# Jet boating on Canterbury rivers

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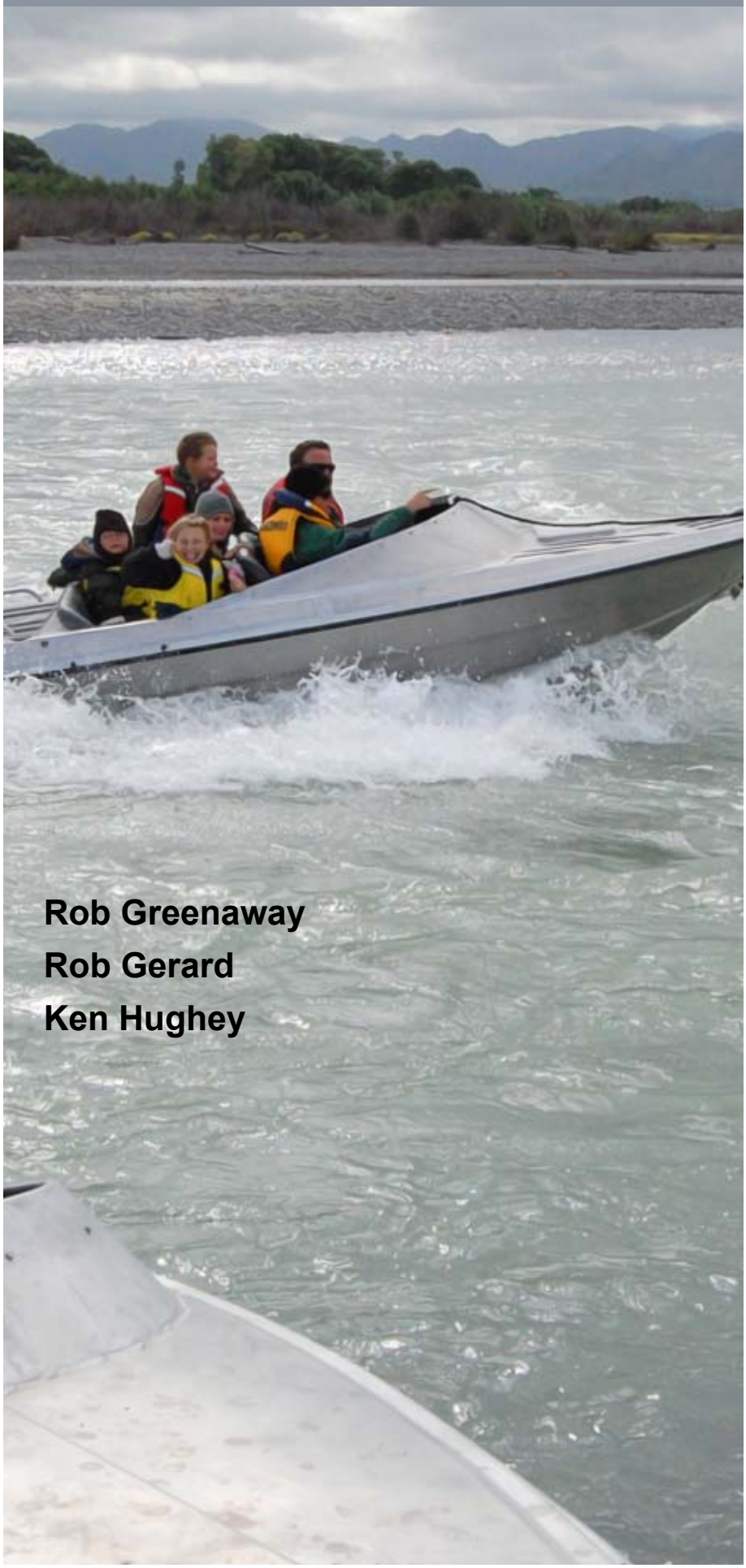


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# Jet Boating on Canterbury Rivers – 2015

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Cover photo: Waiau River family boating. Rob Greenaway

# Contents

# 1 Introduction

Jet boating is an iconic from of recreation in New Zealand, being based on an internationally renowned and commercially successful local invention – the Hamilton jet. And more-so, it is an iconic activity in Canterbury due to the relatively low use of the offshore marine setting for motor boating (the result of a lack of marine recreation facilities and an exposed coastline) and the attractiveness and variety of the region's lakes and rivers. Canterbury has the most-boated river in New Zealand – the Waimakariri – and the widest range of freshwater boating options, with many adventures suited to those with advanced skills, as well as a suite of readily boatable water for those developing their abilities. The region's braided rivers are of particular value. The scenery varies from the mundane and easily accessible to the remote and splendid. Many hunters, anglers and others just seeking access to relatively remote areas have adopted the activity as a core component of their recreation. Salmon fishing in particular – another iconic activity for Canterbury – is strongly associated with jet boating.

This document aims to provide a basis for understanding the river flows needed to support jet boating in Canterbury, as well as other values which jet boaters treasure, such as the rivers' natural values and physical and regulatory access.

The report is set out in a manner which should allow easy updating over time. The first sections (3 to 7) provide the history of the activity and a review of the river values which enable it. These sections are largely nationally relevant and could be repeated throughout the country for any group of rivers. The remaining sections (2 and 7) are specific to Canterbury, but the format could also be used in any region. These two sections have been formatted to allow their easy review over time as more data are collected and resource characteristics change.

The document has been prepared for Environment Canterbury as part of a two-stage assessment for jet boating. The first stage was the preparation of a review of jet boating values using a nationally-accepted river values assessment process ('RiVAS') and a on river-by-river basis, relying largely on expert panel input. That report is available separately.[1] The findings of the RiVAS assessment are, however, incorporated into this document.

Jet Boating New Zealand (JBNZ) has supported this review process.

## 1.1 Acknowledgements

The authors of this report acknowledge the input of the expert panel who assisted in the preparation of the preceding RiVAS report: Brett Dann, Shayne Harris, Vaughan Ingram, Steve Kirner, Linda Lister, Phil McClintock, John Mead, Selwyn Mercer, Ross Millichamp, Graeme Richardt, David Street, Bill Southward and Ed Wicken.

Henry Hudson kindly reviewed a draft of this document. Shane Galloway completed the preliminary literature review. Kate Steel at Environment Canterbury prepared the flow duration tables. Nicki Ablitt and Christina Robb of Environment Canterbury supervised the project.

[1] Hughey, K. Greenaway, R. Gerard. 2015 *Jet Boating on Canterbury Rivers - Application of the River Values Assessment System (RiVAS)*. Environment Canterbury

# 2 History

## 2.1 The boats

The jet boat is the creation of C W F (Bill) Hamilton who sought to realise a long-held dream of building a boat that could travel up and down New Zealand's rivers. He finally made the breakthrough in 1954, and developed a boat that could travel in very shallow (less than 15cm) of water. The early boats were quite primitive with little power, plywood hulls, centrifugal pumps and were quite slow (35kph). Development was rapid, with the design of new axial flow jet units, the use of fibreglass hulls and more powerful motors. Today's river boats are most commonly aluminium hulls with efficient jet units and 200hp plus motors, excellent handling – fast, manoeuvrable and robust.

The enthusiasm for this new and exciting sport rose rapidly as increasing numbers bought boats. Jet boat manufacturers and businesses sprang into existence throughout the country to service the demand. New Zealanders embraced this local invention.

Exploration of New Zealand's rivers began immediately. The ability of the craft to provide access to remote areas soon led to their commercial use for venison recovery and tourism, as well as private recreational use. The boats provided transport to remote settings and a whole new range of fishing reaches and pools that were previously inaccessible to many family groups and individuals. The challenge associated with exploring rivers with their constantly changing conditions and variety of navigational obstacles, as well as the easy access provided by many lowland braided rivers, supported many different styles of participation, ranging from adventure boating in new water to family cruises on familiar territory.

Salmon fishermen in particular embraced jet boats, which gave them access to previously inaccessible pools, plus the ability to fish long sections of the rivers in search of the elusive runs of salmon. This remains a significant use, particularly on the Waitaki and Rakaia Rivers.

Ross Millichamp describes the effect of the jet boat on salmon angling:[2]

**Bill Hamilton on the Ohau River – Easter 1954. Image courtesy of CWF Hamilton & Co Ltd**

[2] Millichamp, R. 1987. *Salmon Fishing*. Shoal Bay Press.

> *They have allowed access to previously inaccessible water and have revolutionised upriver fishing. In earlier days the complexity of using drifting dinghies had put many anglers off boating the rivers, so the arrival of jet boats made boating more attractive (and more fashionable!) to the average angler. Most beginner salmon anglers aspire to own a jet boat for upriver salmon fishing. Many of the more successful anglers own jet boats and so novices feel that they need to have one in order to have any chance.*

Millichamp also notes the heavy use of jet boats, and the need for heavy anchors, when salmon fishing around river mouths.

It wasn't long before a competitive side emerged. The New Zealand Jet Boat Association formed in the late 1960s and promoted rally days – focussed on developing boating and navigation skills – which were immensely popular.

The next step was river racing. The first annual Jet Boat Marathon was held in 1970, and continues to this day. The early boats were commercial family hulls, but as the sport has progressed, hulls designed specifically for racing have been essential for success. Hulls progressed from wide and comparatively slow mono-hulls, to long narrow mono-hulls; and now tunnel hulls reign supreme. Similarly motor and jet unit evolution for racing has progressed, with the use of turbocharged motors and recently the adaption of jet engines for the top boats. Speeds have likewise changed rising from 120kph to 200kph.

River racing next went international, initially with the Rio Balsas race in Mexico in the 1970s. World Jet Boat Marathons are now run regularly with most competitors coming from New Zealand, Canada, USA and Mexico.

In the 1980s another form of the sport emerged; jet sprinting. This initially took place on tight circuitous courses dug in the river beds by diggers. Boats ran one at a time against the clock, in a series of elimination heats. Here the call was for small, light-weight, good handling hulls with big horsepower. This sport has now become an off-shoot of jet boating and is now run almost exclusively on courses dug away from rivers, and providing for spectators. The boats have incredible acceleration and generate very high G forces.

However, for most jet boaters the sport revolves round the family boat. There are a significant number of committed enthusiasts for whom recreation means jet boating. Once the skills are mastered the enthusiasm for jet boating never seems to wane. These enthusiasts are from all walks of life, as jet boats are a mechanically simple and enable the do-it-yourselfers to undertake their own boat building and repairs and maintenance.

Boats with external propellers using either inboard or outboard motors are generally referred to as 'powerboats' (or more derisively by jet boaters as 'eggbeaters'). While these may be used on inland lakes, they are unsuited to rivers due to their depth requirements and the vulnerability of the propeller.

Unlike powerboats, the helm (wheel) on a jet boat is on the port (left hand) side of the vessel. The reason is simple. Quick and accurate throttle control is essential which requires a foot accelerator. People are used to car accelerators controlled by the right foot, so the accelerator needs to be on the right. Moving the helm to the left allows the accelerator pedal to be mounted flush with the floorboards (where there is adequate space between the floor and hull) and a linkage or cable to be run down the centre of the boat to the motor – a safe, simple and comfortable set up.

Jet units are used in a wide range of applications, not just recreational and tourist river boats, with large diameter units used to drive a wide range of vessels, including seagoing passenger ferries and coastal patrol vessels.

### *2.1.1 Boat evolution*

Recreational jet boating has from the start focussed on 4-5 metre boats carrying 2-5 people. The early boats were plywood but they have disappeared from daily use. Very early on, in 1956, the advent of fibreglass allowed stronger hulls, and by the 1960s this was the standard material. In the 1980s the focus shifted to aluminium, using marine grade alloy. This was not only light but easy to repair and is now the industry norm. Some steel hulls were used, but the material was relatively heavy and soft and didn't gain widespread use.

Typically the boats are powered with 'marinised' car engines. The early boats used 4-cylinder motors, but it was quickly realised more power had advantages, and 6-cylinder motors became the norm. The Ford 3 litre V6 became dominant in the late 1960s and '70s. While they were not a success in cars, they proved reliable in jet boats and their compact design was ideal for small jet boats. In the 1980s Chevrolet V8s became commonplace, alongside Leyland P76s and Falcon and Chrysler Hemi motors. The weight of the Chev' V8 was a drawback. However, the arrival of alloy heads, then alloy blocks, means these motors are extremely popular today. Another popular modern motor is the Lexus V8; all-alloy with reasonable power and good economy. Alongside the motors mentioned are a raft of other options including 4-cylinder and turbocharged options.

More recently another type of jet boat has emerged and is gaining in popularity. While small boats (3 to 3.5 metres) with small lightweight motors and small units have been around since the 1970s, they never became popular. Now the advent of high power jet skis has provided a source of reasonably-priced, high-power, light-weight motors and units. These are being put into 3 to 3.5 metre light-weight alloy hulls. These small boats can be taken into small and shallow streams as they are easy to push if run aground, sufficiently robust to take the knocks and have the performance to quickly respond to difficult situations. Unfortunately, they have been involved in several fatal and injury accidents. The exact causes are as yet unclear, but it seems that they have a high centre of gravity which makes them prone to rollover. Hull design is probably a key factor in improving their safety.

### *2.1.2 Boating skills and their acquisition*

The ability to read rivers and handle a boat skilfully is not a universal skill. The normal error of misjudging water depth can result in long periods of hard work pushing a boat to deep water. Fortunately, Canterbury offers a range of accessible and challenging water where skills can be progressively acquired.

Ross Millichamp (1987) notes:

> *An experienced jet boater once told me that it takes only three minutes to learn how to operate a jet boat, but takes three years to learn how to find your way up a braided river! The only way to learn how to drive a jet boat is to spend time being taught by someone who knows. I ran aground more times in the first season I had a jet boat than I have in the nine years since.*

Driving a jet boat is easy – you've only got a steering wheel, an accelerator and a forward/reverse lever. It only takes a matter of minutes to get the idea. The boat steers by deflecting a jet of water which takes a bit of getting used to. If you take your foot off the accelerator, then you lose the steering. Equally, if you are at full lock and apply more power, the boat will turn more. People with a cautious disposition struggle to adapt to the constant need to use power. The other basic is that at displacement the boat sits deep in the water and is at the mercy of the current. However, once up and planing along the surface it needs less than 15cm of water and is not affected by cross currents.

Driving in a river is another matter, and it takes most people 50-100 hours to become proficient. The art of reading the river is a matter of knowing what to look for and knowing what your boat can do. Bill Hamilton developed the rudiments, and his advice still holds good today.

- Wave patterns: ripples mean shallows, long waves mean deep water.
- Shallows: keep speed up, turn slightly to heel boat to one side, keep the jet intake over the deepest water, and be prepared to either stop or turn round if the next section is too shallow.
- River banks: these indicate what the river bottom is likely to be. Fine shingle banks indicate a fine shingle bed, whereas boulder banks indicate a boulder bottom.
- Still water: Beware, if there's little current underwater obstacles won't have a wave to show their presence.

You will also encounter all sorts of different situations, each of which will need a different strategy.

- Shallow braided rivers: boat 'two pools ahead'. When you are going upstream you can usually stop below a shallow bar. Downstream is harder – you need to always allow room to turn round and escape if there is not enough water. Lift off immediately if you hit the bottom firmly or you'll block the jet's water intake grille with gravel. Boating is at its hardest on a falling river as it will not have formed navigable channels in the shallows. (See also the image for the Ashley River in Section 6.3.6 (page 34) of this report.)
- Rocky or boulder sections: Plan the general line by looking for the most water, then dodge rocks as necessary. Take the straightest line possible, because once you start dodging every rock in sight you'll probably finish up in a shallow and damaging location.
- Rapids: Plan your route before entering. The key is keeping the bow of the boat up. If the bow goes under a wave the results can be disastrous.

**Rakaia River, when it goes wrong. Photo: Paul Vernel**

How do you acquire these skills? Many have learnt the hard way, but the best idea is to invite an experienced driver along for your first experiments, and then to go on outings where there are experienced drivers to learn from. Jet Boating NZ offers these opportunities to its members.

Jet boating skill levels are used by JBNZ in the definitions of the Class of a river (see Section 6.1.1 in this report).

### *2.1.3 What are the entry and activity costs in 2015*

Obviously the biggest cost is the boat itself. Choice will depend on the use you plan to make of it. For instance, if it is mainly for lake and deep water use, a fibreglass hull will be acceptable, but you intend being adventurous you need a very good handling, adequately-powered alloy boat.

New boats or near-new second hand family boats range from about $35,000 to $80,000. Many people are prepared to invest $20-30,000, so there is always a shortage of good boats in this price range. If you are going to buy second-hand get advice from an experienced jet boater. There are many potential traps that could turn a 'bargain' into an expensive exercise. However, you should be able to get a good, well set-up alloy boat for family use for about $30,000. The good news is that good, well-maintained boats hold their value and over time may actually increase in value.

Most boats use 15-25 litres petrol per hour, but most outings will probably be less than 2 hours. Insurance is quite reasonable but depends on the value of the boat. For a $30,000 boat it will probably be $400-600 per year. Big maintenance bills are usually due to poor or deferred maintenance or to repairing accumulated hull damage caused by hitting things in the river.

Ideally you will have a 4WD tow vehicle, as many launch sites require 4WD. The fuel costs of getting to the rivers will often exceed the boat fuel for a day out.

Membership of Jet Boating New Zealand is currently about $120 per year. This gives access to organised runs, guidance from experienced drivers and detailed river information.

## 2.2 Participation

Jet Boating NZ estimates that only 20% of jet boaters are members of the association; and association members in Canterbury and Waitaki own approximately 730 boats. This gives an estimate of 3500 jet boats owned in the Canterbury region.

Sport NZ reports on jet boating participation in their periodic Active New Zealand survey with less than 1% of the national adult population having participated in the activity at least once in the 12 month period prior to the survey date. This is the same participation level for 'boating', waka ama and wind surfing. Sailing and yachting participation was at 2.1% and rugby league at 1.3%.[3] For relatively low participation activities, there are likely to be large margins of error in these results.

Kalafatelis & Magill (2013)[4] completed a national survey of recreational boating activity for Maritime NZ with 1500 respondents. The results were not filtered for marine activity only, and jet boats have been grouped with power boats. This indicated, at the national level, that:

- 24% of New Zealanders aged over 18 own or use a vessel for recreation boating purposes (57% male and 43% female):
- 15% own or use a canoe or kayak,

[3] Sport New Zealand, 2015. *Sport and Active Recreation in the Lives of New Zealand Adults. 2013/14 Active New Zealand Survey Results*. Wellington: Sport New Zealand

[4] Kalafatelis, E. & Magill, K. 2013. *Rates of participation in recreation boating*. Research New Zealand client report prepared for Paul Vance, Maritime NZ.

- 9% own or use a power boat under 6m,
- 9% own or use a dinghy,
- 5% own or use a power boat over 6m,
- 3% own or use a sail boat under 6m,
- 2% own or use a sail boat over 6m,
- 2% own or use a jet ski.

Most jet boats used on Canterbury's rivers would be less than 6m in length.

During periods when boaties are 'most active', such as over summer, 24% of users of 'power boats under 6m' went out at least weekly, and another 25% went out once every couple of weeks. Similar levels of activity were evident for other vessels, although power boats under 6m were the most frequently used.

Kalafatelis & Magill (2013) reported 12% of respondents who owned or had access to a boat were based in Canterbury. By comparison, the Auckland region had 32% of the national population in 2013 and 26% of the nation's boat ownership and/or use, Canterbury had 12% of the population and 12% of the boat ownership and/or use (i.e., 61,000 people), Otago 5% of the population and 7% of the ownership and/or use. Of 'power boats', Auckland had 23% of the nation's stock of owners/users, and Canterbury 11%. Considering Canterbury's relatively unsheltered coastal setting and lack of any significant marine recreation centre (like a modern marina), the vast majority of 'power boat' ownership in Canterbury will be vessels used on the region's (and Otago's) lakes and rivers.

Vance (2014)[5] used the data gathered by Kalafatelis & Magill (2013) and older information to review trends in boat ownership. Eight Colmar Brunton surveys completed between 2002 and 2011 gave a range of 16% to 19% of households owning at least one boat in New Zealand; or 641,000 people and 727,000 vessels. Kalafatelis & Magill (2013) gave an estimate of 900,000 vessels, the most popular of which were 'power boats' under 6m, with 210,000 owned in NZ.

Vance (2014) estimated that between 30% and 50% of boat users go out at least every couple of weeks; and that levels of ownership have been reasonably consistent since at least 2006, but with possible increases in the ownership of trailer 'power boats' and canoes and kayaks. However, the use of different survey methods means these trends are not certain.

## 2.3 Commercial jet boating

Commercial jet boating started as early as 1958, with a service on the Whanganui River. In 1960 the first tourist trips started in Queenstown, and other ventures followed, including a trip in the Waimakariri Gorge. Today it is a major industry with a mix of thrill-seeker trips and eco-tourism. The Queenstown-based Shotover Jet is internationally renowned. In Canterbury there are currently operators on the Waiau, Waimakariri and Rakaia Rivers.

