Canterbury Strategic Water Study – Stage II

Draft Summary Report

Project Purpose and Scope

The Canterbury Mayoral Forum, through Environment Canterbury, commissioned Stage 2 of the Canterbury Strategic Water study with the aims of:

- Determining the extent to which it is practical to meet environmental needs and potential consumptive water-use needs through the use of storage as a core component of integrated management of surface water and ground water in the Canterbury region.
- Defining a suite of hydrologically feasible options for meeting long term water needs, including practical methods for sharing water from all sources between neighbouring Districts.
- Gaining insight on the extent to which existing water allocations, via consents issued or plans operative may have foreclosed on water management options that would yield a greater return, overall, to the region.

The focus of the "practicality test" was the hydrological feasibility of water storage options: how much water is it lawful and practical to divert into storage, on a day by day basis, and how much of the foreseeable water need could be met through a combination of direct takes from rivers and aquifers, and releases from storage. Other parties are conducting detailed investigation of other key matters, such as economic feasibility, ability to gain consents, and the broader aspects of engineering feasibility.

Assessment of the environmental effects of taking water and damming water ways was not part of the scope of this project. Neither was assessing the effects of using the water – in particular the effects on water quality of using water to change or intensify land-use was not part of this project. Other projects are developing and applying tools for predicting the effects of land-use practices on the quality of Canterbury's ground water, in particular.

The results of Stage II are intended to feed into a process of water management option assessment and refinement that will contribute to achieving:

- Sustainable development of the region's soil and water resources.
- A net improvement in the quality of in-stream habitats.
- Developments that optimise socio-economic benefits across the region.

Why was this project commissioned?

Stage 1 of the Canterbury Strategic Water Study showed that in principle there is enough water to:

- Meet potential long-term water needs from all sectors.
- Improve the in-stream environment in stressed streams and rivers.

But to achieve this, the region needs to develop a significant amount of water storage. It also needs to be strategic in its actions, and manage resources as an integrated system.

In practice, there are a number of constraints that affect where water can be stored, where water can be taken from to fill reservoirs, how water can be conveyed from the take point to the storage site, and how water can be delivered to end users. The fact that a significant amount of water is already consented to be taken from rivers and groundwater also constrains what could be done in future, including the provision of strategic water supply infrastructure.

These realities mean that what is achievable in principle may not achievable in practice. This project was commissioned by the Canterbury Mayoral Forum to determine the likely extent to which it is practical to meet potential water needs, and to scope out the nature of the storage infrastructure required to meet potential water needs.

This project is part of a process and a growing portfolio of research and technical work that is intended to lead to water management solutions that sustain environmental quality, optimise resource productivity, and underpin social/cultural equity and well-being.

How was the hydrological practicality of meeting potential water needs assessed?

Various parties have already undertaken pre-feasibility and feasibility level investigations of storage-based water supply systems in several parts of the region. The results of this prior work were used, where possible, in this study. However options that were previously discarded, because they were too expensive for example, were reintroduced to the mix of possibilities because of the prospect that their viability would be greater if they could service a wider range of needs than those of the parties who commissioned the initial investigations. Storage sites, for example, may be able to serve a larger user-base in a regional context, compared to that possible in a district context.

A building block approach to developing water supply system options was taken. Under this approach, the initial focus was on defining sets of components, such as intakes, water storage sites, water uses. Previous work was reviewed to identify such components and topographic maps were scanned to identify additional storage and intake sites. Complete systems were then assembled from these components.

Taking this approach meant the results of previous investigations could be used in a way that reduced the risk of becoming constrained by previous thinking. Previous scheme concepts were pulled apart so that their storage sites, for example, could be viewed simply as another storage component. It also imposed fewer constraints on the identification of new storage possibilities in that these did not have to fit in with existing scheme concepts.

Having assembled a list of all potential storage components of the sizes required, each storage component was assessed in terms of engineering, potential environmental effects, and capital cost. The assessment was based on existing information, much of which was at a pre-feasibility level of detail. The same assessment process was applied to water sources / intake sites, and the conveyances that link intakes to storage to water demand areas.

