Ashburton Water Management Zone Committee

AGENDA

A **MEETING** of the
ASHBURTON WATER MANAGEMENT ZONE COMMITTEE
will be held as follows:

Date:	**Tuesday 28 February 2012**
Time:	**9.00 am**
Venue:	**Council Chambers 5 Baring Square West Ashburton**

MEMBERS:

Ben Curry
Donna Field
Gordon Guthrie
Matthew Hall (C)
Greg Roadley
Sheryl Stivens

Karl Russell	**Te Runanga o Arowhenua**
Terrianna Smith	**Te Taumutu Runanga**
Arapata Reuben	**Te Runanga o Ngai Tuahuriri**
Neil Brown	**Ashburton District Council**
David Caygill	**Environment Canterbury**

AGENDA

Time	No.	Item	Page
9.00 am	**1**	**Welcome / Apologies**	
	2	**Notification of Extraordinary Business**	
	3	**Confirmation of Minutes –22 November 2011**	**1**
	3.1	**Matters Arising from Minutes**	
	4	**Correspondence**	
		○ Lake Clearwater Hutholders Association	**5**
		○ Ashburton Lakes Water Quality	**7**
9.10 am	**5**	**Implementation of the Zone Implementation Programme**	
		○ Christina Robb, Environment Canterbury	
		○ Rob Rouse, Ashburton District Council	
9.40 am	**6**	**Briefing on Land and Water Regional Plan**	
		○ Peter Constantine, Environment Canterbury	
10.10 am	**7**	**Ashburton River Plan**	
		○ Don Vattala, Environment Canterbury	
		(Break in middle for morning tea)	
12.15 pm	**8**	**Water Resources**	
		• **Update on regional infrastructure**	
		○ Dennis Jamieson, Environment Canterbury	
		• **Ashburton supply and demand**	
		○ Ashburton Water Security working group	**11**
		○ Andrew Barton, BECA Infrastructure Ltd	
12.50 pm	**9**	**Regional Committee update**	
		○ Ben Curry	**13**
1.00 pm	**10**	**Close**	

Minutes of the **Ashburton Water Management Zone Committee** meeting held at the Ashburton District Council on Tuesday 24 January, 2012, commencing at 2.20 pm.

Present

Matthew Hall (Chair), Ben Curry, Donna Field, Gordon Guthrie, Greg Roadley, Sheryl Stivens.
Also in attendance: Barbara Nicholas (CW Facilitator), Jo Naylor (ADC - minutes).

Technical Support was provided by: Leo Fietje (ECan), Bob Bower (Golder Associates), Jenny Bond (ECan).

Five members of the public attended.

1 Apologies

Committee: Cr Neil Brown, David Caygill, Arapata Reuben, Karl Russell, Terrianna Smith;
Other: Don Vattala (ECan), Gavin Briggs (Rainer Irrigation).

Curry / Guthrie Carried

2 Extraordinary Business

- Debrief on Field Trip

3 Confirmation of Minutes

Amendment:
Item 6 – Immediate Steps to read:
"The reality is that there will never be eradication of gorse and broom in the Rangitata catchment, but it is anticipated that a much reduced level of infestation can be reached and maintained"

> **That** the minutes of the Ashburton Water Management Zone Committee meeting held on Tuesday 22 November 2011, subject to the amendment listed are confirmed.

Stivens / Field Carried

3.1 Matters Arising

- **TrustPower Proposal**

Ian Lees has phoned Barbara Nicholas asking if the committee has any formal feedback to the proposed Enhancement Scheme Fund as presented at the last meeting. Ian thought perhaps a formal letter of support for the scheme may have been forthcoming from the committee which he has signalled may be used in support of the Water Conservation Order amendment proposal.

The committee discussed the request and while supportive of the concept of a TrustPower funded enhancement fund, consider that there is sufficient uncertainty of the projects and their appropriateness, that they would not be able to provide formal support.

The committee has requested that Barbara Nicholas phone Ian Lees and advise him that while the committee is supportive of the concept, they need more information and involvement before providing any written approval.

- **Hui**

The committee is interested in receiving an update of the proposed "Mixing of Waters" hui that was to be held prior to Christmas.

4 Briefing on Managed Aquifer Recharge (MAR) Trial

Leo Fietje, Environment Canterbury, provided the committee with background information to the proposed MAR trial.

Approximately four years ago a hearing was held for the Ashburton River and Valetta groundwater zones. Both were seeking additional allocations. Contrary to staff recommendations, Commissioners granted 60% of the extra requested allocation, with 40% being declined any water at all. An appeal has been lodged to this decision and staff are keen to explore any other avenues to resolve the issue.

The opportunity has arisen, with the summer closedown of the Highbank station, to use some of this water to learn more about the potential benefits of a Managed Aquifer Recharge trial.

Bob Bower (Golder Associates) presented a power point of three potential projects that could be used to explore MAR:

1. Put water into the Hinds River and watch the aquifer respond;
2. Study recharge patterns around an ADC recharge site ECan have consented;
3. A purpose built recharge site at Valetta;

All projects are aimed at balancing recharge with abstraction and environmental gains.

Mr Bower and Mr Fietje will keep the committee updated as to the progress of the trials.

5 Ashburton flow Plan update

- **Public consultation process**

Don Vattala was absent but has advised that it is planned is to start the consultations in March 2012 and continue until end of April. This will include group consultations as well as individuals. When he returns from leave, he will prepare a detailed plan and present it to the committee on 28 February.

- **Land Use and Water Quality workshop (LUWQ)**

Mr Greg Roadley attended a workshop on 23 January 2012. He advised that ECAN intends to prioritise areas throughout Canterbury in setting nutrient load limits and in doing so using nitrogen limits as the targeted measure. It is likely that the area from the Ashburton to the Rangitata is to be a high priority area.

It is anticipated that regional modelling will come up with place holder, region wide limits by July 2012. Following this catchment specific limits will be determined based on priority.

There will be a focus on developing industry led land use plans.

6 Ashburton River B Block water sharing

Jenny Bond, Environment Canterbury, reacquainted the committee with the water sharing proposal. Five landowners on the Ashburton River and tributaries are requesting the ability to share the B block allocation at times when another (of the five) landowner does not require their consented allocation. This would provide them with reliability of water year round.

It is proposed that a trial be undertaken over two irrigation seasons, (or two years from signing the documentation) and to include Audited Self Management (ASM). Boraman Consultants would oversee and monitor the process.

Land owners would need to gain a new resource consent as a group as the additional take would breach their instantaneous flow takes permitted on their individual existing resource consents.

> **That** the Ashburton Zone Committee supports the water sharing trial of B block water on the Ashburton River.
>
> Curry / Hall Carried

Following the trial, if successful and approved, land owners would need to gain resource consent to continue. Concern was raised as to impacts as currently not all consented water is taken, and this would likely increase the amount taken.

> **That** the Ashburton Zone Committee requests, that at the end of the trial, a feedback report on the impact of the water sharing trial, be provided to the committee, that includes impacts on changes in river flow.
>
> Field / Stivens Carried

7 Future Work Programme

The committee discussed the future work programme, as provided. The work plan has been based on work signalled by members as being important.

A date is to be confirmed for the next field trip to the upper Hinds area.

Braided Rivers work may be delayed due to the excessive work loads of committees involved.

Extraordinary Business

- **Debrief on Field Trip**

The committee agreed that the field trip was interesting and worthwhile. It was beneficial to hear the feedback from locals, of whom a large number turned out, indicating that water is an extremely important issue in the area.

Other committee comments included:

- Disappointment in the value of the dongas – underwhelmed; compared with expectations
- Donga contains unique vegetation and are fairly unique to Canterbury
- Pleased that owners are keen to fence donga and provide positive support
- Sand intrusion in pumps is common issue
- Ability to get water from other schemes could be easier than first thought
- Mayfield Hinds irrigation scheme is closer than thought
- There appears to be a disconnect between ECan's thoughts and land owners with water availability in the lower Hinds area
- Would like to identify environmental value of some drains, may be better to concentrate on some and do well instead of all not so well
- Depth of wells in the area was surprising.

The committee was extremely grateful for the organisation of Sheryl Stivens and Donald Smyth and their participation in making the trip worthwhile. They were especially thankful for the efforts of Denis and Malcolm Stoddard who explained the dilemma and issues they face with consents and in using both surface and ground water on their property for irrigation; Mervyn Gray and his presentation on the history of the development of the Hinds (separate paper circulated); Colin Fleming who had developed irrigation in farming the area; Bryan Strange ex Fish and Game who had electric fished for trout a selection of drains; David Keeley and Hamish Tait who explained the changes and opportunities that exist with the Mayfield Hinds schemes; John Morrow with his knowledge of the Wairuna and in farming at Lowcliffe; Ian Mackenzie and who conveyed his knowledge of the area; and the many other contributors who provided valuable information. Commissioner David Caygill was in attendance until 12pm and apologised for non attendance at the afternoon meeting.

As Jenny Bond is leaving ECan to take up a position with Orion, the Chair thanked Jenny for her work and wished her well for her new venture.

8 Next Meeting

The next meeting of the Ashburton Water Zone Committee will be held on Tuesday 28 February 2012, 9am at the Ashburton District Council.

The meeting closed at 4.25pm.

LAKE CLEARWATER HUTHOLDERS ASSN INC

Mr Matthew Hall
Chairman
Ashburton Zone Committee
Email: kmhall@slingshot.co.nz

14 February 2012

Dear Matthew Hall

Our Association's members have a keen interest in maintaining the water quality of Lake Clearwater, adjacent lakes of Camp, Emma and Heron, and smaller lakes in the vicinity. Clearwater is the centre of our settlement and is highly regarded by hutholders, fishermen and recreationalists as a fine high country lake to enjoy and use. We encourage our hutholders to convert their original hole-in-the-ground toilets to holding tanks (to reduce risk of underground seepage) and hut owners keep a close watch on activities on and near the water to ensure water quality is not compromised.

We have many members, especially fishermen, who are adamant that there is deterioration in the water quality, particularly in the last five years. Increasing slime on stones in the shallows, a blue-green hue to the water, increased weed at the water surface, and loss of clarity (murkiness) are key observations. In contrast, nearby Lake Emma, which had been very dirty-looking in recent years, has inexplicably cleared - without any obvious intervention or environmental change.

We are keen to understand better what is actually happening to the water in these high country lakes. On the one hand, we have ECan's evidence of safe E.coli countsi; on the other we have long-term anecdotal observations from people who have used, stood in and looked at the lakes for many, many hours over several decades. As one member succinctly put it, "we need to understand the science" of what's happening to these lakes. We want to act responsibly in our use of them, and encourage sustainable practices.

Therefore, we have the following questions for the Ashburton Zone committee:
1. Is there scientific evidence of changes in Lake Clearwater and nearby lakes' appearance and water quality?
2. If there is no research available, can the Zone Committee consider these actions:
a. establish baseline measurements for the appearance and quality of the lakes' water;
b. introduce a monitoring programme; and
c. advise stakeholders such as ourselves of factors that contribute to changes in their water quality and appearance?

We are keen to work with yourselves and other stakeholders such as the Department of Conservation, landowners and the Ashburton District Council to ensure that Lake Clearwater and nearby lakes can retain high water quality.

We look forward to your consideration of our concerns.

Adair Bruorton
Secretary, LCHHA

7 November 2011

MEMORANDUM

File Reference: WATE/SWQL/1REC

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

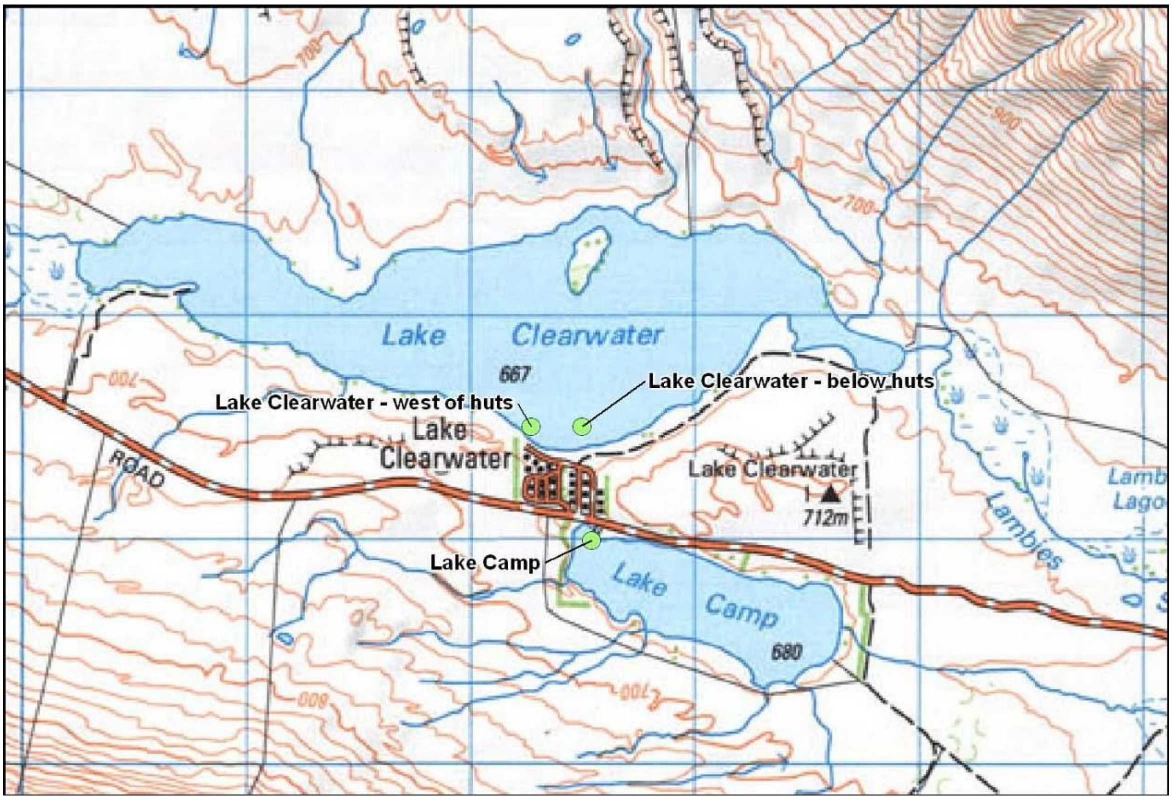
FROM : MICHELE STEVENSON AND KIMBERLEY ROBINSON

