Canterbury's Irrigation Water Resources

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Introduction

With 58% of all water allocated for consumptive use in New Zealand, and 70% of the nation's irrigated land, Canterbury is already critically dependent on water resource development in the form of irrigation and stock water systems. The future prosperity of the region is inextricably linked to how water is allocated and how this affects agriculture's water supply reliability. On-going land use change, primarily in the form of irrigation development, continues to increase demand for water abstraction. Water is highly valued by the regional community for a variety of economic, environmental and social reasons. As a result, there is increasing conflict over the allocation of water for abstraction and for maintenance or improvement of in-stream values.

Lincoln Environmental recently completed a study for the Ministry of Agriculture and Forestry, Environment Canterbury and the Ministry for the Environment on the Canterbury Region's ability to meet the long-term demand for water. It provides information so that strategic decisions about the future management of Canterbury's water resources can be made. Some of the key findings are presented here.

Current and future demand for water

The current peak weekly allocation of water for abstraction in Canterbury is 290 m^3/s. Irrigation dominates this demand with 83.4% of the peak weekly allocation (Figure 1). Currently 63% of water is allocated from surface sources and 37% from groundwater.

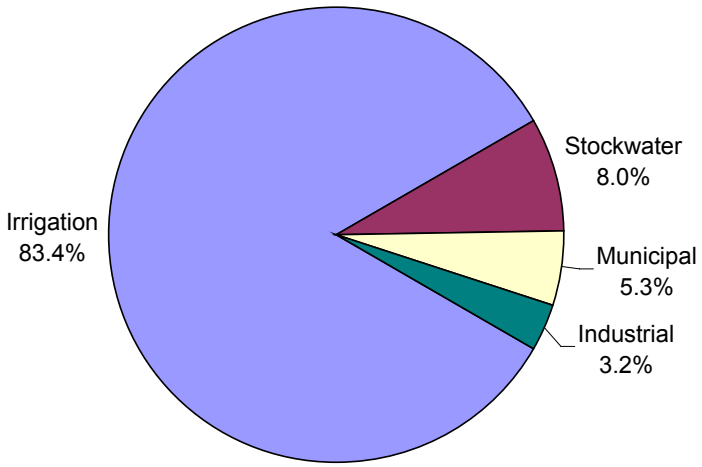

Figure 1: Proportion of total maximum weekly rate of take allocated to each water use type in Canterbury (April 2001).

The current (April 2001) irrigated area from the Environment Canterbury consents database is 438,044 ha. The potentially irrigable area in Canterbury has been estimated at 1,002,420 ha. To meet the demand for irrigating this area under a realistic combination of land-uses, a 210% increase in peak weekly water allocated to irrigation would be required.

The future water scenario indicates that water demand could approximately double to 569 m^3/s. Of this future potential peak demand, 89% is expected to be for irrigation, 5% for stock water, 3% for municipal supplies, 2% for industrial use, and 1% for plantation forestry demand.

Water availability

Surface water

The Waitaki and Rakaia rivers are the largest rivers in Canterbury, providing 48% of the region's measured average surface run-off. When combined with the other major alpine rivers (Waimakariri, Waiau, Rangitata, Hurunui and Clarence), these large rivers contribute 88% of the region's run-off. During periods of low flow, the main alpine rivers provide an even greater proportion of Canterbury's surface water resources (Figure 2).

