed as *actual* or *anticipated* measures. The choice of users' perceptions (*anticipated* measure) for both attributes relates to the greater influence that users' perceptions have on their recreational behaviour (c.f. actual rates and chances).	User's perception of catch rate	National: >0.5 (**score: 3**) Regional: 0.2-0.5 (**score: 2**) Local: <0.2 (**score: 1**) Data result from the following calculation: Respondents to the 2008 FGNZ Pilot Survey were asked to identify the 3 most important attributes (from 8 possible candidates) which characterised each river they fished. Scores for each attribute were derived by expressing the number of respondents who listed that attribute as a proportion of the total responses for each river.	2008 pilot survey (good)
	Anticipated chance of catching a large fish		User's perception of chance of catching a large fish	National: >0.5 (**score: 3**) Regional: 0.2-0.5 (**score: 2**) Local: <0.2 (**score: 1**) Data result from the following calculation: See *Anticipated catch rate*	2008 pilot survey (good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES AND RELIABILITY)
	Angling methods permissible				
	Area of fishable water				
	Species present				
	Species population				
Environmental setting: River features	Water characteristics (e.g., pool/riffle/run sequences)	Given that river features are usually the focus of the decision-making process for which this method will be implemented, ideally all attributes would be selected as primary attributes. However, this is not practical. Water quality was chosen because the water quality requirements of salmonids are well known and most rivers of interest have relevant water quality data			
	Flow (% river segment's length with water deeper than 1 metre, at summer low flow)				
	Water quality	In July 2010, the faecal coliform standard used in calculations of the water quality index was changed. The 2009 report used the 'alert standard' (260); in July 2010 the 'action standard' (550) was adopted. See Appendix 5-5 (worksheet labelled *Water quality calculations)*	Combination of 5 components: water temperature, oxygenation, faecal coliforms, clarity and macro-invertebrate community index	National: >0.8 (**score: 3**) Regional: 0.5-0.8 (**score: 2**) Local: <0.5 (**score: 1**) Data result from the calculations shown in Appendix 5-5 (worksheet	Tasman District Council & some Fish and Game data. Expert Panel estimates (fair).

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES AND RELIABILITY)
				labelled *Water quality calculations)*	
Environmental setting: Landscape	Degree of naturalness natural character				
	Scenic attractiveness	Identified in all of the (few) attempts to rate river recreation (National Angling Survey 1979/80 and the 2008 FGNZ pilot survey). As with wilderness character (see next), the measure is based on users' perceptions rather than professional judgment, as users' perception will influence behaviour and satisfaction. Generally, it is expected that there is a positive correlation between perceived scenic attractiveness and angling amenity.	Anglers' perceptions of scenic attractiveness	National: >0.5 (**score: 3**) Regional: 0.2-0.5 (**score: 2**) Local: <0.2 (**score: 1**) Data result from the following calculation: See *Anticipated catch rate*, above	2008 pilot survey (good)
	Wilderness character	This setting attribute has a positive relationship with wilderness angling – the higher the perceived wilderness character, the higher the angling value (National Angling Survey 1979/80 and the 2008 FGNZ pilot survey). Tierney and Richardson (1992) found that angling attributes directly associated with fishing (such as catch rate or fish size) accounted for less than 30% of perceived fishery value.	Anglers' perceptions of wilderness character	National: >0.5 (**score: 3**) Regional: 0.2-0.5 (**score: 2**) Local: <0.2 (**score: 1**) Data result from the following calculation: See *Anticipated catch rate*, above	2008 pilot survey (good)
Social setting	Encounters with other anglers				
	Encounters with other users (not anglers)				
Managerial	Facility and				

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES AND RELIABILITY)
setting	services provision and regulation (e.g., bridges; air services)				
	Access: Provision of unrestricted public access; Access charges; Degree of difficulty (e.g., walk in)	See Step 9.			
Experiences	**Perceptions of the importance of the river**	Currently the National Angling Survey does not collect this information. A question could be added asking anglers to rate rivers in terms of its overall importance. This differs to the contextual value 'perception of the river's status' in that it is specific to users' perceptions – the latter value relates to the status by which the river is held by the recreational community (users and non-users). For example, the Tongariro River is an iconic New Zealand rainbow trout fishery. It also differs to the angler's perception of the quality of their experience (see next attribute), as that is usually measured based on a single visit. This parameter refers to perception of the river in a general sense (long-term view).	Anglers' perception of the overall importance of the river	National: >4 on question scale (**score: 3**) Regional: 3-4 on question scale (**score: 2**) Local: <3 on question scale (**score: 1**)	1979 National Angling Survey (fair, owing to age of data) While there were more recent data for Otago and Nelson Marlborough, rankings were mostly similar but older data was more robust and a full national dataset
	Perceptions of the quality of the experience				
Other	Economic				

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES AND RELIABILITY)
outcomes	benefits: To local area, region, nation				
	Non-economic benefits, including existence value				
CONTEXTUAL ATTRIBUTES					
Opportunity *spectrum*	Degree of scarcity of the experience	See Step 9.			
	Contribution to a collective value	See Step 9.			
	Users' perceptions of the river's 'status'	See Step 9.			
ATTRIBUTES ASSOCIATED WITH FUTURE AND PAST USE					
Recreation *opportunity*	Potential future angling use (option value) - avoid precluding future uses	See Step 9.			
	Past use (former glory)	See Step 9.			

Appendix 5-4
Assessment of indicators by SMARTA criteria

Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use
Number of angler days p.a.	Yes	No. days	Survey data available	Use implies valued by user	Data available	Yes
Mean free reach	Yes	Fishable reach / angler days p.a.	Survey data available	High intensity implies high value	Data available	Yes
Mean number of km travelled from home by NZ anglers	Yes	No. km	Survey data available	Travel distance = indicator of quality of experience	Data available	Yes
% overseas anglers (of total number of angler days)	Yes	%	Survey data available	Same as above (international travel)	Data available	Yes
User's perception of catch rate	Yes	Response to rating scale question	Survey data available	Known to influence choice of angling site	Data available	Yes
User's perception of chance of catching a large fish	Yes	Response to rating scale question	Survey data available	Known to influence choice of angling site	Data available	Yes
Combination of 5 components: water temperature, oxygenation, faecal coliforms, clarity and MCI	Yes	Combination of relevant components	Data available	Influences both fishery and quality of angling experience	Data available + some estimates	Yes
Anglers' perceptions of scenic attractiveness	Yes	Response to rating scale question	Survey data available	Known to influence choice of angling site	Data available	Yes
Anglers' perceptions of wilderness character	Yes	Response to rating scale question	Survey data available	Known to influence choice of angling site	Data available	Yes
Anglers' perception of the overall importance of the river	Yes	Response to rating scale question	Survey data available	Known to influence choice of angling site	Data available	Yes

Appendix 5-5

Significance assessment calculations for salmonid angling in Tasman District (Steps 1 and 5-8)

Step 1: Define river segments			Additional useful information (not part of method) - You may wish to hide these columns		Step 6A: Apply indicators and thresholds										Step 6B: Apply indicators and thresholds										Step 8: River significance						
River code	Reach	River	Water body type	ROS class	Angler days (n) NAS 2007/8,2001/2,1994/6)	Intensity of use (mean free reach) (NAS 2007/8)	Travel distance (km) (NAS 2007/08,2001/2,1994/6)	Overseas anglers (%) (NAS 2007/8,2001/2,1994/6)	Perception catch rate (0.0-1.0) (FGNZ 2008)	Perception fish size (0.0-1.0) (FGNZ 2008)	Water quality (0.0-1.0) (Expert Panel)	Perception scenic attractiveness (0.0-1.0) (FGNZ 2008)	Perception wilderness (0.0-1.0) (FGNZ 2008)	Perception importance (0.0-5.0) (NAS 1979)	Angler days score	Intensity of use score	Travel distance score	Overseas score	Perception catch rate score	Perception fish size score	Water quality score	Perception scenic score	Perception wilderness score	Perception importance score	Sum Weights 1	Rank1	Sum Weights 2	Rank 2	Sum Weights 3	Rank 3	River significance
21060	**0**	**Travers River**	**Headwater**	**Remote**	**342**	**15.1**	**105.3**	**43%**	**0.37**	**0.44**	**1.00**	**0.81**	**0.74**	**4.06**	**1**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**25**	**1**	**27**	**2**	**29**	**2**	National
21048	**0**	**Sabine River**	**Headwater**	**Remote**	**208**	**28.1**	**108.2**	**45%**	**0.27**	**0.55**	**1.00**	**0.82**	**0.65**	**4.21**	**1**	**1**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**25**	**1**	**28**	**1**	**30**	**1**	National
21013	**0**	**D`Urville River**	**Headwater**	**Remote**	**560**	**14.0**	**113.2**	**39%**	**0.09**	**0.41**	**1.00**	**0.64**	**0.77**	**4.18**	**1**	**2**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**24**	**3**	**26**	**3**	**28**	**3**	National
21009	**1**	**Buller River**	**Mainstem river**	**Natural**	**1470**	**9.0**	**170.5**	**59%**	**0.57**	**0.21**	**0.90**	**0.52**	**0.18**	**3.78**	**2**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**24**	**3**	**26**	**3**	**26**	**4**	National
21017	**0**	**Gowan River**	**Back country**	**Natural**	**267**	**15.1**	**110**	**81%**	**1.00**	**0.10**	**0.90**	**0.50**	**0.35**	**3.33**	**1**	**2**	**3**	**3**	**3**	**1**	**3**	**3**	**2**	**2**	**23**	**5**	**24**	**6**	**25**	**6**	National
21027	**0**	**Maruia River**	**Back country**	**Natural**	**1109**	**30.6**	**119.9**	**39%**	**0.32**	**0.25**	**1.00**	**0.68**	**0.20**	**3.84**	**2**	**1**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**23**	**5**	**26**	**3**	**26**	**4**	National
21026	**0**	**Mangles River**	**Back country**	**Rural**	**479**	**13.1**	**103**	**45%**	**0.28**	**0.17**	**0.80**	**0.61**	**0.22**	**3.69**	**1**	**2**	**3**	**3**	**2**	**1**	**2**	**3**	**2**	**2**	**21**	**7**	**22**	**9**	**23**	**9**	National
21035	**0**	**Owen River**	**Back country**	**Rural**	**519**	**11.9**	**85.9**	**68%**	**0.33**	**0.45**	**0.90**	**0.50**	**0.28**	**2.93**	**1**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**1**	**21**	**7**	**21**	**11**	**21**	**12**	National
21028	**0**	**Matakitaki River**	**Back country**	**Natural**	**1037**	**22.2**	**78.2**	**49%**	**0.20**	**0.36**	**1.00**	**0.64**	**0.18**	**3.54**	**2**	**1**	**2**	**3**	**2**	**2**	**3**	**3**	**1**	**2**	**21**	**7**	**24**	**6**	**24**	**7**	National
21011	0	Cobb River	Headwater	Remote	106	38.2	106.7	0%	0.50	0.08	1.00	0.96	0.54	3.22	1	1	3	1	3	1	3	3	3	2	**21**	**7**	23	8	24	7	National
21073	**0**	**Wangapeka River**	**Back country**	**Natural**	**911**	**15.6**	**46.7**	**44%**	**0.18**	**0.48**	**1.00**	**0.73**	**0.49**	**3.76**	**1**	**2**	**1**	**3**	**1**	**2**	**3**	**3**	**2**	**2**	**20**	**11**	**21**	**11**	**22**	**11**	National
21095	0	Fyfe River	Headwater	Natural	17	47.2	541.2	0%			1.00				1	1	3	1	1	2	3	3	3	2	**20**	**11**	22	9	23	9	Regional
21068	0	Waingaro River	Back country	Natural	29	390.6	220.5	0%	0.00	1.03	1.00	0.53	0.83	1.00	1	1	3	1	1	3	3	3	3	1	**20**	**11**	21	11	21	12	National
21030	**1**	**Motueka River**	**Mainstem river**	**Rural**	**1642**	**4.8**	**33.9**	**39%**	**0.35**	**0.11**	**0.80**	**0.32**	**0.10**	**3.84**	**2**	**3**	**1**	**3**	**2**	**1**	**2**	**2**	**1**	**2**	**19**	**14**	**20**	**14**	**20**	**17**	Regional
21054	2	Takaka River	Lowland river	Rural	638	13.2	76.5	0%	0.33	0.53	0.80	0.53	0.00	3.04	1	2	2	1	2	3	2	3	1	2	**19**	**14**	20	14	21	12	Regional
21042	**0**	**Riwaka River**	**Lowland river**	**Rural**	**304**	**10.8**	**46.7**	**44%**	**0.14**	**0.09**	**0.90**	**0.54**	**0.20**	**3.51**	**1**	**2**	**1**	**3**	**1**	**1**	**3**	**3**	**2**	**2**	**19**	**14**	**20**	**14**	**21**	**12**	National
21067	**0**	**Waimea River**	**Lowland river**	**Rural**	**496**	**5.2**	**124.5**	**22%**	**0.24**	**0.06**	**0.50**	**0.06**	**0.12**	**3.00**	**1**	**2**	**3**	**3**	**2**	**1**	**2**	**1**	**1**	**2**	**18**	**17**	**19**	**18**	**20**	**17**	Regional
21007	**0**	**Baton River**	**Back country**	**Natural**	**222**	**29.9**	**36**	**36%**	**0.23**	**0.19**	**0.90**	**0.73**	**0.15**	**3.29**	**1**	**1**	**1**	**3**	**2**	**1**	**3**	**3**	**1**	**2**	**18**	**17**	**20**	**14**	**21**	**12**	National
21004	**0**	**Aorere River**	**Back country**	**Natural**	**845**	**21.0**	**116.9**	**10%**	**0.17**	**0.12**	**0.90**	**0.56**	**0.48**	**2.91**	**1**	**1**	**3**	**2**	**1**	**1**	**3**	**3**	**2**	**1**	**18**	**17**	**19**	**18**	**19**	**22**	Regional
21002	0	Anatoki River	Back country	Natural	17	305.6	100.7	0%	0.00	0.25	1.00	0.58	0.25	2.50	1	1	3	1	1	2	3	3	2	1	**18**	**17**	19	18	19	22	Regional
21030	**2**	**Motueka River**	**Mainstem river**	**Rural**	**3351**	**4.8**	**23**	**8%**	**0.37**	**0.10**	**0.62**	**0.40**	**0.16**	**3.84**	**2**	**3**	**1**	**1**	**2**	**1**	**2**	**2**	**1**	**2**	**17**	**21**	**18**	**23**	**18**	**29**	Local
21050	0	Speargrass Creek	Back country	Rural	19	135.4	149.9	0%	0.00	1.50	0.90	0.00	0.00	3.00	1	1	3	1	1	3	3	1	1	2	**17**	**21**	19	18	20	17	Regional
21003	0	Anatori River	Back country	Remote	13	234.5	100.7	0%	0.00	0.00	0.90	3.00	0.00	3.00	1	1	3	1	1	1	3	3	1	2	**17**	**21**	19	18	20	17	Regional
21029	0	Matiri River	Back country	Natural	131	46.3	35.2	0%	0.50	0.00	0.90	0.50	0.29	2.85	1	1	1	1	3	1	3	3	2	1	**17**	**21**	18	23	18	29	Regional
21020	0	Howard River	Back country	Rural	62	43.6	202.2	65%	0.00	0.00	0.62	0.75	0.00	2.70	1	1	3	3	1	1	2	3	1	1	**17**	**21**	18	23	18	29	National
21009	**2**	**Buller River**	**Mainstem river**	**Natural**	**483**	**9.0**	**92.9**	**0%**	**0.33**	**0.19**	**0.80**	**0.48**	**0.17**	**3.78**	**1**	**2**	**2**	**1**	**2**	**1**	**2**	**2**	**1**	**2**	**16**	**26**	**17**	**31**	**18**	**29**	Local
21054	1	Takaka River	Lowland river	Rural	223	13.2	38.9	0%	0.00	0.00	0.90	0.50	0.00	3.04	1	2	1	1	1	1	3	3	1	2	**16**	**26**	17	31	18	29	Regional
21063	0	Tutaki River	Back country	Rural	104	55.7	31.3	0%	0.63	0.31	0.60	0.31	0.00	3.58	1	1	1	1	3	2	2	2	1	2	**16**	**26**	18	23	19	22	Local
21031	0	Motupiko River	Lowland river	Rural	66	257.6	54.2	0%	0.15	0.29	0.70	0.47	0.36	3.25	1	1	2	1	1	2	2	2	2	2	**16**	**26**	18	23	19	22	Local
21024	0	Lee River	Back country	Rural	48	90.7	5.5	0%			1.00			3.23	1	1	1	1	1	2	3	2	2	2	**16**	**26**	18	23	19	22	Local

21015	0	Glenroy River	Headwater	Natural	110	41.0	46.4	0%	0.30	0.00	0.90	0.30	0.20	3.00	1	1	1	1	2	1	3	2	2	2	16	26	18	23	19	22	Local
21070	**0**	**Wairoa River**	**Back country**	**Natural**	**200**	**40.2**	**113.4**	**0%**	**0.00**	**0.14**	**1.00**	**0.43**	**0.29**	**2.97**	**1**	**1**	**3**	**1**	**1**	**1**	**3**	**2**	**2**	**1**	**16**	**26**	**17**	**31**	**17**	**34**	Regional
21064	0	Wai-iti River	Lowland river	Rural	193	42.2	396.9	0%	0.00	0.00	0.70	1.00	0.00	2.86	1	1	3	1	1	1	2	3	1	1	15	33	16	35	16	36	Regional
21074	0	Warwick River	Back country	Rural	8	474.3	34.3	0%	0.00	0.00	0.70	3.00	0.00	4.50	1	1	1	1	1	1	2	3	1	3	15	33	18	23	20	17	Regional
21019	0	Hope River	Back country	Natural	18	299.5	211.4	0%	0.00	0.00	0.80	0.00	0.00	3.50	1	1	3	1	1	1	2	1	1	2	14	35	16	35	17	34	Local
21053	0	Station Creek	Back country	Rural	8	409.9	43.6	0%			0.90			4.50	1	1	1	1	1	1	3	1	1	3	14	35	17	31	19	22	Regional

Colour coding:

Blue rows - reliable data

Green rows - less reliable data

Red typeface - data checked by Expert Panel and may have been adjusted

Set of weightings used to test rankings

	Weights 1	1	n/a	1	1	1	1	1	1	1	1
	Weights 2	2	n/a	1	1	1	1	1	1	1	2
	Weights 3	1	n/a	1	1	1	1	1	1	1	3

Weights relate to the column under which they are positioned

e.g., Weights set 3 gives 3x relative contribution to 'Perception importance' attribute

Step 6A > Step 6B

Data for each indicator are tested against the thresholds (identified in Step 5) and translated into an indicator threshold score (1, 2, 3).

e.g., Sabine River has 208 angler days p.a. (Step 6A). This is <1,000 days (the lower threshold) and therefore the Sabine River is of relatively low importance for angler days. In Step 6B it scores 1.

River ranking vs. significance

River rankings do not exactly match river significance (national, regional, local) owing to specific Decision Support System criterion.

e.g., Howard River is assessed as nationally significant because it has a high score (3) for *% overseas anglers* plus high scores (3) for two other attributes

Appendix 5-6
Water quality calculations for Tasman District

River Name	Temperature	Dissolved Oxygen	Faecal coliform (original)	Faecal Coliform (revised May 2010)	Clarity	MCI	Water Quality Score (original)	Water Quality Score (revised May 2010)
	Is maximum summer temperature average over past five years >24 degrees? Yes: 0; 19-23 degrees: 0.5; < 19 degrees: 1	Is oxygen level <80% saturation more than 10% of time in summer? Yes: 0.5, No: 1	Are faecal coliforms likely to exceed alert standard (260) more than once a month under low flow conditions during fishing season? Yes: 0, No: 1	Are faecal coliforms likely to exceed action standard (550) more than once a month under low flow conditions during fishing season? Yes: 0; 520<260, 0.5; <260, 1	Typical water clarity at base flow/level: >7m: 1, 3-7m: 0.5, <3m: 0.1 Average	Is 5 year running average MCI < 100: 0; 100-120: 0.5; >120: 1	**Average of five criteria**	**Average of five criteria**
Aorere River	1	1	1	1	0.5	1	**0.9**	**0.9**
Spey Stream	1	1	1	1	1	1	**1**	**1**
Takaka River (above Lindsay's Bridge)	1	1	1	1	0.5	1	**0.9**	**0.9**
Takaka River (below Lindsay's Bridge)	1	1	1	1	0.5	0.5	**0.8**	**0.8**
Waikoropupu River	1	0.5	1	1	1	0.5	**0.8**	**0.8**
Anatoki River	1	1	1	1	1	1	**1**	**1**
Waingaro River	1	1	1	1	1	1	**1**	**1**
Cobb River	1	1	1	1	1	1	**1**	**1**
Marahau River	0.5	1	1	1	0.5	1	**0.8**	**0.8**
Riwaka River	1	1	1	1	0.5	1	**0.9**	**0.9**
Motueka River (above Wangapeka)	0.5	0.5	1	1	1	1	**0.8**	**0.8**
Motueka River (below Wangapeka)	1	0.5	0	1	0.1	0.5	**0.42**	**0.62**
Graham River	1	1	1	1	1	1	**1**	**1**
Pearse River	1	1	1	1	1	0.5	**0.9**	**0.9**
Dove River	0	0	0	0	0.5	0.5	**0.2**	**0.2**
Baton River	1	1	1	1	0.5	1	**0.9**	**0.9**

Wangapeka River	1	1	1	1	1	1	**1**	**1**
Rolling River	1	1	1	1	1	1	**1**	**1**
Tadmor River	0	0.5	1	1	0.5	0.5	**0.5**	**0.5**
Motupiko River	0	1	1	1	0.5	1	**0.7**	**0.7**
Rainy River	1	1	1	1	0.5	1	**0.9**	**0.9**
Moutere River	0	0	0	0	0.1	0.5	**0.12**	**0.12**
Waimea River	0.5	0	1	1	0.5	0.5	**0.5**	**0.5**
Waiiti River	0.5	1	1	1	0.5	0.5	**0.7**	**0.7**
Wairoa River	1	1	1	1	1	1	**1**	**1**
Lee River	1	1	1	1	1	1	**1**	**1**
Buller River (btw Iron Bridge+Gowanbridge)	0.5	1	1	1	0.5	1	**0.8**	**0.8**
Buller River (upstream Gowanbridge)	1	1	1	1	0.5	1	**0.9**	**0.9**
Maruia River	0.5	1	1	1	1	1	**0.9**	**0.9**
Warwick River	1	1	0	0	0.5	1	**0.7**	**0.7**
Matiri River	1	1	1	1	0.5	1	**0.9**	**0.9**
Matakitaki River (upper)	1	1	1	1	1	1	**1**	**1**
Glenroy River	1	1	1	1	0.5	1	**0.9**	**0.9**
Mangles River	0.5	1	0	1	0.5	1	**0.6**	**0.8**
Tutaki River	0.5	1	0	0	0.5	1	**0.6**	**0.6**
Fyfe River	1	1	1	1	1	1	**1**	**1**
Owen River	1	1	1	1	1	0.5	**0.9**	**0.9**
Gowan River	1	1	1	1	1	0.5	**0.9**	**0.9**
Sabine River	1	1	1	1	1	1	**1**	**1**
D'Urville River	1	1	1	1	1	1	**1**	**1**
Hope River	1	1	1	1	0.5	0.5	**0.8**	**0.8**
Station Creek	1	1	0	1	0.5	1	**0.7**	**0.9**
Howard River	1	0.5	0	1	0.1	0.5	**0.42**	**0.62**
Speargrass Creek	1	1	1	1	0.5	1	**0.9**	**0.9**
Travers River	1	1	1	1	1	1	**1**	**1**
Anatori River	1	1	1	1	0.5	1	**0.9**	**0.9**
Paturau River	1	1	1	1	0.5	1	**0.9**	**0.9**

Notes: RED NUMBERS: estimates based on expert knowledge, rather than data; BLACK NUMBERS: drawn from TDC or FGNZwater quality data; BLUE NUMBERS: revised May 2010; HIGHLIGHTED CELLS: Score revised May 2010.

Appendix 5-7
Other factors relevant to the assessment of significance for salmonid angling (Step 9)

Access
Given access is a prerequisite for angling activity, it is of fundamental importance. Access includes the legal right as well as the practical ability to exercise this right (cross the land). Consideration must be given to the influence that access provision has upon the pattern of existing use - lack of legal or practical access may limit or completely restrict use, even to otherwise suitable sites.
Context
An individual river may have values that relate to its contribution to the regional collective. These may have important benefits to the region but are difficult to quantify. This includes several parameters: **Degree of scarcity of the experience** Where few alternative (substitute) sites exist that will satisfy the recreation experience being sought (e.g., challenging and remote wilderness angling), then the degree of scarcity is high (and vice versa). This notion has parallels with the biodiversity rarity argument – protection of the rare and endangered species. So too, for recreation opportunities – protection of the recreation opportunities that are most scarce. **Contribution to a collective value** Individual sites may contribute to a set of values found within a region or nationally – the sum may be greater than the parts. If parts of the collective are compromised, this may act as a ‘tipping point’ to reduce or negate the value of the collective. A good example is the Buller River, which has a wide range of tributary rivers of differing sizes, settings, and hydrological and fishery characteristics. Many anglers visit this area to be able to fish lake-fed large rivers, small catchment-fed bush streams, remote tannin-stained bush catchments, large lakes of glacial origin and smaller lakes surrounded by bush. Hundreds of kilometres’ length of different fishing water is available and some fishing opportunity is always available irrespective of season or weather. This argument mirrors biodiversity hot spots of endemism – hot spots for angling may occur that require protection. **Users’ perceptions of the river’s ‘status’** While more nebulous, anglers may rate a river in, for example, the top three best fishing areas in New Zealand/internationally.
Potential future angling use
This is about the potential to undertake angling at that place in the future. The goal is to avoid precluding future recreational use. The Recreation Opportunity Spectrum is predicated on the notion of the recreation opportunity rather than recreational use. An opportunity is just that – the *potential* to undertake a recreational activity - which may be currently taken up (or not). This factor is therefore about potential, but not yet realised, opportunities. There are a variety of reasons why recreation opportunities may not be realised. Recreation is subject to rapid developments in technology and changing social preferences. Changes in access similarly may alter use. As a result, dramatic changes in use patterns can occur and existing use patterns may be poor indicators of future use value. For example, individual angler inflatables now facilitate angler access to sections of rivers previously not fished; fish finders have increased the chance for a lake fisher of catching a fish. The best example of this phenomenon is the work by Egarr and Egarr (1981). Their assessment of the recreational potential of New Zealand rivers nearly three decades ago does not match the current use patterns owing to the sort of factors already outlined. For this reason, ‘future proofing’ for potential recreational value is required. Some decisions may inadvertently preclude future recreational options. The goal is to avoid this outcome.
Existence value
Existence value relates to knowing that a resource exists and that the present generation will pass it on to the next generation (in a healthy state suitable for angling).
Past use
This value is also non-quantifiable and is associated with important past uses of a river. With respect to salmonid angling, former ‘world renowned’ fisheries are relevant.