TO : ADAIR BRUORTON, LAKE CLEARWATER HUT HOLDERS ASSOCIATION

SUBJECT : ASHBURTON LAKES WATER QUALITY

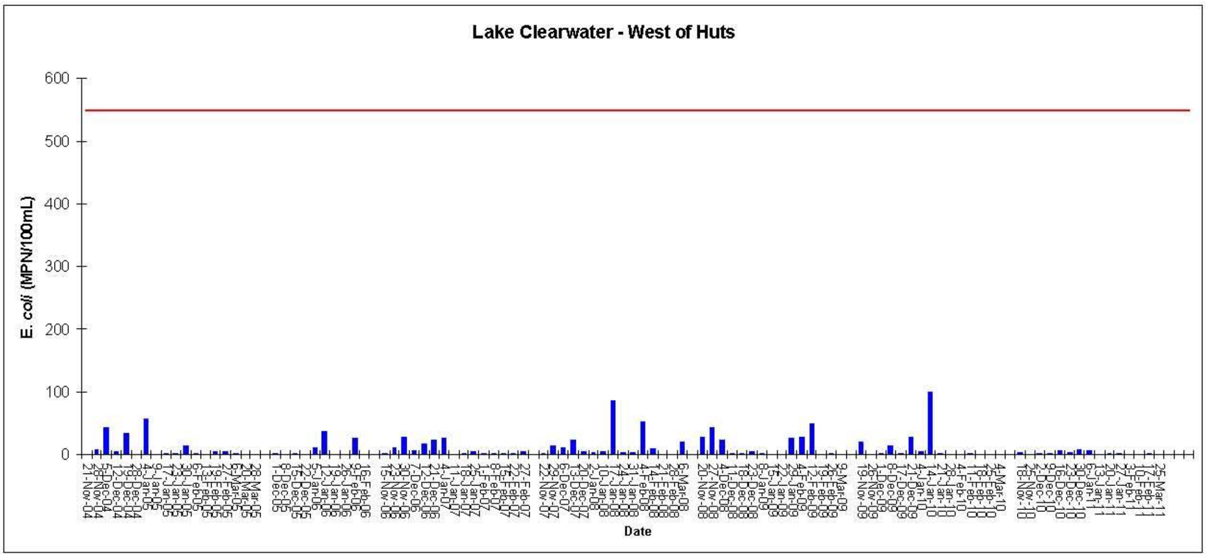
1. Background

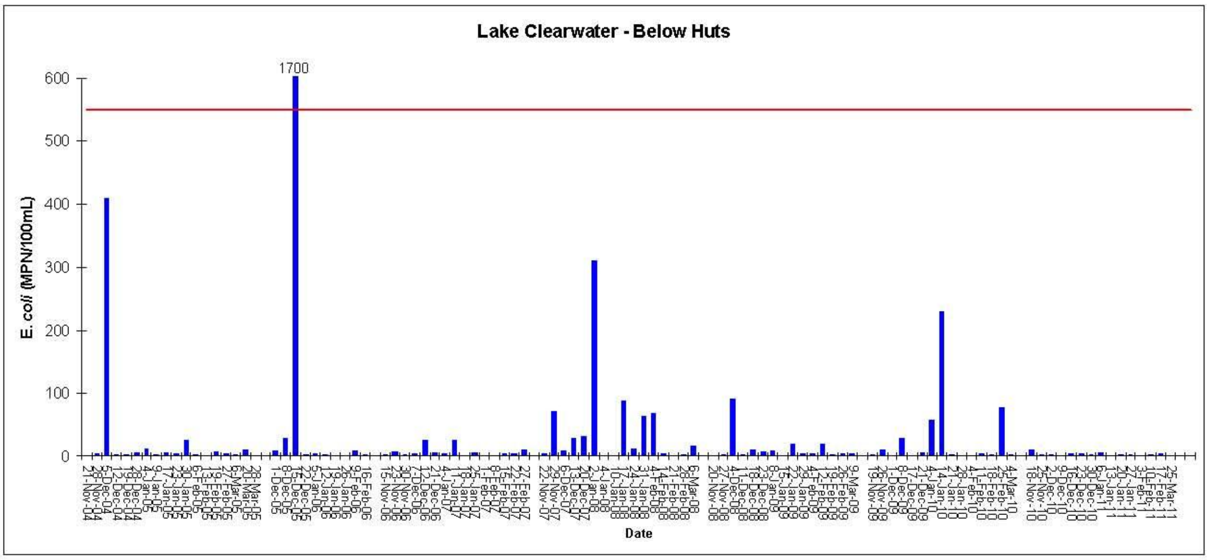
Recreational water quality has been assessed in the Ashburton Lakes area for the last seven summer seasons with the analysis of microbial quality at two sites in Lake Clearwater and one site in Lake Camp (shown on the map below). The first summer of sampling, in 20042005, was initiated at the request of and with help from the Lake Clearwater Hut Holders Association. Since then, all three sites have been monitored on a weekly basis during the summer as part of Environment Canterbury's regional recreational water quality monitoring programme. The results of the sampling provide an indication of the suitability of the lake water for contact recreation.

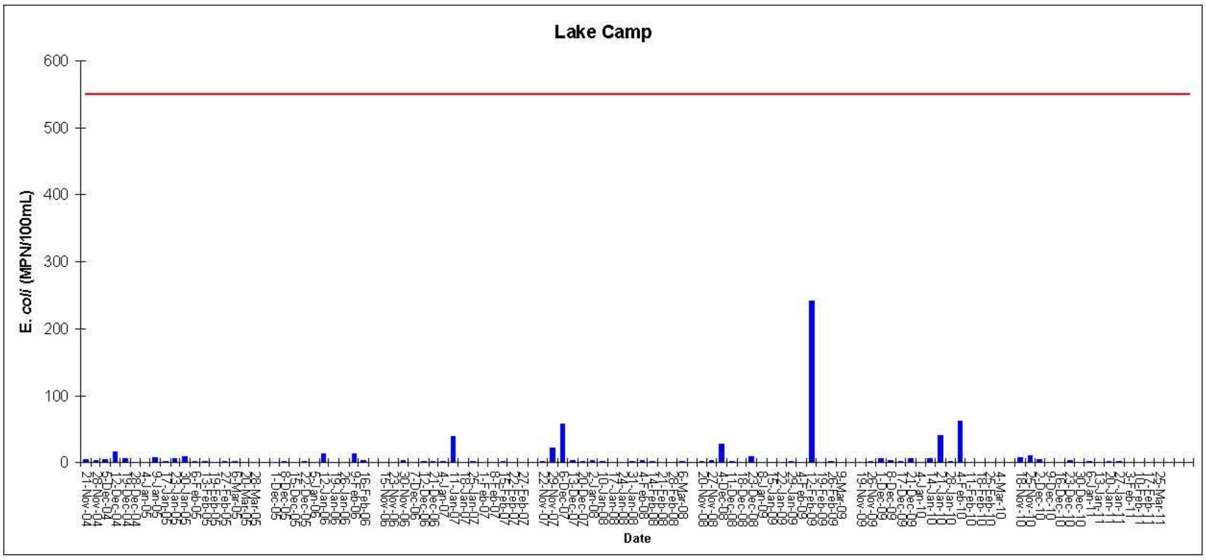


2. Results

The concentration of the microbial indicator E. coli in samples taken over the last seven summer seasons from the three sampling sites are shown in the graphs below. The red line represents the single sample Action guideline value of 550 E. coli/100 mL.







Results from the last seven seasons show that all samples taken from the Lake Clearwater site west of the huts and the Lake Camp site have had very low E. coli concentrations. Most results from these two sites have been less than 100 E. coli/100 mL and all results have been less than the single sample Alert guideline value of 260 E. coli/100 mL.

There have been three occasions where samples from the Lake Clearwater site below the huts have shown high concentrations, including a sample in December 2005 where the concentration of 1700 E. coli/100 mL exceeded the single sample Action guideline value. The reason for this high result is uncertain but may be linked to rainfall runoff. The subsequent sample had a very low E. coli concentration indicating a quick return to acceptable microbial concentrations. All samples taken from this site in the past three summers have had concentrations less than the single sample Alert guideline value.

3. Suitability for recreation

The 2003 Microbiological water quality guidelines for marine and freshwater recreational areas, developed by the Ministry for the Environment and Ministry of Health[1], use a combination of a qualitative risk grading of the catchment (the Sanitary Inspection Category - SIC) and the direct measurement of appropriate faecal indicators (the Microbiological Assessment Category MAC) to assess the suitability of a site for contact recreation. These two components combine to give a site an overall Suitability for Recreation Grade (SFRG). Sites with grades of Fair, Good and Very Good are considered suitable for contact recreation.

In the 201011 season Sanitary Inspection Categories for all three sites were reassessed. It was proposed that Lake Clearwater west of huts and Lake Camp sites be revised from a moderate SIC to very low, while Lake Clearwater below huts was revised from moderate to low. These revised SICs change the SFRG for all three sites to Very Good.

Suitability for recreation grades for the Lake Clearwater and Lake Camp sites are given in the table below.

Site	SIC	MAC at end of 201011	Provisional SFRG at end of 201011
Lake Clearwater – below huts	Low	A	Very Good
Lake Clearwater – west of huts	Very Low	A	Very Good
Lake Camp	Very Low	A	Very Good

The site on Lake Clearwater below the huts was initially included in the sampling programme to assess whether septic tank discharges from the huts may impact on microbiological water quality of the lake. Microbial data with consistently low E. coli concentrations over the last few years suggests that there are no detrimental effects to the recreational water quality of the lake. As mentioned above there were occasions in the first few years of sampling where concentrations exceeded guideline values at this site but the area to the west of the huts that has higher usage for contact recreation has shown no effect. With the close proximity to the Lake Clearwater – west of huts site and the difficult nature of access to the site through the wetland, it has been suggested after consultation with Community and Public Health and Ashburton District Council that the 'below huts' site no longer need be sampled. Sampling will continue at the 'west of huts' site on Lake Clearwater to indicate recreational water quality in Lake Clearwater.

[1] http://www.mfe.govt.nz/publications/water/microbiologicalqualityjun03/

4. Lake trophic state

Additional to the recreational water quality sampling, a high country lakes water quality programme is carried out by Environment Canterbury in which both lakes Clearwater and Camp are included. The lakes are sampled monthly over five months from late spring to early autumn. Sampling is carried out in the centre of the lakes by sampling from a helicopter. The lakes are analysed for chlorophyll a concentrations, total nitrogen and total phosphorus concentrations, and turbidity. Results from the high country lakes programme are used to calculate trophic state of the lakes.

Trophic levels are critical indicators of water quality in lakes and are a measure of the nutrient status of a body of water (Burns et al. 2000[2]). The trophic level index (TLI) is calculated based on measurements of key variables, including chlorophyll a, nitrogen and phosphorus concentrations. Nutrient (nitrogen and phosphorus) sources around lakes Clearwater and Camp include agricultural land use, which has intensified recently in some parts of the Clearwater catchment, and human and other animal waste.

The trophic state of lakes Camp and Clearwater are included in the table below. These trophic states are calculated from average annual summer chlorophyll a, total nitrogen and total phosphorus concentrations. Lake Camp has been fluctuating between an oligotrophic and mesotrophic state since 2004, while Lake Clearwater has been fluctuating between mesotrophic and eutrophic since 2004. The shift towards a eutrophic state in Lake Clearwater can indicate increased productivity in the lake and an increase in nutrients and phytoplankton can lead to a decrease in clarity.

Site	SIC	MAC at end of 201011	Provisional SFRG at end of 201011
Lake Clearwater – below huts	Low	A	Very Good
Lake Clearwater – west of huts	Very Low	A	Very Good
Lake Camp	Very Low	A	Very Good

Location	200406	2007	2008	2009	2010	2011
Lake Camp	2.7	3.2	3.1	3.4	2.9	3.2
Lake Clearwater	3.2	3.6	4.2	3.8	4.3	4.1

Key:

TLI value	Trophic state	General Description
<1	Ultra-microtrophic	practically pure, very clean, often have glacial sources
12	Microtrophic	very clean, often have glacial sources, very low nutrient enrichment
23	Oligotrophic	clear and blue, with low levels of nutrients and algae

[2] http://www.mfe.govt.nz/publications/water/monitoringtrophicstatusofnzlakes01.html

Ashburton Water Zone Committee Report

Date	28 February 2012
Report to	Ashburton Water Zone Committee
From	Zone Facilitator
Subject	Water Security Working Group on Ashburton Zone Supply and Demand

8 Water Resources

Purpose

To consider the report on the Ashburton Zone Water Supply and Demand, prepared for Environment Canterbury by Andrew Barton, BECA Infrastructure Ltd.

Attachments

Ashburton Irrigation Water Supply and Demand by Andrew Barton, BECA Infrastructure Ltd (Appendix 1).

Background

The Ashburton Zone Committee's Zone Implementation Programme recognised that the priority outcomes for water quantity in the zone are:

- Water users, urban and rural, have affordable, reliable and secure access to water that is used efficiently
- There is sufficient security of water supply to protect biodiversity
- Irrigated land area in our zone is increased to meet CWMS targets
- The Ashburton Zone is a vibrant and resilient community that attracts investors and innovative businesses
- We have encouraged local participation in and ownership of water infrastructure

The recommendations recognise that there is a need to

- increase flows in the Ashburton river
- increase efficiency of use
- manage ground water levels
- increase reliability of supply and irrigated area
- optimise water supply and use

In June 2011 the Water Resources working group requested a technical briefing report to inform their understanding of the current and future demands for water in the zone, including what could be achieved by re-distribution of water currently available, improvements in efficiency and by added storage (either in and/or out of zone).

A final brief was contracted for with BECA in August 2011 (detailed p.2 of the report), and an initial draft report discussed with the working group in late October 2011. Following further work and discussion with the working group, the report is now being tabled for consideration by the full committee.

Discussion

The final report identifies the water currently allocated in the zone, and

- considers how it could be redistributed to align with the CWMS, and
- identifies the shortfall that remains following any re-distribution.

It is important to note that this is a high level report, based on desktop review, and that the re-distribution proposed is only one of many options, and takes no account of the economic or political realities of achieving change on the ground. However, it does serve to identify the scale of additional water that would be required (assuming a minimum flow on the Ashburton river of 8^3/s) by increased flows and through storage to provide

- reliable irrigation water (with 95% reliability for surface water and 100% reliability for ground water) for 270 726 ha
- stockwater
- municipal, commercial and industrial demand.

The general conclusions are that the short-fall to meet demand is water sufficient to irrigate 27 000hha, and would require 136 M m3 of storage. A different model or approach to re-distribution may come up with a slightly different figure, but is likely to be of that scale.

The water could come from out of catchment, or be water stored for use as required.

It is important to note some the assumptions of this report. They are detailed in Appendix A and include a range of assumptions around:

- Ashburton river takes and flows
- Hinds Drains
- Water use – for municipal and industrial use, and stockwater
- schemes
- groundwater
- reliability

Challenges ahead

A desk top study is one thing. Implementing change on the ground to optimise distribution is another. Water is currently provided through several irrigation schemes, with both separate and some interlinked governance and business arrangements. There has been considerable individual and collective investment in infrastructure on and off farm that may make some changes difficult to justify on business grounds alone.

The context is always shifting as schemes invest to increase their distribution efficiencies, schemes and farmers put storage in place, and water gained through efficiencies of distribution and on-farm use is made available to others by trading of shares in schemes or transfers of consents.

In addition, the Ashburton zone, and the RDR that is a significant legacy in the district, is likely to be a critical component of a regional infrastructure solution that enables CWMS targets to be delivered from the Waimakariri to the Orari-Opihi-Pareora zones.

The committee may wish to consider whether, in addition to continuing to provide advice to the regional committee on infrastructure demand and development, there are zone initiatives to assist further optimisation of water in the zone.

Recommendations

That the Zone Committee

- Receives the report *Ashburton Irrigation Water Supply and Demand;*
- Notes that this offers one model for how water could be re-distributed within the zone, and in doing so identifies the scale of additional water that needs to be provided by flows or through storage;
- Refers the report to the Regional Infrastructure working group of the Regional Committee;
- Considers if there are any other initiatives from the committee to assist with on-going optimisation of the use of water in the zone.

Ashburton Water Zone Committee Report

Date	28 February 2012
Report to	Ashburton Water Zone Committee
From	Ben Curry
Subject	Regional Committee Update

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8 Regional Committee Update

Dear Committee members

The RC had its first meeting of the year (the 14th in total) on 7th Feb in Lincoln.