Initially commercial operators used available recreational boats carrying about six passengers, but these small boats have largely been replaced by specially designed and built tourist craft seating 15-34 passengers. The larger boats are powered by twin V8 motors driving two jet units.

Maritime NZ estimated in 2012:[6]

[5] Vance, P. 2014. *Synthesis of research conducted in recreational boating.* Maritime NZ internal report.

[6] Maritime NZ, May 2012. Regulatory Impact Statement Maritime Rule Part 82: Commercial Jet Boat Operators – River Agency Disclosure Statement

- There are presently 94 commercial jet boats used by 47 commercial jet boat operators with an estimated of 140-180 drivers.
- The sector is estimated to carry 370,000 passengers annually.
- While it is difficult to quantify the commercial value of the sector, a conservative estimate based on passenger numbers and minimum prices suggests the annual turnover exceeds $31 million.


**Alpine Jet, Waimakariri Gorge. Photo: Alpine Jet**

- The value of the jet boating industry to the branding of NZ"s tourist image is difficult to estimate. However that over 200,000 jet boat passengers are international visitors, and that most make their bookings prior to coming to NZ, suggests it plays a significant role.

Commercial jet boating is controlled by *Maritime Rules Part 82: Commercial Jet Boat Operations – River* which apply to operators and drivers of commercial jet boats that:

- operate on rivers; and
- carry passengers; and
- are less than nine metres in length; and
- are designed to carry no more than 34 people.

## 2.4 Jet Boating New Zealand

An collective of owners of jet boats formed the New Zealand Jet Boat Association in 1962 with a foundation membership of 58. This number had increased to about 2000 by 2015, and the association is known as Jet Boating New Zealand Incorporated (JBNZ).

This is headed by a National Executive with regional branches throughout New Zealand, each formed at different times:

- Northern Districts (1971)
- Taranaki (1976)
- Central Districts (1971)
- Nelson/Marlborough (1971)
- West Coast (1969)
- Canterbury (1968)
- Waitaki (1973)
- Otago (1968)
- Southland (1966)


A member belongs to the JBNZ through their branch, and branches levy their members. Fees are collected by the national secretary. All money held by branches belongs to the Association but each branch conducts its own day to day finances and accounts annually with audited statements provided to the national treasurer.

The Canterbury Region has two branches: Canterbury and Waitaki, divided by the southern side of the Rangitata River. Branches run a number of events for their members during the year, including river runs, weekends away, rallies and social events.

Jet Boating NZ's objectives are to:

- co-ordinate jet boating on a national basis,
- encourage safe jet boating principles and practices,
- protect the rights of jet boaters and JBNZ, and
- establish and maintain harmonious relationships with other water users.

It has a website and publishes an annual 'Safety / Year Book' giving members access to jet boating regulations and a safe boating checklist; as well as a quarterly journal ('Jet Boating'). The rivers information which appears in the Year Book is also available on the JBNZ website (nzjet boating.com) and is accessible to non-members. Jet Boating NZ endeavours to keep its members well-informed of all relevant issues.

A major issue faced by JBNZ, in common with many sports clubs, is attracting and retaining members. Membership is estimated to be only 20-25% of the total number of jet boaters in the country. This means JBNZ and its members bear all the costs of maintaining relationships with other river users, preparing submissions and appearing at hearings on behalf of all jet boaters, with about 80% or boaters freeloading on this work. Ironically, the majority of problems relating to illegal use of rivers are not caused by JBNZ members; rather the 80% who either don't know the regulations or choose to ignore them.

## 2.5 Jet boat events

For most jet boaters private boat trips are the predominant activity, and organised events are secondary.

**JBNZ Club Events**

Jet Boating New Zealand Canterbury and Waitaki Branches run a range of events during the year. These fall into several main categories:

- River runs, either day or weekend, usually with a trip to another region during the year. These cater for family groups and are social and recreational days.
- Rallies. These are competitions focussed on boat handling skills, problem solving and boating knowledge, not on speed.
- Slaloms; A speed event between closely spaced buoys in deep water.

The prime function of club events is to enable jet boaters to get together for recreation and social occasions. They also serve as a useful opportunity for new jet boaters to meet, socialise and boat with experienced members.

JBNZ classic boat run at Woodstock beach. Photo: Paul Vernel

**JBNZ Driver training**

NBNZ is currently completing a Driver Training manual and programme tailored to meet the needs of new jet boaters, and instruct them in safety, regulations and driving.

**Racing**

Races are run by a separate although affiliated organisation, NZ Jet Boat River Racing Association (Inc). It organises a number of races each year throughout New Zealand, including a multi-day Marathon event. The World Jet Boat Marathon also is held in New Zealand on a regular basis.

**Jet Sprinting**

Jet sprint events are run by the New Zealand JetSprint Association which is not affiliated to JBNZ. Its events are run on dug courses away from rivers or, by consent, within a riverbed without affecting the main flow, and the boats are not used on natural rivers.


**Jet sprint boat. NZJSA photo**

## 2.6 Jet boating regulations

The invention of the jet boat posed a problem for regulatory authorities as existing maritime boating rules did not mention to rivers. The Motor Launch Regulations (1962) simply ignored jet boating and required adherence to the old Foreshore Regulations that vessels must not exceed 8 kph within 182 m of the shore on tidal waters and lake shores. Subsequently these were amended to include ‘any shore’. Given that few rivers exceed 400 metres in width, and that jet boats need to exceed 5 knots to get on the plane, this effectively prohibited jet boating on rivers. The newly-formed NZ Jet Boat Association proposed a blanket uplifting of the 5 knot rule. This was not accepted. Rather, a river-by-river process was put in place with consultation required with interested parties for each river. Jet Boating New Zealand proceeded down this course, although ‘upliftings’ have not been applied for all rivers.

In 1991 the process changed with the introduction of the Resource Management Act:

- The RMA created Regional and District Councils and required regional and district plans to include the management and control of river values and uses,
- The Queenstown Lakes District Council was declared as the regulatory body for Navigation and Safety in its district,
- The Local Government Amendment Act 2002 enabled Regional Councils to assume control of maritime navigation and safety in their regions. Most availed themselves of the opportunity, with some exceptions (Maritime NZ upliftings still apply in Taranaki and Westland, and in Otago outside the QLDC area),
- District Councils can also regulate jet boating.

In Canterbury the *Environment Canterbury Navigation and Safety Bylaws 2010* control upliftings and define boating bylaws. These incorporate rules set out in the Timaru District Council District Plan.

Rivers with no speed upliftings exist frequently because no application has been made. Only in exceptional situations have upliftings been declined. The normal situation results in either a total or partial uplifting, with the latter normally to protect salmonid or native bird species at vulnerable times.

### *2.6.1 Recommendations for future regulatory processes (JBNZ perspective)*

Jet Boating NZ would like consideration given to making the existing processes more collaborative, more flexible and more robust.

**Navigation and Safety Bylaws**

These contain the approved upliftings of 5 knot speed restrictions on a river by river basis. Most speed restrictions are based on environmental concerns, such as the protection of river bed nesting birds and of trout and salmon fisheries, rather than on navigation and safety issues.

Jet Boating NZ understands that current legislation restricts Harbourmasters to considering only navigation and safety when preparing bylaws. Bylaws which restrict jet boating upliftings for environmental reasons will need to be developed within other regional plans or consent processes, and would then need to be included in Navigation and Safety Bylaws.

In the past, the process used to achieve existing upliftings and associated restrictions has been a collaborative process between the parties concerned; and undertaken either when new upliftings have been sought or when bylaws have been reviewed. The potential for new restrictions to be prepared via a variety of planning mechanisms presents a challenge to JBNZ's ability to respond effectively and in a timely manner.

Jet Boating NZ is committed to ensuring suitable environment protection and maintaining close relationships with other river users and environmental agencies. It is essential that the regulatory framework incorporates a process to enable this collaborative process prior to access decisions being made. Jet Boating NZ's experience has shown that the requirements of all can usually be met by the formulation of appropriate controls confined to appropriate sections of rivers and times of the year; rather than the complete loss of an uplifting. It is essential that JBNZ be able to provide relevant data to regulatory authorities, beyond that which is available in this document, as allocation decisions are made. The Association is concerned that there is ample scope for its interests to be either easily dismissed or not represented in the new planning environment.

*JBNZ recommendation:*

That when new speed upliftings or changes to existing speed upliftings are proposed Environment Canterbury assists in organising a meeting of interested parties from the environmental and recreational groups of users of the affected waterway(s), chaired by an independent facilitator prior to any review of uplifting definitions. This step should be incorporated in the statutory process.

**Environmental flow setting**

JBNZ encourages a collaborative approach to modifying flow regimes. It is important that competing values are discussed openly rather than hearing panels attempting to balance competing values based on individual submissions.

*JBNZ recommendation*

That when environmental flows are considered, Environment Canterbury ensures environmental and recreational users of the affected waterway (s) are actively involved in facilitated community discussions.

# 3 Resource requirements

## 3.1 Access

Access to rivers to launch boats is serious issue for jet boaters. Because braided rivers alter course frequently and flood often, the situation at any potential launching site can alter overnight. This also means that the provision of permanent formed ramps is not a feasible long term option in most circumstances.

The first requirement is access to the riverbed at a suitable launch site. Often the best access is over private land and relies on the goodwill of the property owner. Fortunately this co-operation has generally been available to date. Many other sites rely on access points used by councils and gravel extractors. Due to inappropriate recreational 4WD access to riverbeds and banks from these sites, they are reducing in number and frequently have locked access.

Access must be such that a 4WD vehicle can tow a trailer with an 850 kg boat onto the riverbed. Once on the riverbed there needs to be suitable terrain to a suitable launching and retrieving spot. This needs to be a suitably sloped riverbank that leads to slow moving water leading into knee deep water close to the bank.

To assist its members JBNZ has a year book that includes launching spots. However, this was prepared over 30 years ago and is now of limited use. JBNZ is undertaking a programme to provide an update (prepared in tandem with this report), and will negotiate new access agreements where required with property owners.

Access for jet boats to all rivers for search and rescue, scientific research and resource management monitoring is normally a permitted activity in resource management plans.

## 3.2 Flows

Establishing definitive flows for each river is difficult because:

- It takes only one impasse to stop a jet boat. This can be a shallow bar, a boulder bar, rock impasse or a rapid.
- Rivers change. A braided river may spread out more, the channel may be blocked with willows, a new rapid may appear.
- Drivers have different skill levels. An expert will routinely boat places where beginners do not have the skills and experience to attempt.
- Drivers have different attitudes. Adventure boaters accept that hull damage is likely and are not deterred. Family boaters will ensure that a very high safety margin is kept.
- Boats have different capabilities based on power and hull design and construction.

**Braided rivers:** Most jet boats require 100-150 mm of water to operate, but by pushing a wave of water ahead of the craft can slide over less for a very short distance. Driving technique plays a large role. On the lower Canterbury Plains, rivers with gradients of 4.0 to 4.5 metres per kilometre, can be navigated in quite low flows provided there are no boulder bars or bouldery sections and that there remains at least one braid with the required water depth. In practice a large braided river with many braids is likely to require about 35 $m^3/s$, whereas a small braided river with fewer braids may only require about 20 $m^3/s$. This 'rule of thumb' must be applied very cautiously and with consideration of the specific characteristics of any river reach, particularly considering that flows measured in one location can rise and fall along the river's length as the height of the base water table changes.

**Rocky and bouldery channels:** Hitting a rock or boulder at planing speed usually results in hull damage and can cause a serious accident. This is because the whole force of the impact

can be taken on a small part of the hull. The safe navigation requirement is an identifiable track through the rocks and boulders, with individual obstacles needing to have more than 150 mm water depth. The average depth in a boulder garden will need to be in the order of 500 mm to provide this. In addition, water speed is usually greater where these conditions occur, which makes downstream travel very challenging. The flow requirement will depend on the width of the channel and the intensity of the rocks/boulders. Consequently it is not possible to give a useful guideline.

### 3.3 Fall and river formation

The steeper the gradient the faster the water moves. This results in the finer material and smaller gravels being washed downstream and deposited on lower gradient reaches. Consequently, gradient is a useful measure of the river conditions likely to be encountered. But in any section of river the gradient will vary, so the gradient figures have to be used with caution.

Low gradients indicate a predominantly mobile bed with only fine materials where groundings will not result in boat damage. There is also a high likelihood of braided conditions with a number of channels, many of which will be too shallow to navigate. A guideline for a low gradient section is a gradient of less than 5 m/km

Moderate gradients will usually contain a mixture slow water with small chutes and rapids. These are often associated with larger boulders and need to be tackled with care. This category is usually in the 5-7 m/km gradient

High gradients. These normally occur as a river nears its headwaters, and are likely to contain rock gardens, boulders, rapids, and gorges and present a high level of challenge to the driver. The guideline is gradients exceeding 7m/km.

### 3.4 Water clarity

Most jet boaters prefer boating in reasonably clear water that is also suitable for fishing and swimming, and is visually attractive. It also makes assessing water depth much easier. The nature of Canterbury's rivers mean they are subject to freshes and floods on a regular basis. These commonly result in high silt loads and dirty water. These conditions can be boated but require a high level of skill since the water depth cannot be assessed visually, and must be read by understanding the water patterns on the surface of the river, and how these relate to water depth. With experience this can be mastered, but even for an expert it can be difficult to decide whether there is sufficient depth to stop the boat. An average family boat requires about knee-deep water to be able to take off, so stopping in less results in the need to manhandle the boat to deeper water and the potential to fill the intake grill of the jet unit with gravel.

# 4 Threats

## 4.1 Flows

An important threat to existing jet boating opportunities is water abstraction for, for example, irrigation or hydropower generation, and damming. Abstractions have two potential effects:

- Lowering of natural flows to less than the required flow for jet boating. Most jet boaters prefer to boat in warm weather in clear water. This coincides with the peak irrigation demand months and time of maximum abstraction. All abstraction activities potentially reduce the availability of jet boating opportunities.
- Clarity of the water. While an abstraction might not change the clarity of the water, the timing of the take may increase the likelihood of boatable (typically therefore higher) flows coinciding with low water clarity. This especially affects 'family boaters'.

## 4.2 Access

Access to many parts of rivers is insecure, relying on the goodwill of private landowners, or at risk of closure at public sites due to the need to control damaging 4WD and stock access along and beside riverbeds.

## 4.3 Willows

Millions of willows have been planted by river engineers as the most cost effective method of riverbank stabilisation. The early variety used (crack willow – *Salix fragilis*) are highly invasive and grow from broken branches washed downstream. They not only alter the river flows by forming islands and forcing the creation of channels, but in time can create a total barrier. This is particularly the case in low-flow hill-fed rivers. Low willow branches prevent boat access in narrow channels, and render the channel and eventually the river unusable.

They also constitute a serious hazard to safe navigation. If a boat loses power or gets a blocked intake grille immediately above a low willow branch, it will be swept onto the branch and, as water pressure builds up, almost instantly roll the boat, with rapid sinking and a high risk of the crew being trapped under the boat. Willows are a significant factor in many recorded boat sinkings.

## 4.4 In-river works

Bank stabilisation undertaken in the past frequently used railway irons driven into the banks or bed. Subsequent erosion can leave these exposed, often with their tips at water level. These constitute a serious danger to safe navigation and have also been the cause of a number of jet boat accidents. Fortunately, Environment Canterbury has recognised this, and takes steps to remove these railway irons when the situation occurs.

Other in-river works most often involve bridge construction, water abstraction structures and works associated with gravel extraction. In general these are easy to observe, are usually notified to JBNZ as part of the resource consent process, and do not cause navigation issues.

# 5 Environmental effects of jet boating

Since the advent of jet boats, various concerns have been voiced regarding their impact on the rivers and on other river users. Resolving conflicting views has been made more difficult by the lack of research data to assist in decision-making. The following is an overview of some of the issues that have arisen in Canterbury.

## 5.1 Impact on riverbed nesting native birds.

The main species involved are the wrybill, black-fronted tern, black-billed gull and black stilt, all of which are 'threatened or at risk' species[7]. These species nest in Canterbury's braided riverbeds from September until typically around early January. If a flood washes out their nests, or nests are lost through other causes early in the season, they generally re-nest and try again. This means that the nesting season through to fledging can extend as late as the end of January. However, the later nests tend to be less successful and the main nesting season is usually over by the middle of December.

Concerns have been raised that jet boats put these species at risk due to wakes washing out nests and washing away unfledged chicks. Disturbance of nesting birds by passing boats has also been identified as a threat.

However, studies of the effects of jet boats suggest that the aquatic birds of the main jet boating rivers around Queenstown do not appear to be greatly disturbed by frequent jet boat travel in close proximity to their nesting, roosting and feeding areas[8]. That review indicates that the wakes are not sufficient to reach nests, unless the nest was very close to the river (which can occur especially for stilts and gulls and terns), in which case it would be lost in quite minor rainfall events causing flow increases. Equally, there is no evidence to suggest that the wakes have caused loss of chicks through being washed away. Hughey (2011)[9] undertook a comparative risk assessment process comparing the risks to birds posed by jet boating, walking (primarily for angling) and 4-wheel driving and found both of the latter to be of much more concern than jet boating. He also noted there is very little quantitative research in this area.

The primary threats to nesting birds identified (see for example, Keedwell 2004)[10] are:

- Floods. Physical destruction of nests. However floods also perform an essential job of removing riverbed vegetation and maintaining habitat.
- Predation. Mammalian predation by stoats, weasels, ferrets, rats, cats and hedgehogs eating eggs is well documented and identified as a major risk. Less well documented but very significant is avian predation, particularly by black-backed gulls and harrier hawks.
- Activities that effect the riverbed environment. Water abstraction, damming, and weed ingress into the riverbeds. Weeds not only reduce habitat but provide cover for predators.

[7] Other species are banded dotterel and pied stilt - the Department of Conservation is responsible for all these species and manages the system for monitoring and defining their conservation status

[8] Hudson, H.R. 2004. *A review of the environmental effects of jet boating.* EMA 2004-05, report for Jet Boating New Zealand. Environmental Management Associates, Christchurch, 40 pages.

[9] Hughey, Ken. 2011. *A comparative risk assessment of jet boating in relation to native birds on Canterbury braided rivers*. Unpublished report prepared for the NZ Jet Boating Association. Department of Environmental Management, Lincoln University

[10] Keedwell, R.J. 2004. *Use of population viability analysis in conservation management in New Zealand. Feasibility of using population viability analysis for management of braided river species*. Science for Conservation 243. Department of Conservation, Wellington.

- Nest disturbance. If the adults are off the nest for too long on a hot or cold day, the embryos die. This can be caused by fishermen, jet boaters, picnickers, and other human activities.
- Nest destruction. Physical destruction by 4WD vehicles, other all-terrain vehicles (ATVs) and trail bikes is also documented. Wrybills, black-fronted terns and banded dotterels tend to nest on riverbed elevated above the channels but adjacent to them. This is the normal route used by vehicles driving up and down the rivers. Cattle on riverbeds have the same result .

Hughey's (2011) analysis of the significance of human activities on the birdlife of braided rivers concluded:

> *The Department of Conservation has been reluctant to grant more jet boat access to New Zealand's braided rivers, especially those in Canterbury. They continue to perceive that jet boating may be a significant cause of damage to threatened and endangered species of native birdlife. This study has shown there is no scientifically robust evaluation of this problem or of the complex relationships that characterise it. However, it remains possible to undertake a largely qualitative community risk assessment and an associated rapid rural assessment. The findings from these analyses indicate that:*
>
> *a) Jet boating is a low risk to river birds*
>
> *b) There are multiple risk reduction options all of which will be effective in reducing any effects from jet boating.*

Jetboating New Zealand has supported the Department of Conservation in placing boating restrictions on the Mackenzie Country rivers to protect riverbed nesting birds, although it feels the risks are generally over-stated. In Canterbury, for example, the Ashley River has been monitored by the Ashley/Rakahuri Rivercare Group with the aid of a professional ornithologist for over ten years. It has only small numbers of birds, and is not heavily jet boated, although the flows that permit jet boating normally occur in the spring months during the nesting season. The Rivercare Group has not viewed jet boats as constituting a significant risk, but have countered other major risks by a combination of education and predator control. Nesting sites are marked and signs posted. A trapping programme is conducted every year. 4WD clubs do not use the riverbed during the nesting season. Users who may threaten the nesting birds are approached and informed. Gravel extractors have consent conditions to protect nesting birds. Wrybill numbers have increased over time. This multi-pronged approach to nest protection is supported by JBNZ.

## 5.2 Impact on salmonid spawning

Sutherland and Ogle (1975)[11] calculated inter-gravel flow velocities from pressure gradients in three artificial spawning bed in the Ashley River. Subjected to inter-gravel velocities of 0.18 to 0.30 m/s, in gravel-filed tubes in the laboratory, mortality of Chinook salmon eggs occurred. For the worst case scenario (9 day old eggs) this investigation showed the equivalent of multiple overhead jet boats passes may cause 20-40% loss of salmon eggs. Fatalities decrease with depth and for younger and older eggs.