Appendix 5-8
Future data requirements for salmonid angling

Data need
Users' perception of scenic attractiveness
Users' perception of wilderness character
Users' evaluation of the overall importance of the river
Users' satisfaction with their visit to the river for angling
Enter Ministry of Works 1956 list of rivers (i.e., make into electronic list) and link to REC

Chapter 6
Whitewater Kayaking

Preamble

Whitewater kayaking provided a range of challenges to application of the RiVAS method. Notably, the sport is characterised by a historic data set and associated priorities now almost 30 years old – much has happened in this sport which is characterised by rapid changes in technology, practice and popularity. The sport is also characterised by a high level of geographic variation; and is enjoyed by a wide range of people at varying levels and with different expectations and experiences. The lack of any recognised national rationale or process for describing the characteristics of river values including white-water kayaking also meant that RiVAS faced challenges in terms of the overall concept as well as in actual development and application for this river value in particular. The method was first trialled by establishing national level attributes, etc, and then applying these on the West Coast of the South Island (Part A); subsequently the approach was then applied to Hawkes Bay (in prep.) and Tasman District (Part B). Issues around final definitions for particular attributes to account for the range of whitewater kayaking experiences that arose following the West Coast trial have now been addressed and are reported in the Tasman application.

Given the level of voluntary and expert input made by kayakers to this process, it is expected that kayakers will be consulted on any application of the RiVAS results to regional water plans or resource consent applications. The application of the methodology does not, in and of itself, constitute consultation with kayakers.

Part A: Whitewater kayaking in the West Coast Region: Application of the River Values Assessment System (RiVAS)

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Andy England (Whitewater New Zealand)
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6.1 Introduction

6.1.1 *Purpose*

This section applies the River Values Significance Assessment Method (RiVAS) outlined in a companion chapter, *River Values Assessment System (RiVAS) – The Method* (Hughey et al. herein), and should be read in conjunction with that chapter. Its purpose is to provide a case study of how to apply the method to whitewater kayaking, using the West Coast region as an exemplar.

The application of the method for whitewater kayaking remains under development. It will be refined through application in other regions, and would be enhanced by research to inform underlying assumptions and replace data estimates (see Step 10). In particular, elucidation of the factors used by kayakers to value rivers is required.

6.1.2 *Summary of the assessment*

An Expert Panel identified eight (subsequently reduced to seven) resource and user attributes to assess 58 river sections in the West Coast Region for their whitewater kayaking value. Few relevant data were available, so the Expert Panel relied on their own assessments for all attributes. As a result of the assessment, river sections were classified for whitewater kayaking as follows: 28 high value, 29 medium value and 1 low value. River sections not assessed were either of negligible value, unknown value (never paddled), were not able to be paddled at the time of the assessment owing to access problems, or were inadvertently missed during the assessment.

6.1.3 *Preparatory step: Establish an Expert Panel and identify peer reviewers*

Two Expert Panels were used for this case study. The first Panel established the assessment criteria and reviewed the method (Parts 1 and 3 of the method). This Panel comprised Doug Rankin and Andy England (Whitewater New Zealand), Martin Unwin (NIWA) and Kay Booth (Lindis Consulting). Part 2 was undertaken by a second Expert Panel comprising whitewater kayakers familiar with West Coast rivers (Andy England, Graham Charles, Keith Riley, Dave Ritchie and Kevin England), facilitated by Kay Booth.

Simon Moran (West Coast Regional Council) and Ken Hughey (Lincoln University) acted as advisors. Rob Greenaway and Duncan Catanach peer reviewed a draft of this chapter.

Credentials of members of the Expert Panels, advisors and peer reviewers are provided in Appendix 6A-1.

The Expert Panels met separately (two weeks apart) to undertake the assessment. The idea of estimating data using the Delphi Technique (individuals transmit their assessments, without meeting, in an iterative manner) was discussed at the second Expert Panel workshop. Such an approach would be practical to administer but would inhibit debate and potentially preclude consensus decision-making. Therefore a face-to-face approach is recommended and was used in this assessment.

6.2 Application of the method

6.2.1 *Step 1: Define river value categories and river segments*

River value categories

Whitewater kayaking is a multi-dimensional form of recreation. It is undertaken by people with different skill levels and encompasses a range of types of experiences (e.g., easy introductory paddling to challenging exploratory descents). It may be undertaken as a commercial activity (e.g., skill instruction or river guiding) or competitively. Whitewater kayaking is usually undertaken in groups for safety reasons, giving the activity a strong social dimension. It is resource-dependent – it requires whitewater and is strongly influenced by the type and quality of whitewater. Whitewater kayaking is also a continually evolving activity, and has changed dramatically since the 1970s with the advent of plastic craft and the resulting ability to paddle increasingly difficult rivers. Kayak design continues to advance and a variety of boat options are available to suit different types of water and paddling styles.

Whitewater kayaking is undertaken using a double-bladed paddle with the kayaker in a sitting position and enclosed in a water-tight cockpit. However, this assessment also covers canoeing – where paddlers use a single-bladed paddle in a kneeling position. Other whitewater pursuits (e.g., rafting, river bugging and river boarding[36)] were excluded from this assessment, because some different characteristics apply to them.

River segments

Using a list of rivers provided by the West Coast Regional Council, the second Expert Panel identified 41 rivers that were regularly kayaked, or had been recently kayaked and were expected to become popular within the next three years. This was based on Panel members' local knowledge and with reference to a whitewater kayaking guidebook (Charles 2006). Using this approach, the selected rivers represent the most valuable kayaking rivers in the region. Twelve rivers were subdivided into two, three or four segments (representing different kayak runs), giving a total of 58 river segments. The resultant list of West Coast whitewater kayaking river sections is presented in Appendix 6A-4.

Subsequent to the assessment, members of both Expert Panels identified river sections that had whitewater kayaking value but had been overlooked in the assessment. This suggests the need for early and careful identification of relevant river sections, and suggests that the West Coast assessment missed some valuable whitewater kayaking river sections.

West Coast rivers which were not included in the assessment were considered, by the second Expert Panel, to hold:

1. Negligible value for whitewater kayaking: either they had no whitewater kayaking value (e.g., flat water) or they had been kayaked but were considered to hold low value (i.e., unlikely to become popular owing to factors such as unusual flow regimes or variable terrain); or
2. Unknown kayaking value (yet to be paddled); or
3. Known kayaking value but not accessible at the time of the assessment: the Panel noted that some highly valued kayak runs had been closed off because air access had been prohibited; or
4. Known kayaking value but had been inadvertently missed in the assessment (e.g., the Milltown run on the Arahura River).

Step 9 identifies that whitewater kayaking has been subject to rapid change. In response to technological advancements in kayaks, the range of river types able to be kayaked has increased and it is notable that some river sections included in the assessment had become known only very recently (first descents in the past couple of years). Furthermore, upper sections on West Coast rivers are susceptible to significant change from natural processes (e.g., river bed realignment from floods and damming from landslides). This means that the assessment of kayaking river sections in this study pertains to present-day kayaking opportunities.

Other

Both Expert Panels noted that the international whitewater difficulty scale provides a categorisation of rivers based on the degree of challenge or difficulty of the whitewater kayaking opportunity (Table 6-1).

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36 A river bug is a small one person inflatable craft specially designed for running rapids, propelled from a seated position by kicking with finned feet and paddling with webbed gloves. The participant moves downriver feet first. In river boarding (also known as whitewater sledging), the participant travels head-first downstream, using a river board that they partially lie on, and steers using fins on their feet.

Table 6-1
International scale of whitewater difficulty (Charles 2006:14-15)

Grade I	Moving water with a few riffles and small waves. Few or no obstructions.
Grade II	Easy rapids with waves up to one metre. Clear channels obvious without scouting. The ability to move your craft across the current is not necessary.
Grade III	Rapids with high, irregular waves and narrow passages. The ability to spin and manoeuvre is necessary.
Grade IV	Difficult rapids requiring a series of controlled moves, cross-current and spinning in confused water. Scouting often necessary and a reliable roll is mandatory.
Grade V	Very difficult, long and violent rapids. Nearly always must be scouted. Definite risks in the event of a mishap. Requires a series of controlled, precise, 'must make' moves to navigate successfully.
Grade VI	Extreme, very dangerous and only for experts. Close inspection is mandatory and all possible safety precautions should be taken.

A river's grade does not imply value (all grades may be equally valued) but provides a useful 'check' on the representativeness of the list of rivers compiled from this assessment. By checking the distribution of rivers by grade, the assessment can be reviewed for any tendency to favour one type of kayaking opportunity over another, in terms of their kayaking challenge or difficulty, bearing in mind the abundance of rivers by grade in the region. Therefore river grade was recorded as part of the process.

Outcomes

Treat whitewater kayaking as one river value (no separate categories).

Obtain a list of rivers from the regional council and select those rivers/reaches, using the knowledge of the Expert Panel and any existing data, on which kayaking currently takes place with some regularity (being aware that more difficult rivers will receive less 'regular' use) or is expected to be popular in the immediate future.

Include the whitewater difficulty classification system to identify the distribution of grades of the rivers selected (Step 1) and their ranking (Step 8).

6.2.2 *Step 2: Identify attributes*

Attributes which describe whitewater kayaking were structured around the Recreation Opportunity Spectrum framework (Brown et al. 1978; Clark and Stankey 1979) (see Appendix 6A-2). By following this framework, the kayaking assessment aligned with the method as outlined in Hughey et al. (Herein).

Most attributes relate to individual rivers. However, the first Expert Panel identified some attributes associated with a set of rivers or the connection between them (e.g., see the attribute *connectedness* in Step 9).

Both Expert Panels thought the assessment must focus upon present-day use and value, whilst acknowledging that future kayaking opportunities are important (see Step 9).

Attributes encompass three of the four well-beings defined in the Local Government Act 2002 (social, economic, environmental). Cultural attributes may be relevant for whitewater kayaking, but little was known about this.

Outcome

A list of attributes is provided in Appendix 6A-2.

6.2.3 *Step 3: Select and describe primary attributes*

From the list of attributes outlined in Step 2, primary attributes were selected to represent whitewater kayaking in the assessment. Selection was based on:

1. The first Expert Panel members' opinion about the relative contribution made by attributes to an understanding of whitewater kayaking opportunities. Owing to a lack of data, expert opinion was the main method for identifying primary attributes;
2. Research literature on the attributes identified by whitewater kayakers as important (Galloway 2008; Galloway in prep.). Very little relevant research was identified;
3. Greatest emphasis placed upon attributes that related to individual rivers. One primary attribute relates to the river's context within a wider set of kayaking opportunities ('scarcity value').
4. The need for pragmatism – only eight attributes were identified; and
5. An emphasis upon setting and activity attributes (e.g., river flows, access), which are those things that councils (and others) directly manage.

The attribute 'economic benefits from kayaking' was discussed but not selected as a primary attribute. It would be difficult to identify the contribution of an individual river to regional economic benefits associated with whitewater kayaking and this attribute is likely to be closely related to other primary attributes, especially the number and origin of users.

Outcome

Appendix 6A-2 identifies the eight primary attributes (in bold) and describes each, with an emphasis on explaining each attribute's validity and reliability as a representative measure of whitewater kayaking.

6.2.4 *Step 4: Identify indicators*

One indicator for each primary attribute was identified using SMARTA criteria (Appendix 6A-3), based on:

1. Expert Panels' judgment;
2. Existing data; and
3. An attempt to identify indicators that may also apply to other forms of river recreation (e.g., 'numbers of users').

Each indicator was considered carefully. Discussion included:

1. *Perception of scenic attractiveness (rating scale):* Initially, the natural character scale used in the landscape case study (Boffa Miskell 2009) was adopted, which is based on the degree of modification:
    1. *Very Low levels of natural character due to Very High levels of modification.*
    2. *Low levels of natural character due to High levels of modification.*
    3. *Moderate levels of natural character due to Moderate levels of modification.*
    4. *High levels of natural character due to Low levels of modification.*
    5. *Very High levels of natural character due to Very Low or no levels of modification.*

However, subsequent discussion of drafts of this chapter highlighted dissatisfaction with this indicator. Natural character (measured inversely by the degree of modification) was felt to be different from scenic attractiveness. Subsequently, a different scale was suggested for future application of this method, namely that used in the 1991 River Use Survey (NZCA 1991), which incorporated elements of river scenery descriptors published by Egarr and Egarr (1981) and Egarr et al. (1979):

1. *Not attractive: river environs and surrounding country generally uninspiring, river water may be dirty or discoloured.*
2. *Moderately attractive: some local features of scenic interest, mixed with less attractive sections.*
3. *Attractive: scenic appeal is significant, but generally derived from local features such as bankside vegetation and the nature of the river environs rather than large scale grandeur.*
4. *Very attractive: river environs scenic and sometimes spectacular. Surrounding country provides striking views.*
5. *Inspiring: scenery spectacular and varied. Large scale vistas (e.g., mountains/bush/open country), and/or unique and striking river environs (e.g., rock formations, gorges, overhanging vegetation, deep and clear pools, rapids).*

It would be desirable to use kayakers' perceptions of scenic attractiveness, as perceived from river level. In the absence of such data, the second Expert Panel provided data estimates.

2. *Perception of wilderness character (rating scale):* This measure was used in the 1991 River Use Survey (NZCA 1991). The second Expert Panel provided estimates for individual rivers, as the 1991 survey data were not available. The 1991 ranking scale was:
    1. *No wilderness feeling; road traffic or other human activity generally visible/audible from river. Highly modified river environment.*
    2. *Little wilderness feeling; roads/human activity readily accessible from river, even if not directly visible. River environment show obvious signs of modification.*
    3. *Some wilderness feeling; river environment may be modified, but canoeist is essentially isolated from immediate human activity. Roads generally reachable from river, but may involve some rough scrambling.*
    4. *Strong wilderness feeling; largely unmodified environment, with very limited access to any form of roading, Walking out from river feasible, but could take up to a day.*
    5. *Exceptional wilderness feeling; pristine environment, extreme sense of remoteness, walk-out long arduous, and difficult.*

3. *Density of high quality hydraulic features (rating scale):* This indicator was defined as 'the number, variety and quality of hydraulic features (e.g., waves, holes, eddies, drops)' (Whitewater New Zealand 2009). The second Expert Panel estimated data for this indicator. It was noted that this is not the same as the whitewater difficulty scale (river grade) – any single grade may offer a high or low density of hydraulic features. The second Panel refined the definition of this attribute: initial emphasis (by the first Panel) had been placed upon <u>diversity</u>, the second Panel chose to place greater emphasis upon <u>density</u> as this was felt to be more important and presents a more practical measure for any given river (count of features c.f. diversity rating).

4. *Flow reliability (% of time river is kayakable):* This attribute was assessed with respect to the percentage of time the river is suitable for the particular kayaking opportunity for which it is valued (e.g., % time able to be paddled as an easy learn-to-kayak opportunity). In the absence of any empirical data, the second Expert Panel estimated data for this indicator. A positive relationship was agreed (high flow reliability corresponds with high kayaking value). It was noted that this attribute may not fit other regions well – where the norm may be that rain is required for the kayaking opportunity.

5. *Ease of access (mode):* A positive relationship was suggested between ease of access and kayaking value (easy access contributes to a higher value assessment). Mode of access was chosen as a practical means to measure 'ease of access' (i.e., 2WD vehicle, 4WD vehicle, walk-in carrying kayak, helicopter). Two exceptions were noted: (1) helicopter access *may* contribute positively to the kayak experience, especially given it is rare nationally and internationally; (2) walk-in access may also contribute positively to the experience as it can add an additional element to the physical activity, enhance the kayaker's relationship with nature and increase the challenge. Most helicopter and walk-in access is focused on Grade 4-

5 kayak runs. There is not a linear relationship between river grade and ease of access (some Grade 5 rivers offer 2WD vehicle access). The second Expert Panel found this attribute troublesome, as they felt that mode of access did not represent the kayaking value of the river. Nonetheless, it was populated with data and tested as part of the method (but ultimately removed – see Step 7).

6. *Number of users (kayaker days per annum):* A positive relationship between numbers and kayaking value is assumed, although high-skill (high river grades) and remote rivers will only be used by small numbers of kayakers and this does not mean those rivers have low kayaking value. Since no data were available, the second Expert Panel estimated kayaker numbers. This was informed by data from helicopter flight records, where relevant. Ideally, more robust user counts data would be used. Future work may refine this indicator to 'kayak season' – which is likely to vary by region and perhaps by river. This is relevant as decisions about water use may vary seasonally and it would be helpful for decision-makers to know times of year when rivers are used by kayakers. Kayakers who accompany rafting trips were counted.

7. *User catchment (home district/region):* The greater the distance a kayaker travels to paddle a river, the greater the value. Kayaker origin was considered the most appropriate metric. 'Travel distance' was discussed but disregarded as it would be influenced by the geographic spread of the region and could result in a 'local' West Coaster skewing the ranking higher (greater travel distance) than someone from a geographically distinct region (e.g., Central Otago). This may have implications for other case study assessments. The scale chosen was:
    1. *Within district (live within territorial authority boundary in which river is located).*
    2. *Within region (regional council boundary) but outside home district.*
    3. *From neighbouring region (home region borders region in which river is located).*
    4. *Rest of New Zealand but beyond neighbouring regions.*
    5. *International.*

   A threshold of 10% of users from the district/region was chosen to trigger the rank (e.g., ≥10% of users from other countries would receive a '5'; ≥10% of users from districts within the region but not the same district as that in which the river is located would receive a '2').

   In the absence of any pre-existing data, estimates of the second Expert Panel were used. To prompt discussion, the Panel sometimes started by considering how widely the section was known and whether it was a 'destination river' for national or international kayakers.

8. *Scarcity of the kayaking opportunity (rating scale):* A positive correlation between scarcity and kayaking value (the more scarce the opportunity, the greater the value). The 'kayaking opportunity' refers to the type of kayaking experience (e.g., paddle on a very scenic Grade 5 river with 2WD access). In the absence of data, estimates from the second Expert Panel were used for this indicator. Considerable debate took place around the geographical scale of application for this indicator, as it places an individual river within its broader context. Initially the first Expert Panel had suggested scarcity should be measured in the regional context. However, when populating this attribute, the second Expert Panel identified many cases where a river offered a rare opportunity nationally (sometimes internationally) but which was relatively common in the West Coast. Therefore, the scale was revised to recognise this diversity:
    1. *Not scarce.*
    2. *Regionally scarce.*
    3. *Nationally scarce (irrespective of whether scarce regionally).*

   International scarcity was noted in the *Comments* column of Appendix 6A-4.

Outcome

Indicators are listed in Appendix 6A-2 and assessed against SMARTA criteria in Appendix 6A-3.

6.2.5 ***Step 5: Determine indicator thresholds***

Thresholds for each indicator were identified by the second Expert Panel, as shown in Appendix 6A-2. Explanations:

- Where a 5-point scale was used to measure the indicator (e.g., perception of wilderness), indicator scores were assigned to thresholds as follows:
  High (3) = 4 or 5 score
  Medium (2) = 3 score
  Low (1) = 1 or 2 score
- User catchment (home district/region): An exception to the 5-point scale application, as follows:
  High (3) = Rest of New Zealand, or International.
  Medium (2) = Within region, or From neighbouring region.
  Low (1) = Within district.
- Flow reliability (% of time river kayakable): Thresholds were chosen in equal divisions (thirds):
  High (3) = > 66%
  Medium (2) = 33-66%
  Low (1) = < 33%
- Number of users (kayaker days per annum): Thresholds were selected so they would work at a national level (West Coast rivers have comparatively few kayaker days since most rivers are technically difficult).

Outcome

Thresholds are identified in Appendix 6A-2.

6.2.6 ***Step 6: Apply indicators and indicator thresholds***

All data were estimated by the second Expert Panel.

Outcome

Data estimates are shown in Appendix 6A-4.

6.2.7 ***Step 7: Weighting the primary attributes***

The second Expert Panel reviewed the eight primary attributes and considered whether some made a relatively greater contribution to the understanding of whitewater kayaking.

The following weighting regimes were considered and changes in the rank order of rivers examined (see Appendix 6A-4):

- Hydraulic features density = x 1.5;
- Flow reliability = x 1.5;
- Deletion of the attribute 'ease of access', both to the original dataset and the datasets pertaining to increased (x 1.5) weightings for hydraulic features density and flow reliability. This deletion followed extensive discussion which related to how well this attribute contributed to an understanding of kayaking value.

After analysis of the datasets, the second Expert Panel chose an equal weighting regime (with the access attribute removed) because weighting adjustments for hydraulic features and flow reliability did not fundamentally alter the river rankings, and no data were available about the relative importance of attributes to kayakers.

Outcome

Equal weighting with access attribute removed. See Appendix 6A-4 for weighting testing.

6.2.8 *Step 8: Determine river value for whitewater kayaking*

Step 8a: Rank rivers

The spreadsheet was used to sum the indicator threshold scores for each river and then sorted in descending order. This provided a list of rivers ranked by their value scores.

This step was undertaken for each of the weighting regimes described in Step 7, as it assisted the Panel to identify the differences between weighting regimes (i.e., it was easy to see which rivers moved up/down the rankings).

Large clusters of rivers were evident (rivers with the same total score) in the different weighting regimes. This can be explained by the nature of many West Coast rivers – which are a collection of rivers with similar attributes. The large number of rivers clustered in the upper values is explained by the fact that West Coast rivers provide a significant proportion of New Zealand's most difficult whitewater kayak runs (see Charles 2006) and only the most valuable kayaking rivers were included in this assessment (see Step 1).

The number and relative rank of rivers in the list attributable to each river difficulty grade was reviewed and no concerns were expressed about the distribution by the second Expert Panel.

Step 8b: Identify river's value to kayaking

West Coast rivers of high, medium and low value for whitewater kayaking were identified by applying thresholds to the final ranked list of rivers chosen in Step 7 (see blue highlighted column labelled FINAL in Appendix 6A-4).

Two approaches were trialled. The first was the selection of thresholds or cut-off points, following careful review of the list of rivers and their scores. As shown in Appendix 6A-4, chosen thresholds were 'high value' >17; 'low value' <10.

The second approach was to apply attribute rules:

- 'High value' river = five or more indicator scores of 3;
- 'Low value' river = five or more indicator scores of 1;
- The remainder classified as 'medium value'.

Rivers were rated as high, medium or low value using these attribute rules. One river was rated as 'medium' using this approach, even though it ranked third equal in the original river rankings (i.e., its value dropped substantially under the attribute rules approach). In addition, three river sections received 'high value' designation using the attribute rules, but had appeared lower in the original rankings than other rivers ranked as 'high value' by the attribute rules approach. Careful consideration of the kayaking value of these four outlier river sections suggested that the application of these attribute rules was not helpful. Therefore, the final assessment used cut-off points or thresholds in the ranked list of rivers to differentiate rivers' kayaking value.

Only one river was designated 'low value' – using both the attribute rules and the Panel assessment of appropriate threshold points. This was not surprising, for the reasons already explained.

No single attribute was considered to be a trigger for high value, although this point was debated during peer review of this chapter. It was noted that Water Conservation Orders often are based on a single outstanding resource attribute. One suggestion was that the presence of an iconic feature may represent such a 'trigger'; however this attribute was not selected as a primary attribute. This attribute, and the broader point about trigger attributes, deserves further consideration in future applications of the method to kayaking.

Outcomes

A list of rivers ranked by a scoring system from highest to lowest, which represents an initial ranking for kayaking value (see Appendix 6A-4 highlighted columns).

Rivers identified as high, moderate and low value for whitewater kayaking. See Appendix 6A-4.

Rivers in the West Coast Region not listed have either negligible whitewater kayaking value or hold value but are unable to be accessed by kayakers (as at October 2009). A small number of river sections were missed in this case study assessment.

6.2.9 *Step 9: Outline other factors relevant to the assessment of significance*

Five attributes of whitewater kayaking have been identified which are not quantifiable but are considered relevant to significance assessment. These attributes are discussed in Appendix 6A-5 in order to highlight their importance to a meaningful understanding of whitewater kayaking. The attributes are:

- Access – a prerequisite for kayaking;
- Connectedness – contribution to the suite of kayaking opportunities in region;
- Users' perceptions of the river's importance (including its 'status');
- Potential future kayaking use; and
- Existence and option value.

These attributes do not influence the numeric calculation of river significance, but are relevant to decision-making about whitewater kayaking.

Outcome

List and description of non-measured attributes (Appendix 6A-5).

6.2.10 *Step 10: Review assessment process and identify future information requirements*

Few published data were available to inform this case study. Desired data are noted in Appendix 6A-6.

Suggested further research includes:

1. Qualitative and quantitative research to identify the factors which influence kayakers' assessments of whitewater kayaking value (i.e., the primary attributes – Step 3), and the relative importance of these factors (i.e., their weightings – Step 7);
2. Data to populate the indicators.