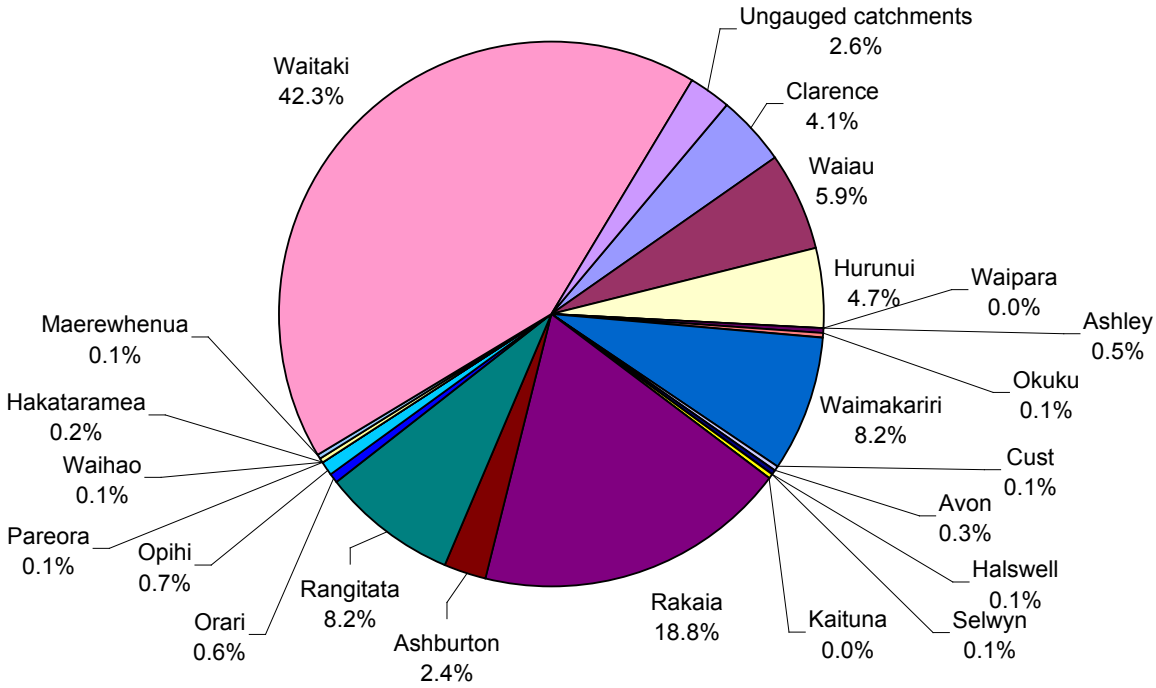

Figure 2: The relative size of Canterbury's surface water resources under low flow conditions.

The greatest pressure from water allocated for abstraction currently occurs in the smaller foothill rivers, such as the Waipara, Maerewhenua, Ashburton and Opihi. The larger alpine rivers are generally less pressured, particularly the Waitaki, Rakaia and Waimakariri (Figure 3).

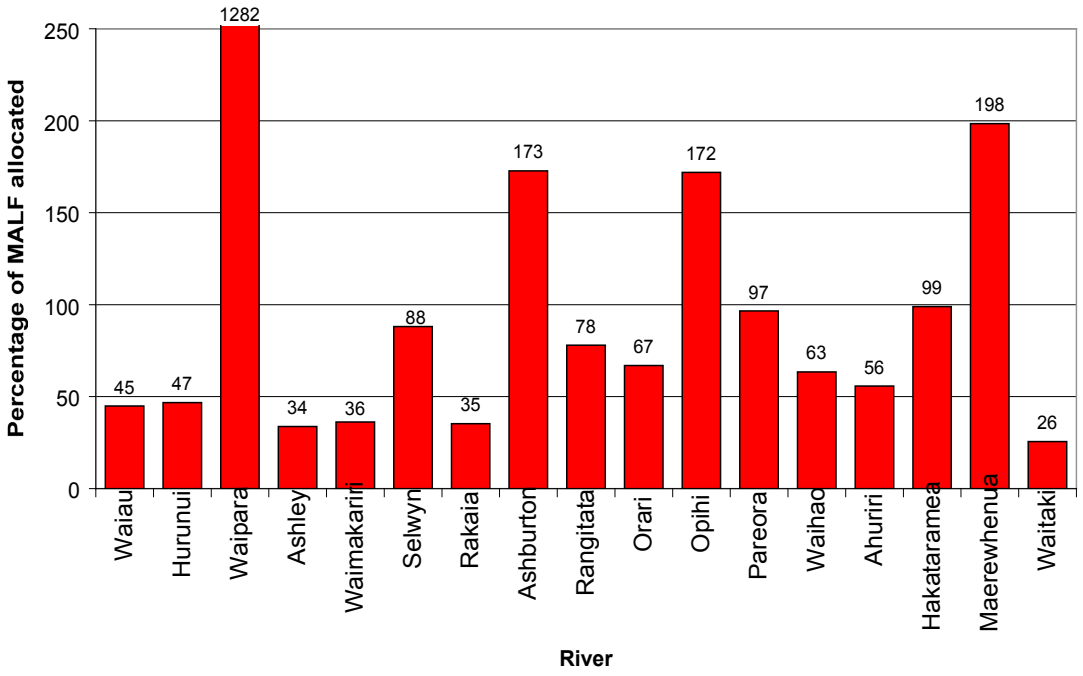

Figure 3: Indicative measure of potential pressure – allocation of surface takes as a proportion of mean annual low flow.