Jet boating NZ has a long established policy of co-operating with the NZ Fish & Game Council and in banning boats from spawning areas as a consequence of this research. However, there is currently no study that evaluates the real impact of the consequences of this policy on a fishery. Given that trout tend to spawn on shallow water at the heads of rivers and in the side

[11] Sutherland, A.J., Ogle, D.G. 1975. Effect of jet boats on salmon eggs. *NZ Journal of Marine and Freshwater Research*. 9(3): 273-282.

streams, it is likely that the majority of the redds are in places that are not accessible to jet boats. The main streams usually have a mobile river base which is not suitable for spawning and is also flood prone. In summary, jet boats can kill salmonid eggs, but the significance of normal jet boating on a fishery is unknown.

It is also pertinent to note the role of natural processes in egg-to-fry or smolt survival. Quinn (2005)[12] reviewed over 200 published and unpublished estimates for wild or naturally rearing populations of Chinook salmon, and reported a mean egg-to-fry survival of 38% and mean egg-to-smolt survival of 10%.

### 5.3 Impact on trout and salmon fishing

Again there is a lack research data to quantify any measurable effects, but there is a plethora of opinion and some anecdotal evidence. There are several aspects worthy of mention: Do passing boats scare trout away so they can't be caught? Mark Taylor of Aquatic Ecology Ltd reports observing trout underwater not taking any notice of a passing jet boat (pers. comm.). Divers reported that adult salmon holding in 2 to 4 m deep pools in the Waimakariri River did not move when jet boats passed overhead (MAF 1976 cited in Hudson 2004[8]). Reid (2007)[13] found motorboats and their wakes did not appear to provoke startle responses in juvenile Chinook salmon when boats passed 3 m or farther from fish. It is a common report from jet boaters that trout are caught in pools immediately after driving the boat into a pool. On the other hand, fishermen report giving up fishing due to the presence of jet boats. There are anecdotal stories of jet boaters having enraged fishermen, so it seems that jet boats cause severe irritation to some anglers.

Ross Millichamp (1987) notes:[14]

> *There is much disagreement between anglers about the effect a jet boat has on fishing when it is driven through a pool. Some jet boaters say they are doing anglers a favour by stirring the salmon up and encouraging them to bite. This may be true in big pools well up the river, where large numbers of salmon are sitting and none is biting. In general, however, I believe that this is just an excuse dreamed up by jet boaters to justify travelling through pools when anglers are present.…*
>
> *If an angler wants to stir up a pool they are quite welcome to throw in rocks or invite a jet boat through on their own account. It is not up to the jet boater to make that decision on their behalf.*

Millichamp recommends jet boaters slow down and move out of the way of shore-based anglers when travelling upriver, with speed depending on how much separation is possible. If boating through a fished pool is unavoidable, the boat should be just at planning speed; and if a fish is being played, the boater should stop and not enter the pool.

Do jet boats on rivers stop fish feeding? On a gravel river, a jet boat dislodges invertebrates and consequently might stimulate trout feeding. There is anecdotal evidence to support this view. Boaters have used this ability to entice trout out of a deep pools.

### 5.4 Impact on river banks

Many jet boated rivers in Canterbury are either rock or gravel, and jet boat-induced bank erosion is considered to be negligible or of no significance relative to natural erosion. In the

[12] Quinn, T. P. 2005. *The behavior and ecology of Pacific salmon and trout*. University of Washington Press, Seattle.
[13] Reid, I.S. 2007. Influence of motorboat use on thermal refuges and implications to salmonid physiology in the lower Rogue River, Oregon. *North American Journal of Fisheries Management* 2: 1162-1173.
[14] Millichamp, R. 1987. *Salmon Fishing*. Shoal Bay Press.

high energy gravel bed of the lower Dart River, Hudson (2014)[15] examined bank erosion from large twin-engine commercial boats which generate much larger wakes than small recreation boats. In bank erosion trials low slope gravel bars, and coarse bed material, were not measurably eroded in multiple boat passes. Passage of jet boats accelerated erosion of a scarp composed of medium gravel in the active channel, but erosion was minor (centimetres) compared with small freshes and floods where metres to tens of metres of erosion occurred. Continual bend erosion was observed in the absence of jet boat passage.

Some jet boated rivers have unvegetated banks, composed of fine, unconsolidated sediment. Under these circumstances measurable erosion may result from jet boat passage. Hudson (2015)[16] undertook site inspections, and reviewed detailed bank erosion surveys and video evidence from several sites in the Kaituna River, Bay of Plenty. Jet boat wash may suspend sediment from bare banks composed of easily erodible material and where stock trampling of the river margin occurs; but vegetated banks appear to withstand wave action from commercial jet boat passage. In the absence of floods, during a period of high jet boat use, there was little net change to river banks in the jet boat reach (overall average net positive change of +0.03 m). Net erosion (-0.14 m) occurred for moderate floods (2 year events); and large floods (5 to 10 year events) caused major erosion (overall average net erosion of -0.70 m) for the surviving survey sites within the jet boat reach and control reach further downstream.

Erosion of the cohesive river flat banks in the lower Dart River was not evident with multiple boat passes (Hudson 2015). However, bank failures were observed in a small fresh; and bank retreat of 0 to 11.5 m was measured during a single small flood event. Differences in bank retreat are attributed to exposure and flow alignment. Aerial photographs show that over the longer term (1966 to 2013) the cohesive river flats retreated tens to hundreds of metres.

Jet boat wakes are comparatively low energy and small events compared to floods, and in most circumstances in Canterbury rivers, natural processes are the most significant factor in bank erosion.

### 5.5 Impact on natural values

**Noise**: Jet boats can be a significant intrusion into a river environment, particularly on smaller rivers. This is largely due to engine noise and also by the noise generated by the action of the hull on river waves. People seeking quiet and remoteness have objected on these grounds, as demonstrated in the Queenstown Lake's District Council's 2010 deliberations over jet boat access to the Hunter River:[17]

> *It is clear from the submissions and the hearing that this is a matter that continues to have divergent views and seemingly no common ground. On the one hand the jet boaters want access to the river as provided for in the District Plan. They claim that there are no safety or nuisance issues that should preclude access to the river. Furthermore they claim that, as occurred over the 2009/2010 summer, weather conditions determine that there are relatively few occasions when jet boats can actually access the river. On the other hand, the views of the (largely) angling community are that jet boats create a nuisance to them and ruin the tranquillity of*

[15] Hudson, H.R. 2014. *An evaluation of jet boat and natural river bank erosion in the lower Dart River, New Zealand.* EMA 2014-01 report for Ngāi Tahu Tourism Dart River Jet Safaris. Environmental Management Associates, Christchurch, 60 pages.

[16] Hudson HR, 2015. *Review of jet boating effects on river bank erosion in the Kaituna River New Zealand.* Environmental Management Associates Report EMA 2015-03 for Jet Boating New Zealand. 36 pages.

[17] Queenstown Lakes District Council, Report for meeting of 17 August 2010 Report For Agenda Item: 4 Submitted By: General Manager Regulatory And Corporate Services Report Dated: 19 July 2010 Hunter River – Proposed Amendment To Navigation Safety Bylaw. Available on 6 Aug 2015 at: http://www.qldc.govt.nz/assets/OldImages/Files/Full_Council_agendas_2010/17_August_2010/4_-_Hunter_River.pdf

> *the remote wilderness amenity that is enjoyed in the Hunter valley. They also claim that there is a safety issue between jet boats and anglers in the rivers casting for fish….*
>
> *Overall, the working party considered that neither the argument from the jet boaters nor the argument from the [predominantly] anglers was sufficiently strong so as to provide grounds to exclude the interests of the other party. Consequently, the working party favours an option that safely caters for both groups despite there being no middle ground proposed or discussed at the hearing.*

Most recreational jet boats have silencing systems to minimise engine noise, but there are exceptions that cause objectionable and unnecessary noise. JBNZ has set an 80 dBA limit for recreational boats (lower than the legal noise limits for road vehicles) and 95 dBA for race boats (similar to legal noise limits for road vehicles).

Generally, boats are being used as a means of transport to the destination for the day, so will only spend a short time passing people on river banks. These destinations are frequently places where there are few other people, as the boats provide the main means of access.

**Pollution:** There is an extensive literature on the effects of outboard motors (particularly two-stroke engines) on water bodies. Most researchers conclude that at the concentrations at which they actually occur, the effects of outboard engine exhausts are small, even in extreme high use areas. In-board marine engine exhausts may have some effect on air and water quality and aquatic ecosystems, but these effects are expected to be less than from outboard engines because of their inherently low emissions (citations in Hudson 2004).[18] The major issues are related to bilge water and refuelling.

Bilge water may contain oil residues. Bilge water pollution can be prevented with appropriate absorbent pads that soak up hydrocarbons but not water. Use of these pads should be encouraged.

Fuel spillage is a major problem in marinas. General compliance with the New Zealand jet boat river racing rules is recommended (JBNZ 2003: 40): "(e) *General Racing Rules: (xiv) Refuelling Area – all boats must be removed from the river to an area designated by the race organisers for the refuelling only of boats and support vehicles…*"

**Physical damage**: Jet boats do not damage gravel, rocks and trees. The reverse is true, and a major part of the necessary skill in driving a jet boat is to avoid these solid obstructions as they constitute potential hazards to the boat and its occupants.

[18] Hudson, H.R. 2004. *A review of the environmental effects of jet boating.* EMA 2004-05, report for Jet Boating New Zealand. Environmental Management Associates, Christchurch, 40 pages.

# 6 The Rivers

This section summarises jet boating use and knowledge about each river section in Canterbury. Two data sources are relied on for base data:

- Hughey, K. Greenaway, R. Gerard. 2015 *Jet Boating on Canterbury Rivers - Application of the River Values Assessment System (RiVAS)*. Environment Canterbury
- Jet Boating New Zealand. 2015, *Yearbook*. with updates by Rob Gerrard. JBNZ

Where flow data are available, these are also provided.

Headwater tributaries are included, generally, in the same section as the main-stem river. If a river does not appear in the contents page, use a digital search function before abandoning hope.

The rivers described are (by section number and page):



## 6.1 Definitions

### *6.1.1 River classes (Jet Boating NZ)*

Classifications vary with river flow, and those used here are assessed at about average flows. Higher or lower flows may change the classification.

**Class 1:** Easy boating, suitable for beginners and family boating. Boat damage unlikely. Deep water, braids with fine gravel, shingle, minor rapids only. In different flow conditions can encounter boulders, minor rock gardens, small but lively rapids or very shallow water

**Class 2:** More advanced, comfortable after 100 hours experience. Contains challenges. Boat damage and risk of injury may result from misjudgements. Medium rapids, shallow water, complicated braids, some boulders/rocks, occasional willows.

**Class 3:** Adventure boating. Expert skills required. Boat damage/loss probable if mistakes made. Families not recommended. Crew and driver at risk if accident occurs. White water

covers recommended. Maximum 2 persons/boat recommended. Challenging rock gardens, boulders, major rapids, chutes, willows, often shallow and flooded conditions.

**Class 4:** Unlikely to be boated. Impasses, waterfalls, no water.

As discussed, it is not possible to set definitive absolutes for flow requirements due to the number of variables at play. These include:

- the changing nature of rivers,
- presence/absence of impasses,
- boat performance and
- driver experience in particular.

The approach adopted for this report is to give an experience-based estimate which takes into account the river Class of each section. That is, Class 1 river flows are suitable for beginners, Class 2 river flows are suitable for experienced drivers, and Class 3 river flows require expert skills. Much of the data produced in setting minimum flow requirements in consent hearings has been based on providing flows suitable for only those with expert skills, changing what may have been a Class 1 or 2 opportunity into a dominant Class 3 setting. Describing minimum flows only does not therefore adequately provide for the activity.

Most family boaters stay in Class 1 and 2 rivers sections, but in suitable flow conditions may occasionally venture into class 3.

**Summary of Canterbury JBNZ Branch river sections by class**

| All measures in kms | Class 1 | Class 2 | Class 3 | Class 4 | Total |
|---|---|---|---|---|---|
| Total in Canterbury | 411 | 313 | 588 | 38 | 1350 |
| With full uplifting | 373 | 202 | 330 | 30 | 935 |
| With partial uplifting | 38 | 50 | 193 | 0 | 281 |
| No uplifting | 0 | 61 | 65 | 8 | 134 |
| Useable in high flow or flood only | 0 | 116 | 540 | 32 | 668 |

Key points:

- Class 1 and 2 is family boating: 724 km = 54%
- Class 3 is adventure boating: 588 km = 44%
- High flow only: 668 km = 50%
- Class 1 and 2 high flow only: 116 km = 16%
- Class 1 and 2 fully uplifted: 575 km = 80%
- Full uplifting: 908 km = 53%
- Partial upliftings: 281 km = 21%

**Waitaki JBNZ Branch River sections by class**

| All measures in kms | Class 1 | Class 2 | Class 3 | Class 4 | Total |
|---|---|---|---|---|---|
| Total in Waitaki | 66 | 126 | 86 | 8 | 271 |
| With full uplifting | 66 | 0 | 25 | 0 | 91 |
| With partial uplifting | 0 | 50 | 51 | 0 | 101 |
| No uplifting | 0 | 61 | 10 | 8 | 79 |
| Useable in high flow or flood only | 0 | 54 | 56 | 8 | 118 |

Key points

- Apart from the lower Waitaki River there is only 25 km of river length permanently uplifted, and all of this is Class 3, and all requires above average flows.
- The 50 km of Class 2 with partial upliftings all require above average flows.
- There is Class 3 water that can be boated all year in the lower sections of the rivers (about 10 km), and this is also useable for experienced Class 2 boaters.

### *6.1.2 Gradients*

These are shown in metres per kilometre (m/km) for each section of each river. The gradients given are an average for each river section, and steeper and flatter parts will be present within each.

**Low gradient sections:** (<5 m/km) The low gradient results in slow water speed, so smaller stones and sand settle out in these areas. Floods move them, and new channels form progressively as the water levels drop following a flood. Boating just after a flood is more difficult due to lack of defined channels. The accumulation of bed material also means that there are not many exposed rocks or boulders. Therefore these are suitable for beginners and are generally Class 1 sections with the Exception is the Clarence River which has an low average gradient, but many steeper section in its 160 stretch.

**Medium Gradient sections** (5-7 m/km): Canterbury rivers tend to increase in gradient as you go upstream towards the foothills and alps. Consequently the upper sections tend to be rougher and harder boating as fast flowing water washes small stones and sand downstream.. Boulder s, boulder banks and rocks increase in abundance.

**High Gradient Rivers** (>7 m/km). The steeper and faster flowing water washes fine gravels and sand downstream leaving beds with bigger boulders, and rocks protruding above the surface. Most of these sections are Class 3 boating. They usually also contain medium to large rapids in constricted areas.

## 6.2 Ashburton

**Ashburton North and South Branches**

River section length: 25km

Boatable distance: 10km

**Forks (North and South Branches) to Sea**

River section length: 10km

Boatable distance: 10km

### *6.2.1 RiVAS summary (expert panel estimates)*

**Ashburton North and South Branches**

- User days estimate: 30
- Origin of users: regional
- Organised events: none
- Quality of experience: something a bit special
- Percent of time flows are boatable: 5-10 – restricted by low flows
- Uses: family boating, adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: no restrictions
- Access (legal and physical reliability): OK
- Significance: local

**Ashburton River forks to sea**

- User days estimate: 40
- Origin of users: regional
- Organised events: none
- Quality of experience: something a bit special
- Percent of time flows are boatable: 10 – restricted by low flows
- Uses: family boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: no restrictions
- Access (legal and physical reliability): OK
- Significance: local

### 6.2.2 JBNZ Yearbook 2015

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| North & South Branch above forks | Yes | Class 3-4 Boulders/shingle/braided/willows Gradient 4.7 m/km | Below SH1 bridge. Blowing Point Bridge in high flows | Needs high flow >40 $m^3/s$ (no gauge) |
| Forks to Sea | Yes | Class 2 Shingle/braided/willows 21 km. Gradient 4.5m/km | Below SH1 bridge. | Flow required: >20 $m^3/s$ at Ashburton gauging site |

### 6.2.3 Regulations

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Ashburton River (Hakatere) | From its sources to the sea, including the Ashburton River (Hakatere) Lagoon and the tributaries of the Ashburton River (Hakatere). Any lakes draining into the Ashburton River (Hakatere) and the tributaries flowing into Ashburton River (Hakatere) | Any lakes draining into the Ashburton River (Hakatere) and the tributaries flowing into these lakes |

### 6.2.4 Flows

Boatable flows shown in red (according to RIVAS panel assessment).

**North Ashburton** at Old Weir – Site number 68810

Topo50 NZTM Map Reference: BX20:77981-74127

6/05/82 – 31/07/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 20.5 |
| **10** | 15.3 |
| **15** | 12.6 |
| **20** | 11 |
| **25** | 9.9 |
| **30** | 8.9 |
| **35** | 8.2 |
| **40** | 7.5 |
| **45** | 6.9 |
| **50** | 6.4 |
| **55** | 5.9 |
| **60** | 5.4 |
| **65** | 4.9 |
| **70** | 4.5 |
| **75** | 4.2 |
| **80** | 3.8 |
| **85** | 3.5 |
| **90** | 3.2 |
| **95** | 2.8 |
| **100** | 2 |

**South Ashburton**

South Ashburton at Mount Somers – 68806

Topo50 NZTM Map Reference: BX19:62628-64483

27/04/67 – 20/07/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 23.3 |
| **10** | 18.3 |
| **15** | 15.7 |
| **20** | 14.1 |
| **25** | 12.9 |
| **30** | 11.8 |
| **35** | 11 |
| **40** | 10.3 |
| **45** | 9.7 |
| **50** | 9.1 |
| **55** | 8.7 |
| **60** | 8.2 |
| **65** | 7.7 |
| **70** | 7.3 |
| **75** | 6.8 |
| **80** | 6.3 |
| **85** | 5.8 |
| **90** | 5.3 |
| **95** | 4.8 |
| **100** | 2.5 |

**Ashburton Sea to North and South Branch confluence**

Ashburton River at State Highway 1 Bridge – 68801

Topo50 NZTM Map Reference: BY21:99649-36002

01/01/87 – 03/08/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 50.1 |
| **10** | 36.9 |
| **15** | 30.3 |
| **20** | 24.9 |
| **25** | 21.3 |
| **30** | 18.3 |
| **35** | 16 |
| **40** | 13.8 |
| **45** | 11.8 |
| **50** | 10.2 |
| **55** | 8.8 |
| **60** | 7.8 |
| **65** | 6.9 |
| **70** | 6.2 |
| **75** | 5.6 |
| **80** | 5 |
| **85** | 4.5 |
| **90** | 4.1 |
| **95** | 3.5 |
| **100** | 1.6 |

### 6.2.5 Notes

- Flows: River is very flow dependant.
- Willows: Continuing spread and invasion is likely to pose an increasing problem and threats to safe navigation.
- Access: .Depends on access to riverbed being available and useable. Access is over District Council controlled road ends.
- Estuary has high birdlife values

### 6.2.6 Other data from literature

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Ashburton River – sea to the North and South Branch confluence | Family boating Experience needed | Minimum expert 20 $m^3/s$ Minimum family boater 30 $m^3/s$ | | |

## 6.3 Ashley

**Upper - Gillespie's Bridge to Camp ground/Gorge Bridge**

River section length: 20km

Boatable distance: 20km

**Lower – Ashley Gorge to Sea**

River section length: 44km

Boatable distance: 41km (no uplift SH1 to sea)

### *6.3.1 RiVAS summary (expert panel estimates)*

**Upper Ashley**

- User days estimate: 10
- Origin of users: regional
- Organised events: none
- Quality of experience: bucket list
- Percent of time flows are boatable: 5 – restricted by low flows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 4
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: regional

**Lower Ashley**

- User days estimate: 200
- Origin of users: regional
- Organised events: none
- Quality of experience: something a bit special
- Percent of time flows are boatable: 15 – restricted by low flows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: no restrictions
- Access (legal and physical reliability): OK
- Significance: local

### 6.3.2 JBNZ Yearbook 2015

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Gilliespies Bridge to Middle Bridge | Yes | Class 2<br>Rocks/ gorgy/no access<br>8 km. Gradient 7.5m/km | As above, or at Middle Bridge with difficulty | Needs high flow as below. 50 $m^3/s$ at Ashley Gorge recorder |
| Middle Bridge to Ashley Gorge | Yes | Class 3<br>Rocks, chutes/gorgy/no access<br>12 km. Gradient 8.3m/km | Ashley Camping Ground | Needs high flow >70 $m^3/s$ at Ashley Gorge site |
| Ashley Gorge to SH1 | Yes | Class 2<br>Shingle/braided/willows. 44km . Gradient 5.0m/km | SH 1 bridge, north side | Needs >20 $m^3/s$ at Ashley Gorge gauging site |
| Sea to SH1 | No | | | |

### 6.3.3 Regulation

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Ashley River (Rakahuri) | The Ashley River (Rakahuri) upstream of the State Highway 1 Bridge. | The Ashley River (Rakahuri) downstream of the State Highway 1 Bridge; all tributaries of the Ashley River (Rakahuri). |

### 6.3.4 Flows

Boatable flows shown in red (according to RIVAS panel assessment).