The water supply system options assembled from the short-listed components were subject to a detailed hydrological feasibility study. The hydrological performance of each option was evaluated by computer simulating the day-to-day operation of each system over a 30 year period, approximately, for which historical data was available. A key element of this evaluation was the simulated application of rules for controlling the diversion and taking of water, and for allocating the water that is available for abstraction to competing consumptive uses. This is essentially a "Try before you Buy" approach that:

- Tested feasibility and enabled supply reliability to be quantified.
- Identified potentially adverse effects on river flow regimes.
- Provides a consistent basis on which to compare water storage options.

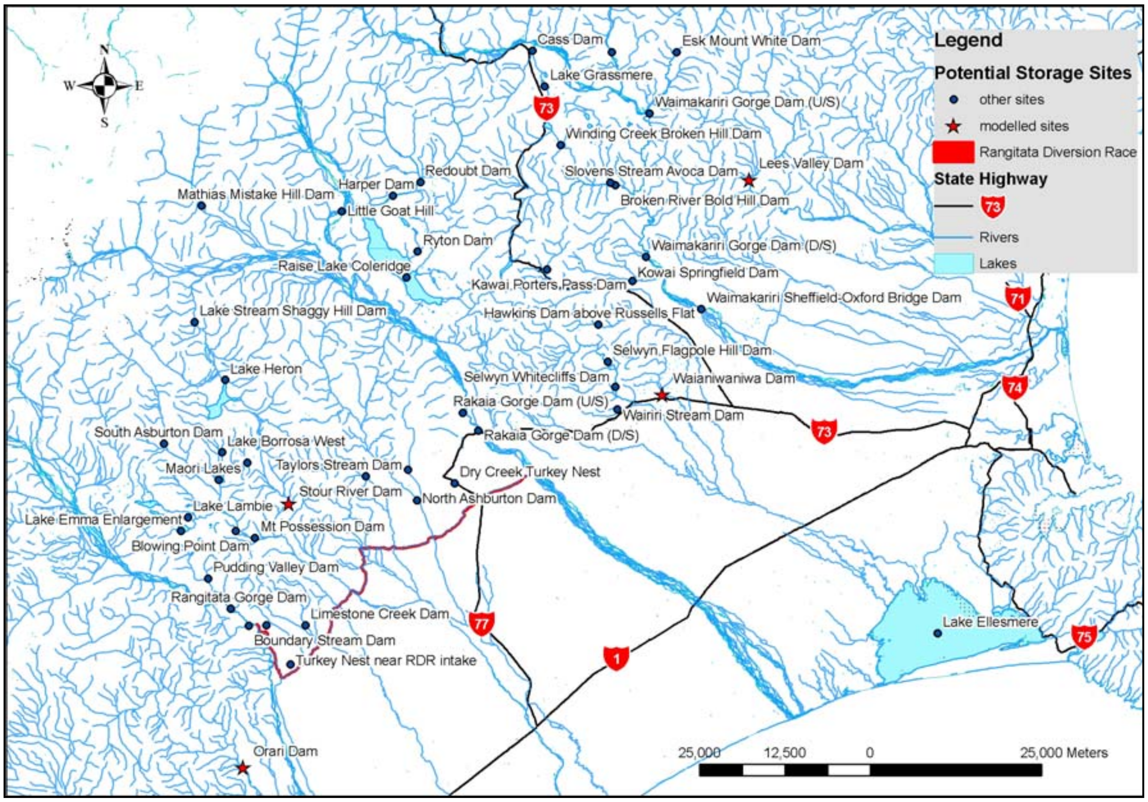
Each practical water supply system option that was tested is reported on in terms of:

- The location of key components
- Their size and other physical attributes
- The operating rules and any related assumptions
- The extent to which potential water needs could be met
- Water supply reliability
- Expected costs
- Potential effects on river flow regimes – positive and negative.