The bulk of the meeting concerned the draft Regional Implementation Plan (RIP). the four chapters of the dRIP are:

- Land Use and Water Quality
- Ecosystem Health and Biodiversity
- Kaitiakitanga
- Regional Infrastructure

Each draft chapter was discussed individually. The following are the key issues raised:

Land Use and Water Quality: Much discussion around what the regional "default" position is/should be. The NRRP table 5 was proposed by ECan as it has legal status, being the operative plan. If so then perhaps the dRIP should refer to it. My reading was that ECan would prefer to leave this a little vague at this stage so that have flexibility when thinking around load limits matures.

Ecosystem health and Kaitiakitanga: Generally the draft chapters were accepted with relatively minor comments.

Regional Infrastructure: Again, much discussion on this chapter. Concern over some unsubstantiated value judgments made which potentially closed out options (eg Tekapo water and Lees Valley). Whole chapter is to be reorganised and parts re-written. There is a lot of movement in the infrastructure space at present from central government downwards and I'm not convinced it is fully joined up. The sub-committee dealing with Infrastructure has a role to play clearly, but the issue is being run from ECan and there seem to be a number of "consultants" who are providing advice, I'm just not sure that the advice is unbiased.

Timing: This is the crunch area. The dRIP has to be out in less than 2 weeks as it needs to inform the Land and Water Regional Plan which is to be publicly notified by July. There are plans to hold meetings with Zonal Committees and public as follows

21 Feb Ashburton
29 Feb Timaru
2 Mar Culverden
5 Mar Christchurch

There were serious doubts raised over this very tight timeline. The two commissioners present (David Caygill and Peter Skelton) said that they would look at their timelines to see if extra time could be given to the dRIP process. I have yet to hear whether these dates will be amended.

Regards
Ben

Report

Ashburton Irrigation Water Supply and Demand

Prepared for Environment Canterbury (Client)

By Beca Infrastructure Ltd (Beca)

17 February 2012

Revision History

Revision Nº	Prepared By	Description	Date
A	Andrew Barton	Draft for Client Review	5/12/2011
B	Andrew Barton	Final	17/2/2012

Document Acceptance

Action	Name	Signed	Date
Prepared by	Andrew Barton		17/2/2012
Reviewed by	Graham Levy		17/2/2012
Approved by	Graham Levy		17/2/2012
on behalf of	Beca Infrastructure Ltd		

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Appendices

1 Introduction

1.1 Background

The Canterbury Water Management Strategy (CWMS) sets out a vision for managing the water resources of Canterbury and specified principles and targets that are to be met in order to achieve the vision. The Ashburton Zone Management Committee (AZMC) has been established to implement the CWMS in the Ashburton District. The AZMC has prepared a draft Zone Implementation Plan (ZIP) and feedback is being sought from the stakeholders on the ZIP.

1.2 Purpose of this Document

The AZMC sought a high level summary of supply and demand of water within the Ashburton Zone. The AZMC requested that Beca Infrastructure Limited (Beca) write a report regarding the supply of water and the demand for irrigation within the Ashburton Zone. The AZMC also asked Beca to consider potential redistribution of water and identify the consequent storage requirement.

Specifically, Beca's brief was to:

1. Obtain the monthly demand for irrigation, stockwater and drinking water (obtain from Strategic Water Study Stage 1) for full development scenario of the Ashburton District and attend a meeting with Environment Canterbury staff to confirm methodology;
2. Assess run-of-river surface water availability from Rakaia and Rangitata Rivers using consented minimum flows, which will require preparation of a consent list and undertaking a flow analysis;
3. Assess run-of-river surface water availability from Ashburton assuming minimum flows of 6/8/10 m^3/s at SH1, and assuming stockwater is piped (i.e. only sufficient taken to meet demand), which will require preparation of a consent list and undertaking a flow analysis;
4. Assess availability of groundwater, by using existing allocation estimates (obtained ECan on-line GIS), including surface water consents from lowland streams;
5. Estimate how much water could be stored from existing run-of-river takes (Rakaia, Ashburton, Rangitata), using the assumptions from Stage 1 of Strategic Water Study;
6. Match supply and demand, optimised on a spatial basis, with preference to groundwater use east of SH1;
7. Outline an implementation strategy for the preferred allocation regime for the Ashburton Zone.

1.3 Limitations

In order to be able to undertake the high level analysis within the available timeframe and budget, Beca has made a number of simplifying assumptions throughout the report. A list of key assumptions is included as **Appendix A**.

This document has been prepared by Beca Infrastructure Ltd (Beca) for Environment Canterbury. Beca has relied upon the information provided by Environment Canterbury in completing this document. Unless otherwise stated, Beca has not sought to independently verify the information provided. This report is, therefore, based upon the accuracy and completeness of the information provided at the time of the review, and Beca cannot be held responsible for any misrepresentations, incompleteness, or inaccuracies inherent within that information. Should any other information become available, this report will need to be reviewed accordingly.

The intent of this document is to identify the water allocated within the Ashburton District, and consider how this water could be potentially be redistributed to align with the CWMS, as well as to identify the shortfall following the redistribution of water. The redistribution of water that is promoted in this report is based upon a desktop review of the existing allocation and consideration of bulk supply and demand for the Ashburton District.

There are many potential combinations for redistributing water within the Ashburton District. The option promoted in this report is but one of those, and has been selected as a starting point to promote discussion at the AZMC. The reconfiguration options outlined in this report were discussed in meetings with Ashburton Zone Water Supply sub-committee prior to finalising this report.

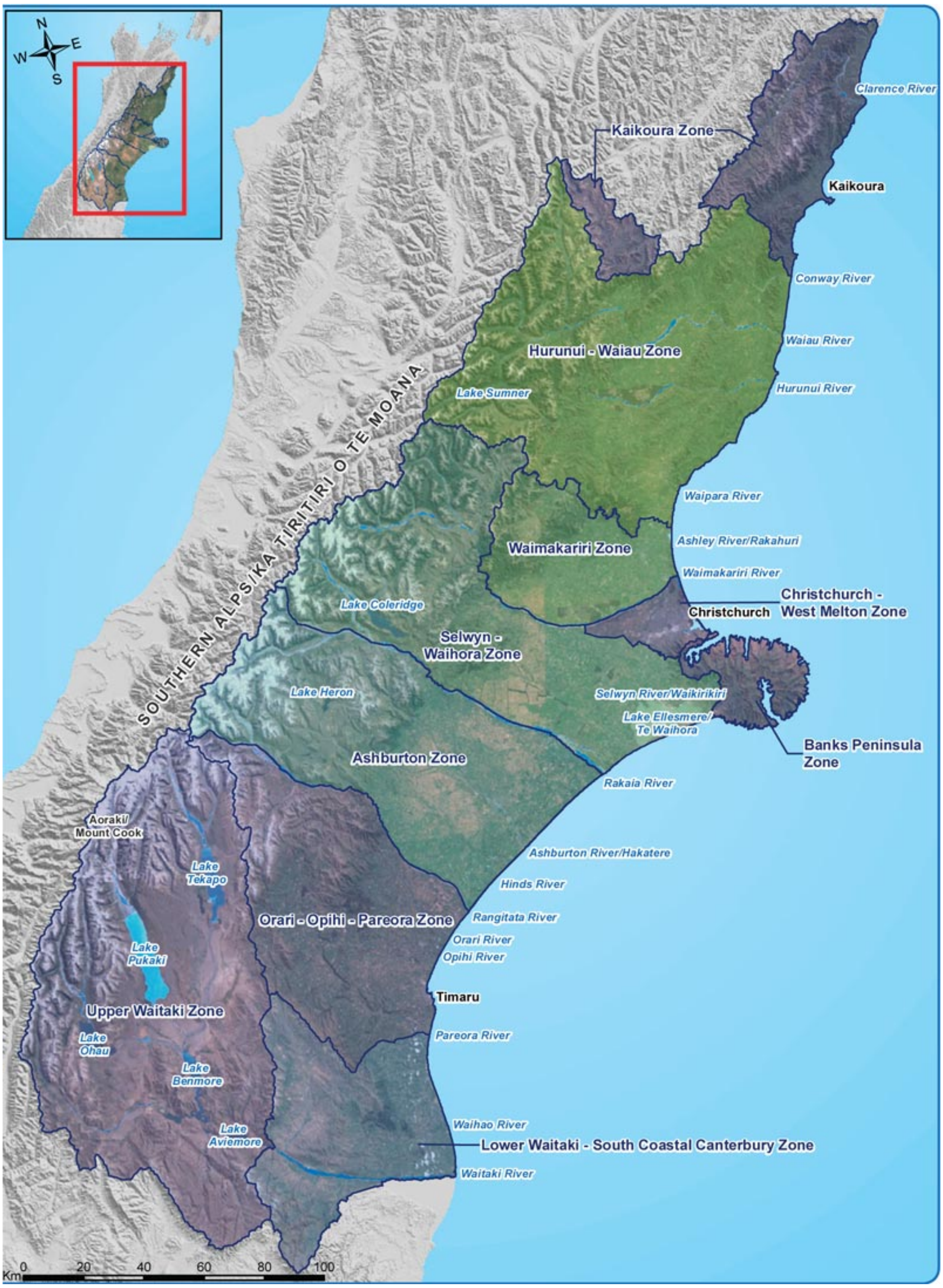
This report does not consider the infrastructure that would be required to redistribute or store the water. This report also excludes any demand modelling. Instead simplifying assumptions have been made regarding irrigation demand.

2 Water Supply

2.1 Water Supply

The Ashburton Zone is bounded by, the Rangitata and Rakaia Rivers, as shown in Figure 1.

Figure 1 – Water Allocation Zones



The key water supply sources in the Ashburton Zone that have been considered in this report are:

- Rakaia River
- Rangitata River
- Ashburton River
- Hinds Drains
- Groundwater

These water resources have only been considered with respect to the existing water permits that are authorised for use within the Ashburton Zone. Water permits for use in neighbouring zones have been discounted. For the purpose of this report, both surface water and groundwater will be considered in the context of the groundwater allocation zone boundaries.

2.2 Surface Water

2.2.1 Surface Water Supply

Figure 2 shows the main surface water resources available to the Ashburton District.

Figure 2 – Ashburton Surface Water Resources

The peak rate allocated to existing water permits to take surface water[1] for use in the Ashburton District[2] is outlined in **Table 2.1**. Individual surface water consent allocations are included as **Appendix B**.

[1] Excludes hydraulically connected groundwater, but includes both stockwater and irrigation.

Table 2.1 - Ashburton Zone Surface Water Allocation

Source	Peak Rate Allocated to Ashburton Zone (m^3/s)[3]
Rakaia River	34.890[4]
Rangitata River	31.628
Ashburton River	17.934
Hinds Drains	3.771
Total	**88.223**

Ashburton Community Water Trust (ACWT) holds a resource consent to divert water up to 40 m^3/s from the Rakaia River, jointly with Central Plains Water Limited (CPW), who are authorised to take water to the north of the Rakaia River. ACWT and CPW have an agreement that provides ACWT with 44% of the water available, with CPW taking the remaining 56%. ACWT do not currently take and use water for irrigation purposes. ACWT have signalled that they wish to use their allocation for irrigation in the future. Therefore, this report assumes that ACWT take 44% of the available water, which is estimated to be 15.8 m^3/s.

Barrhill Chertsey Irrigation Ltd (BCI) hold another large resource consent to take from the Rakaia River, which is being used. Currently 3 m^3/s of the BCI allocation is able to be taken through an intake at Acton (downstream of SH1). The balance of the water is able to be pumped from the river at Highbank into the RDR and is used to supplement the Ashburton Lyndhurst Irrigation Scheme in exchange for BCI taking an equivalent rate of Ashburton Lyndhurst's allocation from the RDR at various locations across the Ashburton District.

2.2.2 Surface Water Allocation

a. Rakaia River

The Rakaia River is considered to be fully allocated. TrustPower's proposal to use Lake Coleridge to store and release water for irrigation includes the potential for a supply of stored water to the Ashburton District. The current consent held by the Ashburton District Council from the Rakaia River for the Acton stockwater race is Band 1 Rakaia Water. This existing allocation may provide reliable irrigation water in the event that the stockwater race is piped or replaced by a network of groundwater wells, and the currently authorised use of water is changed to allow irrigation.

b. Rangitata River

The Rangitata River, via the RDR supplies the bulk of the surface water to mid Canterbury. The RDR takes up to 30.7 m^3/s from the Rangitata to supply the Mayfield Hinds, Valetta and Ashburton Lyndhurst irrigation schemes, which are all open race schemes. The RDR has an estimated

[2] The Rangitata and Rakaia Rivers have water permits granted on the south and north bank respectively, which are not included within the allocation rate column in Table 2.1.

[3] Obtained from ECan's online GIS database, and the Draft Ashburton ZIP

[4] Assumes that ACWT's share of the Rakaia River water permit held jointly with CPW is 15.8 m3/s.

leakage rate of 5%[5] for the main canal, which could equate to as much as 1.77 m^3/s. The RDR has a continuous programme of lining the canal, which is providing additional water.

Individual irrigation schemes have higher leakage rates, estimated to be in the order of 15-20%. Assuming a loss of 20% from the individual schemes, this loss could be the equivalent of 6.8 m^3/s. These irrigation schemes are either installing or investigating piped delivery, which will eliminate the scheme losses, which will provide sufficient to irrigate an additional 13,000 ha.

The RDR and irrigation schemes are progressively lining their open races, and the irrigation schemes are considering replacing open race networks with pipe, which will reduce losses and allow further land to be irrigated. This report assumes that the RDR irrigation schemes are supplied with water at their existing agreed allocations, and that all of these schemes are piped. Any potential savings from RDRs current programme of race lining has not been considered, which may allow further irrigation.

There is further water that may be available to allocate from the Rangitata River, albeit it at a low level of the reliability of supply. As with the Rakaia River, ADC holds a stockwater race consent from the Rangitata River (Cracroft) that may provide additional reliable irrigation water if the stockwater race is piped or replaced by a network of groundwater wells.

c. Ashburton River

The Ashburton River is considered to be over-allocated. The Ashburton ZIP recommends that the Ashburton allocation be reduced significantly, from the existing allocation of approximately 18 m^3/s to 11.8 m^3/s. The total peak stockwater allocation from the Ashburton River (also listed in **Appendix B**) is over 7 m^3/s, which includes approximately 500 L/s[6] supplied by the RDR. A reduction in stockwater abstractions by piping open races or replacing surface takes with groundwater are the most likely means of reducing pressure on the Ashburton River.

Potentially a proportion of any water saved could be used for further irrigation. However, the proposed 11.8 m^3/s A allocation block will limit any potential use of saved stockwater. For the purpose of this report, the rate of allocated water that has been considered to be available for irrigation use from the Ashburton River is 11.8 m^3/s.

RDR has a consent to take up to 7.1 m^3/s from the South Ashburton River, with a combined rate of 35.4 m^3/s from both rivers. The Rangitata is considerably more reliable than the Ashburton. Therefore, it is assumed that the full take from the Rangitata is utilised, with 4.7 m^3/s coming from the Ashburton River.

d. Hinds Drains

The Hinds Drains network supplies a number of farmers in the coastal area of the Ashburton District, south of the Ashburton River. Further development of the Hinds Drains water resource is considered unlikely because of the potential risk that flows in these drains may drop as up-gradient irrigation schemes become more efficient, resulting in less recharge to the aquifer that supplies these drains.

[5] Figure supplied by Ben Curry, RDR.