**Ashley at Gorge – 66204**

Topo50 NZTM Map Reference: BW22:36411-13276

28/10/60 – 15/07/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 18.91 |
| **10** | 14.69 |
| **15** | 11.61 |
| **20** | 10.19 |
| **25** | 9.23 |
| **30** | 8.12 |
| **35** | 7.24 |
| **40** | 6.46 |
| **45** | 5.58 |
| **50** | 4.82 |
| **55** | 4.11 |
| **60** | 3.6 |
| **65** | 3.25 |
| **70** | 2.91 |
| **75** | 2.55 |
| **80** | 2.32 |
| **85** | 2.31 |
| **90** | 2.29 |
| **95** | 1.99 |
| **100** | 1.18 |

### 6.3.5 Notes

- Flows: All the river is very flow dependant, and the Ashley Gorge requires flood conditions
- Willows: Rampant spread between Rangiora and Gorge is limiting boating and creating navigational and safety hazards. Boats have been sunk due to willows in the past.
- In-river works: Gravel extraction works present in lower river.
- Access: Fencing at Rangiora by ECan restricting access.
- Gorge has been boated on several occasions in flood conditions. Downstream run is very challenging. Access is only at camping ground, Middle Bridge and Gillespies Bridge.
- Riverbed nesting birds are found from SH 1 to Okuku confluence. The Ashley/Rakahuri Rivercare Group has a well-established management and monitoring programme. No uplift for river below SH1.

### 6.3.6 Other data from literature

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Ashley River – Domain to SH1 | Experience needed Classic challenging small braided river. Willows are a hazard | Minimum expert 20 $m^3/s$ Minimum family boater 30 $m^3/s$ | Gorge: Mean 12 Median 7 Flood 298 7DMALF 2 | Est. >90th percentile |
| Ashley River – Lees Valley Bridge to middle bridge | Adventure boating Wilderness feel Wild and scenic river gorge | Minimum 50 $m^3/s$ | Gorge: Mean 12 Median 7 Flood 298 7DMALF 2 | Est. >95th percentile |
| Ashley River – middle bridge to Domain | Adventure boating Wilderness feel Wild and scenic river gorge | Minimum 70 $m^3/s$ | Gorge: Mean 12 Median 7 Flood 298 7DMALF 2 | Est. >95th percentile |

**Ashley River grounding (see text below). Photo: Paul Vernel**

Paul Vernel: “If your lead boat goes down a wrong channel, the sheep tend to follow. Or the lead boat runs aground blocking the channel for safe passing. In this picture it looks like the stream was marginal anyway. So the lead boat runs aground; the followers try and slow down to give them more time to take evasive action. The next boat runs aground. The third arrives and sees two boats aground and the water is disturbed making channel-reading harder; and then they are aground. It all happens very quickly.”

## 6.4 Clarence

River section length: 196km

Boatable distance: 189km (flow dependant)

### *6.4.1 RiVAS summary (expert panel estimates)*

- User days estimate: 100
- Origin of users: regional
- Organised events: local and family
- Quality of experience: bucket list
- Percent of time flows are boatable: 20 – restricted by low flows
- Uses: adventure boating, hunting, trout fishing, salmon fishing
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: no restrictions
- Access (legal and physical reliability): unreliable
- Significance: regional

### *6.4.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Lake Tennyson to Leader stream | Yes | Class 4. Rocks, boulders. 24 km. Gradient 10.4m/km | Off riverbed where possible | Requires above average flows |
| Leader Stream to Jollies Pass | Yes | Class 3. Rocks, boulders 12 km. Gradient 6.7m/km | Off riverbed where possible | |
| Jollies Pass to sea | Yes | Class 3. Boulders, gorgy, rapids, isolated 160km. Gradient 5.25 m/km | Near Acheron accommodation House, or from farm land near Glen Alton | Minimum flow 10 $m^3/s$ at Jollies Pass recorder. Ideal about 15 $m^3/s$ |

### *6.4.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Clarence River (Waiau-Toa) | The Clarence River (Waiau-Toa). | All tributaries of the Clarence River (Waiau- Toa) |

### 6.4.4 Flows

Boatable flows shown in red (according to RIVAS panel assessment).

Clarence at Jollies – 62105

Topo50 NZTM Map Reference: BT25:92300-99443

01/01/60 – 11/02/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 36.7 |
| **10** | 26.9 |
| **15** | 21.8 |
| **20** | 18.5 |
| **25** | 16.1 |
| **30** | 14.1 |
| **35** | 12.4 |
| **40** | 11.1 |
| **45** | 10 |
| **50** | 8.9 |
| **55** | 8 |
| **60** | 7.2 |
| **65** | 6.4 |
| **70** | 5.8 |
| **75** | 5.1 |
| **80** | 4.6 |
| **85** | 4 |
| **90** | 3.5 |
| **95** | 2.8 |
| **100** | 1.7 |

### 6.4.5 Notes

- Flows: Usually only boatable as a complete trip in October/November. Day trips from either Clarence Bridge access or Acheron Accommodation House access are possible when flows permits. The Jollies Pass recorder is upstream from the Acheron River which contributes nearly half the flow at this location.
- Willows: Spread is occurring but only affecting the bed of the river in the vicinity of Muzzle Station homestead. Not a problem at present but will pose an increasing problem over time if not controlled.
- Access: Lower River unreliable, from private land adjacent to river. Permission required.
- Isolation: Parties entering need to be aware of the need to be self-sufficient and it is advisable to have a way of contacting the outside world. Vehicle access to Muzzle Station or to Quail Flat via Clarence Reserve station (DOC permission and keys) is possible.
- An iconic adventure of extremely high values.
- Sea to Glen Alton Bridge not usually boated.

### 6.4.6 Other data from literature

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Clarence – Lake Tennyson to Acheron confluence | Adventure boating. Seldom boated. Needs high flows. Has been boated to Lake Tennyson. | Only suitable high flows | Jollies: Mean 15<br>Median 11<br>Flood 196<br>7DMALF 3.3 | Flood |
| Clarence – Acheron confluence to Glen Alton Bridge | Outstanding adventure boating but not 'hard core'. Multi-day wilderness trip, sought-after by jet boaters from throughout New Zealand. Remote isolated, 160 km boatable. Outstanding wild, scenic and alpine environment, with spectacular river gorges. Warrants a Water Conservation Order. | High enough flows needed to navigate river | Estimated: Mean 38<br>Median 26<br>Flood 526<br>7DMALF 8.0 | At least >10 $m^3/s$<br><br>at Jollies (Natural) |
| Bridge to SH1 or sea | Seldom boated. Needs high flow. Access difficult. | | Median 26<br>Flood 526<br>7DMALF 8.0<br>(NB flows at run start, higher at end) | |

a Estimated flow at the start of the Clarence run from the Acheron down to the sea; sum of the flows from the Acheron and Clarence Rivers.
b Estimated flow at the start of the Clarence run from the Acheron down to the sea; sum of the flows from the Acheron and Clarence Rivers. Note that the flows at the Glen Alton Bridge will be far higher than those at the start of the run, depending on how much water has been added from side streams down the length of the Clarence River.

## 6.5 Conway

River section length: 10km

Boatable distance: 10km

### *6.5.1 RiVAS summary (expert panel estimates)*

- User days estimate: 20
- Origin of users: local
- Organised events: no
- Quality of experience: something a bit special
- Percent of time flows are boatable: 5 – restricted by low flows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: local

### *6.5.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| All | Yes | Class 3. Shingle, gorgy | Ferniehurst Rd Bridge | Needs high flow conditions |

### *6.5.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Conway River (Tutae Putaputa) | The Conway River (Tutae Putaputa) | All tributaries of the Conway River (Tutae Putaputa). |

### *6.5.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

Conway at SH1 – 64304

Topo50 NZTM Map Reference: BU26:34222-83643

03/12/08 – 04/03/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 10.47 |
| **10** | 6.32 |
| **15** | 4.90 |
| **20** | 4.10 |
| **25** | 3.47 |
| **30** | 3.01 |
| **35** | 2.68 |
| **40** | 2.38 |
| **45** | 2.13 |
| **50** | 1.91 |

| | |
|---|---|
| **55** | 1.72 |
| **60** | 1.55 |
| **65** | 1.36 |
| **70** | 1.21 |
| **75** | 1.05 |
| **80** | 0.89 |
| **85** | 0.80 |
| **90** | 0.73 |
| **95** | 0.61 |
| **100** | 0.33 |

### *6.5.5 Notes*

- Flows: Requires flood or high flow conditions
- Willows: Present but not a problem. Wattle invasion has also occurred in lower section above SH 1 bridge.
- Seldom boated

### *6.5.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Conway River | Adventure boating | Flood only | | Flood |

## 6.6 Hakataramea

River section length: 16km All the river

Boatable distance: 5km (flow dependant)

### *6.6.1 RiVAS summary (expert panel estimates)*

Not assessed

### *6.6.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Upstream from Waitaki confluence | Yes | Class 3. Shingle, rocks, willows.<br>16 km. Gradient 6.25 | Waitaki River | Heavily fished. Needs high flow conditions. |

### *6.6.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Waitaki River | The Waitaki River downstream of the Waitaki Dam to the sea, including all of the tributaries of the Waitaki River that have their confluence with the Waitaki River downstream of the Waitaki Dam. | |

### *6.6.4 Flows*

Hakataramea at State Highway 82 Bridge – 71103

Topo50 NZTM Map Reference: CB17:01271-44556

01/01/64 – 28/01/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 14.47 |
| **10** | 9.92 |
| **15** | 7.71 |
| **20** | 6.34 |
| **25** | 5.29 |
| **30** | 4.58 |
| **35** | 4.01 |
| **40** | 3.5 |
| **45** | 3.07 |
| **50** | 2.69 |
| **55** | 2.36 |
| **60** | 2.08 |
| **65** | 1.84 |
| **70** | 1.62 |
| **75** | 1.43 |
| **80** | 1.23 |
| **85** | 1.03 |
| **90** | 0.87 |
| **95** | 0.72 |
| **100** | 0.44 |

### 6.6.5 Notes

- Flows: Need high flow conditions – probably more than 20 $m^3/s$.
- Willows: A major threat making the river difficult and dangerous.
- Seldom boated

### 6.6.6 Other data from literature

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Hakataramea River | Adventure boating Value reduced by willows Wild and scenic river | Needs high flow Should not have any abstractions | | Natural |

## 6.7 Hurunui

**Lake Sumner to Mandamus confluence**

River section length: 36km

Boatable distance: 36km

**Mandamus confluence to the sea**

River section length: 69km

Boatable distance: 69km

**Hurunui North Branch – No. 2 hut to sea**

River section length: 16

Boatable distance: 10km (flow dependant)

### *6.7.1 RiVAS summary (expert panel estimates)*

**Hurunui North Branch – No. 3 Hut to Lake Sumner**

- User days estimate: <50
- Origin of users: regional
- Organised events: no
- Quality of experience: something a bit special
- Percent of time flows are boatable: 10 – restricted by low flows
- Uses: family boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: local

**Lake Sumner to Mandamus confluence**

- User days estimate: 100
- Origin of users: regional
- Organised events: no
- Quality of experience: bucket list
- Percent of time flows are boatable: 10 – restricted by low flows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 3
- Regulations: no restrictions
- Access (legal and physical reliability): OK
- Significance: regional

**Mandamus confluence to sea**

- User days estimate: 500
- Origin of users: regional

- Organised events: regional, local and family
- Quality of experience: something a bit special
- Percent of time flows are boatable: 30 – restricted by low flows
- Uses: family boating, trout fishing, salmon fishing
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring):2
- Regulations: no restrictions
- Access (legal and physical reliability): OK
- Significance: regional

### *6.7.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| No 3 Hut to Lake Sumner (north branch) | Yes | Class 3. Shingle, braided<br>16 km. Gradient 7.2m/km | Loch Katrine | Requires high flow conditions. Seldom boated. |
| Mandamus to Lake Sumner | Yes | Class 3. Rocks, boulders, gorgy, rapids.<br>36 km. Gradient 6m/km | The Peaks. Ask permission. | Requires high flow conditions. 100-140 $m^3/s$ at Mandamus recorder. |
| Mandamus to SH7 | Yes | Class 2. Boulders, shingle, braided.<br>20 km. Gradient 6m/km | Balmoral Bridge south side at times in to the Waitohi | 40 $m^3/s$ at Mandamus |
| SH7 to sea | Yes | Class 1. Shingle, braided, gorge.<br>49km. Gradient 4.1 m/km | SH 1 | 35 $m^3/s$ at Mandamus |

### *6.7.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Hurunui River | The Hurunui River from its source to the sea including: the Hurunui River Lagoon; and the Hurunui River upstream of Lake Sumner (Hoka Kura). | The South Branch of the Hurunui River; any other tributary; any lakes draining into the Hurunui River or their tributaries. |

### *6.7.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

**Hurunui North Branch - No. 3 Hut to Lake Sumner**

Hurunui at No. 2 Hut – 65108

Topo50 NZTM Map Reference: BU22:27251-71481

07/05/75 – 31/03/14

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 53.4 |
| **10** | 35 |
| **15** | 27.7 |
| **20** | 22.9 |
| **25** | 19.7 |
| **30** | 17.5 |
| **35** | 15.8 |
| **40** | 14.5 |
| **45** | 13.3 |
| **50** | 12.3 |
| **55** | 11.3 |
| **60** | 10.3 |
| **65** | 9.5 |
| **70** | 8.7 |
| **75** | 7.9 |
| **80** | 7.1 |
| **85** | 6.3 |
| **90** | 5.5 |
| **95** | 4.7 |
| **100** | 2.5 |

**Hurunui at Mandamus – 65104**

Topo50 NZTM Map Reference: BU23:62505-62359

26/10/56 – 11/08/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 133.7 |
| **10** | 98.2 |
| **15** | 81.5 |
| **20** | 70.3 |
| **25** | 62.3 |
| **30** | 55.9 |
| **35** | 50.7 |
| **40** | 46.3 |
| **45** | 42.4 |
| **50** | 38.8 |
| **55** | 35.8 |
| **60** | 33.2 |
| **65** | 30.7 |
| **70** | 28.3 |
| **75** | 26.2 |
| **80** | 23.9 |
| **85** | 21.6 |

| | |
|---|---|
| **90** | 19.1 |
| **95** | 15.9 |
| **100** | 8.3 |

**Hurunui Mandamus to Sea**

Topo50 NZTM Map Reference: Hurunui at State Highway 1 Bridge – 65101

BV25:07705-50954

13/12/74 – 28/05/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 158.7 |
| **10** | 118.1 |
| **15** | 98.8 |
| **20** | 86 |
| **25** | 76.4 |
| **30** | 69.1 |
| **35** | 63.2 |
| **40** | 58.2 |
| **45** | 53.5 |
| **50** | 49 |
| **55** | 45 |
| **60** | 41.3 |
| **65** | 38 |
| **70** | 34.7 |
| **75** | 31.7 |
| **80** | 28.9 |
| **85** | 26.2 |
| **90** | 23.4 |
| **95** | 19.6 |
| **100** | 12.4 |

### *6.7.5 Notes*

- Flows: Flow estimates from NIWA with respect to the SH 7 to Pahau section are not supported by experienced jet boaters. This could be explained by the river being in a particularly favourable configuration at the time of their review, but jet boaters are advised that even in best conditions a flow below 20 $m^3/s$ is extremely challenging. Maori Gulley can be boated safely at 50 $m^3/s$, but has been boated at 35 $m^3/s$.
- Willows: Present below Mandamus. Can present difficulties from SH7 bridge to Pahau.
- In-river works: Development of HWP Irrigation intake may threaten launching at The Peaks.
- Access: Variable, although SH 1 site is reliable.
- The Mandamus to Lake Sumner trip is an iconic trip for adventure boaters, and has a very high value for this reason. A new rapid (The Fang) has appeared, above Maori Gully, which requires flows of about 100 $m^3/s$ at Mandamus to be safely navigable.
- The river from SH 7 to sea is used a lot as it has nice scenery and good swimming and fishing opportunities. Existing irrigation abstraction is 6.5 $m^3/s$ (A permit). B permit allows a further 10 $m^3/s$, and C permit another 33 $m^3/s$. Minimum flow Sept-April is 15 $m^3/s$ for A permits, 26.5 $m^3/s$ for B, 36.5 $m^3/s$ for C. Note that abstraction point is below Mandamus recorder so abstractions need to be subtracted from recorder flows to get

actual river flow below Mandamus. The abstractions are immediately below Mandamus recorder i.e recorder shows pre-abstraction flows.

### *6.7.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Hurunui River – Lake Sumner outlet to Mandamus | Adventure boating Part of a source to sea trip Wild, scenic river gorges and Canterbury high country environment | 80-130 $m^3/s$ | Mandamus: Mean 52 Median 39 Flood 531 7DMALF 17 | >80 $m^3/s$ at Mandamus Natural |
| Hurunui River – Mandamus to SH7 | Family boating Part of a source to sea trip | Minimum expert 35 $m^3/s$ Minimum family boater 45 $m^3/s$ | Mandamus: Mean 52 Median 39 Flood 531 7DMALF 17 | Natural |
| Hurunui River – SH7 to sea | Family boating Part of a source to sea trip | Minimum expert 20 $m^3/s$ Minimum family boater 30 $m^3/s$ Preferred flow range 30-40 $m^3/s$ | SH1: Mean 70 Median 53 Flood 772 7DMALF 23 | Natural |

*Duncan, M. (2012). Proposed Hurunui and Waiau River Regional Plan and Proposed Plan Change 3 to the Canterbury Natural Resources Regional Plan. Section 42A Report. Salmon and jet boat passage, river bird habitat. Prepared by NIWA for Environment Canterbury.*

Jet-boat suitability curves were developed from criteria in Mosley (1983) as listed in MFE (1998). These criteria indicate minimum widths and depths of 5 m and 0.1m respectively and a maximum velocity of 4.5 $m^3/s$. The preferred values are for width >5 m, depths >0.6 m (minimum depth over riffles of 0.2 m) and velocity of <4.5 ms-1. These criteria were interpreted to mean that if the water depth was more than 0.3 m then there was sufficient water for jet boating. Experienced jet boaters agree that a depth of 0.3 m is adequate for jet boating, but jet boats can be operated in shallower water (pers. comm. Rob Gerard, Canterbury Regional Council). However, it only takes one impasse to stop a jet boat. Typically in a braided river this is due either to a boulder bar spreading the water so that there is no boatable channel, or by the river braiding into many very small channels, none of which contain navigable water. Skilled and experienced boaters will manage at lower flows than learners or inexperienced drivers (pers. comm. Rob Gerard, Canterbury Regional Council).

*Hurunui River*

The modelling indicates jet-boat passage is possible when the flow is 10 $m^3/s$ in the Hurunui River. Caution needs to be exercised when interpreting modelled flows to determine jet-boat passage depth as the model returns the average depth of water over the cell and does not take into account the depth of water over cobbles that may be protruding from the bed and may compromise jet-boating. However, during the course of field work the study reach was traversed when the flow was approximately 13 $m^3/s$. The boat used was a large and heavy work boat that needs more water depth than lighter recreational jet boats.

The lowest proposed minimum monthly flow is 12 $m^3/s$, prior to storage being developed and the winter minimum flow for non-consumptive takes is 10 $m^3/s$. At 10 $m^3/s$ the modelled water depth in parts of the main braid was between 0.1 and 0.3 m. This water depth should be sufficient for jet-boat passage for a skilled driver. However, the geomorphology of the river bed is constantly changing, so at times the river may be navigable at 10 $m^3/s$ and at other times it may not.

Methodology: Two-dimensional (2-D) modelling and riffle depth survey. Format: Local government authority technical report. Relevance: Direct measurement and modelling using recognized methodologies.