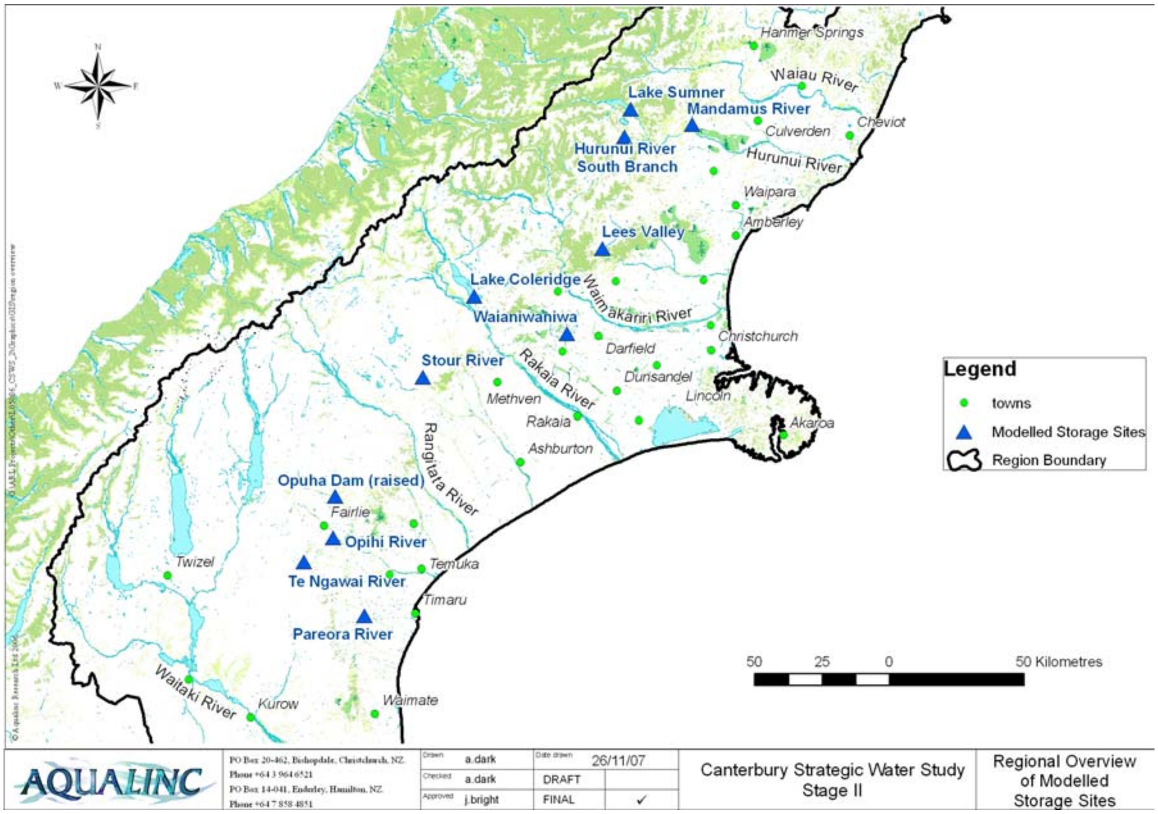
Several primary options, and variations on them, were developed and tested for each District to provide fundamental information for the ongoing process of determining the extent to which potential water needs could be met, and how best to do so.

What options were considered?

The number and range of potential storage sites considered during this project is illustrated by the following map which shows all storage sites considered in the Ashburton and Selwyn Districts.



The potential storage sites were filtered down to the sites identified on the following map, on the basis of environmental, technical or cost factors.



<u>Waitaki</u>

Existing hydro-power storage lakes provide a reliable source of water for consumptive uses, such as irrigation, if legal access to this water can be obtained. The allocation of water in the Waitaki catchment is determined through a special statutory process. The water set aside under this process for irrigation upstream of the Waitaki Dam is insufficient to irrigate all of the potentially irrigable land, even if additional storage was developed. Therefore additional storage-based water supply options were not sought.

South Canterbury

The total potentially irrigable land that is dependent on surface water sources and is south of Geraldine is approximately 41,000 ha (net area). The proportion of this total that is able to be irrigated under the options investigated is summarized in the following table.

Development Option	Net area reliably irrigated (ha)	% of total area reliant on surface water sources
Status-quo (irrigated area affiliated to Dam)	16,000	39%
Opuha Dam Raised	18,800	46%
Opuha Dam Raised + Opihi Dam	33,000	80%
Tekapo inflow (+ various storage options)	33,000	80%

Mid-Canterbury

The total potentially irrigable area between the Rakaia and Rangitata Rivers is 270,000 hectares (gross). Of this area approximately 115,000 hectares is able to be supplied from groundwater sources. The balance, 155,000 hectares, is dependent on surface water sources.

