4.1 Introduction

This section describes the various alternatives that have been considered; including doing nothing, developing a community based water enhancement scheme, the different water resources considered, alternative intake sites, alternative storages and alternative distribution systems. A detailed description of these alternatives is contained in the feasibility study[1].

The Resource Management Act no longer requires the "best practicable option" to be adopted, nor does it require the consent authority under section 104 to have regard to the consideration of alternatives. The Fourth Schedule of the RMA, Clause 1 identifies the aspects that should be included in an assessment of environmental effects (AEE). Clause 1(b) states that;

> *"Where it is likely that an activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity"*

4.2 No further irrigation

The option of no further irrigation on the Central Plains runs contrary to the purpose of the Resource Management Act 1991 and cannot be considered as sustainable management, in that it will not provide for the use and development of the natural and physical resources of the region in a way that enables people and communities to provide for their social, economic and cultural wellbeing, nor for their health and safety. Given this, the "do nothing" alternative has been discounted.

4.3 Multiple small schemes

As presented in Section 2, the failure to provide a centralised community-owned, comprehensive irrigation and water enhancement scheme for the Central Plains will result in the ad hoc development of small individual schemes that will not provide for the efficient and wise use of water from what is becoming a scarce resource. The Central Plains scheme has the size and scale to be able to provide water storage and to adopt water harvesting principles to fill the storage. This raises the reliability of the water supply in the rivers from the low 70 percents to the high 90 percents. Thus the use of the river resources is enhanced through the provision of storage. The small schemes taking water from both the Rakaia and Waimakariri Rivers that are being considered at present do not include storage and therefore should not be considered as a viable alternative to that proposed here.

[1] Central Plains Water Enhancement Feasibility Study, URS January 2002, prepared for the Central Plains Water Enhancement Committee and the Selwyn District Council and Christchurch City Council.

4.4 Major community owned scheme

As presented in Section 2, this option is for a major community owned scheme. The Central Plains Water Trust will hold the consents, and as its overriding objective is the continued public ownership of the resource consents, this will ensure long-term community protection of the Region's scarce water resources. The Trust has not been established purely to pursue commercial objectives, it being the intention that such commercial objectives will instead be pursued through Central Plains Water Ltd.

Central Plains Water Limited has been formed by the Central Plains Water Trust to investigate, construct and operate a water enhancement scheme, providing surface water for community irrigation to farmers who farm within the Central Plains area. The company has been charged with obtaining the necessary resource consents for and on behalf of the Trust. This is an important feature, in that the resource consents will be held by the Trust, while the scheme will be operated by the company.

The Company has entered into a Memorandum of Agreement (as appended) with the Trust that sets out the respective roles of the Company and the Trust and, in particular, specifies the basis on which the Company will apply for the resource consents on behalf of the Trust. The Trust will subsequently making the resource consents available to the Company for the purposes of constructing and operating the Scheme, on agreed terms and conditions to ensure that the needs of irrigators and the wider objectives of the Trust as set out in the Memorandum of Agreement are realised in an enduring and practical way.

From these initiatives and scheme has been developed that will provide a reliable source of water for all those parts of the Central Plains that do not have access to groundwater due to resource or financial constraints.

It is clearly the position of the applicants, that a community based approach to the use of the water resources of the Central Plains is the best alternative.

4.5 Alternatives within proposed scheme

4.5.1 Alternative water sources

The main water sources within the Central Plains area are the Rakaia and Waimakariri Rivers. These are the only rivers that have flow regimes suitable for meeting spring and early summer water demands from run-of-river abstractions because of their response to north west weather in the main divide area. This also means reduced size for the water storage needed to meet scheme demand. Other water sources such as the Selwyn River and its various tributaries and the Kowai River are all far too small and unreliable to consider as a suitable source of water for irrigation and enhancement opportunities. The focus of these studies (and the many previous studies) has been on these two main rivers, fed from catchments in the Southern Alps.