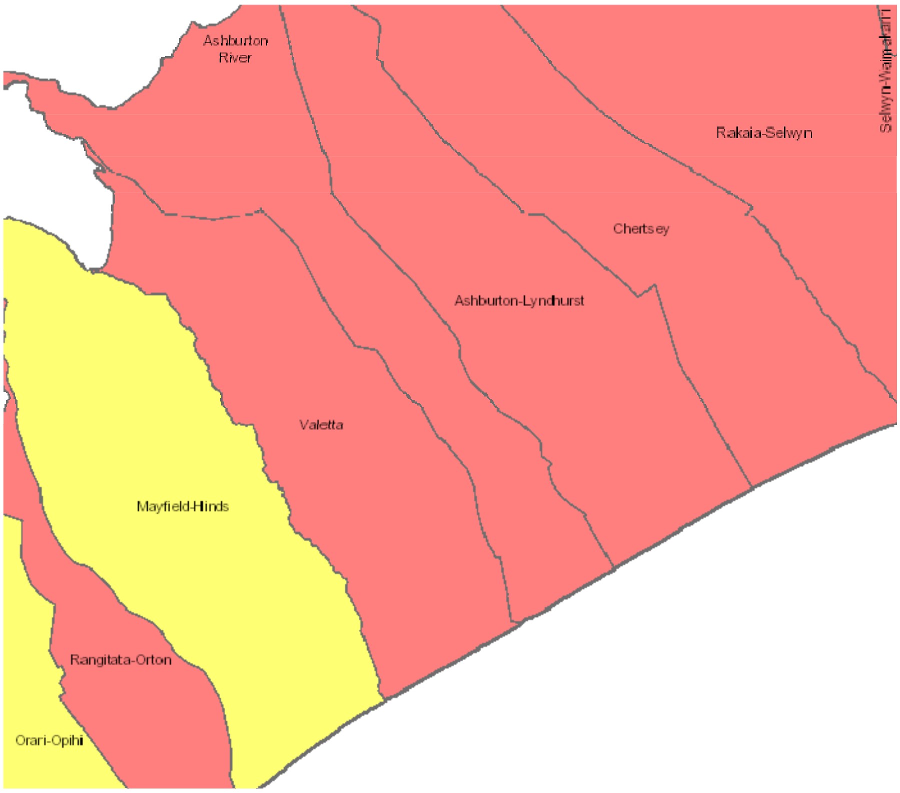
[6] Figure supplied by Ben Curry, RDR

2.3 Groundwater

2.3.1 Groundwater Supply

Figure 3 includes the Groundwater Allocation Zones of the Ashburton District, which range from the Mayfield-Hinds zone in the southwest to the Chertsey zone in the northeast. Groundwater is available at varying depths and yields across the Ashburton District.

Figure 3 – Groundwater Allocation Zones



2.3.2 Groundwater Allocation

The annual volume allocated to existing water permits to take groundwater, as well as the allocation limits specified in Schedule WQN4 of the Natural Resources Regional Plan (NRRP) are identified in **Table 2.3**.

Thorley et al. (2008) consider the development of further groundwater and management of the groundwater resource in the Chertsey and Ashburton Lyndhurst zones, and concluded that further development should be to the east of SH1, with every effort to use surface water to the west of SH1. These two zones do not have any coastal streams, which are supplied by aquifer discharge.

Recent resource consent decisions have granted water permits in excess of the allocation limits in these fully allocated zones. It is possible that further groundwater consents may be granted in the Ashburton Lyndhurst and Chertsey zones, where groundwater is not contributing to lowland stream flows. In the Valetta and Ashburton River zones, some of the recent applications were declined, indicating that further groundwater consents are less likely to be granted in these zones.

Table 2.3 - Ashburton Zone Groundwater Allocation

Zone	Allocation Limit (million m^3/year)	Current Allocation (million m^3/year)
Chertsey	112.4	120.4
Ashburton Lyndhurst	126.6	133.5
Ashburton River	69.5	74.3
Valetta	96.6	122.8
Mayfield Hinds	148	119.1
Total	**553**	**570**

In the long-term, the use of groundwater is likely to be more concentrated in the vicinity of State Highway 1, and the area to the east. This is a function of the deeper groundwater further west of SH1, and the associated increased energy costs from pumping. However, those irrigators who have sunk investments in groundwater wells west of SH1 are considered unlikely to abandon those wells. Instead, those wells have the potential to form a valuable source of water storage during times of low surface water supply that they may experience if they are supplied by BCI or ACWT. This report assumes that wells can be used to supplement run-of-river irrigation schemes.

Table 2.4 estimates the existing groundwater allocation and allocation limits for the areas east and west of SH1 respectively. The existing groundwater allocation volume has been estimated by selecting all groundwater permits in each zone, and dividing them into separate groups either side of SH1[7]. The proportion of water permits east and west of SH1 was applied to the allocation limit recorded on ECan's website. No effort has been made to reconcile the ECan allocation figures provided on the website. The allocation limits for each zone have been split into areas east and west of SH1 by apportioning the volume based on land area east and west of SH1.

For the purpose of considering groundwater availability, the existing allocation has been adopted for all zones except for the Mayfield Hinds zone. The Mayfield Hinds zone is not yet fully allocated, so it has been assumed that the full allocation will be granted with time.

[7] Accessed from ECans Online GIS 1 September 2011.

Table 2.4 - Ashburton Zone Groundwater Allocation Breakdown Estimates

Zone	Allocation Limit (million m^3/year)	Current Allocation(million m^3/year)
Chertsey – East	39.7	42.5
Chertsey – West	72.7	77.9
Ashburton Lyndhurst – East	51.6	54.5
Ashburton Lyndhurst – West	75	79.1
Ashburton River – East	16.2	17.4
Ashburton River – West	53.3	57
Valetta – East	34.5	43.8
Valetta – West	62.1	79
Mayfield Hinds – East	45.3	36.5
Mayfield Hinds – West	102.7	82.7
Total	**553**	**570**

2.4 Water Storage

Currently, the water storage in the Ashburton District is limited to on-farm storage ponds. These are currently limited to individual use. The collective total volume of water stored in these on-farm storage ponds is not insignificant. The Mayfield Hinds Irrigation scheme has approximately 6.6 million m^3 of storage, which is approximately 200 m^3/ha on average across the scheme area[8]. It is expected that the Valetta scheme would have a similar volume of storage per hectare, which would result in a scheme storage of 1.5 million m^3 of whereas the Ashburton Lyndhurst scheme will have less because of the higher percentage of border dyke irrigators and a moratorium that is in place on any further ponds.

If Ashburton Lyndhurst also stored 200 m^3/ha across their scheme, there would be 5 million m^3 of stored water, a total of 13 million m^3 altogether. In addition, Mayfield Hinds is also about to construct a 6 million m^3 scheme storage, with other schemes likely to include some storage in their redevelopments. The Acton scheme also makes use of on-farm storage to improve reliability. Potentially, up to 20 million m^3 of collective storage within the irrigation schemes could be available in the foreseeable future.

Water storage infrastructure has been considered for some time for the Ashburton District. The currently mooted storage options are TrustPower's Lake Coleridge redevelopment, and storage at Klondyke using water supplied by the RDR. There have also been investigations into a dam on the Stour River, but this option does not appear to be favoured at present.

[8] Hamish Tait, General Manager Mayfield Hinds Irrigation Limited pers. comm..

3 Water Demand

3.1 Irrigation Demand

Lincoln Environmental (2002) estimate that there is 270,000 ha of irrigable land in the Ashburton District. The 270,000 ha area has been pro-rated among the groundwater zones, which total 310,000 ha[9]. The estimated irrigable areas in each zone could be refined, but are considered to be sufficient for the purpose of this report. The area apportioned to areas east and west of SH1 in each zone is shown in **Table 3.1**.

Table 3.1 - Ashburton Zone Assumed Irrigable Areas

Area	Irrigable Area[10]
Chertsey East	21,309 ha
Chertsey West	39,027 ha
Ashburton-Lyndhurst East	22,468 ha
Ashburton-Lyndhurst West	32,617 ha
Ashburton River East	10,447 ha
Ashburton River West	34,295 ha
Valetta East	17,491 ha
Valetta West	31,542 ha
Mayfield-Hinds East	18,838 ha
Mayfield-Hinds West	42,696 ha
Total	**270,729**

The demand assumptions outlined in the ensuing sections are considered appropriate for use in this high level review. They are approximate numbers that could be refined further with more detailed modelling.

3.1.1 Groundwater Demand

Irrigation demand figures from groundwater are detailed in **Table 3.2**. These figures represent assumed average demands using efficient irrigation practices and typical soil types. Demand during droughts is considered likely to be greater than the below figures, while in higher rainfall irrigation seasons demand will be lower.

Annual demand has been used to reflect the fact that groundwater is used and managed as a storage reservoir that is drawn down over the irrigation season and replenished over winter months. The figures below considered to be are equally applicable to any surface water storage reservoir that may service the Ashburton District. If these demand figures are reduced, (e.g. 450 mm - 550 mm/year) a greater area can be serviced by groundwater.

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9 ECan Online GIS, accessed

10 Irrigable is defined as the area of land able to be irrigated, whether or not it is presently irrigated.

Table 3.2 - Ashburton Zone Seasonal Irrigation Demand

Area	Moderate Use	Higher Use
East	550 mm/ha/year (5,500 m^3/ha/year)	600 mm/ha/year (6,000 m^3/ha/year)
West	500 mm/ha/year (5,000 m^3/ha/year)	550 mm/ha/year (5,500 m^3/ha/year)

3.1.2 Surface Water

Surface water is obtained from waterways that are flowing, i.e. run-of-river takes. The water is either available to be taken or not. Therefore, surface water resources have been considered using an instantaneous demand. The assumed demand across the Ashburton District is 4.5 mm/day (0.52 L/s/ha), which is considered to be a suitable average application depth for an efficient irrigation system. Design application rates tend to range from 4-5 mm/day. A demand of 4.5 mm/day has been chosen as a reasonable average figure for the purpose of this report.

The assumed requirement of 4.5 mm/day (0.52 L/s/ha) continuously over a nominal 212 day irrigation season, amounts to 9,540 mm/year. Comparing this figure with the assumed demand of up to 6,000 mm/year (133 days of irrigation at 4.5 mm/day) for groundwater, the surface water requirement is considered to be conservatively high. A significant percentage of the surface water that is allocated could be diverted into storage during periods where irrigation is not required.

These figures illustrate the limitation of not using the results of a soil water balance model for this report. However, for the higher level nature of this study, it is considered that some consented run-of-river water will be available for storage during periods when irrigation is not required. In the case of the RDR, storing water is likely to reduce flow of water available for hydropower generation.

3.2 Stockwater Demand

Stockwater demand for the Ashburton Zone is considered to be 1 m^3/s (Lincoln Ventures, 2002). This figure represents the total net use of stockwater. If open stockwater races continue to be used, the rate allocated to stockwater will be appreciably higher than 1 m^3/s, to address losses to ground from open races. Over a full year of taking stockwater at 1 m^3/s the stockwater demand equates to 31.5 million m^3.

Lincoln Ventures (2002) considered that over 50% of the Ashburton District could be converted to dairy farming. In most cases, dairy farmers use groundwater to supply stock in order to control water quality. If 50% of the stockwater take was coming from groundwater that would equate to approximately 16 million m^3 per annum. The volume of stockwater required from groundwater relative to irrigation allocations is relatively small. Further, a significant volume of groundwater is already abstracted for stockwater and not included in any allocations. Therefore, an allowance for stockwater demand from groundwater has not been included in this report. Instead, all allocated groundwater is considered available for irrigation use.

The balance of the stockwater requirement of 16 million m^3 per annum (500 L/s) of stockwater is likely to continue to be supplied by surface water resources. This report assumes that stockwater is supplied by a piped network, potentially in combination with irrigation scheme development. This surface water could potentially come from the Ashburton, Rakaia or Rangitata Rivers. It has been assumed that the stockwater will be supplied by a mixture of these sources, in order to reduce the infrastructure requirements.

3.3 Municipal, Commercial and Industrial Demand

The Ashburton District is a rurally dominated district, but water is used for purposes other than irrigation and stockwater. Therefore, these water uses have been set aside for this report, with all the groundwater allocated assumed to be used for irrigation. These water uses will need to be considered further if this work is to be refined. The volume required to meet demand for these uses is considered to be small compared to irrigation use.

4 Reliability of Supply

4.1 Reliability

Reliability has a number of different definitions. In the context of this report, reliability is expressed as the percentage of the average flow of water that was available be taken during the irrigation season (September-April), compared with the rate of water authorised by each consent.

4.2 Surface Water Reliability

The average surface water reliability of the main surface water resources in mid Canterbury over the irrigation season and winter months are expressed in **Table 4.1**.

Reliability has been averaged over the months of the irrigation season, for the length of available record[11]. Irrigation demand is likely to be higher during the months of December-February, and the repercussions of not meeting demand during these months is greater than say October or April. However, for simplicity the demand of 4.5 mm/day has been considered over the full irrigation season.

Policy WQN13(5) of the NRRP seeks to set A block allocation limits that on average provide:

> *(a) the full allocation rate 95% or more of the time during the period mid October to mid March in 6 years out of 10; and*
>
> *(b) the full allocation rate 75% or more of the time during the period mid October to mid March in 9 years out of 10.*

For the purpose of this report the reliability that is targeted is approximately 95% in every season. This is a conservative assumption, which potentially allocates too much water for the area able to be irrigated over the shoulder periods of the irrigation season. This point is best illustrated by Lincoln Ventures (2002), who estimated the peak demand for irrigation of the Ashburton District was 120 m^3/s, whereas the average demand annual demand is only 40 m^3/s. These figures show that the peak demand is not required for the entire irrigation season.

[11] Nominally 1 October to 30 April

Table 4.1 - Ashburton Zone Surface Water Reliability

Source	Band[12]	Irrigation Season Reliability[13]	Winter Reliability
Rakaia River	1	92%	91%
	2	86%	80%
	3	78%	66%
	4	66%	47%
	5	55%	31%
	6	43%	21%
Rangitata River	RDR	94%[14]	85%
Ashburton River	6	73%	84%
	8	63%	76%
	10	53%	68%
Hinds Drains	Boundary Drain[15]	78%	N/a[16]

The reliability of the Rakaia River resource consents is varied, with the bulk of water allocated to the Ashburton District in Bands 4-6. **Table 4.1** demonstrates that the Band 4-6 water is less reliable, and needs storage in order to make irrigation a viable option for shareholders. With the bulk of the Rakaia River allocated to Ashburton being unreliable, the TrustPower concept for the use of Lake Coleridge as a storage reservoir becomes an attractive prospect.

The reliability of the bulk of the Rangitata River water supplied has relatively high reliability, which is being increased by use of on-farm storage, groundwater and proposed storage within the RDR and irrigation schemes.

The Ashburton River reliability has been based upon the minimum flow scenarios in the brief, and the ZIP allocation, rather than the existing minimum flows and allocation. An unmodified flow record for the Ashburton River was not available for this report, so a simple unmodified flow was estimated, by increasing the recorded flow at SH1 by 6 m^3/s, to allow for stockwater takes, which are not subject to irrigation restrictions.

The estimated reliability of supply reduces significantly with increasing minimum flows. However, it is important to recognise that the estimated reliability is indicative only. It is anticipated that the

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[12] For the Ashburton River, the ZIP allocation and

[13] Reliability is the number of whole days that irrigation water is available expressed as a percentage of the irrigation season (1 October to 30 April).

[14] RDR residual min flow at South Ashburton is not limiting factor and has been discounted.

[15] This site has a permanent recorder and is considered to be broadly representative of the Hinds Drains reliability.

[16] Storage from Hinds Drains over winter months has not been considered.

reliability of supply will be considered in detail as an Ashburton River Regional Plan is prepared, which will require analysis of an unmodified flow.