*Duncan, M. (2008). Hurunui River: B Block allocation review. NIWA Client Report: CHC2009-017.*

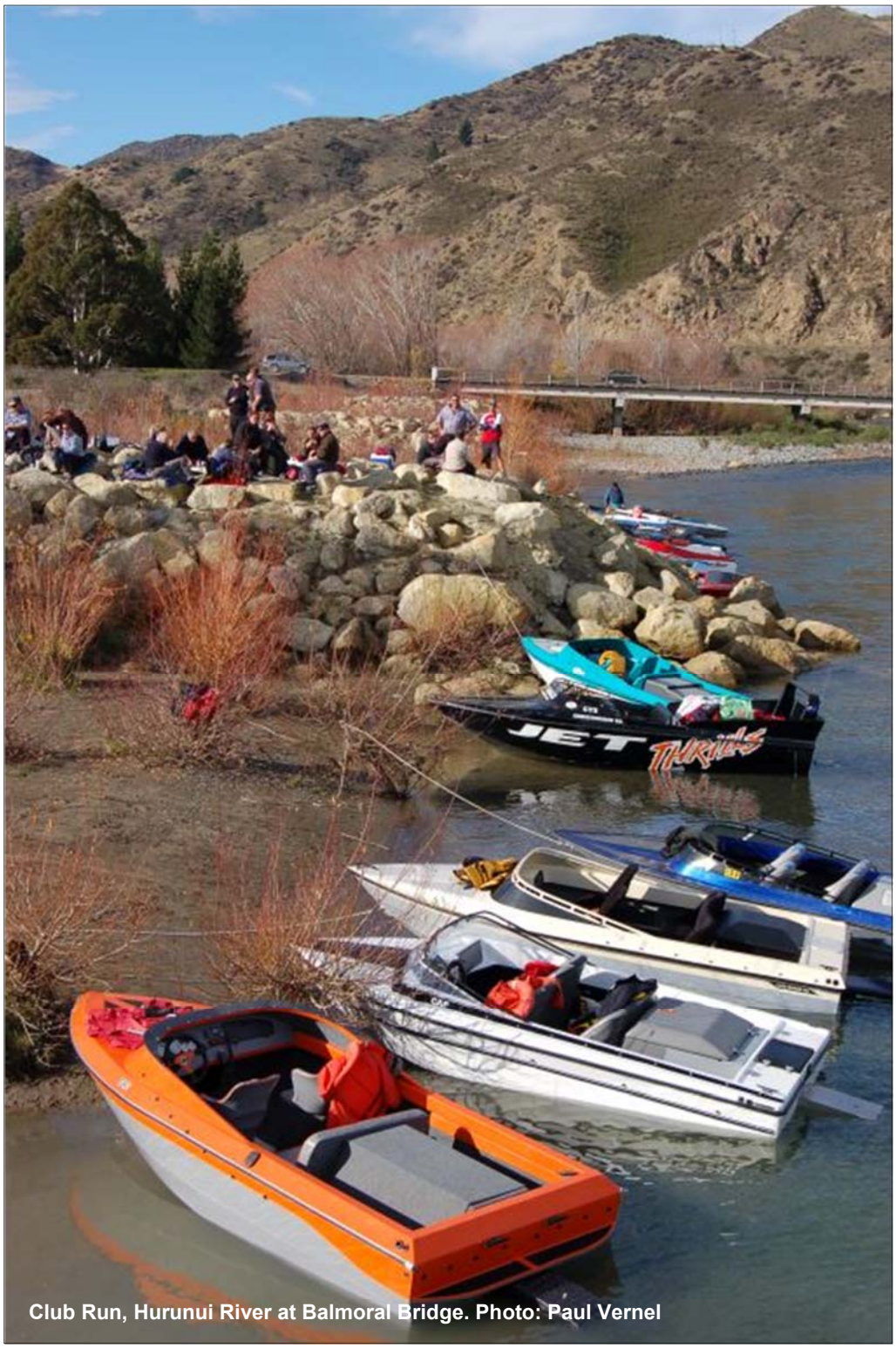
Duncan and Shankar (2004) concluded that a flow of 15 m3/s would provide passage for canoes and jet boats, but R Gerard, an experienced jet boater suggests that the Amuri plains reach would not be used by recreational boaters at less than 35 m3/s (Familton 2007). It is likely that kayakers too would find it easier to paddle the reach at flows greater than 15 m3/s even though passage is possible at such flows. The author has travelled much of the length of the braided Amuri Plains reach with a skilled driver in a jet boat that is larger and heavier than most recreational jet boats when the flow was 13.5 m3/s. This experience suggests that Mr Gerard's recommended minimum flow is rather conservative and a flow of 20 m3/s is suggested here as providing sufficient depth for recreational jet boats with moderately experienced drivers. Most jet boating is assumed to be done during December to March (Adams 2008). Pp. 9.

Methodology: Direct Observation and unmodified flow data. Format: Crown Research Institute Technical Report. Relevance: High – conclusions based on direct observation and flow modelling. This report is mostly concerned with flow regime variances that are meant to increase access to various communities – including jet boating – rather than discussion of minimum flows.

*Duncan, M. and Shankar, U. (2004). Hurunui River Habitat 2-D Modelling. Report No U04/19. NIWA for Environment Canterbury. Christchurch.*

Both canoes and jet boats should be able to traverse the river when it is flowing at 10 $m^3/s$, but jet boat drivers would require a high degree of skill to avoid the cobbles that protrude from the bed and present a shallower passage for navigation than the modelled depths. At a flow of 15 $m^3/s$ maximum flow depths exceed 0.3m and should allow trouble free passage for kayakers and jet-boaters with average ability. (Executive Summary)

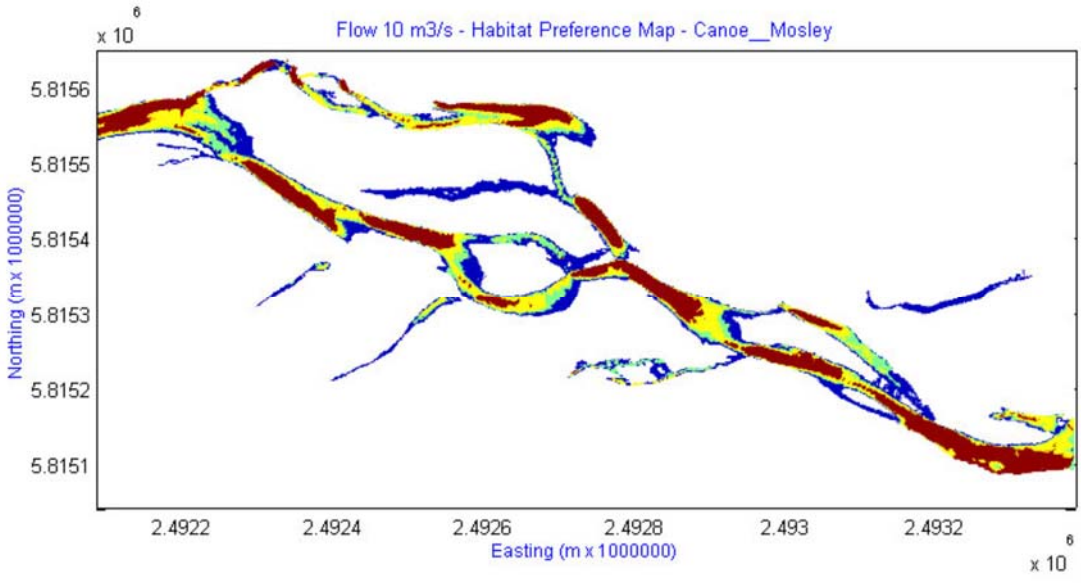
The modelling indicates jet-boat passage is possible at 10 $m^3/s$ (Figure 20) and during the course of field work the study reach was traversed when the flow was about 13 $m^3/s$. Caution needs to be exercised when using modelled flows to determine jet-boat passage depth as the model returns the average depth of water over the cell and does not take into account the depth of water over cobbles that may be protruding from the bed and may compromise jet-boating.




Club Run, Hurunui River at Balmoral Bridge. Photo: Paul Vernel

There is also sufficient depth for canoe passage when the flow is 10 $m^3/s$, but at least one of the riffles in the study each would be shallow and would require skill to negotiate. Elsewhere in the braided sections of the river, care would have to be taken to avoid cobbles that may protrude from the bed and reduce the local water depth. The jet-boat passage plot for a flow of 15 $m^3/s$ (Appendix 4) indicates a passage depth of more than 0.3 m along the main stem of the study reach. At this flow jet boating and canoeing may be safer, and more enjoyable with less potential for damage for people with only average skill (p. 34).

**Figure 20: Jet-boat passage at a flow of 10 $m^3/s$. Yellow and brown indicate depths of 0.1-0.3 m and > 0.3 m respectively. Jet-boat passage of the yellow areas requires skill.**




Methodology: Two-dimensional (2-D) hydrodynamic modelling for prediction of depths and velocities for flows from 5 to 80 $m^3/s$. Format: Local Government Authority Technical Report. Relevance: High – direct measurement and modelling using recognized methodology.

*Gerard, R. (2007). Statement of Evidence. In Familton, H. (2007). Planning Report Hurunui River and Tributaries Environmental flow and water allocation. Report No. U07/60. Environment Canterbury*

Hurunui River below Mandamus needs to be considered in three sections:

Section 1: Sea to SH1 Bridge.

This section is braided. The flow required for jet boating depends on the number of braids, but a flow of 25 $m^3/s$ is adequate for jet boating throughout this section.

Section 2: SH1 Bridge to SH7 Bridge.

Between SH1 and the Pahau confluence, the Hurunui River is mostly in one channel in a gorge. Above the Pahau confluence the riverbed spreads out and the flow is often in two or more braids. A flow of 20 $m^3/s$ is adequate for jet boating between the SH1 and SH7 bridges.

Section 3: SH7 Bridge to Mandamus.

Above SH7 Bridge, the river is braided and climbs more steeply. Boulder bars restrict passage at low flows, particularly where there are multiple braids. A flow of 35 $m^3/s$ is adequate for jet boating between SH7 and the Hurunui Mandamus flow recorder. Experienced and skilled adventure boaters will boat the Hurunui River at lower flows than above, and inexperienced or recreational boaters will only use the river at higher flows. For example, I have boated Section 2 at a flow of 13 $m^3/s$, but had to navigate a bar that necessitated crashing over boulders and traversing a difficult and very shallow braided section. On another occasion when there were multiple braids, it was difficult to find a navigable channel at 30 $m^3/s$.

Section 3 generally will not be used by recreational boaters below 40 $m^3/s$. Over time, the number of braids in any braided section of the Hurunui River will change, as will the flow distribution across boulder bars. Therefore, the flows considered adequate may not always mean that unimpeded access is possible through these sections of the river at the minimum flows needed for jet boating identified above.

Methodology: Professional experience and observation. Format: Court evidence. Relevance: High – experienced jet boater and formerly National Rivers Officer for the New Zealand Jet Boaters Association and presented in a Local Government Authority Technical Report.

*Greenaway, R. and Associates. (2002). Hurunui River Recreation Study 2001/2 Client Report 936. Prepared for Environment Canterbury/North Canterbury Fish and Game Council*

Several club events are held on the river annually, from SH1 and SH7. Maori Gully is a dangerous route and requires reasonable flows to be attempted (a minimum of 80 $m^3/s$). The remainder of the river requires around 25 $m^3/s$ to be boatable.

Methodology: Quantitative survey (n=936), Key informant interviews and review of literature. Format: Research report. Relevance: Partial – low response from jet boaters (n=15).

*Vernel, P. (2013), Statement of evidence of Paul Vernel on behalf of the Canterbury Branch of Jet Boating New Zealand (Inc), presented to the resource consent Hearing Commissioners on the Proposed Hurunui Water Project Waitohi Irrigation and Hydro Scheme, March 2013, Christchurch*

For example, adventure boaters attempting an up river run from the Mandamus confluence to Lake Sumner on the Hurunui River require 50-80 $m^3/s$ at the Mandamus flow recorder to get to Devil's Fang Falls rapid near Dozy Stream above Māori Gully, and 80-120 $m^3/s$ at Mandamus to get past Devil's Fang Falls and continue on up to the Lake.

Methodology: Observation based on experience. Format: Evidence submitted in court proceedings. Relevance: High – based on considerable experience.

## 6.8 Kahutara

River section length: 16km

Boatable distance: 5km

### *6.8.1 RiVAS summary (expert panel estimates)*

- User days estimate: <10
- Origin of users: local
- Organised events: no
- Quality of experience: something a bit special
- Percent of time flows are boatable: 5 – restricted by low flows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: local

### *6.8.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Sea to SH70 Bridge | Sea to source | Shingle, willows. Fast and mean above SH 70.<br>16 km. Gradient 11.9m/km<br>Please give information to JBNZ if you boat it | Railway bridge at the mouth | No current information. History not known. |

### *6.8.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Kahutara River | The Kahutara River | All tributaries of the Kahutara River |

### *6.8.4 Flows*

No recorder.

### *6.8.5 Notes*

- Flows: Flood only
- Willows: Present and create a hazard

### *6.8.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Kahutara River | Adventure boating | Flood only | | Flood |

## 6.9 Waitaki – Lower (Waitaki Dam to sea)

River section length: 66km

Boatable distance: 66km

### *6.9.1 RiVAS summary (expert panel estimates)*

**Waitaki Dam to Bells Pond**

- User days estimate: 3000
- Origin of users: national
- Organised events: international, regional and local
- Quality of experience: something a bit special
- Percent of time flows are boatable: 95 – restricted by high flows
- Uses: Salmon fishing, trout fishing, duck hunting, family boating, racing, search & rescue.
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: national

**Bells Pond to Sea**

- User days estimate: 12,000
- Origin of users: international, regional and local - according to RiVAS assessment
- Organised events: international, regional and local - according to RiVAS assessment
- Quality of experience: something a bit special
- Percent of time flows are boatable: 95 – restricted by high flows
- Uses: Salmon fishing, trout fishing, duck hunting, family boating, racing, search & rescue.
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: national

### *6.9.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Waitaki Dam to sea | Yes | Class 1. Shingle, braided, willows<br>66km.Gradient 3.25m/km | Ramps at SH1 bridge, north side Kurow Island, and Duntroon, Bells Pond. | |

### 6.9.3 Regulations

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Waitaki River | The Waitaki River downstream of the Waitaki Dam to the sea, including all of the tributaries of the Waitaki River that have their confluence with the Waitaki River downstream of the Waitaki Dam. | |

### 6.9.4 Flows

Boatable flows shown in red (according to RIVAS panel assessment).

Lower Waitaki Bells Pond to sea

Lower Waitaki River at Kurow – 71104

Topo50 NZTM Map Reference: CA17:98069-47154

07/09/64 – 16/06/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 616.3 |
| **10** | 522.2 |
| **15** | 481.2 |
| **20** | 448.5 |
| **25** | 432.4 |
| **30** | 415.5 |
| **35** | 399.9 |
| **40** | 386.6 |
| **45** | 368.2 |
| **50** | 350.5 |
| **55** | 340.3 |
| **60** | 328.5 |
| **65** | 317.3 |
| **70** | 304.7 |
| **75** | 292.5 |
| **80** | 264.1 |
| **85** | 251.9 |
| **90** | 233.5 |
| **95** | 208.4 |
| **100** | 87.7 |

**Lower Waitaki - Waitaki Dam to Bells Pond – No recorder**

### 6.9.5 Notes

- Flows: Only unboatable in flood flows.
- Willows: Present and spreading. Jet boat sinkings due to willows have been reported, usually due to loss of power resulting in the boat being swept under low branches, trapped and capsized.
- Access: Launching at SH 1 is problematic at present.
- River is heavily used by salmon anglers during the season.

### *6.9.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Waitaki River – Kurow to Sea | Family boating | Flows controlled by hydro dam schemes on river | Residual flows set at present acceptable. Proposed lower flows should also be satisfactory. | Residual flows set at present acceptable. Proposed lower flows should also be satisfactory. |

## 6.10 Makikihi

River section length: 20km

Boatable distance: 10km (flow dependant)

### *6.10.1 RiVAS summary (expert panel estimates)*

- User days estimate: 5
- Origin of users: local
- Organised events: no
- Quality of experience: everyday boating
- Percent of time flows are boatable: 5 – restricted by low flows
- Uses: Adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 1
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: local

### *6.10.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| All | Yes | Class 3. Shingle | | Needs high flow, dry in summer |

### *6.10.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Makikihi River | The Makikihi River | All tributaries of the Makikihi River |

### *6.10.4 Flows*

No recorder.

### *6.10.5 Notes*

- Needs flood flows
- Willows present
- Seldom boated

### *6.10.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Makikihi River | Adventure boating | Needs high flows | | |

## 6.11 Opihi

River section length: 39km

Boatable distance: 10km (flow dependant)

### *6.11.1 RiVAS summary (expert panel estimates)*

- User days estimate: 50
- Origin of users: local
- Organised events: local family
- Quality of experience: everyday boating
- Percent of time flows are boatable: 5 – restricted by low flows
- Uses: Adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 3
- Regulations: seasonal limits (see 'other data' below)
- Access (legal and physical reliability): reliable
- Significance: local

### *6.11.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Rockwood Bridge to estuary | JBNZ can conduct 2 day events between 1/9 and 28/2 between 10 am-3 pm each year when flow exceeds 30 $m^3/s$ at SH1 bridge | Class 3.Shingle, braided, rocks, willows.<br>39 km. Gradient 5.1m/km | Ramp at Milford Huts. Limited launching at SH1, Pleasant Point Saleyards, Hanging Rock, Raincliff and Rockwood bridges. | Needs above average flows |

### *6.11.3 Regulations*

Timaru District Council District Plan – General Rules – activities on the surface of water. Permitted activities (Part D, 6):

> *Opihi River*
>
> *(a) The use of motorised craft by the New Zealand Jet Boat Association for up to two family day events on the Opihi River between the State Highway 1 Bridge and the confluence of the Opihi and Opuha Rivers within the period September to February (inclusive) conducted between 10.00am and 3.00pm when the river flow measured at the State Highway 1 Bridge exceeds 30 $m^3/s$.*
>
> *(b) The use of motorised craft on the waters of the estuarine lagoon area of the Opihi River at speeds not exceeding 5 knots.*
>
> *(c) Up to one jet sprint event conducted by the New Zealand Jet Boat Association outside but adjacent to the mainstream of the Opihi River, of up to two days duration in September of any one year*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Opihi River | No uplifting | |

### *6.11.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

Opihi Boatable section from Rockwood Bridge to Estuary

Opihi River at Rockwood – 69618

Topo50 NZTM Map Reference: BZ18:35557-07425

11/05/64 – 10/06/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 14.32 |
| **10** | 9.46 |
| **15** | 7.52 |
| **20** | 6.35 |
| **25** | 5.51 |
| **30** | 4.85 |
| **35** | 4.32 |
| **40** | 3.88 |
| **45** | 3.47 |
| **50** | 3.13 |
| **55** | 2.85 |
| **60** | 2.58 |
| **65** | 2.34 |
| **70** | 2.13 |
| **75** | 1.92 |
| **80** | 1.72 |
| **85** | 1.5 |
| **90** | 1.27 |
| **95** | 1.01 |
| **100** | 0.43 |

### *6.11.5 Notes*

- Flows: See TDC District Plan rules above. Flows exceeding 30 $m^3/s$ are very rare. In the period 1/9/14 to 30/4/15 only one such event occurred. This condition is so restrictive that it effectively prohibits jet boating on this river. These flow events are also of such short duration that organising an event would be difficult.
- Willows: Present.

## 6.12 Otaio

River section length: 25km

Boatable distance: flow dependant

### *6.12.1 RiVAS summary (expert panel estimates)*

- User days estimate: 5
- Origin of users: local
- Organised events: none
- Quality of experience: everyday boating
- Percent of time flows are boatable: 5 – restricted by low flows
- Uses: Adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 1
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: local

### *6.12.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| All | Yes | Class 3.<br>No information | | Need high flow |

### *6.12.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Otaio River | The Otaio River | |

### *6.12.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

Otaio at Gorge – 70303

Topo50 NZTM Map Reference: CA18:35731-68410

04/04/01 – 04/11/14

| Percentage exceedance | Oct – March (l/s) |
|---|---|
| **5** | 1682 |
| **10** | 1004 |
| **15** | 733 |
| **20** | 595 |
| **25** | 512 |
| **30** | 452 |
| **35** | 405 |
| **40** | 365 |
| **45** | 329 |
| **50** | 294 |

| | |
|---|---|
| **55** | 262 |
| **60** | 234 |
| **65** | 212 |
| **70** | 194 |
| **75** | 173 |
| **80** | 154 |
| **85** | 138 |
| **90** | 123 |
| **95** | 106 |
| **100** | 55 |

### *6.12.5 Notes*

- Flows: Flood only
- Willows present on berms

### *6.12.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Otaio River | **Adventure boating** | **Needs high flows** | | |

## 6.13 Rakaia

**Above Wilberforce confluence**

River section length: 32km

Boatable distance: 20km

**Wilberforce to Gorge Bridge**

River section length: 34km

Boatable distance: 34km

**Gorge Bridge to sea**

River section length: 65km

Boatable distance: 65km

### *6.13.1 RiVAS summary (expert panel estimates)*

**Above Wilberforce confluence**

- User days estimate: 100
- Origin of users: regional
- Organised events: regional, local and family
- Quality of experience: something special
- Percent of time flows are boatable: 70 – restricted by low flows
- Uses: family boating, adventure boating, trout fishing, access.
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: seasonal limits
- Access (legal and physical reliability): OK
- Significance: national

**Wilberforce to Gorge Bridge**

- User days estimate: 5000 casual plus 7500 commercial (Discovery Jet)
- Origin of users: International, national, regional, local
- Organised events: International, national, regional, local and family
- Quality of experience: something special
- Percent of time flows are boatable: 95 – restricted by high flows
- Uses: salmon fishing, trout fishing, family boating, racing, commercial, tramping, search & rescue, training
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: no limits
- Access (legal and physical reliability): reliable
- Significance: national

**Gorge Bridge to sea**

- User days estimate: 10,000

- Origin of users: national
- Organised events: national, regional, local and family
- Quality of experience: something a bit special
- Percent of time flows are boatable: 95 – restricted by high flows
- Uses: salmon fishing, trout fishing, family boating, racing, search & rescue, training, white baiting, duck hunting
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 3
- Regulations: no limits
- Access (legal and physical reliability): reliable
- Significance: national

### *6.13.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Jagged Stream to Wilberforce | Yes, but not in April, May or June (salmon spawning) | Class 3. Boulders, braided 32 km. Gradient: 7.8 m/km | Lake Coleridge Power Station outfall | |
| Wilberforce to sea | Yes | Class 1. Braided, shingle. 96km. Gradient 4.1m/km | SH1, Gorge Bridge. | Always boatable |

### *6.13.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Rakaia River | The Rakaia River including the Rakaia River Lagoon and all of the tributaries of the Rakaia River. | That part of the Rakaia River Lagoon to the north-east of the boat ramp at North Rakaia Huts or within 50 metres of the boat ramp |

### *6.13.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

Above Wilberforce confluence – No recorder

Lower Rakaia River below Gorge – SH1 68501 – Not rated

**Wilberforce to Gorge Bridge**

Rakaia at Gorge – 68502

Topo50 NZTM Map Reference: BX20:91456-80761

17/12/57 – 19/02/14

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 558.6 |
| **10** | 393.3 |
| **15** | 315.7 |
| **20** | 267.8 |
| **25** | 239.1 |
| **30** | 219.7 |
| **35** | 206.3 |
| **40** | 195.1 |
| **45** | 184.9 |
| **50** | 176.6 |
| **55** | 169.3 |
| **60** | 162.4 |
| **65** | 156 |
| **70** | 148.5 |
| **75** | 141.9 |
| **80** | 134.3 |
| **85** | 126.8 |
| **90** | 118.4 |
| **95** | 106.6 |
| **100** | 72.2 |

### *6.13.5 Notes*

- Flows: Above Wilberforce limited by flows, but boatable in high flows.
- Heavily fished for salmon during season. Closure in upper reaches due to salmon migration & spawning in April/May/June.
- Commercial operator in Gorge.