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Appendix 6A-1
Credentials of the Expert Panel members and peer reviewers

First Expert Panel (Parts 1 and 3 of the method):

1. **Dr Kay Booth** is an outdoor recreation researcher and planner. She is the Director of Lindis Consulting and, until recently, a Senior Lecturer in parks, recreation and tourism at Lincoln University. She is conversant with existing data about outdoor recreation. With colleagues, Kay developed the significance assessment method on which this case study is based. She holds appointments on the New Zealand Walking Access Commission, the New Zealand Geographic Board and the New Zealand Conservation Authority. She is a novice whitewater kayaker.

2. **Andy England** is a member of Whitewater New Zealand based on the West Coast. He has been kayaking whitewater since he was a teenager growing up in the UK. Andy has competed in slalom kayaking and travelled the world to kayak and explore whitewater rivers in Norway, France, Austria, Italy, the USA, Canada, Nepal and New Zealand. He is qualified as a Level 1 kayak coach by the New Zealand Outdoor Instructors Association and has taught kayaking since 1988. In 1991 he moved to Scotland to be closer to more adventurous whitewater rivers and since 2001 has lived in Greymouth. Andy has kayaked rivers extensively on the West Coast. He is Deputy Principal of Greymouth High School.

3. **Dr Doug Rankin** is a member of Whitewater New Zealand, President of the BugSports Club, and a life member of the University of Canterbury Canoe Club. He has been kayaking (and more recently river bugging) whitewater both in New Zealand and overseas (France, Germany, Austria, USA) for over 35 years. In his professional life Doug is a scientist with AgResearch. Doug has presented evidence as an expert witness for the New Zealand Canoeing Association (now Whitewater New Zealand) on the utility and whitewater values of many of New Zealand's rivers to Special Tribunals and Environment Court Hearings, to gain protection for the recreation values of many of New Zealand's outstanding wild and scenic rivers.

4. **Martin Unwin** is a fisheries scientist with over 30 years experience, based with NIWA in Christchurch. He has contributed to, or had oversight of, the four National Angler Surveys and other related angler surveys. His current research interests include linking recreational usage data for New Zealand lakes and rivers to NIWA's River Environmental Classification (REC) scheme, so as to allow recreational activities such as angling and kayaking to be mapped and modelled in relation to hydrologic and catchment descriptors. In previous years he was an active social (i.e., Grade 3) whitewater kayaker, and continues to enjoy sea-kayaking and flatwater paddling in a Canadian canoe.

Second Expert Panel (Part 2 of the method):

1. **Andy England** (see above).

2. **Graham Charles** is a professional outdoors adventurer and the author of New Zealand Whitewater: 125 Great kayaking runs He a founding member of Adventure Philosophy, an outdoors team of adventurers, with which he has undertaken world-first expeditions to the Antarctic Peninsula, Darwin Cordillera and South Georgia. Graham is an outdoors photographer, writer and presenter. A former national representative in whitewater slalom racing, he has paddled and adventured in over a dozen countries and pioneered new ascents in the mountains and rivers of New Zealand.

3. **Kevin England** has been kayaking in various mountainous regions around the world for the past 20 years. Calling the West Coast home for the past three years, he has been active in exploring new runs and becoming familiar with the classic rivers of the West Coast. Kevin has worked in geological exploration, river guiding, river safety equipment design and is a regular contributor to New Zealand's whitewater kayaking media. Based at the West Coast Regional Council, Kevin is

currently studying towards a Master's Degree in Natural Hazard Management from the University of Canterbury.

4. **Keith Riley** has been exploring New Zealand whitewater for over 20 years. It is likely that he has paddled more South Island rivers than any other person. Keith has spearheaded numerous first descents of some of New Zealand's hardest stretches of whitewater. He has represented New Zealand at slalom kayaking and adventure racing. He currently works at Tai Poutini Polytechnic on the West Coast, where he teaches in the kayak, rock, mountain and bush programmes.

5. **Dave Ritchie** is a highly regarded river instructor and a New Zealand authority on instructing kayaking, rafting and river rescue. Dave has been kayaking and rafting internationally for over 20 years. He is currently programme coordinator for the Outdoor Recreation Department at Tai Poutini Polytechnic.

Advisors

1. **Simon Moran** is the Manager (Planning and Environmental) with the West Coast Regional Council.

2. **Prof Ken Hughey** is a professor of environmental management at Lincoln University. He is the Project Leader for the River Values project and led the development of the significance assessment method.

Peer reviewers

1. **Rob Greenaway** is a consultant recreation planner with over 20 years professional experience. His background includes event management, outdoor recreation research, recreation planning and impact assessment for territorial authorities and for private developers, and journalism. He is regularly called as an expert witness for RMA hearings associated with rivers, for which he advises on recreation and tourism. He is a member of the Sir Edmund Hillary Outdoor Recreation Council and is an active member of the New Zealand Recreation Association and New Zealand Association for Impact Assessment.

2. **Duncan Catanach** has kayaked for over fifteen years (up to Grade IV+ level) and has paddled extensively in New Zealand, Australia, Canada, Nepal and Tibet (including participation in two first descents). He is currently Vice President of Whitewater New Zealand (formerly the New Zealand Recreational Canoeing Association). Prior to this role, he was the North Island Conservation Officer for five years. He has a particular interest in freshwater management policy and has represented whitewater kayakers in a number of forums including the Land and Water Forum and is the principal author of Whitewater New Zealand's Conservation Policy (draft, currently out for consultation). He has a first class Honours degree in Economics from the University of Melbourne (including a sub-speciality in environmental economics) and post-graduate qualifications in econometrics (economic statistics).

Appendix 6A-2
Assessment criteria for whitewater kayaking (Steps 2-4)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR THRESHOLDS	DATA SOURCES (AND RELIABILITY)
Step 2: Identify attributes Step 3: Select and describe primary attributes		Step 3: Select and describe primary attributes	Step 4: Identify indicators	Step 5: Determine significance thresholds	
ATTRIBUTES ASSOCIATED WITH EXISTING USE					
Users	**Number of users**	High use implies high value. However, this assumption will under-value special and remote places for several reasons, including: **Activity specialisation.** Resources suitable for highly specialised participants (high skill levels) will attract low numbers of users but may be highly valued and/or rare opportunities. **Access.** Restrictions upon access will reduce use and/or make it available only to some potential users due to cost, availability of time, specialised equipment or transport, physical capability, etc. **Wilderness and remote areas**. Areas that offer few encounters with other people may be highly valued for this attribute (amongst other things).	Number of kayaker days p.a.	High: >500 kayaker days p.a. (**score: 3**) Medium: 100 - 500 kayaker days p.a. (**score: 2**) Low: <100 kayaker days p.a. (**score: 1**)	Expert Panel estimate (fair)
	Level of commercial use	This may imply higher value (positive relationship with level of commercial use).			
	User catchment	Origin of users is suggested as an indicator of quality of the recreational experience, based on the assumption that the higher the expected quality of the	Kayaker's home district/region: 1=Within district (live	High: Rest of New Zealand, or International (**score: 3**) Medium: Within region, or	Expert Panel estimate (fair)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		experience, the greater the distance users will be prepared to travel. A threshold of 10% of users from the district/region triggers the rank, e.g., 10% of users from other countries receive a '5'; 10% of users from districts within the region but not the same district as that in which the river is located receive a '2'.	within territorial authority boundary in which river is located). 2=Within region (regional council boundary) but outside home district. 3=From neighbouring region (home region borders region in which river is located). 4=Rest of New Zealand but beyond neighbouring regions. 5=International.	From neighbouring region (**score: 2**) Low: Within district (**score: 1**)	
Activity	Skill required	Correlates positively with the river's whitewater grade			
	Type of use	For example, beginner instruction; adventure kayaking			
Environmental setting: Water characteristics	**Density of high quality hydraulic features**	Number, variety and quality of hydraulic features (e.g., waves, holes, eddies, drops)	Kayakers' perception. Interim metric is Expert Panel estimate (5-point rating scale): 1=Very few features	High: High density (**score: 3**) Medium: Medium density (**score: 2**) Low: Low density (**score: 1**)	Expert Panel estimate (good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR THRESHOLDS	DATA SOURCES (AND RELIABILITY)
			to 5=Very many features		
	Flow reliability	Correlates positively with kayaking value, although some exceptions. Will influence user catchment – locals more able to take advantage of unpredictable flow events	% of time river is kayakable. Expert Panel estimate: bands of 10%	High: >66% (**score: 3**) Medium: 33-66% (**score: 2**) Low: <33% (**score: 1**)	Expert Panel estimate (fair)
	Whitewater character	Includes gradient and volume of river section (e.g., low volume, high gradient pool drop c.f. continuous low gradient but large volume river sections)			
	Continuity of whitewater features	How often features occur in a single run			
	Length of kayak run	Usually, the longer the run, the higher the value			
	Presence of 'play spots'	'Playing' does not involve travel downstream. Play spots may be present only in certain flows.			
	Presence of iconic river features	Examples – scenic gorge, cliffs faces (natural landscape features or human artefacts)			
	Water quality	Includes clarity, purity and ability to support ecosystems and species. High water quality is 'nice to have' and not essential but normally adds to a river's value.			
	Scenic attractiveness	A common attribute in (the few) river user surveys. Generally, it is expected that there is a positive relationship between perceived scenic attractiveness and kayaking amenity.	Kayaker's perception of scenic attractiveness. Expert Panel estimate (5-point rating scale): 1=Highly modified to	High: Barely modified / high scenic value (**score: 3**) Medium: Little modification with moderate degree of scenic value (**score: 2**) Low: Modified with little	Expert Panel estimate (good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR THRESHOLDS	DATA SOURCES (AND RELIABILITY)
			5=Not modified While this indicator was used for this application, see Step 4 of the chapter for the recommended alternative indicator.	scenic value (**score: 1**) While these indicator thresholds were used for this application, see Step 4 of the chapter for the recommended alternative indicator.	
	Wilderness character	This setting attribute has a positive relationship with kayaking amenity – the higher the perceived wilderness character, the higher the kayaking value.	Kayaker's perception of wilderness character. Expert Panel estimate (5-point rating scale): 1=No wilderness value to 5=Exceptional wilderness value	High: Very high wilderness value (**score: 3**) Medium: Moderate wilderness value (**score: 2**) Low: Low wilderness value (**score: 1**)	Expert Panel estimate (good)
Social setting	Encounters with other river users	May influence (positively or negatively) the kayaking experience			
	Behaviour of other river users	May influence (positively or negatively) the kayaking experience			
Managerial setting	Ease of access (initially selected as a primary attribute, then removed)	Mode of access used as a surrogate for ease of access. Usually the easier the access, the higher the value, however helicopter access may be a positive aspect of the kayak experience and therefore reverse this relationship.	Transport mode: 1=helicopter 2=long walk-in 3=4WD vehicle 4=2WD vehicle	High: 2WD (score: 3) Medium: 4WD (score: 2) Low: helicopter, walk-in (score: 1)	Expert Panel estimate (very good)
Experiences	Perceptions of	Linked to river's status to kayakers. Any future survey			

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR THRESHOLDS	DATA SOURCES (AND RELIABILITY)
	the importance of the river	of kayakers should ask this question, as has been done in the past. In a sense, it synthesises all other attributes			
Other outcomes	Economic benefits	Expenditure by kayakers in local area, region, nation			
	Non-economic benefits	For example, kayakers attracted to live in region owing to kayaking amenity			
ATTRIBUTES ASSOCIATED WITH A SET (RATHER THAN INDIVIDUAL) RIVERS					
Opportunity *spectrum*	**Scarcity of the kayaking opportunity**	The availability of similar opportunities influences significance. Opportunities that can be easily substituted (not scarce) are less valued than those that are scarce. It is possible to have opportunities that are common regionally but scarce nationally (and internationally).	Expert Panel estimate (3-point rating scale): 1=Not scarce 2=Regionally scarce 3=Nationally scarce	High: Nationally scarce (**score: 3**) Medium: Regionally scarce (**score: 2**) Low: Not scarce (**score: 1**)	Expert Panel estimate (good)
	Connectedness –suite of kayaking opportunities	See Step 9			
ATTRIBUTES ASSOCIATED WITH FUTURE USE					
Recreation *opportunity*	Potential future kayaking use - avoid precluding future uses	See Step 9			

Appendix 6A-3
Assessment of indicators by SMARTA criteria

Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use
Perception of scenic attractiveness	Yes	Kayakers' response to rating scale question	Expert Panel estimate; ideally survey kayakers	Contributes to quality of kayaking experience	No data available	Yes (used in recreation surveys)
Perception of wilderness character	Yes	Kayakers' response to rating scale question	Expert Panel estimate; ideally survey kayakers	Contributes to quality of kayaking experience	No data available	Yes (used in recreation surveys)
Density of high quality hydraulic features	Yes	Kayakers' assessment	Expert Panel estimate; ideally survey kayakers	Whitewater kayaking experience dependent on quality of whitewater	No data available	No
Flow reliability (% of time river is kayakable)	Yes	Flows data assessment; kayakers' assessment	Flow data could be used in future; kayakers' assessment	Relates to opportunity to kayak	Flow data available but assessment not done; Expert Panel assessment	No
Ease of access (mode)	Yes	Kayakers' response to transport mode question	Expert Panel estimate; ideally survey kayakers	Relates to ease of opportunity to kayak	Guidebook assessment	Yes (used in recreation surveys)
Number of users (kayaker days p.a.)	Yes	Number of kayaker days	Expert Panel estimate; ideally count kayakers	Use implies value	No data available	Yes (used in recreation surveys)
User catchment (home district/region)	Yes	Kayakers' response to home location question	Expert Panel estimate; ideally survey kayakers	Greater distance from home implies higher value	No data available	Yes (used in recreation surveys)
Scarcity of kayaking experience	Yes	Rating scale	No data available	Indicator of significance	No data available	Yes (used in previous significance assessments)

Appendix 6A-4
Significance assessment calculations for whitewater kayaking (Steps 1 and 5-8)

Step 1: Define river segments				Step 6A: Apply indicators									Step 6B: Apply thresholds									Step 8: River value													Step 9: Issues
River no.	River	Reach	Whitewater grade	Perception of scenic attractiveness (rating scale)	Perception of wilderness (rating scale)	Density of quality hydraulic features (rating scale)	Flow reliability (% of time river kayakable)	Ease of access (mode)	No. of users (kayaker days p.a.)	User catchment (home district/region)	Scarcity of kayaking opportunity (rating scale)		Scenic attractiveness	Perception of wilderness	Density of quality hydraulic features	Flow reliability	Ease of access	No. of users	User catchment	Scarcity of kayaking opportunity		**Sum Weights 1**	River rank 1	Sum Weights 2	River rank 2	Sum weights 3	River rank 3	**Sum Weights FINAL**	River rank FINAL	Sum Weights 5	River rank 5	Sum Weights 6	River rank 6	**River kayaking value**	Comments
				1=highly modified to 5=not modified	1=no wilderness to 5= exceptional wilderness	1=very low density to 5= very high density	Recorded as 10% bands	Mainly: 1=helicopter; 2=long walk-in; 3=4WD; 4=2WD	Recorded as no.	1=intra-district; 2=intra-region; 3=bordering regions; 4=other NZ; 5=international	1=not scarce; 2=regionally scarce; 3=nationally scarce		1= 1 or 2= modified with little scenic value; 2= 3 = little modification with moderate degree of naturalness; 3= 4 or 5 = barely modified and highly natural	1= 1 or 2= low wilderness value; 2= 3 = moderate wilderness value; 3= 4 or 5 = high wilderness value	1= 1 or 2= low density; 2= 3= moderate density; 3= 4 or 5= high density	1=<33%; 2= 33-66; 3=>66%	1=1 or 2 helicopter or walk-in; 2=3 4WD; 3=4 2WD	1<100; 2= 100-500; 3=>500	1=intra-district; 2= intra- or bordering region; 3=rest of NZ or initial	1=not scarce; 2=regionally scarce; 3=nationally scarce		**Equal weights**		Hydraulic density x 1.5		Flow reliability x 1.5		**No access attribute. Equal weights**		No access attribute. Hydraulics x 1.5		No access attribute. Flow reliability x 1.5			More comments could be added to this column
908000	Arahura River	Newton Ck put in	4, 5	5	5	5	90	1	250	5	3		3	3	3	3	1	2	3	3		**21**	1	22.5	1	22.5	1	**20**	1	21.5	1	21.5	1	High	
906000	Hokitika River	Kakariki	4	5	5	5	80	1	150	5	3		3	3	3	3	1	2	3	3		**21**	1	22.5	1	22.5	1	**20**	1	21.5	1	21.5	1	High	
893250	Perth River	Five Finger	4, 5	5	5	5	80	1	160	5	3		3	3	3	3	1	2	3	3		**21**	1	22.5	1	22.5	1	**20**	1	21.5	1	21.5	1	High	
906055	Styx River	Tindall Creek	4, 5	5	4	4	90	2	200	5	3		3	3	3	3	1	2	3	3		**21**	1	22.5	1	22.5	1	**20**	1	21.5	1	21.5	1	High	
893000	Whataroa River	Lower	3, 4	5	5	5	80	1	160	5	3		3	3	3	3	1	2	3	3		**21**	1	22.5	1	22.5	1	**20**	1	21.5	1	21.5	1	High	
906140	Whitcombe River	Cropp	4, 5	5	5	5	90	1	200	5	3		3	3	3	3	1	2	3	3		**21**	1	22.5	1	22.5	1	**20**	1	21.5	1	21.5	1	High	
951000	Karamea River	Roaring Lion	4	5	5	5	80	1	80	5	3		3	3	3	3	1	1	3	3		**20**	2	21.5	2	21.5	2	**19**	2	20.5	2	20.5	2	High	
943000	Mokihinui River	Forks	4	5	5	4	100	1	40	4	3		3	3	3	3	1	1	3	3		**20**	2	21.5	2	21.5	2	**19**	2	20.5	2	20.5	2	High	
893250	Perth River	Scone	5	5	5	5	70	1	80	5	3		3	3	3	3	1	1	3	3		**20**	2	21.5	2	21.5	2	**19**	2	20.5	2	20.5	2	High	
911310	Taipo River	Julia Creek hut	4, 5	5	5	4	80	1	80	5	3		3	3	3	3	1	1	3	3		**20**	2	21.5	2	21.5	2	**19**	2	20.5	2	20.5	2	High	
906054	Toaroha River	Below T Canyon	4	5	5	5	60	2	100	5	3		3	3	3	2	1	2	3	3		**20**	2	21.5	2	21	3	**19**	2	20.5	2	20	3	High	
901000	Waitaha River		5	5	5	5	80	1	50	5	3		3	3	3	3	1	1	3	3		**20**	2	21.5	2	21.5	2	**19**	2	20.5	2	20.5	2	High	
897000	Wanganui River	Upper	4, 5	5	5	4	80	1	40	5	3		3	3	3	3	1	1	3	3		**20**	2	21.5	2	21.5	2	**19**	2	20.5	2	20.5	2	High	
897000	Wanganui River	Lower	3, 4	5	5	4	90	1	100	3	3		3	3	3	3	1	2	2	3		**20**	2	21.5	2	21.5	2	**19**	2	20.5	2	20.5	2	High	
901100	Kakapotahi River	Lower	4	4	3	4	80	4	200	5	2		3	2	3	3	3	2	3	2		**21**	1	22.5	1	22.5	1	**18**	3	19.5	3	19.5	4	High	
903000	Mikonui River		2	5	5	4	100	4	50	2	3		3	3	3	3	3	1	2	3		**21**	1	22.5	1	22.5	1	**18**	3	19.5	3	19.5	4	High	

929000	Totara River		4	4	4	5	10	4	150	5	3		3	3	3	1	3	2	3	3		**21**	1	22.5	1	21.5	2	**18**	3	19.5	3	18.5	6	High	
911310	Taipo River	Seven Mile	2, 3	4	4	4	90	3	160	3	2		3	3	3	3	2	2	2	2		**20**	2	21.5	2	21.5	2	**18**	3	19.5	3	19.5	4	High	
906000	Hokitika River	Mungo	5	5	5	5	40	1	20	5	3		3	3	3	2	1	1	3	3		**19**	3	20.5	3	20	5	**18**	3	19.5	3	19	5	High	
906000	Hokitika River	Serpentine	5	5	5	5	60	1	60	5	3		3	3	3	2	1	1	3	3		**19**	3	20.5	3	20	5	**18**	3	19.5	3	19	5	High	
906050	Kokatahi River	Crawford	5	5	5	5	60	1	50	5	3		3	3	3	2	1	1	3	3		**19**	3	20.5	3	20	5	**18**	3	19.5	3	19	5	High	Internationally scarce
868200	Landsborough River		4	5	5	3	80	1	50	5	3		3	3	2	3	1	1	3	3		**19**	3	20.0	4	20.5	4	**18**	3	19	4	19.5	4	High	
893250	Perth River	Upper	5	5	5	5	50	1	20	5	3		3	3	3	2	1	1	3	3		**19**	3	20.5	3	20	5	**18**	3	19.5	3	19	5	High	
864000	Waiatoto River		4	5	5	4	80	1	40	3	3		3	3	3	3	1	1	2	3		**19**	3	20.5	3	20.5	4	**18**	3	19.5	3	19.5	4	High	
893000	Whataroa River	Upper	5	5	5	4	40	1	10	5	3		3	3	3	2	1	1	3	3		**19**	3	20.5	3	20	5	**18**	3	19.5	3	19	5	High	
906140	Whitcombe River	Wilkinson	5	5	5	5	60	1	20	5	3		3	3	3	2	1	1	3	3		**19**	3	20.5	3	20	5	**18**	3	19.5	3	19	5	High	
906140	Whitcombe River	Prices	5	5	5	5	60	1	60	5	3		3	3	3	2	1	1	3	3		**19**	3	20.5	3	20	5	**18**	3	19.5	3	19	5	High	
	Crooked River	Upper	4, 5	5	5	5	30	2	100	5	3		3	3	3	1	1	2	3	3		**19**	4	20.5	5	19.5	8	**18**	3	19.5	3	18.5	6	High	
901100	Kakapotahi River	Upper	5	5	3	5	60	4	150	5	2		3	2	3	2	3	2	3	2		**20**	2	21.5	2	21	3	**17**	4	18.5	5	18	7	Med	
908000	Arahura River	Styx Saddle	5	5	5	5	50	1	10	2	3		3	3	3	2	1	1	2	3		**18**	4	19.5	5	19	7	**17**	4	18.5	5	18	7	Med	
868250	Burke River		5	5	5	5	60	1	10	3	3		3	3	3	2	1	1	2	3		**18**	4	19.5	5	19	7	**17**	4	18.5	5	18	7	Med	
	Red Granite		5	5	5	5	10	1	5	5	3		3	3	3	1	1	1	3	3		**18**	4	19.5	5	18.5	8	**17**	4	18.5	5	17.5	8	Med	Recently kayaked
	Roaring Meg		5	5	5	5	5	2	5	5	3		3	3	3	1	1	1	3	3		**18**	4	19.5	5	18.5	8	**17**	4	18.5	5	17.5	8	Med	Recently kayaked
906054	Toaroha River	Upper	4	5	5	4	50	1	10	3	3		3	3	3	2	1	1	2	3		**18**	4	19.5	5	19	7	**17**	4	18.5	5	18	7	Med	
914060	Arnold River		2	3	2	4	100	4	800	3	2		2	1	3	3	3	3	2	2		**19**	3	20.5	3	20.5	4	**16**	5	17.5	6	17.5	8	Med	
914000	Grey River	Gentle Annie	3	5	4	3	100	4	80	2	2		3	3	2	3	3	1	2	2		**19**	3	20.0	4	20.5	4	**16**	5	17	7	17.5	8	Med	
952000	Oparara River		5	5	5	5	10	4	20	3	3		3	3	3	1	3	1	2	3		**19**	3	20.5	3	19.5	6	**16**	5	17.5	6	16.5	10	Med	Internationally scarce
943000	Mokihinui River	North Branch	4, 5	5	5	5	30	1	20	2	3		3	3	3	1	1	1	2	3		**17**	5	18.5	7	17.5	10	**16**	5	17.5	6	16.5	10	Med	
	Stony River (Reefton)		5	5	5	5	10	1	10	3	3		3	3	3	1	1	1	2	3		**17**	5	18.5	7	17.5	10	**16**	5	17.5	6	16.5	10	Med	
906055	Styx River	Grassy Flats	5	5	5	5	20	2	20	2	3		3	3	3	1	1	1	2	3		**17**	5	18.5	7	17.5	10	**16**	5	17.5	6	16.5	10	Med	
866000	Turnbull River		5	3	4	5	40	2	40	3	3		2	3	3	2	1	1	2	3		**17**	5	18.5	7	18	9	**16**	5	17.5	6	17	9	Med	
906140	Whitcombe River	Saddle	5	5	5	5	10	1	2	2	3		3	3	3	1	1	1	2	3		**17**	5	18.5	7	17.5	10	**16**	5	17.5	6	16.5	10	Med	
914190	Ahaura River		2	3	4	3	90	4	20	2	2		2	3	2	3	3	1	2	2		**18**	4	19.0	6	19.5	6	**15**	6	16	9	16.5	10	Med	
947000	Falls Creek	Hokitika	5	4	4	5	10	4	50	1	3		3	3	3	1	3	1	1	3		**18**	4	19.5	5	18.5	8	**15**	6	16.5	8	15.5	11	Med	
924000	Fox River	Fox Glacier	3, 4	3	2	5	100	4	50	2	3		2	1	3	3	3	1	2	3		**18**	4	19.5	5	19.5	6	**15**	6	16.5	8	16.5	10	Med	
	Big Totara		4	4	4	4	10	2	20	2	2		3	3	3	1	1	1	2	2		**16**	6	17.5	9	16.5	11	**15**	6	16.5	8	15.5	11	Med	
914140	Blackball Creek	Smoke Ho	5	4	5	5	10	2	30	2	2		3	3	3	1	1	1	2	2		**16**	6	17.5	9	16.5	11	**15**	6	16.5	8	15.5	11	Med	
	Crooked River	Lower	3	5	2	3	50	4	150	3	2		3	1	2	2	3	2	2	2		**17**	5	18.0	8	18	9	**14**	7	15	10	15	12	Med	
868000	Haast River		5	4	2	3	90	4	20	3	2		3	1	2	3	3	1	2	2		**17**	5	18.0	8	18.5	8	**14**	7	15	10	15.5	11	Med	
	Chasm Creek		4	4	3	4	30	4	10	1	2		3	2	3	1	3	1	1	2		**16**	6	17.5	9	16.5	11	**13**	8	14.5	11	13.5	14	Med	
914170	Moonlight Creek	To bailey bridge	3	4	3	4	10	4	30	2	1		3	2	3	1	3	1	2	1		**16**	6	17.5	9	16.5	11	**13**	8	14.5	11	13.5	14	Med	
911380	Otira River		5	3	1	5	10	4	10	3	3		2	1	3	1	3	1	2	3		**16**	6	17.5	9	16.5	11	**13**	8	14.5	11	13.5	14	Med	
	Waimangaroa		4	3	3	5	40	2	50	1	2		2	2	3	2	1	1	1	2		**14**	8	15.5	12	15	13	**13**	8	14.5	11	14	13	Med	
	Waiho River		3, 4	2	2	4	90	4	40	2	1		1	1	3	3	3	1	2	1		**15**	7	16.5	10	16.5	11	**12**	9	13.5	12	13.5	14	Med	
932000	Buller River	Iron Br downstream	2	3	1	2	100	4	90	1	2		2	1	2	3	3	1	1	2		**15**	7	16.0	11	16.5	11	**12**	9	13	13	13.5	14	Med	
859000	Cascade River		4	3	3	3	40	4	10	1	2		2	2	2	2	3	1	1	2		**15**	7	16.0	11	16	12	**12**	9	13	13	13	15	Med	
906014	Bluebottle Creek		4	3	2	4	10	4	30	2	1		2	1	3	1	3	1	2	1		**14**	9	15.5	13	14.5	14	**11**	10	12.5	14	11.5	16	Med	
939000	Ngakawau River		5	1	2	1	30	2	5	1	3		1	1	1	1	1	1	1	3		**10**	10	10.5	14	10.5	15	**9**	11	9.5	15	9.5	17	Low	Scarce because poor quality