There are two potentially viable sources of water for irrigation in the Central Plains area: surface water from the Rakaia and Waimakariri Rivers, and groundwater. Where the depth to the water table is shallow,

and groundwater is plentiful, the economically viable source of water is this groundwater. Where the water table is at greater depth, surface water resources become more economically viable. Thus, the general boundary of the scheme area was determined by reference to the availability of groundwater as an economic alternative to a surface supplied source of water. Where the lower plains (generally southeast of SH 1) have easier access to groundwater, it is in the upper plains area that is more suited to irrigation from surface water from the two rivers.

The major consideration with this proposal has therefore been how much water to take from the Rakaia and Waimakariri Rivers. A wide perspective was adopted, taking into consideration the potential water demands from Ashburton District as well as Selwyn District. From this a co-operative sharing agreement has been reached with the Ashburton Community Water Trust for the remaining water in the Rakaia River. Of the ~ 40 cumecs of available water in the Rakaia, the agreement provides for equal sharing of 20 cumecs each, with the ability of either party to take the full entitlement should the other party not use their share. The definition of available water in the Rakaia River is that portion of the 70 cumecs allocated in the National Water Conservation Order for abstractive uses, and provides for the proposed Barrhill-Chertsey abstraction even though that take has not yet been exercised. The Central Plains/Ashburton Community Water Trust takes therefore do not affect the priority of any of the existing resource consent holders.

The take from the Waimakariri River is in accordance with the sharing regimes within the Waiamakariri River Regional Plan, where Central Plains would utilise the remaining ~2 cumecs of "A Class" water, and up to an additional 38 cumecs of the more unreliable "B Class" water. "A Class" water would be shared on an equal priority as the other A Class water users within that allocation band. As part of this application, Central Plains Water would also seek to use the unallocated winter water not currently part of the Waimakariri Irrigation Ltd's resource consent – given that they do not have water storage and therefore do not take irrigation water during the winter.

Therefore the consideration of the available sources of water has been comprehensive and these applications are for the best and only source of water to meet the community needs.

4.5.2 Alternative intakes

Intakes from the two rivers need to be above RL 235 m (plus head losses) to enable water to flow into the headrace. This dictated the two intake sites being that on the Rakaia River and at the Gorge Bridge on the Waimakariri River. As the scheme concept developed, an intake above the confluence with the Kowai River was seen as a practical alternative to provide water to the Waianiwaniwa reservoir without the need for pumping. Therefore the upper Waimakariri intake site became desirable.

Intakes above the two main gorges are physically not practical due to the steep rocky terrain, and are also not provided for by way of the NWCO for the Rakaia River or the Plan for the Waimakariri River. Nevertheless an intake located at Lake Coleridge was considered with a canal sidling down the higher terraces to the Rakaia River through the gorge to the Windwhistle area. A Lake Coleridge intake was favoured early in the feasibility study as it could provide a reliable flow of ~ 8 cumecs of clean water to a storage reservoir in the Wairiri Valley under gravity flow.

The Coleridge intake was discounted for a number of reasons, including:

- The water in Lake Coleridge has been fully allocated to TrustPower for electricity generation;
- The NWCO prohibits the reduction in flow of water through the Rakaia Gorge, anticipating the discharge of all Lake Coleridge water (harvested from the Harper and Wilberforce Rivers) through the power station and then through the gorge;
- The cost of the canal from Lake Coleridge to the plains; and
- The ultimate rejection of the Wairiri Valley as the preferred storage site.

It is therefore contended that the intake sites on the Rakaia and Waimakariri Rivers are the only three alternative sites that are practicable.

The intake structures proposed are all considered to be current best practice and therefore alternatives such as sonic fish screens, not using settling basins, using infiltration galleries etc have not been considered in any detail and are not discussed further.

4.5.3 Alternative water storages

Wairiri Valley

The initial phases of the project focused on the Wairiri Valley for water storage. This valley had the advantage of being able to be fed by gravity from Lake Coleridge. This concept provided for a uniform flow of 8 cumecs all year round from the Lake into the reservoir. Having the ability to call on a fully reliable source of water to fill the reservoir resulted in a smaller storage volume being required. This is in essence because some of the required storage would be provided within Lake Coleridge.