### *6.13.6 Other data from literature*

Water Conservation Order in place. Data about significance to jet boating in WCO decision.

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Rakaia River – Lake Stream | Adventure boating<br>Small and scenic river | High flow<br>No further abstractions | | Natural |
| Rakaia River – Wilberforce River | Adventure boating<br>Wild and scenic river | High flow<br>No further abstractions<br>Existing natural flows | | Natural |

| | | | | |
|---|---|---|---|---|
| Rakaia River – Gorge, and to sea | Family boating<br>Wild and scenic river gorge | Happy with minimum flows as they are on the river.<br>WCO on river including Gorge | Fighting Hill:<br>Mean 212<br>Median 157<br>Flood 2514<br>7DMALF 92 | Natural |

*Greenaway, R. (2012). Statement of Evidence on behalf of TrustPower Limited. Application to amend the NCO (Rakaia River) 1988.*

Cites 80m$^3$/s as minimum safe flow for jet boating through the Rakaia Gorge and notes that gorge was boatable down to 75 m$^3$/s in the winter of 2011.

Methodology: literature review, site visits, recreation user interviews, on-site user surveys. Format: court evidence. Relevance: Partial-based on reports

*Greenaway, R. (2011a). Annexure M: Lake Coleridge Project Recreation and Tourism Survey. Prepared for TrustPower Ltd. Rob Greenaway Associates. www.greenaway.co.nz.*

Jet boating amenity in the upper River (between the Wilberforce confluence and the Gorge Bridge) appears to be protected by a minimum flow of 80m$^3$/s when the 'critical shallows' upstream of the Rakaia Gorge are suitably formed within a confined channel. Otherwise, as was the case in mid- 2010, a flow closer to 100m$^3$/s is required for the Gorge. Discovery jet operates throughout the year, with winter and spring important seasons. Management of the bed of the river to maintain a channel above the Gorge may be required to sustain the outstanding opportunity at flows below 100m$^3$/s.

Jet boating amenity in the lower Rakaia River will decline as flows fall below 100m$^3$/s as braids become fewer and/or more difficult to navigate. However, if the majority of boating is related to salmon angling, jet boating will occur when flows suit angling rather than boating per se.

Methodology: On-site survey, resource flyovers and user interview. Format: Research Report to Client. Relevance: High – Interview with experienced commercial operator regarding direct observations. Survey does not capture minimum flow data, but does discuss recreation user preferences.

*Greenaway, R. (2011b). Lake Coleridge Project Recreation and Tourism Survey. Prepared for TrustPower Ltd. Rob Greenaway Associates. www.greenaway.co.nz.*

The survey presents some jet boat user preference data – from 80 to 500 m$^3$/s - however none relates to minimum flows. A low number of data points, possible multiple counts and self-reports limit the validity of the survey – as noted by the author.

Methodology: On-site survey and resource flyovers. Format: Research Report to Client. Relevance: Low – Survey does not capture minimum flow data, but does discuss recreation user preferences.

*Greenaway, R. (2011). Rakaia River Low Flow Jet Boat Run, Discovery Jet. Memo prepared for TrustPower Ltd. Rob Greenaway Associates. www.greenaway.co.nz.*

Blair was of the opinion that the River could drop a few more cubic metres before any real issues arose and that it could be possible to revise the company's SOP to permit operation at 75 m$^3$/s. However, the changeable nature of the River meant that an assessment would need to be made after every major flood event to check how the river bed had reformed, as is done now.

Methodology: Direct Observation, single instance. Format: Memo. Relevance: Partial – Single observation with experienced jet boat operator.

## 6.14 Rangitata (including Clyde and Havelock)

**Clyde and Havelock**

River section length: 22 (Havelock) + 23 (Clyde) km

Boatable distance: 15 on Clyde. Havelock – not usually boated and flow dependent

**Upper braided**

River section length: 38km

Boatable distance: 38km

**Top of Gorge to RDR intake**

River section length: 6km

Boatable distance: 6km

**Middle – RDR intake to SH1**

River section length: 40km

Boatable distance: 40km

**SH1 to sea**

River section length: 18km

Boatable distance: 18km

### *6.14.1 RiVAS summary (expert panel estimates)*

**Clyde and Havelock**

- User days estimate: 10
- Origin of users: regional
- Organised events: none
- Quality of experience: something special
- Percent of time flows are boatable: 20 – restricted by low flows
- Uses: adventure boating, hunting
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: seasonal limits (see 'other data' below)
- Access (legal and physical reliability): OK
- Significance: local

**Upper braided**

- User days estimate: 1000
- Origin of users: regional
- Organised events: regional, local and family
- Quality of experience: something special
- Percent of time flows are boatable: 95 – restricted by high flows
- Uses: family boating, salmon fishing, trout fishing, hunting
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5

- Regulations: none
- Access (legal and physical reliability): OK
- Significance: national

**Top of Gorge to RDR intake**

- User days estimate: 2
- Origin of users: local
- Organised events: none
- Quality of experience: bucket list
- Percent of time flows are boatable: 5 – restricted by low flows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: no limits
- Access (legal and physical reliability): OK
- Significance: regional

**Middle – RDR intake to SH1**

- User days estimate: 20
- Origin of users: regional
- Organised events: none
- Quality of experience: something a bit special
- Percent of time flows are boatable: 5 – restricted by low flows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: no limits
- Access (legal and physical reliability): reliable
- Significance: regional

**SH1 to sea**

- User days estimate: 400
- Origin of users: regional
- Organised events: none
- Quality of experience: something a bit special
- Percent of time flows are boatable: 70 – restricted by low flows
- Uses: salmon fishing, white baiting, trout fishing, family boating, duck hunting
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: no limits
- Access (legal and physical reliability): reliable
- Significance: regional

### 6.14.2 JBNZ Yearbook 2015

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Havelock. Forbes Junction to Clyde | Yes, but not during 1/3 to 31/7 | Class 3. Boulders, braided.<br>15 km. Gradient 12m/km | | |
| Clyde | Yes, but not during 1/3 to 31/7 | Not usually boatable | | |
| Clyde to Turnagain Point | Yes, but not during 1/3 to 31/7 | Class 1. Shingle, braided<br>25 km. Gradient 5.2 m/km | | |
| Turnagain Point to Gorge | Yes | Class 1. Shingle, braided<br>13 km. Gradient 1.4m/km | | |
| Gorge to RDR Intake | Yes | Class 4 . Rapids, rocks.<br>6 km. Gradient 10m/km | | Has been boated at 150 $m^3/s$ |
| RDR Intake to SH 1 | Yes | Class 3. Boulders,<br>69 km. Gradient 3.9m/km | | Flow required: 85 $m^3/s$ at Klondyke recorder<br>Plus RDR abstraction (see Notes) |
| SH1 to sea | Yes | Class 2. Boulders, braided<br>18 km. Gradient : 5.5m/km | | |

### 6.14.3 Regulations

Timaru District Council District Plan – General Rules – activities on the surface of water. Permitted activities (Part D, 6):

*(4) Rangitata River*

*The use of motorised craft on the Rangitata River at any time other than above Red Rocks also known as Turn Again Bend (NZMS 260, Sheet J36, Grid Reference 515208) between March and July (inclusive), or where used as part of a commercial activity.*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Rangitata River | The Rangitata River, including Rangitata River Lagoon and the tributaries of the Rangitata River. | The reserved areas. (See clauses 11.12.12 to 11.12.14) |

*RANGITATA RIVER Reserved Areas - Non-Powered Craft Area*

*11.2.12 The Rangitata River, including its tributaries, upstream of Red Rocks, (also known as Turn Again Point), at Map Reference NZMS 260 J36-515-208, located approximately three kilometres up stream of Rata Peaks, are reserved for nonpowered vessels between 1 March and 31 July in any year. Reserved Areas - No Boating Areas*

11.2.13 Deep Stream (Mesopotamia) is reserved as a No Boating Area.

11.2.14 Deep Creek (Mount Potts) is reserved as a No Boating Area.

### *6.14.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

Clyde & Havelock confluence to top – No recorder

Upper braided – No recorder

Lower Rangitata - SH1 to sea – No recorder

Mid-low Rangitata - RDR to SH1 – No recorder

**Rangitata Top of Gorge to RDR Intake**

Rangitata at Klondyke – 69302

Topo50 NZTM Map Reference: BY19:56746-53179

13/08/79 – 16/06/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 268.5 |
| **10** | 200.1 |
| **15** | 167.6 |
| **20** | 146.6 |
| **25** | 132.4 |
| **30** | 122 |
| **35** | 113.5 |
| **40** | 106.8 |
| **45** | 100.8 |
| **50** | 95.9 |
| **55** | 91 |
| **60** | 86.4 |
| **65** | 81.6 |
| **70** | 76.7 |
| **75** | 72 |
| **80** | 67.3 |
| **85** | 62.3 |
| **90** | 56.7 |
| **95** | 49.7 |
| **100** | 35.4 |

### *6.14.5 Notes*

- Flows: There is abstraction for irrigation at the lower end of the gorge. The river from this point to SH1 bridge is very rocky and boulder, and consequently seldom boated. The RDR takes 30.7 $m^3/s$ most of the time during the irrigation season and so while the preferred minimum flow for jet boating is 85 $m^3/s$ below the gorge, the Klondyke flow recorder would need to be showing 115 $m^3/s$ to ensure the required flows for jet boating below the intake.
- Salmon fishing is a major activity during the season on the rest of the river.
- The upper river above the gorge is very highly valued.

- The gorge constitutes one of the major white water challenges in New Zealand, requires the right flow (about 140 to 160 $m^3/s$), It has been boated but is a very high risk undertaking.

### *6.14.6 Other data from literature*

The Water Conservation Order decision provides a review of the scale of jet boating values.

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Rangitata River – Upper River above Gorge and White Rock | Family boating | All flows up to flood | Klondyke: Mean 97<br>Median 75<br>Flood 1085<br>7DMALF 42 | Natural |
| Rangitata Gorge | Extreme adventure boating, Very big rapids | 130-180 $m^3/s$ at Klondyke | | |
| Rangitata River – Klondyke to Peel Forest | Family boating | 80 $m^3/s$ + to flood. Flows severely and routinely reduced to levels at which many jet boating values absent because of large off-take by the RDR for irrigation and hydroelectricity generation WCO on reach | Klondyke: Mean 97<br>Median 75<br>Flood 1085<br>7DMALF 42 | >80 $m^3/s$ to flood |

## 6.15 Selwyn

River section length: 53km

Boatable distance: 20km Flow dependant, but no uplift

### *6.15.1 RiVAS summary (expert panel estimates)*

- No data – not uplifted

### *6.15.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Whitecliff to Leeston Highway Bridge | No | Class 3. Shingle/braided 53 km. Gradient: 5.2m/km | | |

### *6.15.3 Regulations*

No uplifting

### *6.15.4 Flows*

**Leeston Bridge to Lake Ellesmere**

Selwyn at Coes Ford – 68002

Topo50 NZTM Map Reference: BX23:52643-61694

29/02/84 – 26/03/15

| Percentage exceedance | Oct – March (l/s) |
|---|---|
| **5** | 6127 |
| **10** | 3008 |
| **15** | 1987 |
| **20** | 1616 |
| **25** | 1407 |
| **30** | 1275 |
| **35** | 1192 |
| **40** | 1115 |
| **45** | 1030 |
| **50** | 942 |
| **55** | 867 |
| **60** | 807 |
| **65** | 752 |
| **70** | 691 |
| **75** | 616 |
| **80** | 522 |
| **85** | 407 |
| **90** | 302 |
| **95** | 213 |
| **100** | 20 |

**Selwyn Whitecliffs to Leeston Highway Bridge**

Selwyn at Whitecliffs – 68001

Topo50 NZTM Map Reference: BX21:10512-87228

26/05/64 – 23/01/15

| Percentage exceedance | Oct – March (l/s) |
|---|---|
| **5** | 7309 |
| **10** | 4940 |
| **15** | 3906 |
| **20** | 3263 |
| **25** | 2814 |
| **30** | 2466 |
| **35** | 2184 |
| **40** | 1972 |
| **45** | 1784 |
| **50** | 1609 |
| **55** | 1452 |
| **60** | 1328 |
| **65** | 1208 |
| **70** | 1106 |
| **75** | 1022 |
| **80** | 937 |
| **85** | 857 |
| **90** | 774 |
| **95** | 686 |
| **100** | 419 |

### *6.15.5 Notes*

- Most of river requires high flow or flood conditions.
- Willows present in much of the river.

### *6.15.6 Other data from literature*

None.

## 6.16 Upper Waitaki: Ahuriri

River section length: 35km

Boatable distance: 35km but no uplift

### *6.16.1 RiVAS summary (expert panel estimates)*

- No data – not uplifted

### *6.16.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Canyon Creek to waterfall below Ben Avon | No | Class 1, Swamp, shallows, meandering.<br>30 km. Gradient 4.5m/km | | |
| Waterfall to Lake Benmore | No | Class 2. below impassable waterfall, braided, braided.<br>35km. Gradient 7.4m/km | Lake Benmore off SH 83; . SH 8 Bridge | |

### *6.16.3 Regulations*

No uplifting

### *6.16.4 Flows*

**Upper Waitaki Ahuriri - South Diadem Recorder to lake**

Ahuriri River at South Diadem – 71116

Topo50 NZTM Map Reference: CA14:39735-70328

04/09/63 – 09/01/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 59.5 |
| **10** | 45.5 |
| **15** | 38.4 |
| **20** | 34.4 |
| **25** | 31.3 |
| **30** | 28.9 |
| **35** | 26.8 |
| **40** | 25 |
| **45** | 23.3 |
| **50** | 21.8 |
| **55** | 20.5 |
| **60** | 19.3 |
| **65** | 18.1 |
| **70** | 16.9 |
| **75** | 15.8 |
| **80** | 14.5 |
| **85** | 13.3 |
| **90** | 11.9 |
| **95** | 10.4 |
| **100** | 7.3 |

### *6.16.5 Notes*

- Not currently uplifted

- Riverbed nesting birds present in spring, notably the black stilt.
- Willows: Present
- High value trout fishery
- Has high jet boating values in an area that has limited boating opportunities.

#### *6.16.6 Other data from literature*

None.

## 6.17 Upper Waitaki: Dobson/Hopkins

**Dobson - Watsons Stream to Hopkins confluence**

River section length: 20km

Boatable distance: 10km (flow dependent)

**Hopkins - Watsons stream to Lake Ohau**

River section length: 35km

Boatable distance: 20km (flow dependent)

### *6.17.1 RiVAS summary (expert panel estimates)*

Dobson/Hopkins

- User days estimate: 300
- Origin of users: regional
- Organised events: regional, local and family
- Quality of experience: something a bit special
- Percent of time flows are boatable: 70 – restricted by low flows
- Uses: Family boating, adventure boating, hunting, trout fishing
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: restrictions (see 'other data' below)
- Access (legal and physical reliability): reliable
- Significance: national

### *6.17.2 JBNZ Yearbook 2015*

**Dobson**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Watsons Stream to Hopkins confluence | All from 25/12 to 30/4 | Class 3. Boulders, braided. 20 km. Gradient 6m/km | Lake Ohau | Gradient increases steadily from Hopkins confluence. Has a fence across. |

**Hopkins**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Thompson Stream to Lake Ohau | All from 25/12 to 30/4 each year | Class 3. Boulders, braided 35 km. Gradient 7.4m/km. | Lake Ohau | Gradient increases steadily from Dobson confluence |

### 6.17.3 Regulations

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Dobson River (Otao) | The Dobson river (Otao) from 25 December to 30 April in the following year | The Dobson river (Otao) from 1 May to 24 December; all tributaries of the Dobson (Otao) |
| Hopkins River (Te Awa Aruhe) | The Hopkins River (Te Awa Aruhe) from 25 December to 30 April in the following year | The Hopkins River (Te Awa Aruhe) from 1 May to 24 December; all tributaries of the Hopkins River (Te Awa Aruhe). |

Dobson River. Photo: John Mead

### 6.17.4 Flows

No recorder.

### 6.17.5 Notes

- Flows: Need high flows to reach upper valleys.
- Lower Hopkins is Class 1 for a short distance
- No spring uplifting to protect riverbed nesting birds.

### *6.17.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Dobson River – Head of Lake Ohau | Adventure boating<br>High value<br>Wild and scenic river | High flow<br>Should not have any abstractions | | Natural |
| Hopkins River – Head of Lake Ohau | Adventure boating<br>Medium high value<br>Wild and scenic river | High flow.<br>Should not have any abstractions | | Natural |

## 6.18 Upper Waitaki: Godley - McKinnon Stream to Lake Tekapo

River section length: 29km

Boatable distance: 12km (flow dependent)

### *6.18.1 RiVAS summary (expert panel estimates)*

- User days estimate: 100
- Origin of users: regional
- Organised events: regional, local and family
- Quality of experience: bucket list
- Percent of time flows are boatable: 70 – restricted by low flows
- Uses: Family boating, adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: restrictions (see 'other data' below)
- Access (legal and physical reliability): OK?
- Significance: regional

### *6.18.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| McKinnon stream to Macaulay confluence | All from 25/12 to 30/4 each year | Class 3. Shingle, boulders, braided.<br>23 km. Gradient 8.7m/km | Lake Tekapo | Offers greatest altitude possible by boat in Canterbury in high flow conditions. |
| Macaulay confluence to Lake Tekapo | All from 25/12 to 30/4 each year | Class 2. Shingle, boulders, braided<br>6 km Gradient 5.0m/km | Lake Tekapo | |

### *6.18.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Godley River (Whimiahao) | The Godley River (Whimiahao) from 25 December to 30 April in the following year. | The Godley River (Whimiahao) from 1 May to 24 December; all tributaries of the Godley River (Whimiahao). |

### *6.18.4 Flows*

No recorder.

### *6.18.5 Notes*

- No spring uplifting to protect riverbed nesting birds.

### *6.18.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Godley River – Head of Lake Tekapo | Adventure boating Wild and scenic river | High flow Should not have any abstractions | | Natural |

## 6.19 Upper Waitaki: Macaulay - North Branch Junction to Lake Tekapo

River section length: 10km

Boatable distance: 3km (flow dependent)

### *6.19.1 RiVAS summary (expert panel estimates)*

- No data

### *6.19.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Godley confluence upstream | 25/12 to 30/4 each year | Class 3. Boulders, shingle, braided.<br>10 km Gradient 8m/km | Lake Tekapo | |

### *6.19.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Macaulay River (Maukakakuta) | The Macaulay River (Maukakakuta) from 25 December to 30 April in the following year. | The Macaulay River (Maukakakuta) from 1 May to 24 December; all tributaries of the Macaulay River (Maukakakuta). |

### *6.19.4 Flows*

No recorder.

### *6.19.5 Notes*

Flows: Requires high flow.

No spring uplifting to protect riverbed nesting birds.