Appendix 6A-5
Other factors relevant to the assessment of significance for whitewater kayaking (Step 9)

Access Access is a prerequisite for kayaking and will influence the pattern of use. Lack of legal or practical access may limit or completely restrict use, even to otherwise suitable sites.
Connectedness – the suite of kayaking opportunities in the region Individual rivers may contribute to a set of values found within a region or nationally – the sum may be greater than the parts. If parts of the collective are compromised, this may act as a 'tipping point' to reduce or negate the value of the collective. For example, the West Coast attracts international kayakers, partly because it offers multiple whitewater kayaking trips across a spectrum of rivers. There is an 'itinerary' of river trips, which builds up (by river) in terms of the kayaking skill required. Kayakers visit the West Coast because of this collective of high volume, technically challenging wilderness rivers, which occur in close proximity to each other. This argument mirrors biodiversity hot spots of endemism – hot spots for whitewater kayaking may occur that require protection.
Users' perceptions of the river's importance (including its 'status') Certain rivers have national or international status (reputation) within the kayaking community. The Expert Panels noted that many West Coast rivers have an international reputation or status. This makes the West Coast unique within New Zealand for whitewater kayaking value.
Potential future kayaking use This is about the potential to undertake kayaking in the future. The goal is to avoid precluding future recreational use. Kayaking has been subject to a dramatic increase in the type and number of rivers that are able to be paddled in the last 20 years primarily as a result of technological advancements in kayak design and materials. Changes in access similarly may alter use. As a result, existing use patterns may be poor indicators of future use value. The best example of this phenomenon is the work by Egarr and Egarr (1981). Their assessment of the recreational potential of New Zealand rivers nearly three decades ago does not match the current use patterns owing to the sort of factors already outlined. For this reason, 'future proofing' for potential recreational value is required. Some decisions may inadvertently preclude future recreational options. The goal is to avoid this outcome.
Existence and option value Existence value - Some river sections are valued because they have not been paddled (e.g., Morgan Gorge, Waitaha River) or can only be paddled by the elite few who have the technical skill to do so. Option value - For the West Coast, option value is particularly associated with kayakers' aspirations to paddle challenging whitewater river sections, once their kayaking skills have developed to that level.

Appendix 6A-6
Future data requirements for whitewater kayaking (Step 10)

Data need
Testing the attributes identified for whitewater kayaking and identifying their relative co to kayaking value
Users' perception of scenic attractiveness
Users' perception of wilderness character
Hydraulic morphological index (for hydraulic density indicator)
Data for flow reliability indicator
Number of kayaker days (by time period over which river is kayaked)
Users' home location
Data for scarcity of kayaking opportunity indicator
Users' evaluation of the overall importance of the river

Part B: Whitewater kayaking in the Tasman District: Application of the River Values Assessment System (RiVAS)

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Geoff Miles (Kayaker)
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6.3 Introduction

6.3.1 *Purpose*

This section presents the results from an application of the river values assessment system (RiVAS) for whitewater kayaking in the Tasman District undertaken in June 2010. This is the third application of the RiVAS for whitewater kayaking; the first was conducted in the West Coast Region (Booth, et al., Part A, herein) and the second by the Hawke's Bay Regional Council (HBRC in prep.). A workshop was held on 26 June to apply this method to Tasman District rivers. Hughey et al. (Chapter 3 herein) outline the RiVAS method.

6.3.2 *Preparatory step: Establish an Expert Panel*

The Expert Panel for the whitewater kayaking application in Tasman District comprised Trevor James, Stu McGowan, Geoff Miles and Matt Price (all experienced kayakers from Tasman District). Andy England (Whitewater New Zealand) acted as an advisor. Kay Booth (Lindis Consulting) facilitated the workshop and drafted this chapter. Credentials of members of the Expert Panel and the advisors are provided in Appendix 6B-1.

It was noted that a lot of valuable information about rivers emerged during the workshop; and having a council staff member is invaluable for recording this information at RiVAS workshops.

6.3.3 *Summary of this assessment*

The Expert Panel applied seven resource and user attributes to assess 52 whitewater kayaking runs in the Tasman District. The method was applied to differentiate sites of high, medium and low importance for whitewater kayaking. Few data were available, so the Expert Panel relied on their own assessments for most attributes. Minor revision was made to the RiVAS approach for whitewater kayaking, notably the scarcity attribute was redefined as 'regional value' (and national value was separately recorded), and *density* of hydraulic features was applied with respect to the primary kayaking opportunity (i.e., revised to *suitability* of the hydraulic features to the primary user group).

6.4 Application of the method

6.4.1 *Step 1: Define river value categories and river segments*

River value categories

Whitewater kayaking is a multi-dimensional form of recreation. It is undertaken by people with different skill levels and encompasses a range of types of experiences (e.g., easy introductory paddling to technically challenging descents). It may be undertaken as a commercial activity (e.g., skill instruction or river guiding), part of a school or tertiary education programme/curriculum, or competitively. Whitewater kayaking is usually undertaken in groups for safety reasons, giving the activity a strong social dimension. It is resource-dependent – it requires whitewater and is strongly influenced by the type and quality of whitewater. Whitewater kayaking is also a continually evolving activity, and has changed dramatically since the 1970s with the advent of plastic craft and specialised designs. This has resulted in an ability to paddle a wide range of river environments, including increasingly difficult rivers. Kayak design continues to advance and a variety of boat options are available to suit different types of water and paddling styles.

Whitewater kayaking is undertaken using a double-bladed paddle with the kayaker in a sitting position and enclosed in a water-tight cockpit. Kayaking is the primary activity focus of this chapter, however this assessment also covers canoeing – where paddlers use a single-bladed paddle in a kneeling position. Other whitewater pursuits (e.g., rafting, river bugging and river boarding) were excluded from this assessment, because some different characteristics apply to them.

River segments

In advance of the workshop, one member of the Expert Panel identified river reaches that were kayaked. These were mostly drawn from a list already compiled by the Council for the Tasman Resource Management Plan. The resultant list was discussed by the Panel at the beginning of the assessment workshop and additions made. The list represents sections of rivers that are regularly kayaked (as at 2010), or hold value for whitewater kayakers even if seldom kayaked.

Many rivers were divided into multiple kayak runs (e.g., 14 rivers sections were listed for the Buller River). Three 'park and play' features were separately listed from river runs, as they represent different 'sections' of the river effectively. 'Park and play' refers to a single high quality river feature (e.g., a wave, hydraulic or eddy line), that is easily accessible by road and may be a destination in itself due to the potential kayaking experience it offers. Key Grade 1-2 runs, including adjacent flatwater river sections, were included in the assessment as the Panel considered them to be critical for whitewater kayaking as 'learning grounds'. These were defined as the sections used regularly by local canoe clubs.

A total of 52 river sections were identified (see Appendix 6B-4).

This identification of rivers was based on Panel members' local knowledge and with reference to a whitewater kayaking guidebook (Charles 2006). Using this approach, the selected rivers represent the most valuable kayaking whitewater rivers in the region.

Tasman rivers which were not included in the assessment were considered to hold:
1. Negligible value for whitewater kayaking: either they had no whitewater kayaking value or they had been kayaked but were considered to hold low value (i.e., unlikely to become popular owing to factors such as unusual flow regimes or variable terrain); or
2. Unknown kayaking value (yet to be paddled); or
3. Known kayaking value but not accessible at the time of the assessment.

It was noted that the Buller River Earthquake section had been missed in the West Coast whitewater kayaking RiVAS application. This section is in the West Coast Region and, therefore, should have been assessed in that Region. So they were not missed altogether, these sections were assessed by the Tasman Expert Panel (who were familiar with the sections).

The assessment of kayaking river sections in this study pertains to <u>present-day</u> kayaking opportunities. The Panel stressed that river value may change over time, subject to access provision and other factors.

As part of the assessment, the river grade and mode of access were recorded (Appendix 6B-4). A river's grade does not imply value (all grades may be equally valued) but provides a means to identify the type of kayaking experience available on that section of river. See Table 6-2.

Table 6-2
International scale of whitewater difficulty (Charles 2006:14-15)

Grade I	Moving water with a few riffles and small waves. Few or no obstructions.
Grade II	Easy rapids with waves up to one metre. Clear channels obvious without scouting. The ability to move your craft across the current is not necessary.
Grade III	Rapids with high, irregular waves and narrow passages. The ability to spin and manoeuvre is necessary.
Grade IV	Difficult rapids requiring a series of controlled moves, cross-current and spinning in confused water. Scouting often necessary and a reliable roll is mandatory.
Grade V	Very difficult, long and violent rapids. Nearly always must be scouted. Definite risks in the event of a mishap. Requires a series of controlled, precise, 'must make' moves to navigate successfully.
Grade VI	Extreme, very dangerous and only for experts. Close inspection is mandatory and all possible safety precautions should be taken.

Initial assessment

On the advice of Whitewater New Zealand, the Expert Panel started the workshop by undertaking an 'overall importance for whitewater kayaking' assessment of all river sections. Collectively, the Panel assigned high, moderate or low value to each river section. This was then set aside and revisited at the end of the workshop.

When compared with the RiVAS assessment results, a close match was evident. Of the 52 sections, 10 differed (the RiVAS assessment rated 5 sections higher, 2 sections lower, and 3 sections differed by only a slight margin – e.g., high c.f. moderate-high). The Panel discussed each point of difference and opted in each case to retain the value assessed by the RiVAS method. See the discussion in Step 8B.

Outcomes

The activity of whitewater kayaking was defined: excludes rafting, river bugging and similar pursuits but includes all types of whitewater kayaking on rivers of Grade II and above.

A list of Tasman river sections used for whitewater kayaking was identified.

6.4.2 ***Step 2: Identify attributes***

Attributes to describe whitewater kayaking developed for the West Coast case study (Booth et al., Part A herein) were 'taken as given'.

Outcome

A list of all attributes is provided in Appendix 6B-2. This list is the same as that presented for the West Coast Region.

6.4.3 ***Step 3: Select and describe primary attributes***

The primary attributes used for the West Coast and Hawke's Bay case studies were applied to Tasman rivers. The Panel discussed the primary attributes at the beginning of the workshop to familiarise themselves and discussion centred on the Advisors concern that the present method favoured rivers of higher grades. With respect to this concern, several approaches were discussed and trialled during the workshop, including:

- *Perception of wilderness*: The issue with this attribute was that the more accessible rivers, valued be Grade II paddlers, by definition are unlikely to have high wilderness value. The Panel tried assessing each river for its *suitability* of its wilderness value to the primary user group. This did not work. It was felt that wilderness was a concept that either existed or did not. Defining it in as 'suitable' would result in consistently high ratings (e.g., the Penrith whitewater course has no wilderness value but would rate highly as its degree of wilderness is very suitable for its purpose). The assessment criteria reverted back to the attribute as it stood – *perception* of wilderness. This was confirmed as an important attribute by the Panel and should be retained as well as *perception of scenic attractiveness*.
- *Density of high quality hydraulic features:* A positive relationship between hydraulic density and river grade (a kayaker skill level required) was noted – the higher the grade, the more dense the features (generally). However, it was believed that less skilled kayakers did not value very dense hydraulic features, as they needed a break between features – high density was not always a good thing. Therefore this attribute was adjusted to *suitability of hydraulic features* for the primary type of kayaker.
- *Scarcity of kayaking opportunity:* While the attribute was confirmed to be important, the Panel agreed with advisors that its definition was problematic (this had been highlighted in the Hawke's Bay application). Two issues were identified:

  Value was considered more pertinent than scarcity as it includes both the scarcity of the opportunity (a resource factor) and convenience (a user-related factor). An opportunity might be very scarce but not very valuable if it was very distant, whereas an opportunity might be more common but very valuable because of its close proximity.

  Scale of application – 'regional' value was felt to be the most relevant but it was noted that this differs from national value. For example, the Hurunui River in Canterbury was believed to hold low national value, but very high value for Canterbury kayakers.

  The agreed solution was to separately identify 'regional value' and 'national value' for each river section. The workshop assessed both regional and national value and ran sensitivity analysis to test their inclusion (discussed later under Step 7). Inclusion of 'national value' in the assessment did not improve results and was therefore dropped (it is suggested that this is recorded but not assessed in future applications). The redefined attribute *Regional value* was found to work well. Its rating scale was defined as:

  1. *Not very valuable.*
  2. *Somewhat valuable.*
  3. *Valuable (preferred choice).*
  4. *Very valuable.*
  5. *Essential (only one of its kind).*

  In the assessment, participants considered the value to local kayakers (e.g., Golden Bay rivers were assessed for their value to kayakers from Golden Bay).

All other attributes were applied as without modification.

Outcome

Appendix 6B-2 describes the seven primary attributes (in bold).

6.4.4 ***Step 4: Identify indicators***

Indicators were adopted from the WC application with adaption for the modified attribute (that was 'scarcity' - now 'regional value'). The seven indicators were:

1. *Perception of scenic attractiveness (rating scale):* The scale from the 1991 River Use Survey (NZCA 1991) was used, which incorporates elements of river scenery descriptors published by Egarr and Egarr (1981) and Egarr et al. (1979).

    1. *Not attractive: river environs and surrounding country generally uninspiring, river water may be dirty or discoloured.*
    2. *Moderately attractive: some local features of scenic interest, mixed with less attractive sections.*
    3. *Attractive: scenic appeal is significant, but generally derived from local features such as bankside vegetation and the nature of the river environs rather than large scale grandeur.*
    4. *Very attractive: river environs scenic and sometimes spectacular. Surrounding country provides striking views.*
    5. *Inspiring: scenery spectacular and varied. Large scale vistas (e.g., mountains/bush/open country), and/or unique and striking river environs (e.g., rock formations, gorges, overhanging vegetation, deep and clear pools, rapids).*

    It would be desirable to use kayakers' perceptions of scenic attractiveness, as perceived from river level. In the absence of such data, the Expert Panel provided data estimates.

2. *Perception of wilderness character (rating scale):* This measure was used in the 1991 River Use Survey (NZCA 1991). The Expert Panel provided estimates for individual rivers. The 1991 ranking scale was:

    1. *No wilderness feeling; road traffic or other human activity generally visible/audible from river. Highly modified river environment.*
    2. *Little wilderness feeling; roads/human activity readily accessible from river, even if not directly visible. River environment show obvious signs of modification.*
    3. *Some wilderness feeling; river environment may be modified, but canoeist is essentially isolated from immediate human activity. Roads generally reachable from river, but may involve some rough scrambling.*
    4. *Strong wilderness feeling; largely unmodified environment, with very limited access to any form of roading, Walking out from river feasible, but could take up to a day.*
    5. *Exceptional wilderness feeling; pristine environment, extreme sense of remoteness, walk-out long arduous, and difficult.*

3. *Suitability of high quality hydraulic features (rating scale):* This indicator was defined as 'the number, variety and quality of hydraulic features (e.g., waves, holes, eddies, drops)' (Whitewater New Zealand 2009) suitable for the primary kayaking opportunity**.** The Expert Panel estimated data for this indicator.

4. *Flow reliability (% of time river is kayakable):* This attribute was assessed with respect to the percentage of time the river is suitable for the particular kayaking opportunity for which it is valued (i.e., % time able to be paddled when suitable for the primary kayaking opportunity). In the absence of any empirical data, the Expert Panel estimated data for this indicator.

5. *Number of users (kayaker days per annum):* A positive relationship between numbers and kayaking value is assumed, although high-skill (high river grades) and remote rivers will only be used by small numbers of kayakers and this does not mean those rivers have low kayaking value. Since no data were available, the Expert Panel estimated kayaker numbers. Ideally, more robust user counts data would be used.

6. *User catchment (home district/region):* The greater the distance a kayaker travels to paddle a river, the greater the value. Kayaker origin was considered the most appropriate metric. The scale used was:

    1. *Within district (live within territorial authority boundary in which river is located; or was considered primarily to attract 'local' users).*
    2. *Within region (regional council boundary) but outside home district.*
    3. *From neighbouring region (home region borders region in which river is located).*
    4. *Rest of New Zealand but beyond neighbouring regions.*

5. *International.*

A threshold of 10% of users from the district/region was chosen to trigger the rank (e.g., ≥10% of users from other countries would receive a ‘5’; ≥10% of users from districts within the region but not the same district as that in which the river is located would receive a ‘2’).

In the absence of any pre-existing data, estimates of the Expert Panel were used.

In the view of the Murchison-based New Zealand Kayak School clients and staff, use of local rivers was considered ‘local’ or within-district (i.e., while the kayaker might be from overseas, the distance was measured from Murchison). Before or after their course, overseas clients of the New Zealand Kayak School may stay in the Murchison area to kayak independently. In this context their use is considered ‘international’.

7. *Regional value of the kayaking opportunity (rating scale):* The ‘kayaking opportunity’ refers to the type of kayaking experience (e.g., introductory; multi-day wilderness kayak trip). In the absence of data, estimates from the Expert Panel were used for this indicator.

   The following scale was used:

   1. *Not very valuable.*
   2. *Somewhat valuable.*
   3. *Valuable (preferred choice).*
   4. *Very valuable.*
   5. *Essential (only one of its kind).*

National value of the kayaking opportunity was tested as an attribute and rejected – the decision was made to record but not assessed this information. The following scale was devised:

1. *Not very valuable.*
2. *Locally valuable.*
3. *Regionally valuable.*
4. *North or South Island valuable.*
5. *Nationally valuable.*

Outcome

Indicators are listed in Appendix 6B-2and assessed against SMARTA criteria in Appendix 6A-3.

6.4.5 ***Step 5: Determine indicator thresholds***

The thresholds developed as part of the West Coast case study were used, with modification only for the revised attribute ’regional value’. The thresholds are given in Appendix 6A-4.

1. Where a 5-point scale was used to measure the indicator (e.g., perception of wilderness), indicator scores were assigned to thresholds as follows:

   High (3) = 4 or 5 score
   Medium (2) = 3 score
   Low (1) = 1 or 2 score

2. *User catchment (home district/region):* An exception to the 5-point scale application, as follows:

   High (3) = Rest of New Zealand, or International.
   Medium (2) = Within region, or From neighbouring region.
   Low (1) = Within district.

3. *Flow reliability (% of time river kayakable):* Thresholds were chosen in equal divisions (thirds):

   High (3) = > 66%
   Medium (2) = 33-66%
   Low (1) = < 33%

4. *Number of users (kayaker days per annum):* Thresholds were:

High (3) = > 500
Medium (2) = 100-500
Low (1) = < 100

Outcome

Thresholds are identified in Appendices 6B-2 and 6B-4.

6.4.6 ***Step 6: Apply indicators and indicator thresholds***

All data were estimated by the Expert Panel.

Outcome

Data estimates are shown in Appendix 6B-4.

6.4.7 ***Step 7: Weighting the primary attributes***

The Expert Panel reviewed the seven primary attributes and considered whether some made a relatively greater contribution to the understanding of whitewater kayaking. Several scenarios were tested (sensitivity analysis):

- With (and without) scores for national value;
- Flow reliability decreased in weighting (by half).

Flow reliability was reduced in weighting because many of the high quality kayak runs in Tasman District are rain dependent.

The outcome of the subsequent discussion of the various scenarios was to leave the attributes equally weighted and leave out the 'national value' attribute. The primary rationale for equal weighting was that data were not available to identify the relative contribution of each attribute to the value placed on rivers by kayakers. The inclusion of the 'national value' scores resulted in a ranked list that was very similar to the list without these scores. It was decided these scores added little and it was better to leave them out.

Outcome

Equal weighting applied to the seven primary attributes.

6.4.8 ***Step 8: Determine river value for whitewater kayaking***

Step 8a: Rank rivers

The spreadsheet was used to sum the indicator threshold scores for each river and then sorted in descending order. This provided a list of rivers ranked by their value scores. It was agreed that rankings *per se* were not particularly helpful (i.e., the exact order of one river compared with the next). The strength of the process was the grouping of rivers into high-medium-low (Step 8B). Where an individual reach seemed out of its expected 'place' in the list, individual indicators were reviewed. Occasionally these were adjusted (i.e., where it was felt they had been incorrectly assigned in the first place). This was not done arbitrarily – the integrity of the process was maintained. Instead it served as a useful check on results.

Step 8b: Identify river's value to kayaking

The Panel assessed whether the selection of thresholds or cut-off points was the best method to assign high-med-low value to the list of rivers, or whether to apply attribute rules.

While the West Coast kayaking assessment used cut-off points, the Hawke's Bay kayaking assessment used the rules system, as this seemed to better fit Hawke's Bay rivers.

After discussion, the Panel decided that using cut-off points was a fair representation of Tasman rivers' kayaking values (see Appendix 6B-4). As a result, 20 river sections (including 2 'park & play' features) were assessed as high value, 13 as moderate value (including 1 'park & play' feature) and 19 as low value (including 1 'park & play' feature).

Comparison of RiVAS assessment with initial assessment

As discussed earlier (Step 1), a comparison was made at this stage in the workshop between the results of the RiVAS assessment and the initial 'top of mind' assessment undertaken at the beginning of the workshop. Results were closely aligned. Ten (out of 52) river sections differed. Each case was discussed and in all cases, the Panel chose the RiVAS result. The differences were:

Five sections were rated higher by RiVAS (c.f. initial) assessment:

- 2 were High for RiVAS and Moderate for the initial assessment;
- 3 were Moderate for RiVAS and Low for the initial assessment

Two sections rated lower by RiVAS (c.f. initial) assessment:

- 1 was Moderate for RiVAS and High for the initial assessment;
- 1 was Low for RiVAS and Moderate for the initial assessment.

Three sections differed by 'half' a rating:

- 1 was High for RiVAS and Moderate-High for the initial assessment
- 1 was Moderate for RiVAS and Moderate-High for the initial assessment;
- 1 was Low for RiVAS and Low-Moderate for the initial assessment.

Outcomes

A list of rivers ranked by the scoring system from highest to lowest, which represents an initial ranking for kayaking value (see Appendix 6B-4).

Rivers identified as high, moderate and low value for whitewater kayaking. See Appendix 6B-4.

Rivers in the Tasman District not listed have either negligible whitewater kayaking value or hold value but are unable to be accessed by kayakers (as at June 2010).

Comparison between the RiVAS assessment results and an initial 'top of mind' kayakers' assessment showed close alignment. The Panel choose the RiVAS results for each case where results differed.

6.4.9 ***Step 9: Outline other factors relevant to the assessment of significance***

During the workshop, the Expert Panel discussed various factors relevant to the assessment. These were:

- Access – a prerequisite for kayaking;
- Users' overall rating of the river's importance; and
- Potential future kayaking use – the river's value is associated with the opportunity to kayak at times of differing use levels.

These attributes were not assessed, but are relevant to decision-making about whitewater kayaking.

The Panel noted that the collection of rivers around Murchison, which is centred on the Buller River catchment, has significant value associated with its *collection* of numerous high quality kayak runs. Reliable kayaking opportunities exist for the beginner through to the experienced kayaker. If one river is not suitable for kayaking (owing to flooding or similar), another river section will be available. These values relate to a 'set' of rivers and are somewhat lost in the assessment because of the focus on individual sections (rather than whole waterways and catchments). The ‘number of users’ and ‘user catchment’ attributes for these rivers, while typically scoring high, do not fully reflect the bigger picture of the Murchison experience.

Outcome

List and description of non-measured attributes (Appendix 6B-5).

6.4.10 *Step 10: Review assessment process and identify future information requirements*

The Expert Panel did not discuss future research needs. However, it was clear from the workshop that the Panel wish to replace data estimates with empirical data. This would increase confidence in the assessment outcome.