Groundwater

There is a good relationship between the flow in Canterbury's spring-fed streams and the water levels in the region's groundwater systems. The study used the flow impacts on spring-fed streams as an indicator of the cumulative effects of groundwater abstraction. Only a relatively small amount (10 to 30%) of the combined river and land surface recharge can be abstracted in addition to current volumes before flow reductions greater than the assumed sustainable limit will occur in Canterbury's spring-fed streams.

Results indicate groundwater is significantly over-allocated in many zones. However, as net consumptive use is considerably less than allocation, the sustainable limit has not yet been reached in any zone. (Figure 4).

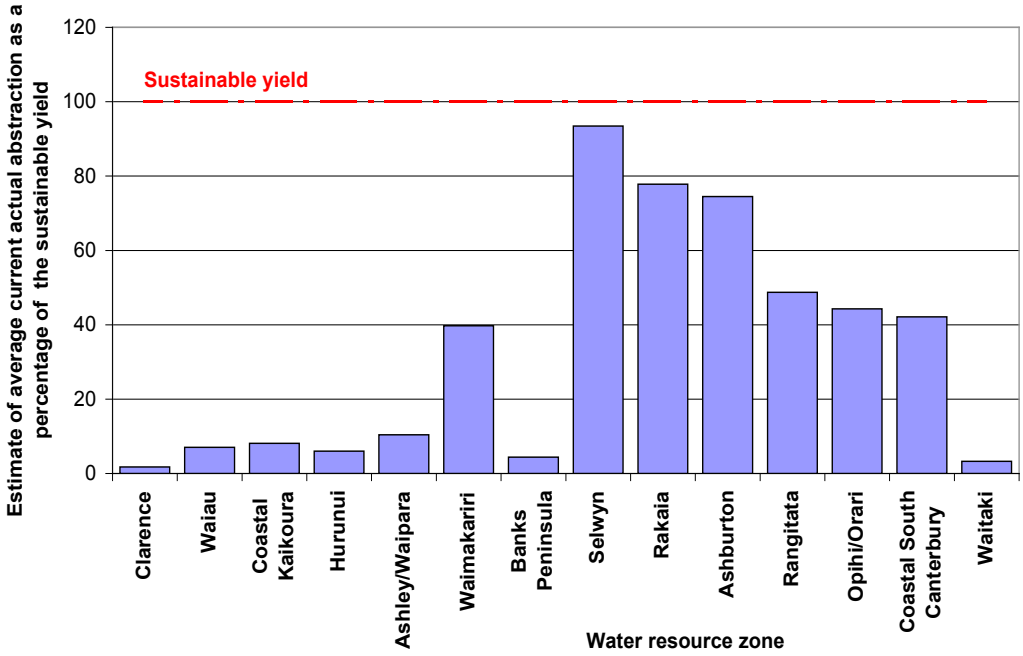

Figure 4: Indicative measure of groundwater stress – average current actual groundwater abstraction as a percentage of the sustainable yield.

Water balance—can the water available meet the demand?

The Canterbury region was divided into fourteen water resource zones. Although they can be considered arbitrary boundaries, an attempt was made to ensure grouping of areas with similar geographical (particularly hydrological and hydrogeological) characteristics. In order to compare available water supply with future demand, the areas of potential water demand have been further divided into three types of areas, depending on their likely access to water. These are:

- **Riparian supply areas**: Areas adjacent to the region's major rivers where access to the surface water (or connected groundwater) is likely to be feasible at an individual landowner level.
- **Groundwater supply areas**: Areas where access to groundwater at an economic cost and quantity is likely to be feasible at an individual landowner level.
- **Community supply areas**: Remaining water demand areas without access to water where some form of "community" scheme would be required.

Canterbury is clearly a water-short region, when comparing water demand with availability on a daily or weekly basis (Figure 5). Under typical low flow conditions, the flow allocable for abstraction under the current allocation regimes cannot meet the current peak water demand. With increasing pressure on Environment Canterbury from some sectors to raise the minimum flows on several rivers, and the need to establish abstraction limits and/or flow

sharing rules, it is expected that this shortfall situation will become even more pronounced. The peak water demand for the future scenario exceeds the total mean annual low flow of the water resource.