### *6.19.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Macauley River – Head of Lake Tekapo | Adventure boating Wild and scenic river | High flow Should not have any abstractions | | Natural |

## 6.20 Upper Waitaki: Pukaki - Pukaki dam to Tekapo Junction

River section length: 12km

Boatable distance: 3km normally and 12 km when releases are made from lake

### *6.20.1 RiVAS summary (expert panel estimates)*

- User days estimate: 60
- Origin of users: regional
- Organised events: local and family
- Quality of experience: bucket list
- Percent of time flows are boatable: 5 – restricted by flow releases
- Uses: Family boating, adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: high – flow release dependent
- Access (legal and physical reliability): reliable
- Significance: regional

### *6.20.2 JBNZ Yearbook 2015*

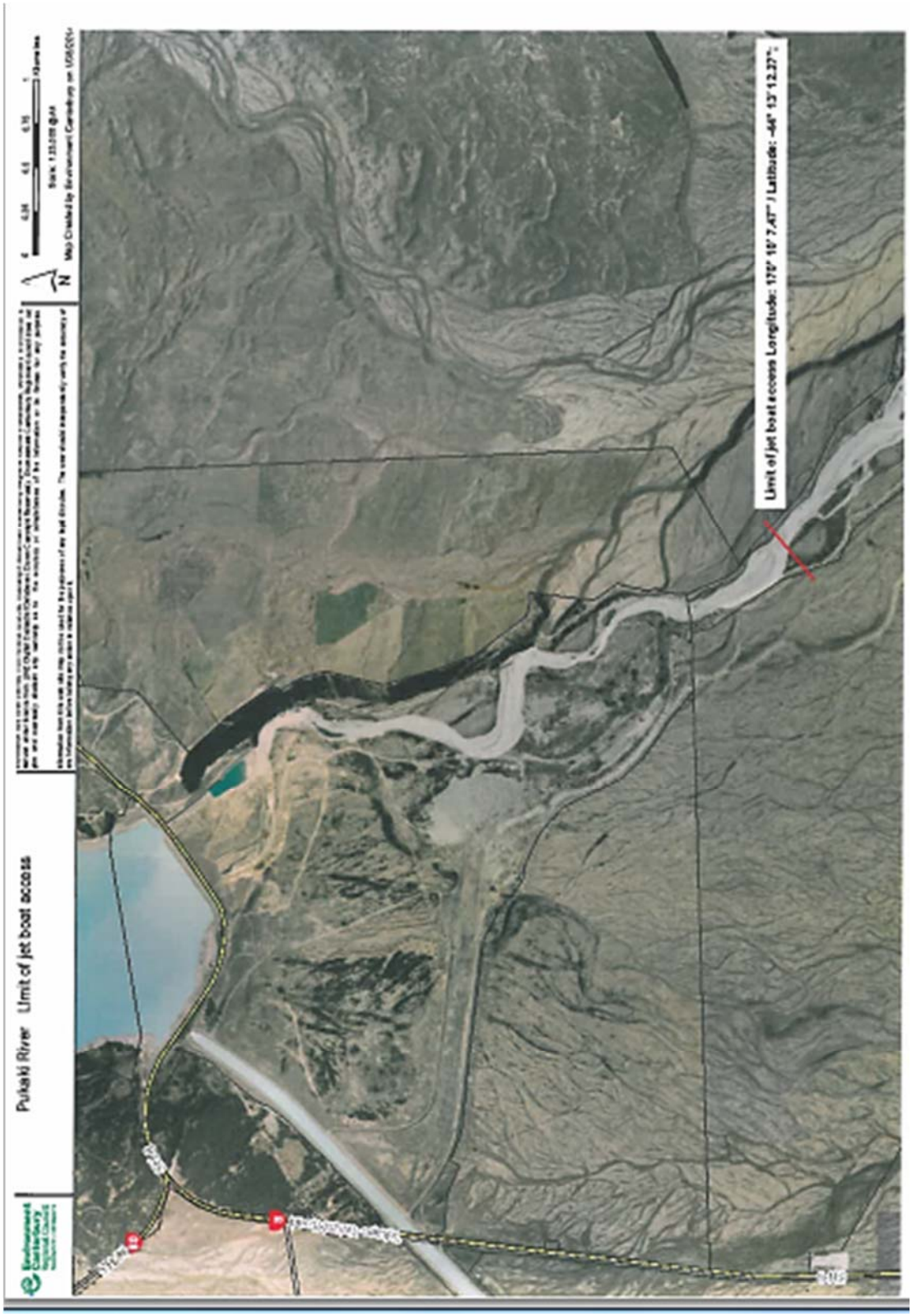
| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Tekapo River to Rapids approx. 12 km upstream | 1/2 to 30/4 each year. | Class 3. Shingle, rocks 12 km. Gradient 5m/km | From Tekapo River | Need water to be released from dam. |

### *6.20.3 Regulations*

Temporary Regulation Certificate Environment Canterbury Navigation Safety Bylaws 2010

Part 7.2.1 (a) Part 7.2.1 (b)

| |
|---|
| **DRAFT Name of holder:** Jet Boating New Zealand Inc. (JBNZ) |
| **Regulation:** To uplift the 5 knot speed limit in the Tekapo River when the flow in the Tekapo River is greater than 20 cubic metres per second as measured at the flow recorder on the Tekapo River downstream of Maryburn, and in the Pukaki River when the flow in the river is boatable, but only in the period 1 February to 30 April inclusive each year. |
| **Regulated/Reserved Area:** The Tekapo River from Lake Benmore to the weir below Lake George Scott and the Pukaki River from the confluence with the Tekapo River to the location marked on the attached map approximately 12 kilometres above the confluence. |
| **Period:** Indefinite until incorporated in the Navigation Safety Bylaws by a review, or revoked. |
| **Map attached:** Yes |
| **Purpose:** To allow jet boat access for JBNZ members only to transit the Tekapo and Pukaki Rivers at periods of high flow during releases or spill events, at the time of year which causes the least disruption to wildlife and fisheries values. |
| **Conditions:** |
| **Publication of notice of Temporary Regulation:** A copy of this notice is to be displayed at the boat ramps at Ohau C and Haldon Arm. |
| **A copy of the Temporary Regulation Certificate to be carried by:** Not applicable |
| **Safety conditions:** All JBNZ jet boats to carry safety equipment as required by the Association. |
| **Nominated controller:** Not applicable |
| **Approval date:** 16 September 2014 |
| **Issued under delegation by:**  **Evan Walker Recreational Boating Officer Environment Canterbury** |


Pukaki River Limit of jet boat access
Limit of jet boat access Longitude: 170° 18' 7.47" / Latitude: -44° 13' 12.27"

### *6.20.4 Flows*

Not relevant (see below).

### *6.20.5 Notes*

- Can only be boated when releases are made from Lake Pukaki. Kayakers will also use it on these occasions, above the rapids and in the rapids.
- Note this is for JBNZ Members only. Boats must display registration numbers.

### *6.20.6 Other data from literature*

None.

## 6.21 Upper Waitaki: Tasman - Tasman Glacier to Pukaki

River section length: 18km

Boatable distance: 18km

### *6.21.1 RiVAS summary (expert panel estimates)*

- No data

### *6.21.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Glacier Lake to Airfield | No | Class 4 Rocks, boulders, braided, steep, rapids<br>8 km. Gradient 10m/km | Lake Pukaki | Has been boated. Is in National Park. |
| Airfield to Lake | No | Class 2. Shingle, rapids, boulders, sand, shallow<br>16 km. Gradient: 6.2m/km | Lake Pukaki | Silt laden water hard to read. |

### *6.21.3 Regulations*

No uplifting

### *6.21.4 Flows*

No recorder.

### *6.21.5 Notes*

- Closed as it is in a National Park and due to presence of riverbed nesting birds.
- Is permanently discoloured and hard to read. Lower section to Airfield has quicksand. It becomes rocky and bouldery above airfield with steep rapids.

### *6.21.6 Other data from literature*

None.

## 6.22 Upper Waitaki: Tekapo

Lake George Scott weir to Iron Bridge

River section length: 44km

Boatable distance: 44km

**Iron Bridge to Lake Benmore**

River section length: 5km

Boatable distance: 5km

### *6.22.1 RiVAS summary (expert panel estimates)*

**Lake George Scott weir to Iron Bridge**

- User days estimate: 100? (new uplifting so no data available).
- Origin of users: regional
- Organised events: none
- Quality of experience: something a bit special
- Percent of time flows are boatable: 20 – restricted by flow releases (20 $m^3$/s min)
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: high – flow release dependent
- Access (legal and physical reliability): reliable
- Significance: local

**Iron Bridge to Lake Benmore**

- User days estimate: 300?
- Origin of users: regional
- Organised events: local and family
- Quality of experience: everyday boating
- Percent of time flows are boatable: 20 – restricted by flow releases (20 $m^3$/s min)
- Uses: adventure boating, family boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2
- Regulations: high – flow release dependent
- Access (legal and physical reliability): reliable
- Significance: local

### 6.22.2 JBNZ Yearbook 2015

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Lake Benmore to weir Below Lake George Scott | 1/2 to 30/4 each year when flow at recorder downstream of Maryburn exceeds 20 $m^3/s$ | Class 2 Shingle, braided, willows. 44km. Gradient 6.8m/km | Lake Benmore: Haldon, Falstone, Ohau C | |

### 6.22.3 Regulations

See Pukaki River

### 6.22.4 Flows

More than 20 $m^3/s$ required as per uplift regulations. A rare event.

### 6.22.5 Threats

- Flows: High flow only
- Willows: Present

### 6.22.6 Other data from literature

None.

## 6.23 Waiau, Hope and Boyle

**Boyle River**

River section length: 13 km

Boatable distance: Flow dependant

**Hope River**

River section length: 27 km

Boatable distance: Flow dependant

**Waiau River**

**Edwards to Hope confluence**

River section length: 19km

Boatable distance: 17km

**Hope confluence to Leslie Hills**

River section length: 19km

Boatable distance: 19km

**Leslie Hills to sea**

River section length: 64 km

Boatable distance: 64 km

### *6.23.1 RiVAS summary (expert panel estimates)*

**Hope and Boyle**

- User days estimate: 10
- Origin of users: regional
- Organised events: none
- Quality of experience: something a bit special
- Percent of time flows are boatable: 10 – restricted by low flows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 4
- Regulations: high (see ‘other data’ below)
- Access (legal and physical reliability): unreliable
- Significance: local

**Waiau**

**Edwards to Hope confluence**

- User days estimate: 50
- Origin of users: regional
- Organised events: none

- Quality of experience: something a bit special
- Percent of time flows are boatable: 20 – restricted by low flows
- Uses: adventure boating, hunting, trout fishing
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: no restrictions
- Access (legal and physical reliability): unreliable
- Significance: local

**Hope confluence to Leslie Hills**

- User days estimate: 2500 + 5000 commercial (Thrillseekers Adventures). Thrillseekers think the recreational estimate is too high, but for consistency with other river estimates from the RiVAS expert panel their data are shown here. See 'notes' below for more detail.
- Origin of users: international, national, regional, local
- Organised events: international, regional, local and family
- Quality of experience: something a bit special
- Percent of time flows are boatable: 80 – restricted by high flows
- Uses: commercial, trout fishing, salmon fishing, family boating, racing
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 4
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: national

**Leslie Hills to sea**

- User days estimate: 700
- Origin of users: international, national, regional, local
- Organised events: international, regional, local and family
- Quality of experience: something a bit special
- Percent of time flows are boatable: 40 – restricted by low flows
- Uses: commercial, hunting, trout fishing, salmon fishing, family boating, white baiting, racing
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 4
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: national

### *6.23.2 JBNZ Yearbook 2015*

**Hope River**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Kiwi Hut to Waiau River confluence | 1/12 to Easter Monday | Class 3. Boulders.<br>27 km. Gradient 7.8 m/km | River bed near Gabriel's Gully if possible or Waiau or Hope rivers | Needs high flow conditions |

**Boyle River**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Hope River to Lewis River Confluence | 1/12 to Easter Monday | Class 3+<br>Rocks, boulder, gorge.<br>13 km Gradient: 9.2m/km<br>Has been boated to 1 km below Lewis | Hope | Need above average flow |

**Waiau River**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Ada to Narrows (Stanley River Confluence) | No | | | |
| Narrows to Hope confluence | Yes | Class 3+. Rocky, rapids, gorgy.<br>19 km. Gradient 8.9m/km | Waiau Riverbed above Hanmer Ferry Bridge | Narrows have been boated.<br>Very isolated section. |
| Hope to Ferry Bridge | Yes | Class 2. Boulders, braided.<br>19 km. Gradient 6.3 m/km | | |
| Ferry Bridge to Leslie Hills | Yes | Class 2. Gorgy, rocks<br>14 km. Gradient 3.9m/km | Waiau township Mason river junction | Notify commercial operator |
| Leslie Hills to sea | Yes | Class 1. Shingle, braided.<br>64 km. Gradient 3.75m/km | SH1 bridge or Waiau township | Note: low flows can present issues / Minimum flow 35 $m^3/s$ |

### *6.23.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Waiau River | The Waiau River downstream from the Stanley River confluence including the Waiau River Lagoon. | All tributaries of the Waiau River other than those specifically listed above i.e. Boyle and Hope rivers. |

### *6.23.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

**Waiau Confluence of Hope & Waiau to Leslie Hills**

Waiau at Marble Point – 64602

Topo50 NZTM Map Reference: BU24:81469-78543

06/01/67 – 16/07/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 242.6 |
| **10** | 176.5 |
| **15** | 145.8 |
| **20** | 127.2 |
| **25** | 114.4 |
| **30** | 104.3 |
| **35** | 95.2 |
| **40** | 86.7 |
| **45** | 79.1 |
| **50** | 72.6 |
| **55** | 66.7 |
| **60** | 61.5 |
| **65** | 56.7 |
| **70** | 52 |
| **75** | 47.4 |
| **80** | 43.1 |
| **85** | 39.1 |
| **90** | 35 |
| **95** | 29.2 |
| **100** | 20 |

**Waiau Edwards to Hope Confluence**

Waiau at Glenhope – 64604

Topo50 NZTM Map Reference: BU23:63608-85052

31/01/74 – 18/07/08 (Site was not rated 30/06/99 – 27/09/03 and after 18/07/08)

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 85.6 |
| **10** | 65.4 |
| **15** | 56 |
| **20** | 49.6 |
| **25** | 44.4 |
| **30** | 40.5 |
| **35** | 37.5 |
| **40** | 34.7 |
| **45** | 32.2 |
| **50** | 29.8 |
| **55** | 27.4 |
| **60** | 25.4 |
| **65** | 23.3 |
| **70** | 21.6 |
| **75** | 19.9 |
| **80** | 18.3 |

| | |
|---|---|
| **85** | 16.8 |
| **90** | 15.2 |
| **95** | 13.1 |
| **100** | 8 |

**Waiau Hope and Boyle**

Waiau at Glen Wye – 64608

Topo50 NZTM Map Reference: BU23:59821-84668

04/02/74 – 18/07/08 (Site was not rated 30/06/99 – 18/09/03 and after 18/07/08)

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 122.1 |
| **10** | 85.9 |
| **15** | 69.4 |
| **20** | 60 |
| **25** | 53.7 |
| **30** | 48.6 |
| **35** | 44.4 |
| **40** | 40.7 |
| **45** | 37.3 |
| **50** | 34.2 |
| **55** | 31.3 |
| **60** | 28.7 |
| **65** | 26.3 |
| **70** | 24.2 |
| **75** | 21.9 |
| **80** | 19.9 |
| **85** | 17.9 |
| **90** | 15.9 |
| **95** | 13.9 |
| **100** | 7.7 |

**Waiau Leslie Hills to Sea**

Waiau at Mouth – 64609

Topo50 NZTM Map Reference: BU26:29344-64960

30/11/73 – 20/01/15 (Site closed 17/08/95 – 17/02/10)

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 249.6 |
| **10** | 186.1 |
| **15** | 155.2 |
| **20** | 135.9 |
| **25** | 122 |
| **30** | 111 |
| **35** | 100.2 |
| **40** | 91.7 |
| **45** | 83.9 |
| **50** | 76.9 |
| **55** | 70.5 |
| **60** | 64.1 |
| **65** | 58.4 |
| **70** | 52.5 |

| | |
|---|---|
| **75** | 47.2 |
| **80** | 42.2 |
| **85** | 38 |
| **90** | 34 |
| **95** | 27.8 |
| **100** | 13.3 |

### *6.23.5 Notes*

- Hope River above Boyle needs high flow conditions.
- Boyle River requires above average flows and is rocky and bouldery with rapids. Has been boated to 1 km below Lewis confluence. Waiau River above the Hope confluence: above average flows required, isolated, and challenging boating.
- Commercial operator at Ferry Bridge. Thrillseekers' 'day sheets' (activity records) show a total for private jet boats from October 2014 – May 2015 to be 17 boats, giving a total estimate of 68 people during their working hours, 9am to 5pm, for 7 months using the Marble Gorge (Christian Chester, pers comm).

**Thrillseekers, Marble Gorge Waiau. Photo: Thrillseekers Adventures**

- Flow requirements for jet boating in the Waiau River from Leslie Hills to the sea need to be in line with JBNZ recommended flows (as identified here), as experienced jet boaters have found the river to be impassable at lower flows (Paul Vernell pers comm). Flows of less than 30 $m^3/s$ from Leslie Hills to Waiau township can be boated by experts in some conditions, but are not recommended for families.
- SH 1 to sea can also become either very difficult or impossible.

- These situations may become more frequent as the Environment Canterbury Hurunui and Waiau Rivers Regional Plan sets the minimum flow as measured at the Marble Point recorder at 20 $m^3/s$ (i.e in general not boatable). Allocations in the plan allow for further abstractions. A Permits (existing) total 17.83 $m^3/s$. The plan provides for further abstractions of B Permits 11 $m^3/s$ (of which 6 $m^3/s$ must be taken below the Stanton river) and C Permits at 42 $m^3/s$.
- Marble Point recorder is above the abstraction point, so irrigation takes need to be subtracted to get actual river flow.

### *6.23.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Waiau River – Hope, above Waiau confluence | Adventure boating<br>Wild and scenic character Scenic gorges | Only suitable high flows | | Est. >90th percentile |
| Waiau River – Boyle, above Hope confluence | Adventure boating<br>Wild and scenic character Scenic gorges<br>Bouldery and challenging | Only suitable high flows | | Est. >90th percentile |
| Waiau River – Upper to Hope confluence | Adventure boating up to 'Narrows'<br>Outstanding wild and scenic gorges and alpine and high country environment | Only suitable high flows<br>>85 $m^3/s$ at Marble Point | Glenhope: Mean 35<br>Median 28<br>Flood 288<br>7DMALF 13 | Natural |
| Waiau River – below Hope/Waiau confluence to Hanmer confluence | Adventure and family boating<br>Scenic gorges | Only suitable high flows | Marble Point:<br>Mean 97<br>Median 72<br>Flood 1059<br>7DMALF 32 | Est. >Median (Natural) |
| Waiau River – Leslie Hills Bridge to sea | Family boating<br>Scenic gorge | Natural flows; any flow up to flood<br>Minimum expert 25 $m^3/s$<br>Minimum family boater 35 $m^3/s$ | Marble Point:<br>Mean 97<br>Median 72<br>Flood 1059<br>7DMALF 32 | Natural |

*Duncan, M. (2012). Proposed Hurunui and Waiau River Regional Plan And Proposed Plan Change 3 to the Canterbury Natural Resources Regional Plan. Section 42A Report. Salmon and jet boat passage, river bird habitat. Prepared by NIWA for Environment Canterbury.*

Jet-boat suitability curves were developed from criteria in Mosley (1983) as listed in MFE (1998). These criteria indicate minimum widths and depths of 5 m and 0.1m respectively and a maximum velocity of 4.5 $m^3/s$. The preferred values are for width >5 m, depths >0.6 m (minimum

depth over riffles of 0.2 m) and velocity of <4.5 ms-1. These criteria were interpreted to mean that if the water depth was more than 0.3 m then there was sufficient water for jet boating. Experienced jet boaters agree that a depth of 0.3 m is adequate for jet boating, but jet boats can be operated in shallower water (pers. comm. Rob Gerard, Canterbury Regional Council). However, it only takes one impasse to stop a jet boat. Typically in a braided river this is due either to a boulder bar spreading the water so that there is no boatable channel, or by the river braiding into many very small channels, none of which contain navigable water. Skilled and experienced boaters will manage at lower flows than learners or inexperienced drivers (pers. comm. Rob Gerard, Canterbury Regional Council).

*Waiau River*

The modelling indicates jet boat passage is possible at 15 $m^3/s$ which is the lowest minimum flow proposed for the Waiau River, prior to storage being developed. During the course of field work the study reach was traversed with a large and heavy jet boat when the measured flow was 15.3 $m^3/s$. A longer reach than the modelled area was also able to be jet boated when the flow was 18 $m^3/s$.