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Appendix 6B-1
Credentials of the Expert Panel members and advisors

Expert Panel

Trevor James has held numerous executive canoe club positions (President and committee member, Nelson Canoe Club; past President Westland Canoe Club; committee member of University of Canterbury Canoe Club; past member of Auckland Canoe Club). He is the current President of the Nelson Canoe Club. He has a kayak instructor's qualification (NZCA Level One) and has been teaching whitewater kayaking since 1986. He has paddled extensively in New Zealand and overseas up to Grade 5. In his professional life, he is a resource scientist with the Tasman District Council, where he is responsible for surface water quality and aquatic ecology monitoring, reporting on the State of the Environment, and advising consents and planning staff on specific issues and options.

Stuart McGowan is an outdoor education teacher at Murchison Area School. He has been kayaking for more than 20 years throughout New Zealand and overseas. In 2003 and 2004 he was manager and coach for the National Junior Kayak Slalom Team on competition trips to Europe and Australia. He is currently President of the River Guardians Society of Murchison. Stuart has chosen to live in the Nelson/Tasman district primarily because of the river and outdoor opportunities in the region.

Geoff Miles has an extensive whitewater kayaking background with over 25 years experience on rivers around New Zealand and internationally. Based in Nelson, he works as a chemist at the Cawthron Institute with a focus on water quality.

Matt Price has been kayaking in the Tasman district for 15 years, having learnt to kayak through the Nelson Canoe Club in 1995. He has spent the last 7 years in the Motueka Valley, using most of his spare time exploring the rivers of the Mt Arthur range and Golden Bay. He is a member of Whitewater New Zealand.

Advisor:
Andy England is a member of Whitewater New Zealand based on the West Coast. He has been kayaking whitewater since he was a teenager growing up in the UK. Andy has competed in slalom kayaking and travelled the world to kayak and explore whitewater rivers in Norway, France, Austria, Italy, the USA, Canada, Nepal and New Zealand. He is qualified as a Level 1 kayak coach by the New Zealand Outdoor Instructors Association and has taught kayaking since 1988. In 1991 he moved to Scotland to be closer to more adventurous whitewater rivers and since 2001 has lived in Greymouth. Andy has kayaked rivers extensively on the West Coast. He is Deputy Principal of Greymouth High School.

Facilitator:
Dr Kay Booth is an outdoor recreation researcher and planner. She is the Director of Lindis Consulting and, until recently, a Senior Lecturer in parks, recreation and tourism at Lincoln University. With colleagues, Kay developed the significance assessment method on which this application is based and advised the Expert Panels for the West Coast and Hawke's Bay whitewater kayaking case studies. She holds appointments on the New Zealand Walking Access Commission and the New Zealand Conservation Authority. She is a novice whitewater kayaker.

Appendix 6B-2
Assessment criteria for whitewater kayaking (Steps 2-4)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR THRESHOLDS	DATA SOURCES (AND RELIABILITY)
Step 2: Identify attributes Step 3: Select and describe primary attributes		Step 3: Select and describe primary attributes	Step 4: Identify indicators	Step 5: Determine significance thresholds	
ATTRIBUTES ASSOCIATED WITH EXISTING USE					
Users	**Number of users**	High use implies high value. However, this assumption will under-value special and remote places for several reasons, including: **Activity specialisation.** Resources suitable for highly specialised participants (high skill levels) will attract low numbers of users but may be highly valued and/or rare opportunities. **Access.** Restrictions upon access will reduce use and/or make it available only to some potential users due to cost, availability of time, specialised equipment or transport, physical capability, etc. **Wilderness and remote areas**. Areas that offer few encounters with other people may be highly valued for this attribute (amongst other things).	Number of kayaker days p.a.	High: >500 kayaker days p.a. (**score: 3**) Medium: 100 - 500 kayaker days p.a. (**score: 2**) Low: <100 kayaker days p.a. (**score: 1**)	Expert Panel estimate (fair)
	Level of commercial use	This may imply higher value (positive relationship with level of commercial use).			
	User catchment	Origin of users is suggested as an indicator of quality of the recreational experience, based on the assumption that the higher the expected quality of the experience, the greater the distance users will be prepared to travel. A threshold of 10% of users from the district/region triggers the rank, e.g., 10% of users from other countries	Kayaker's home district/region: 1=Within district (live within local area in which river is located). 2=Within region (Tasman District boundary) - outside home area. 3=From neighbouring region	High: Rest of New Zealand, or International (**score: 3**) Medium: Within region, or From	Expert Panel estimate (fair)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		receive a '5'; 10% of users from districts within the region but not the same district as that in which the river is located receive a '2'.	(home region borders region in which river is located). 4=Rest of New Zealand but beyond neighbouring regions. 5=International.	neighbouring region (**score: 2**) Low: Within district (**score: 1**)	
Activity	Skill required	Correlates positively with the river's whitewater grade			
	Type of use	For example, beginner instruction; adventure kayaking			
Environmental setting: Water characteristics	**Suitability of hydraulic features**	Number, variety and quality of hydraulic features (e.g., waves, holes, eddies, drops) suitable for the primary kayaking opportunity/users	Kayakers' perception. Expert Panel estimate (5-point rating scale): 1=Not at all suitable to 5=Very suitable	High suitability (**score: 3**) Moderate suitability (**score: 2**) Low suitability (**score: 1**)	Expert Panel estimate (good)
	Flow reliability	Correlates positively with kayaking value, although some exceptions. Will influence user catchment – locals more able to take advantage of unpredictable flow events	% of time river is kayakable. Expert Panel estimate: bands of 10%	High: >66% (**score: 3**) Medium: 33-66% (**score: 2**) Low: <33% (**score: 1**)	Expert Panel estimate (fair)
	Whitewater character	Includes gradient and volume of river section (e.g., low volume, high gradient pool drop c.f. continuous low gradient but large volume river sections)			
	Continuity of whitewater features	How often features occur in a single run			
	Length of kayak run	Usually, the longer the run, the higher the value			
	Presence of 'play spots'	'Playing' does not involve travel downstream. Play spots may be present only in certain flows.			
	Presence of	Examples – scenic gorge, cliffs faces (natural landscape			

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR THRESHOLDS	DATA SOURCES (AND RELIABILITY)
	iconic river features	features or human artefacts)			
	Water quality	Includes clarity, purity and ability to support ecosystems and species. High water quality is 'nice to have' and not essential but normally adds to a river's value.			
	Scenic attractiveness	A common attribute in (the few) river user surveys. Generally, it is expected that there is a positive relationship between perceived scenic attractiveness and kayaking amenity.	Kayaker's perception of scenic attractiveness. Expert Panel estimate (5-point rating scale): 1=Not attractive to 5=Inspiring	High scenic value (**score: 3**) Moderate scenic value (**score: 2**) Low scenic value (**score: 1**)	Expert Panel estimate (good)
	Wilderness character	This setting attribute has a positive relationship with kayaking amenity – the higher the perceived wilderness character, the higher the kayaking value.	Kayaker's perception of wilderness character. Expert Panel estimate (5-point rating scale): 1=No wilderness value to 5=Exceptional wilderness value	High wilderness value (**score: 3**) Moderate wilderness value (**score: 2**) Low wilderness value (**score: 1**)	Expert Panel estimate (good)
Social setting	Encounters with other river users	May influence (positively or negatively) the kayaking experience			
	Behaviour of other river users	May influence (positively or negatively) the kayaking experience			
Managerial setting	Mode of access	Recorded but not part of quantitative assessment	Transport mode: 1=helicopter; 2=long walk-in; 3=4WD vehicle; 4=2WD vehicle		
Experiences	Perceptions of the importance of the river	Linked to river's status to kayakers. Any future survey of kayakers should ask this question, as has been done in the past. In a sense, it synthesises all other attributes			
Other	Economic	Expenditure by kayakers in local area, region, nation			

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR THRESHOLDS	DATA SOURCES (AND RELIABILITY)
outcomes	benefits				
	Non-economic benefits	For example, kayakers attracted to live in region owing to kayaking amenity			
ATTRIBUTES ASSOCIATED WITH A SET (RATHER THAN INDIVIDUAL) RIVERS					
Opportunity *spectrum*	**Regional value of the kayaking opportunity**	Comprises scarcity of the opportunity and convenience to users (close proximity). The availability of similar opportunities influences significance. Opportunities that can be easily substituted (not scarce) are less valued than those that are scarce. Convenience is also an important component of value. An opportunity might be very scarce but not very valuable if it is very distant, whereas an opportunity might be more common but very valuable because of its close proximity.	Expert Panel estimate (5-point rating scale): 1=Not very valuable 2=Somewhat valuable 3=Valuable (preferred choice) 4=Very valuable 5=Essential (only one of its kind)	High value (**score: 3**); Moderate value (**score: 2**); Low value (**score: 1**)	Expert Panel estimate (good)
	National value of the kayaking opportunity	Recorded but not part of quantitative assessment	Rating scale: 1=Not very valuable 2=Locally valuable; 3=Regionally valuable; 4=North or South Island valuable; 5=Nationally valuable		
	Connectedness – suite of kayaking opportunities	See Step 9			
ATTRIBUTES ASSOCIATED WITH FUTURE USE					
Recreation *opportunity*	Potential future kayak use - avoid precluding future uses	See Step 9			

Appendix 6B-3
Assessment of indicators by SMARTA criteria

Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use
Perception of scenic attractiveness	Yes	Kayakers' response to rating scale question	Expert Panel estimate; ideally survey kayakers	Contributes to quality of kayaking experience	No data available	Yes (used in recreation surveys)
Perception of wilderness character	Yes	Kayakers' response to rating scale question	Expert Panel estimate; ideally survey kayakers	Contributes to quality of kayaking experience	No data available	Yes (used in recreation surveys)
Suitability of hydraulic features	Yes	Kayakers' assessment	Expert Panel estimate; ideally survey kayakers	Whitewater kayaking experience dependent on suitability and quality of whitewater	No data available	No
Flow reliability (% of time river is kayakable)	Yes	Flows data assessment; kayakers' assessment	Flow data could be used in future; kayakers' assessment	Relates to opportunity to kayak	Flow data available but assessment not done; Expert Panel assessment	No
Number of users (kayaker days p.a.)	Yes	Number of kayaker days	Expert Panel estimate; ideally count kayakers	Use implies value	No data available	Yes (used in recreation surveys)
User catchment (home district/region)	Yes	Kayakers' response to home location question	Expert Panel estimate; ideally survey kayakers	Greater distance from home implies higher value	No data available	Yes (used in recreation surveys)
Regional value of kayaking experience	Yes	Rating scale	No data available	Indicator of significance	No data available	Yes (used in previous significance assessments)

Appendix 6B-4
Significance assessment calculations for whitewater kayaking (Steps 1 and 5-8) – see also 6B-5

Step 1: Define river segments						Step 6A: Apply indicators								Step 6B: Apply thresholds									Step 8: River value				Step 9: Issues	Comparison
River no.	River	Reach	Whitewater grade	Mode of access	National value	Perception of scenic attractiveness (rating scale)	Perception of wilderness (rating scale)	Suitability of quality hydraulic features (rating scale)	Flow reliability (% of time river kayakable)	No. of users (kayaker days p.a.)	User catchment (home district/region)	Regional value (rating scale)		Scenic attractiveness	Perception of wilderness	Suitability of quality hydraulic features	Flow reliability	No. of users	User catchment	Regional value	National value		Flow reliability x 0.5	Equal weights with 'national value'	Equal weights without 'national value'	**Whitewater kayaking importance**	Comments	Comparison with initial assessment - see other worksheet
			National grading system	Mainly: 1=helicopter; 2=long walk-in*; 3=4WD; 4=2WD	1= not very valuable; 2=locally valuable; 3=regionally valuable; 4=NI or SI valuable; 5=nationally valuable	1=not attractive to 5=inspiring	1=no wilderness to 5= exceptional wilderness	1=not at all suitable to 5= very suitable	Recorded as 10% bands	Recorded as no.	1=intra-district; 2=intra-region; 3=bordering regions; 4=other NZ; 5=international	1= not very valuable; somewhat valuable; 3= valuable (preferred choice) 4=very valuable; 5=essential (only one of its kind)		1= 1 or 2= low scenic value; 2= 3 = moderate scenic value; 3= 4 or 5 = high scenic value	1= 1 or 2= low wilderness value; 2= 3 = moderate wilderness value; 3= 4 or 5 = high wilderness value	1= 1 or 2= low suitability; 2= 3= moderate suitability; 3= 4 or 5= high suitability	1=<33%; 2= 33-66%; 3=>66%	1<100; 2= 100-500; 3=>500	1=within-district; 2= within- or bordering region; 3=rest of NZ or initial	1= 1 or 2= low value; 2= 3 = moderate value; 3= 4 or 5 = high value	1= 1 or 2= low value; 2= 3= moderate value; 3= 4 or 5= high value		Tested & rejected	Tested & rejected	FINAL			
	Mid Matakitaki	700m upstream Ten Mile to Six Mile	2+	4	5	4	3	5	100	2500	5	4		3	2	3	3	3	3	3	3		18.5	23	20	High	Primary user very diverse	High
	Buller	Kennedy Creek (about 1.5km upstream of O'Sullivans Bridge) to Brown Creek (about 1.5km downstream Ariki Falls)	3	4	4	4	3	4	100	1500	5	5		3	2	3	3	3	3	3	3		18.5	23	20	High		High
	Buller	O'Sullivans Rapid ('park & play' feature)	3	4	5	4	3	5	100	2500	5	5		3	2	3	3	3	3	3	3		18.5	23	20	High		
	Glenroy	E branch (about 6km upstream of Glenroy Bridge) to Matakitaki River	4	4	5	4	4	4	40	250	5	5		3	3	3	2	2	3	3	3		18.0	22	19	High		High
	Maruia	Creightons Rd to Rough Ck	3	4	4	4	5	3	80	120	4	4		3	3	2	3	2	3	3	3		17.5	22	19	High		Mod-High
	Buller	Gowan Bridge to Mangles (including Granity Rapid)	3	4	5	3	3	5	100	2500	5	5		2	2	3	3	3	3	3	3		17.5	22	19	High		High
	Buller	Gowan Bridge to Raits Rd	3	4	5	3	3	5	100	1000	5	5		2	2	3	3	3	3	3	3		17.5	22	19	High		High
	Buller	Owen River to Claybank Creek	2+	4	3	3	3	5	100	700	4	4		2	2	3	3	3	3	3	2		17.5	21	19	High		High
	Buller	Claybank Creek to Doctors Creek	2+	4	3	3	3	5	100	700	4	4		2	2	3	3	3	3	3	2		17.5	21	19	High		High
	Buller	Doctors Creek to Mangles River	2+	4	3	3	3	5	100	1500	5	4		2	2	3	3	3	3	3	2		17.5	21	19	High		High
	Matiri	About 2.5km upstream of Matiri River W branch to 8 km downstream confluence of Matiri River W branch	3	4	3	4	4	4	30	300	5	4		3	3	3	1	2	3	3	2		17.5	20	18	High		High
	Anatoki	Anatoki Hut to Anatoki Valley sawmill	5	1	3	4	5	5	40	20	5	4		3	3	3	2	1	3	3	2		17.0	20	18	High		High
	Pearce		3,5	3	3	5	4	5	35	90	3	4		3	3	3	2	1	2	3	2		16.0	19	17	High		Mod
	Mangles	4 km upstream of Blackwater River to Buller River	3	4	3	3	2	4	40	700	5	5		2	1	3	2	3	3	3	2		16.0	19	17	High		High
	Takaka	Gabbro Ck to Cobb HEPS	5	2	3	4	4	4	40	30	3	5		3	3	3	2	1	2	3	2		16.0	19	17	High		High
	Waingaro	Waingaro to Takaka confluence	4	1	3	4	5	5	40	30	3	5		3	3	3	2	1	2	3	2		16.0	19	17	High		Mod
	Matakitaki Earthquake Rapids	500m d-s Johnson Ck to 3.7m u-s SH6	3+	4	5	2	2	5	100	2000	5	5		1	1	3	3	3	3	3	3		15.5	20	17	High		High
	Buller	Eel Hole	1	4	2	2	1	4	100	1500	5	5		1	1	3	3	3	3	3	1		15.5	18	17	High		High
	Waingaro	Lake Stanley to Waingaro	4+	1	3	4	5	5	20	10	3	5		3	3	3	1	1	2	3	2		15.5	18	16	Moderate		-

Baton River and Ellis Creek	Baton River & Ellis Creek	3,4	4	2	4	3	4	30	150	2	4		3	2	3	1	2	2	3	1		15.5	**17**	**16**	Moderate	Kayakable at flows above 40 cumecs in the Baton River	Mod
Buller	Lake Rotoiti to Teetotal Creek	3	4	2	3	3	4	70	200	3	3		2	2	3	3	2	2	2	1		14.5	**17**	**16**	Moderate		Mod-High
Motueka	Macleans Reserve to Woodstock	2	4	2	3	2	5	90	550	1	4		2	1	3	3	3	1	3	1		14.5	**17**	**16**	Moderate		Mod
Aorere	15 Mile Ck to Salisbury Br	2	4	2	3	3	4	90	50	2	4		2	2	3	3	1	2	3	1		14.5	**17**	**16**	Moderate		Mod
Wairoa	L branch: road end to Lee River confluence	3-3+	4	2	4	2	5	10	200	2	4		3	1	3	1	2	2	3	1		14.5	**16**	**15**	Moderate		Mod
Slate	8 km upstream of Aorere River to Aorere River confluence at Devils Boots	4+	1	2	4	5	5	20	10	3	3		3	3	3	1	1	2	2	1		14.5	**16**	**15**	Moderate		High
Takaka	Cobb HEP to Sams Ck	3+	4	2	4	3	4	30	80	3	3		3	2	3	1	1	2	2	1		13.5	**15**	**14**	Moderate		Mod
Parapara	Richmond Flat to SH60	4+	3	2	3	4	5	20	10	3	3		2	3	3	1	1	2	2	1		13.5	**15**	**14**	Moderate		Low
Upper Matakitaki	Mole Stream confluence to Horse Tce	1,3-	3	1	4	3	3	80	10	2	1		3	2	2	3	1	2	1	1		12.5	**15**	**14**	Moderate		Low
Mid-upper Matakitaki	From Horse Terrace or Glenroy Maruia Saddle Rd to 700m upstream Ten Mile	2+	4	1	4	3	3	100	80	3	2		3	2	2	3	1	2	1	1		12.5	**15**	**14**	Moderate		Low
Wairoa	Lee River confluence to WEIS weir	1+	4	2	2	1	5	80	300	1	4		1	1	3	3	2	1	3	1		12.5	**15**	**14**	Moderate	Primary introductory training ground for Nelson	Mod
Cobb	Reservoir to Takaka River	5+	2	1	4	5	4	30	5	1	1		3	3	3	1	1	1	1	1		12.5	**14**	**13**	Low		Low
Wangapeka	Road end to Motueka River confluence	2+	4	1	4	3	3	40	20	2	2		3	2	2	2	1	2	1	1		12.0	**14**	**13**	Low		Low
Motueka	Baton Bridge (Woodstock) to SH60	1+-2	4	1	3	2	4	90	120	1	2		2	1	3	3	2	1	1	1		11.5	**14**	**13**	Low		Low
Buller	Hope River to Gowan Bridge	1	4	1	4	3	2	90	50	2	2		3	2	1	3	1	2	1	1		11.5	**14**	**13**	Low		Low
Maruia	Maruia Falls to Buller	3	4	1	4	3	2	80	10	1	1		3	3	1	3	1	1	1	1		11.5	**14**	**13**	Low		Low
Wainui	From falls down to car park, 30 min walk in	4	2	1	4	2	4	10	10	2	2		3	1	3	1	1	2	1	1		11.5	**13**	**12**	Low		Low
Takaka	5 km upstream of Paynes Ford to SH60	1+	4	1	2	1	4	50	30	1	3		1	1	3	2	1	1	2	1		10.0	**12**	**11**	Low	Expert Panel knowledge poor	Low
Buller	Howard to Harleys	2	4	1	3	2	1	70	20	2	1		2	1	1	3	1	2	1	1		9.5	**12**	**11**	Low		Low
Gowan River	Lake Rotoroa to Buller River	3	4	1	3	2	1	100	50	3	2		2	1	1	3	1	2	1	1		9.5	**12**	**11**	Low		Low
Aorere	Salisbury Bridge to Collingwood	2	4	1	3	2	2	90	50	2	2		2	1	1	3	1	2	1	1		9.5	**12**	**11**	Low		Low
Lower Matakitaki	3.7km u-s SH6 to SH6	1+	4	1	2	2	2	100	180	1	2		1	1	1	3	2	1	1	1		8.5	**11**	**10**	Low		Mod
Buller	Mangles River to Riverview Campground	2	4	1	2	2	2	100	50	2	2		1	1	1	3	1	2	1	1		8.5	**11**	**10**	Low		Low-Mod
Buller	Riverview Campground to O'Sullivans	2	4	1	2	2	2	100	10	2	2		1	1	1	3	1	2	1	1		8.5	**11**	**10**	Low		Low
Lee	Cement Works to Lee Reserve	3	4	2	3	2	3	10	50	1	2		2	1	2	1	1	1	1	1		8.5	**10**	**9**	Low		Low
Riwaka	Including north and south branches and resurgences	4	4	1	3	2	3	10	10	1	1		2	1	2	1	1	1	1	1		8.5	**10**	**9**	Low		Low
Johnson	Johnson Ck (u-s West Bank Rd) to Matakitaki	4	3	1	3	2	2	10	10	1	1		2	1	1	1	1	1	1	1		7.5	**9**	**8**	Low		Low
Six Mile		4	3	1	3	2	2	10	10	1	1		2	1	1	1	1	1	1	1		7.5	**9**	**8**	Low		Low
Owen River	Bulmer Ck to Johnson Ck	3	4	1	2	2	2	20	10	2	2		1	1	1	1	1	2	1	1		7.5	**9**	**8**	Low		Low
'Park & play' features																											
Buller	O'Sullivans Rapid	3	4	5	4	3	5	100	2500	5	5		3	2	3	3	3	3	3	3		18.5	**23**	**20**	High		High
Maruia	Maruia Falls	4	4	5	4	2	5	80	300	5	3		3	1	3	3	2	3	2	3		15.5	**20**	**17**	High		High
Motueka	Blue Gums	3	4	3	2	1	5	20	550	2	5		1	1	3	1	3	2	3	2		13.5	**16**	**14**	Moderate		Mod
Blackwater River	Blackwater Falls	4	4	1	2	1	5	10	90	4	2		1	1	3	1	1	3	1	1		10.5	**12**	**11**	Low		Low
West Coast Region																											
Buller	Earthquake	3	4	5	4	3	4	100	1000	5	5		3	2	3	3	3	3	3	3		18.5	**23**	**20**	High		High
EASE OF ACCESS NOTE:																											
* Long walk in means > half an hour (you have to put decent shoes on)																											

Appendix 6B-5
Other factors relevant to the assessment of significance for whitewater kayaking (Step 9)

Access Access is a prerequisite for kayaking and will influence the pattern of use. Lack of legal or practical access may limit or completely restrict use, even to otherwise suitable sites.
Connectedness – the suite of kayaking opportunities in the region Individual rivers may contribute to a set of values found within a region or nationally – the sum may be greater than the parts. If parts of the collective are compromised, this may act as a 'tipping point' to reduce or negate the value of the collective. For example, the Murchison area attracts international kayakers, partly because it offers multiple whitewater kayaking trips across a spectrum of rivers. Kayakers visit Murchison because of the reliability of kayaking opportunities in this collective of rivers, which occur in close proximity to each other. This argument mirrors biodiversity hot spots of endemism – hot spots for whitewater kayaking may occur that require protection.
Users' perceptions of the river's importance (including its 'status') Certain rivers have national or international status (reputation) within the kayaking community. The Buller River has a national reputation for whitewater kayaking (and the Buller Water Conservation Order cites recreation as a primary reason for the Order, including canoeing).
Potential future kayaking use This is about the potential to undertake kayaking in the future. The goal is to avoid precluding future recreational use. Kayaking has been subject to a dramatic increase in the type and number of rivers that are able to be paddled in the last 20 years primarily as a result of technological advancements in kayak design and materials. Changes in access similarly may alter use. As a result, existing use patterns may be poor indicators of future use value. The best example of this phenomenon is the work by Egarr and Egarr (1981). Their assessment of the recreational potential of New Zealand rivers nearly three decades ago does not match the current use patterns owing to the sort of factors already outlined. For this reason, 'future proofing' for potential recreational value is required. Some decisions may inadvertently preclude future recreational options. The goal is to avoid this outcome.
Existence and option value Existence value - Some river sections are valued because they have not been paddled or can only be paddled by the elite few who have the technical skill to do so. Option value - Particularly associated with kayakers' aspirations to paddle challenging whitewater river sections, once their kayaking skills have developed to that level.

Appendix 6B-6
Future data requirements for whitewater kayaking (Step 10)

Data need
Testing the attributes identified for whitewater kayaking and identifying their relative contr kayaking value
Users' perception of scenic attractiveness
Users' perception of wilderness character
Data for flow reliability indicator
Number of kayaker days (by time period over which river is kayaked)
Users' home location
Users' evaluation of the overall importance of the river

Chapter 7
River swimming

Preamble

Swimming is widely regarded as one of the main recreational activities undertaken in New Zealand's rivers, yet little is known about the key attributes of swimming sites, nor about the relative importance of these sites. Application of RiVAS to river swimming is therefore timely, but also entirely novel. Given this context the researchers faced some major challenges and these are reflected in a final, largely subjective expert panel evaluation of this activity, in both case studies. Despite this conclusion, it is clear that rivers and sites on rivers can be evaluated for their relative importance but it is notable that in neither case study is any site considered of national importance. Further discussion with Kay Booth (pers. comm. 2010) has led to the view there are probably no nationally important swimming sites or rivers in New Zealand, but swimming is an activity nevertheless that is of national importance.