There is the potential that a B allocation block may provide further water to supplement irrigation. The reliability of a B block was not analysed for this report. Given the relatively low reliability of the A block, the B block is considered to be an unreliable source of water. However, it could yet be an alternative to supplying ACWT to the southern area of the district.

The RDR water permit to take water from the South Ashburton has a residual minimum flow to meet. An analysis of the South Ashburton flow record indicates that this minimum flow is unlikely to be a limiting factor when compared to the SH1 flow. Therefore, this residual minimum flow has been set aside for the Ashburton River analysis.

The Hinds Drains have mixed reliability of supply, with reliability considered to have reduced in recent years, which has been attributed to more efficient irrigation in the upper plains. The Boundary Rd Drain has been used a representative site for all of the drains. This is a simple assumption, and there will be drains with higher and lower reliability than this site. However, given the high level nature of this exercise, and the lack of alternative flow sites, this assumption is considered appropriate.

4.3 Groundwater Reliability

Using the definition of reliability adopted in Section 4.1 of this report, groundwater will, in most cases, be 100% reliable. The only constraint on reliability could be the yield of the well being used. The rate at which groundwater is able to be abstracted from wells in the Ashburton District has not been considered as a constraint to meeting the reliability target.

Policy WQN13(7) of the NRRP states:

> *For a groundwater body when establishing an allocation block for Schedule WQN3:*
>
> *(a) unless an alternative catchment specific approach is more appropriate, the size of the A allocation block shall be set so that all takes from the block have a level of reliability that will provide, on average:*
>
> *(i) the full seasonal allocation in nine years out of 10; and*
>
> *(ii) 80% or more of the full seasonal allocation in 19 years out of 20;*

The groundwater allocation that will be provided under the NRRP is anticipated to be sufficient to meet demand 90% of the time. This is the target adopted for groundwater supply, and it is assumed that the figures in Table 3.2 will meet that reliability target.

For simplicity, any wells that are hydraulically connected to a surface water resource are assumed to be unaffected by minimum flow restrictions. The percentage of groundwater takes that are hydraulically connected is relatively low, so this assumption is not considered to influence the outcome of this report.

5 Matching Supply with Demand

5.1 Method

The demand figures that have been adopted for this report express demand in different units, i.e. groundwater in m^3/ha/year, and surface water in mm/day/ha. In order to match supply and demand over the irrigable area, the water allocations within each zone must be converted into a common unit. The unit that has been chosen for this report is irrigation area in hectares.

Groundwater and surface water allocations will be considered in bulk, e.g. 10 m^3/s, will irrigate 19,231 ha at 4.5mm/day; or 10 million m^3/year will irrigate 1,818 ha at 5,500 m^3/ha/year.

Current allocations have been converted into potential irrigation areas, which are tabled for each zone and separated into areas east and west of SH1. The current allocations tables are contained in Section 5.2. Groundwater is considered to be limited to the zone in which it is presently allocated. ACWT and BCI have broad proposed service areas. For the purpose of this exercise, their allocations have been limited to supplying the Chertsey and Ashburton Lyndhurst zones.

A potential reconfiguration of current allocations is described in tables in Section 5.3, and is illustrated in **Appendix C**. The reconfiguration seeks to preferentially transfer groundwater to the eastern side of SH1. Existing groundwater allocations have been partially retained on the western side of SH1, to provide storage to supplement run-of-river supply from ACWT and BCI. This approach was adopted because the continuing to use the existing investment in the groundwater resource (i.e. well, pump, power supply) is assumed to be cheaper than an alternative source of storage.

The existing RDR schemes all have a good reliability of supply. There is a number of storage ponds located within these schemes. This report assumes that RDR schemes will achieve 95% reliability by moving to piped delivery and use of scheme and on-farm storage.

By reconfiguring the allocations and matching bulk supply with assumed demand, the water allocation shortfalls will be identified. These shortfalls will have to be supplied by storage.

For the purpose of this report, it is assumed that groundwater will supply 50% of the stockwater demand for the Ashburton Zone, without being included in the consented allocation. The balance of the stockwater is assumed to be provided by a piped reticulation network supplied by surface water. The 500 L/s of stockwater that is supplied from surface water is assumed to be split between the Rangitata (50 L/s), Ashburton (400 L/s) and Rakaia Rivers (50 L/s). Alternative options are providing 500 L/s from the Rangitata or supplying all stockwater from groundwater, but neither were considered in this report.

5.2 Current Allocation

The current allocation of water in this zone is considered in bulk in **Table 5.1**. The purpose of this exercise is to attempt to improve the reliability of the BCI and ACWT water, which makes up the bulk of the surface water allocation, while maximising the irrigable area. The ACWT consent does not currently authorise irrigation, so has not been included in this section. The ACWT consent will be considered further in the following section. The irrigation areas identified in Table 5.1 have been rounded to the nearest thousand hectares for simplicity, with more precise figures provided in **Appendix D**.

Table 5.1 - Bulk Allocation Figures

Water Resource	Total Allocation	Irrigation Area
Groundwater	586 million m^3/year	107,000 ha[17]
Surface Water	72.4 m^3/s	139,000 ha[18]

5.2.1 Mayfield Hinds

Table 5.2 shows the allocation of water in the Mayfield Hinds zone.. It is assumed that the ADC Cracroft stockwater take becomes available for irrigation inland, less 50 L/s retained for stockwater supply. There is sufficient water available to be allocated to irrigate the inland area, and a surplus of water in the coastal area. This potentially allows 3,000 ha to be transferred to another zone or used to bolster reliability of the Hinds Drains.

Table 5.2 - Mayfield Hinds Zone Allocations

	Inland (ha)	Coastal (ha)
Irrigable	43,000	19,000
Groundwater	19,000	8,000
Hinds Drains	0	4,000
MHIL	22,000	10,000
Rangitata	2,000[19]	0
Total	**43,000**	**22,000**
Surplus/Deficit	**0**	**+3,000**

5.2.2 Valetta

Table 5.3 shows the allocation of water in the Valetta zone. Valetta Irrigation scheme is a relatively small scheme, and there is a shortfall of irrigation water amounting to 16,000 ha. Given the recent decision to refuse the last applicants for additional groundwater consents, there is no additional groundwater available to be allocated to this zone. Reconfiguration of the Ashburton District water allocations may be necessary to increase the irrigation area in this zone.

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[17] Assuming an average demand of 5,500 m^3/ha/year

[18] Assuming an average demand of 0.52 L/s/ha

[19] Assuming all Rangitata River water is supplied upstream of SH1

Table 5.3 - Valetta Zone Allocations

	Inland (ha)	Coastal (ha)
Irrigable Area	32,000	17,000
Groundwater Area	14,000	7,000
Hinds Drains Area	0	4,000
VIL Area	8,000	0
Total	**22,000**	**11,000**
Surplus/Deficit	**-10,000**	**-6,000**

5.2.3 Ashburton River

Table 5.4 shows the allocation of water in the Ashburton River zone. There is no water from the Rangitata River allocated within this zone. The figures indicate a 18,000 ha shortfall in this zone. Excluding the RDR take, the remaining 7.1 m^3/s allocated from the Ashburton River[20] is assumed to be used in this zone. This 7.1 m^3/s does not offer the necessary reliability, so storage will be required to supplement this allocation. This zone has a first order groundwater allocation, and there is the potential that natural losses from the Ashburton River in the coastal area could allow further groundwater to be allocated without causing further losses from the Ashburton [21].

Table 5.4 – Ashburton River Zone Allocations

	Inland (ha)	Coastal (ha)
Irrigable Area	34,000	10,000
Groundwater Area	10,000	3,000
Ashburton	13,000	0
Total	**23,000**	**3,000**
Surplus/Deficit	**-11,000**	**-7,000**

5.2.4 Ashburton Lyndhurst

Table 5.5 shows the allocation of water in the Ashburton Lyndhurst zone. The zone has a surplus in the inland area and a deficit in the coastal area. Overall, the zone has a 4,000 ha shortfall. This zone appears to favour reconfiguration of groundwater allocations. The most recent decision to grant further groundwater consents in this zone indicates that further groundwater is available to allocate as a result of irrigation scheme recharge to the aquifers.

[20] Assumed allocation is 11.8 m^3/s as specified in Draft ZIP, with an 8 m^3/s minimum flow at SH1.

[21] Pers. Comm. Matt Smith, ECan Jan 2012

Table 5.5 – Ashburton Lyndhurst Zone Allocations

	Inland (ha)	Coastal (ha)
Irrigable Area	33,000	22,000
Groundwater Area	16,000	10,000
ALIL Area	25,000	0
Total	**41,000**	**10,000**
Surplus/Deficit	**+8,000**	**-12,000**

5.2.5 Chertsey

Table 5.6 shows the allocation of water in the Chertsey zone. The BCI allocation, not including the Acton sub-scheme, has been included in the inland Chertsey zone, as a starting point for this exercise. There appears to be a surplus of 3,000 ha in the Chertsey zone. However, it is important to emphasise the less than desirable reliability associated with the BCI, consent. While there is a surplus if the minimum flow is being met, the minimums flows are not met often enough, which will lead to deficits without storage.

Table 5.6 - Chertsey Zone Allocations

	Inland (ha)	Coastal (ha)
Irrigable Area	39,000	21,000
Groundwater Area	18,000	8,000
Rakaia Area	1,000	3,000
BCI Area	27,000[22]	0
Acton	0	6,000
Total	**46,000**	**17,000**
Surplus/Deficit	**+7,000**	**-4,000**

5.2.6 Summary

Table 5.7 summarises the current deficits and surpluses in irrigation area in the Ashburton District. This figure does not include any ACWT water and assumes that the Ashburton River, Hinds Drains and BCI are al 95% reliable, which is clearly not the case.

[22] Assumes all BCI water is allocated to Chertsey zone upstream of SH1

Table 5.7 – Reconfigured Ashburton Zone Allocation Deficits/Surpluses

	Inland (ha)	Coastal (ha)
Mayfield Hinds	0	+3,000
Valetta	-10,000	-6,000
Ashburton River	-11,000	-7,000
Ashburton Lyndhurst	+8,000	-12,0000
Chertsey	+7,000	-4,000
Total	**-6,000**	**-26,000**

5.3 Potential Reconfiguration Scenario

This section considers a potential reconfiguration scenario that allows the BCI water reliability to be enhanced by use of supplementary groundwater. This reconfiguration has two objectives:

1. Retain sufficient groundwater for existing wells in the inland areas to make BCI, ACWT and Ashburton River water more reliable
2. Transfer any surplus groundwater to the coastal area

The BCI water is considered to be approximately 67% reliable. If a 200 ha property was to be supplied with BCI water, it would require a rate of 104 L/s. Assuming this property is in the inland area and is already irrigated with groundwater, the property may elect to retain 33% of their groundwater allocation to make up the BCI shortfall, and transfer the balance of their groundwater allocation to another site.

For ACWT, which has a lower reliability of 50%, half of the groundwater allocation would be retained. The Ashburton River water, using the 8 m^3/s minimum flow scenario, has approximately the same reliability as BCI, so 33% of groundwater will also be retained at any existing property irrigated by Ashburton River water.

Transferring groundwater from inland to coastal areas is likely to introduce increased well interference effects. This report has not considered these potential effects and whether or not they can be mitigated. Transferred groundwater has been assumed as being retained in the same irrigation area, even though the groundwater may be moved to an area with a higher irrigation demand, e.g. moving from inland Chertsey with a demand of 5,000 m^3/ha/year to coastal Chertsey with a demand of 5,500 m^3/ha/year. The transferred volumes are relatively small compared with the allocation as a whole, and so this assumption is considered to be reasonable, particularly given areas have been rounded to the closest 1,000 ha.

5.3.1 Mayfield Hinds

Mayfield Hinds has a surplus of 3,000 ha of water, which may be able to be transferred to another zone. Groundwater is not considered to be able to be transferred from zone to zone. Hinds Drains water is considered to be limited to the specific drain the allocation is associated with. However, the RDR provides the potential means of exporting the surplus water to a neighbouring zone.

The surplus water has been removed from the MHIL allocation in the coastal area and reassigned in the Valetta zone. Clearly, this assumption may not be palatable to the Mayfield Hinds scheme, but is considered a reasonable assumption for maximising water use within the District.

The Hinds Drains have an assumed reliability of supply of 78%, requiring an additional 17% of the allocation on average to be supplied to boost reliability to the target level of 95%. This shortfall is assumed to be able to be provided by augmenting drains with groundwater, as is presently undertaken by Eiffleton Irrigation. The volume of groundwater required to improve reliability of these drains is considered to relatively small compared with the allocation for the zone. **Table 5.8** shows the reconfigured allocation for this zone.

Table 5.8 – Reconfigured Mayfield Hinds Zone Allocations

	Inland (ha)	Coastal (ha)
Irrigable Area	43,000	19,000
Groundwater Area	19,000	8,000
Hinds Drains Area	0	4,000[23]
MHIL	22,000	7,000
Rangitata Area	2,000	0
Total	**43,000**	**19,000**
Surplus/Deficit	**0**	**0**

5.3.2 Valetta

Table 5.9 shows the reconfigured allocation of water in the Valetta zone. The additional groundwater necessary to fully irrigate the coastal area (6,000 ha worth) has been transferred from the inland area. This leaves 8,000 ha worth of groundwater in the inland area. This groundwater can be used as storage for water supplied by ACWT, assuming that the necessary infrastructure and/or arrangements are in place to convey water from the Rakaia River to this zone.

The ACWT water is considered to be approximately 50% reliable. If a 200 ha property irrigated by groundwater was to be supplied with ACWT water, it would require a rate of 104 L/s. Assuming this property is in the inland area and is already irrigated with groundwater, the property would elect to retain 50% of their groundwater allocation (2,750 m^3/ha) to make up the BCI shortfall, and transfer the balance of their groundwater allocation to another site. Using this approach, the 8,000 ha of groundwater can be used to improve the reliability of 8.3 m^3/s of ACWT to irrigate 16,000 ha in the inland area. This leaves a shortfall of 6,000 ha in the inland area.

[23] Includes an allowance for groundwater to boost reliability.

Table 5.9 – Reconfigured Valetta Zone Allocations

	Inland (ha)	Coastal(ha)
Irrigable Area	32,000	17,000
Groundwater Area	8,000[24]	13,000
Hinds Drains Area	0	4,000[25]
VIL Area	8,000	0
MHIL export Area	3,000	0
ACWT	16,000	0
Total	**27,000**	**17,000**
Surplus/Deficit	**-5,000**	**0**

5.3.3 Ashburton River

Table 5.10 shows the reconfigured allocation of water in the Ashburton River zone. The reliability of the Ashburton River will need to be supplemented with storage to meet the reliability target. The use of B allocation, and potentially further ACWT or RDR water, along with storage has been assumed to bring the Ashburton River allocation up the target reliability of supply.

Introducing 7.5 m^3/s of ACWT water, using groundwater as storage, and transferring 3,000 ha of surplus groundwater to the coastal area increases the area able to be irrigated. The 7,000 ha of groundwater retained in the inland area will be used to improve the reliability of the ACWT water so that it is able to be used for irrigation of 14,000 ha. However, there is still a deficit of 10,000 ha in this zone.

Table 5.10 – Ashburton River Zone Allocations

	Inland (ha)	Coastal(ha)
Irrigable Area	34,000	10,000
Groundwater Area	7,000[26]	6,000
Ashburton River Area	13,000	0
ACWT	14,000	0
Total	**27,000**	**6,000**
Surplus/Deficit	**-7,000**	**-4,000**

[24] A representative area only, and will not count towards the total area irrigated in the zone, because this water is required to make up the shortfall of reliability of supply under ACWT.