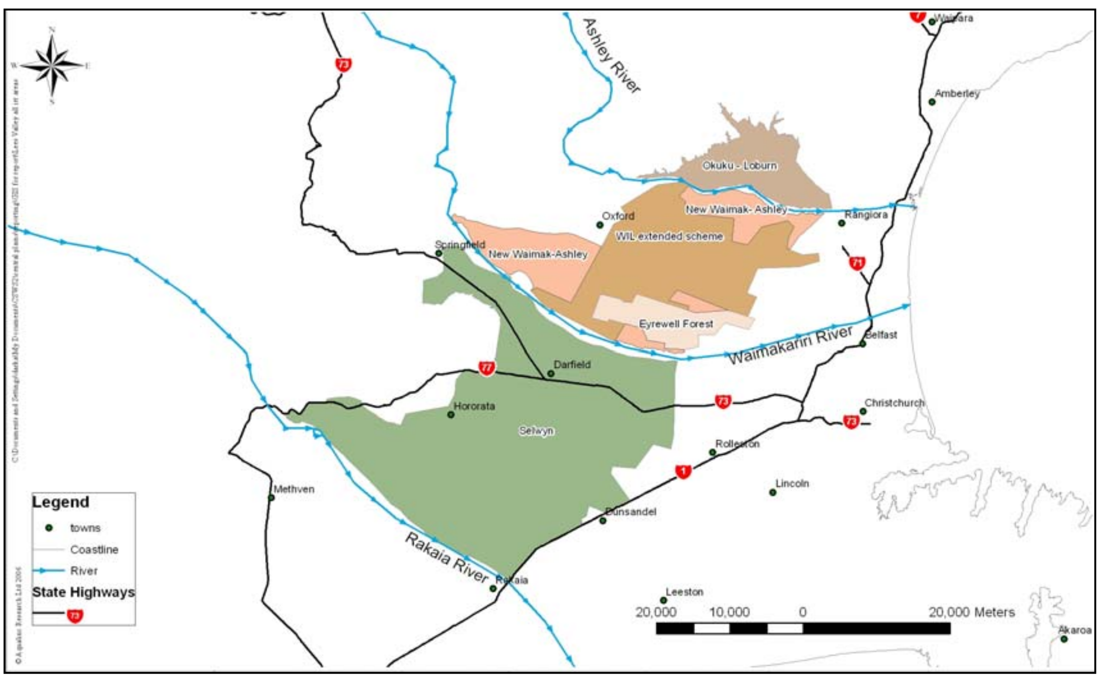
The options evaluated and the extent to which potential irrigation water needs can be met is summarized in the following table.

Development Option	Net area reliably irrigated (ha)	% of total area reliant on surface water sources
Status-quo (existing RDR schemes)	63,800	46%

Stour Dam + RDR	126,632	91%
Lake Coleridge + RDR	92,000	66%
Groundwater area	92,000	100%

Selwyn and Waimakariri Districts

The potentially irrigable area that is dependent on surface water sources is 141,000 ha (net). The location of this land is shown in the following figure.