Finally, it is important to note that there are scoring system differences between the two applications. In the first application (Part A) only 1-2 scale primary data scoring was provided for. While the final outcome appeared robust it was decided that subsequent applications should revert to the 1-3 scoring scale common to most other applications and which is consistent with the three significance assessment levels. This was used in Tasman (Part B). While a case exists for a 0-3 scale to occur when an attribute indicator scores a zero, e.g., for river swimming absence of a toilet still scores a 1 in the facilities attribute, the overall results remain defensible with the 1 – 3 scale.

Part A: River swimming in the Manawatu-Wanganui Region: Application of the River Values Assessment System (RiVAS)

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Barry Gilliland (Horizons Regional Council)
Kate McArthur (Horizons Regional Council)
Helen Marr (Horizons Regional Council)

Peer reviewed by: Rob Greenaway

7.1 Introduction

7.1.1 *Purpose*

This section applies the River Values Assessment System (RiVAS) (Hughey et al., Chapter 3 herein). Its purpose is to provide a case study of how to apply the method to river swimming, using the Manawatu-Wanganui Region as an exemplar. Horizons Regional Council was the host for this case study.

7.1.2 *Preparatory step: Establish an Expert Panel and identify peer reviewers*

The Expert Panel for the swimming trial in the Manawatu-Wanganui Region comprised Kay Booth (Lindis Consulting) and Barry Gilliland, Kate McArthur and Helen Marr (all of Horizons Regional Council). One member of the team was a frequent user of rivers in the region for swimming but otherwise no separate 'experts' were used. Rob Greenaway peer reviewed the work.

Credentials of the Expert Panel and the peer reviewer are provided in Appendix 7A-1.

7.1.3 *Summary of this assessment*

The Expert Panel identified nine resource and user attributes to assess 29 known river swimming locations in the Manawatu-Wanganui Region. The Panel identified that national significance did not apply to river swimming; therefore, the method was applied to differentiate swimming sites of regional significance from those of local significance. Two attributes proved particularly useful in defining significance for swimming sites: 'scenic attractiveness' and the 'presence of camping facilities'. Few data were available, so the Expert Panel relied on their own assessments for most attributes.

7.2 Application of the method

7.2.1 *Step 1: Define river value categories, river sites and levels of significance*

River value categories

The Expert Panel defined 'swimming' based on the following characteristics:

1. Contact recreation - participants get wet;
2. Site-focused - participants get in and out of the water at the same location;
3. No commercial dimension - swimming is not offered as a stand-alone[37] commercial recreation opportunity.

This definition encompasses swimming, playing around in the water and paddling. While these different activity styles may require different resource conditions (e.g., shallow slow-moving water c.f. deep holes) the Expert Panel believed they could be addressed collectively.

River sites

Swimming is site-specific. It was agreed that the method should be applied to specific river locations (sites) rather than river reaches.

Horizons Regional Council structures its freshwater management by catchment-based water management zones, as do some other regional councils in New Zealand.

Initially the method was applied to only the Manawatu River catchment, chosen because it offered a diversity of types of environments (urban, rural, remote) and a large number of potential swimming sites. Following the single catchment application, the method was applied across the whole region. It worked equally well at both geographical scales.

As part of a prior exercise, Council planners had identified sites for the swimming-spot health-risk monitoring programme, which were swimming locations considered to have high levels of use and that (with a few exceptions) were serviced by territorial authorities, e.g., rubbish bins, toilets, barbecues. This list of swimming spots was checked against the list of sites considered to have active and passive recreational values for the purpose of regional planning ('Amenity Sites') in the Council's *Proposed One Plan*[38]. A final list of 29 sites was derived for application in this study (see Appendix 7A-4).

Some swimming sites within the Region are not included. It has been assumed that any sites where swimming takes place which are not listed are of only highly localised value.

37 Some commercial recreation trips may incorporate swimming as part of the experience.

38 Horizons Regional Council has combined its regional policy statement and regional plans, termed the 'One Plan' (Horizons Regional Council, 2007).

Levels of significance

The Expert Panel could not identify a circumstance where a river swimming site would have national significance and the decision was made that a national significance level would not apply to swimming for assessment within the method. Considerations in this decision were that swimming sites did not attract users to travel inter-island or internationally (although travel distance was not considered the sole arbiter of significance) and that the community of interest for swimming was likely to be local or regional (the question was posed: who would respond to any threat to the loss of swimming at the site?).

Outcomes

Treat swimming as one river value (no separate activity categories).

For the base list of swimming sites, use the list of swimming spots (from Council records) and any other lists of amenity sites (from Council planning documents) that are located alongside rivers.

Consider regional and local levels of significance (not national significance).

7.2.2 ***Step 2: Identify attributes***

Attributes to describe swimming were structured around the following framework[39]:

1. *Social attributes* – users and their perceptions, behaviour and use;
2. *Amenity attributes* – managerial dimensions of the site (facilities, services, maintenance activities, regulations);
3. *Aesthetic/scenic attributes* – natural character of the site;
4. *River attributes* – physical structure (morphology) of the river bed and shore; and
5. *Water quality attributes* – clarity, health risk and nuisance algal growths affecting water quality.

The Expert Panel felt that future or potential use was important but recognised that a focus upon existing use was the most practical approach. See Step 9 for reference to future use.
Two attributes were identified that referred to the collection of swimming sites rather than the individual site - the degree of scarcity of the experience within the catchment/region and site clusters offering choice to swimmers.

Attributes encompass three of the four well-beings defined in the Local Government Act 2002 (social, economic, environmental). Cultural attributes may be relevant for swimming (it was hypothesised that different ethnic groups may have different propensities to go swimming), but no data were available to evaluate this notion.

Outcome

A list of all attributes is provided in Appendix 7A-2, structured by the five categories identified above.

7.2.3 ***Step 3: Select and describe primary attributes***

From the list of attributes outlined in Step 2, primary attributes were selected to *represent* swimming. Selection was based on:

1. Expert Panel members' opinion about the ability of attributes to help differentiate regionally significant swimming sites from locally significant sites. Owing to a lack of data, Expert Panel judgement was the key means for identifying primary attributes;

39 Members of the Expert Panel were not familiar with the Recreation Opportunity Spectrum framework (Brown et al., 1978; Clark and Stankey, 1979), so it was not used to structure the attributes. However, it was used to check the comprehensiveness of the list of attributes.

2. Research literature on the attributes identified by swimmers as important (e.g., Fink-Jensen et al., 2004a, b; Galloway, 2008; Orr, 1982; TRC, 1992). Very few relevant data were identified;
3. Use of national environmental and health guidelines for water quality associated with contact recreation (MfE/MoH, 2009; Biggs, 2000);
4. Coverage of all five attribute categories (as outlined in Step 2) – each was considered to influence the presence and significance of swimming sites;
5. The need for pragmatism – only nine primary attributes were identified but these covered three of the four well-beings;
6. Acknowledgement that certain attributes represent desirable site characteristics for swimming – i.e., without these attributes, swimming may be absent from the site (discussed in Step 9). Some of these attributes were initially selected as primary attributes, but later rejected, as they did not differentiate sites – they were universally present and did not vary in quality;
7. Identification of some ‘experience’ attributes (e.g., perception of safety) that were not selected because they represent users’ *evaluation* of other attributes (e.g., river morphology, water quality);
8. Recognition that some attributes contributed to the level of local use rather than helping to identify a regionally (c.f. locally) significant site (e.g., the presence of a community facility, such as a Scout den or a marae, next to a swimming site might increase use by local residents); and
9. Consideration was not given to the availability of existing data, as very few data existed.

Outcome

Appendix 7A-2 identifies the nine primary attributes (in bold) and describes them, with an emphasis on explaining each attribute’s validity and reliability as a representative measure of swimming value.

7.2.4 ***Step 4: Identify indicators***

One indicator for each primary attribute was identified, using SMARTA[40] criteria, based on:
1. Expert Panel judgment;
2. Existing data – available for some of the water quality and facility indices; and
3. Transferability - attempts to identify indicators that may be portable to other river values (e.g., ‘level of use’ and ‘travel distance’).

Appendix 7A-3 shows the assessment of each indicator using SMARTA criteria. No primary attributes were dropped owing to difficulty in devising measurable indicators.

Each indicator was considered carefully, including:
1. The presence of facilities was considered a good indicator because facilities are associated with high use sites and their presence is easy to measure. However, a ‘feedback loop’ was noted - facilities respond to demand (i.e., indicate high use) but they may also encourage use. Some district councils are more likely to provide facilities than others. This will affect the ranking of sites across individual districts and should be considered by the Expert Panel once site rankings are explicit (Step 8B).
2. The presence of a formal camping opportunity was considered to reflect the availability of a diverse range of recreation opportunities and/or sufficient use to warrant facility provision (by either a public or private provider). The presence of camping facilities was considered likely to increase users’ propensity to travel a long distance in order to visit the site and the length of time

40 Specific, measurable, achievable, relevant, timely and already in use.

(or number of swims) spent at a particular site (see 'level of use' indicator). This example illustrates the inter-connection of attributes.
3. The attribute *travel distance* is a surrogate for quality of the swimming site – it measures swimmers' willingness to pay for travel time/cost. This is a different measure from the site's proximity to a large population base (which may increase local use rather than signify regional importance). The choice between measuring travel time or travel distance was debated. Distance was selected on the basis that in the future (if data on users' home locations are available), this metric can be quantified using GIS. It also removed the complexities of different types of transport modes (car, bicycle, etc).
4. *Variable water depth* was chosen to represent the attractiveness of the physical structure of the shore/river bed for the range of styles of swimming (children's paddling, diving into deep holes, etc). Some depths are more attractive to certain styles of activity – so this indicator deliberately covers the range. It was considered that variability (the presence of shallow and deep water) was attractive for swimming. The indicator had to depict this in some meaningful manner. This proved a challenging task. Ultimately, pragmatism led to the choice of a simple measure – whether the river bed profile was flat or not. The profile of the shoreline (to facilitate easy access to the water) was also considered but dismissed owing to difficulty in quantification.
5. *Level of use* – the Expert Panel liked the metric 'angler days per annum' used in the National Angling Survey (Unwin, 2009). An equivalent measure (participant days p.a.) for all recreational activities would be ideal but requires a population-based survey (see Step 10). An alternative is to count users on-site (number of swimmers per peak use day).

Outcome

Indicators are listed in Appendix 7A-2 and assessed against SMARTA criteria in Appendix 7A-3.

7.2.5 ***Step 5: Determine indicator thresholds***

Thresholds for each indicator were identified by the Expert Panel as follows:

1. *Level of use (number of swimmers on a peak use day)*: Since no data were available, the Expert Panel estimated swimmer numbers (high/low). Ideally, actual data would be used;
2. *Travel distance (number of kilometres travelled from home by swimmer)*: An initial analysis using the threshold of 30 km did not trigger any sites as regionally significant for this attribute, therefore the threshold was adjusted to 20 km (which did differentiate between sites and the division seemed appropriate);
3. *Toilet facilities (presence of toilets):* Maintained toilets available at the site;
4. *Camping facilities (presence of camp facilities):* Camp facilities maintained by the Territorial Authority, another public agency or a private provider;
5. *Perception of scenic attractiveness*. Since the Expert Panel assessed scenic attractiveness, the threshold was kept simple (high/low). Ideally, a professional landscape assessment or users' perceptions would be used. Outstanding natural landscapes identified within Regional Plans (or similar classifications in other planning documents) can inform this assessment;
6. *Swimming holes (maximum water depth)*. >2 m depth allows for diving (Expert Panel assessment) and, assuming high water clarity, visual identification of underwater obstructions;
7. *Variable water depth (river bed profile)*. The need for a simple metric that could be identified from a site visit (and was easy to implement) led to the choice of flat/variable river bed profile;
8. *Algae (compliance with periphyton and cyanobacteria guidelines)*. A breach of the draft national cyanobacteria guidelines (MfE/MoH, 2009) triggers the Regional Council to post public health warnings. Therefore, this indicator influences the public's perception of site safety, as well as providing a physical measure of public health risk and pollution. Other periphyton (filamentous

algae and diatoms) may be a nuisance to swimmers and has national guidelines (Biggs, 2000). Compliance with both sets of national guidelines (MfE/MoH, 2009; Biggs, 2000) was chosen as the indicator. The assessment was kept simple – the indicator score being % time the site met both guidelines (threshold of 25% of the time). A scoring system that differentiated between public health (cyanobacteria) and nuisance periphyton was considered but dismissed owing to complexity. Repeated breaches of either health risk or nuisance algae guidelines diminishes the swimming value of the site; and

9. *Water clarity* (compliance with national guidelines). ANZECC (2000) guidelines for horizontal visibility were chosen as the indicator.

All indicators were scored on a dichotomous scale (1 or 2). Future applications of the method should apply a three-point scale (high=3; medium=2; low=1) where feasible (e.g., perception of scenic attractiveness).

Outcome

Thresholds are identified in Appendix 7A-2.

7.2.6 ***Step 6: Apply indicators and indicator thresholds***

Expert Panel estimates were required for most indicators. Some data were available for four indicators: water clarity, algae, toilets and camp facilities.

Outcome

Data estimates are given in Appendix 7A-4.

7.2.7 ***Step 7: Weighting the primary attributes***

The Expert Panel reviewed the nine primary attributes and considered whether some made a relatively greater contribution to the rating of swimming value.

The indicators *swimming holes* and *variable water depth* were combined (their weighting was halved). Results from this weighting scenario were compared with an equal weighting analysis, and the rank order of rivers examined. Fundamentally little changed, so the decision was reached to keep weightings equal.

Outcome

Equal weighting. See Appendix 7A-4.

7.2.8 ***Step 8: Determine river site significance***

Step 8a: Rank sites

The spreadsheet was used to sum the indicator threshold scores for each swimming site. Since we had chosen to have equal weightings for the primary attributes, we did not have to first multiply the threshold scores by the weightings. The sums of the indicator threshold scores were placed in a column and then sorted in descending order. These sums were then converted into rankings (1st, 2nd, 3rd, etc) to provide a list of the sites ranked for their swimming value.

Step 8b: Identify river site significance

Using the ranked list from Step 8A, the Expert Panel closely examined the river sites and their attribute scores. After much discussion, the Expert Panel decided greatest importance should be placed on social attributes and the scenic attractiveness attribute, as these were felt to most strongly influence swimmers' site selection. In part this related to the inter-connection of attributes (e.g., physical river features are likely to underpin users' evaluation of scenic attractiveness). Also, the use of facility provision attributes allowed a very practical means to assess significance (easy to implement the method).

A threshold score of 1 (low) for *travel distance* appeared to be a strong determinant of the subsequent ranking of the site as locally significant for swimming. However, this did not hold true in all cases, so was not chosen as a criteria for local significance.

The significance criteria selected were:

Regional significance:

Criterion 1: *Presence of camp facilities* = 2, plus *scenic attractiveness* = 2; or
Criterion 2: 80% or more of the attributes = 2

Local significance:

Remaining sites on the list

Translation of these criteria to sites is shown in Appendix 7A-4. Some refinement of these criteria may be required once the method has been applied in other regions with different site conditions.

The Expert Panel examined the resulting river significance allocation and noted that the Manawatu River at Ashhurst Domain ranked 12th for swimming value but was designated of regional significance, while some rivers ranked higher but only achieved local significance status. The Panel confirmed that Ashhurst Domain should be designated regionally significant – it scores poorly for physical river features (swimming holes, variable water depth and algae) but otherwise is a very good recreation site which experiences a high level of use by swimmers – and confirmed all other site significance ratings.

Simplified assessment process

Based on the significance criteria, a simplified process was developed to assess significance for swimming (Figure 7-1). It recognises that only two primary attributes (scenic attractiveness and presence of camp facilities) determined six of the seven sites which rated as regionally significant for swimming. The purpose of this simplified assessment process is to offer a quick way to identify regionally significant swimming sites, as it removes the need to assess the other seven primary attributes.

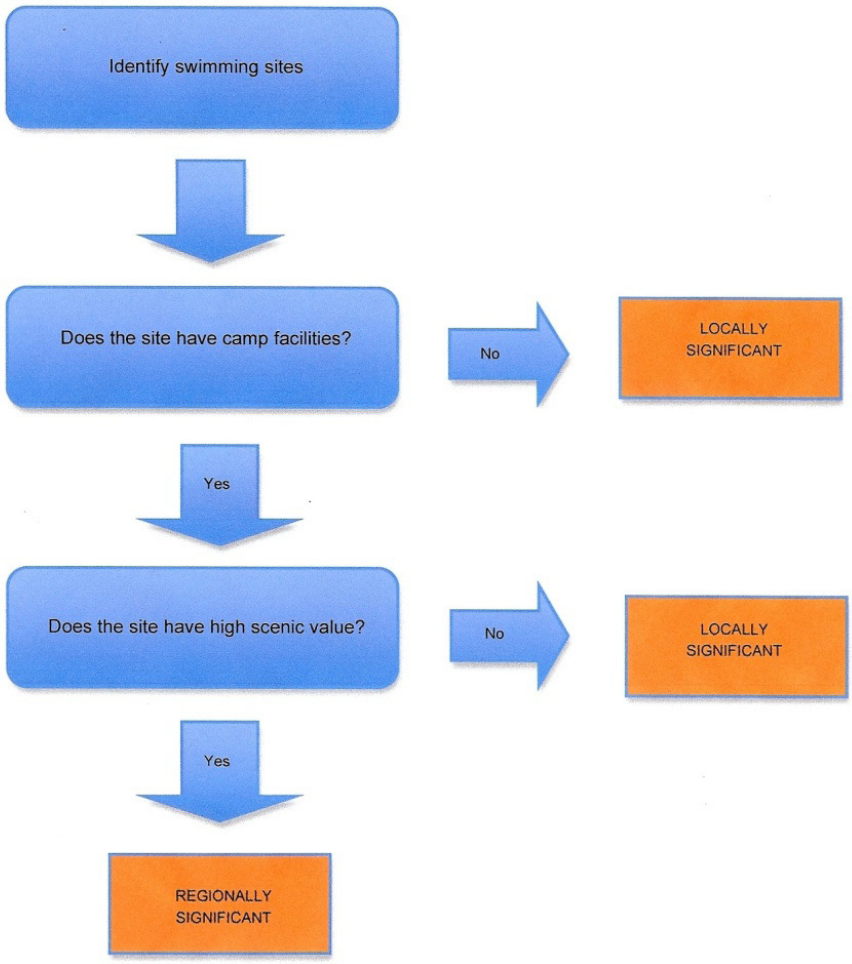
However, we believe the full method provides a more robust assessment and should be used wherever possible. In the Manawatu-Wanganui Region case study, one site (Tokomaru River at Horseshoe Bend) would not have triggered regional significance on the simplified criteria alone (because it does not have camping facilities).

Step 1: Identify swimming sites. Compile a list of swimming sites by asking district/city councils to identify locations where people swim. If a site is not known by district council staff, then it is unlikely to be regionally significant.

Step 2: Identify whether the site has formal camping facilities (designated camping sites, ablution block, camping signage, etc). If yes, go to Step 3. If no, the site is locally significant for swimming.

Step 3: Identify whether the site has high scenic qualities. If yes, the site is regionally significant for swimming. If no, the site is locally significant for swimming.

Figure 7-1
A simplified significance assessment method for swimming



Outcome
A list of sites ranked by a scoring system from highest to lowest, which represents an initial significance ranking list. See Appendix 7A-4.

Sites identified as significant at the regional and local level. See Appendix 7A-4.

Sites where people swim which are not listed have only highly localised swimming value.

A simple swimming assessment process identified (Figure 7-1).

7.2.9. *Step 9: Outline other factors relevant to the assessment of significance*

This step comprises two parts: (1) identification of site characteristics desirable for swimming; and (2) discussion of factors which are not quantifiable but considered relevant to significance assessment (see also Appendix 7A-5).

Desirable site characteristics for swimming
Some site characteristics were identified by the Expert Panel as highly desirable for swimming – in most (but not necessarily all) cases, a 'good' swimming site will have all of these characteristics. A

change in any of them may affect the ability to undertake swimming at the site or the perception of its attractiveness to users. See Appendix 7A-5.

Desirable site characteristics include:

1. Public access available;
2. Appropriate flow (velocity);
3. Adequate river width;
4. Perception of safety; and
5. Presence of beach.

***Other factors relevant to significance assessment*:**

- Future use of a site – the desire to avoid precluding swimming at a site in the future;
- Degree of scarcity of the experience.

Outcome

List and description of non-measured attributes (Appendix 7A-5).

7.2.10 ***Step 10: Review assessment process and identify future information requirements***

Few data were available to inform this case study. Desired data are noted in Appendix 7A-6.

References

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Appendix 7A-1
Credentials of the Expert Panel members and peer reviewer

The Expert Panel comprised four members. Their credentials are:

1. **Dr Kay Booth** is an outdoor recreation researcher and planner. She is the Director of Lindis Consulting and, until recently, a Senior Lecturer in parks, recreation and tourism at Lincoln University. She is conversant with existing data about outdoor recreation, having undertaken reviews of the research literature for outdoor recreation (for the Department of Conservation) and nature-based tourism (for the Ministry of Tourism). She has worked on a range of outdoor recreation planning projects, from the Molesworth Recreation Reserve management plan to the Milford Sound/Piopiotahi user monitoring programme. She has more than 30 peer-reviewed research publications and holds appointments on the New Zealand Walking Access Commission, the New Zealand Geographic Board and the New Zealand Conservation Authority.

2. **Barry Gilliland** is a resource management policy analyst with a work history focussed on water quality management at Horizons Regional Council. He has worked in the Manawatu River catchment since 1975 and the wider Manawatu-Wanganui Region since 1988. He set up the Regional Council's swimming site monitoring programme in 2004 and continues to manage this annual programme.

3. **Kate McArthur** is a senior scientist at Horizons Regional Council. She leads the State of Environment Water Quality and Aquatic Biodiversity programmes, project managing and co-ordinating input from other Council staff and external science providers. She also undertakes technical assessments of environmental effects for resource consent and compliance enforcement activities. At a personal level, she is a frequent user of swimming sites in the Region and has a sound practical knowledge of the needs of swimming site users.

4. **Helen Marr** is a senior policy analyst specialising in resource management and a qualified RMA decision maker under the 'Making Good Decisions' programme. She is currently the project manager of Horizons Regional Council's *Proposed One Plan* process.

The peer reviewer for this work was:

1. **Rob Greenaway** is a consultant recreation planner with over 20 years professional experience. His background includes event management, outdoor recreation research, recreation planning and impact assessment for territorial authorities and for private developers, and journalism. He is regularly called as an expert witness for RMA hearings associated with rivers, for which he advises on recreation and tourism. He is a member of the Sir Edmund Hillary Outdoor Recreation Council and is an active member of the New Zealand Recreation Association and New Zealand Association for Impact Assessment.