[25] Reliability boosted by ground water

[26] A representative area only, and will not count towards the total area irrigated in the zone, because this water is required to make up the shortfall of reliability of supply under ACWT.

5.3.4 Ashburton Lyndhurst

Table 5.11 shows a potential reconfiguration of the Ashburton Lyndhurst zone. The surface water currently allocated to this zone is reliable. There is the need to shift a considerable volume of groundwater to the coastal area. This could be achieved by introducing BCI water into the zone. With a reliability of 67%, BCI water requires approximately 1 ha of groundwater for each 3 ha that can be irrigated at a peak rate of 0.52 L/s/ha. The greater irrigation demand in the coastal area means that the volume of water that can irrigate 12,000 ha in the inland area can only irrigate 11,000 ha when moved to the coastal area.

Table 5.11 – Ashburton Lyndhurst Zone Allocations

	Inland (ha)	Coastal (ha)
Irrigable Area	33,000	22,000
Groundwater Area	4,000[27]	21,000
ALIL Area	25,000	0
BCI	6,000	0
Total	**33,000**	**21,000**
Surplus/Deficit	**0**	**-1,000**

5.3.5 Chertsey

Table 5.12 shows potential re-allocation of water in the Chertsey zone. The BCI area requires storage, which is assumed to be provided by groundwater. Based on the assumed requirement of 33% of groundwater allocation, the BCI area requires 7,000 ha of groundwater to boost reliability. The Acton schemes and individual Rakaia allocations are assumed to either have sufficient storage or be capable of installing sufficient on-farm storage to have sufficient reliability.

Using these assumptions, there is a deficit of 10,000 ha in the inland area of the Chertsey zone. This deficit, if met by water supplied from storage, at an assumed demand of 5,000 m^3/ha/year, would require 50 million m^3.

[27] A representative area only, and only 2,000 ha will count towards the total area irrigated in the zone, because the remaining 2,000 ha of water is required to make up the shortfall of reliability of supply under BCI.

Table 5.12 – Reconfigured Chertsey Zone Allocations

	Inland (ha)	Coastal (ha)
Irrigable Area	39,000	21,000
Groundwater Area	14,000[28]	12,000
Rakaia Area	1,000	3,000
BCI Area	21,000	0
Acton	0	6,000
Total	**29,000**	**21,000**
Surplus/Deficit	**-10,000**	**0**

5.3.6 Summary

Table 5.13 shows the consequences of the reconfiguration scenario. By introducing ACWT and BCI water in combination with groundwater reconfiguration and storage within the RDR schemes, the coastal demand can largely be satisfied, but there will be a shortfall existing in inland areas. The reallocation has improved the reliability of the BCI and ACWT water, while retaining the same overall shortfall for the zone outlined in **Table 5.7**.

Table 5.13 – Reconfigured Ashburton Zone Allocation Deficits/Surpluses

	Inland (ha)	Coastal (ha)
Mayfield Hinds	0	0
Valetta	-5,000	0
Ashburton River	-7,000	-4,000
Ashburton Lyndhurst	0	-1,000
Chertsey	-10,000	0
Total	**-22,000**	**-5,000**

The estimated requirement for supply of stored water to meet the demand identified above is shown in **Table 5.1**4. The volume of stored water does not need to be this size, but will need to be able yield this volume during an irrigation season. The storage could come in the form of bulk storage, on-farm storage or additional groundwater allocations. Comparing the figures in Table 5.13 with Table 5.7 shows that the area able to be irrigated has increased by 5,000 ha, but more importantly run-of-river surface water has been increased to the target reliability.

[28] Only 7,000 ha is counted towards the total, with the remaining 7,000 ha required for BCI storage in the upper plains.

Table 5.14 – Reconfigured Ashburton Zone storage requirement

	Inland (million m^3)	Coastal (million m^3)
Mayfield Hinds	0	0
Valetta	27.5	24
Ashburton River	38.5	6
Ashburton Lyndhurst	0	0
Chertsey	50	0
Total	**115**	**0**

Based upon this exercise, and use of groundwater as a source of storage in the upper plains, an additional 115 million m^3/year of water from storage and/or groundwater is required for irrigation development of the Ashburton District.

5.4 Alternative Scenarios

There are other scenarios that could have been developed. For example, BCI and ACWT could be used in the Ashburton Lyndhurst and Chertsey zones. ALIL water could have been pushed south of the Ashburton River. However, at this stage reconfiguring existing users to such a significant degree was not considered. The cost of infrastructure of supplying water as far south as the Valetta zone was not considered in this report. Clearly the cost of infrastructure is likely to be a significant limitation, and any reconfiguration planning should include consideration of most effective use of existing infrastructure and minimising the cost of new infrastructure.

The irrigation demand figures are key assumptions. Using lower irrigation demand assumptions will increase the area able to be irrigated. By reducing irrigation demand, **Table 5.1** can be updated, as shown in Table **15.15**. The revised figures increase the total potential irrigation area by 31,000 ha.

Table 5.15 – Revised Bulk Allocation Figures

Water Resource	Total Allocation	Irrigation Area
Groundwater	586 million m^3/year	117,000 ha[29]
Surface Water	72.4 m^3/s	161,000 ha[30]

[29] Assuming an average demand of 5,500 m^3/ha/year

[30] Assuming an average demand of 0.52 L/s/ha

6 Implementation

6.1 Groundwater

The approach of moving groundwater to the area east of SH1 promoted by Thorley et al (2008), is considered to consistent with the CWMS. In order to move groundwater towards the coast, there needs to be an incentive for an existing groundwater user to relinquish their consent. The incentive is likely to be reliable and lower cost surface water as a replacement. However, reliable surface water will require storage, which is unlikely to be low cost.

It is considered unlikely that an irrigator that has paid for installing and developing a well will be able to afford to write off the well and groundwater consent and pay to irrigate the property from surface water. For example, an irrigation scheme that costs $7,000/ha will require $560/ha to service the debt on the capital outlay (assuming 100% borrowing and 8% interest). This cost may be higher than the annual cost of pumping groundwater, which would not be attractive

That leaves the consent holder with two potential options: either use their existing well as storage, allowing part of the allocation to be transferred to another site; or sell the groundwater permit and use the capital raised to fund the share of infrastructure costs for storage.

For example, BCI water is estimated to be available on average 2/3 of the irrigation season, By using an assumed demand of 6,000 m^3/ha/year, that would indicate that 2,000 m^3/ha/year of groundwater allocation would need to be retained by a BCI shareholder to allow them to meet their annual demand. The balance of 6,000 m^3/ha/year could be transferred to another site. Assuming the water is sold, the consent holder could then afford to contribute to the cost of investing in a surface water supply scheme.

A potential impediment to groundwater transfers is the well interference effects that are likely to arise if allocations are transferred to the coastal area. Presently, those parties seeking to transfer groundwater are required to install and develop the well and undertake aquifer testing to show that no neighbours will be potentially affected by the proposed transfer. This process requires a significant outlay prior to the transferee having any comfort that they will be able to irrigate from the well that has been sunk.

The vast majority of groundwater resource consent applications are able to show that neighbours are not affected by taking more water at a new site. It is possible that groundwater zone models could be developed to consider potential well interference effects, and identify potential sensitive areas where aquifer testing will be required before an application can be granted. However, outside of those areas, aquifer testing and the requirement to drill the well prior to being granted the application could be avoided. Such an approach would encourage the transfer of groundwater and uptake of surface water schemes with lower reliability.

A further concept that could be considered is the use of aquifers as a “bank”. If surface water is able to be used in preference to groundwater for a number of seasons aquifers are expected to be replenished. In the event that surface water supply is limited, there is the potential that groundwater allocations could be exceeded for a single season. This concept allows groundwater to be “carried over”, in part or full, from a previous season. Such an approach could be significantly cheaper than investing in a large storage facility that is infrequently required to be used to its full capacity.

The concept of an Aggregated Consent Entity (ACE) could be adopted to facilitate the transfer of groundwater. An ACE would hold a resource consent for all of the groundwater takes in the zone, and would be a vehicle with sufficient financial backing to fund the necessary modelling to consider the potential for large scale transfers to fund surface water irrigation development and considering the concept of carrying over groundwater allocations. An ACE will provide a platform for leadership that is difficult to foster amongst a large group of individual consent holders. There are number of attractive features of an ACE that would attract members, such as economy of scale allowing cheaper representation. However, there may also be perceived disadvantages, such as loss of control over decision making. Incentives may be necessary to bring the users into an ACE. .

6.2 Surface Water

In order to reduce the taking of groundwater in inland areas, surface water allocations should be fully utilised. The RDR has the largest and most reliable allocation in the Ashburton District. However, the RDR is also used for hydropower generation over winter months and during irrigation season when water is not being used for irrigation. Therefore, while the RDR potentially has water that could be stored for irrigation, the continued use of water for hydro generation is also a beneficial use of water. Therefore, assuming the current situation does not change, the less reliable water permits, such as BCI and ACWT are likely to be required, in combination with additional stored water and groundwater.

Therefore, a key implementation strategy is facilitating investment in the BCI and ACWT schemes. Providing flexibility to take groundwater to boost reliability will assist to improve reliability of these schemes. Introducing additional affordable storage will also assist these schemes achieving sufficient uptake to become operational.

However, in particular for ACWT, the reliability offered is so low that the use of this water must be partnered with more reliable water. The volume of storage required may make the cost of investment in storage prohibitive. Therefore, groundwater seems to be a sensible partner for ACWT water. Encouraging groundwater users to adopt ACWT water will help to achieve more groundwater transfers, as surplus groundwater is realised to contribute to the cost of ACWT. As outlined in Section 6.1, the potential use of an ACE (or similar structure) is likely to be required to bring the users together to work collectively. BCI and Ashburton River users are also able to make use of groundwater, but will require less water to have sufficient reliability, making investment in storage more viable than

Irrigation allocations have been assigned to individual schemes, which have obligations to their shareholders. This structure potentially reduces the effectiveness of water use across the Ashburton District. Arrangements between irrigation schemes to make more effective use of surface water resources should be encouraged.

The RDR is a key piece of infrastructure for implementing the shift of groundwater to the coast and most effective use of surface water in the upper plains. BCIs concept of pumping water to the RDR and offsetting Ashburton Lyndhurst water allocation is innovative and is an example of what can be achieved. The main limitation of the BCI arrangement appears to be the cost of pumping from the Rakaia River in the long term. The significant height of pumping from the Rakaia River is comparable with pumping deep groundwater, which is likely make it difficult to sell BCI water to those who have already invested in deep groundwater.

On a long term basis, that pumping from the Rakaia to the RDR is unlikely to be favoured, and instead, Rangitata River water could be supplied to the upper plains, with ACWT and BCI water being used down-gradient of the contour line that can be reached under gravity from the proposed intake at Happy Valley, upstream of Highbank. Such an approach would require a considerable change to the way that water is managed, and would require existing schemes to forgo more reliable allocations. This could be achieved by forming an ACE across the whole District and/or entering into further water swap agreements.

6.3 Storage

Storage is likely to be necessary to supplement run-of-river takes and groundwater. Options that have been considered to date include the Stour River, Lake Coleridge, RDR at Klondyke. The proposed storage options are likely to be used in tandem with run-of-river schemes, because it is unlikely that an irrigator could afford to rely on storage to fulfil the irrigation requirements every year.

The volume of water stored within schemes and on-farm is considerable. Linking these smaller storages together and managing them collectively could allow for additional irrigation. Currently RDR irrigation schemes run on border dyke return periods, which reflects the original use of the schemes. On-farm storages are used to convert a 'slug' of border dyke water into a continuous spray irrigation allocation. If water can be conveyed by pipe instead of open race, the schemes will provide water on a continuous average flow rather than at peak flows (230 L/s) for a limited number of days. This will allow the on-farm storage ponds to be used as storage for periods of reduced supply, rather than to convert a border dyke allocation into a spray allocation. Utilising these on-farm storages may allow irrigation schemes to spread their water out further (e.g. 4 mm/day) and make more use of storage. Therefore, encouragement of piped irrigation schemes should increase the area of land that can be irrigated from the present allocation.

6.4 Stockwater

Stockwater currently accounts for a considerable rate of water allocation. There appears to be the potential to make use of surplus stockwater from the Rangitata and Rakaia Rivers. However, the Ashburton River is the main source of stockwater for the district. It appears that the Ashburton River allocation anticipates the return of all stockwater allocation to the Ashburton River. Such an approach is unlikely to be favoured by ADC who will have to invest in piping or wells as an alternative to supplying stockwater by open race from the Ashburton River.

There is the potential that some of the ADC allocation could be sold for irrigation to fund the investment in infrastructure, which is why a range of minimum flows were considered for the Ashburton River. Using an unmodified flow record and considering the scenarios for revising the current stockwater allocation and infrastructure in partnership with ADC appears to be a sensible approach to encouraging.

The stockwater race network potentially offers habitat to a range of in-stream life as a result of the stockwater race network being largely unscreened. This will be an important consideration when contemplating the future of the stockwater race network. There may be merit in identifying any key water races and working to line and retain those races as examples of the network.

7 Summary

- The Ashburton District has a considerable surface and groundwater resource that is used primarily for irrigation.
- Improved efficiency of delivery of existing irrigation schemes and increased in-scheme storage will allow these schemes to expand.
- The reliability of the Ashburton River, and large allocations from the Rakaia River currently have inadequate reliability of supply that will require additional water from storage to boost reliability.
- Increasing the minimum flow on the Ashburton River will appreciably reduce the reliability of supply provided by that water resource.
- Using existing wells as a form of storage is considered to be an efficient use of existing infrastructure.
- Existing groundwater allocations can be reduced in inland areas and be used to supplement run-of-river supply, with surplus groundwater transferred to the coastal area.
- Maximising use of existing consented allocations will allow Ashburton to largely meet irrigation demand, but further storage will be required.
- The Ashburton District has a large rate of surface water allocated that can be stored outside of the irrigation season and during periods of low irrigation demand.
- Collective water resource management and improved irrigation efficiency will to make the most of existing consented allocations and minimise the need for storage infrastructure.