There were a number of disadvantages with the Wairiri Valley that ultimately lead to it being discounted. These included:

- The use of Lake Coleridge water to fill the reservoir and the potential conflicts with the NWCO and TrustPower's rights to that water;
- The need to rely on pumping to fill the lake from other sources.
- The limited storage volume provided by the valley;
- Unfavourable foundations conditions for the dam site;
- The need for extensive ridge and saddle dams to provide the required storage; and
- No future ability to increase storage should the need arise.

Lake Coleridge

Lake Coleridge itself could have provided the necessary storage. As above there are major impediments with the use of water from the lake, and utilising the lake for the full storage requirements for the scheme exacerbated these difficulties. These included:

- The need for a very large race from the lake to supply the peak demand;
- The large variation in lake level that would result from this (in the order of 6m), which would have unacceptable effects on the margins of a very sensitive environment; and
- Conflict with the NWCO and TrustPowers' sole rights to the use of that water.

Other storage locations

The prefeasibility study considered other sites in the foothills, including sites at Flagpole Hill on the High Peak Station in the upper Selwyn River and Whitecliffs. These were discounted on the grounds of cost, environmental effects and social impacts. Storage above the Waimakariri gorge in the Broken, Esk or Poulter Rivers was also considered, but discounted primarily as these are prohibited activities under the Waimakariri River Regional Plan.

Waianiwaniwa Valley

The Waianiwaniwa Valley is the best practicable option for storage, as it can be filled either by a gravity canal from the Waimakariri River as proposed, or by pumping from the main headrace canal utilising water from both the Rakaia and Waimakariri Rivers. There is a suitable dam site at the mouth of the valley that does not required extensive excavation and foundation work. An alternative dam site was considered in the valley approximately 500m to the north of the proposed site, however this site had unsuitable foundation conditions that would have required extensive remedial works.

The Waianiwaniwa Valley has the potential to store 450 million cubic metres of water and therefore, should there be a future need for stored water, the capacity exists within the valley.

4.5.4 Alternative Distribution Systems

All of the distribution systems considered involve the level headrace canal. Having the ability to transfer Rakaia River water as far north as the Waimakariri River and vice versa enhances the combined reliability of water from the two rivers. It also enables water from either river to be used to fill the reservoir if a pumped option is finally selected.

Gravity water races

This proposal includes an extensive network of gravity canals across the plains, as described in Section 3. Races are efficient carriers of water when economic factors are taken into account. While distribution through races will result in leakage to groundwater, this has the potential to enhance groundwater levels

through recharge and therefore if a broad perspective of water use efficiency is adopted, then the leakage itself does not constitute an inefficient use of the resource. The leakage is small compared with the total take.

Gravity piped distribution

A gravity piped distribution system was considered as part of the feasibility study. Reticulation via the piped gravity system would utilise gradient of the Canterbury plains (approximately 1 in 170) to provide water to the farm boundary at a minimum head of 50 m. This requires that the irrigation area is located approximately 11 km down-gradient of the headrace. For land closer than 11 km to the headrace, additional pumping would be required.

The key features of a piped system compared to a gravity canal system are:

Advantages

- Water is delivered at pressure at the farm gate – no pumping costs;
- Water losses are minimised through distribution – reduced leakage and bywash; and
- No visual impacts or loss of land as pipes are all buried.

Disadvantages

- Much more expensive even when additional pumping costs are taken into account;
- Only the properties on the lower extremities of the command areas get water at sufficient pressure to avoid pumping;
- Design considerations for transient pressure surges (water hammer) become critical to the project; and
- Lose some of the environmental habitat advantages of races.

Preliminary assessment of the piped alternative shows that in comparison to the open channels, there would be increased costs across the whole distribution network, and operational issues for those areas not commanded by sufficient gravity head. Further consideration will be given at the final design and financial packaging stages. In general, the environmental footprint of a piped system will be clearly less than the open channel option described here, and it is the wish of the applicant that this alternative be considered under the present resource consent applications. If a piped distribution system were to be constructed, it would follow the alignment of the races described in Section 3.