Appendix 7A-2
Assessment criteria for swimming (Steps 2-4)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
Step 2: Identify attributes Step 3: Select and describe primary attributes		Step 3: Select and describe primary attributes	Step 4: Identify indicators	Step 5: Determine significance thresholds	
ATTRIBUTES ASSOCIATED WITH EXISTING USE					
Social	**Level of use**	High use implies high value. This may not hold true for two reasons: **Remote places**, which offer few encounters with other people, may be highly valued for their wilderness value and the experience of 'having the place to ourselves'. **Crowding** may occur at popular sites, which may turn people away. This may be anticipated and the site not chosen for a swim, or occur on arrival (displaced to another nearby site, if one exists).	Number of swimmers on a peak use day NOTES: An ideal indicator would be number of swimmer days p.a.	High (**score: 2**) Low (**score: 1**)	Expert Panel estimate (good)
	Travel distance	Origin of users is suggested as an indicator of quality of the recreational experience, based on the assumption that the higher the expected quality of the experience, the greater the distance users will be prepared to travel. A site close to a large population (short travel distance) will receive more use for reasons of convenience (close to home) resulting in a higher level of local use rather than necessarily signifying regional importance.	Number of kms travelled from home by swimmers NOTES: Travel time was considered but distance offers a more standard metric as time introduces the factor of travel style (e.g., walk, car, cycle).	High: >20 km (**score: 2**) Low: <20 km (**score: 1**)	Expert Panel estimate (poor)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
	Perception of safety	Overall evaluation that accounts for a range of perceptions (e.g., flow, water quality, presence of others). Outcome of swimmers' decision-making can be measured via numbers of swimmers attribute.	**Desirable site characteristic**		
	Other users and uses	This includes other users' demographics, their behaviour and the style of their use (e.g., organised events). The types of people who frequent a site may influence its perceived suitability (e.g., site popular with young males who 'take over the place').			
	Diversity of recreation opportunities	Swimming is often undertaken by groups with a range of activity interests. For example, young children who paddle with their parents, some family members who want to go fishing, others who want to sun bathe and swim to 'cool off'. The diversity of opportunities available to cater for different group members may therefore increase a site's attractiveness.			
Amenity / managerial setting	**Toilet facilities**	When a site is well used, councils provide facilities (such as toilets). However, the provision of facilities may also encourage use (people go to sites where there are toilets, which means they can plan to stay all day, for example). Since some councils provide a higher level of facility provision than others, the Expert Panel needs to maintain oversight of these data.	Presence/absence of toilets maintained by the Territorial Authority	High: Present (**score: 2**) Low: Absent (**score: 1**)	Council data (excellent)
	Camping facilities	As already noted, swimming is often associated with other recreational activities (picnicking, fishing, etc). Camping indicates significant length of stay and often a willingness to travel a long distance to the	Presence/absence of camping facilities (e.g., designated camping sites, ablution block,	High: Present (**score: 2**) Low: Absent (**score: 1**)	Council data (excellent) Expert Panel estimate

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		site. Camping facilities may be provided by different types of provider (public or private). Since some councils have a greater propensity to provide facilities than others, the Expert Panel needs to maintain oversight of these data. NOTES: This attribute was initially defined as the opportunity to camp, but this did not differentiate sites, given people can freedom camp near many swimming areas.	signage, etc).		(excellent)
	Maintenance activities	Some form of council maintenance (e.g., lawn mowing, rubbish collection, weed control) suggests high usage sites.			
	Public access - unrestricted public access; no access charges; easy practical access	Public access to the site and within the site to the water is critical. This attribute is one of the essential elements of swimming sites – without access, no swimming can occur	**Desirable site characteristic**		
	Jump-off points	A high point (e.g., bridge, rope swing) adds to the swimming site - amenity feature			
Aesthetic / scenic	**Perception of scenic attractiveness**	It is expected that there is a positive correlation between perceived scenic attractiveness and swimming amenity. This attribute refers to the integrated set of aesthetic components, many of which are listed as	Perception of high/low attractiveness		Expert Panel estimate (good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		separate attributes in this cluster (see next rows). Ideally a professional landscape assessment would be used or else the perceptions of users/residents. In the absence of these data, Expert Panel estimates were used.			
	Degree of naturalness	Amenity feature			
	Wilderness character	Amenity feature			
	Visual landscape back-drop	Amenity feature			
	Flora and fauna	Amenity feature			
	Open space	Amenity feature			
	Natural features that offer jump-off points (big rock, cliff, etc)	Amenity feature			
	Water temperature	Amenity feature			
	Cleanliness and tidiness	Amenity feature			
Physical river features	**Swimming holes**	The opportunity to dive and play around in deeper water was considered to be an attractive feature – people often talk about 'good swimming holes'	Maximum water depth	High: >2 m (**score: 2**) Low: <2 m (**score: 1**)	Expert Panel estimate (good)
	Variable water depth	A flat river bed was considered less attractive for swimming than a variable or asymmetric (shallow +	River bed profile	High: variable (**score: 2**) Low: flat (**score: 1**)	Expert Panel estimate

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		deep) bed profile.			(good)
	Width of river	A river needs to be wide enough to make it worthwhile for swimming	**Desirable site characteristic**		
	Flow	Velocity <1 m/s, as >1 m/s is too fast for an adult to wade (at depth of 1 m after which point person likely to swim rather than walk)	**Desirable site characteristic**		
	Hard/soft river bed bottom	Soft river beds are muddy and may be less popular			
	Natural jump-off features (e.g., large rock)	Amenity feature			
	Beach	Somewhere to sit and easy access to the water	**Desirable site characteristic**		
	Pools	Amenity feature			
	Pool/riffle/run sequences	Amenity feature			
	Rapids	Amenity feature			
Water quality	**Algae**	The presence of blue-green algae (cyanobacteria) presents a public health issue. Draft national guidelines (MfE and MoH, 2009) have been developed – cyanobacteria guideline breaches trigger the posting of public health warnings. Other periphyton (filamentous algae and diatoms) present a nuisance to swimmers and detract from aesthetic appeal (Biggs, 2000) rather than present a potential health issue. This attribute encompasses types of algae that relate	Compliance with national periphyton guidelines and draft national guidelines for cyanobacteria, i.e.: The maximum cover of visible stream or river bed by periphyton: filamentous algae more than 2 cm long shall not	**High**: Meet guidelines >25% of the time in past year (**score: 2**) **Low**: Meet guidelines <25% of the time in past year (**score: 1**)	Expert Panel estimate (fair) Some council data available (very good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		to a health risk (cyanobacteria) or a nuisance (filamentous algae/diatoms) for swimmers.	exceed 30%; diatoms more than 3 mm thick shall not exceed 60%; or cyanobacteria cover shall not exceed 50%		
	Blue-green algae	Covered above – initially separately identified owing to its importance for public health			
	Water clarity	Users prefer clear water	Compliance with ANZECC (2000) guidelines, i.e.: Horizontal visibility >1.6 m (black disc visibility)	**High**: >1.6 m horizontal visibility when river is below median flow (**score: 2**) **Low**: <1.6 m horizontal visibility when river is below median flow (**score: 1**)	Expert Panel estimate (fair) Some council data available (very good)
	Faecal contaminants	This is related to water clarity and flow (data indicate a positive correlation)			
	pH	Acid or alkaline pH may cause skin irritations and make eyes and cuts sting			
CONTEXTUAL ATTRIBUTES					
Collective value	Site clusters	The proximity of sites to each other may influence site selection, as it provides options (e.g., if one site looks crowded, users can go to a nearby site).			
	Scarcity	Where few swimming sites exist within an area, then each site is more significant			

Appendix 7A-3
Assessment of indicators by SMARTA criteria

Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use
Number of swimmers on a peak use day	Yes	Number of swimmers	Requires on-site monitoring	Use implies site valued by user	Data not available (requires monitoring)	Standard recreation metric
Number of km travelled from home by swimmers	Yes	Number of km	Requires user survey to identify home location	Large travel distance implies high value	Data not available (requires user survey)	Question been asked in recreation surveys
Presence of toilets	Yes	Toilet present/absent	Data available for Council toilets; Non-council facilities known by Expert Panel	Facilities response to demand/high use	Data available	Data used by councils for other purposes
Presence of camp facilities (allocated camp sites, ablution block, signage)	Yes	Camp facilities present/absent	Data available for council facilities; Non-council facilities known by Expert Panel	Facilities response to demand/high use	Data available	Data used by councils for other purposes
Scenic attractiveness	Yes	Response to user survey rating scale question; Professional assessment by landscape planner	Requires site visit (planner) or else user survey	Likely to influence choice of swimming site	Data not available (but could obtain from site visit – user survey or professional assessment)	Assessments undertaken by landscape planners for other purposes; Question been asked in recreation surveys
Maximum water depth	Yes	Physical measure	Site visit required	Provides swimming hole	Data not available (easy to obtain from site visit)	No
River bed profile	Yes	Physical measure	Site visit required	Provides site conducive to swimming	Data not available (easy to obtain from site visit)	No
Compliance with periphyton and cyanobacteria guidelines	Yes	National water quality measures	Part of council monitoring programme	Triggers posting of health risk warning and/or nuisance	Data available	Data used by councils for public health warnings
Horizontal visibility	Yes	National water quality measure	Part of Council monitoring programme	Likely to influence choice of swimming site	Data available	Data used by councils for other purposes

Appendix 7A-4
Significance assessment calculations for swimming (Steps 1 and 5-8)

Swimming site	**Description**	**Primary attribute, indicator, threshold and data source**				**SIGNIF CRITERION**				**SIGNIF CRITERION**	**Sum**	**Rank**	River significance
		Water clarity	Swimming holes	Variable water depth	Algae	Scenic attractiveness	Origin of users	Level of use	Facilities	Camping opportunity	Equal weight		
		Horizontal visibility	Max water depth	River bed profile	G/lines compliance	Overall rating	Km from home	No. swimmers/ peak day	Presence of toilet	Presence camp facilities			
		1<1.6m, 2>1.6m	1<2m, 2>2m	1=flat, 2=variable	1>25%, 2<25%	1=low, 2=high	1<20km,2>20km	1=low, 2=high	1=no, 2=yes	1=no, 2=yes			
		RC data + EP estimate	EP estimate	EP estimate	RC data + EP estimate	EP estimate	EP estimate	EP estimate	RC data	RC data + EP estimate			
Pohangina R at Totara Reserve (Regional Park)	Rural/ remote	2	2	2	2	2	2	2	2	2	18	1	Regional
Managua o Te Ao R at Ruatiti	Rural	2	2	2	2	2	2	2	2	2	18	1	Regional
Rangitikei R at Vinegar Hill	Rural	2	2	2	2	2	2	2	2	2	18	1	Regional
Tokomaru R at Horseshoe Bend	Rural	2	2	2	2	2	2	2	2	1	17	4	Regional
Rangitikei R at Mangaweka	Rural	2	2	2	1	2	2	2	2	2	17	4	Regional
Ohau R at Kimberley Reserve	Rural	2	2	2	2	2	1	2	2	2	17	4	Regional
Pohangina R at Raumai Reserve	Rural	2	2	2	2	1	2	2	2	1	16	7	Local
Ohau R at Gladstone Reserve	Rural	2	2	2	2	2	1	2	2	1	16	7	Local
Mangahao R at Marima Domain	Rural	2	2	2	2	2	2	1	1	1	15	9	Local
Manawatu R at Woodville Ferry Reserve	Rural	2	2	2	1	2	2	2	1	1	15	9	Local
Oroua R at Londons Ford	Rural	2	1	2	2	1	2	2	2	1	15	9	Local

Manawatu R at Ashhurst Domain	Rural	2	1	1	1	2	1	2	2	2	14	12	Regional
Kahuterawa Stm at Reserve	Rural	2	1	1	2	2	1	1	2	1	13	13	Local
Mangatainoka R at SH2 Reserve	Rural	2	2	2	1	1	1	2	1	1	13	13	Local
Manawatu R at Albert St	Urban	2	2	2	1	1	1	2	1	1	13	13	Local
Kahuterawa Stm at Camp Kilsby	Rural	2	1	1	2	1	1	1	2	1	12	16	Local
Whanganui R at Cherry Grove	Urban	2	1	1	2	1	1	2	1	1	12	16	Local
Mowhanau Stm at Kai-Iwi Beach	Urban	1	1	1	2	1	1	2	2	1	12	16	Local
Whanganui R at Mosquito Point	Rural	1	2	1	2	1	1	2	1	1	12	16	Local
Ohau R at Kirkauldies Bridge	Rural	2	1	1	2	2	1	1	1	1	12	16	Local
Makakahi R at Bridge St, Eketahuna	Urban	1	1	2	2	1	1	1	1	1	11	21	Local
Oroua R at Bartletts Ford	Rural	1	1	1	2	1	1	1	2	1	11	21	Local
Oroua R at Almadale	Rural	1	1	1	2	1	1	1	2	1	11	21	Local
Whanganui R at Town Bridge	Urban	1	2	1	2	1	1	1	1	1	11	21	Local
Manawatu R at Maunga Rd	Rural	1	1	1	2	1	1	1	1	1	10	25	Local
Manawatu R at Weber Rd	Rural	1	1	1	2	1	1	1	1	1	10	25	Local
Oroua R at Timona Park	Urban	1	1	1	1	1	1	1	2	1	10	25	Local
Manawatu R at Kumeroa (Little Rd)	Rural	1	1	1	1	1	1	1	1	1	9	28	Local
Manawatu R at Hopelands Domain (River Rd)	Rural	1	1	1	1	1	1	1	1	1	9	28	Local

Appendix 7A-5
Other factors relevant to the assessment of significance for swimming (Step 9)

Desirable site characteristics for swimming
Public access The public must be able to access the site. Access for vehicles is important for most sites and includes space for parking (which may be informal). It was noted that access to most swimming sites is free of charge in New Zealand and this is expected by New Zealanders.
Flow (velocity) The water should be flowing (not stagnant) and able to be waded (<1 m/s at 1 m depth).
River width A river that is too narrow is unlikely to attract swimmers. The Expert Panel suggested a width of approximately >5 m.
Perception of safety Swimmers are unlikely to use a site they consider too risky.
Beach Ideally, the shore provides somewhere to sit and enables easy access to the water.
Other factors
Potential future use Some sites may receive a low level of existing use (or none at all) but have the potential to be well-used swimming sites (e.g., from a change to a desirable site characteristic).
Degree of scarcity of the experience Where few alternative (substitute) sites exist that suit swimming, then the degree of scarcity is high (and vice versa). This places greater significance upon sites. Conversely, where sites exist in close proximity, this may influence site selection as it provides options (e.g., if one site looks crowded, users can go to a nearby site).

Appendix 7A-6
Future data requirements for swimming (Step 10)

Data need
User monitoring at swimming sites on peak use days – numbers of users
Professional assessment of scenic attractiveness by landscape planner
User surveys at swimming sites (home location; perception of scenic attractiveness; use by different ethnic groups; satisfaction with visit)
Population-based survey (in conjunction with other recreation data collection) - to enable calculation of swimmer/days + evaluation of the overall importance of different sites for swimming

Part B: River swimming in the Tasman District: Application of the River Values Assessment System (RiVAS)

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7.3 Introduction

7.3.1 *Purpose*

This section presents the results from an application of the river values assessment system (RiVAS) for river swimming in the Tasman District undertaken in June 2010. This is the second application of the RiVAS for river swimming. A workshop was held on 25 June to apply this method to Tasman District rivers. Hughey et al. (Chapter 3, herein) outline the RiVAS method.

7.3.2 *Preparatory step: Establish an Expert Panel*

The Expert Panel for the swimming application in the Tasman District comprised Mary-Anne Baker, Trevor James and Rob Smith (all of the Tasman District Council). Kay Booth (Lindis Consulting) acted as an advisor. Credentials for the Expert Panel are provided in Appendix 7B-1.

7.3.3 *Summary of this assessment*

The Expert Panel identified eight resource and user attributes to assess 62 known river swimming locations in the Tasman District. The method was applied to differentiate swimming sites of regional significance (n=14) from those of local significance. Few data were available, so the Expert Panel relied on their own assessments for most attributes. Minor revision was made to the RiVAS approach for swimming, notably amalgamation of the two facilities-related attributes, and use of a 3-point scale (rather than a 2-point scale) for indicator thresholds.

7.4 Application of the method

7.4.1 *Step 1: Define river value categories, river sites and levels of significance*

River value categories

The Expert Panel confirmed the definition of ‘swimming’ as:

1. Contact recreation (participants get wet);
2. Site-focused (participants get in and out of the water at the same location); and
3. No commercial dimension (swimming is not offered as a stand-alone[41] commercial recreation opportunity).

This definition encompasses swimming, playing around in the water and paddling. While these different activity styles may require different resource conditions (e.g., shallow slow-moving water c.f. deep holes) the Expert Panel believed they could be addressed collectively.

River sites

Swimming is site-specific and it was agreed that it was appropriate to focus on specific river locations (sites). However, multiple swimming sites occur on some river reaches in the Tasman District. For practical reasons, these sites were treated as a set (i.e., the river reach was used to describe this set of swimming sites). Where sites within such reaches were considered important

41 Some commercial recreation trips may incorporate swimming as part of the experience.

(e.g., they receive considerably more use than the other sites in that reach), they were separately listed.

In preparation for the workshop held on 25 June, Council planners consulted with selected high schools in the District (Golden Bay, Motueka and Murchison High Schools – teachers co-ordinated student input) to collect information about sites used for swimming and their attributes.

A list of swimming sites (and reaches to represent multiple sites) was compiled using information from the schools, the Council's water quality monitoring sites, and sites known to the Expert Panel from their local knowledge. A final list of 62 sites (which includes four sets of sites – referred to as a reach) was derived for application in this study (see Appendix 7B-4).

Swimming sites without public access were excluded from the analysis.

A brief discussion on hot springs concluded that they would fit the definition of a swimming site and the activity, likewise, could be considered 'swimming'. This was a hypothetical discussion, as Tasman does not have any springs with public access for swimming.

It has been assumed that any sites where swimming takes place which are not listed are of only highly localised value. The Expert Panel commented that there are a lot of sites that would fit this category.

Levels of significance

Following the RiVAS method for swimming (Booth et al., 2009), it was agreed that the method would be used to identify regionally and locally significant swimming sites (not national significance). It was noted that swimming as an activity (or river value) is nationally significant.

Outcomes

The activity of swimming was defined (see above).

A list of swimming sites was defined using the list of Council water quality monitoring sites, information gathered from high schools and local knowledge.

Significance of a site for swimming was agreed to be either regional or local (not national significance).

7.4.2 *Step 2: Identify attributes*

Attributes to describe river swimming developed for the Manawatu-Wanganui case study (Booth et al., herein) were 'taken as given'.

Outcome

A list of all attributes is provided in Appendix 7B-2. This list is the same as that presented for the Manawatu-Wanganui Region.

7.4.3 *Step 3: Select and describe primary attributes*

The primary attributes used for the Manawatu-Wanganui case study were discussed and adapted following application to Tasman rivers. One revision was made to the primary attributes: the two attributes associated with facilities were combined into one, specifically:

- Facilities: 'presence of toilet'; and
- Camping opportunities: 'presence of camp facilities'.

This became

- Facilities: ‘presence of facilities’ (which includes toilet facilities and camping facilities).

Outcome

Appendix 7B-2 identifies the eight primary attributes (in bold) and describes them.

7.4.4 ***Steps 4 & 5: Identify indicators & determine indicator thresholds***

Indicators were adopted from the Manawatu-Wanganui application, with revision for the modified (combined) facilities primary attribute (as described in Step 3).

The thresholds developed as part of the Manawatu-Wanganui case study were modified to match the approach taken for other river values within the RiVAS system and better differentiate between sites. Therefore, instead of using a 1-2 scoring system, a 1-3 scoring system was applied. This was a recommendation of the Manawatu-Wanganui swimming report. Care was taken to match (and add to) the thresholds used in the Manawatu-Wanganui application as much as possible.

The Expert Panel developed thresholds that would fit nationally (for most attributes) and within the Tasman District. It was acknowledged that the thresholds may be set to best suit Tasman conditions and they may need to be fine-tuned in future applications.

Discussion associated with the primary attributes and their indicators included:

1. *Water clarity:* Horizontal visibility
   It was agreed that it is useful to apply the national guidelines (ANZECC, 2000) for horizontal visibility. Thresholds adopted the 1.6m trigger point used in the guidelines and added a 3.0m additional threshold.

2. *Swimming holes:* Maximum water depth
   It was agreed that where a site was large, then an average across the site would be used. Where a collective of sites (a reach) was assessed, the average across the sites was used (the average of each site’s maximum depth).

   Thresholds were set as <2m and >3m.

3. *Variable water depth:* Morphological variability
   This indicator was renamed - the previous terminology was ‘river bed profile’. It remains the same indicator, just with a new name. The revised thresholds were low-med-high variability (c.f. previous application which used flat or variable).

   Where sites are considered as a collective within one reach, the measure was the variability of each site averaged across all sites (rather than the range of variability across sites).
   It was agreed that the threshold scores for this indicator ranged from 3 = presence of deep holes *and* shallow water, to 1 = very shallow, very safe ’gentle’ site that provided an opportunity for people with little swimming ability.

   The difference between variability and water depth was discussed. It was felt that shallow rivers would score lower for this indicator as they had little opportunity for variability in their depth. In Tasman District this equates to gravel river beds. Rivers with hard rock outcrops (e.g., mid section Motueka River) have greater variability in depth.

4. *Algae:* Compliance with national guidelines
   A breach of the draft national cyanobacteria guidelines (MfE/MoH, 2009) triggers the Council to consider posting public health warnings. Therefore, this indicator influences the public's perception of site safety, as well as providing a physical measure of public health risk. Other periphyton (filamentous algae and diatoms) may be a nuisance to swimmers and has national guidelines (Biggs, 2000). Compliance with both sets of national guidelines (MfE/MoH, 2009; Biggs, 2000) was the indicator. The assessment was kept simple – the indicator score being % time the site met both guidelines (thresholds of 25% and 50% of the time). Repeated breaches of either health risk or nuisance algae guidelines diminish the swimming value of the site.

5. *Scenic attractiveness:* Overall rating
   The Panel identified that this included local features (e.g., granite outcrops) as well as the surrounding landscape. As with the previous application in the Manawatu-Wanganui region, this attribute was assessed by the Expert Panel. Ideally, a professional landscape assessment or users' perceptions would be used.

   It was agreed that the assessment considered people in the water as well as those on the shore. In other words, 'swimming' encompasses shore-based use.

   In its assessment, the Panel initially discussed specific sites and used these as reference points (e.g., high scoring (score of 3) sites included Paynes Ford and Salisbury Bridge; low scoring sites (score of 1) were Riwaka at SH60 and the Lower Motueka). All other sites were then assessed relative to these sites.

   It was felt that Tasman sites may rate very highly in a national assessment. The current assessment had integrity *within* the District.

6. *Origin of users:* Km travelled that day (from previous night's accommodation)
   It was agreed this measure was the mean distance travelled to the site *that day* by users (i.e., from their location the previous night). This differed from the Manawatu-Wanganui approach which used travel distance *from home*. Similarly, it differs to the salmonid angling river value approach (also distance from home). The reason for this adjustment in the swimming method was that swimming is usually not the primary reason people travel to a site, and Tasman is a popular visitor destination. Distance from home would unduly weight towards sites popular with tourists.

   People who had travelled from a camping site, for example, would record distance from the camping site (not from home), e.g., international visitors (especially rock climbers) camp at Paynes Ford and often swim there, but they were not attracted to Paynes Ford *because* of the swimming opportunity.

   The Panel considered the distance travelled in terms of a radius from the major population centre (Nelson) rather than the distance travelled by road.

   It was noted that swimming is often a secondary activity on a recreational trip. Pelorus Bridge is a good illustration – many people plan to stop and have a swim but seldom travel there specifically for that purpose.

   An interesting variant for this indicator may be how far people would go to access a favoured swimming site.

Following consideration of Tasman swimming sites, thresholds were set at 10 km and 20 km (<10 km, 10-20 km, >20 km).

7. *Levels of use:* Number of swimmers per day

   Since no data were available, the Expert Panel estimated swimmer numbers (high-med-low). As for some other indicators, reference sites were chosen to assist with the assessment.

   Considerable discussion ensued about the most useful and practical indicator – peak number (the number of users at any one time on a peak use day) c.f. user numbers over a peak use day. It was agreed that the metric would be finalised in the coming months, as the Council intends to monitor users at selected swimming sites during the 2010/2011 summer.

   It was agreed that the thresholds set for this indicator were relevant to the Tasman District and applications elsewhere could adjust for the regional population (e.g., Auckland could apply a ten-fold factor as Auckland's population (rating base) is ten times that of the Tasman District). This is based on the premise that residents (c.f. visitors) undertake most of the swimming activity in Tasman.

8. *Presence of facilities:* Combined the previous two indicators of 'presence of toilet' and 'presence of camp facilities'.

   The chosen thresholds were: 1=no facilities, 2=toilet only, 3=camp and toilet facilities. The definition of these facilities was adopted from the Manawatu-Wanganui study:

   Maintained toilets available at the site
   Camp facilities maintained by the Territorial Authority, another public agency or a private provider (e.g., designated camping sites, ablution block, signage).

For swimming sites within river reaches (e.g., three reaches on the Motueka River and one on the Waimea River), the assessment was derived from the average of the sites within the reach – not the sum of the sites. Therefore, if user numbers were high at a few sites but not others, it depressed the level of use score for the set of sites within the reach.

It was noted that there was an additional value for sites within such reaches – swimmers had a wide choice of location (e.g., if a site was busy).

Outcome

Indicators and thresholds are listed in Appendix 7B-2 and indicators are assessed against SMARTA criteria in Appendix 7B-3.

7.4.5 *Step 6: Apply indicators and indicator thresholds*

Expert Panel estimates were required for most indicators. Some data were available for three indicators: water clarity, algae and facilities.

Outcome

Data estimates are given in Appendix 7B-4.

7.4.6 *Step 7: Weighting the primary attributes*

The Expert Panel reviewed the eight primary attributes and considered whether some made a relatively greater contribution to the rating of swimming value.

Several weighting scenarios were tested – various combinations of *Levels of use* and *Facilities* were increased in weighting (see Appendix 7B-4). Given that the facilities attribute had decreased from two attributes to one, this was weighted x2 as part of this phrase of the assessment. Results from the weighting scenarios were compared with an equal weighting analysis, and the rank order of rivers examined.

The decision was made to keep weightings equal. It was noted that the use of equal weighting ranked rivers that received high levels of use, as well as rivers that scored well for other reasons, as would be expected, not just those that provided additional facilities. The Panel felt this was a good outcome, as it balanced the attributes in an appropriate manner.

Outcome

Equal weighting. See Appendix 7B-4.

7.4.7 ***Step 8: Determine river site significance***

Step 8a: Rank sites

The spreadsheet was used to sum the indicator threshold scores for each swimming site. Since we had chosen to have equal weightings of the primary attributes, we did not have to first multiply the threshold scores by the weightings. The sums of the indicator threshold scores were placed in a column and then sorted in descending order. These sums were then converted into rankings (1st, 2nd, 3rd, etc) to provide a list of the sites ranked for their swimming value.

Step 8b: Identify river site significance

Using the ranked list from Step 8A, the Expert Panel closely examined the river sites and their attribute scores. The Expert Panel looked for cut off points in the list of swimming sites. A score of 19 looked like the appropriate threshold for regional significance (i.e., the Panel's knowledge of sites suggested that those scoring 19 and above were of regional significance and those below 19 were not).

The Wairoa River at WEIS weir scored 18 so was assessed as being of local significance. One characteristic of this site is the width of the swimming hole – you can use it for training as it is approximately 50m across and quite long. This feature is not covered by any of the attributes. It was decided that this site was an outlier and that the importance placed on this site by the Panel should be recorded, but the assessment should not be adjusted to try to 'elevate' it. As noted in other RiVAS assessments, sites very close to thresholds need to be treated with some 'give and take'.

At this stage of the assessment, some general comments about swimming sites and rivers, as well as their perceived importance, were made including:

- The Panel expected the Motueka River to score as the most significant river for swimming in Tasman District – not all its sites did. Since the assessment is site focused, the value of rivers like the Motueka which provide many swimming sites, is lost somewhat. For this reason, it is very important to note the *number of sites* on any given river. This relates to the value of a whole waterway compared with the value of a specific site.
- Similarly, the Waimea River, as a complete waterway was expected to be regionally significant. Its value primarily lies in its close proximity to the main population centre and the ease of access over its entire length. However, its individual sites did not achieve regional significance listing. Again, this was partly due to the range of sites available.
- Conversely, the Motupiko site at Quinney's Bush was listed as regionally significant due to its close proximity to a very popular camp ground and not because the site is particularly noteworthy by itself.
- Tasman District has nationally recognised beaches and therefore sea swimming opportunities ('trips to the beach') are probably better known than its abundance of river swimming opportunities. Indeed many of the campgrounds and accommodation options are located to

capture the advantages of the beach rather than the river. This may suppress river-based swimming (i.e., on any one day it is possible that there will be many times more people at the four most popular beaches than at all the river sites combined).

- Disaggregating swimming from the recreational trip was noted as a challenge to the method. As discussed earlier, swimming is often one component of a trip and not always the primary purpose.