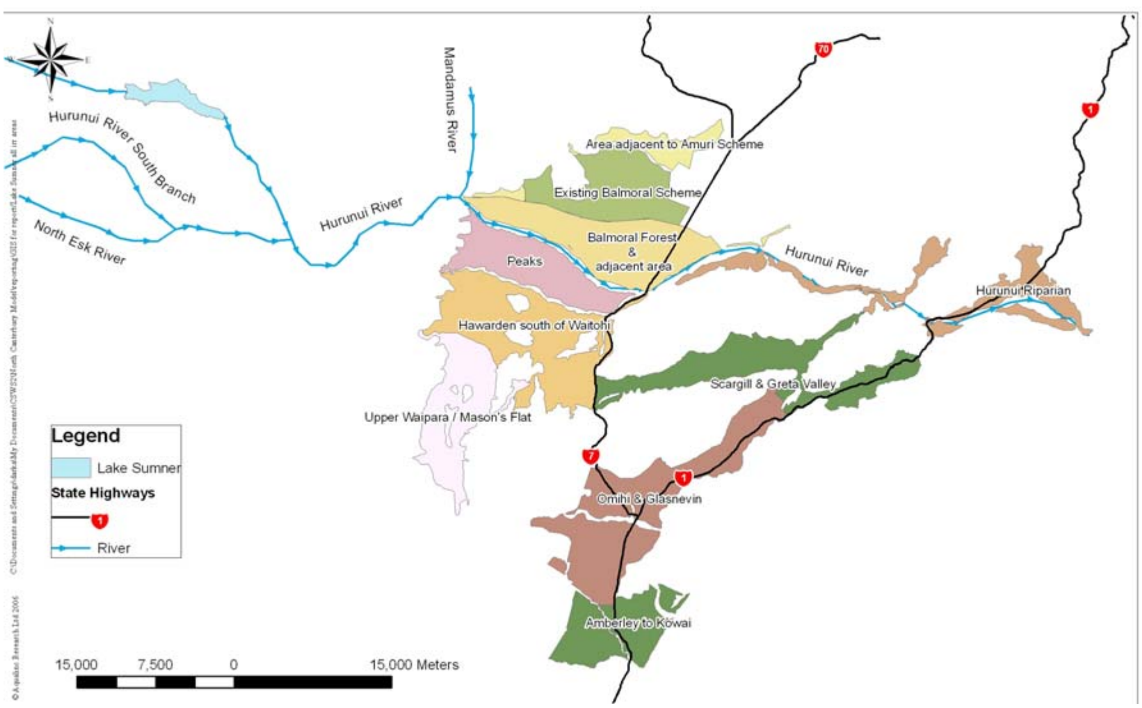


The extent to which the water needs of the potentially irrigable land within these districts can be met is shown in the following table.

Development Option	**Net area reliably irrigated (ha)**	**% of total area reliant on surface water sources**
Waianiwaniwa	63,300	45%
Lees Valley	141,100	100%
Groundwater area		100%

<u>Hurunui and Waipara</u>

The area of potentially irrigable land that is dependent on surface water sources is 60,500 ha (net). The location of this land is shown in the following map.



The proportion of land that can be irrigated from surface water sources is summarized in the following table.

Development Option	**Net area reliably irrigated (ha)**	**% of total area reliant on surface water sources**
South Branch Dam	37,500	61%
Lake Sumner Only	29,900	49%
Lake Sumner & South Branch	55,200	91%
Lake Sumner & Mandamus	36,300	60%

Key Findings

Under the present water allocation arrangements, potential water needs cannot be met in the following areas:

- Between the Rakaia and Orari Rivers
- Opihi / Opuha / Pareora catchments
- Hakataramea valley
- Waitaki Catchment upstream of Waitaki Dam.
- Waipara

Potential water needs between the Rakaia and Orari Rivers could be met if:

- More of the water set aside for taking from the Rakaia River is allocated to move south of Rakaia River. This would enable some Rangitata River water to go south, into the Orton area.
- There is greater use of groundwater within the existing RDR schemes.

Refilling storage will significantly affect in-stream flow regimes on the smaller rivers.

Suitable storage sites are the scarcest resource

Meeting potential water needs requires:

- Integrated management of the rivers and groundwater systems.
- Significant re-allocation of water.
- Comprehensive specification of existing entitlements to take water.
- Efficiency gains in the distribution and use of water.
- The development of a small number of large storage reservoirs.
- Greater reliance on alpine rivers.

Conclusions

While Canterbury has very substantial water resources – more than enough to meet foreseeable water needs, in theory – often it is not in the right place at the right time.

The development of a substantial amount of water storage will be required if foreseeable water needs are to be met. It appears unlikely that foreseeable water needs for irrigation will be met in all areas because of existing water allocations.

Taking a “Business As Usual” (ad hoc) approach to water management is very unlikely to maximize the degree to which foreseeable water needs are met, because of the nature and scale of the water allocation changes and infrastructure investment required.