From the riffle depth survey carried out when the flow was ~ 18 $m^3/s$ we know that the modelled reach is likely to be navigable when the flow is 15 $m^3/s$. However, during the riffle depth survey the downstream extent was limited by lack of certainty of navigable water for the surveying jet boat (Duncan and Bind, 2008). This means that it is unlikely that the whole river could be navigated when the flow is at the lowest minimum flow of 15 $m^3/s$. In addition, if there are water losses from the river downstream of Marble Point, or if the water spreads out over more braids than in the modelling reach, then the minimum flow of 15 $m^3/s$ may not be sufficient to ensure jet-boat passage between Waiau Township and Marble Point. Because braided river morphology is constantly changing, the river may be navigable at 15 $m^3/s$ at one time but may need considerably more flow at others times to obtain sufficient depth for navigation.

In conclusion, while most of the Waiau River could be jet boated by a skilled driver when the flow was 15 $m^3/s$, a flow of 20 $m^3/s$ is probably required for a jet boat driver with average skill to traverse the entire reach between Waiau Township and Marble Point. Most jet boaters would be more comfortable boating with 25-30 $m^3/s$ (pers. comm. Rob Gerard, Canterbury Regional Council).

Methodology: Two-dimensional (2-D) modelling and riffle depth survey. Format: Local government authority technical report. Relevance: Direct measurement and modelling using recognized methodologies.

*Duncan. M.J. and Bind, J. (2008). Waiau River instream habitat based on 2-D hydrodynamic modelling. NIWA Client Report CHC 2008-176.*

The modelling indicates jet boat passage is possible at 15 $m^3/s$ (Figure 23) and during the course of field work the study reach was traversed with a large and heavy jet boat when the flow was measured at 15.3 $m^3/s$. A longer reach was able to be jet boated when the flow was 18 $m^3/s$. Caution needs to be exercised when using modelled flows to determine jet boat passage depth as the model returns the average depth of water over the cell and does not take into account the depth of water over cobbles that may be protruding from the bed and may compromise jet boating. So while the river could be jet boated by a skilled driver when the flow was 15 $m^3/s$, a flow of 20 $m^3/s$ is probably required for a jet boat driver with average skill average to traverse the reach.

While the model does overestimate shallow depths, because the large jet boat was able Waiau River instream habitat based on 2-D hydrodynamic modelling to navigate a long reach of the river when the flow was 18 $m^3/s$ we think that a minimum flow of 20 $m^3/s$ is adequate for jet boat passage.

Figure 23 illustrates Jet boat passage at a flow of 15 $m^3/s$. Yellow and brown indicate depths of 0.1-0.3 m and > 0.3 m respectively. Jet boat passage of the yellow areas requires skill. Pp. 44.

Methodology: Two-dimensional (2-D) hydrodynamic modelling for prediction of depths and velocities for flows from 10 - 100 $m^3/s$. Format: Crown Research Institute Technical Report. Relevance: High - Direct measurement and modelling using recognized methodologies.

*Mosley, M.P. (2004). Waiau River: Instream Values and Flow Regime. Report R04/02. Environment Canterbury*

Unrestricted safe passage for jet boats (recreational season: December-Easter): >30 m3/s (p 73)

Table 7.1. Principal in-stream flow needs in the Waiau River system [edited to include jet boating only]. (p 90)

| **Reach** | **Instream flow needed** |
|---|---|
| Lower Waiau gorge, Parnassus to sea | >20-30 $m^3/s$ safe passage |
| Parnassus gorge | >20-30 $m^3/s$ safe passage |
| Marble Point gorge | >20-30 $m^3/s$ minimal passage, >50 $m^3/s$ to provide a satisfactory recreational boating experience |

Unrestricted safe passage for jet boats (recreational season: December-Easter): >30 $m^3/s$ (p 93).

Methodology: Hydrological assessment of flows relying on data from water level recording sites 64602, 64608 and 64609. Format: Local Government Authority Technical Report. Relevance: High – although reliance on water recording instrumentation provides a somewhat less direct and reliable assessment as other methodologies (i.e. Two-Dimensional Modelling).

## 6.24 Waihao

River section length: 44km

Boatable distance: 44km

### *6.24.1 RiVAS summary (expert panel estimates)*

- User days estimate: 10
- Origin of users: local
- Organised events: none
- Quality of experience: everyday boating
- Percent of time flows are boatable: 5 – restricted by low flows, willows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 1
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: local

### *6.24.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Waihao Box upstream | Yes | Class 3. Shingle 20 km. Gradient 4.5 m/km | Waihao Box or SH 1 | Needs high flow conditions |

### *6.24.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Waihao River (a) | (a) The Waihao River, including the Dead Arm, within 400 metres of the landward end of the Waihao Box Outlet, including for waterskiing and towing | |
| Waihao River (b) | (b) The Waihao River between the area described in (a) above and the confluence of the Waihao River and Willowbridge Creek between 1 December of any year and 31 March of the following year and between the hours of 10.00 am and sunset | Waihao River- Area (b): Between 1 April and 30 November of any year. (See reserved area clause 11.2.16 |

### *6.24.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

McCulloughs Bridge – 70902

Topo50 NZTM Map Reference: CB18:39733-37156

24/09/82 – 05/02/15

| Percentage exceedance | Oct – March (l/s) |
|---|---|
| **5** | 8136 |
| **10** | 4955 |
| **15** | 3492 |
| **20** | 2707 |
| **25** | 2220 |
| **30** | 1871 |
| **35** | 1567 |
| **40** | 1354 |
| **45** | 1176 |
| **50** | 1023 |
| **55** | 894 |
| **60** | 786 |
| **65** | 692 |
| **70** | 603 |
| **75** | 517 |
| **80** | 439 |
| **85** | 364 |
| **90** | 294 |
| **95** | 226 |
| **100** | 87 |

### *6.24.5 Notes*

- Needs high flows
- Willows present.

### *6.24.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Waihao River (and Wainono Lagoon) | Adventure boating | Needs high flows | | |

## 6.25 Waimakariri, Poulter, Esk, Broken and Eyre Rivers

**Poulter**

River section length: 15 km

Boatable distance: 15 km

**Esk**

River section length: 10km

Boatable distance: flow dependent

**Broken**

River section length: 13 km

Boatable distance: 13 km

**Eyre**

River section length: 35 km

Boatable distance: 35 km

**Waimakariri River**

**National Park boundary (Bealey Bridge) to Poulter confluence**

River section length: 17km

Boatable distance: 17km

**Poulter to Woodstock**

River section length: 29km

Boatable distance: 29km

**Woodstock to SH1 bridge**

River section length: 69km

Boatable distance: 69km

### *6.25.1 RiVAS summary (expert panel estimates)*

**National Park boundary (Bealey Bridge) to Poulter confluence**

- User days estimate: 100
- Origin of users: regional
- Organised events: none
- Quality of experience: something a bit special
- Percent of time flows are boatable: 20 – restricted by low flows
- Uses: family boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 4
- Regulations: some (see ‘other data’ below)
- Access (legal and physical reliability): OK
- Significance: local

**Poulter to Woodstock**

- User days estimate: 5000 + 7500 commercial (Jet Thrills)
- Origin of users: international, national, regional, local
- Organised events: international, national, regional, local and family
- Quality of experience: bucket list
- Percent of time flows are boatable: 95 – restricted by high flows
- Uses: commercial, trout fishing, salmon fishing, racing, tramping, search and rescue, industry
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 5
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: national

**Woodstock to SH1 bridge**

- User days estimate: 15,000 + 1000 commercial (Jet Thrills)
- Origin of users: international, national, regional, local
- Organised events: international, regional, local and family
- Quality of experience: something special
- Percent of time flows are boatable: 95 – restricted by high flows
- Uses: commercial, trout fishing, salmon fishing, family boating, racing, search and rescue, industry
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 2

Deer Print Cove, Waimakariri Gorge. Photo: Alpine Jet

- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: national

### *6.25.2 JBNZ Yearbook 2015*

**Poulter**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Lake Minchin to East Branch | No | As below | As below | Has been boated to Thompson Stream |
| Waimakariri to East Branch confluence | 1/12 to 30/4. | Class 3. Boulders, shingle, braided<br>15 km. Gradient 7.3m/km | Access from Waimak. | |

**Esk River**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Gorge to Waimakariri River | No | Class 3. Boulders, braided.<br>10 km. Gradient 28m/km<br>Has been boated 10 km in high flow conditions?? | From Waimakariri | Needs high flow conditions |

**Broken**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Flock Hill Stream to Waimakariri | 1/12-30/11 | Class 3+. Rocks, rapids,<br>13 km Gradient 8.5m/km<br>Has been boated to Flock Hill Stream | Waimakariri | Need above average flows. |

**Eyre River**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Waimakariri river to Oxford Bridge | No | Class 3. Shingle, willows, braided.<br>35 km. Gradient 6.3m/km | From Waimakariri or at South Eyre Rd Bridge | Needs high flow (flood) |

**Waimakariri**

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Bealey Bridge to Poulter | Yes, excluding April, May and June | Class 3-. Braided, shingle.<br>17km. Gradient 5.3m/km | | |

| | | | | |
|---|---|---|---|---|
| Poulter to Woodstock | Yes | Class 1. Rocks, rapids, gorgy. Note: benches between Esk and Poulter can be Class 3.<br>29km. Gradient 4.6m/km | Woodstock. | |
| Woodstock to SH1 Bridge | Yes | Class 1. Shingle, braided.<br>69km. Gradient 4.4m/km | Gorge Bridge, JBNZ SH1 Ramp | |
| SH1 Bridge to sea | No | 6 km | | |

### *6.25.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Poulter River | The Poulter River below the east branch confluence from 1 December of any year to 30 April in the following year | The Poulter River below the east branch confluence between 1 May and 30 November; the Poulter River above the east branch confluence; all tributaries of the Poulter River. |
| Esk River | The Esk River from 1 December of any year to 30 April in the following year. | The Esk River from 1 May to 30 November; all tributaries of the Esk River. |
| Broken River | The Broken River from 1 December of any year to the 30 April in the following year. | The Broken River from 1 May to 30 November; all tributaries of the Broken River. |
| Waimakariri River | The Waimakariri River upstream of the twin State Highway 1 bridges, and downstream of the Bealey Bridge on State Highway 73. | The Waimakariri River downstream of the twin State Highway 1 bridges, and upstream of the Bealey Bridge on State Highway 73. Any tributaries of the Waimakariri River other than those specifically listed above e.g. Esk and Poulter Rivers. |

### *6.25.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

Waimakariri Nattional Park Boundary to Poulter – No recorder

Waimakariri Poulter – No recorder

**Waimakariri Poulter to Woodstock (Gorge)**

Waimakariri at Otarama – 66403

Topo50 NZTM Map Reference: BW21:14505-10139

30/05/08 – 18/02/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 259.4 |
| **10** | 188.7 |
| **15** | 159.7 |
| **20** | 142.5 |
| **25** | 127.9 |
| **30** | 116.6 |
| **35** | 108 |
| **40** | 101.4 |
| **45** | 96.1 |
| **50** | 90.9 |
| **55** | 86 |
| **60** | 81 |
| **65** | 75.9 |
| **70** | 71 |
| **75** | 65.8 |
| **80** | 59.7 |
| **85** | 54.7 |
| **90** | 49.6 |
| **95** | 45.5 |
| **100** | 39 |

**Waimakariri Woodstock to Sea (Lower) SH1 bridge**

Waimakariri River at Old Highway Bridge – 66401

Topo50 NZTM Map Reference: BW24:71827-93101

31/12/66 – 07/05/15

| Percentage exceedance | Oct – March ($m^3/s$) |
|---|---|
| **5** | 325.5 |
| **10** | 226.1 |
| **15** | 182.6 |
| **20** | 156.1 |
| **25** | 138.3 |
| **30** | 124.9 |
| **35** | 113.3 |
| **40** | 103.7 |
| **45** | 95.5 |
| **50** | 88.4 |
| **55** | 82 |

| | |
|---|---|
| **60** | 75.9 |
| **65** | 70.2 |
| **70** | 64.7 |
| **75** | 59 |
| **80** | 53.8 |
| **85** | 48.8 |
| **90** | 42.5 |
| **95** | 36.5 |
| **100** | 22.1 |

### *6.25.5 Notes*

**Poulter**

- Needs average flows
- Braids are broken by short gorges

**Broken**

- Narrow, tight, challenging boating.
- Small boat has got to Flock Hill Stream. Four metre boats have been to site of old coal mine.

**Esk**

- Needs high flow conditions.
- Seldom boated probably because Waimakariri will be in flood on the occasions when the Esk has enough water.

**Eyre**

- No uplifting
- Needs high flow
- Can be boated to Oxford

**Waimakariri**

- New Zealand's most boated river.
- Gorge is spectacular, and offers great picnicking, fishing swimming opportunities.
- Lower Waimakariri River is offers excellent shallow water and braided challenges. It is excellent for learning to read shallow water, and develop and hone the techniques necessary in these situations without risking boat damage.
- Even in low summer flows it remains boatable, although the level of challenge increases. It can drop to about 30 $m^3/s$ in the lower section, when a minimum flow for Class 1 boaters is 60 $m^3/s$.
- Willows are present on the berms, but can be avoided.

### *6.25.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Waimakariri River – Poulter | Adventure boating up to DoC boundary | Only suitable high flows | | Natural |
| Waimakariri River – Broken River tributary | Adventure boating Wilderness feel<br>Wild and scenic river gorge Very challenging | Only suitable high flows | | Natural |
| Waimakariri River – Esk River tributary | Adventure boating Wilderness feel<br>Not commonly boated | Only suitable high flood flows | | Natural |
| Waimakariri River – Kowhai River tributary | Adventure boating | Only suitable high flood flows | | Natural |
| Waimakariri River – Mount White Bridge to Gorge Bridge | Family boating<br>Most highly valued jet boating water, worthy of WCO Overnight wilderness trip<br>Impressive wild and scenic river gorges | Natural flows; any flow up to flood<br>No further abstraction as natural flows too low at times | Old Highway Bridge: Mean 119<br>Median 86<br>Flood 1495<br>7DMALF 40 | Natural |
| Waimakariri River – Gorge Bridge to SH1 Bridge | Family boating<br>Most highly valued jet boating water, worthy of WCO<br>Most jet boated river reach in world<br>Proximity to Christchurch | Current minimum flow in river 41 $m^3/s$ is too low | Old Highway Bridge: Mean 119<br>Median 86<br>Flood 1495<br>7DMALF 40 | Natural |

*Adams, R.H. (2008). Evidence presented to the Central Plains Water Enhancement Scheme Hearings.*
*http://www.ecan.govt.nz/Resource+Consents/Central+Plains+Water/PlansAndReports.htm*

Referred to in Waimakariri River: B/C Block Allocation Review. Cites 50-70 $m^3/s$ as "the ideal amount of water for [jet] boating", then goes on to say that it can be utilized at "40 $m^3/s$ or even less for experienced boaters."

Methodology: Observation and experience. Format: Evidence given in court proceedings. Relevance: High – based on extensive personal and professional experience on this waterway.

## 6.26 Waipara

River section length: 24km

Boatable distance: 24km

### *6.26.1 RiVAS summary (expert panel estimates)*

- User days estimate: 40
- Origin of users: regional
- Organised events: none
- Quality of experience: something a bit special
- Percent of time flows are boatable: 5 – restricted by low flows
- Uses: adventure boating
- Scenic attractiveness (1-5 scale; 1=uninspiring, 5-inspiring): 3
- Regulations: no restrictions
- Access (legal and physical reliability): reliable
- Significance: regional

### *6.26.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| White Gorge to sea | Yes | Class 3.Shingle, braided, willows, gorgy at top.<br>24 km. Gradient 5.8m/km | Double Corner bridge, or SH 1 | Needs high flows. |

### *6.26.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Waipara River | The Waipara River | Any tributaries of the Waipara River |

### *6.26.4 Flows*

Boatable flows shown in red (according to RIVAS panel assessment).

**Waipara at White Gorge – 65901**

Topo50 NZTM Map Reference: BV24:68639-32082

25/02/88 – 04/02/15

| Percentage exceedance | Oct – March (l/s) |
|---|---|
| **5** | 5929 |
| **10** | 3313 |
| **15** | 2205 |
| **20** | 1626 |
| **25** | 1236 |
| **30** | 998 |
| **35** | 822 |
| **40** | 678 |
| **45** | 562 |
| **50** | 466 |

| | |
|---|---|
| **55** | 387 |
| **60** | 312 |
| **65** | 256 |
| **70** | 209 |
| **75** | 174 |
| **80** | 142 |
| **85** | 114 |
| **90** | 90 |
| **95** | 65 |
| **100** | 23 |

**Waipara at Teviotdale – 65904**

Topo50 NZTM Map Reference: BV24:81780-26951

07/04/00 – 03/12/14

| Percentage exceedance | Oct – March (l/s) |
|---|---|
| **5** | 7749 |
| **10** | 4498 |
| **15** | 3030 |
| **20** | 2327 |
| **25** | 1874 |
| **30** | 1612 |
| **35** | 1374 |
| **40** | 1160 |
| **45** | 991 |
| **50** | 844 |
| **55** | 721 |
| **60** | 615 |
| **65** | 526 |
| **70** | 455 |
| **75** | 395 |
| **80** | 341 |
| **85** | 292 |
| **90** | 254 |
| **95** | 215 |
| **100** | 96 |

### *6.26.5 Notes*

- Willow present which present hazards
- Interesting adventure trip up to the spectacular and unusual White Gorge.

### *6.26.6 Other data from literature*

*Gerard, R. (2013). Statement of Evidence on behalf of Jet Boating New Zealand and White Water New Zealand in the matter of the Proposed Canterbury Land and Water Regional Plan.*

Submits expert evidence which cites the problematic nature of fixed minimum flows.

| River /reach | Jet boater values | Flow requirements | Flows at gauge $m^3/s$ | Flows needed |
|---|---|---|---|---|
| Waipara River | Adventure boating | Flood only | | |

## 6.27 Wakanui Creek

### *6.27.1 RiVAS summary (expert panel estimates)*

None

### *6.27.2 JBNZ Yearbook 2015*

| Section | Uplifting | Description | Launching | Comments |
|---|---|---|---|---|
| Above tidal influence | Yes | No information | | |

### *6.27.3 Regulations*

| Environment Canterbury Navigation and Safety Bylaw 2010 | River open speed area (OSA) excluded from OSA (5 knot speed limit applies) | Excluded from OSA (5 knot speed limit applies) |
|---|---|---|
| Wakanui Creek | The Wakanui Creek | Any tributaries of the Wakanui Creek |

### *6.27.4 Flows*

No recorder.

### *6.27.5 Notes*

- No information, obviously has boated in the past or by locals.

### *6.27.6 Other data from literature*

None.

## Appendix 1: Literature review approach

The literature review was based on a review of the literature on flows for jet boating on Canterbury Rivers, including:

- Work by Mosley, M.P. from 1982
- Work on rivers not reviewed by Mosley from 1982
- Reports by experienced and professional jet boat operators
- Reports to clients made by consultants

**Methodology**

Databases used for the review of literature include: Science Direct. Web of Science, Ebscohost, the Environment Canterbury Library, the NIWA library, and Google Scholar. Only references to primary works are included. Secondary works that only refer to primary works are excluded from this report.

Terms used for the database searches included: hydrology, instream values, instream uses, jet boat*, Canterbury rivers, MP Mosley, M. Paul Mosley. Searches were also conducted for the following Canterbury waterways: Conway, Waiau, Hurunui, Ashley, Waimakariri, Selwyn, Rakaia, Ashburton, Rangitata, Orari, Opuha, Opihi, Upper Waitaki, Makikihi, Waihao, Hakataramea, Poulter, Motunau, Waipara, Wilberforce, Wakanui CK, Kowai, Kowhai, Kahutara, Lake Stream, Boyle, Broken, Haupuka, Hope, Hopkins, Esk, Erye, Kaiapoi, and Omarama Stream.

**Findings**

Annotations include information on evidence cited, methodology, format, and relevance. Evidence cited include direct quotes when possible, author edits or corrections are noted in text with brackets. Relevance is assessed as either non-relevant, partially-relevant or highly-relevant. Highly-relevant works include direct measures salient to the topic published in peer reviewed journals; or assessments of condition based on extensive experience on the topic. Works judged to be partially-relevant will include indirect measures or secondary reports of primary evidence. Non-relevant works are not included in this review of literature. For consistency all references to cubic meters per second have the notation $m^3/s$.

A total of 16 works matching the search criteria were retrieved and assessed out of a total of 30 works initially identified as concerning jet boating, flow levels and the identified Canterbury Rivers. Of the 16 included articles four are statements of evidence in court hearings given by experienced and/or professional jet boat operators; seven are research reports conducted for Crown Research Institutes and/or published in peer-reviewed journals; and five are reports to clients by consultants. A considerable amount of repetition occurs within the larger set of documents and duplicated works were not included where possible. Many of the documents not selected referred to jet boating use but not to any particular flow.

The literature review was completed by Shane Galloway of Galloway Recreation Research Ltd.