8 References

Lincoln Environmental, 2002, *Canterbury Strategic Water Study;* Report 4557/1

Thorley, MJ, Bidwell, VJ, and DM Scott, 2010. *Landsurface recharge and groundwater dynamics – Rakaia-Ashburton Plains*; Environment Canterbury technical report U09/55

Appendix A

Key Assumptions

Appendix B

Irrigation and Stockwater Resource Consents

Rakaia

RecordNo	HolderName	BandDesc	Activities	Rate (l/s)	Allocated rate (l/s)	average rate	Volume	Return Period	FlowRestric
NCY800538	ADC (Acton)	Band 1	Take Surface Water	680	680	680			
CRC970828	Mr Philip Gilmore Brown	Band 2	Take Surface Water	42	42	35			
CRC990660	South Rakaia Irrigation Partnership	Band 2	Take Surface Water	1800	1800	1100			
CRC940050.2	Mr & Mrs Maw, Beverley Farm Limited & Mr Campion	Band 2	Take Surface Water	100	100	100			
CRC990136.1	L J & A M & C R & A C & G D & V Maw, Maw & Campion	Band 3	Take Surface Water	175	175	175			
CRC990088.6	Barrhill Chertsey Irrigation Limited	Band 4/5	Take Surface Water	17000	17000	17000			
	ACWT	Band 6	Take Surface Water	40000		15800			
CRC970827	Philip Gilmore Brown	Band 1a	Take Surface Water						
CRC992181.3	Orton Holdings Limited	Band 9a	Take Surface Water (via intake gallery)	150	150	150			As above
						34890			

Rangitata

RecordNo	HolderName	BandDesc	Activities	Rate (l/s)	Allocated rate (l/s)	average rate	Volume	Return Period	FlowRestric	
CRC970991	Farmleigh Limited	Band 1	Take Surface Water	38	38	38			As above	
CRC981744.2	Mt Potts Lodge Limited	Band 1	Take Surface Water	41	41	41			As above	
CRC110225	Rangitata Diversion Race Management Limited	Band 3	Take Surface Water	3000		3				110.1
CRC011237	Rangitata Diversion Race Management Limited	Band 4	Take Surface Water	30700	30700	30.7				
	ADC (Cracroft)				849					
					31628					

Hinds River and Drains

RecordNo	HolderName	BandDesc	Activities	Rate (l/s)	Allocated rate (l/s)	average rate	Volume (m^3)	Return Period	FlowRestric		
Dawsons Drains at Lower Beach Road											
CRC001700	Bellwin Farms Limited	Band 1	Take Surface Water	35	35	33.54166667	2898	1	Cease: 10L/s	1/2 volume: 20L/s	
Deals Drain at Poplar Road											
CRC103406	A J C Farming Company Limited	Band 1	Take Surface Water	13	13		174250	7	70 L/s		
CRC962600.1	Eiffelton Community Irrigation Scheme Inc	Band 1	Take Surface Water	289	289	288.1117725	174250	7	70 L/s		
Parakanoi Drain at Lower Beach Road											
CRC012024.1	New Zealand Rural Property Trust Management Limited	Band 1	Take Surface Water	45	45	42.16242284	43714	12	Cease: 30 L/s	1/2 volume: 100L/s	
CRC951691	Mr & Mrs I R & R D Moore	Band 1	Take Surface Water	16	16	14.66435185	1267	1	Cease: 30 L/s	1/2 volume: 100L/s	
CRC951894.2	Longbeach Estate Ltd & Raynham Dairies Ltd	Band 1	Take Surface Water	60	60	60	5184	1	Cease: 30 L/s	1/2 volume: 100L/s	
CRC951900	Messrs R S & R I S Mackenzie	Band 1	Take Surface Water	65	65	65	5616	1	Cease: 30 L/s	1/2 volume: 100L/s	
CRC951927.1	Mr & Mrs G T & K L Fleming	Band 1	Take Surface Water	34	34	12.23544974	7400	7	Cease: 30 L/s	1/2 volume: 100L/s	
CRC952125.1	Deodara Farm Limited	Band 1	Take Surface Water	32	32	26.66666667	2304	1	Cease: 30 L/s	1/2 volume: 100L/s	
CRC952155	N Stoddart Limited	Band 1	Take Surface Water	67	67	55.83333333	4824	1	Cease: 30 L/s	1/2 volume: 100L/s	
CRC952160	Mr & Mrs J D & C M McKenzie	Band 1	Take Surface Water	54	54	43.81613757	53000	14	Cease: 30 L/s	1/2 volume: 100L/s	
CRC960188.1	Geoffrey Ian Royds	Band 1	Take Surface Water	5.5	5.5	3.53587963	4277	14	Cease: 30 L/s	1/2 volume: 100L/s	
CRC960189.1	Warobar Farm Limited	Band 1	Take Surface Water	26.5	26.5	20.9837963	1813	1	Cease: 30 L/s	1/2 volume: 100L/s	
CRC960293.2	Kintyre Investments Limited	Band 1	Take Surface Water	45	45	3.214285714	5832	21	Cease: 30 L/s	1/2 volume: 100L/s	
CRC960871	Eskdale Farm Limited	Band 1	Take Surface Water	78	78	78.00925926	6740	1	Cease: 30 L/s	1/2 volume: 100L/s	
Windermere Drain at Poplar Road											
CRC962601.1	Eiffelton Community Irrigation Scheme Inc	Band 1	Take Surface Water	415	415	414.9718915	250975	7	80 L/s		
CRC962603.1	Eiffelton Community Irrigation Scheme Inc	Band 1	Take Surface Water	150	150	150	90720	7	80 L/s		
CRC962606.1	Eiffelton Community Irrigation Scheme Inc	Band 1	Take Surface Water	150	150	150	90720	7	80 L/s		
Hinds River at Boundary Road											
CRC000341	Grattanville Farm Limited	Band 1	Take Surface Water	65	65	59.58333333	113256	22	Hinds River: 1/2 volume: 300 L/s		Cease: 150 L/s
									Cease from Swamp River Rd drain when flow in Taylors Drain OR Windermere Cutoff: 25 L/s		
CRC000510.1	Mark Andrew Fletcher	Band 1	Take Surface Water	38	38	17.36111111	10500	7	Cease: 150 L/s	1/2 volume: 300 L/s	
CRC000701.2	Pike Farms Limited	Band 1	Take Surface Water	16.7	16.7	13.92361111	8421	7	Cease: 150 Ls	1/2 volume: 300 L/s	
CRC012026.1	Grantham Farming Limited	Band 1	Take Surface Water	224.6	224.6	44.47131283	107585	28	1/2 volume: 300 L/s	Cease: 150 L/s	
			Take Surface Water	56.6	56.6	21.22519841	51348	28			
CRC031603.1	Mr K B & Mrs R A Townshend & A W Trustee Services Limited	Band 1	Take Surface Water	33	33	16.89814815	43800	30	Cease: 150 L/s	1/2 volume or max 15hrs/day on alternative days: 300 L/s	
CRC940895B.2	Mr K B & Mrs R A Townshend & A W Trustee Services Limited	Band 1	Take Surface Water	38	38	31.66666667	19152	7	Cease: 150 L/s	1/2 volume: 300 L/s	
CRC951928	Messrs C C, C N & G T Fleming	Band 1	Take Surface Water	60	60	26.78571429	48600	21	Cease: 150 L/s	1/2 volume or max 15hrs/day on alternative days: 300 L/s	
CRC952615	Dennis Wilbur Taylor	Band 1	Take Surface Water	30	30	27.77777778	16800	7	Cease: 150 L/s	1/2 volume or max 22hrs/day on alternative days: 300 L/s	
CRC960115.1	Neil Taylor Ross	Band 1	Take Surface Water	30	30	27.77777778	16800	7	Cease: 150 L/s	1/2 volume or max 22hrs/day on alternative days: 300 L/s	
CRC990615.2	Mr G R & Mrs R C Wilson	Band 1	Take Surface Water	45	45	45	3888	1	Hinds River: 1/2 volume: 300 L/s. Cease: 150 L/s		
									Swamp Rd Drain: Cease when flow in Taylors Drain: 25 L/s		
CRC951619	Lynnford Irrigation Association	Band 2	Take Surface Water	256	256	157.9034392	95500	7	Cease: 150 L/s	1/2 volume or max 15hrs/day on alternative days: 400 L/s	
Montgomerys Drain at Hinds River confluence											
CRC951931	Messrs C C, C N & G T Fleming	Band 1	Take Surface Water	45	45	20.08928571	36450	21	Cease: 10 L/s		
CRC952206	Murray Robert Falconer Keir	Band 1	Take Surface Water	45	45	5.303571429	16038	35	Cease: 10 L/s		
CRC952327.1	Ballymore Farm Limited	Band 1	Take Surface Water	35	35	17.36111111	45000	30	Cease: 10 L/s		
Northern Drain at confluence with Hinds River											
CRC951102.1	Graycrop Limited	Band 1	Take Surface Water	38	38	28.27380952	17100	7	Cease: 80 L/s		
CRC952136	Mr & Mrs K J & M C Read	Band 1	Take Surface Water	26.25	26.25	123.0908565	212701	20	Cease: 80 L/s		
CRC952618	Dennis Wilbur Taylor	Band 1	Take Surface Water	30	30	7.44047619	4500	7	Cease: 80 L/s		
CRC971569.1	Mr A I & Mrs J M Cameron	Band 1	Take Surface Water	80	80				Cease: 80 L/s		
CRC971570	Mr A I & Mrs J M Cameron	Band 1	Take Surface Water	32	32	17.36111111	21000	14	Cease: 80 L/s		
Northern Drain at Surveyors Road											
CRC001155.1	Lyncross Farm Limited	Band 2	Take Surface Water	30	30	27.5	33264	14	Cease: 210 L/s		
CRC050915.3	Ortongreen Farm Limited	Band 2	Take Surface Water	70	70	67.08333333	40572	7	Cease: 210 L/s		
CRC070745	Eildon Farming Limited	Band 2	Take Surface Water	50	50	47.91666667	28980	7	Cease: 210 L/s		
OShaughnessys Drain (Ashburton) at Poplars Road											
CRC031604	Neil Taylor Ross	Band 1	Take Surface Water	33	33	6.25	16200	30	Cease: 25 L/s		
CRC951249	Messrs R G & C R G Read	Band 1	Take Surface Water	25	25	8.333333333	720	1	Cease: 25 L/s		
CRC951981	Geoffrey Edgar Walter Deal	Band 1	Take Surface Water	12.6	12.6	9.900793651	5988	7	Cease: 25 L/s		
CRC952616	Dennis Wilbur Taylor	Band 1	Take Surface Water	30	30	6.613756614	4000	7	Cease: 25 L/s		
CRC952654.1	Mr K B & Mrs R A Townshend & A W Trustee Services Limited.	Band 1	Take Surface Water	30	30	20	1728	1	Cease: 25 L/s		
CRC960116.2	Mr K B & Mrs R A Townshend & A W Trustee Services Limited	Band 1	Take Surface Water	33	33	16.89814815	43800	30	Cease: 25 L/s		
CRC960123	David James Read	Band 1	Take Surface Water	30	30	11.45833333	11880	12	Cease: 25 L/s		
CRC960170.1	Grantham Farming Limited	Band 1	Take Surface Water	114	114	44.99834656	54430	14	Cease: 25 L/s		
CRC960285.1	A J C Farming Company Limited	Band 1	Take Surface Water	25	25	14.88095238	18000	14	Cease: 25 L/s		
CRC960546	Mr L P & Mrs M M Read	Band 1	Take Surface Water	30	30	25	43200	20	Cease: 25 L/s		