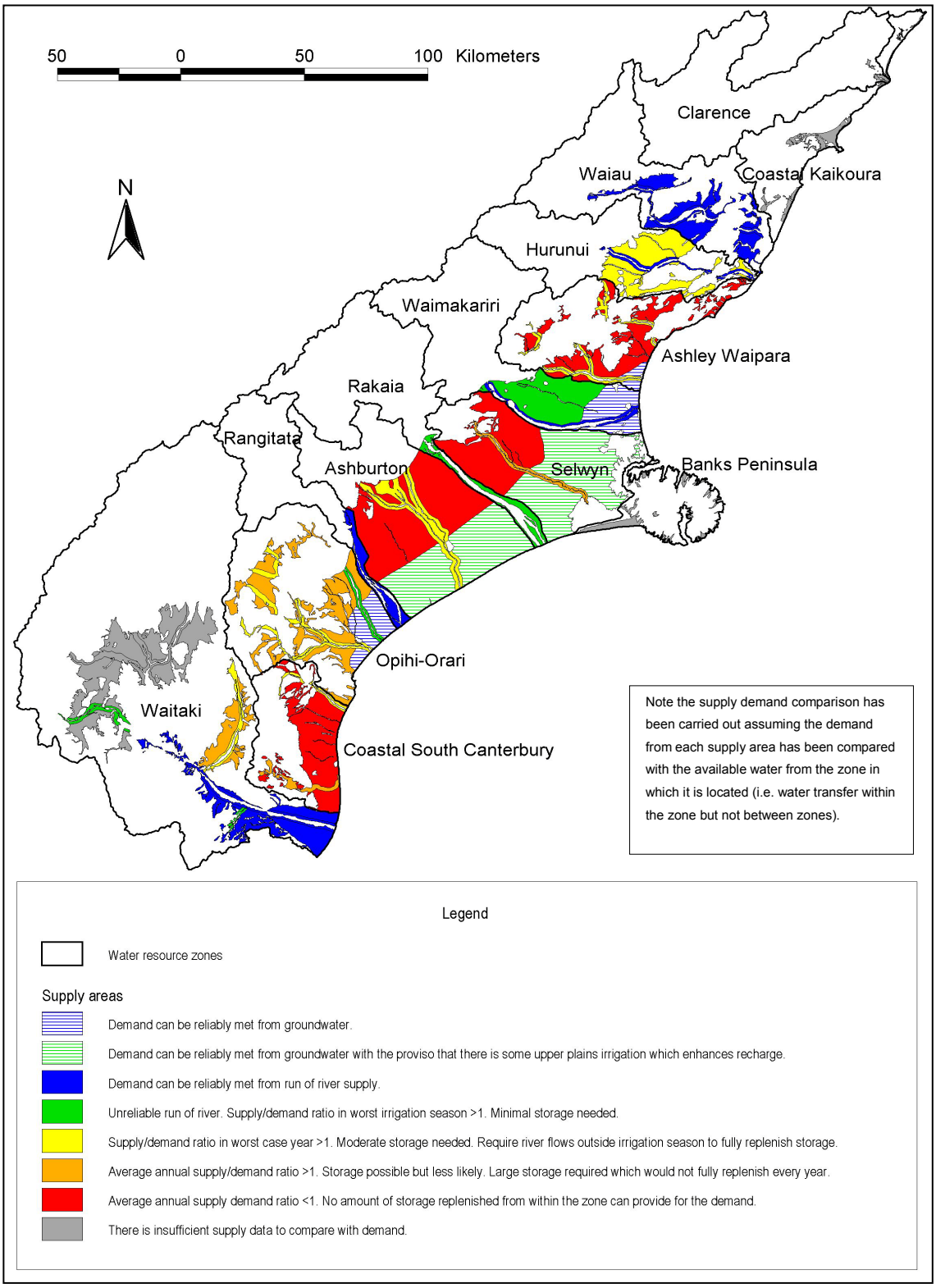

Figure 5: Summary map of final supply and demand situation.

However, when comparing the water demand with the water availability on an annual basis, the region has enough water to meet its foreseeable abstractive needs and provide for in-stream flow requirements. This implies that significant water storage will be required to meet this future water demand.

Utilising water available in the region's larger rivers will be required if the potential development of resources is to be realised. Redistribution will be required to reduce pressure on small streams.

If the potential demand on the groundwater supply areas comes to fruition in the Selwyn and Ashburton water resource zones, then irrigation of the upper plains will probably be necessary to maintain spring-fed stream flows. This implies the need to manage the surface water and groundwater resources together.