Simplified assessment process

The simplified process developed as part of the Manawatu-Wanganui case study was not applied. This followed the recommendation from that report that "the full method provides a more robust assessment and should be used wherever possible" (Booth et al., herein).

Outcome

A list of sites ranked by a scoring system from highest to lowest, which represents an initial significance ranking list. See Appendix 7B-4.

Sites identified as significant at the regional and local level. See Appendix 7B-4.

Sites where people swim which are not listed have only highly localised swimming value.

7.4.8 *Step 9: Outline other factors relevant to the assessment of significance*

This step comprises two parts: (1) identification of site characteristics desirable for swimming; and (2) discussion of factors which are not quantifiable but considered relevant to significance assessment (see also Appendix 7B-5).

Desirable site characteristics for swimming

Characteristics of sites considered highly desirable for swimming were adopted from the Manawatu-Wanganui report. In most (but not necessarily all) cases, a 'good' swimming site will have all of these characteristics. A change in any of them may affect the ability to undertake swimming at the site or the perception of its attractiveness to users. See Appendix 7B-5.

Desirable site characteristics include:
1. Public access available;
2. Appropriate flow (velocity);
3. Adequate river width;
4. Perception of safety; and
5. Presence of beach.

Other factors relevant to significance assessment

- Future use of a site – the desire to avoid precluding swimming at a site in the future;
- Degree of scarcity (or rarity) of the experience.

Outcome

List and description of non-measured attributes (Appendix 7B-5).

7.4.9 *Step 10: Review assessment process and identify future information requirements*

Few data were available to inform this case study. Desired data are noted in Appendix 7B-6.

References

Australia and New Zealand Environment and Conservation Council (ANZECC) (2000). *Australian and New Zealand guidelines for fresh and marine water quality*. Australia and New Zealand Environment and Conservation Council, and Agriculture and Resource Management Council of Australia and New Zealand.

Biggs, B.J.F. (2000). *New Zealand periphyton guidelines: Detecting, monitoring and managing enrichment of streams.* A report prepared for the Ministry for the Environment, Wellington, New Zealand.

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Hughey, K., Booth, K., Deans, N., Baker, M-A. Herein. *River Values Assessment System (RiVAS) – The Method.*

Ministry for the Environment and Ministry of Health. (2009). *Draft New Zealand guidelines for managing cyanobacteria in recreational waters.* A draft prepared for the Ministry for the Environment and the Ministry of Health by S.A. Wood, D.P. Hamilton, W.J. Paul, K.A. Safi and W.M. Williamson.

Appendix 7B-1
Credentials of the Expert Panel members and advisor

The Expert Panel comprised three members. Their credentials are:

1. **Mary-Anne Baker** is a policy planner with Tasman District Council, with 20 years experience in soil conservation and freshwater management. She has contributed to the preparation of the Council's water and contaminant discharge management provisions in its Resource Management Plan.
2. **Trevor James** is a resource scientist at the Tasman District Council, with 18 years experience in both the private and public sector. He is responsible for surface water State of the Environment monitoring and assessment at Council, with familiarity of, and access to, water quality data for the District.
3. **Rob Smith** is the Environmental Information Manager at Tasman District Council with 18 years experience in the monitoring or management of freshwater resources.

Advisor:

1. **Dr Kay Booth** is an outdoor recreation researcher and planner. She is the Director of Lindis Consulting and, until recently, a Senior Lecturer in parks, recreation and tourism at Lincoln University. She has more than 30 peer-reviewed outdoor recreation research publications and holds appointments on the New Zealand Walking Access Commission and the New Zealand Conservation Authority.

Appendix 7B-2
Assessment criteria for swimming (Steps 2-4)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
Step 2: Identify attributes Step 3: Select and describe primary attributes		Step 3: Select and describe primary attributes	Step 4: Identify indicators	Step 5: Determine significance thresholds	
ATTRIBUTES ASSOCIATED WITH EXISTING USE					
Social	**Level of use**	High use implies high value. This may not hold true for two reasons: **Remote places**, which offer few encounters with other people, may be highly valued for their wilderness value and the experience of 'having the place to ourselves'. **Crowding** may occur at popular sites, which may turn people away. This may be anticipated and the site not chosen for a swim, or occur on arrival (displaced to another nearby site, if one exists).	Number of swimmers on a peak use day NOTES: Alternative indicators: 1. Maximum number of swimmers at peak time on a peak use day 2. Number of swimmer days p.a.	High (**score: 3**) Medium (**score: 2**) Low (**score: 1**)	Expert Panel estimate (good)
	Travel distance	Origin of users is suggested as an indicator of quality of the recreational experience, based on the assumption that the higher the expected quality of the experience, the greater the distance users will be prepared to travel. A site close to a large population (short travel distance) will receive more use for reasons of convenience (close to home) resulting in a higher level of local use rather than necessarily signifying regional importance.	Number of kms travelled by swimmers from previous night's location NOTES: Travel time was considered but distance offers a more standard metric as time introduces the factor of travel style (e.g., walk, car, cycle).	High: >20 km (**score: 3**) Med: 10-20 km **(score: 2)** Low: <20 km (**score: 1**)	Expert Panel estimate (poor)
	Perception of safety	Overall evaluation that accounts for a range of perceptions (e.g., flow, water quality, presence of others). Outcome of swimmers' decision-making can be measured via numbers of swimmers attribute.	**Desirable site characteristic**		
	Other users and uses	This includes other users' demographics, their behaviour and the style of their use (e.g., organised events). The types of people who frequent a site may influence its perceived suitability (e.g., site popular with young males who 'take over the place').			
	Diversity of recreation	Swimming is often undertaken by groups with a range of activity			

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
	opportunities	interests. For example, young children who paddle with their parents, some family members who want to go fishing, others who want to sun bathe and swim to 'cool off'. The diversity of opportunities available to cater for different group members may therefore increase a site's attractiveness.			
Amenity / managerial setting	**Presence of facilities**	When a site is well used, councils provide facilities (such as toilets). However, the provision of facilities may also encourage use (people go to sites where there are toilets, which means they can plan to stay all day, for example). Since some councils provide a higher level of facility provision than others, the Expert Panel needs to maintain oversight of these data. Camping indicates significant length of stay and a swimming hole can be well used by local campers. Camping facilities may be provided by different types of provider (public or private). Since some councils have a greater propensity to provide facilities than others, the Expert Panel needs to maintain oversight of these data. NOTES: This attribute does not include freedom camping which can happen almost anywhere.	Presence/absence of toilets maintained by the Territorial Authority Presence/absence of camping facilities (e.g., designated camping sites, ablution block, signage, etc) maintained by public or private provider	Camp + toilet (**score: 3**) Toilet only (**score 2**) Absent (**score: 1**)	Council data (excellent) Expert Panel estimate (excellent)
	Maintenance activities	Some form of council maintenance (e.g., lawn mowing, rubbish collection, weed control) suggests high usage sites.			
	Public access - unrestricted public access; no access charges; easy practical access	Public access to the site and within the site to the water is critical. This attribute is one of the essential elements of swimming sites – without access, no swimming can occur	**Desirable site characteristic**		
	Jump-off points	A high point (e.g., bridge, rope swing) adds to the swimming site - amenity feature			
Aesthetic /	**Perception of scenic**	It is expected that there is a positive correlation between perceived	Perception of scenic attractiveness	High (**score: 3**)	Expert

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
scenic	**attractiveness**	scenic attractiveness and swimming amenity. This attribute refers to the integrated set of aesthetic components, many of which are listed as separate attributes in this cluster (see next rows). Ideally a professional landscape assessment would be used or else the perceptions of swimmers. In the absence of these data, Expert Panel estimates were used.		Medium (**score: 2**) Low (**score: 1**)	Panel estimate (good)
	Degree of naturalness	Amenity feature			
	Wilderness character	Amenity feature			
	Visual landscape back-drop	Amenity feature			
	Flora and fauna	Amenity feature			
	Open space	Amenity feature			
	Natural features that offer jump-off points (big rock, cliff, etc)	Amenity feature			
	Water temperature	Amenity feature			
	Cleanliness and tidiness	Amenity feature			
Physical river features	**Swimming holes**	The opportunity to dive and play around in deeper water was considered to be an attractive feature – people often talk about 'good swimming holes'	Maximum water depth	High: >3 m (**score: 3**) Medium: 2-3m (**score: 2**) Low: <2 m (**score: 1**)	Expert Panel estimate (good)
	Variable water depth	A flat river bed was considered less attractive for swimming than a variable (shallow + deep) bed profile.	Morphological variability	High (**score: 3**) Medium (**score: 2**) Low (**score: 1**)	Expert Panel estimate (good)
	Width of river	A river needs to be wide enough to make it worthwhile for swimming	**Desirable site characteristic**		
	Flow	Velocity <1 m/s, as >1 m/s is too fast for an adult to wade (at depth of 1 m after which point person likely to swim rather than walk)	**Desirable site characteristic**		
	Hard/soft river bed bottom	Soft river beds are muddy and may be less popular			

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
	Natural jump-off features (e.g., large rock)	Amenity feature			
	Beach	Somewhere to sit and easy access to the water	**Desirable site characteristic**		
	Pools	Amenity feature			
	Pool/riffle/run sequences	Amenity feature			
	Rapids	Amenity feature			
Water quality	**Algae**	The presence of blue-green algae (cyanobacteria) presents a public health issue. Draft national guidelines (MfE and MoH, 2009) have been developed – cyanobacteria guideline breaches trigger the posting of public health warnings. Other periphyton (filamentous algae and diatoms) present a nuisance to swimmers and detract from aesthetic appeal (Biggs, 2000) rather than present a potential health issue. This attribute encompasses types of algae that relate to a health risk (cyanobacteria) or a nuisance (filamentous algae/diatoms) for swimmers.	Compliance with national periphyton guidelines and draft national guidelines for cyanobacteria, i.e.: The maximum cover of visible stream or river bed by periphyton: filamentous algae more than 2 cm long shall not exceed 30%; diatoms more than 3 mm thick shall not exceed 60%; or cyanobacteria cover shall not exceed 50%	**High**: Meet guidelines >50% of the time in past year (**score: 3**) **Medium**: Meet guidelines 25-50% of the time in past year (**score: 2**) **Low**: Meet guidelines <25% of the time in past year (**score: 1**)	Expert Panel estimate (fair) Some Council data available (very good)
	Blue-green algae	Covered above – initially separately identified owing to its importance for public health			
	Water clarity	Users prefer clear water	Compliance with ANZECC (2000) guidelines, i.e.: Horizontal visibility >1.6 m (black disc visibility)	**High**: >3.0 m horizontal visibility when river is below median flow (**score: 3**) **Medium**: 1.6-3.0 m horizontal visibility when river is below median flow	Expert Panel estimate (fair) Some Council data available (very good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
				(**score: 2**) **Low**: <1.6 m horizontal visibility when river is below median flow (**score: 1**)	
	Faecal contaminants	This is related to water clarity and flow (data indicate a positive correlation)			
	pH	Acid or alkaline pH may cause skin irritations and make eyes and cuts sting			
CONTEXTUAL ATTRIBUTES					
Collective value	Site clusters	The proximity of sites to each other may influence site selection, as it provides options (e.g., if one site looks crowded, users can go to a nearby site).			
	Scarcity	Where few swimming sites exist within an area, then each site is more significant			

Appendix 7B-3
Assessment of indicators by SMARTA criteria

Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use
Number of swimmers on a peak use day	Yes	Number of swimmers	Requires on-site monitoring	Use implies site valued by user	Data not available (requires monitoring)	Standard recreation metric
Number of kms travelled by swimmers from previous night's location	Yes	Number of km	Requires user survey to identify previous night location	Large travel distance implies high value	Data not available (requires user survey)	Question been asked in recreation surveys
Presence of facilities (toilets; camp facilities - designated camping sites, ablution block, signage, etc)	Yes	Toilet and camp facilities present/absent	Data available for Council facilities; Non-council facilities known by Expert Panel	Facilities respond to demand/high use	Data available	Data used by councils for other purposes
Perception of scenic attractiveness	Yes	Response to user survey rating scale question; Professional assessment by landscape planner	Requires site visit (planner) or else user survey	Likely to influence choice of swimming site	Data not available (but could obtain from site visit – user survey or professional assessment)	Assessments undertaken by landscape planners for other purposes; Question been asked in recreation surveys
Maximum water depth	Yes	Physical measure	Site visit required	Provides swimming hole	Data not available (easy to obtain from site visit)	No
Morphological variability	Yes	Physical measure	Site visit required	Provides site conducive to swimming	Data not available (easy to obtain from site visit)	No
Compliance with periphyton and cyanobacteria guidelines	Yes	National water quality measures	Part of Council monitoring programme	Triggers posting of health risk warning and/or nuisance	Data available	Data used by councils for public health warnings
Compliance with horizontal visibility guidelines	Yes	National water quality measure	Part of Council monitoring programme	Likely to influence choice of swimming site	Data available	Data used by councils for other purposes

Appendix 7B-4
Significance assessment calculations for swimming (Steps 1 and 5-8)

Swimming site	Description		Data									Threshold scores									Sum of threshold scores						River
	R=rural	Primary attribute:	Water clarity	Swim holes	Variable water depth	Algae	Scenic attractiveness	Origin of users	Level of use	Facilities		Water clarity	Swim holes	Variable water depth	Algae	Scenic attractiveness	Origin of users	Level of use	Facilities		Equal wt.	Equal wt.	Level of use x2	Facilities x2	Use+ Facilities x2	Use x3, Facilities x2	Significance
	RR=rural+	Indicator:	Horizontal visibility	Max water depth	Morphological variable	G/lines compliance	Overall rating	Km travelled that day	No. swimmers/ peak day	Presence facilities		Horizontal visibility.	Max water depth	Morphological variability.	G/lines compliance	Overall rating	Km from home	No. swimmers/ peak day	Presence facilities		Score	Rank	Tested & rejected	Tested & rejected	Tested & rejected	Tested & rejected	i.e. Regional
	remote	Thresholds:	1<1.6m, 2=1.6-3m, 3>3.0	1<2m, 2=2-3m, 3>3m	1=low, 2=med, 3=high	1>50%,2=25-50%,3<25%	1=low, 2=mod, 3=high	1<10km,2=10-20km,3>20	1=low,2=med ,3=high	1=no, 2= toilet only, 3= camp+ toilet		1<1.6m 2=1.6-3m,3>3m	1<2m,2=2-3m,3>3m	1=low, 2=med, 3= high	1>50%,2=25-50%,3<25%	1=low, 2=mod, 3= high	1<10km ,2=10-20km, 3>20km	1=low,2=med ,3= high	1=no,2= toilet only,3= camp+ toilet								or local
		Data sources:	TDC data + EP estimate	EP estimate	EP estimate	TDC data + EP estimate.	EP estimate	EP estimate	EP estimate.	TDC data		TDC data + EP estimate	EP estimate	EP estimate	TDC data + EP estimate	EP estimat.	EP estimate	EP estimate	TDC Data								
Takaka River at Paynes Ford	R		3	3	2	3	3	2	3	2		3	3	2	3	3	2	3	2		21	1	24	23	26	29	Regional
Buller River at Riverview Camp, Murchison	R		3	3	3	3	2	1	3	3		3	3	3	3	2	1	3	3		21	1	24	24	27	30	Regional
Lee River Reserve	R		3	2	3	3	2	3	3	2		3	2	3	3	2	3	3	2		21	1	24	23	26	29	Regional
Aorere River at Salisbury Bridge	RR		3	3	3	3	3	3	1	2		3	3	3	3	3	3	1	2		21	1	22	23	24	25	Regional
Motueka River at McLeans Reserve	RR		3	2	3	3	2	3	2	2		3	2	3	3	2	3	2	2		20	5	22	22	24	26	Regional
Roding River at Hackett Reserve	RR		3	2	3	3	2	3	2	2		3	2	3	3	2	3	2	2		20	5	22	22	24	26	Regional
Motueka River at Peninsula Bridge	RR		3	3	3	3	2	3	2	1		3	3	3	3	2	3	2	1		20	5	22	21	23	25	Regional
Takaka River at Blue Hole	RR		3	3	3	3	2	3	1	2		3	3	3	3	2	3	1	2		20	5	21	22	23	24	Regional
Motupiko River at Quinney's Bush	R		3	2	2	3	2	1	3	3		3	2	2	3	2	1	3	3		19	9	22	22	25	28	Regional
Motueka River at Alexanders Bridge	RR		3	2	3	3	2	2	2	2		3	2	3	3	2	2	2	2		19	9	21	21	23	25	Regional
Wainui River at falls track	RR		3	2	3	3	3	2	2	1		3	2	3	3	3	2	2	1		19	9	21	20	22	24	Regional
Roding River at White Gates	RR		3	2	3	3	2	3	1	2		3	2	3	3	2	3	1	2		19	9	20	21	22	23	Regional
Aorere River at Devils Boots	R		3	3	3	3	3	2	1	1		3	3	3	3	3	2	1	1		19	9	20	20	21	22	Regional
Roding River at Twin Bridges	R		3	1	2	3	2	3	3	2		3	1	2	3	2	3	3	2		19	9	22	21	24	27	Regional
Buller River at Motorhome Park	R		3	3	2	3	2	1	1	3		3	3	2	3	2	1	1	3		18	15	19	21	22	23	Local
Waingaro River upstream Takaka			3	2	2	3	2	1	2	3		3	2	2	3	2	1	2	3		18	15	20	21	23	25	Local
Wairoa River at WEIS Weir	R		3	2	2	3	2	2	3	1		3	2	2	3	2	2	3	1		18	15	21	19	22	25	Local
Motueka River at Blue Hole			3	3	2	3	2	2	2	1		3	3	2	3	2	2	2	1		18	15	20	19	21	23	Local
Motueka River - Mcleans to Woodstock	RR		3	2	2	3	2	3	2	1		3	2	2	3	2	3	2	1		18	15	20	19	21	23	Local
Riwaka River at North Branch source			3	1	2	3	3	3	1	2		3	1	2	3	3	3	1	2		18	15	19	20	21	22	Local
Lee River at Mead Reserve	R		3	2	2	3	2	3	1	2		3	2	2	3	2	3	1	2		18	15	19	20	21	22	Local
Lee River at Firestone			3	2	2	3	2	3	1	2		3	2	2	3	2	3	1	2		18	15	19	20	21	22	Local
Buller River at Owen River Camp	RR		3	3	3	3	2	1	1	2		3	3	3	3	2	1	1	2		18	15	19	20	21	22	Local
Motueka River at Gravel Pit/Greg's Rock			3	2	3	3	2	3	1	1		3	2	3	3	2	3	1	1		18	15	19	19	20	21	Local
Wairoa River at DOC Reserve (d-s left & right branch confluence)	RR		3	2	3	3	2	3	1	1		3	2	3	3	2	3	1	1		18	15	19	19	20	21	Local
Torrent River at Cleopatras Pool			3	1	2	3	3	3	2	1		3	1	2	3	3	3	2	1		18	15	20	19	21	23	Local

Motueka River - SH60 to Alexander Br	RR		3	2	3	2	2	2	2	1		3	2	3	2	2	2	2	1		17	27	19	18	20	22	Local
Motueka River at Durants			3	2	2	3	2	2	2	1		3	2	2	3	2	2	2	1		17	27	19	18	20	22	Local
Motueka River - Alexander to Peninsula Br	RR		3	2	2	3	2	2	2	1		3	2	2	3	2	2	2	1		17	27	19	18	20	22	Local
Motueka River at Hadlees			3	2	2	3	2	2	2	1		3	2	2	3	2	2	2	1		17	27	19	18	20	22	Local
Motueka River at Tinpot			3	2	2	3	2	2	2	1		3	2	2	3	2	2	2	1		17	27	19	18	20	22	Local
Motueka River at Jenkins			3	2	2	3	2	2	2	1		3	2	2	3	2	2	2	1		17	27	19	18	20	22	Local
Takaka River at SH60	R		3	2	2	3	2	2	1	2		3	2	2	3	2	2	1	2		17	27	18	19	20	21	Local
Motueka River at Pokororo			3	2	2	3	2	2	1	2		3	2	2	3	2	2	1	2		17	27	18	19	20	21	Local
Abel Tasman NP along Track			3	1	2	3	2	3	2	1		3	1	2	3	2	3	2	1		17	27	19	18	20	22	Local
Tukurua Stream at mouth	R		3	1	1	3	2	1	2	3		3	1	1	3	2	1	2	3		16	36	18	19	21	23	Local
Motueka River SH60 Bridge	R		3	2	3	2	1	1	3	1		3	2	3	2	1	1	3	1		16	36	19	17	20	23	Local
Motueka River at Gorge	RR		3	1	2	3	2	3	1	1		3	1	2	3	2	3	1	1		16	36	17	17	18	19	Local
Owen River at Owen River Camp			3	2	2	3	2	1	1	2		3	2	2	3	2	1	1	2		16	36	17	18	19	20	Local
Waimea River at Appleby Bridge	R		3	1	2	3	1	1	2	2		3	1	2	3	1	1	2	2		15	40	17	17	19	21	Local
Motueka River at Tapawera	R		3	1	2	3	1	1	1	3		3	1	2	3	1	1	1	3		15	40	16	18	19	20	Local
Motueka River at Blue Gums			3	2	2	2	2	1	2	1		3	2	2	2	2	1	2	1		15	40	17	16	18	20	Local
Anatoki River at Happy Sams	R		3	2	2	3	2	1	1	1		3	2	2	3	2	1	1	1		15	40	16	16	17	18	Local
Aorere River at Collingwood-Pakawau Rd			3	2	2	3	2	1	1	1		3	2	2	3	2	1	1	1		15	40	16	16	17	18	Local
Marahau River at Old MacDonalds Farm			2	1	1	3	2	1	2	3		2	1	1	3	2	1	2	3		15	40	17	18	20	22	Local
Marahau River at camp u-s Old MacDonalds Farm			2	1	1	3	2	1	2	3		2	1	1	3	2	1	2	3		15	40	17	18	20	22	Local
Motueka River at Whakarewa St (Blue Rk)			3	2	2	2	1	1	2	1		3	2	2	2	1	1	2	1		14	47	16	15	17	19	Local
Motueka River at Pah St (Red Rock)			3	2	2	2	1	1	2	1		3	2	2	2	1	1	2	1		14	47	16	15	17	19	Local
Motueka River at Elephant Rk (Woodmans Bend)			3	2	2	2	1	1	2	1		3	2	2	2	1	1	2	1		14	47	16	15	17	19	Local
Waimea River - SH60 to Bryants			3	1	2	3	1	1	2	1		3	1	2	3	1	1	2	1		14	47	16	15	17	19	Local
Wairoa River at Bryants Rd	R		3	1	2	3	1	1	2	1		3	1	2	3	1	1	2	1		14	47	16	15	17	19	Local
Takaka River at Kotinga (pony club)			3	1	2	3	2	1	1	1		3	1	2	3	2	1	1	1		14	47	15	15	16	17	Local
Anatoki River at One Spec Rd			3	1	2	3	2	1	1	1		3	1	2	3	2	1	1	1		14	47	15	15	16	17	Local
Wai-iti River at Waimea West Rd	R		3	1	2	3	1	1	2	1		3	1	2	3	1	1	2	1		14	47	16	15	17	19	Local
Waimea River at Bartletts	R		3	1	2	3	1	1	1	1		3	1	2	3	1	1	1	1		13	55	14	14	15	16	Local
Waimea River at Blackbyre Rd	R		3	1	2	3	1	1	1	1		3	1	2	3	1	1	1	1		13	55	14	14	15	16	Local
Wairoa River at Clover Rd	R		3	1	2	3	1	1	1	1		3	1	2	3	1	1	1	1		13	55	14	14	15	16	Local
Takaka River at Reilly's Rd			3	1	1	3	1	1	1	1		3	1	1	3	1	1	1	1		12	58	13	13	14	15	Local
Brooklyn Stm at Westbank Rd			3	1	1	3	1	1	1	1		3	1	1	3	1	1	1	1		12	58	13	13	14	15	Local
Riwaka River at SH60			3	1	1	3	1	1	1	1		3	1	1	3	1	1	1	1		12	58	13	13	14	15	Local
Wai-iti River at Pidgeon Valley Rd (Wakefield)	R		3	1	1	3	1	1	1	1		3	1	1	3	1	1	1	1		12	58	13	13	14	15	Local
Motupipi River at Abel Tasman Dr	R		1	2	2	2	1	1	1	1		1	2	2	2	1	1	1	1		11	62	12	12	13	14	Local

Appendix 7B-5
Other factors relevant to the assessment of significance for swimming (Step 9)

Desirable site characteristics for swimming
Public access The public must be able to access the site. Access for vehicles is important for most sites and includes space for parking (which may be informal). It was noted that access to most swimming sites is free of charge in New Zealand and this is expected by New Zealanders.
Flow (velocity) The water should be flowing (not stagnant) and able to be waded (<1 m/s at 1 m depth).
River width A river that is too narrow is unlikely to attract swimmers - a width of approximately >5 m was suggested.
Perception of safety Swimmers are unlikely to use a site they consider too risky.
Beach Ideally, the shore provides somewhere to sit and enables easy access to the water.
Other factors
Potential future use Some sites may receive a low level of existing use (or none at all) but have the potential to be well-used swimming sites (e.g., from a change to a desirable site characteristic).
Degree of scarcity of the experience Where few alternative (substitute) sites exist that suit swimming, then the degree of scarcity is high (and vice versa). This places greater significance upon sites. Conversely, where sites exist in close proximity, this may influence site selection as it provides options (e.g., if one site looks crowded, users can go to a nearby site).

Appendix 7B-6
Future data requirements for swimming (Step 10)

Data need
User monitoring at swimming sites on peak use days – numbers of users
Professional assessment of scenic attractiveness by landscape planner
User surveys at swimming sites (home location; perception of scenic attractiveness; use by different ethnic groups; satisfaction with visit)
Population-based survey (in conjunction with other recreation data collection) - to enable calculation of swimmer/days + evaluation of the overall importance of different sites for swimming