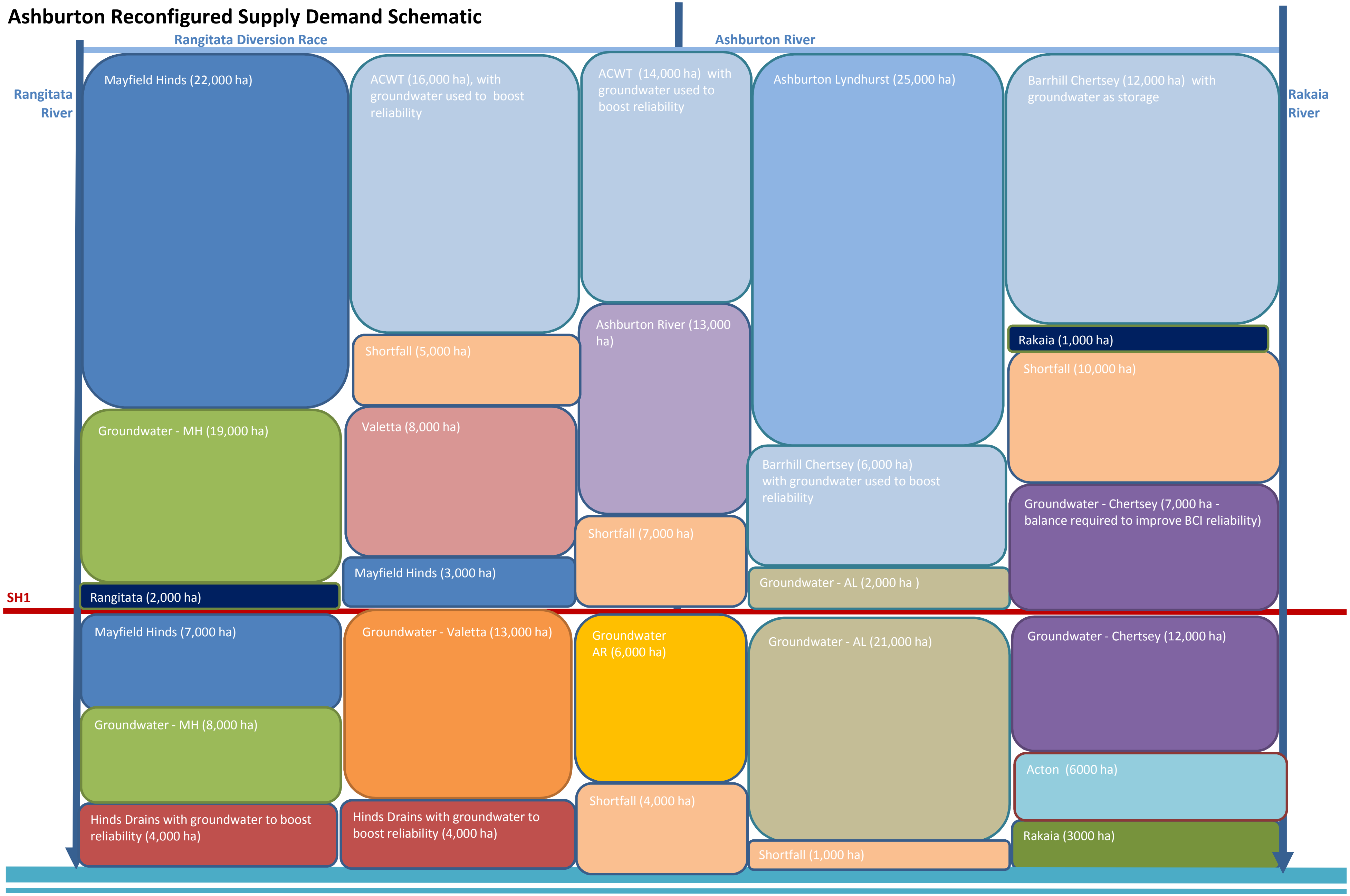
Boundary Drain at Lower Beach Road											
CRC952083.3	Dalmeny Farm Limited	Band 1	Take Surface Water		65	65	59.58333333	72072	14	Cease: 150 L/s	
CRC952161	Mr & Mrs J D & C M McKenzie	Band 1	Take Surface Water		145	145	60.41666667	5220	1	Cease: 150 L/s	
CRC952326.1	Ballymore Farm Limited	Band 1	Take Surface Water		40	40	38.33333333	3312	1	Cease: 150 L/s	
CRC960269	Mr & Mrs J D & C M McKenzie	Band 1	Take Surface Water		105	105	39.26917989	23750	7	Cease: 150 L/s	
Boundary Drain at Trigpole Road											
CRC951929	Messrs C C, C N & G T Fleming	Band 1	Take Surface Water		60	60	35.71428571	21600	7	Cease: 150 L/s	
CRC951932	Messrs C C, C N & G T Fleming	Band 1	Take Surface Water		45	45	20.08928571	12150	7	Cease: 150 L/s	
CRC952202	Murray Robert Falconer Keir	Band 1	Take Surface Water		38	38	19.00462963	1642	1	Cease: 150 L/s	
CRC952205	Murray Robert Falconer Keir	Band 1	Take Surface Water		45	45	22.5	68040	35	Cease: 150 L/s	
CRC952546.1	Eiffelton Contractors Limited	Band 1	Take Surface Water		35	35	27.03703704	2336	1	Cease: 150 L/s	
CRC980005	Murray Robert Falconer Keir	Band 1	Take Surface Water		38	38	19.84126984	12000	7	Cease: 150 L/s	
CRC980359	Eiffelton Contractors Limited	Band 1	Take Surface Water		34	34	21.24944885	38555	21	Cease: 150 L/s	
CRC951602	Grant Timothy Fleming	Band 2	Take Surface Water		34	34	15.17857143	9180	7	Cease: 150 L/s	1/2 volume: 200 L/s
CRC951978	Little Ridge Trust	Band 2	Take Surface Water		38	38	15.70767196	9500	7	Cease: 150 L/s	1/2 volume: 200 L/s
CRC061336	Charlotte Joan Perkins	Band 3	Take Surface Water		32	32	25.6	22118.4	10	Boundary Drain - Cease: 235 L/s Dobsons Drain - Cease: 215 Ls	
Dobsons Drain at Twenty One Drain Road											
CRC061183	E G Perkins Limited	Band 1	Take Surface Water		78	78	71.5	61776	10	Cease: 150 L/s	
CRC952493.1	Charlotte Joan Perkins	Band 1	Take Surface Water		32	32	16.86507937	10200	7	Cease: 150 L/s	
CRC960090.1	Charlotte Joan Perkins	Band 1	Take Surface Water		25	25	2.083333333	5400	30	Cease: 150 L/s	
CRC960091.1	Charlotte Joan Perkins	Band 1	Take Surface Water		25	25	2.083333333	5400	30	Cease: 150 L/s	
CRC960092.1	Charlotte Joan Perkins	Band 1	Take Surface Water		25	25	2.083333333	5400	30	Cease: 150 L/s	
CRC971297.2	Mr G A & Mrs L P Irvine	Band 1	Take Surface Water		143	143	27.05026455	16360	7	Cease: 150 L/s	
CRC981629.1	Charlotte Joan Perkins	Band 1	Take Surface Water		70	70	64.16666667	38808	7	Cease: 150 L/s	
CRC952682.3	Morag Farm Limited	Band 2	Take Surface Water		56	56	53.66898148	4637	1	Drop to 25 L/s: 180 L/s Cease: 150 L/s	
CRC061336	Charlotte Joan Perkins	Band 3	Take Surface Water		32	32	25.6	22118.4	10	Boundary Drain - Cease: 235 L/s	
CRC091965	Charlotte Joan Perkins	Band 5	Take Surface Water		50	50	47.91666667	4140	1	Drop to 360 m^3/day: 230 L/s	
							23.95833333	28980	14	Cease: 150 L/s	
Griggs Drain at Lower Beach Road											
CRC952084.2	Dalmeny Farm Limited	Band 1	Take Surface Water		65	65	16.53439153	20000	14	Cease: 10 L/s	
CRC952328.1	Ballymore Farm Limited	Band 1	Take Surface Water		35	35	28.93518519	52500	21	Cease: 10 L/s	
Pyes Drain at Lower Beach Road											
CRC092650.2	West Peak Dairy Limited										
		Band 2	Take Surface Water	SWAP K38/2416 - 110		110	82.46527778	7125	1	Cease: 50 L/s	
				SWAP K38/2326 - 106		106	105.9953704	9158	1	1/2 volume: 75 L/s	
				SWAP K38/2327 - 45		45	33.75	2916	1		
								261	1	Until 1/04/2019: 13789/day, 1,426,816/year After 2/04/2019: 7921/day, 874,787/year	
Stormy Drain at Lower Beach/Ocean View Road											
CRC952369	Messrs D J & A G Smyth	Band 1	Take Surface Water		230	230				Cease: 150 L/s	
CRC952373	Messrs D J & A G Smyth	Band 1	Take Surface Water		230	230				Cease: 150 L/s	
CRC952375	Messrs D J & A G Smyth	Band 1	Take Surface Water		230	230				Cease: 150 L/s	
CRC952376	Messrs D J & A G Smyth	Band 1	Take Surface Water		230	230	26.04166667	15750	7	Cease: 150 L/s	
CRC952377	Messrs D J & A G Smyth	Band 1	Take Surface Water		50	50	33.06878307	20000	7	Cease: 150 L/s	
CRC952379	Messrs D J & A G Smyth	Band 1	Take Surface Water		230	230	26.04166667	15750	7	Cease: 150 L/s	
CRC960224.1	Charene Farming Company Limited	Band 1	Take Surface Water		53	53	24.29398148	58772	28	Cease: 150 L/s	
CRC960934.3	MrN K & Mrs K L Hammond	Band 1	Take Surface Water		24	24	20	1728	1	Cease: 150 L/s	
CRC952371	Messrs D J & A G Smyth	Band 2	Take Surface Water		50	50	21.08134921	12750	7	Cease: 150 L/s	1/2 volume: 200 L/s
Twenty One Drain at Twenty One Drain Road											
CRC952132.1	Mr G K Shearer, Mr S R Waite, Mr R M Dodunski & Ms A M Dodunski	Band 1	Take Surface Water		38	38	13.56646825	8205	7	Cease: 50 L/s	
CRC952653.2	Mr G A & Mrs L P Irvine	Band 1	Take Surface Water		150	150	33.33333333	86400	30	Cease: 50 L/s	
CRC960089.1	D J, A G & E M Smyth	Band 1	Take Surface Water		25	25	2.083333333	5400	30	Cease: 50 L/s	
CRC971296.2	Mr G A & Mrs L P Irvine	Band 1	Take Surface Water		30	30	4.133597884	2500	7	Cease: 50 L/s	
CRC981629.1	Charlotte Joan Perkins	Band 1	Take Surface Water		70	70	64.16666667	38808	7	Twenty One Drain: Cease: 50 L/s. Dobsons Drain, Prices Drain and/or Srhoys Drain: 150 L/s	
							3770.866667				

Record No	Client Name	Stockwater Scheme	Water Course	Rate (L/s)	Intake
CRC012126	Ashburton District Council	Winchmore-Rakaia Stock	Rakaia River	680	Acton Intake
	Ashburton District Council	Winchmore-Rakaia Stock	Un-named Asburton Nth Trib	790	Winchmore intake
CRC012114	Ashburton District Council	Montalto-Hinds Stock	Rangitata River	849	Cracroft Intake
	Ashburton District Council	Montalto-Hinds Stock	Limestone creek	50	Limestone Intake
CRC012123	Ashburton District Council	Methven-Lauriston Stock	South Ashburton	1955	Brothers intake
	Ashburton District Council	Methven-Lauriston Stock	Flemming Drain	100	Flemming Drain Booster Intake
	Ashburton District Council	Methven-Lauriston Stock	Clearwell Spring	100	Clearwell Spring Intake
	Ashburton District Council	Methven-Lauriston Stock	Lagmor Creek	56	Lagmor Intake
	Ashburton District Council	Methven-Lauriston Stock	Langdons Creek	40	Langdons Intake
	Ashburton District Council	Methven-Lauriston Stock	Langdons Creek	120	Langdons Intake
	Ashburton District Council	Methven-Lauriston Stock	Maginess Drain	30	Maginess Drain Booster
	Ashburton District Council	Methven-Lauriston Stock	Remmington Creek	120	Remmington Creek Intake
	Ashburton District Council	Methven-Lauriston Stock	Russels Drain	20	Russell Drain Intake
	Ashburton District Council	Methven-Lauriston Stock	Stoney Creek	110	Stoney Creek Intake
	Ashburton District Council	Methven-Lauriston Stock	Windermere Cut Off Drain	200	Windermere Cut Off Drain Intake
	Ashburton District Council	Methven-Lauriston Stock	Taylors Stream	70	Bushside Intake
	Ashburton District Council	Methven-Lauriston Stock	Taylors Stream	100	Bushside Intake
	Ashburton District Council	Methven-Lauriston Stock	Taylors Stream	70	Bushside Intake
	Ashburton District Council	Methven-Lauriston Stock	Carneys Creek	10	Carney creek Intake
	Ashburton District Council	Methven-Lauriston Stock	North Ashburton River	1700	Methven Aux Intake
	Ashburton District Council	Methven-Lauriston Stock	Pudding Hill Stream	500	Pudding Hill Stream Intake
	Ashburton District Council	Methven-Lauriston Stock	North Ashburton River	100	MacFarlanes Terrace Intake
	Ashburton District Council	Methven-Lauriston Stock	Washpen Creek	340	Washpen Creek Intake
	Ashburton District Council	Methven-Lauriston Stock	Un-named Taylors Trib	10	Alford Forest Intake
			Total	**8120**	
			Rakaia River	680	
			Rangitata River	849	

Appendix C

Reconfiguration Diagram

Ashburton Reconfigured Supply Demand Schematic



Appendix D

Allocation and Reconfiguration

	Mayfield Hinds	Valetta	Ashburton River	Ashburton Lyndhurst	Chertsey
Inland					
Area (ha)	42696	31542	34295	32617	39027
Groundwater					
Assumed Demand (m3/ha/yr)	*5500*	*5500*	*5500*	*5000*	*5000*
Current Allocation (Mm3/yr)	102.7	79	57	79	90.5
Current Allocation (ha)	18672.7	14363.6	10363.6	15800.0	18100.0
Surface Water					
Assumed Demand (l/s/ha)	*0.52*	*0.52*	*0.52*	*0.52*	*0.52*
ACWT (m3/s)					
ACWT (ha)					
BCI (m3/s)					14
BCI (ha)					26923.07692
AL (m3/s)				13	
AL (ha)				25000	
Valetta (m3/s)		4.4			
Valetta (ha)		8461.5			
MH (m3/s)	11.55				
MH (ha)	22211.5				
Ashburton (m3/s)			6.7		
Ashburton (ha)			12884.6		
Rakaia (m3/s)					0.425
Rakaia (ha)					817.3076923
Rangitata stock (m3/s)	0.8				
Rangitata stock (ha)	1538.461538				
Rangitata (m3/s)	0.016				
Rangitata (ha)	30.76923077				
TOTAL (HA)	42422.7	22825.2	23248.3	40800.0	45840.4
SHORTFALL (HA)	-273.3	-8716.8	-11046.7	8183.0	6813.4
Coast					
Area (ha)	18838	17491	10447	22468	21309
Groundwater					
Assumed Demand (m3/ha/yr)	*6000*	*6000*	*6000*	*5500*	*5500*
Current Allocation (m3/yr)	45.3	43.8	17.4	54.5	45.9
Current Allocation (ha)	7550.0	7300.0	2900.0	9909.1	8345.5
Scheme					
Assumed Demand (l/s/ha)	*0.52*	*0.52*	*0.52*	*0.52*	*0.52*
Rakaia (m3/s)					1.135
Rakaia (ha)					2182.692308
BCI/Acton (m3/s)					3
BCI/Acton (ha)					5769.230769
MH (m3/s)	4.95				
MH (ha)	9519.2				
Acton stockwater (m3/s)					0.63
Acton stockwater (ha)					1211.538462
Hinds Drains (m3/s)	1885	1885			
Hinds Drains (ha)	3625	3625			
TOTAL (HA)	20694.2	10925.0	2900.0	9909.1	17508.9
SHORTFALL (HA)	1856.2	-6566.0	-7547.0	-12558.9	-3800.1
OVERALL SHORTFALL	1583.0	-15282.8	-18593.7	-4375.9	3013.3
GRAND TOTAL SHORTFALL	-33656.2				

	Mayfield Hinds	Valetta	Ashburton River	Ashburton Lyndhurst	Chertsey
Inland					
Area (ha)	42696	31542	34295	32617	39027
Groundwater					
Assumed Demand (m3/ha/yr)	*5500*	*5500*	*5500*	*5000*	*5000*
Current Allocation (m3/yr)	102.7	42	38	18	66.9
Current Allocation (ha)	18672.7	7636.4	6909.1	3600.0	13380.0
Surface Water					
Assumed Demand (l/s/ha)	*0.52*	*0.52*	*0.52*	*0.52*	*0.52*
ACWT (m3/s)		*8.3*	*7.5*		
ACWT (ha)		*15961.53846*	*14423.07692*		
BCI (m3/s)				3.3	10.7
BCI (ha)				6346.153846	20576.92308
AL (m3/s)				13	
AL (ha)				25000	
Valetta (m3/s)		4.4			
Valetta (ha)		8461.5			
MH (m3/s)	11.55	1.45			
MH (ha)	22211.5	2788.5			
Ashburton (m3/s)			6.5		
Ashburton (ha)			12500.0		
Rakaia (m3/s)					0.425
Rakaia (ha)					817.3076923
Rangitata stock (m3/s)	0.8				
Rangitata stock (ha)	1538.461538				
Rangitata (m3/s)	0.016				
Rangitata (ha)	30.76923077				
TOTAL (HA)	42422.7	26867.1	26620.6	33146.2	28084.2
SURPLUS (HA)	-273.3	-4674.9	-7674.4	529.2	-10942.8
Coast					
Area (ha)	18838	17491	10447	22468	21309
Groundwater					
Assumed Demand (m3/ha/yr)	*6000*	*6000*	*6000*	*5500*	*5500*
Current Allocation (m3/yr)	45.3	80.8	36.4	115.5	69.5
Current Allocation (ha)	7550.0	13466.7	6066.7	21000.0	12636.4
Scheme					
Assumed Demand (l/s/ha)	*0.52*	*0.52*	*0.52*	*0.52*	*0.52*
Rakaia (m3/s)					1.135
Rakaia (ha)					2182.692308
BCI/Acton (m3/s)					3
BCI/Acton (ha)					5769.230769
MH (m3/s)	3.5				
MH (ha)	6730.8				
Acton stockwater (m3/s)					0.63
Acton stockwater (ha)					1211.538462
Hinds Drains (m3/s)	1885	1885			
Hinds Drains (ha)	3625	3625			
TOTAL (HA)	17905.8	17091.7	6066.7	21000.0	21799.8
SURPLUS (HA)	-932.2	-399.3	-4380.3	-1468.0	490.8
OVERALL SURPLUS	-29725.2				

Ashburton River

Ashburton River allocation is set at 11.8 m3/s, as per Draft ZIP

RDR takes 4.7 m3/s from the Ashburton River

Minimum flow scenarios of 6, 8 and 10 m3/s considered

Simple unmodified added 6 cumecs to the recorded SH1 flow record

Hinds Drains

Hinds Drains total allocation split evenly between Valetta and MH

Hinds Drains can meet reliability target with groundwater augmentation

Water use

Other water uses such as municipal and industrial are relatively small compared with irirgation, and have been set aside

Stockwater can be used for irirgation in the future

Stockwater use from groundwater is small relative to irrigation

ACWT consent can be used for irrigation

Stockwater is taken from Rangitata and Rakaia at 50 L/s each and 400 L/s from Ashburton

Water consented for use in the Ashburton District can be used anywhere in the Ashburton District

schemes

5% leakage from the RDR

15-20% leakage from irrigation scheme races

All irrigation schemes are piped

Acton is reliable enough with on-farm storage

RDR water savings from canal lining have not been considered

groundwater

Groundwater and surface water can be used interchangably on properties with existing wells

Hydraulically connected groundwater takes are a relatively small component of the allocation, and do not have any reliablity issues

Well interference issues are not a constraint

Mayfields Hinds will become fully allocated

Irrigable area is distributed evenly among the existing groundwater allocation zone areas

reliability

Rangitata and Rakaia stockwater takes are 95% reliable when converted to run-of-river irrigation takes

RDR schemes can meet 95% reliability with scheme storage

BCI and Ashburton consents are 67% reliable on average

ACWT consent is 50% reliable on average

Irrigation Demand

0.52 L/s/ha for surface water

5,000-6,000 m3/ha for groundwater and storage