Other Conclusions and Implications

Due to poor reliability of supply from run-of-river sources, there is likely to be minimal new irrigation development sourced directly from surface water. Groundwater development is steadily increasing, but is expected to begin to level off in future due to availability and cost constraints. Without the development of significant water storage, the irrigated area in Canterbury can be expected, in the future, to plateau well short of the potential irrigated area.

The region has enough water to meet foreseeable, reasonable water demands, including in-stream flow requirements. However, the water is not always in the right place at the right time. Large areas of Canterbury do not have ready access to a reliable water source. Balancing water supply and demand in the long term will require a significant amount of storage in the foothills and redistribution of water across water resource zones.

As there are relatively few suitable storage sites, there is a need to retain options for future development of water storage sites.

There is no agency with the mandate to plan the long-term development of the region's water resources. For legal reasons, Environment Canterbury has historically chosen to distance itself from planning for future water resource development, and has largely tackled water quantity issues as they arise through the resource consent process. This approach often disillusions both those who want to abstract water and those with interests in seeing it remains in-stream. The region needs a strategic plan that integrates both the long-term development, and the protection of Canterbury's water resources.

The future development of Canterbury's water resources will require strategic, integrated water resource management. The local and regional communities will be required to make decisions to ensure water is fairly and equitably distributed amongst stakeholders.

Co-operation amongst these stakeholders will be necessary to ensure that Canterbury's water resources are developed and used wisely for the long-term benefit of the regional community.

Further information and a full copy of the Canterbury Strategic Water Study can be found at http://www.ecan.govt.nz/Plans-Reports/water.html

Workshop summary

Questions

- What is the water bearing capacity of the Rangatata scheme? It is shallower, but is the sub-surface porous enough, and can you pump it at a high enough rate for irrigation? Is there enough water in the catchments to replace what is taken? In the Orari region the supply is the limiting factor. Consider the yield of water, and if the supply is sustainable.
- Most farmers use the first water-bearing layer. Are there likely to be deeper layers? In most areas, gravel sound down to 500 m. Christchurch city has five aquifers underneath, this is expected to fan out further than the city. Work has been done to quantify how much is recharging, from rain and rivers, so sometimes needs to be looked at as a single source.
- What solutions need to lead strategic development? For the last 6-9 months the regional and district councils have been working together towards an agreement. In theory there is enough water to meet long term demand, so now it needs to be looked at in practice such as storage sites, plumbing etc.
- What is the source to recharge the under ground water? The rivers contribute 1 to 2 times more the water compared to rainfall recharge.
- What storage sizes have been looked at? In mid Canterbury a range of sizes from individual on farm to large scale has been looked at, but ultimately comes down to cost. Individual on farm storage systems have been two to three times more expensive per m^3 compared to one or two main large storage systems. Mid Canterbury would require the equivalent of 5-6 m of Lake Coleridge, which is 4,000 ha in size.
- Is present legislation hindering development of storage systems? The concept of long-term strategic thinking has been lost. And there is no responsibility given to any one organisation.
- Are we in an optimal time to work in conjunction with someone like hydro electricity? If you can build hydro electricity into a scheme, it would be a more effective use of infrastructure, only appropriate if the site is suitable.
- Looking at potential sites, have the landowners been approached? There is sufficient awareness by people involved. Landowners have been approached, which may lead to walking away from a potential site.
- Are deep-water aquifers sustainable at present? There is an issue of access to groundwater, depends on depth, neighbour wells and the amount pumped. Intensive development is impacting on access to water. Total supply is relative to what is taken out, so there is still potential supply but not for much longer.
- What danger is there of international investment, turning water into oil? Region needs billion dollars of investment in infrastructure, so is a possibility.
- How do we get billion dollars started? Positive signs of MAF, Ecan and councils working together. Ultimately back on water users, need to get people signed up to take water. Depends on rate of uptake, need cashflow to service debt and operating costs. But is a long term investment.

Conclusion

- Poor reliability of supply from run-of-river sources will restrict new irrigation development.
- Without development of significant water storage, the irrigated area in Canterbury can be expected, in the future to be well short of potential area.
- In theory, there is enough water to meet long-term demands from all sectors.
- There is enough water, but it is not at the right place at the right time.
- What is required is a significant amount of storage in the foothills and a redistribution of water across zones. Need to identify site now so they are not developed into houses etc.
- There is no agency with the mandate to plan the long term water resource development.
- If a strategic plan is integrated, all sectors can be satisfied.